

# 43<sup>rd</sup> Annual Phoenix Surgical Symposium

February 5-7, 2015

Scottsdale Resort and Conference Center  
Scottsdale, AZ



Banner Health.

Jointly sponsored by  
Banner Health and The Phoenix Surgical Society

43rd ANNUAL PHOENIX SURGICAL SYMPOSIUM  
February 5-7, 2015  
**Scottsdale Resort and Conference Center- Scottsdale, AZ**

**MEETING LOCATION:**

The General Sessions will be held in **Maricopa I**. Continental breakfasts, exhibits and breaks will be held in **Maricopa II/III**. Lunch will be provided in the **Vista Verde Dining Room**. ***Tickets are required for the lunches. Please check with the registration staff to see if there are still tickets available.***

**CONFERENCE EVALUATION/QUIZ:**

In order to maintain compliance with our CME provider, a quiz must be submitted to all attendees. The quiz is attached to the evaluation form and must be completed in full and returned with the evaluation form in exchange for your CME certificate. Both pieces will help with future planning and CME compliance. Please see the registration staff for more details.

**PROGRAM OBJECTIVES:**

After completing this program, the participant will be able to:

- 1) Integrate new information into current clinical practice.
- 2) Identify current issues surrounding the optimal care of the surgical patient.
- 3) Identify current trends in multiple topics including breast surgery, trauma and critical care, endocrine surgery and hernia surgery.
- 4) Compare new surgical approaches to dealing with common and complex surgical problems.

**EDUCATION CREDIT INFORMATION**

This activity has been planned and implemented in accordance with the accreditation requirements and policies of the Accreditation Council for Continuing Medical Education (ACCME) through the Joint Providership of Banner Health and The Phoenix Surgical Society. Banner Health is accredited by the ACCME to provide continuing medical education for physicians.

Banner Health designates this live activity for a maximum of 18.00 **AMA PRA Category 1 Credits™**. Physicians should claim only the credit commensurate with the extent of their participation in the activity.

Faculty members have been requested to disclose any relevant conflicts of interest they may have at the beginning of their presentation. Such disclosure allows you to better evaluate the objectivity of the information present in the lectures. Please report on your evaluation form an undisclosed or perceived conflict of interest. Thank you.

These disclosure forms are on file at the registration desk, and each ***faculty and planning team member*** has indicated the following relationships:

**Joshua Bloomstone, MD, CSSGB, CLS** – Speakers Bureau – Edward LifeSciences

**Martin Croce, MD, FACS** - No conflict to disclose

**Robert Fitzgibbons, Jr., MD, FACS** - Product and/or Device Cook Critical (a royalty for a CBD catheter)

**Clive S. Grant, MD, FACS** - No conflict to disclose

**Steven B. Johnson, MD, FACS, FCCM** - No conflict to disclose

**Pat McGrath, MD, FACS** - No conflict to disclose

**Donald W. Northfelt, MD, FACP** - No conflict to disclose

**Amy Sisley, MD, FACS** - No conflict to disclose

**Planning Committee Disclosures**

**Jon King, MD, Chair:** Speakers Bureau/Consultant - Pfizer

**Laura Tillman, MD:** No Conflict

**Cathy Clifton, CMP, CMM:** No Conflict

**Larry Koep, MD:** No Conflict

**Kumash Patel, MD:** No Conflict

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### **CME CERTIFICATES:**

CME Certificates will be available for pick-up, at the conclusion of the course, in exchange for your **Physician's Request for CME form, Evaluation and Quiz**. Please be sure to sign in one time on the official CME forms located at the registration desk.

### **SPECIAL NEEDS:**

If you need any special services, please advise a PSS representative at the registration desk.

# CME Daily Breakdown

<u>Date</u>	<u>Hours</u>
Thursday, 2/5/15	6.75 hrs
Friday, 2/6/15	7.25 hrs
Saturday, 2/7/15	4.00 hrs
<b>Total</b>	<b>18.00 hrs</b>

Meeting Management provided by:

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## **National Faculty**

**Joshua Bloomstone, MD, CSSGB, CLS**  
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Phoenix, AZ

**Martin Croce, MD, FACS**  
Professor and Division Chief  
University of Tennessee-Memphis  
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**Robert Fitzgibbons, Jr., MD, FACS**  
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**Clive S. Grant, MD, FACS**  
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**Steven B. Johnson, MD, FACS, FCCM**  
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**Pat McGrath, MD, FACS**  
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Phoenix, AZ



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## Thursday, February 5, 2015

7:30 am	<b>Continental Breakfast</b>	
8:15 am	<b>Welcome and Introduction:</b> Jon King, MD, FACS: Moderator	
8:30 am	<b>Blunt Cerebrovascular Injuries:</b> Martin Croce, MD, FACS	Page 7
9:00 am	<b>Adrenal Incidentalomas - Evaluation &amp; Surgical Management:</b> Clive S. Grant, MD, FACS	Page 11
9:45 am	<b>Strategies for Treatment of Complex Malignancies:</b> Pat McGrath, MD, FACS	Page 13
10:15 am	<b>Break/Exhibits</b>	
10:30 am	<b>Training of the General Surgeon: - Are we Making the Cut?:</b> Steven B. Johnson, MD, FACS, FCCM	Page 14
11:00 am	<b>Reoperative Hyperparathyroidism:</b> Clive S. Grant, MD, FACS	Page 15
11:30 am	<b>Surgical Oncology Lessons Learned:</b> Pat McGrath, MD, FACS	Page 17
12:15 pm	<b>Q &amp; A Panel</b>	
12:30 pm	<b>Lunch</b>	
1:15 pm	<b>Management of Pancreatic and Duodenal Trauma:</b> Martin Croce, MD, FACS	Page 18
2:00 pm	<b>Surgical Approaches to Thyroid Cancer &amp; Strategies for Optimal Individualized Surgical Management:</b> Clive S. Grant, MD, FACS	Page 23
2:45 pm	<b>Break/Exhibits</b>	
3:00 pm	<b>Surgeon – Performed Ultrasound: What Role Does it Have in Your Practice:</b> Amy Sisley, MD, FACS	Page 24
3:45 pm	<b>Hyperinsulism &amp; the Surgeon:</b> Clive S. Grant, MD, FACS	Page 25
4:30 pm	<b>Q &amp; A Panel</b>	
4:45 pm	<b>Adjourn</b>	

## Friday, February 6, 2015

7:30 am	<b>Continental Breakfast</b>	
8:15 am	<b>Welcome and Introduction</b> Steven B. Johnson, MD, FACS, FCCM	
8:30 am	<b>Complications of Inguinal Herniorrhaphy: From Post Inguinal Herniorrhaphy Groin Pain to Infertility:</b> Robert Fitzgibbons, Jr., MD, FACS	Page 30
9:00 am	<b>Abdominal Wall Reconstruction:</b> Martin Croce, MD, FACS	Page 42
9:30 am	<b>Primary Aldosteronism &amp; Pheochromocytoma:</b> Clive S. Grant, MD, FACS	Page 49
10:15 am	<b>Break/Exhibits</b>	
10:30 am	<b>Neoadjuvant Therapy for Breast Cancer:</b> Donald Northfelt, MD, FACP	Page 54
11:00 am	<b>Adjunctive Nutrition/Physical Activity Strategies to Reduce Cancer Relapse Risk:</b> Donald Northfelt, MD, FACP	

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## Friday, February 6, 2015 continued

11:30 am	<b>Patient panel: "My breast cancer surgical consultation: what went well, what could have been better":</b> Donald Northfelt, MD, FACP	Page 59
12:00 pm	<b>Q &amp; A Panel</b>	
12:15 pm	<b>Lunch</b>	
1:00 pm	<b>History of Colon Wounds:</b> Martin Croce, MD, FACS	Page 61
1:30 pm	<b>Current Management of Breast Cancer:</b> Pat McGrath, MD, FACS	Page 66
2:15 pm	<b>Treatment of Giant Ventral/Incisional Hernias:</b> Robert Fitzgibbons, Jr., MD, FACS	Page 67
2:45 pm	<b>Break/Exhibits</b>	
3:00 pm	<b>Ventilator Associated Pneumonia: From Soup to Nuts:</b> Martin Croce, MD, FACS	Page 77
3:30 pm	<b>Infection: The Achilles Heel of Abdominal Wall Reconstruction:</b> Robert Fitzgibbons, Jr., MD, FACS	Page 82
4:00 pm	<b>Four Generations and the Impact on Surgery:</b> Clive S. Grant, MD, FACS	Page 93
4:45 pm	<b>Q &amp; A Panel</b>	
5:00 pm	<b>Adjourn</b>	

## Saturday, February 7, 2015

7:30 am	<b>Full Breakfast</b>	
7:55 am	<b>Welcome and Introduction:</b> Kumash Patel, MD, FACS: Moderator	
8:00 am	<b>Complications Related to Prosthetic Placement at the Esophageal Hiatus:</b> Robert Fitzgibbons, Jr., MD, FACS	Page 95
8:30 am	<b>Pre-operative Screening and Risk Assessment:</b> Joshua Bloomstone, MD, CSSGB, CLS	Page 105
9:15 am	<b>Watchful Waiting for Inguinal Hernias: Current Status:</b> Robert Fitzgibbons, Jr., MD, FACS	Page 106
9:45 am	<b>Break</b>	
10:00 am	<b>Perioperative Fluid Therapies and Enhanced Surgical Recovery:</b> Joshua Bloomstone, MD, CSSGB, CLS	Page 115
10:45 am	<b>Care Surgery: The Evolution of a Specialty:</b> Amy Sisley, MD, FACS	Page 116
11:15 am	<b>Treatment of Choledocholithiasis in the era of Laparoscopic Cholecystectomy:</b> Robert Fitzgibbons, Jr., MD, FACS	Page 117
11:45 am	<b>Q &amp; A Panel</b>	
12:00 pm	<b>Adjourn</b>	

## **Blunt Cerebrovascular Injuries**

Martin A. Croce, MD, FACS

Professor of Surgery

University of Tennessee Health Science Center

Blunt carotid injuries are generally thought to be quite uncommon, if not rare lesions. Until the past decade, the majority of reports in the medical literature were basically case reports, with large series being in the vicinity of ten patients accumulated over one to two decades. The trend toward regionalization of trauma care in the United States and many other countries around the world has led to a number of uncommon injury types being filtered into fewer referral centers. In 1990, we noted that there were a total of 96 cases of BCVI reported in the literature up to 1980, and that over the ensuing decade there were another 75 cases reported. In the subsequent five years, we have identified 242 additionally reported cases, which yields 480 BCVI patients from all of these reports. Are there more cases being recognized, or has the funneling effect provided enough cases at individual institutions to stimulate interest in evaluation and publication? Both phenomena are likely involved. However, we believe that BCVI remains an underdiagnosed problem.

Davis and colleagues have reported an incidence of 0.08% among blunt trauma victims admitted to trauma centers in the San Diego area. We found an incidence of 0.33%, four times greater than that report. A recent multicenter study involving 11 trauma centers reported on 49 patients (60 arterial injuries) over a six-year period. Those results compared with the present study would support the suggestion that many injuries are not recognized.

Issues relating to diagnosis are salient because the present data demonstrate that early diagnosis (prior to significant symptoms) affords improved outcome, and that outcome is improved because of the positive effect associated with therapy. The most likely explanation for our relatively large experience with BCVI is the aggressive diagnostic approach of our neurosurgical colleagues. They evaluate blunt trauma admissions that have evidence of even mild head injury. The potential for carotid injury is considered in nearly all cases. Thus, mild deficits are sought, with or without significant head injury, and pursued by angiography if the CT scan does not clearly demonstrate intracranial pathology accounting for the deficit. Horner's syndrome is produced by stretching of the sympathetic plexus and interruption of the superior sympathetic ganglion, which is the basic mechanism which produces the ICA intimal injury. Prompt recognition followed by angiography will yield good outcomes, especially in the absence of associated brain injury. Blunt carotid lesions can be easily missed in the face of significant associated closed head injury (CHI). Approximately 70% of patients with BCVI are diagnosed after they have had major deficits, and 43% developed their deficit following hospital admission. There are two potential approaches to enable diagnoses prior to progression of symptoms: 1) definition of a target population identified as being high risk for BCVI; 2) broad scale diagnostic screening programs. There are major problems with either of these approaches.

A broad scale screening program is probably the best way to diagnose asymptomatic lesions. However, conventional arteriography is not a practical approach for mass screening. Duplex doppler examination has been reported accurate for the diagnosis in 12 of 14 BCVI. Lesions high in the ICA will be difficult to evaluate by doppler. Though that approach is appealing, it would require a substantial commitment of resources and personnel. At a time when resource utilization is coming under increasing scrutiny, there are probably many institutions which would have difficulty making that commitment. Magnetic resonance angiography may also have a place for wide scale screening in the future, but costs and resource availability are currently prohibitive. Until such technologic avenues are open, it is doubtful that there will be substantial improvement in earlier diagnosis and subsequent outcome of BCVI.

Many institutions have adopted computed tomographic angiography (CTA) to replace DSA since it is less resource intensive, less invasive, and less expensive. While CTA has been widely adopted for BCVI screening, evidence of its diagnostic sensitivity is marginal. Previous studies have reported varying CTA sensitivities ranging from 41-98%, and often these studies are difficult to interpret because not all patients had both CTA and DSA. Previous work from our institution using 32-channel multidetector CTA in 684 patients demonstrated a sensitivity of 51%.

Digital subtraction angiography has long been the reference standard for screening, identifying, and treating BCVI. Some prior publications report excellent sensitivity for CTA, but only obtain the reference angiography on patients with positive results on CTA, which would falsely elevate sensitivity and potentially miss injuries. The group from Dallas in 2006 reported a 98% sensitivity in 146 patients screened using 16-channel CTA scanners. In 2007 the group from Richmond reported a sensitivity of 74% on 92 patients, and suggested a radiology learning curve, as their results approached 100% in the second portion of the 40-month study. Unfortunately, ensuing studies have not replicated these results. In 2008, the group from Baltimore reported 77 patients screened using CTA with a sensitivity of 64%. A year later, investigators from Columbus screened 158 patients with 16- and 64- channel CTAs, and reported an improvement in sensitivity from 29% to 54%. In 2011, our institution analyzed 684 patients that underwent *both* CTA and DSA and reported a sensitivity of 51% for the 32-channel multidetector CTA.

From 2009-2010, both the Western Trauma Associations (WTA) and Eastern Association for the Surgery of Trauma (EAST) made recommendations pertaining to BCVI screening. Both guidelines recognize the role of DSA as the reference standard, but suggest 16-channel CTA may be an adequate screening modality. In a 2011 survey conducted among trauma surgeons, neurosurgeons, and radiologists, sixty percent of practitioners in North America report using CTA for screening and diagnosis of BCVI while only fifteen percent continue to use the reference standard of DSA despite the relatively poor sensitivity of CTA.

In 2014, a report from our institution evaluated 594 patients who underwent both DSA and *64 channel* CTA. The more technically advanced scanner resulted in improved

sensitivity and specificity. Considering the complications, cost, and resource demands associated with DSA, this study suggests that these newer scanners may replace DSA as the primary screening tool for patients with BCVI.

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## BENIGN NONFUNCTIONAL ADRENOCORTICAL TUMORS

Clive Grant  
Mayo Clinic

### Criteria for Diagnosis

- $\geq 1$  cm diameter
- Well defined

### Exclude

- Suspected hormonal hyperfunction
- Prior/concurrent malignancy
- Localized tumor symptoms/signs
- Constitutional symptoms of malignancy

### Assessment for Biochemical Hormonal Hyperfunction

- 24-hr urine metanephrines, fractionated catecholamines
- 1-mg overnight DST
- If  $\uparrow$  BP: serum K<sup>+</sup>, PAC/PRA (see evaluation aldosteronism above)

### Assessment for Possible Adrenal Malignancy

#### *Tumor Characteristic: Size and Phenotype*

##### Adenoma

- Size--small, typically  $\leq 3$  cm
- Shape--round to oval, smooth margins
- Texture--homogeneous, low density
- Laterality--solitary, unilateral
- Contrast enhancement—limited
- MR imaging—iso-intense to liver on T2-weighted image
- Necrosis, hemorrhage, Ca<sup>2+</sup>--rare
- Growth--usually stable, very slow growth

##### Adrenocortical carcinoma

- Size--large, typically  $> 4$  cm
- Shape--irregular, unclear margins
- Texture--inhomogeneous, mixed densities
- Laterality--solitary, unilateral
- Contrast enhancement--vascular, marked
- MR--hyperintense on T2
- Necrosis, hemorrhage, Ca<sup>2+</sup>--common
- Growth—rapid

##### Based on observations:

- ~10% incidentalomas hyperfunctional, autonomous
- $< 5\%$  adrenocortical carcinomas
- 95% adrenocortical cancers  $> 4$  cm
- 95% cortical adenomas  $< 5$  cm
- Imaging phenotype very helpful
- FNA rarely indicated

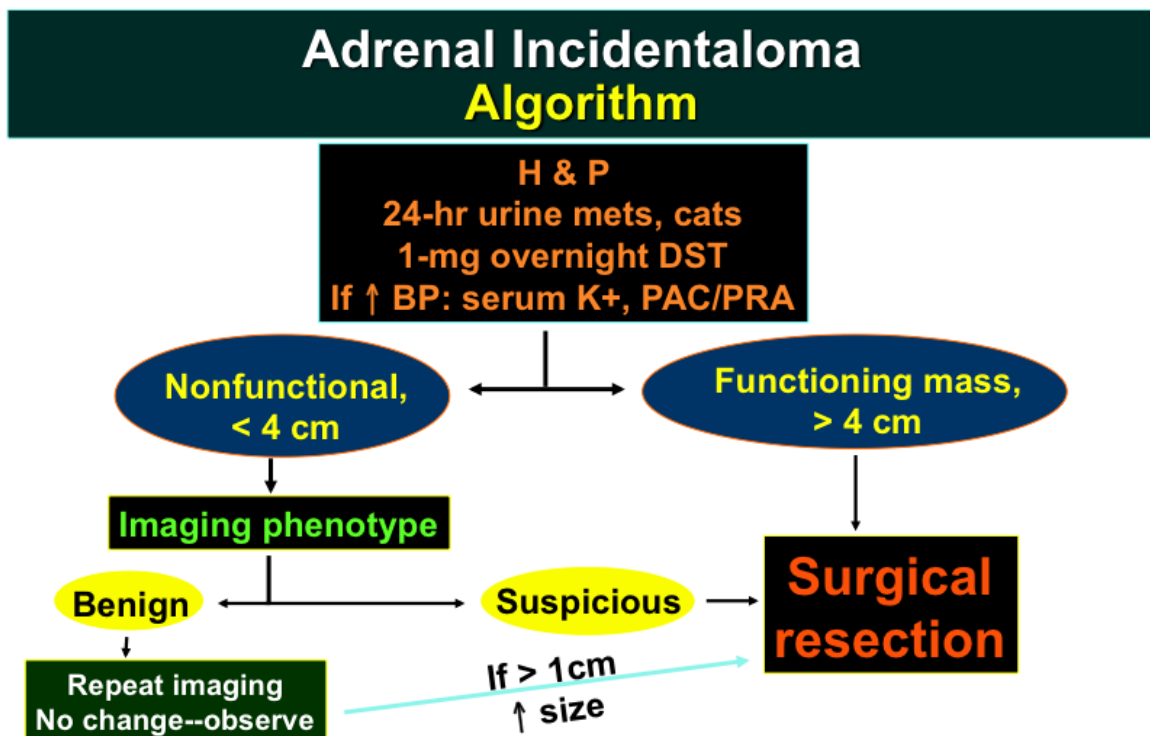
##### Recommendations



- Endocrine evaluation tumors  $\geq 1$  cm
- Resection tumors  $\geq 4$  cm
- Observation: CT re-evaluation  $\sim 3$  months

### SURGICAL INDICATIONS

Almost all patients with aldosteronomas, benign tumors causing Cushing's syndrome, and small non-functioning tumors, and the overwhelming majority of pheochromocytomas can be safely and effectively removed laparoscopically. Large pheochromocytomas may require open or hand-assisted resection to facilitate removal through an enlarged abdominal incision, and safe dissection. For large adrenocortical neoplasms that may be carcinoma, we have usually favored an open, anterior approach. However, if all surgical oncologic principles can be followed laparoscopically as would be through an open approach, then we would consider the lesser-invasive approach. This implies that the tumor is well-circumscribed, does not involve other organs and has no intravascular tumor extension, can be dissected and removed completely in tact, and excision of associated fat and lymph node bearing tissue can also be excised. From our experience, this is rare.



Note Page for

**Strategies for Treatment of Complex Malignancies:**  
Pat McGrath, MD, FACS

Note Page for

**Training of the General Surgeon: - Are we Making the Cut?:**  
Steven B. Johnson, MD, FACS, FCCM

## CLINICAL MANAGEMENT OF PERSISTENT AND RECURRENT PRIMARY HYPERPARATHYROIDISM (HPT)

Clive S. Grant, M.D.

Professor of Surgery

Mayo Clinic

For more than 3 decades, it has been our policy to advise cervical exploration for patients with primary HPT. Such advice seems justified since eucalcemia is restored in at least 95% of patients, mortality is nearly nil, and morbidity is <1% when the operation is performed by an experienced surgeon. Successful initial cervical exploration is critically dependent on 2 elements: a correct diagnosis and a qualified surgeon. With the conviction that the diagnosis is accurate, the surgeon will almost invariably locate the enlarged parathyroid gland in the neck or upper mediastinum. Following a patient systematic approach, search even for an elusive gland will be rewarded with success.

In contrast, reoperative parathyroid surgery is far more complex, requiring a number of considerations both before and during the procedure. No less crucial, in fact magnified, are the elements of accurate diagnosis and surgical expertise. The indications for reexploration may be more stringent, sometimes excluding the patient with minimal symptoms and mild hypercalcemia. The operative strategy, including considerations both before and during the procedure are considerably more demanding and involve substantially higher risk than for initial explorations. Despite the diligent input of a team of specialists, the likelihood of restoring eucalcemia drops to 67-75%. The patient's perspective must be appreciated. Disappointed with initial failure to cure the disease, he/she faces the continued threat of disease complications or the specter of yet another operation. This procedure, the patient learns, bears higher risk, reduced likelihood of success, even the possibility of a median sternotomy, and up to a 15-30% chance of needing lifelong, unpalatable medication. All this, and it will cost at least 2-3 times as much as the first operation, not to mention time lost and money spent for *repeat* preoperative testing and prolonged hospitalization.

### **Reoperative Strategy**

The sequential concepts that optimize reoperative HPT surgery include:

1. Reestablish the diagnosis unequivocally
  - a. Consider the presence of MEN or familial HPT
  - b. Exclude FHH
2. Attempt review of prior operative notes and pathology slides even though often confusing, inadequate, or misleading

3. Localization
4. Indications for reoperation
5. Obtain vocal cord analysis
6. Reoperate in <1 week or >3-4 months
7. Direct vs. lateral cervical approach
8. Consider relevant anatomy—RLN, carotid artery, phrenic nerve, innominate artery and vein
9. IOPTH monitoring
10. Consider autotransplantation

## Conclusion

To embark on a parathyroid reoperation necessitates not only the capacity and patience to complete the evaluation as described previously, but also a thorough knowledge of parathyroid and cervical anatomy, and true "hands-on" experience in parathyroid surgical technique. While the characteristic color and texture of both normal parathyroid glands and adenomas are generally easily recognized during *initial* cervical exploration, fibrous scar tissue invariably obscures these as well as the usual dissection planes in the reoperative setting. Tactile as well as visual discrimination plays an important role in parathyroid reexplorations.

The causes for failure of the initial cervical exploration include unrecognized multiple gland disease, parathyroid carcinoma, inaccurate diagnosis, and rupture of a hyperplastic gland with subsequent seeding (parathyromatosis). But by far the majority is due to a missed adenoma in the neck. Although blamed on unusual, ectopic locations of these glands, we agree with Rothmund: "a normal position of a parathyroid gland or a tumor also includes a superior gland located underneath the inferior thyroid artery lying beside the esophagus or a lower gland located in the thyrothymic ligament or in the thymus itself. These are at least typical variations. *Not to find enlarged glands in these positions does not mean lack of experience, it means lack of knowledge.*" Reoperative parathyroid surgery requires cooperation of an expert team of physicians, thoroughly conversant with all aspects of the diagnosis, surgical indications, localization, and operative strategy. Despite our operative experience with more than 600 parathyroid reoperations at the Mayo Clinic since 1978 and the significant advances including localization and IOPTH, resolution of hypercalcemia is still limited to about 90%.

Note Page for

**Surgical Oncology Lessons Learned:**  
Pat McGrath, MD, FACS

## **Management of Pancreatic and Duodenal Trauma**

Martin A. Croce, MD, FACS  
Professor of Surgery  
University of Tennessee Health Science Center

The duodenum is primarily a retroperitoneal structure and is relatively well protected. However, injuries to the duodenum are fraught with potential complications for several reasons. The duodenum is primarily a retroperitoneal structure, much of it is devoid of serosa, and repairs have a higher failure rate. Secondly, there is a large volume of combined gastric, biliary, and pancreatic juices which traverse the duodenum, and leakage of these contents can be catastrophic. Finally, the duodenum is in close proximity to other major vascular structures and obviously the pancreas.

There are a number of described techniques for management of simple and complex duodenal injuries. Many of these have been described in conjunction with associated pancreatic injuries. The simplest method is primary repair of the duodenum. This may be accomplished in either a single or double layer of suture. If the wound is simple, without devascularization of tissue, and the defect may be closed without tension, then primary repair is the method of choice for these simple, low-grade duodenal injuries. More complex injuries, however, may require more complex operative procedures. Twin jejunostomies were described by Stone and Fabian years ago and this method of management remains an integral part of management of duodenal injuries. This technique should be reserved for more complex injuries but still duodenal repair should be accomplished without tension on the suture line. Placement of the afferent jejunostomy allows for internal drainage of the duodenum and the efferent tube may be used for enteral feeding. For even more complex injuries, including those on the medial wall of the duodenum, then pyloric exclusion is our preferred technique. This is typically combined with afferent and efferent jejunostomies and will allow for duodenal healing with diversion of enteric contents. The algorithm demonstrates our preferred management technique for simple and more complex duodenal injuries. Pancreaticoduodenectomy should be reserved for completely devascularizing injuries or destructive injuries to the ampulla and these should be rare events.

The pancreas is likewise a retroperitoneal structure and combined pancreaticoduodenal injuries are not uncommon following penetrating injury. While there have been a number of methods described for pancreatic injury management we think that the simplest methods afford the best results. This management scheme is based on pancreatic ductal integrity, which can be determined operatively. There is no need for preoperative ERCP or even intraoperative pancreatography in the overwhelming majority of cases. Ductal integrity can be determined based on the location of the injury, presence of visible secretion of pancreatic juice, and the severity and extent of injury to the

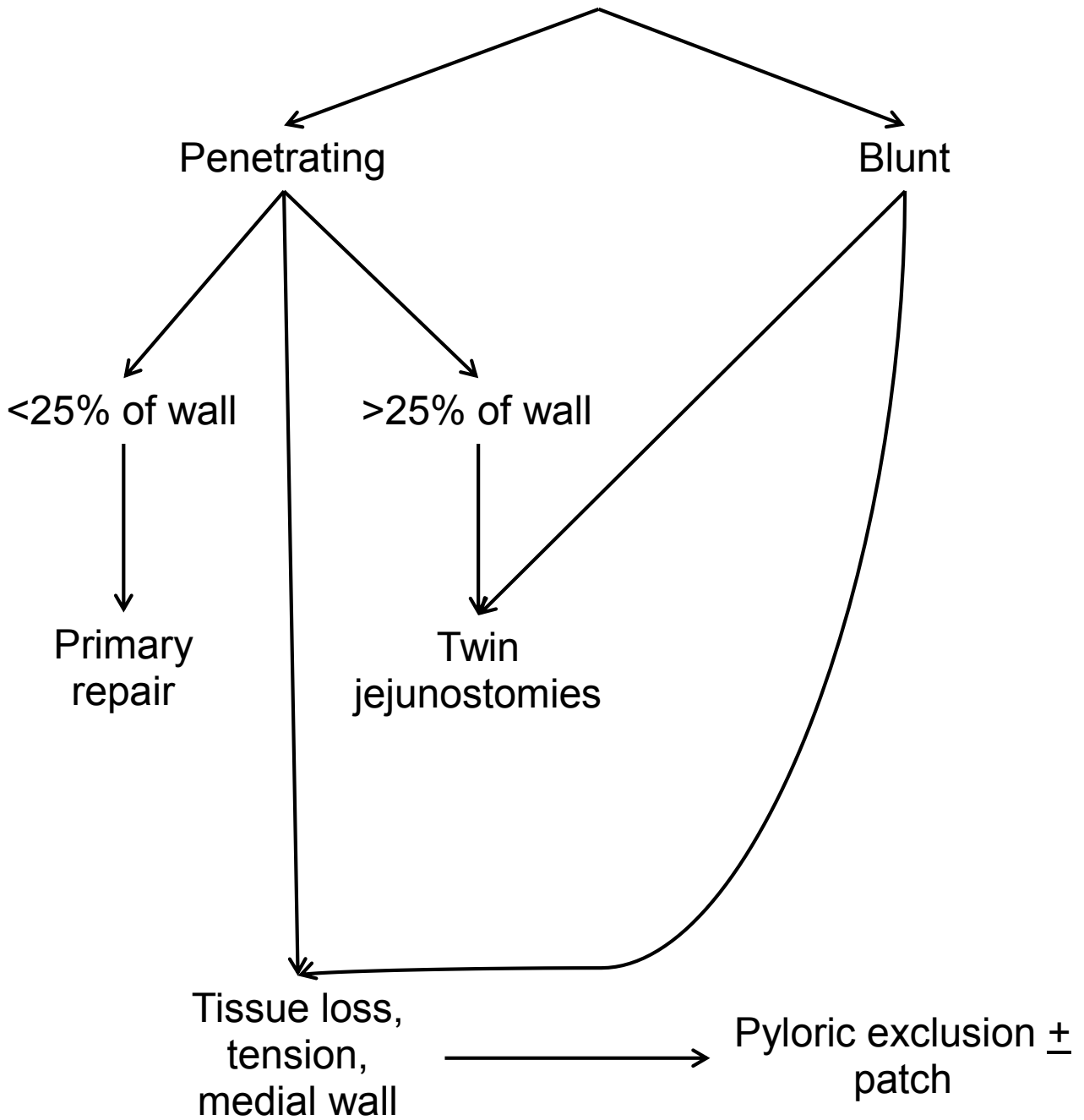
pancreas. For distal injuries, if there is ductal involvement, our preferred method of treatment is a distal pancreatectomy with or without splenectomy. In general, we perform splenectomy since it substantially reduces operative time. If there is no distal injury in the distal pancreas, closed suction drainage is the management of choice. For pancreatic head injuries we employ closed suction drainage routinely and very rarely perform pancreatic resection for pancreatic head injuries. Pancreaticoduodenectomy should be reserved for patients in whom there is either ampullary destruction or if the dissection has basically been completed by the injury itself. The below algorithm illustrates our management of pancreatic injuries. When compared to other published data this seems to be the optimal management technique for simple and complex pancreatic injuries regardless of the mechanism.



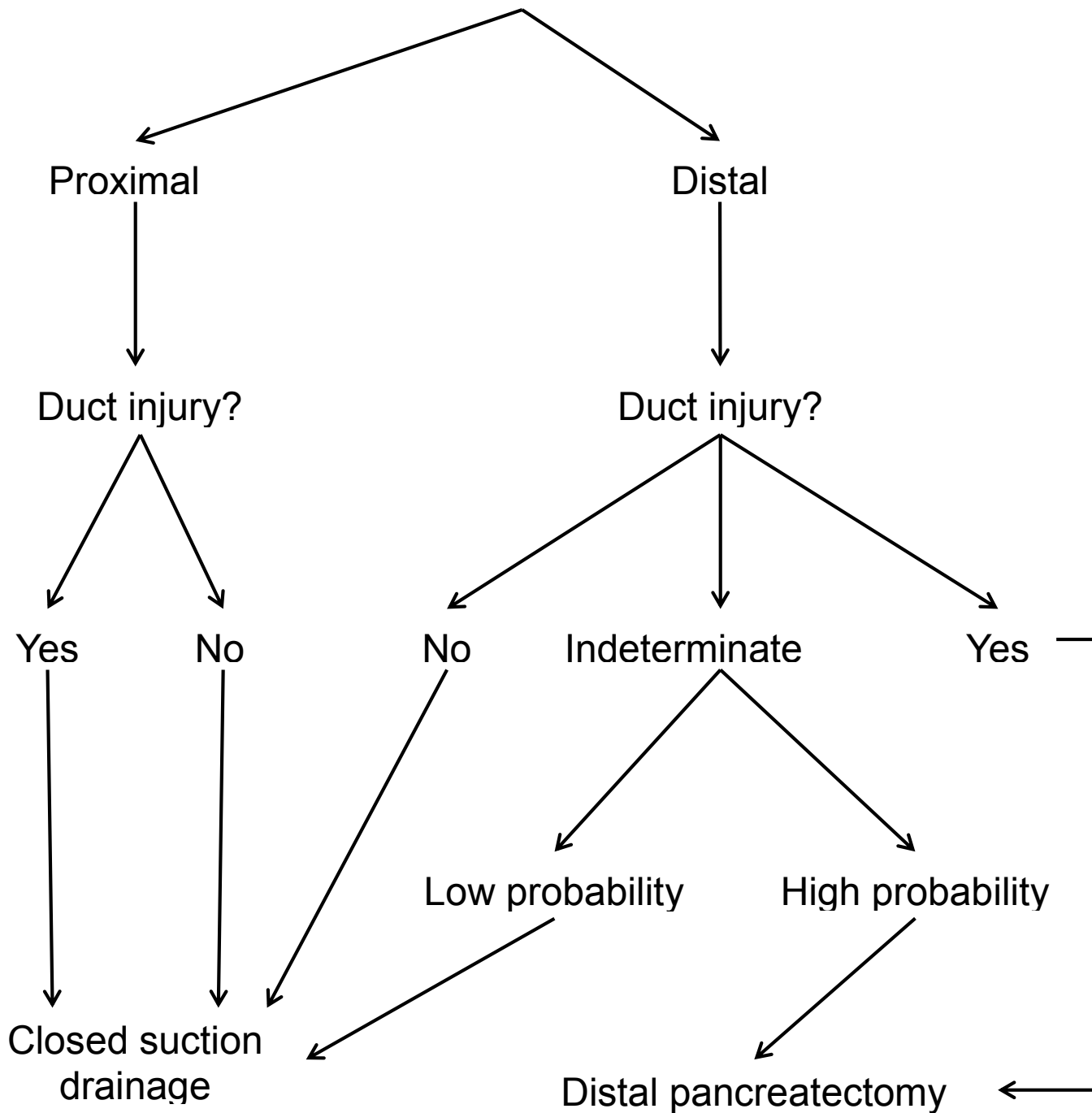
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# Duodenal Injury



# Pancreatic injury



Papillary Thyroid Cancer:  
Strategies for Optimal Individualized Surgical Management  
Clive Grant  
Mayo Clinic

Papillary thyroid carcinoma is nearly unique among nondermatologic invasive malignancies because 1) it is rarely lethal, and 2) regional metastatically involved lymph nodes do not portend distant metastases and inevitable death. From 85-90% of PTC patients will have a 30-year disease-specific death rate of about 3%. These outcomes are extraordinary, but they are not new or unexpected. The uncommon patient with high-risk PTC needs complete resection of all disease if possible followed by RAI or other appropriate adjuvant therapy. The high-risk patient's outcome is probably dictated more by the inherent biology of the disease and less by the treatment rendered.

Disease **recurrence** is usually different. True soft tissue recurrence—almost never encountered in low-risk PTC—is often invasive of soft tissues and structures adjacent to the thyroid bed, and may be a harbinger of lethal disease.

In contrast, LNMs are the most common form of disease relapse either in the central or lateral neck. In the setting of a low-risk primary PTC, they pose minimal threat to the patient's well-being from a malignancy standpoint. With few exceptions, LN relapse is reported to occur in 15-50% of patients—including low risk. But we as surgeons **can** influence this. Clearly, not all lymph nodes with microscopic PTC, if left *in situ*, will become clinically apparent. But we cannot presently distinguish which will from those that will not. If the contention that damage to the RLN is reason to avoid removing these nodes, the concept is badly misguided. These nerves require exposure and protection in every thyroid cancer case. I think it is incumbent on any surgeon undertaking a thyroidectomy to have the requisite skills to preserve the RLNs. However, balancing the risk of hypoparathyroidism against *prophylactic* central neck dissection requires careful consideration. In my view, the optimal management of routine central neck LN dissection can be achieved in nearly all patients with preservation of at least 1 well-vascularized parathyroid gland. When parathyroid preservation is in serious doubt, if avoidance of LN dissection will assure a viable parathyroid gland, this trade-off seems reasonable. For the relative few, perhaps 10-20% of patients, with consequent central neck LN relapse, referral to a center specializing in reoperative thyroid surgery would be an excellent alternative—what I refer to as “Plan B”.

Note Page for

**Surgeon – Performed Ultrasound: What Role Does it Have in Your Practice:**

Amy Sisley, MD, FACS

## Insulinoma

Clive S. Grant, M.D.

Professor of Surgery

Mayo Clinic

### Preoperative Management

#### Symptoms

- Fasting
- Relief of symptoms with glucose administration

<b>Neuroglycopenia (glucose &lt;50 mg/dL)</b>	<b>Autonomic Response (glu &lt;55 mg/dL)</b>
Diplopia	Sweating
Blurred vision	Weakness
Confusion	Tremor, palpitations
Abnormal behavior	Feeling warmth
Amnesia	Anxiety

#### Diagnosis

Whipple's Triad (historic interest, still clinically sound)

- Symptoms of hypoglycemia
- Plasma glucose level <50 mg/dL
- Relief of symptoms with administration of glucose

#### Current biochemical criteria

- Plasma glucose  $\leq$  45 mg/dL
- Concomitant insulin levels  $\geq$  6  $\mu$ U/ml by IRMA ( $\geq$  3 $\mu$ U/ml by ICMA)
- Elevated C-peptide levels  $\geq$  200 pmol/L
- Absence of sulfonylurea in the plasma

#### Adjuncts for biochemical diagnosis

- Insulin to glucose ratios are inaccurate (34% in our experience)
- Insulin "surrogates" may be valuable as insulin assay is sometimes difficult technically; when glucose is  $\leq$  50 mg/dL and patient is symptomatic for hypoglycemia, draw following tests in addition to above key laboratory tests:
  - Beta-hydroxy butyrate (a ketone) is suppressed when insulin is present
  - Glucose response to glucagon (1 mg) in setting of insulinoma will rise  $\geq$  25 mg/dL (check every 10 minutes over 30 minutes)

## Localization

- Preoperative transabdominal ultrasonography
  - Inexpensive, non-invasive, widely available
  - Highly operator dependent, markedly varied accuracy
  - Partially filling the stomach with fluid enhances ability to evaluate distal body and tail of pancreas
  - Most PNETs are hypoechoic compared to surrounding normal pancreatic parenchyma
- CT scan
  - Relatively noninvasive, widely available
  - Triple phase (“pancreas protocol”) rapid IV infusion, rapid sequence, thin cuts
  - Best imaging study to allow interpretation by surgeons to aid in surgical planning
  - Computer reconstructions can aid in identification when overlying vessels may obscure tumor
- Endoscopic ultrasound
  - Perhaps best single test for localization
  - Very operator dependent
  - Much more difficult for surgeon to interpret anatomic relationships
  - Advantage of US-directed fine needle aspiration (FNA) if necessary
- Arteriography with Selective Arterial Calcium Stimulation
  - Reserved for lack of localization by other means noted above
  - Invasive, requires considerable interventional radiologist expertise
  - Selective cannulation of gastroduodenal, superior mesenteric, and splenic arteries
  - Injection of calcium with venous catheterized right hepatic vein sampling at 20, 40, and 60 seconds after each subselective artery injection
  - Regionalization—not truly localization
  - Aberrant anatomy must be recognized and influence appreciated
- Intraoperative US (IOUS)
  - Extremely useful adjunct—we have radiologist scrub and perform
  - Find or confirm exact presence of tumor and elucidate anatomic relationships, particularly the main pancreatic duct

## Preoperative Risk Assessment (implications regarding open vs laparoscopic intervention)

- Patient factors
  - Obesity—not uncommon since patients with insulinomas must consume sugar-containing products frequently to sustain normal mental function—all operative aspects technically more difficult
    - ✓ May be more difficult to identify small tumors in enlarged fatty pancreas
    - ✓ Increases risk dramatically for pancreatic head resection and reconstruction (Whipple procedure) due to soft pancreas and consequent risk of anastomotic leak from pancreaticojejunal anastomosis

- ✓ Distal pancreatic resections have higher association of postoperative development of diabetes
  - Initial vs reoperation
    - ✓ Prior pancreatic mobilization and/or resection may increase pancreatic firm consistency—compromise ability to feel pancreatic neuroendocrine tumor (PNET)
    - ✓ Size of remaining pancreas if resection necessary—be aware of potential for pancreatic exocrine and endocrine insufficiency
  - Sporadic vs MEN-1 patient
    - ✓ Sporadic patients have >95% single tumor
    - ✓ MEN-1 patients have nearly 100% multiple PNETs
- Tumor factors
  - Location
    - ✓ Tail—most straightforward—either enucleation or resection
    - ✓ Neck/body: enucleation preferred. Can resect and if patient not obese, likely even with distal resection can avoid diabetes and exocrine insufficiency
    - ✓ Head: most dangerous. Enucleation far preferred unless tumor buried or characteristics of malignancy
    - ✓ Uncinate: care in gaining exposure. Enucleation much preferred—main PD usually well away from tumor
  - Benign vs malignant
    - ✓ >95% insulinomas benign
    - ✓ Nonfunctioning PNETs <2 cm often benign
    - ✓ A PNET that causes narrowing of main pancreatic duct (PD) with distal dilatation should be considered malignant
    - ✓ Irregular borders on PNET strong sign of malignancy—requires resection rather than enucleation
    - ✓ Benign PNETs may have lobulated borders
  - Relationship to important structures
    - ✓ Most important is PD. If adjacent to PD, even if deviating its course, PNET can be enucleated with precise dissection
    - ✓ Account for adjacency to common bile duct (CBD), gastroduodenal artery (GDA; PNET behind can still be enucleated with ligation of GDA), duodenal wall, splenic vein
- Surgeon factors
  - Experience/expertise
    - ✓ Overall pancreatic surgery
    - ✓ Resection vs enucleation
    - ✓ Open vs laparoscopic
- Medical center experience, capabilities
  - Established protocols, instrumentation, personnel, laboratory support for diagnosis, localization



- Operative team prepared for intraoperative plan and changes in plan with alternate operative procedures
- Interventional radiology/gastroenterology when necessary for postoperative intervention (ability to rescue)

### Postoperative Management

- During the first 24 hours the blood glucose level typically rises to 130-160 mg/dL even just with enucleation, and above 200 mg/dL if significant pancreatic resection was necessary.
- Small doses of insulin may be necessary for a few days postoperatively, but in some patients may extend for several weeks.
- Vaccinations are given to patients who have undergone splenectomy prior to leaving the hospital.
- Enucleation sites may develop temporary localized inflammation and small adjacent fluid collections. If these are located adjacent to the duodenum in the head or uncinata, or on the anterior surface of the pancreas in the neck or body of the pancreas, they can cause irritation to either the duodenum or stomach with consequent transient nausea, food or fluid retention that usually is self-limited over 10-14 days. If reassured, patients can usually eat and drink adequately outside the hospital during this time of resolving inflammation. CT imaging offers reassurance that no significant size pseudocyst or other problem exists that might require intervention.

### Complications

- Non-pancreatic complications—usual problems of major abdominal operations of this magnitude
- Pancreatic (15-25%)
  - All related to pancreatic ductal leak: pseudocyst, abscess, fistula
  - Most can be managed with interventional radiology/gastroenterology rather than reoperation
    - ✓ Drain placement for fluid collections
    - ✓ Papillotomy can be added to diminish distal duct fistula
    - ✓ PD stent to seal side duct leak

### Outcomes and Follow-Up

- Because >90% are benign, excision of insulinomas is almost always curative
- After an interval of insulin/glucose adjustment and sometimes weight loss, glucose regulation usually returns to normal
- Recurrence of hypoglycemia
  - Retained portion of the tumor in same location (<5%)
  - Malignancy with either local recurrence or metastasis (functioning)
- Convalescence is typical for any major abdominal operation
  - Even a temporary period of insulin supplement may be required if hyperglycemia persists post-hospitalization. With weight loss and gradual autoregulation,

especially since continual caloric intake is no longer required for mental functioning after excision of the tumor, euglycemia is often eventually restored.

- No need to obtain any screening laboratory studies for tumor recurrence—if recurrence occurs, the prototypical symptoms the patient experienced preoperatively will return. Documentation of endogenous insulin oversecretion with serious hypoglycemia would again be required.

**Complications of Inguinal Herniorrhaphy: From Post Inguinal Herniorrhaphy Groin Pain to Infertility**

Robert J. Fitzgibbons, Jr., MD FACS  
 Harry E. Stuckenhoff Professor of Surgery  
 Creighton University School of Medicine  
 Omaha, Nebraska

Friday February 6, 2015

**Faculty Disclosure**

- ⌘ Ad Hoc Paid Consultant (In the last year)
  - ⊖ None
- ⌘ Retainer
  - ⊖ None
- ⌘ Speaker's Bureau
  - ⊖ None
- ⌘ Grant Support (In the last 2 Years)
  - ⊖ None
- ⌘ Fellowship Support
  - ⊖ None
- ⌘ Financial interest (≥ \$10,000 US)
  - ⊖ None
- ⌘ Royalty
  - ⊖ Cook Critical: Fitzgibbons, Jensen, Gohetter
- ⌘ I will not discuss Off Label Use of Products


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**Groin Hernia: The Scope of the Problem**

- ⌘ **Definition**
  - ⊖ Inguinal
    - ⊖ Direct ~ 32%
    - ⊖ Indirect ~ 63%
  - ⊖ Femoral ~ 5%
- ⌘ **Lifetime Risk**
  - ⊖ Male 27%
  - ⊖ Female 3%
- ⌘ **Right > Left**
- ⌘ **10 Times More Common in Males**

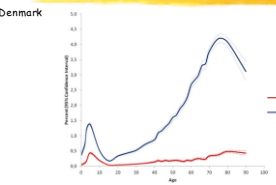
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**Important Terms**



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**Percentage of Persons at a Given Age Operated For a Groin Hernia**



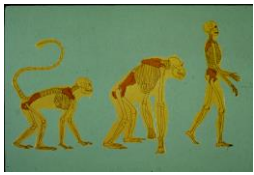
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**Groin Hernias in Women**

- ⌘ **Femoral Hernias are More Common in Women Than Men**
- ⌘ **A Woman With A Groin Mass is Still 5 Times More Likely to Have an Inguinal Hernia Than A Femoral**
- ⌘ **Inguinal Hernias in Women Are Almost Always Indirect**
- ⌘ **35-40% of Femoral Hernias Present With Strangulation**

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**Why Do Humans Develop Inguinal Hernias?**




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**Why Do Humans Develop Inguinal Hernias?**

- ⌘ **Male Sex**
- ⌘ **Family History**
- ⌘ **COPD/ Smoking**
- ⌘ **High Intra-abdominal Pressure**
- ⌘ **Collagen Vascular Disease**
- ⌘ **Thoracic Or Abdominal Aortic Aneurysm**
- ⌘ **Patent Processus Vaginalis**
- ⌘ **Matrix Metalloproteinase Abnormalities**

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**Heavy Lifting?**

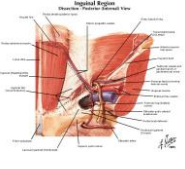


- ⌘ **Occasional Heavy Lifting?**
- ⌘ **Repeated Heavy Lifting?**
- ⌘ **A Single Strenuous Lifting Episode?**
- ⌘ **Recent Systematic Review was Inconclusive\***

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### Critical Anatomy From an Abdominal Perspective

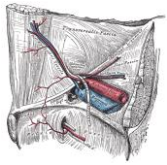
- ⌘ Inferior Epigastric Vessels
- ⌘ Iliac Vessels
- ⌘ Internal Spermatic Vessels
- ⌘ Vas Deferens
- ⌘ Inguinal Ligament
- ⌘ Direct Indirect And Femoral Hernia Spaces
- ⌘ Transverses Abdominis Muscle
- ⌘ Aponeuritic Arch
- ⌘ Rectus Abdominis Muscle
- ⌘ Iliopsoas Muscle
- ⌘ Superior Pubic Ramus With Attached Cooper's Ligament



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### The Myopectineal Orifice of Fruchaud

- ⌘ Bordered By:
  - ⌘ Termination Of The Aponeuritic Fibers Of The Transverses Abdominis Muscle Cranially
  - ⌘ Rectus Abdominis Muscle Medially
  - ⌘ Iliopsoas Muscle Laterally
  - ⌘ Superior Pubic Ramus With Attached Cooper's Ligament Inferiorly



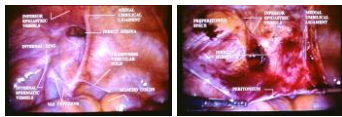
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### Common Cause of all Groin Hernias

Failure of the Peritoneum/Transversalis Fascia to Retain Intraabdominal Contents from Protruding Through Myopectineal Orifice Of Fruchaud

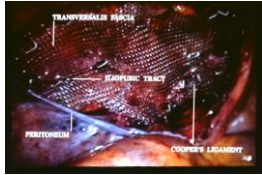
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### Preperitoneal Space



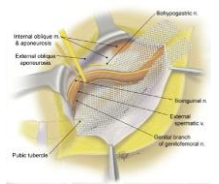
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### Mesh Between the Transversalis Fascia and the Abdominal Wall



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### Anterior Anatomy



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### Treatment of a Groin Hernia

- ⌘ Open (Anterior)
  - ⌘ Sutured Repair
  - ⌘ Prosthetic Repair (Tension Free Repair or TFR)
- ⌘ Preperitoneal (Posterior)
  - ⌘ Groin Approach
  - ⌘ Laparoscopic
    - ⌘ Transabdominal Preperitoneal (TAPP)
    - ⌘ Totally Extraperitoneal (TEP)

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### Inguinal Herniorrhaphy Complications

- ⌘ Recurrence
- ⌘ Chronic Groin Pain
- ⌘ Wound
- ⌘ Cord & Testicular
- ⌘ Bowel & Bladder Injury
- ⌘ Prosthetic
- ⌘ General
- ⌘ Laparoscopic

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**February 6, 2015 43rd Annual Phoenix Surgical Symposium**  
**Complications of Inguinal Herniorrhaphy: From Post Inguinal Herniorrhaphy**  
**Groin Pain to Infertility**  
**Robert Fitzgibbons**

### Inguinal Herniorrhaphy Complications

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- ⌘ Chronic Groin Pain
- ⌘ Wound
- ⌘ Cord & Testicular
- ⌘ Bowel & Bladder Injury
- ⌘ Prosthetic
- ⌘ General
- ⌘ Laparoscopic

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### Groin Herniorrhaphy Recurrence

## Tension Free Vs. Sutured

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### Groin Herniorrhaphy Recurrence

REVIEW

Repair of Groin Hernia With Synthetic Mesh  
 Meta-Analysis of Randomized Controlled Trials  
 The ESI Hernia Trials Collaboration

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### Groin Herniorrhaphy Recurrence

- ⌘ Population Based Studies (as Apposed to Personal Series) Demonstrate Recurrence Rates of 10-15% for Sutured Repairs\* In The General Surgical\*
- ⌘ Wide Spread Adoption of the Routine Use of a Prosthesis ↓ Recurrence Rates 50-75%\*

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### Groin Herniorrhaphy Recurrence

## Tension-Free Vs. Laparoscopic

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### Groin Herniorrhaphy Recurrence

- ⌘ An Often Referenced Cochrane Analysis Including 41 Randomized Trials Demonstrated No Significant Difference In Recurrence Rates Between Open Mesh And Laparoscopic Repairs\*
- ⌘ More Recent Data for a Primary Hernia Repair Shows ↑ Recurrence Rate for Laparoscopy
- ⌘ Large Cohort Study from England
- ⌘ More Recent Meta-analysis Including 27 Randomized Trials (Mainly TEP)\*
- ⌘ No Difference for Recurrent Hernias\*

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Treadwell J, Tipton K, Oyesami O, Sun F, Schoelles K. Surgical options for inguinal hernia: comparative effectiveness review. Agency Healthc Res Qual. 2012;Comparativ(70):1-121.9

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### 30 Trials Reporting Recurrence

Year	Open	TEP	TOT	Open	TEP	TOT
1990	1	0	1	0	0	0
1991	1	0	1	0	0	0
1992	1	0	1	0	0	0
1993	1	0	1	0	0	0
1994	1	0	1	0	0	0
1995	1	0	1	0	0	0
1996	1	0	1	0	0	0
1997	1	0	1	0	0	0
1998	1	0	1	0	0	0
1999	1	0	1	0	0	0
2000	1	0	1	0	0	0
2001	1	0	1	0	0	0
2002	1	0	1	0	0	0
2003	1	0	1	0	0	0
2004	1	0	1	0	0	0
2005	1	0	1	0	0	0
2006	1	0	1	0	0	0
2007	1	0	1	0	0	0
2008	1	0	1	0	0	0
2009	1	0	1	0	0	0
2010	1	0	1	0	0	0
2011	1	0	1	0	0	0
2012	1	0	1	0	0	0
2013	1	0	1	0	0	0
2014	1	0	1	0	0	0
2015	1	0	1	0	0	0
TOTAL	30	0	30	0	0	0

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### Recurrence Results(Meta-analysis)

- ⌘ Recurrence Was More Likely After Laparoscopic Surgery Than After Open Surgery
- ⌘ Open 2.49%
- ⌘ Laparoscopic 4.46%
- ⌘ Conclusion: The Difference Between Open And Laparoscopy, While Statistically Significant, is Not Substantial.

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### Groin Herniorrhaphy Recurrence

- ⌘ Numerous Studies Have Shown That the Most Important Factor is the Experience of the Surgeon
- ⌘ Inexperienced Surgeons Have Poorer Results With Higher Complication and Recurrence Rates
- ⌘ Steep Learning Curve: Number Of Procedures Required to Become Proficient is Not Clearly Defined

Friday February 6, 2015 Phoenix Authors et al. Veterans Affairs Cooperative 456 Study Program

### Factors associated with postoperative complications and hernia recurrence for patients undergoing inguinal hernia repair: a report from the VA Cooperative Hernia Study Group

Richard D. Matthews, MD,<sup>1</sup> Thomas Anthony, MD,<sup>2</sup> Lawrence T. Kim, MD,<sup>3</sup> Jia Wang, M.S.,<sup>4</sup> Robert J. Fitzgibbons Jr, M.D.,<sup>5</sup> Anita Giobbie-Hurder, M.S.,<sup>4</sup> Dominic J. Reza, Ph.D.,<sup>4</sup> Kamal M.F. Hani, M.D.,<sup>1</sup> Leigh A. Neumayer, MD,<sup>1,4</sup> for the Veterans Affairs Cooperative 456 Studies Program Investigators

Friday February 6, 2015 Phoenix Authors et al. Veterans Affairs Cooperative 456 Study Program

### Predictors of Recurrence (Open Repair)

- ⌘ Bivariate Analysis
  - ⌘ Single
  - ⌘ If Marital Status = Separated
  - ⌘ Functional Status Classified As Totally Dependent
  - ⌘ Cirrhosis
  - ⌘ Surgical Time | By 9 minutes
- ⌘ Multivariable Analysis
  - ⌘ Recurrent Hernia
  - ⌘ Absence Of A Caregiver
  - ⌘ Higher Nyhus Classification
  - ⌘ Length Of Surgery

Friday February 6, 2015 Phoenix Authors et al. Veterans Affairs Cooperative 456 Study Program

### Predictors of Recurrence (Laparoscopic Repair)

- ⌘ Bivariate Analysis
  - ⌘ Foley Catheter
  - ⌘ Smaller Piece of Mesh
  - ⌘ CHF (Although NS, P=.08)
- ⌘ Multivariable Analysis
  - ⌘ Active Lifestyle
  - ⌘ BMI Of 25 Or Less
  - ⌘ Low Surgeon Volume
  - ⌘ ASA Score + Recent Enlargement

Friday February 6, 2015 Phoenix Authors et al. Veterans Affairs Cooperative 456 Study Program

### Patient-Related Risk Factors for Recurrence After Inguinal Hernia Repair: A Systematic Review and Meta-Analysis of Observational Studies.

[Barnes J, Gombardik M, Bessell J, Hamilton J](#)

- [Helsinki University of Espoo, Helsinki, Finland](#)
- [University of Copenhagen, Copenhagen, Denmark](#)
- [Helsinki University of Espoo, Helsinki, Finland](#)
- [Helsinki University of Espoo, Helsinki, Finland](#)

Friday February 6, 2015 Phoenix Barnes et al. 2014 Surg 31

### Patient-Related Risk Factors

- Female Sex
- Direct Inguinal Hernias At the Primary Procedure
- Operation For A Recurrent Inguinal Hernia
- Smoking

Friday February 6, 2015 Phoenix Authors et al. Veterans Affairs Cooperative 456 Study Program

### Recurrence patterns of direct and indirect inguinal hernias in a nationwide population in Denmark

Jakob Burchardt, MD,<sup>1</sup> Kristofer Andreassen,<sup>2</sup> Hans-Christiaan Pommergaard, MD,<sup>3</sup> Thor Ringgaard, MD, DMS,<sup>2\*</sup> and Jacob Rosenberg, MD, DMS,<sup>2\*</sup> Copenhagen, Denmark

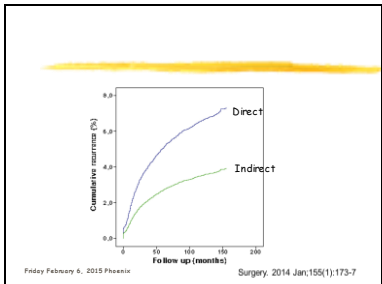
Friday February 6, 2015 Phoenix Surgery, 2014 Jan;155(1):173-7

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**85,314 Male Patients Undergoing a Primary Inguinal Hernia**

Friday February 6, 2015 Phoenix Surgery, 2014 Jan;155(1):173-7



**Groin Herniorrhaphy Recurrence**

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**Taking the Operation Seriously**


Friday February 6, 2015 Phoenix

**Taking the Operation Seriously**

- ⌘ 1990: 144 Patients with 147 Inguinal Hernias
- ⌘ 1996: 154 Patients with 165 Inguinal Hernias
- ⌘ 1993: inguinal Herniorrhaphy Changed to "High Status" Operation
  - ⌘ Shouldice, Lichtenstein, and Laparoscopy Introduced
  - ⌘ Primary Teaching Operation for Surgical Residents
- ⌘ Recurrence Rate Decreased From 28% To 3%

Benedict F. Sevostin D. Swedin  
 Eur J Surg. 2002;168(11):992-6.  
 Friday February 6, 2015 Phoenix

**Groin Herniorrhaphy Recurrence**



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**Groin Hernias in Women**

- ⌘ Paucity of Information in the Literature to Guide Management in Women With Groin Hernias
- ⌘ Of Particular Concern is Their Higher Frequency of Femoral Hernias, With Attendant High Risks of Strangulation
- ⌘ The Most Common Operation in Men, the Lichtenstein operation, Will Miss a Femoral Hernia, Unless Modified

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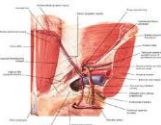
**Recurrence after Groin Hernia Repair in Woman\***

- ⌘ Large Study Of Over 6000 Women From Sweden
- ⌘ Much Higher Femoral Hernia Recurrence Rate Compared To Men, Especially After The Repair Of A "Direct" Hernia
- ⌘ But Direct Hernia are almost Unheard of in Females
- ⌘ Strongly Suggests That the Femoral Hernia Was Actually Missed At The Index Operation


\*Koch A, Edwards A, Haggren S, Nordin S, KSSA, Fransson M, Lichtenfeld 1995  
 groin hernia repair in women. Br J Surg. 1995;82(10):1013-1018.  
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**Treatment of Groin Hernias in Woman**

- ⌘ Modified Lichtenstein
- ⌘ Fitztenstein




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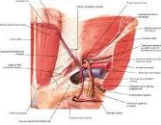
**Modified Lichtenstein**



Zwickel M. The modified lichtenstein technique for complex inguinal hernia repair. Int J Surg. 2005;3(2):103-106.  
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**Treatment of Groin Hernias in Woman**

- ⌘ Modified Lichtenstein
- ⌘ Fitztenstein
- ⌘ Laparoscopy



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# February 6, 2015 43rd Annual Phoenix Surgical Symposium

## Complications of Inguinal Herniorrhaphy: From Post Inguinal Herniorrhaphy Groin Pain to Infertility

### Robert Fitzgibbons

### Inguinal Herniorrhaphy Complications

- ⌘ Recurrences
- ⌘ Chronic Groin Pain
- ⌘ Wound
- ⌘ Cord & Testicular
- ⌘ Bowel & Bladder Injury
- ⌘ Prosthetic
- ⌘ General
- ⌘ Laparoscopic

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### Chronic Groin Pain

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### Post-herniorrhaphy Pain The Scope of the Problem!

- ⌘ Incidence Varies Greatly in the Literature
- ⌘ ↓ in Specialty Centers, ↑ in General Practice
- ⌘ Range 0 - 53% But Consensus
  - ⊠ 10% Some Chronic Pain
  - ⊠ 2 to 4% Interferes With Daily Living

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### Post-herniorrhaphy Pain Which Operation is Better?

Heena (2009) (1341-40)  
DOI: 10.1007/s10026-009-9129-1

EDITORIAL

European Hernia Society guidelines on the treatment of inguinal hernia in adult patients

M. P. Simons, T. Adreucker, M. Ege-Nabian, J. L. Bouillot, G. Casagrande, J. Casan, H. de Lange, R. Ferkler, T. Brückner, A. Knapenich, J. Kulkarni, S. Mariani-Godt, P. Norda, V. Schumpelick, S. Savelberg, M. Sauerwald, G. Weber, M. Murrer

Received: 17 June 2009 / Accepted: 19 June 2009 / Published online: 2 July 2009  
© The Author(s) 2009. This article is published with open access at [springerlink.com](http://springerlink.com)

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### Post-herniorrhaphy Pain Laparoscopy Vs. Open

Chronic pain

Conclusions; causes and risk factors

Level 1B The risk of chronic pain after hernia repair with mesh is less than after non-mesh repair.

The risk of chronic pain after endoscopic hernia repair is lower than after open hernia repair.

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Treadwell J, Tipton K, Oyesemi O, Sun F, Schoelles K. Surgical options for inguinal hernia: comparative effectiveness review. Agency Healthc Res Qual. 2012;Comparativ(70):1-1219

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### Post-herniorrhaphy Pain Laparoscopy Vs. Open

Study	Relative Risk (95% CI)	
	Laparoscopic	Open
Anderson et al (2003)	0.57 (0.38-0.86)	1.00
Bonaguidi et al (2005)	0.25 (0.14-0.45)	1.00
Chouk et al (2003)	0.50 (0.33-0.68)	1.00
Chouk et al (2005)	0.40 (0.27-0.58)	1.00
Shah et al (2005)	0.40 (0.27-0.58)	1.00
Johannesen et al (1999)	2.40 (1.72-3.35)	1.00
Chouk et al (2005)	0.40 (0.27-0.58)	1.00
Laparoscopic vs. Open (2005)	0.54 (0.39-0.75)	1.00
Lau et al (2005)	0.26 (0.16-0.42)	1.00
MRC et al (1999)	0.87 (0.54-1.40)	1.00
Pharmakides et al (2005)	0.60 (0.40-0.90)	1.00
Pharmakides et al (2008)	1.00 (0.71-1.41)	1.00
Sarantis et al (2008)	0.63 (0.43-0.94)	1.00
Stavrou et al (2008)	0.55 (0.37-0.82)	1.00
Stavrou et al (2008)	0.55 (0.37-0.82)	1.00
Ward et al (2006)	0.20 (0.11-0.37)	1.00
Ward et al (2008)	0.20 (0.11-0.37)	1.00

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### Post-herniorrhaphy Pain Laparoscopy Vs. Open

↓ Long-term Pain After Laparoscopic Surgery Than Open Surgery (OR=0.61; 95% CI, 0.48 To 0.78)

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### Post-herniorrhaphy Pain Laparoscopy Vs. Open

META-ANALYSIS

A Meta-Analysis of Surgical Morbidity and Recurrence After Laparoscopic and Open Repair of Primary Unilateral Inguinal Hernia

Elmas A, O'Reilly MB, BCK, John P, Burke PhD, MRCSEd, and P. Roman O'Connell MD, FRCS

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**Post-herniorrhaphy Pain  
Laparoscopy Vs. Open**

- ⌘ Fourteen Trials Included Chronic Groin Pain
- ⌘ Follow-up Range 1 To 70 Months
- ⌘ 1975 Patients LIHR/2234 Patients OIHR,
- ⌘ **Results:**
  - ⌘ Overall: Significantly ↓ Risk for LIHR
  - ⌘ TAPP: Significantly ↓ Risk
  - ⌘ TEP: NS

Cibicik DA, Saini J, O'Connell JG. Randomization of laparoscopic and open inguinal hernia operations and the effect of primary hernial repair. *Ann Surg*. 2012;255:963-970.

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**Post-herniorrhaphy Pain  
Classification**

Etiology

- ⌘ **Nociceptive**
  - ⌘ Somatic
  - ⌘ Visceral pain
- ⌘ **Neuropathic**

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**Post-herniorrhaphy Pain  
Classification**

Etiology

- ⌘ **Nociceptive**
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- ⌘ **Neuropathic**

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**Post-herniorrhaphy Pain  
Etiology**

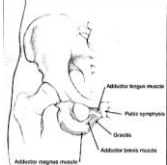
Somatic\*

- ⌘ Osteitis Pubis
- ⌘ Ligament Damage
- ⌘ Muscle Damage

\*Most Common

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**Adductor Tenoperiostitis**



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**Post-herniorrhaphy Pain  
Classification**

Etiology

- ⌘ **Nociceptive**
  - ⌘ Somatic
  - ⌘ Visceral pain
- ⌘ **Neuropathic**

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**Post-herniorrhaphy Pain  
Etiology**

Visceral

- ⌘ **Pain only with Specific Activities**
  - ⌘ Urination
  - ⌘ Ejaculation

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**Post-herniorrhaphy Pain  
Classification**

Etiology

- ⌘ **Nociceptive**
  - ⌘ Somatic
  - ⌘ Visceral pain
- ⌘ **Neuropathic**

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**Post-herniorrhaphy Pain  
Neuropathic**

- ⌘ **Caused by Damage to a Major Sensory Nerve**
  - ⌘ Partial or Complete Division
  - ⌘ Stretching
  - ⌘ Contusion
  - ⌘ Crushing
  - ⌘ Electrical Damage
  - ⌘ Suture

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### Post-herniorrhaphy Pain Treatment

1. Ice, NSAIDs, Rest
2. Imaging Studies
3. Physical Therapy
4. Pain Clinic: Injections Medical Manipulation
5. Surgery (Rarely before one year):  
 Combined Laparoscopy and Conventional if preperitoneal  
 Triple Neurectomy, Mesh Removal, Adhesiolysis for Conventional

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### Post-herniorrhaphy Pain Treatment

**Lidocaine Patch (5%) in Treatment of Persistent Inguinal Postherniorrhaphy Pain**  
*A Randomized, Double-blind, Placebo-controlled, Crossover Trial*

Joakim M. Eklöf, M.D.,<sup>1</sup> Martin Petersen, Ph.D.,<sup>1</sup> Nuran Üçeyler, M.D.,<sup>1</sup> Claudia Sommer, M.D.,<sup>5</sup> Henrik Kehlet, M.D., D.M.Sc.,<sup>1</sup> Mads U. Werner, M.D., D.M.Sc.<sup>4</sup>

**Conclusion:**  
 Lidocaine Patch Treatment Did Not Reduce Combined Resting And Dynamic Pain Ratings Compared With Placebo in Patients With Severe, Persistent Inguinal Postherniorrhaphy Pain.

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### Post-herniorrhaphy Pain Treatment

**Ultrasound-Guided Ilioinguinal/Iliohypogastric Nerve Blocks for Persistent Inguinal Postherniorrhaphy Pain: A Randomized, Double-Blind, Placebo-Controlled, Crossover Trial**

Joakim M. Eklöf, M.D.,<sup>1</sup> Zsolt J. Kocsis-Nelson, MD, DMSc, FRCA,<sup>1</sup> Henrik Kehlet, MD, DMSc,<sup>1</sup> and Mads U. Werner, MD, DMSc<sup>4</sup>

**Conclusion:** Ultrasound-guided Lidocaine Blocks Of The Ilioinguinal And Iliohypogastric Nerves, At The Level Of The Anterior Superior Iliac Spine, Are Not Useful In Diagnosis And Management Of Persistent Inguinal Postherniorrhaphy Pain.

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### Post-herniorrhaphy Pain Prevention

**Preservation Versus Division of Ilioinguinal Nerve on Open Mesh Repair of Inguinal Hernia: A Meta-analysis of Randomized Controlled Trials**

Wayne Hsu · Cheng-Shyang Chen · Hung-Chia Lee · Hung-Hua Liang · Li-Jen Kao · Po-Li Wei · Ka-Wai Tam

**No Significant Differences Were Found Between The Groups For Chronic Groin Pain or Numbness**

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### Inguinal Herniorrhaphy Complications

- ⌘ Recurrence
- ⌘ Chronic Groin Pain
- ⌘ Wound
- ⌘ Cord & Testicular
- ⌘ Bowel & Bladder Injury
- ⌘ Prosthetic
- ⌘ Genital
- ⌘ Laparoscopic

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### Wound

- ⌘ Infection Rate Extremely Low
- ⌘ Protected Site
- ⌘ Seroma
  - ⌘ With Large Indirect Sacs
  - ⌘ With LIHR
  - ⌘ Most Resolve Spontaneously
  - ⌘ Repeated Aspiration Associated with ↑ Infection
- ⌘ Hematoma
  - ⌘ With LIHR
  - ⌘ Only Large Hematomas With Severe Pain and/or Tension On the Skin Need Evacuation

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### Inguinal Herniorrhaphy Complications

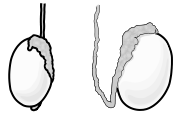
- ⌘ Recurrence
- ⌘ Chronic Groin Pain
- ⌘ Wound
- ⌘ Cord & Testicular
- ⌘ Bowel & Bladder Injury
- ⌘ Prosthetic
- ⌘ Genital
- ⌘ Laparoscopic

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### Cord and Testicular Short Term

**The Swollen Testicle**

- ⌘ Hematoma
- ⌘ Seroma
- ⌘ Orchitis



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### Cord and Testicular Immediate

**Ischemic Orchitis**

- ⌘ 1-3 Days Following Hernia Repair
- ⌘ Painful, Indurated, Swollen Testicle, +/- Fever
- ⌘ <1% of First Time Repairs but increases to ~5% for Recurrent Hernia
- ⌘ Caused by Injury to the Pampiniform Venous Plexus Rather Than The Testicular Artery

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### Cord and Testicular Immediate

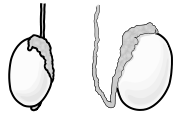
Ischemic Orchitis

- ⌘ Testicular Sonography Demonstrates Decreased Testicular Blood Flow
- ⌘ Treatment is Nonoperative
  - ☐ Reassurance And Analgesia
  - ☐ +/- Antibiotics Testicular
- ⌘ Emergent Orchiectomy Rarely Indicated
- ⌘ Ultrasounds At 6 Months Shows Resolution of Flow Abnormality in the Vast Majority

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### Cord and Testicular Long Term

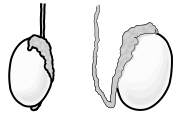
- ⌘ Hydrocele
- ⌘ Testicular Atrophy
- ⌘ Injury to the Vas
- ⌘ Dysejaculation
- ⌘ Testicular Descent



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### Cord and Testicular Long Term

- ⌘ Hydrocele
- ⌘ Testicular Atrophy
- ⌘ Injury to the Vas
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- ⌘ Testicular Descent



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### Cord and Testicular Long Term

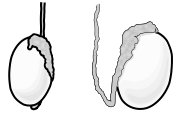
Hydrocele

- ⌘ .5 - 1 % of All Inguinal Hernia Repairs
- ⌘ Etiology:
  - ☐ Excessive Skeletonization of the Cord Structures With Disruption of Lymphatics
  - ☐ ? In situ Distal Sac
- ⌘ Treatment is Observation Initially
- ⌘ Hydrocelectomy for Persistent and symptomatic

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### Cord and Testicular Long Term

- ⌘ Hydrocele
- ⌘ Testicular Atrophy
- ⌘ Injury to the Vas
- ⌘ Dysejaculation
- ⌘ Testicular Descent



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### Cord and Testicular Long Term

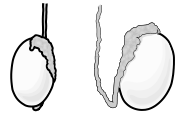
Testicular Atrophy

- ⌘ < 1% Overall but Higher in Recurrent Hernias
- ⌘ Etiology unproven But May be Arterial
- ⌘ No history of Testicular Complication Initially is Common
- ⌘ Gradual Shrinkage of Testicle 6 Months to a Year

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### Cord and Testicular Long Term

- ⌘ Hydrocele
- ⌘ Testicular Atrophy
- ⌘ Injury to the Vas
- ⌘ Dysejaculation
- ⌘ Testicular Descent



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### Cord and Testicular Long Term

Injury to the Vas

- ⌘ Repair at the Time of Injury if Complete Transection Recognized
- ⌘ Can Result in Infertility
  - ☐ Bilateral Injury
  - ☐ Sperm Antibodies
  - ☐ Mesh Fibrosis???

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PLASTIC

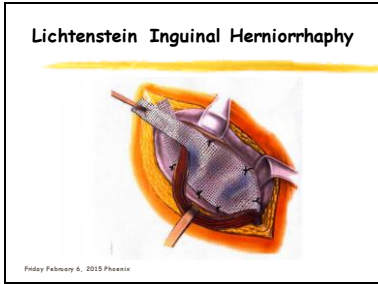
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Herniorrhaphy With Polypropylene Mesh Causing Inguinal Vasal Obstruction  
 A Preventable Cause of Obstructive Azoospermia

David Shin, MD,\* Larry J. Lipshultz, MD,\* Marc Goldmann, MD,† Gregory A. Bernal, MD,‡  
 Eugene F. Poch, MD,§ Dennis M. Ruyter, MD,¶ Stewart F. McGowan, MD,¶  
 Craig C. Nussleberger, MD,¶ Richard L. Schroy, MD,‡ Frank H. Rongh, III, MD,‡ and  
 Susan C. Hong, MD,§§

Shin et al. Ann Surg. 2005; Apr;241(4):553-8.

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**Generally Accepted Recurrence Rate in General Practice**

- ⌘ TFR ↓ 5%
- ⌘ Non-TFR 10-15%

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**Generally Accepted Testicular Atrophy Rates**

- ⌘ Primary Herniorrhaphy 0.5%
- ⌘ Herniorrhaphy for Recurrence 5.0%

Specialization In Elective Herniorrhaphy, Lancet 1965 Apr 3:17791-5. Worts SE, Testicular Atrophy And Chronic Scrotal Neuropathia After Of Inguinal Herniorrhaphy, Surg Clin North Am. 1993 Jun;73(3):571-81.

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**Therefore, TFR Should Result in a ↓ in Infertility**

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**FEATURE**

**Herniorrhaphy With Polypropylene Mesh Causing Inguinal Vasa Obstruction**  
*A Preventable Cause of Obstructive Azoospermia*

David Shin, MD\* Larry L. Lyballe, MD\* Marc Goldsare, MD† Gregory A. Rovati, MD‡ Eugene F. Facki, MD§ Robert M. Nagler, MD|| Dennis W. McCubbin, MD¶ Craig C. Schneiderberger, MD\*\* Richard J. Schover, MD†† Peter M. Rugh III, MD‡‡ and Susan C. Hong, MD§§

Friday February 6, 2015 Phoenix Shin et al. Ann Surg. 2005 Apr;241(4):553-8

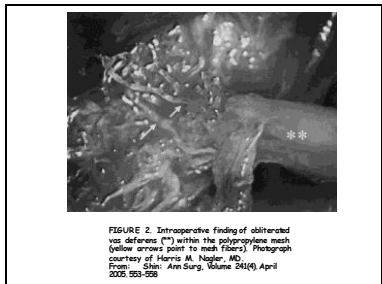
- ⌘ Eight US Institutions
- ⌘ 14 Cases
- ⌘ Obstructive Azoospermia (Normal Sperm in A Testicular Biopsy Yet No Sperm in Ejaculate)
- ⌘ Previous Polypropylene Mesh Herniorrhaphy
- ⌘ All Patients Underwent Surgical Exploration With Intraoperative Vasography
- ⌘ Obstruction Caused by Mesh

Friday February 6, 2015 Phoenix Shin et al. Ann Surg. 2005 Apr;241(4):553-8

**Patient Characteristics**

- ⌘ Mean Age 35.5 Years
- ⌘ Previous Repair
  - ⌘ Open 10
  - ⌘ Laparoscopic 2
  - ⌘ Both 2
- ⌘ Operative Findings
  - ⌘ Dense Fibroblastic Response Encompassing the Polypropylene Mesh with Either Trapped Or Obliterated Vas
  - ⌘ Bilateral Obstruction 9
  - ⌘ Unilateral Obstruction With Incidental Contralateral Testicular Pathology 5

Friday February 6, 2015 Phoenix Shin et al. Ann Surg. 2005 Apr;241(4):553-8



**Conclusion**

**" Before Undergoing Polypropylene Mesh Herniorrhaphy, Men, Especially of Young Reproductive Age or with a Solitary Testicle, Need to be Carefully Advised of Potential Obstruction and Compromise to Future Fertility"**

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### Is Routine Use of Mesh OK?

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### Problems with the Shin Article

- ⌘ Surgeons Perform Groin Exploration for Reasons Other than Infertility
  - ⌘ Recurrence
  - ⌘ Post Herniorrhaphy Pain or Neuralgia
- ⌘ Invariably Cord Structures are Involved with Similar Dense Adhesions

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EDITORIAL

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Can We Be Sure Polypropylene Mesh Causes Infertility?

*Robert J. Fitzgibbons, Jr. MD*

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### Where Would Such An Injury Most Likely Adhere?

- ⌘ Division
- ⌘ Ligation
- ⌘ Clipping
- ⌘ Stapling
- ⌘ Electrocauterization
- ⌘ Devascularization
- ⌘ Scarification.
- ⌘ Traction Injuries\*

\*Ceylan H, Karabek M, Gokturk S, Cengiz B, Bayraktar C, Mijic E. Temporary Stricture Of The Testicular Duct: The Vas Deferens And The Testis. J Pediatr Surg. 2003 Oct;38(10):1155-8.

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### Cord and Testicular Long Term

- ⌘ Hydrocele
- ⌘ Testicular Atrophy
- ⌘ Injury to the Vas
- ⌘ Dysejaculation
- ⌘ Testicular Descent

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### Cord and Testicular Long Term

Dysejaculation

- ⌘ Groin Pain or Burning Just Before, During, or Immediately After Ejaculation The
- ⌘ Incidence Approximately 0.4%.
- ⌘ Usually Self-limiting. The
- ⌘ Etiology probably Crushing or Scarring of the Vas Deferens

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### Cord and Testicular Long Term

Surg Endosc. (2012) 26:979-980  
 DOI 10.1007/s00164-011-1989-y

Dysejaculation after laparoscopic inguinal herniorrhaphy: a nationwide questionnaire study

Jankin M, Biehoff C, Gitter Lindorfer S, Fokkema A, Aavang M, Mah U, Werner H, Herzig Kohler

Biehoff J, Lindorfer S, Aavang M, Werner H, Kohler H. Dysjaculation after laparoscopic inguinal herniorrhaphy: a nationwide questionnaire study. Surg Endosc. 2012 Apr;26(4):979-83.

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### Cord and Testicular Sexual Impairment after LIHR

- ⌘ Dysejaculation 3.1%
- ⌘ Pain From The Groin Or Genitals During Sexual Activity 10.(% Was Reported By 88 Patients (10.9%)
  - ⌘ Moderate Or Severe 2.4%
- ⌘ ↓ Older Patients
- ⌘ ↓ With Longer Follow-up

Biehoff J, Lindorfer S, Aavang M, Werner H, Kohler H. Dysjaculation after laparoscopic inguinal herniorrhaphy: a nationwide questionnaire study. Surg Endosc. 2012 Apr;26(4):979-83.

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### Cord and Testicular Long Term

- ⌘ Hydrocele
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### Cord and Testicular Long Term

Testicular Descent

- ⌘ Sagging of the Testicle with Elongation of the Scrotum on the Side of a Previous Repair
- ⌘ Felt to be Caused by Skeletonization of the Cord with Complete Division of the Cremasteric Muscle
- ⌘ Suturing the Medial Stump of the
- ⌘ Muscle to the Pubic Tubercle (i.e. Shouldice) felt to be Preventative

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### Inguinal Herniorrhaphy Complications

- ⌘ Recurrence
- ⌘ Chronic Groin Pain
- ⌘ Wound
- ⌘ Cord & Testicular
- ⌘ Bowel & Bladder Injury
- ⌘ Prosthetic
- ⌘ General
- ⌘ Laparoscopic

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### Bladder And Bowel Injury

- ⌘ Anterior Repair
  - ⌘ Unusual Except When a Sliding Hernia is not Recognized
- ⌘ Preperitoneal Repair
  - ⌘ Bladder at Greater Risk
  - ⌘ Previous Space of Retzius Surgery Should be Considered a Relative Contraindication To Preperitoneal Repair
  - ⌘ Repair in Two Layers With Absorbable Suture Followed By Extended Foley Decompression Until A Cystogram Confirms Bladder Integrity

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### Urinary Retention

- ⌘ Urinary Retention Is Higher After LIH Because Of The Need For General Anesthesia
- ⌘ Voiding Before Operation and Fluid Restriction to Less Than 500CC During Surgery are Preventative

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### RCTs are not Perfect!

<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4119126/>  
<http://www.sciencedirect.com/science/article/pii/S1473210114000000>

**Bias-Variation Dilemma Challenges Clinical Trials: Inherent Limitations of Randomized Controlled Trials and Meta-Analyses Comparing Hernia Therapies**  
 R. Fitzgibbons, Jr., M.D., FACS, et al.

Received 20 April 2014; revised 17 May 2014; accepted 17 June 2014  
 This article is intended solely for the personal use of the individual user and is not to be disseminated broadly.

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### Complications of Inguinal Herniorrhaphy: From Post Inguinal Herniorrhaphy Groin Pain to Infertility

**Robert J. Fitzgibbons, Jr., MD FACS**  
**Harry E Stuckenhoff Professor of Surgery**  
**Creighton University School of Medicine**  
**Omaha, Nebraska**

Friday February 6, 2015

## **Abdominal Wall Reconstruction**

Martin A. Croce, MD, FACS

Professor of Surgery

University of Tennessee Health Science Center

There are few surgical problems more challenging than the patient with a giant abdominal wall defect. There are a number of reasons patients have these large hernias. Both short and long-term therapy should be directed toward the etiology of the defect.

Massive fluid resuscitation from either hemorrhagic shock or septic shock results in significant soft tissue edema. The abdominal viscera are not spared in this development of edema and this massive visceral edema may preclude abdominal closure following celiotomy for either hemorrhage or infection. Another etiology for these defects is tissue loss. This tissue loss may be due either to trauma such as a shotgun blast with massive tissue destruction or necrotizing soft tissue infection, which requires resection of a significant portion of the abdominal wall. In any of these cases, attempted abdominal closure under tension will likely lead to fascial necrosis. This fascial necrosis may then precipitate ongoing necrotizing soft tissue infection, which would then require more resection of the abdominal wall, thus creating a vicious cycle. Abdominal closure under tension may also precipitate development of abdominal compartment syndrome, which is characterized by increased intraabdominal pressure, decreased venous return, increased intrathoracic pressure, respiratory failure, renal failure, and decreased cardiac output. Recognition of these complications has led to a much wider application of the “open abdomen” after either the primary surgery or after a decompressive laparotomy for a patient with abdominal compartment syndrome. There are a number of techniques for managing the patient with this resulting defect.

Polypropylene mesh has been used for temporary closure and is probably the most widely used artificial material. However, it has a number of problems associated with it, including infection, mesh extrusion, and fistula. Other methods of temporary abdominal closure include coverage with intravenous solution bags or other plastics such as an x-ray cassette cover, closure with zipper or Velcro devices, which are sewn to the fascial edges, large sheets of PTFE, closure with an absorbable mesh that is sewn to the fascial edges, and vacuum type dressing devices. In instances of abdominal wall loss such as with necrotizing soft tissue infection, then it is likely impossible to ever expect autologous closure of the resulting hernia defect. However, in cases where the etiology of the defect is massive visceral edema, it is clear that once the initial problem has been solved, the edema will resolve, thus leaving the patient with a correctable giant abdominal wall defect.

When prosthetic materials are used to repair these giant defects there are 3 main complications. First is intestinal fistula, which may occur when the prosthetic is being used as a temporary closure, or may occur if this prosthetic is being used for definitive reconstruction. Prosthetic infection may occur at any time, although it is far more likely if the prosthetic is being used for definitive reconstruction. Recurrent hernia follows definitive reconstruction and can be quite problematic, especially in patients who have large sheets of prosthetic sewn to the fascial edges. Not infrequently, these patients will develop hernias right along the fascial edges and these hernias may be multiple. Intestinal fistula rates are widely variable in the literature, ranging from 12 to 50 percent when the prosthetics are used for acute management. Recurrent hernia rates are likewise quite variable and range from 15 to 50 percent when polypropylene mesh is used for definitive reconstruction.

In order to minimize the incidence of intestinal fistula and also to minimize problems with infection or recurrent hernia we have developed a 4 stage method



for management of the giant abdominal wall hernias. This staged management is as follows:

- Stage I      Absorbable mesh is inserted for temporary closure. This is sewn to the fascial edges. As the edema resolves over the first week or so, the mesh can be gradually pleated, frequently at the bedside, and occasionally allowing for delayed fascial closure. This is successful in              about 1/3 of the patients.
- Stage II      Mesh removal in patients without prompt edema resolution. This typically occurs after an early bed of granulation tissue forms over the abdominal viscera. The absorbable mesh then will separate from the underlying granulation allowing for easy removal. At this point the patient has a split thickness skin graft placed over the defect.
- Stage III      Definitive reconstruction after 6 to 12 months. This time period allows for inflammation and dense adhesions to resolve and also allows for relatively easy skin graft removal from the underlying viscera. The giant defect can then be closed using the modified component separation technique.

This modified component separation procedure involves fascial separation and local advancement of muscle and fascia. Basically, a relaxing incision is made along the external oblique fascia lateral to the rectus abdominus. The posterior sheath is then dissected free from the posterior wall of the rectus muscle. The anterior component of the internal oblique is then incised, creating a full thickness defect lateral to the rectus muscle once the posterior sheath is completely dissected free from the rectus abdominus. At this point, the medial border of the posterior sheath is then sewn to the lateral border of the anterior sheath. This provides approximately 8 to 10 cm of mobilization in the epigastric

area, 10 to 15 cm in the mid-abdomen, and 6 to 8 cm in the superpubic region on either side.

We analyzed our patients over an 8 year period where 274 consecutive patients underwent staged management of their open abdomens. Eighty-seven percent suffered from hemorrhagic shock and massive visceral edema and the remainder had septic shock from abdominal infection. It is interesting to note that the incidence of necrotizing soft tissue infection around mid-line abdominal incisions has virtually disappeared since we no longer close abdomens under any tension. If there is any doubt a temporary prosthetic material will be used to close the abdomen.

This staged management was fairly successful in avoiding intestinal fistula. There were 14 out of the 167 survivors who developed intestinal fistula for a fistula rate of 8 percent. While these can be challenging wounds to care for, usually a skin graft can be placed around the fistula site and an appliance may be placed over that to collect the fistula drainage. This then can be treated as an ostomy until the time of abdominal wall reconstruction.

We then evaluated all patients who underwent definitive abdominal wall reconstruction over a 15 year period, specifically looking at long term recurrence rates. Follow up ranged from 9 months to 14.6 years, with a mean time of 5.3 years. Overall recurrence was 16%, and was dependent of the type of repair. The lowest rate was seen in patients who underwent the modified component separation technique without additional prosthetic material (5%), and the highest rate was in patients with the components separation with the addition of prosthetic material (44%).

One important aspect for abdominal wall reconstruction is to not wait too long to reconstruct the abdominal wall. If one waits much more than 10 to 12 months, there will be loss of domain, which is difficult to recover. These patients will

typically require some kind of prosthetic material in order to achieve definitive closure.

One particular issue with these patients who require delayed abdominal wall reconstruction involves the mental health of these patients. In a separate study, the quality of life was evaluated in 41 patients who had abdominal wall reconstruction. These patients demonstrated decreased physical functioning, and had a high prevalence of PTSD and depression – after reconstruction. Consideration should be given to screening these patients for PTSD and depression around the time of reconstruction.

In summary, there are a number of different methods for abdominal wall reconstruction for both acute and definitive closure. We feel that the staged management with component separation technique offers many distinct advantages, not the least of which is that permanent prosthetic mesh is usually not required. This staged management technique can be accomplished with acceptable fistula and recurrent hernia rates.

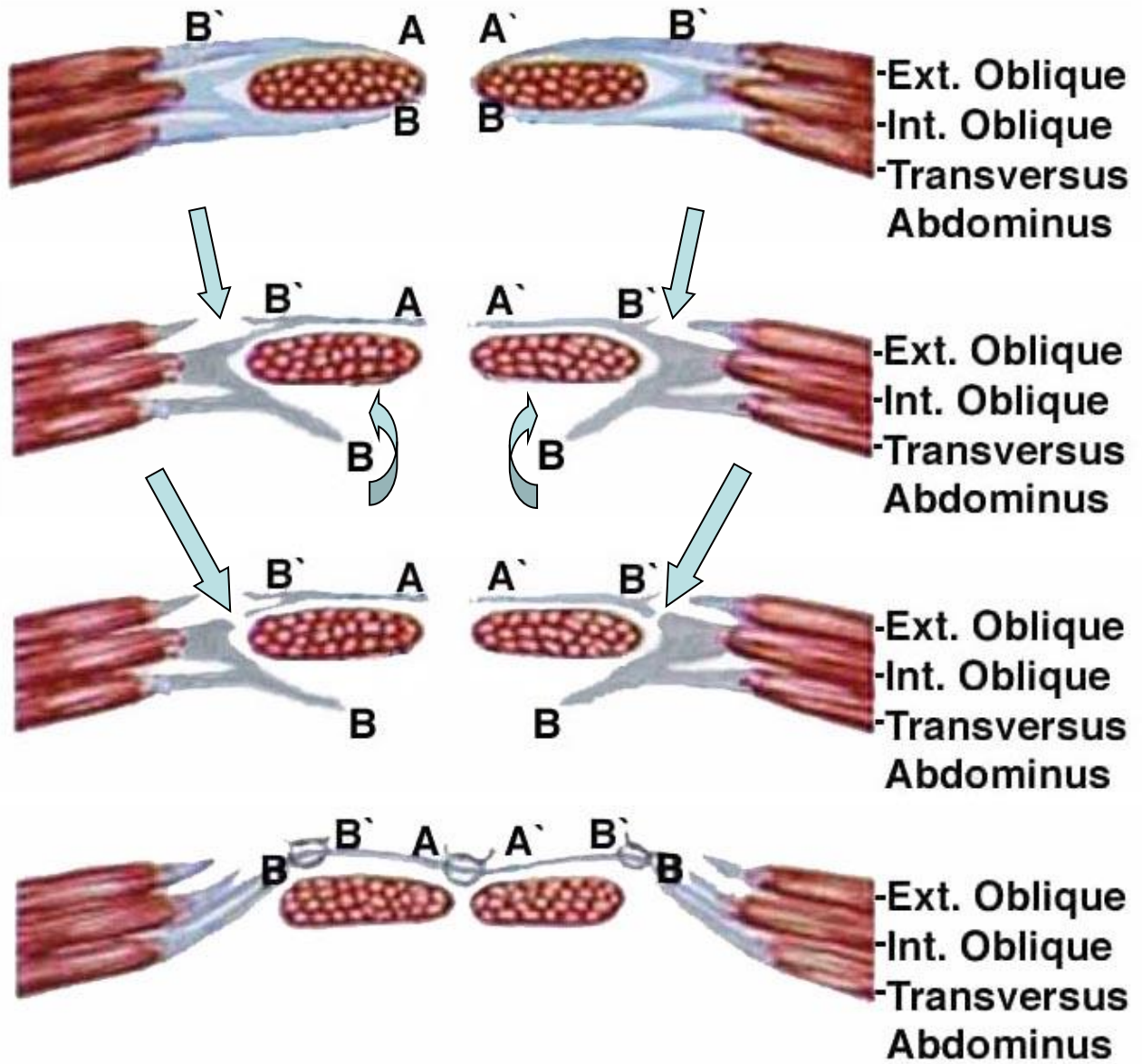
### **References**

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2. Fabian TC, Croce MA, Pritchard FE, et al. Planned ventral hernia: staged management for acute abdominal wall defects. *Ann Surg.* 1994; 210: 643-653.
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4. Karakausis CP, Volpe C, Tanski J, et al. Use of mesh for musculoaponeurotic defects fo the abdominal wall in cancer surgery and the risk of bowel fistulas. J Am Coll Surg 1995; 181: 11 – 16.
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## Modified Components Separation

Arrows denote planes of dissection



Primary Aldosteronism  
Pheochromocytoma

Clive Grant  
Professor of Surgery  
Mayo Clinic

PRIMARY ALDOSTERONISM

Primary Aldosteronism: Syndrome

This syndrome was first described in 1955 by Conn and is characterized by hypertension, suppressed plasma renin activity (PRA), increased plasma aldosterone concentration (PAC), and unsuppressible aldosterone levels in the blood or urine.

Prevalence of Primary Aldosteronism

Conn estimated that 20% of patients with essential hypertension might actually harbor an aldosteronoma, and could be surgically cured. Prior prevalence estimates have varied from 0.05% to 2% of hypertensive patients. The frequency of this diagnosis at the Mayo Clinic averaged 9 cases per year from 1957-1985. However, after instituting more recent screening methods for primary aldosteronism, this diagnosis is probably the most common form of secondary hypertension. The frequency of this diagnosis in 1998-99 reached 120 cases/year.

Subtypes of Primary Aldosteronism

Six forms of this syndrome must be differentiated for appropriated treatment.

1. Aldosterone-producing adenoma (APA)
2. Idiopathic hyperaldosteronism (IHA)
3. Primary adrenal hyperplasia (PAH)
4. Aldosterone-producing adrenocortical carcinoma
5. Aldosterone-producing ovarian tumor
6. Familial hyperaldosteronism (FH): glucocorticoid-remediable aldosteronism (GRA) (FH type I); FH type II (APA or IHA)

Unilateral adrenalectomy cures primary aldosteronism including hypokalemia with either cure or significant amelioration of the hypertension in patients with APA or PAH, whereas medical treatment is indicated for patients with IHA and GRA.

Clinical Presentation

Marked kaliuria may lead to polyuria and polydipsia, and the associated hypokalemia can cause muscle weakness, cramping, headaches, and palpitations. The degree of hypertension may be quite marked, resistant to standard medical therapy.

Diagnosis: Screening

Even though the association of hypertension and unprovoked hypokalemia should trigger investigation for primary aldosteronism, the serum potassium has more

recently been recognized to be within the normal range is at least 1/3 of these patients. The most effective and highly sensitive screening method is to obtain:

- Plasma aldosterone concentration (PAC)
- Plasma renin activity (PRA)
- *Positive screen*: ratio of PAC/PRA >20 ng/dL with a PAC >15 ng/dL

This test may be performed while the patient is taking antihypertensive medications with the exception of spironolactone (which interferes with any interpretation of the test). Angiotensin converting enzyme (ACE) inhibitors may “falsely elevate” PRA.

### Confirmatory Tests

Suppression tests of aldosteronism can be conveniently performed by salt loading for 3 days orally, controlling hypertension and hypokalemia. A 24-hr urine collection for aldosterone, sodium, and potassium is obtained. The urinary sodium should exceed 200 mEq to verify adequate salt loading. Urinary aldosterone excretion >12 µg/24 hr confirms autonomous aldosterone secretion.

### Subtype Differentiation

Patients considered to be high probability of APAs have

- More severe hypertension
- More profound hypokalemia (<3.0 mEq/L)
- Higher plasma aldosterone (>25 ng/dL)
- Higher urinary aldosterone (>30 µg/24 hrs)
- Younger age (<50 yrs)

### Imaging: CT scan

When a solitary unilateral macroadenoma >1 cm is found in one adrenal gland, and the contralateral adrenal gland is completely normal, unilateral adrenalectomy is a reasonable therapeutic option.

However, CT scan often results in ambiguous findings:

- Normal-appearing adrenal glands
- Minimal unilateral adrenal limb thickening, unilateral microadenomas <1 cm
- Bilateral macroadenomas

In these cases, additional testing is required to determine the source of excess aldosterone secretion, and not misinterpret a small APA as IHA. In the Mayo Clinic experience, we have found a unilateral APA in 36% of those patients with primary aldosteronism with clinically “high probability” of APA who had normal findings or unilateral adrenal limb thickening on CT scan.

### Adrenal Venous Sampling

Adrenal venous sampling requires cannulating both adrenal veins through a transfemoral venous approach that necessitates considerable angiographic expertise. To minimize fluctuations of aldosterone secretion, 50µg of cosyntropin per hour is given prior to and during the procedure. Blood is sampled for aldosterone (A) and cortisone (C), and the A/C ratio is calculated for each adrenal venous effluent. The respective right and left adrenal vein A/C ratios are then compared and positive lateralization

requires a 4:1 ratio. From 3 to 4:1 is an overlap zone, and ratios  $\leq 3$  are consistent with bilateral aldosterone secretion that is treated medically.

From 1990 through 7/2002, 94% of 168 patients with primary aldosteronism successfully underwent adrenal venous sampling at the Mayo Clinic.

### Treatment Results

Following unilateral adrenalectomy for either APA or PAH, nearly 100% of patients have improved blood pressure control postoperatively, although long-term cure of hypertension averages about 60-70%. Delay in resolution of hypertension typically requires 1 to 6 months postoperatively. Persistent hypertension after adrenalectomy is directly correlated with older age and duration of hypertension. Hypokalemia is cured in virtually all patients.

## PHEOCHROMOCYTOMA

### General Characteristics and Genetics

Pheochromocytomas (and paragangliomas—the same tumor as pheochromocytoma but located in an extra-adrenal site) should be resected as the associated hypertension is often curable, the potentially lethal paroxysms are avoided, and some of these tumors are malignant. They have a number of the following characteristics:

- Bilateral
- Malignant
- Extra-adrenal
- Multiple
- Familial
- Occur in children
- Discovered as incidentalomas

They may also be associated with neuroectodermal and familial, genetically transmitted diseases:

- MEN IIa (medullary thyroid cancer, pheochromocytomas, hyperparathyroidism)
- MEN IIb (MTC, pheochromocytomas, mucosal neuromas, marfanoid appearance, intestinal ganglioneuromatosis) syndromes
- Von Hippel-Lindau syndrome (pheochromocytoma, retinal angiomas, cerebellar hemangioblastoma, renal and pancreatic cysts and tumors, renal cell carcinoma)
- Carney's triad (gastric leiomyosarcoma, pulmonary chondroma, extra-adrenal pheochromocytoma)
- Von Recklinghausen's syndrome
- SDH mutations
  - SDH B ("bad")
    - Extraadrenal 60%
    - Malignant 30-40%
  - SDH C (rare; nonfunctional neck paragangliomas)
  - SDH D
    - Head, neck 90%



- Multiple 10%

### Prevalence of Pheochromocytoma

The estimated annual incidence of pheochromocytomas is 2 to 8 cases per million people.

### Clinical Presentation

Patients may be completely asymptomatic, the tumor being discovered incidentally on abdominal imaging obtained for another unrelated reason. When symptoms occur, headaches, excess sweating, and palpitations are the most common of the catecholamine-induced symptoms. Hypertension may be either sustained, mimicking essential hypertension, but during paroxysms the blood pressure may be dramatically and dangerously elevated.

### Screening and Confirmatory Testing

On the basis of 147 patients with confirmed benign sporadic adrenal pheochromocytomas, and 2,281 patients tested for “spells” who did not have pheochromocytomas, abnormally elevated levels of total metanephrines or fractionated catecholamines on a 24-hr urine collection were 99% sensitive, and 99.6% specific. Whereas fractionated plasma metanephrines have a 99% sensitivity, the specificity is only 89%<sup>6</sup>, rendering it useful in selected situations, but not for screening. Drugs that may elevate catecholamines and produce confusing results include tricyclic antidepressants, labetalol, levodopa, drugs containing catecholamines (decongestants), and methyl dopa.

### Imaging

Once the biochemical diagnosis of pheochromocytoma has been confirmed, the objectives of radiologic localization include defining whether the tumor is intra- or extra-adrenal, which side, whether there are multiple tumors or evidence of malignancy, and other related anatomy.

### CT scan

CT scan is usually the first and often the only imaging required. 95% of pheochromocytomas are located in the adrenal, and 98% are within the abdomen. CT offers exquisite anatomic detail, moderate cost, wide availability, but has no “physiologic” component and delivers some radiation.

### MRI

Anatomic detail with MRI is usually not as precise as with CT scans. It is expensive and less available than CT, but there is no radiation, it defines vascular anatomy quite well, and offers both anatomic and “physiologic” evidence of the tumor. That means, on T2-weighted images, a characteristic bright white mass is very suspicious for pheochromocytoma.

## MIBG

This nuclear medicine scan has a sensitivity of 88% and a specificity of 99%. It does not provide anatomic detail, is relatively less available, involves radiation, and requires considerable patient preparation and several days to complete. But it is based on physiologic uptake of the agent by catecholamine-producing tumors and images the entire body.

### Preoperative Patient Preparation

To avoid wide and potentially dangerous swings in blood pressure and pulse intraoperatively, patients have been prepared for a minimum of a week to 10 days with an  $\alpha$ -adrenergic blocking agent. We have used phenoxybenzamine (Dibenzylamine) for decades with excellent results, although patients must tolerate nasal stuffiness and postural hypotension during the preparation. For the 3 days prior to the operation,  $\beta$ -adrenergic blockade in the form of propranolol or atenolol may be used if tachycardia is present.

### Treatment Results

Approximately 95% of patients with paroxysmal hypertension are cured with the other 5% improved. Patients with sustained hypertension are cured 66% of the time, and the remainder are improved.

**Neoadjuvant Systemic Treatment Strategies for Breast Cancer**

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**DISCLOSURES**

- no conflicts of interest
- no off-label uses discussed

**Historical Treatment Paradigm for Breast Cancer**

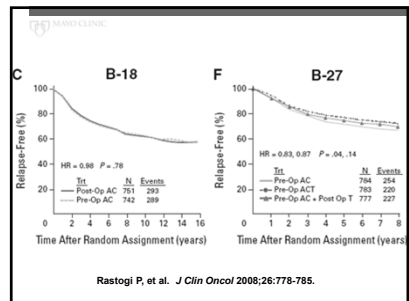
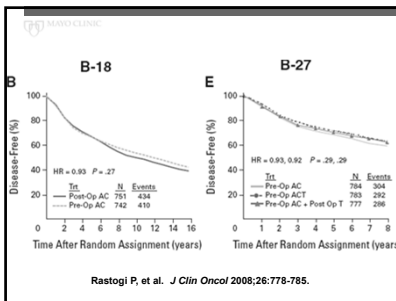
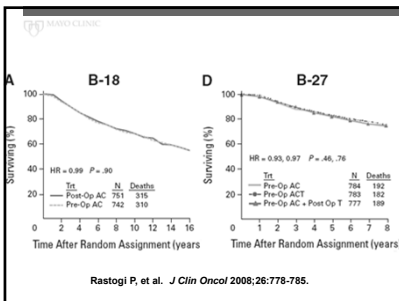
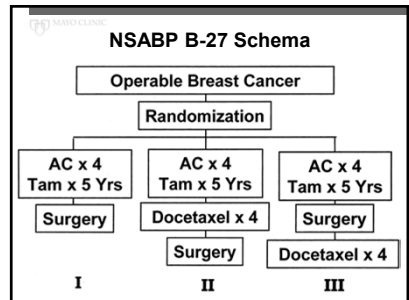
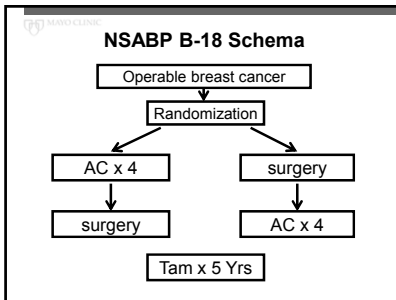
- Radical surgery
- Radical surgery + post-operative systemic therapy (improve long term disease free survival)
- Limited surgery + post-operative systemic therapy
- Pre-operative systemic therapy to facilitate *even more limited* surgery
- *Curative systemic therapy*

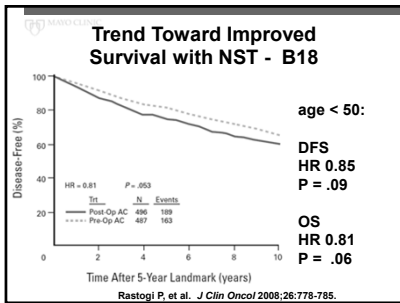
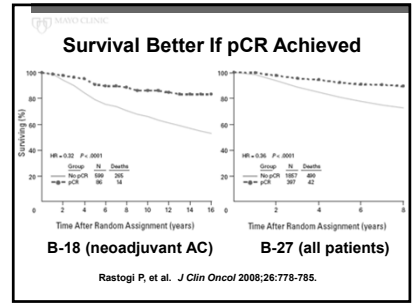
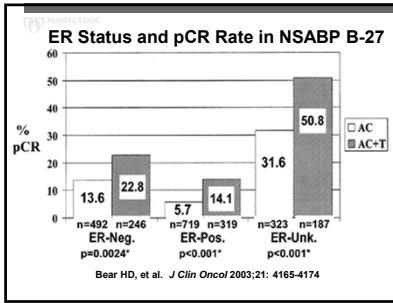
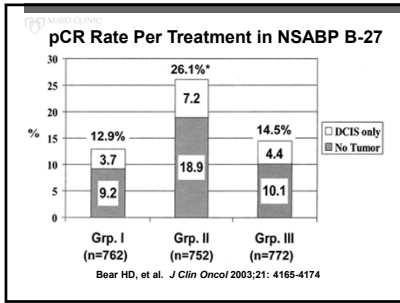
**Rationale for Neoadjuvant Systemic Therapy**

- to improve surgical options
- to determine the response to NST (and abandon ineffective therapy?)
- to obtain long-term disease-free survival

(conventional post-operative adjuvant therapy addresses only the third objective)

Kauffman, et al. J Clin Oncol 2006;24:1940-1949.



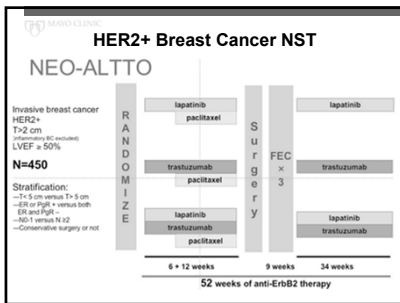


### Lobular Histology and ER Expression: Poor Outcome with Neoadjuvant Therapy

	Breast conserving surgery		Complete pathological response	
	RR (95% CI)	P value	RR (95% CI)	P value
Histological type				
Ductal	1		1	
Lobular	0.24 (0.08-0.76)	0.03	0.003 (0.00->10)	0.75
Initial size				
T2	1		1	
T3/4	0.22 (0.14-0.37)	< 0.001	0.28 (0.11-0.76)	0.01
Histological grade				
SBR I/II	1		1	
III	10.45 (8.86-20.46)	0.17	10.9 (8.80-40.95)	0.14
Initial ER status				
Negative	1		1	
Positive	0.65 (0.36-10.19)	0.16	0.24 (0.09-0.63)	0.004

Mathieu M -C, et al. *Eur J Cancer* 2004;40:342-351

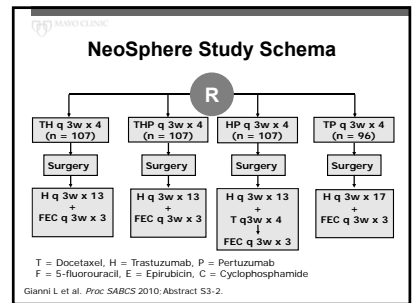
### HER2 + Breast Cancer Neoadjuvant Systemic Therapy

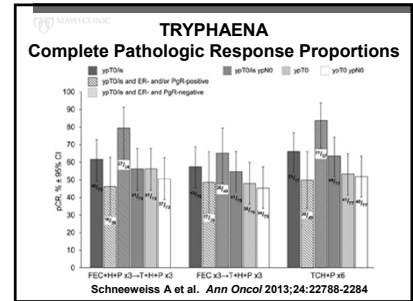
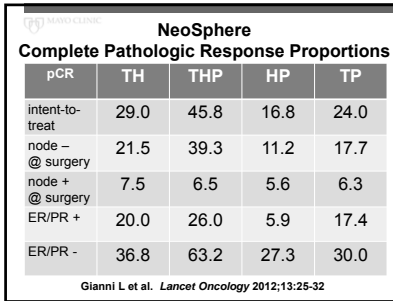
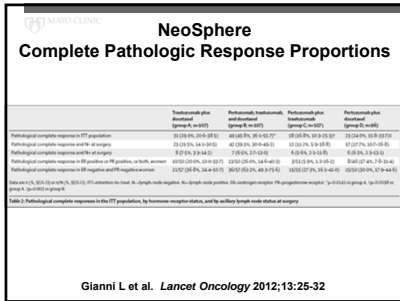


### Neo-ALTTO Complete Pathologic Response Proportions

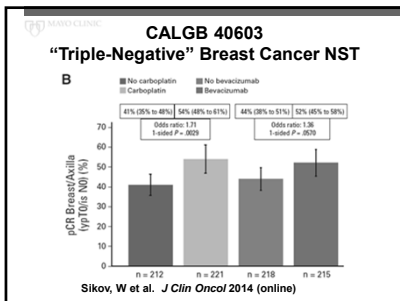
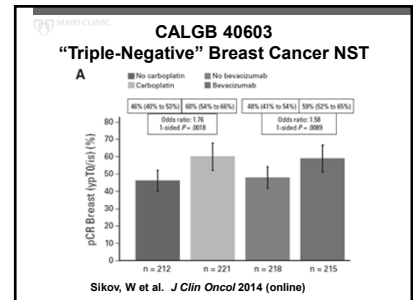
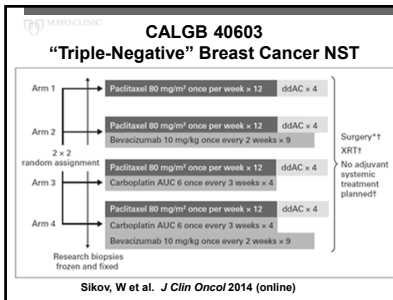
	Lapatinib (n=154)	Trastuzumab (n=149)	Lapatinib plus trastuzumab (n=152)
Event-free survival			
Alive, enrolled in follow-up, event-free at 30 weeks, pCR status available	134 (87%)	139 (93%)	138 (91%)
Excluded from analysis	20 (13%)	10 (7%)	14 (9%)
Event before landmark	3	1	2
Clinical follow-up ended before landmark	13	6	5
pCR status missing	4	3	7
Achieved pCR at 30 weeks*	30 (20%)	40 (27%)	67 (44%)

de Azambuja E et al. *Lancet Oncology* 2014;15:1132-1146



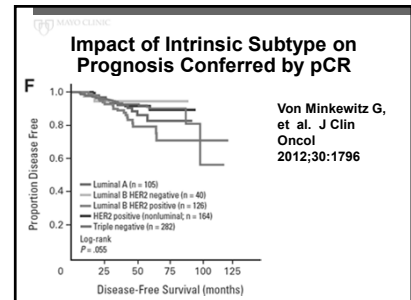
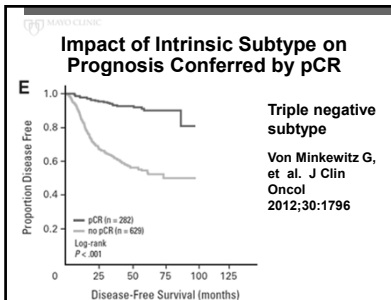
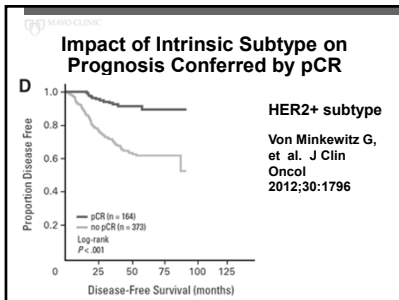
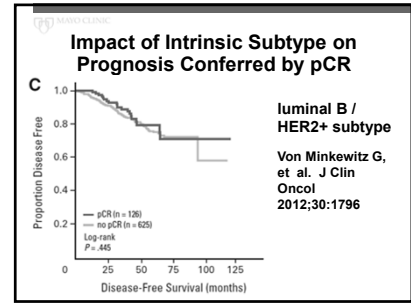
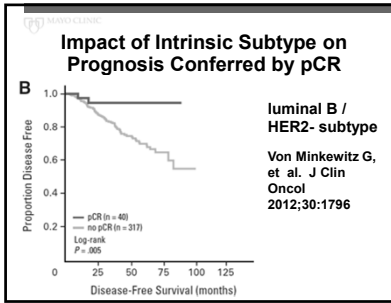
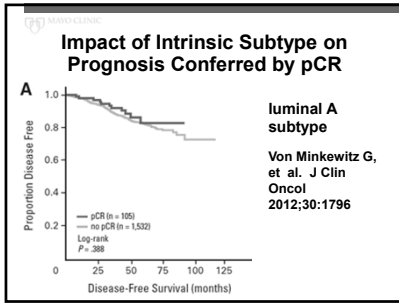


### "Triple Negative" Breast Cancer Neoadjuvant Systemic Therapy



- ### Neoadjuvant Endocrine Therapy
- safety established
  - clinical responses frequent
  - proportion of patients undergoing breast conservation can be increased
  - pCR is rare (< 5% of patients)
  - efficacy: AIs > tamoxifen
  - decline in Ki67 may predict outcome
  - optimal duration of therapy uncertain

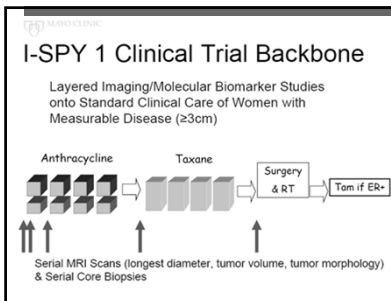
### Selection of Patients for Neoadjuvant Systemic Therapy



**Selection of Patients for Neoadjuvant Systemic Therapy**

- pCR = lower recurrence risk
- factors associated with a higher likelihood of pCR:
  - tumor size (small > large)
  - histology (ductal > lobular)
  - intrinsic subtype (basal, HER2 > luminal)
  - hormone receptor status (ER- > ER+)
  - grade (high > low)

Gralow JR et al. J Clin Oncol 2008;22:814-819.



**I-SPY 1 Biomarker Platforms**

Tissue: Core or Surgical

H&E, IHC, FISH  
UNC, Penn

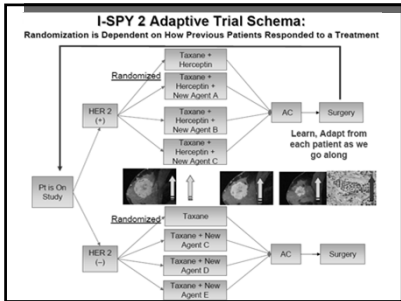
Expression Arrays  
UNC, UCSF

Reverse Phase Protein Lysate Arrays  
George Mason

CGH  
Serum  
I&I proteins, autoantibodies, phosphoproteins  
UCSF

**Molecular Predictors of pathologic Complete Response (pCR)**

Predictor	P Value
NKI 70 genes (Van 't Veer)	0.007
GHI Recurrence Score (Paik)	0.007
T-FAC 30 gene set (MDACC)	0.02
TP53 (Perou)	0.01
Molecular Subtypes (Sorlie)	0.02
ER, Phospho ER	(-) 0.0002
Her-2, Phospho Her-2	0.009
MRI Volume	significant



**CONCLUSIONS**

- Neoadjuvant systemic therapy is appropriate (preferred?) for any patient for whom adjuvant systemic therapy is appropriate.
- Increasingly effective neoadjuvant strategies are being developed.
- Importance of pathologic complete response may vary with breast cancer subtype.

## Exercise as Standard of Care for Oncology Practice: A Timeline

- 2002** Jones/Courneya examine the role of the oncologist in promoting exercise in cancer patients. (*Cancer Practice*, Mar-Apr)
- 2003** Rocky Mountain Cancer Rehabilitation Institute (RMCRI at Univ. No. CO) publishes Exercise & Cancer Recovery. (C. Schneider, C. Dennehy, S. Carter, authors).
- 2004** Jones/Courneya report that an oncologist's recommendation may increase exercise behavior in newly diagnosed breast cancer survivors. (*Ann Behav Med*, Oct)
- 2005** Jones/Courneya survey oncologists about their beliefs and tendencies to recommend exercise to patients. (*Rehabilitation Oncology*, Vol 23(3))
- 2006** Damush et al. report that an oncologist-referred, exercise self-management program inspires breast cancer survivors to exercise more. (*Psycho-Oncology*, Oct)
- 2007** American College of Sports Medicine (ACSM) and American Medical Association (AMA) launch "Exercise is Medicine" initiative. ([www.ACSM.org](http://www.ACSM.org))
- 2008** RMCRI at UNCO creates a 40-hour, on-site "Cancer Exercise Specialist" certification.
- 2009** Katzmarzyk et al. signal a paradigm shift toward viewing a sedentary lifestyle as a chronic disease. (*Med & Sci in Sports Med*, 41)
- ACSM/American Cancer Society create on-line "Cancer Exercise Trainer" certification.
- ACSM expert roundtable concludes that exercise offers significant benefits to people diagnosed with cancer and it is safe; roundtable experts publish ACSM guidelines.
- 2010** McNeely/Courneya summarize studies indicating that exercise reduces cancer-related fatigue. (*J Natl Compr Canc Netw*, 18)
- Oncology Nursing Society (ONS) endorses exercise for cancer patients; extensive exercise resources become available on ONS website.
- American Society of Clinical Oncology (ASCO) endorses ACSM's 2009 exercise guidelines.
- 2011** YMCA partners with LIVESTRONG to create "LIVESTRONG at the Y," a 12-week, standardized, structured exercise program.
- 2012** ACSM and AMA create on-line "Exercise Is Medicine" certification: Levels 1, 2, and 3.
- Aug 28 post from Bryan Anderson in Mayo Clinic's Network News: "Mayo study: Exercise can help cancer patients, but few oncologists suggest it."
- ACSM publishes American College of Sports Medicine's Guide to Exercise and Cancer Survivorship. (M. Irwin, author)
- Hass/Kimmel report 5-year evaluation of FitSTEPS for Life® community-based exercise program (700 participants w/cancer diagnosis) results in improved, sustainable QOL for all cancers. (*Journal of Oncology Practice*, Nov 2012, [jop.ascopubs.org](http://jop.ascopubs.org))
- 2013** Barton reports in *CA* (Mar/Apr) world-wide data that associates physical activity, not BMI, with improved outcomes.



## Exercise as Standard of Care Timeline (continued)

- 2013** National Comprehensive Cancer Network provides exercise guidelines for cancer patients on March 14.

Jones/Alfano publish literature review that summarizes 25 years of evidence-based research, and describes the parameters of an additional 82 on-going clinical studies. Review documents cumulative evidence of the benefits of physical activity and exercise for persons living with a cancer diagnosis. (*ACTA Oncologica*, 52:195-215)

Courneya et al. report that a higher volume of exercise may manage declines better than standard volumes. (*J Natl Cancer Inst*, 105(23))

Storic et al. conclude in a systemic review that exercise provides a positive therapeutic effect for patients with cancer-related fatigue. (*Rehabilitation Oncology*, Vol 31 (4))

Cheville et al., Mayo Clinic, report “R.E.S.T.” home-based exercise program improves mobility, fatigue, and sleep quality in Stage IV lung/colorectal patients. (*J Pain Symptom Management*, May, 45(5): 811-21)

Irwin reports a year-long exercise program (HOPE study) contributes to alleviation of pain caused by taking aromatase inhibitors. (Announced at the San Antonio Breast Cancer Symposium, Dec)

- 2014** American Council on Exercise (ACE) creates an on-line “Behavioral Change Specialist” certification in recognition of the goals, and difficulty, of life-long behavior change.

G. Kimmel, oncologist-developer of **FitSTEPS for Life®**, proposes a Standard of Care Model to assimilate exercise into routine oncology practice. (*Current Sports Med Reports*, Jul/Aug, a publication of American College of Sports Medicine)

A. Cheville reports that physical activity has been particularly beneficial for cancer patients experiencing movement-related pain. (*Journal Clinical Oncology*, Vol 32, 16)

- 2015** A keyword search on the Amazon website for “**Cancer + Exercise + Rehabilitation**” yields 64 books for both for the layperson audience and college textbooks.

A keyword search on the Amazon website for “**Cancer + Exercise + Program**” yields 104 books and 13 DVD/CDs (under Movies/TV) for home use.

Commission on Cancer enforces accreditation requirement of a survivorship program directed at exercise. (Private communication, G. Kimmel, Cancer Foundation For Life®)

### Further Information:

To learn more about the free-to-clinicians R.E.S.T. (Rapid, Easy, Strength Training) exercise DVD, contact Dr. Andrea Cheville: [Cheville.Andrea@Mayo.edu](mailto:Cheville.Andrea@Mayo.edu).

To learn more about about FitSTEPS for Life®, see at [www.FitstepsForLife.org](http://www.FitstepsForLife.org) or contact Dr. Gary Kimmel: [G.Kimmel@suddenlink.net](mailto:G.Kimmel@suddenlink.net).

To learn more about “LiveSTRONG at the Y,” see [www.LiveSTRONG.org](http://www.LiveSTRONG.org), What We Do, Programs and Partnerships.

## **History of Colon Wounds**

Martin A. Croce, MD, FACS

Professor of Surgery

University of Tennessee Health Science Center

The overall management of patients with colon injuries is surrounded by myths and dogma. From the earliest case of a patient with a penetrating colon wound in the Book of Judges through the time of World War I these injuries have been associated with an incredibly high morbidity and mortality. However, with the advent of antibiotics and a better understanding of resuscitation with crystalloids, blood, and blood products, morbidity and mortality have decreased through the years. Currently the intraabdominal abscess rate following colon injuries is in the 10 – 20% range, and is associated with the overall degree of contamination in addition to presence of shock.

In World War II, it was mandated that all colonic injuries be treated with colostomy. This reduced the morbidity and mortality following this injury. The military experience was then carried over to the civilian experience and penetrating colon wounds were primarily managed by colostomy. Woodall and Ochsner in 1951 then described the management of colon wounds by primary repair. They pointed out that civilian wounds at that time were very different wounds and that many of the civilian injuries could be managed by primary repair. There was much debate until the late 1970's when Stone and Fabian published a randomized trial comparing colostomy to primary repair in selected patients with hemodynamic stability and nondestructive wounds. They demonstrated that primary repair was associated with less morbidity than colostomy. This paved the way for a subsequent study from Memphis in which primary repair was demonstrated to be the treatment of choice for virtually all penetrating colon wounds.

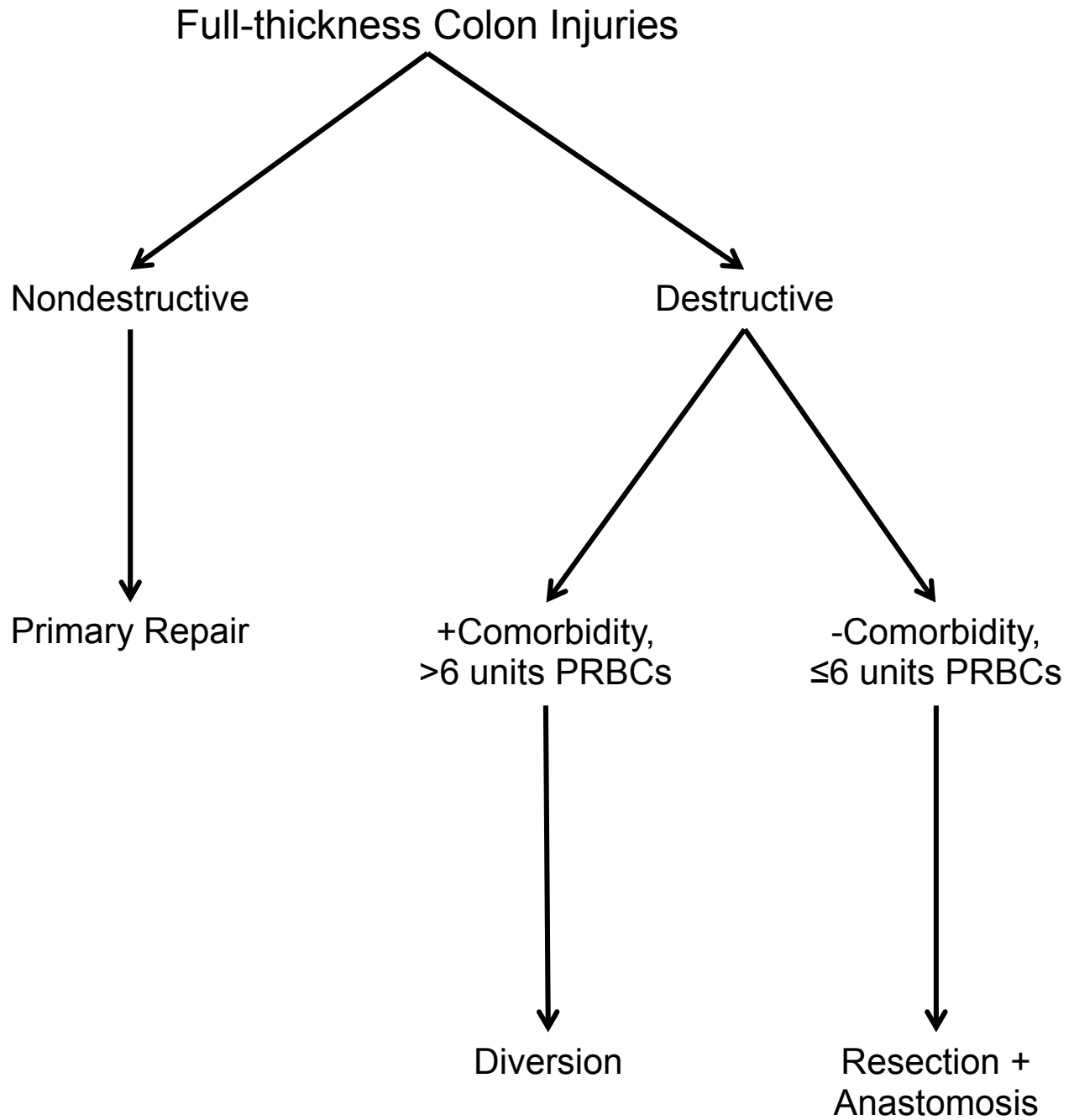
The patient who has a destructive colon wound, however, raises a different set of issues. Resection and anastomosis vs. colostomy then became very debatable. Stewart described an algorithm that is presented below for management of patients with destructive colon wounds who required resection and anastomosis. By employing this algorithm prospectively, we demonstrated decreased morbidity that was associated with significant colon wounds. This colon wound management algorithm also was quite durable and proved to be beneficial for management of patients with blunt colon injury and those who were managed with open abdomen.

The primary concern in management of patients with colon wounds is the integrity of the suture line. Much has been written about suture line dehiscence, degree of contamination, and associated intraabdominal abscess. It appears that the formation of intraabdominal abscess is related to the degree of contamination and the severity of shock and not the method of repair of the colon. In other words, massive contamination in a patient with a colon wound that is amenable to primary repair should not preclude primary repair. Rather, primary colonic repair can be performed in these patients and the development of intraabdominal abscess has nothing to do with the method of repair. Therefore, severe contamination is not an indication for colostomy in these patients. Perioperative antibiotics obviously are very important when it comes to intraabdominal abscess. Preoperative antibiotics should be administered prior to skin incision and should include coverage for Gram-negative enterics and anaerobes. There is no indication for prolonging antibiotic therapy longer than 24 hours regardless of extent of intraabdominal injury or the extent of colonic contamination. There have been multiple studies that demonstrate the prolonged antibiotic therapy is not beneficial and potentially harmful.

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14. Applicability of an established management algorithm for destructive colon injuries after abbreviated laparotomy: a 17-year experience. Sharpe JP, Magnotti LJ, Weinberg JA, Shahan CP, Cullinan DR, Marino KA, Fabian TC, Croce MA. J Am Coll Surg. 2014 Apr;218(4):636-41.



Note Page for

**Current Management of Breast Cancer:**  
Pat McGrath, MD, FACS

### Treatment of Giant Ventral/Incisional Hernias

Robert J. Fitzgibbons, Jr., MD FACS  
 Harry E Stuckenhoff Professor of Surgery  
 Creighton University School of Medicine  
 Omaha, Nebraska

Friday February 6, 2015 Phoenix

### Reimbursement for Ventral/Incisional Hernia Repair in the United States

- 49560 Repair Initial Incisional or Ventral Hernia; RV=20.95 (\$750.55)
- 49561 Repair Initial Incisional or Ventral Hernia; Incarcerated or Strangulated RV= 28.45 (\$947.51)
- 49565 Repair Recurrent Incisional or Ventral Hernia; Reducible RV=21.87 (\$783.44)
- 49566 Repair Recurrent Incisional Or Ventral Hernia; Incarcerated Or Strangulated RV=26.74 (\$957.90)
- 49568 Implantation of Mesh or Other Prosthesis For Open Incisional or Ventral Hernia Repair RV=7.63 (\$273.33)
- Conversion Factor for Medicare in Nebraska in 2014 = 35,8228

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### Faculty Disclosure

- Ad Hoc Paid Consultant (In the last year)
  - None
- Retainer
  - None
- Speaker's Bureau
  - None
- Grant Support (In the last 2 Years)
  - None
- Fellowship Support
  - None
- Financial Interest (≥ \$10,000 US)
  - None
- Royalty
  - Cook Critical; Fitzgibbons Jenkins Catheter
- I will not Discuss Off Label Use of Products

Friday February 6, 2015 Phoenix

### Faculty Disclosure

- Ad Hoc Paid Consultant (In the last year)
  - None
- Retainer
  - None
- Speaker's Bureau
  - Medline
- Grant Support
  - USCCell: Prospective, Randomized, Controlled, Multicenter Evaluation of Strategies vs. Ultrapro in the Repair of Inguinal Hernias
  - Biomatrix Corporation: Phase II Trial to Determine Efficacy of a Polycarbonate Polyethylene Biomaterial for Repair of an Inguinal Hernia
- Fellowship Support
  - None
- Financial Interest (≥ \$10,000 US)
  - None
- Royalty
  - Cook Critical; Fitzgibbons Jenkins Catheter
- I will not Discuss Off Label Use of Products

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### What is a Giant Ventral Hernia?

There is No Consistent Definition!

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### Incisional Hernia Classification

Location	Obstruction
Vertical	Primary
Midline	Multiple Recurrent
Midline including Umbilicus	Recurrence for Type d Previous Repair
Parastomal	
Transverse	
Above or Below Umbilicus	
Oblique	Yes
Above or Below Umbilicus	Obstruction
Combined	Non-obstruction
Asymptomatic	No
Symptomatic	Obstruction
	Non-obstruction
< 5 CM	
5 - 10 CM	
> 10 CM	

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Hernia 2011; 15(5):460  
 DOI: 10.1007/s10026-011-0472-y

**ORIGINAL ARTICLE**

### Peritoneal volume is predictive of tension-free fascia closure of large incisional hernias with loss of domain: a prospective study

C. Sahlgah - F. Dumont - B. Robert -  
 R. Barakat - P. Verhaeghe - J.-M. Regimbeau

Friday February 6, 2015 Phoenix

### Intraoperative and Extraperitoneal Volume Analysis

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**Intraoperative and Extraperitoneal Volume Analysis**

- Volumes based on Non-contrast Multi-detector CT Scans Using Myrian Expert Software
- A ratio of the Total Volume(Hernia + Intraabdominal volume) Divided by the Intraabdominal Volume
- A Ratio of > 20% Spells Trouble

Friday February 6, 2015 Phoenix      Hernia 2011 Oct:15(5):559-65

**Giant Ventral Hernia**

**Synonyms**

- Large
- Massive
- Huge
- Complex
- Sometimes the Whole Visceral Contents Herniate Into the Hernia Sac Outside the Abdominal Cavity

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**What is a Giant Ventral Hernia?**

But You Know One  
When You See One

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**Giant Ventral Hernia**




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**Large Ventral Hernia**



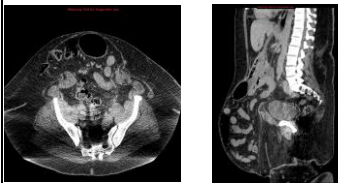
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**Burst Abdomen**



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**Loss of Domain**



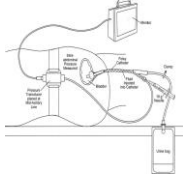
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**Loss of Domain**

- Lack of Viscera in the Abdominal Cavity Causes:
  - Decrease in Abdominal Wall Muscle Elasticity
  - Abdominal Wall Muscular Atrophy
  - Reduced Volume Due to Disuse Atrophy
  - Altered Ventilatory Equilibrium
  - Diaphragmatic Decent
- Impaired Venous and Lymphatic Return From Long Standing Prolapse of the Intestines Causes Edematous Thickened Bowel Which is Difficult to Reduce

Friday February 6, 2015 Phoenix      Ann Surg 2010;195:1518-4


**Abdominal Compartment Syndrome**



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### Commonly Associated Conditions

- Overlying Skin Ulceration
- Persistent Infection
- Enterocutaneous Fistulas
- Diverting Stomas
- Morbid Obesity
- Multiple Previous Repairs



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### Clinical Presentation

- Incapacitating Huge Pannus
  - Unightly
  - Painful,
  - Restricted Mobility
  - Back Problems
  - Altered Respiratory Mechanics
- Dramatic Effects on Functional Status and Quality of Life

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### Clinical Presentation

- Almost Never Reducible Because of Loss of Domain.
- May Present With Bowel Obstruction
  - Narrow Sac Neck
  - Swiss Cheese Fascial Defect Pattern.
  - May be Caused By Factors Exclusively Within The Sac Such as a Volvulus or Adhesions to the Unprotected Extraabdominal Bowel Caused By Inflammation
    - Abscess Formation or Even Gangrene can Occur and the Patient Not Appear Toxic As Patients With More Classical Intraabdominal Bowel Obstructions Presumably Because the Process Becomes Relatively Isolated From the Systemic Circulation as Edema Increases.

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### Pre-operative Work Up

- Computed Tomography Scan Of The Abdomen And Pelvis
  - Status of the Abdominal Wall Musculature
  - Defect Size
  - Volume of the Hernia Sac
  - To Exclude Incidental Unsuspected Conditions

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### Pre-operative Work Up

- Bariatric Considerations
  - Morbid Obesity is the Rule Rather Than the Exception
  - Chance of a Successful Hernia Repair is Inversely Proportional to BMI
  - A BMI of Less Than 30 is Ideal
  - Comprehensive Abdominal Wall Reconstruction Program Should Include a Bariatric Arm

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### Pre-operative Work Up

- Bariatric Considerations
  - Rarely a Reality
    - Incapacitating Symptoms
    - Signs of Impending Bowel Obstruction Commonly
    - Insurance Issues
      - Outright Denial
      - Minimum of One Year of Supervised Weight Loss Before Approval

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### Pre-operative Work Up

- Control of Abdominal Wall Sepsis
  - Drainage Procedures
  - Removal Of Prior Infected Prostheses
  - Serial Debridements,
  - Appropriate Antibiotics
  - Topical Treatment of Pannus Related Intertriginous Skin Problems
    - Yeast
    - Staphylococcus Species
    - Corynebacterium Are Common and Should Be Treated Topically.

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### Pre-operative Work Up

- Repair of Huge Ventral Hernias are Extensive Operations
  - Cardio Respiratory Complications and Pulmonary Embolism are Common
    - Prolonged Anaesthetic
    - Massive Fluid Shifts Due to Third Spacing Will Continue in the Post-operative Period.
    - Post-operative Ventilation, Renal Failure, Intra-abdominal Hypertension, and Wound Related Complications are Common
  - Cardiopulmonary Status Should be Thoroughly Assessed and Medically Optimized
    - Pulmonary Function Studies
    - Stress Testing For Dynamic Cardiac Function
    - Appropriate Deep Venous Thrombosis (DVT) Prophylaxis is Critical and May Even Require a Venacaval Filter

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**Pre-operative Work-Up**

Surgeons Are Often Faced With Patients Who Despite Significant Operative Risk Due to the Magnitude of the Hernia as Well as Associated Comorbidities, are Insistent Because Their Quality of Life is So Poor That They Would Rather Die Than Have to Continue to Live the Way They Are

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**Operative Management**

Conventional vs. Laparoscopic

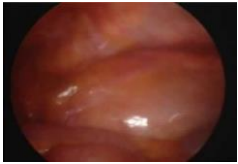
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**Primarily an Adjuvant**



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**Wide Separation of the Rectus Muscles**



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**Operative Management**

Prosthetic Materials


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**Operative Management**


Technique

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**Prosthetic Repairs:**


**Overlay** 


**Inlay** 


**Underlay** 

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**Prosthetic Repairs:**

**Overlay** 

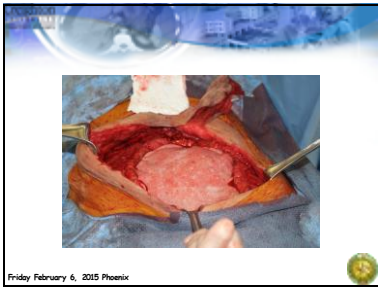
**Inlay** 

**Underlay** 

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**Prosthetic Repairs:**

- Overlay**
- Inlay**
- Underlay**

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**Combined Fascia and Onlay Mesh Closure**

M. S. Whitley, A. B. Raychaudhuri and R. B. Belland. Combined fascia and onlay closure of large incisional hernias. *J.R. Coll. Surg. Edinb.* 43, February 1994, pp 24-30.

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**Chevreil Prosthetic Onlay**

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**Prosthetic Repairs:**

- Overlay**
- Inlay**
- Underlay**

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**Retro-Rectus Ventral Hernia Repair**

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**Retro-Rectus Ventral Hernia Repair**

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**Abdominal Wall Fixation**

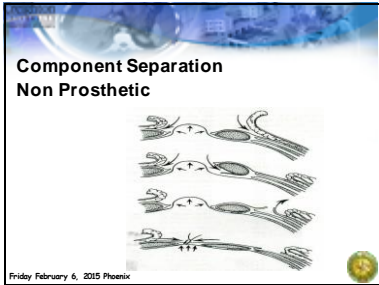
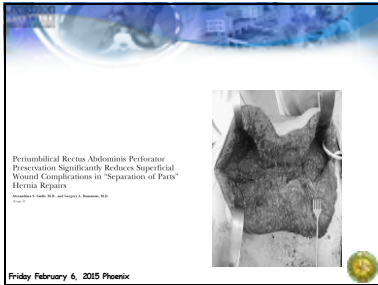
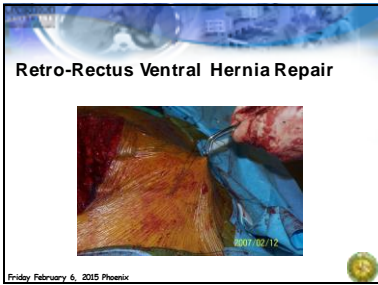
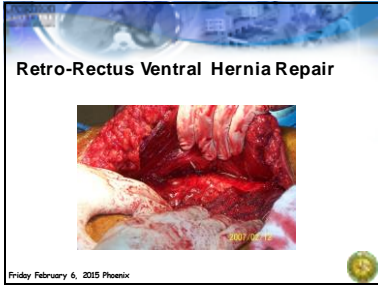
Step 1: Tackers placed through the skin and muscle layers.

Step 2: Mesh placed behind the muscle.

Step 3: Mesh secured to the posterior rectus sheath.

Step 4: Skin closure and final mesh position.

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**Component Separation With a Prosthesis?**

Friday February 6, 2015 Phoenix

World J Surg (2014) 38:2396-2402  
 DOI 10.1007/s12093-014-0494-4

**Components Separation Technique Combined with a Double-Mesh Repair for Large Midline Incisional Hernia Repair**

Mirdeh Brikker · Ewald Verhaar · Tim Kester

Received: 1 September 2013  
 © The Author(s) 2014. This article is published with open access at Springerlink.com

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**Periumbilical Rectus Abdominis Perforator Preservation Significantly Reduces Superficial Wound Complications in "Separation of Parts" Hernia Repairs**

Alexandros S. Sarris, M.D., and Gregory A. Dumanian, M.D.  
 Chicago, IL

Friday February 6, 2015 Phoenix

The American Journal of Surgery (2013) 206, 106-110

The American Journal of Surgery

**Clinical Science**

**Transversus abdominis muscle release: a novel approach to posterior component separation during complex abdominal wall reconstruction**

Paul W. Novitsky, M.D.<sup>1,2,3,4</sup>, Heidi L. Ebbert, M.D.<sup>1,2</sup>, Sean B. Greenstein, M.D.<sup>1</sup>, Michael J. Brown, M.D.<sup>1</sup>

<sup>1</sup>Department of Surgery, University of Connecticut Health Center, Farmington, CT, USA; <sup>2</sup>Veterans Affairs Medical Center, University Hospital, Case Medical Center, Case Western Reserve University, 11100 Euclid Ave., Cleveland, OH 44106, USA

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**Component Separation Posterior**

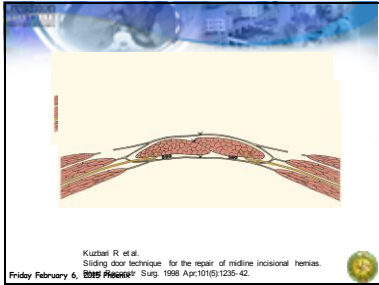
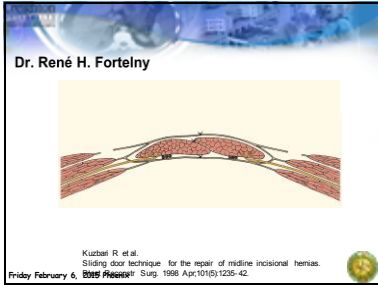
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**Component Separation Posterior**

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**Component Separation Posterior**

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- Adjuvant Strategies**
- Pneumoperitoneum
  - Medialization
  - Resection of Intraabdominal Viscera
  - Tissue Expanders
  - Pedicled Flaps
  - Free Flaps
  - Negative Pressure Wound Therapy
  - Abdominal Wall Transplantation
- Friday February 6, 2015 Phoenix

- Adjuvant Strategies**
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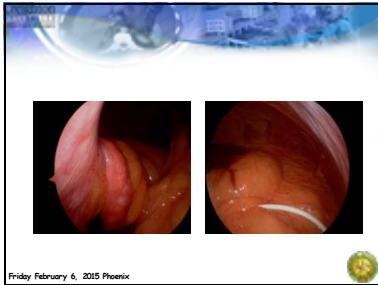
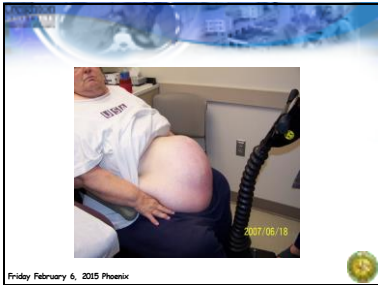
World J Surg (2012) 36:31-40  
 DOI 10.1007/s12010-011-0462-2

ORIGINAL ARTICLE

Progressive preoperative pneumoperitoneum preparation (the Goni Moreno protocol) prior to large incisional hernia surgery: volumetric, respiratory and clinical impacts. A prospective study

C. Sahbani · F. Dumont · B. Feki · T. Yari · P. Verhaeghe · J.-M. Reijnen

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- Adjuvant Strategies**
- Pneumoperitoneum
  - **Medialization**
  - Resection of Intraabdominal Viscera
  - Tissue Expanders
  - Pedicled Flaps
  - Free Flaps
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  - Abdominal Wall Transplantation
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**Medialization of the Abdominal Wall**

The American Journal of Surgery, Vol. 188, No. 4, 481-484  
 Clinical Surgery—American  
 Staged repair of massive incisional hernias with loss of abdominal  
 domain: a novel approach.  
 Jeremy Lipman, M.D., David Mehlis, M.D., Michael J. Rosen, M.D.\*  
 Department of General Surgery, Case Medical Center, University Hospitals, Cleveland, OH, USA  
 \*Research and Academic Director, St. Rita's Medical Center, Elkhart, IN, USA


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**Medialization of the Abdominal Wall**



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**Medialization of the Abdominal Wall**



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**Medialization of the Abdominal Wall**



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**Adjuvant Strategies**

- Pneumoperitoneum
- Medialization
- Resection of Intraabdominal Viscera
- Tissue Expanders
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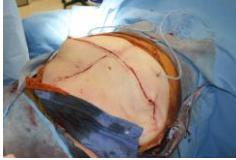
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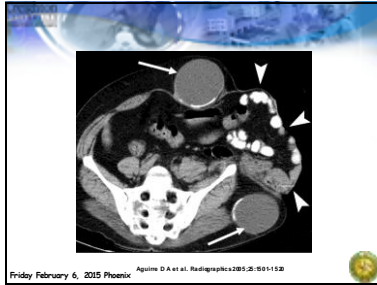
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**Adjuvant Strategies**

- Pneumoperitoneum
- Medialization
- Resection of Intraabdominal Viscera
- Tissue Expanders
- Pedicled Flaps
- Free Flaps
- Negative Pressure Wound Therapy
- Abdominal Wall Transplantation

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- ### Adjuvant Strategies
- Pneumoperitoneum
  - Medialization
  - Resection of Intraabdominal Viscera
  - Tissue Expanders
  - **Pedicled Flaps**
  - Free Flaps
  - Negative Pressure Wound Therapy
  - Abdominal Wall Transplantation
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- ### Autologous Grafts and Flaps
- Tensor Fascia Lata (TFL) Graft
  - Flaps
    - TFL
    - Rectus Abdominis
    - Latissimus Dorsi
    - Rectus Femoris
    - Anterolateral Thigh (ALT)
    - Rectus Femoris
    - Pedicled Groin
    - Gracilis
    - Vastus Lateralis Flap.
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- ### Adjuvant Strategies
- Pneumoperitoneum
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- ### Adjuvant Strategies
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  - Pedicled Flaps
  - Free Flaps
  - **Negative Pressure Wound Therapy**
  - Abdominal Wall Transplantation
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- ### Adjuvant Strategies
- Pneumoperitoneum
  - Medialization
  - Resection of Intraabdominal Viscera
  - Tissue Expanders
  - Pedicled Flaps
  - Free Flaps
  - Negative Pressure Wound Therapy
  - **Abdominal Wall Transplantation**
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- ### Conclusion
- Repair of Giant Ventral Hernias Is Technically Challenging
  - The Morbidity and Mortality is High
  - Pre-operative Medical Optimization is Paramount
  - The Retromuscular Mesh Repair is the Gold Standard Operation
  - Adding Component Separation is Increasingly Popular
  - Adjuvant Strategies Need to be Kept in Mind
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### Treatment of Giant Ventral/Incisional Hernias

Robert J. Fitzgibbons, Jr., MD FACS  
 Harry E Stuckenhoff Professor of Surgery  
 Creighton University School of Medicine  
 Omaha, Nebraska

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## VAP: From Soup to Nuts

Martin A. Croce, MD, FACS

Professor of Surgery

University of Tennessee Health Science Center

Hospital acquired infections are a major cause of morbidity and mortality in Intensive Care Unit patients. The classic signs of sepsis, including fever (or hypothermia), leukocytosis (or leukopenia), and a hyperdynamic state may or may not be related to invasive infection. At a consensus conference the only difference between the definition of invasive infection and Systemic Inflammatory Response Syndrome (SIRS) was the presence or absence of invasive organism. Clinical manifestations of both SIRS and sepsis due to infection are the same. Treating SIRS with antibiotics is not beneficial at all and only subjects the patient to the potential hazards of unnecessary antibiotic therapy. In addition to risks of unnecessary antibiotics, hospital costs are increased.

Nosocomial pneumonia and especially ventilator associated pneumonia is probably the most significant of all hospital acquired infections and is the leading cause of death from nosocomial infection. Accurate diagnosis and prompt therapy are extremely important, however, the accurate diagnosis of ventilator associated pneumonia is difficult. The conventional clinical criteria of fever, leukocytosis, and purulent sputum in the presence of an infiltrate on chest x-ray are not specific for the diagnosis of pneumonia especially in the multiply injured trauma patient. Routine tracheal aspirates have been shown to be notoriously inaccurate and will not differentiate *colonization* from *infection*. The lack of diagnostic accuracy has led to more invasive techniques that are more specific for culturing the lower airways. Bronchoalveolar lavage (BAL) and protected specimen brushing have been studied extensively but are invasive and will significantly increase hospital costs. However, if these invasive procedures can distinguish between SIRS and pneumonia, then the additional costs may be more than offset by savings in unnecessary costs.

We examined the efficacy of using BAL alone for the diagnosis of pneumonia and also the utility of Gram's stain for dictating empiric therapy in trauma patients. A series of 232 patients underwent 443 bronchoscopies with BAL. The diagnostic threshold for pneumonia was  $\geq 105$  cfu/mL, and at that point antibiotics were continued. Antibiotics were stopped if a patient had  $\leq 105$  cfu/mL and a diagnosis of SIRS was made. The causative organisms for pneumonia were then compared to the organisms seen on Gram's stain. The overall incidence of pneumonia was 39% in this study and was not different regardless of the number of BAL a patient had. There was a false negative rate of 7%. Gram's stain was not helpful in dictating empiric therapy. The duration of

ICU stay relative to the timing of BAL was more beneficial for guiding empiric therapy. BAL during week 1 primarily identified *H. influenzae* in gram positives while *Acinetobacter* species and *Pseudomonas* species were more common in BALs performed after week 1. We concluded that bronchoscopy with BAL is an effective method to diagnose pneumonia and can avoid prolonged antibiotic therapy. The empiric therapy should be adjusted to the duration of ICU stay as the causative bacteria flora changes over time. Gram's Stain in the BAL effluent correlates poorly with quantitative cultures as not reliable for dictating empiric therapy.

A separate study analyzed the charges associated with bronchoscopy with BAL and quantitative cultures compared to routine sputum specimens. In 107 ICU patients, three sets of cultures were obtained: routine sputum samples, protected specimen brushing, and bronchoalveolar lavage. Routine sputum specimens identified pathogens in 73% of cultures. Protected specimen brush identified significant colony counts in 34% and BAL identified significant colony counts in 25%. When one compares antibiotic usage of a 3 day course of antibiotics (patients with negative quantitative cultures) with a 14 day course (duration of therapy following the diagnosis of pneumonia), then quantitative cultures are significantly more cost effective than routine sputum sampling. Although bronchoscopy with quantitative cultures is certainly more expensive than a routine sputum culture, the amount of money saved by stopping unnecessary antibiotic therapy is substantial. By using bronchoscopy with BAL for the diagnosis of pneumonia then one can safely treat nosocomial pneumonia and also do this with decreased costs.

As demonstrated in the Figure, our algorithm for the diagnosis of VAP requires clinical evidence of pneumonia. When the patient develops clinical evidence of VAP they undergo fiberoptic bronchoscopy with bronchoalveolar lavage and empiric antibiotic therapy is instituted. Therapy is continued if the quantitative cultures demonstrate  $10^5$  or greater colonies per mL. If there are less than  $10^5$  colonies per mL the empiric therapy is stopped. This clinical pathway substantially reduces the impact of unnecessary antibiotic therapy in these patients. Using this pathway for several years, our institution has demonstrated low rates of resistant organisms and methicillin resistant *Staphylococcus aureus*. In addition, we have not experienced worsening antibiotic sensitivities to particular organisms such as *Pseudomonas* or *Acinetobacter* spp. The antibiotic choice for empiric therapy is based on duration of time the patient has spent in the ICU. Our institutional antibiogram is used and we have demonstrated that those patients who develop early pneumonia (within the first week in the ICU) typically have sensitive Gram-positive organisms or *Haemophilus* sp. Those that develop late VAP (greater than 1 week) tend to develop Gram-negative rods and MRSA. Thus, empiric therapy for the first week is ampicillin/sulbactam, and empiric therapy for late suspected VAP is a third generation anti-pseudomonal cephalosporin plus vancomycin. It is strongly recommended that each ICU

review their individual antibiogram and the timing of the development of VAP so that informed empiric therapy may be used.

It is likely that the best method for improving outcome following post-traumatic VAP is prevention. There are a number of general preventive measures, such as a strict hand-washing protocol and the use of gloves. Other, more novel approaches include continuous subglottic suctioning to prevent the aspiration of oral pharyngeal secretions. Ventilator circuits have also been implicated. However, routine changing of ventilator circuits is not recommended as colonization of this tubing occurs quite rapidly. Removing the gross condensation, however, is recommended as that can prevent the collection of a perfect culture medium for bacteria. Heat-moisture exchangers have been used to decrease the condensation, and while they have been shown to lower cost and maintenance, they have not been shown to decrease overall incidence of VAP. Early tracheostomy remains quite controversial, although it is our institutional policy and the policy of a number of trauma centers throughout the country to perform tracheostomy as soon as possible in patients at high risk for developing VAP. Another area for prevention that shows some promise involves the use of aerosolized antimicrobial therapy. There has been extensive use of this in certain patients with inherited lung diseases, such as cystic fibrosis. There is little experience with this in the trauma setting. A recent pilot study demonstrated reduced incidence of VAP in high-risk patients when these patients received aerosolized sephthazidine compared to placebo. It is clear that further work is necessary in this area, but this preliminary data is certainly quite promising.

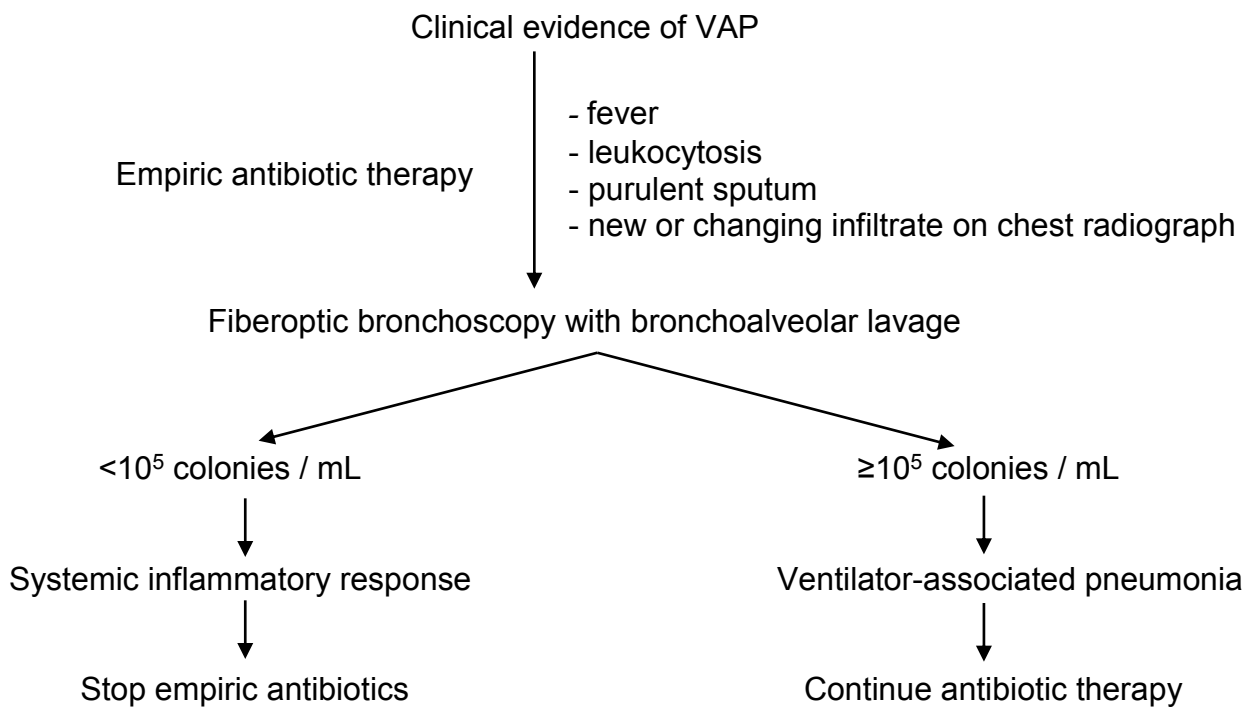
In summary, adequate identification of risk factors is very important for the overall management of the patient with VAP. Use of the equation for calculating the probability of pneumonia can facilitate communication between the surgeon, patient, family members, and third party payors. Further work is necessary to identify specific prevention strategies to combat this serious illness.

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**Figure**

Diagnosis of Ventilator-Associated Pneumonia



### Infection: The Achilles Heel of Abdominal Wall Reconstruction

Robert J. Fitzgibbons MD, FACS  
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Friday February 6, 2015 Phoenix

### Faculty Disclosure

- Ad Hoc Paid Consultant (in the last year)
  - None
- Retainer
  - None
- Speaker's Bureau
  - None
- Grant Support (in the last 2 Years)
  - None
- Fellowship Support
  - None
- Financial Interest (> \$10,000 US)
  - None
- Royalty
  - Cook Critical: Fitzgibbons Jenkins Cateher
  - I will not discuss Off Label Use of Products

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### Healthcare-Associated Infections (HAIs)

- HAIs Are Those That Develop in the Hospital That Were Neither Incubating Nor Present at the Time of Admission
- 40 Million Persons Hospitalized Annually in US; 5% or 2M Will Develop a HAI
  - Morbidity and Mortality (90,000 Deaths); 6<sup>th</sup> Leading Cause of Death in the US
  - Variable Prolongation of Hospital Stay
  - \$5-10 Billion/Year

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### Most Prevalent

Infection Type	Percentage
Urinary Tract	33%
Surgical Site	23%
Primary Bloodstream	19%
Other	25%

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### Surgical Site Infection

- SSIs are the Third Most Common HAI, Accounting For 14-16% of All HAIs
- Among Surgical Patients, SSIs Were Most Common Accounting For ~40% of Healthcare-associated Infections
  - 67% Incisional Infections (Confined To Incision)
  - 33% Organ/Space Infections
- Increase An Average of 7 Days to Each Hospitalization
- Increase >\$10,000 (2005 \$) To Each Hospitalization
- Appropriate Preoperative Administration of Antibiotics and Other Prevention Measures Are Effective in Preventing Infection

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### Surgical Site Infection

- Among Surgical Patients, SSIs Were Most Common Accounting For ~40% of Healthcare-associated Infections
  - 67% Incisional Infections (Confined To Incision)
  - 33% Organ/Space Infections
- Increase An Average of 7 Days to Each Hospitalization
- Increase >\$10,000 (2005 \$) To Each Hospitalization

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### Impact of Healthcare-Associated Infections

Infection Type	Deaths Directly Due To Infection		Deaths, Infections Contributed	
	%	U.S. Total	%	U.S. Total
Pneumonia	3.1	7,087	10.1	22,983
BSI	4.4	4,496	8.6	8,844
SSI	0.6	3,251	1.9	9,726
UTI	0.1	947	0.7	6,503
Total	0.9	19,027	2.7	58,092

Source: Emon TG, Gaynes R. Clin Microbio Rev 1993;6:429

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### Abdominal Wall Hernia

- Ventral Hernia = Any Fascial Defect of the Abdominal Wall
  - Groin Hernia
    - Inguinal, Femoral
  - Non-Groin Hernia
    - Primary
      - Umbilical, Epigastric, Spigelian, Peristomal, Lumbar
    - Secondary
      - Incisional, Traumatic

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### Incidence of Wound Infection Following Hernia Repair

- Groin Hernia Repair
  - 0 - 6%
- Ventral Hernia Repair
  - 0 - 23% Percent


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# February 6, 2015 43rd Annual Phoenix Surgical Symposia

## Infection: The Achilles Heel of Abdominal Wall Reconstruction

### Robert J Fitzgibbons

#### Infection Following Groin Hernia Repair



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#### Infection Following Groin Hernia Repair

- Severe Infection Rate (Protected Area)
- Scattered Case Reports of Cases
- Necrotizing Fasciitis
- Usually Associated With Strangulated Bowel or Appendicitis (Ayman'd's) in The Hernial Sac
- Otherwise Group A Streptococcus Most Common

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#### Rates of Infection Following Incisional Hernia Repair

Open	Laparoscopic
5-10 %	0-3%

SURGICALINFECTIONS Vol 2, Number 3, 2011 205-210

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#### Infection Following Open Ventral Hernia Repair

Study	Open	Infection rate (%)	Recurrence rate (%)
Total	151	9%	20%

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#### Retro-muscular Open Repair

Author	Year	n	Infection %	Mortality %	Recurrence %
Waters	1999	369	12	1.8	5.5
Blanco	1992	228	7.7	0.8	—
Stoppa	1991	39	18	—	—
Milgram	1987	106	18	—	2.9
Schumpelck	1999	81	8	—	22 mo
Martin-Ducer	2004	152	11	—	9.9
Petersen	2004	175	8	—	20 mo
Kingsnorth	2004	53	8	—	6 mo-6 y
Pajunen	2004	84	6	—	5 y
Borges	2004	489	18	—	10-20
Isomitsum	2006	228	12	—	15-24 mo
Nevozhik	2006	32	12	—	5 y
Total	1407	10	6.3	3.7	7.5

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#### Laparoscopic Ventral Hernia Repair Postoperative Findings

Study	Series size (%)	Infection rate (%)	Recurrence rate (%)	Protein seal	Transabdominal etiology	Average follow-up (months)
Tou [96]	609	3.0	4.9	—	—	48
Klein [97]	241	2.9	2.9	—	—	48
Blank [98]	444	4.4	4.8	—	—	129
Chew [97]	309	2.9	1.9	PPH	—	5.9
Nguyen [99]	163	4.3	3.9	PPH	—	39.9
Nguyen [99]	309	3.0	3.9	PPH	—	39.9
Wooden [20]	119	1.0	2.5	—	—	39.9
Wooden [20]	327	0	3.9	—	—	39.9
Crislip [100]	141	0	1.8	PPH	—	39.9
Wu [20]	18	0	5.6	—	PPH + collagen	39.9
Chialvo [21]	158	0	3.9	—	—	39.9
Chialvo [21]	158	0	4.4	PPH	—	39.9
Chialvo [21]	158	0	4.7	PPH	—	39.9
Blanco [101]	24	0	4.2	—	—	39.9
Blanco [101]	24	0	4.2	—	—	39.9
Blanco [101]	24	0	4.2	—	—	39.9
Wicker [102]	149	2.9	2.9	PPH	—	39.9
Wicker [102]	149	0	3.3	PPH, collagen	—	39.9
Franklin [103]	11	0	1.9	—	—	24.9
Franklin [103]	11	0	1.9	—	—	24.9
Average	159	1.9	4.2	—	—	23.9

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#### Laparoscopic Ventral Hernia Repair Infection Rate

Study	Series size (%)	Infection rate (%)	Recurrence rate (%)	Protein seal	Transabdominal etiology	Average follow-up (months)
Tou [96]	609	3.0	4.9	—	—	48
Klein [97]	241	2.9	2.9	—	—	48
Blank [98]	444	4.4	4.8	—	—	129
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Wicker [102]	149	0	3.3	PPH, collagen	—	39.9
Franklin [103]	11	0	1.9	—	—	24.9
Franklin [103]	11	0	1.9	—	—	24.9
Average	159	1.9	4.2	—	—	23.9

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#### Laparoscopic Ventral Hernia Repair Enterotomy

Study	Series size (%)	Infection rate (%)	Operating rate (%)	Conversion rate (%)	Discharge rate (%)
Tou [96]	144	1.8	1.9	1.4	1.4
Klein [97]	42	—	1.9	—	1.4
Blank [98]	72	1.9	1.9	2	2.7
Chew [97]	202	—	1.9	—	1.4
Nguyen [99]	64	1.9	1.9	0	1.1
Nguyen [99]	119	1.9	1.9	—	1.4
Wooden [20]	86	—	1.4	—	4.9
Wooden [20]	139	1.4	1.4	—	1.4
Wu [20]	76	2.1	1.9	1.2	1.4
Chialvo [21]	76	—	1.9	—	1.4
Chialvo [21]	76	—	1.9	—	1.4
Chialvo [21]	76	—	1.9	—	1.4
Chialvo [21]	76	—	1.9	—	1.4
Blanco [101]	206	1.4	1.4	0	1.1
Blanco [101]	206	1.4	1.4	0	1.1
Blanco [101]	206	1.4	1.4	0	1.1
Blanco [101]	206	1.4	1.4	0	1.1
Blanco [101]	206	1.4	1.4	0	1.1
Wicker [102]	96	1.4	1.4	1.4	1.4
Wicker [102]	96	1.4	1.4	1.4	1.4
Franklin [103]	104	1.4	1.4	—	1.4
Franklin [103]	104	1.4	1.4	—	1.4
Average	132	1.4	1.4	2.4	1.4

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#### Comparison of Laparoscopic and Open Repair With Mesh for the Treatment of Ventral Incisional Hernia

A Randomized Trial

Karnal M, J, Butt, MD, Ezzat Har, PhD, Lawrence F, Ekin, MD, Thomas Anthony, MD, Donald H, Berger, MD, MRCSC, Dennis S, PhD, English-Nemmers, MD, Jon W, Veterans Affairs Ventral Incisional Hernia Investigators

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**Table 2. Postoperative Complications (Primary and Secondary Outcomes)**

Primary outcome	Patients, No. (%)		OR (95% CI)	OR (95% CI) (95% CI)
	Exposure group	Non-exposure group		
Wound-healing complications	Wound-healing complications	23 (21.4)	26 (24.3)	
	Wound dehiscence	2 (1.9)	0	
	Wound infection	2 (1.9)	0	
	Wound infection and dehiscence	2 (1.9)	0	
Other wound-healing complications	Wound dehiscence	2 (1.9)	2 (1.9)	
	Wound infection	2 (1.9)	2 (1.9)	
	Wound infection and dehiscence	2 (1.9)	2 (1.9)	
	Wound dehiscence and infection	2 (1.9)	2 (1.9)	
	Wound dehiscence and infection	2 (1.9)	2 (1.9)	
	Wound infection and dehiscence	2 (1.9)	2 (1.9)	
	Wound infection and dehiscence	2 (1.9)	2 (1.9)	
Infection and wound-healing complications	Infection and wound-healing complications	11 (10.2)	16 (14.9)	0.3 (0.1-0.8)
	Infection	2 (1.9)	0	
	Wound-healing complications	9 (8.3)	16 (14.9)	
	Other	0	0	
Other outcomes	Other	1 (1.0)	1 (1.0)	
	Other	2 (1.9)	1 (1.0)	
	Other	2 (1.9)	2 (1.9)	
	Other	2 (1.9)	2 (1.9)	
	Other	2 (1.9)	2 (1.9)	
	Other	2 (1.9)	2 (1.9)	
	Other	2 (1.9)	2 (1.9)	
	Other	2 (1.9)	2 (1.9)	
	Other	2 (1.9)	2 (1.9)	

### Wound Complications

Serious Complications

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### The Prevention of Infectious Complications is One of the Most Important Measures of Successful Surgery

Infect Control Hosp Epidemiol 1999;20:250-278

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### A Current Look at the Key Performance Measures Considered Critical by Health Care Leaders

Dianne Love, Lee Revere, and Ken Black

J. Health Care Finance, 2008, 34, 3, 19-33

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### Health Care Quality Performance Measures

- Financial
  - Operating Profit Margin
  - Days Cash On Hand
  - Charity Care
  - Net Profit Margi
  - Bad Dept Expense
  - Days In Accounts Receivable A/R Continue
- Non-financial
  - Physician and Employee Satisfaction
  - Hospital-acquired Infection Rates
  - Surgical Site Infection Rates
  - Inpatient Mortality
  - Infection Control Outcomes
  - Medication Error Rates

J. Health Care Finance, 2008, 34, 3, 19-33

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### Health Care Quality Performance Measures

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J. Health Care Finance, 2008, 34, 3, 19-33

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### The Prevention of Surgical Site Infections: An Overview

SSI Series Part 1

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### INFECTION CONTROL AND HOSPITAL EPIDEMIOLOGY GUIDELINE FOR PREVENTION OF SURGICAL SITE INFECTION

Alicia J. Mangram, MD; Teresa C. Horan, MPH, CIC; Michele L. Pearson, MD; Leah Christine Silver, B.S.; William R. Rupp, MD

The Hospital Infection Control Practices Advisory Committee  
 National Center for Infectious Diseases  
 Centers for Disease Control and Prevention  
 Public Health Service  
 US Department of Health and Human Services

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### Surgical Site Infection-Definition

- Infections of Tissues, Organs, or Spaces Exposed During An Invasive Procedure
- Classification
  - Incisional
    - Superficial (Limited to Skin / Subcutaneous Tissue)
    - Deep
    - Organ/Space

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### SSI Infection: Definition

- Infection Within 30 Days of Operation (With Implant →1 Year)
- At Least One of the Following:
  - Purulent Drainage from Wound
  - At Least One of the Cardinal Signs of Infection:
    - Pain or Tenderness
    - Localized Swelling
    - Redness
  - Is Deliberately Opened by Surgeon, Unless Incision Is Culture-negative
  - Organisms Isolated From an Aseptically Obtained Culture
  - An Abscess or Other Evidence of Infection Involving the Space is Found on Direct Examination, During Reoperation, by Radiologic Examination or by Histopathology
  - Documentation of Deep SSI by the Surgeon or Attending Physician.

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### Imaging Studies

- Infected Fluid Collections around Mesh Must Be Distinguished from Non-Infected Seromas
- The Presence of Gas is Diagnostic
  - Anaerobic Infection
  - Communication With the GI Tract Hollow Viscus Is Possible. In Any Case, The
- When a Mesh Infection Is Suspected, Fluid Should Be Aspirated

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### Prosthesis Infection Following Incisional Hernia Repair

- Difficult Rate to Calculate Because Most Series Report Only Surgical Site Infection (Ssi) Rate
- Prosthesis Rate is Not Broken Out
- Lack of Consensus for a Definition of a Prosthetic Infection

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### Development and Validation of a Risk-Stratification Score for Surgical Site Occurrence and Surgical Site Infection after Open Ventral Hernia Repair

Rachel J. Boger, MD, Linda T. Li, MD, Stephanie C. Hicks, PhD, Justin A. Dierke, PhD, Lilian S. Kao, MD, MS, PhD, Miles K. Liang, MD

**BACKGROUND:** Current risk assessment tools for surgical site occurrence (SSO) and surgical site infection (SSI) are based on expert opinion or are not specific to open ventral hernia repair. We aimed to develop a risk assessment tool for SSO and SSI for ventral hernia repair, a procedure with unique anatomic and operative characteristics such as patients with open ventral hernia repair.

**STUDY DESIGN:** A prospective study of patients undergoing open ventral hernia repair in 2003 was conducted in a single institution from 2008 through 2013. Data of 202 patients were used.

J Am Coll Surg. 2013 Dec;217(6):974-82.

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### Factors Associated With Increased Odds of SSI

Variable	Points
Mesh Implantation	0
Concomitant Hernia Repair *	2
Creation Of Skin Flaps	2
ASA Class 3	2
BMI ≥40	3
Wound Class 4	7

Hernia Repair: During a Procedure by Another Surgical Institution

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### Incidence of SSI by Ventral Hernia Risk Score stratification

J Am Coll Surg. 2013 Dec;217(6):974-82.

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### Patient Risk Factors for Infection Level of Evidence

- High
  - Nicotine Use/COPD
- Moderate
  - Malnutrition
  - Blood Glucose Level
- Questionable
  - Diabetes
  - Steroids/immuno-suppressive Drugs
- Unproven
  - Staphylococcus Aureus Nasal Carriage
  - Mucocutaneous Ostent
  - Preoperative Transfusion

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### Preoperative Issues Related to Infection Level of Evidence

- High
  - Hair Removal
  - Identification of Colonized Surgical Personnel
- Moderate
- Questionable
  - Antiseptic Showering
- Unproven
  - Choice of Patient Skin Preparation
  - Choice of Personnel Skin Preparation

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### Biomaterials and Infection

Material	Infection Rate
Polypropylene	2.5 To 5.9%
ePTFE	0 To 9.2%
Polyester Meshes	Up To 16%

Floeg et al

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### Where do They Come From?

- Patient
  - Endogenous Flora of Skin or Mucous Membranes
    - Usually Aerobic Gram-positive Cocci (E.G., Staphylococci)
  - Hollow Viscera (E.G., Enterotomy)
    - Fecal Flora
      - Gram Negative Bacilli (e.g., E. coli)
      - Gram-positive Organisms (e.g., Enterococci)
      - Anaerobes (E.g., Bacteroides, Fragilis)
- Exogenous Sources
  - Surgical Personnel
  - The Operating Room Environment (Air Flow)
  - Instruments Placed on the Sterile Field
  - Primarily Gram-positive Aerobes (E.G., Staphylococci and Streptococci)

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### Proven Strategies to ↓ SSI

- Minimize Preoperative Stay
- Identify and Treat Remote Site Infections
- Control Glucose in a Diabetic
- Address Obesity
- Smoking Cessation
- Correct Malnutrition
- Physical Conditioning
- No recommendations to taper or discontinue steroids (Unresolved issue)
- Preoperative Shower
  - Chlorhexidine Probably Best
- Appropriate Hair Removal
- Appropriate Antisepsis for the Surgical Team
- Normothermia

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### Intraoperative Risk Factors Associated With SSI

- Enterotomy
- Bowel Resection
- Emergency Procedure
- Prolonged Operative Time
- Perioperative Blood Transfusion
- Use Of Mesh To Repair Large Ventral Hernia Defects (>10 Cm)

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### Microbiology

Disinfectants or Preservatives Used? (From Technical Note, Antiseptics, Disinfectants, Sterilization, Immunization, Immunology, 1986 to 1996)

Pathogen	1986-1989 <sup>†</sup> (n=16,121)	1990-1992 <sup>‡</sup> (n=12,474)
Staphylococcus aureus	27	26
Clostridium difficile (spore)	12	14
Escherichia coli	10	10
Pseudomonas aeruginosa	4	4
Fusobacterium spp.	4	7
Actinomyces	4	3
Staphylococcus epidermidis	3	3
Other Staphylococci spp.	3	3
Candida albicans	2	3
Group D streptococci (pyoderma)	—	2
Other gram positive aerobes	—	2
Streptococcus faecalis	—	2

†Reference specimens that do not include an isolator.  
 ‡Reference specimens that do include an isolator.

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### Microbiology

- ↑ Proportion of SSIs Caused By Antimicrobial-resistant Pathogens i.e. Methicillin-resistant S. Aureus (MRSA) or Candida Albicans
- May Reflect Increasing Numbers of Severely ill and Immunocompromised Surgical Patients and the Impact of Widespread Use of Broad-spectrum Antimicrobial Agents
- Outbreaks or Clusters of SSIs Caused by Unusual Pathogens Invariably Can be Traced to Contaminated Surgical Paraphernalia or Colonized Surgical Personnel

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### Microbiology

Dose of bacterial contamination × virulence = Risk of surgical site infection  
 Resistance of the host patient

- Classically, Contamination With >10<sup>5</sup> Microorganisms Per Gram of Tissue Markedly Increases Risk
- Three Factors are Additive with Abdominal Wall Reconstruction
  - Foreign Material
  - Extensive Skin and Subcutaneous Tissue Dissection → Seroma / Blood Supply Issues
  - Biofilm Formation

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### SSI: Pathogenesis

Risk of surgical site infections =

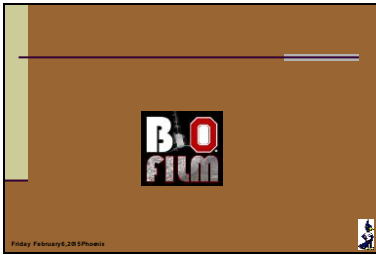
$$\frac{\text{Dose of bacterial contamination} \times \text{virulence (toxins)}}{\text{Resistance of the host}}$$

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### Microbiology

Importance of the So Called Biofilm (\*Polysaccharide Slime)

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### Microbiology: The Biofilm

- Bacterial Adherence to Prosthetic Material is Required to Produce an Infection
- The Mechanism of Adherence is to Create a Microenvironment Called a "Biofilm" or "Polysaccharide Slime."
- Different Constructs of Prosthetic Material Have Differing Abilities to Withstand Biofilm Formation
  - E.G. Monofilament Devices Relatively Impervious

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### Microbiology: The Biofilm

- Biofilm-dwelling Bacteria Behave Differently From Their Free Counterparts (So called Planktonic Bacteria)
- The Shielding Within The Coating Confers Protection Against Antimicrobial Treatment
  - Planktonic Bacteria Die Rapidly and Thus are Susceptible to Antibacterial Agents
  - Bacteria In Biofilm are Dormant and Thus Non-susceptible
  - High Antibiotic Concentrations Cannot be Achieved, Because Biofilm Create A Physical Barrier To Antibiotic Penetration
    - Bacteria In Biofilm Can Survive in a Tissue Antibiotic Concentration as High as 1,000-1,500 Times That Tolerated by Planktonic Bacteria

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### Prosthesis Infection Following Incisional Hernia Repair

- Difficult Rate to Calculate Because Most Series Report Only Surgical Site Infection (Ssi) Rate
- Prosthesis Rate is Not Broken Out
- Lack of Consensus for a Definition of a Prosthetic Infection

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### Antibiotic Prophylaxis

The Patient's Need: ↓ Infection Rate

Society's Need: ↓ Cost  
↓ Bacterial Resistance

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### Meta-analysis

Systematic review and meta-analysis of the effectiveness of antibiotic prophylaxis in prevention of wound infection after mesh repair of abdominal wall hernia

T. J. Aufhauser<sup>1</sup>, M. J. W. Koelma<sup>2</sup>, D. J. Goema<sup>2</sup> and M. P. Simons<sup>1</sup>

<sup>1</sup>Department of Surgery, Thea Lee-Vosma Center and Academic Medical Center, University of Amsterdam, Amsterdam, and <sup>2</sup>Department of Surgery, The Netherlands

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- Randomized Placebo-controlled Trials of Antibiotic Prophylaxis In Abdominal Wall Mesh Hernia Repair
- Only 2 Relevant Trials for Umbilical, Incisional or Laparoscopic
- Results:
  - Infection Rate Significantly Higher After Incisional Compared to Inguinal Hernia Repair
  - Insufficient Data to Draw Conclusion about the Value of Prophylaxis

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### Conclusion

- In the Absence of Objective Data, Antibiotics are the Standard of Care
  - Larger Wounds
  - More Extensive Dissection
  - Greater Likelihood of Enterotomy
  - Higher Risk of Seroma And Hematoma
  - Need For Surgical Drains

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### Predictors of Mesh Infection Ventral hernia


- Repair Of Recurrent Hernia
- Current or Recent Smoking History
- Operation Time
- Body Mass Index
- Immunosuppression
- Steroids
- Coronary Artery Disease
- Serum Albumin

SurgicalInfections (2008)9: 1, 23-32

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### Mesh Infection

#### Bimodal Distribution



Some score patterns have two (or more) central clusters, rather than one.

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### Bimodal Distribution

- Early
  - Usually Superficial SSI
  - May or May Not Involve Mesh
- Late
  - Usually Deep

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### Treatment of Early Infection

- Antibiotics Alone Sufficient for Many (Cellulitis)
- I&D For Fluctuance or Radiological Evidence of Collection
- Vigilance for Signs of Mesh Involvement
  - May Need to Aspirate the Normal Mesh Seroma to be Sure
    - Mesh Determined to be Infected
    - I&D with Local Wound Management For Most
    - Explant if Patient Unstable (Septic)
    - ePTFE Rarely Salvageable

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### Ischemic Wound



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### Meta-analysis

Systematic review and meta-analysis of the effectiveness of antibiotic prophylaxis in prevention of wound infection after mesh repair of abdominal wall hernia

T. J. Aufmaeker<sup>1</sup>, M. J. W. Koekamp<sup>1</sup>, D. J. Gouma<sup>2</sup> and M. P. Simons<sup>3</sup>

Departments of Surgery, The Erasmus Cancer and Academic Medical Center, University of Rotterdam, Rotterdam, and <sup>2</sup>Colophon-Bioscience, Eindhoven, The Netherlands; <sup>3</sup>Department of Surgery, The Erasmus Cancer Center, Rotterdam, 371, 1011 RB, Amsterdam, The Netherlands (e-mail: r.aufmaeker@erasmus.nl)

5312 Journal of the Royal Society of Medicine 10

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### Randomized Placebo-controlled Trials of Antibiotic Prophylaxis In Abdominal Wall Mesh Hernia Repair

- Only 2 Relevant Trials for Umbilical, Incisional or Laparoscopic
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5312 Journal of the Royal Society of Medicine 10

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5312 Journal of the Royal Society of Medicine 10

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### Supplemental O2

Hyperoxia and infection. Hopf HW, Holm J. Best Pract Res Clin Anaesthesiol. 2008 Sep;22(3):553-69


- Maintaining Perfusion and Oxygenation of the Wound is Paramount
- Once Perfusion is Assured, Addition Of Increased Inspired Oxygen Substantially Reduces Surgical Site Infection In At Risk Patients

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### Surgical Drains

Wound drains after Inguinal Hernia Repair (Review)

Cochrane Review



THE COCHRANE COLLABORATION®

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### Authors' Conclusions

**"There is Insufficient Evidence to Determine Whether Wound Drains After Incisional Hernia Repair are Associated With Better or Worse Outcomes Than No Drains"**

Cochrane Database Syst Rev. 2012 Feb 15;CD009570. Review.  
 Friday February 6, 2015 Phoenix

The American Journal of Surgery

**Clinical Science**  
**Predictors of mesh explantation after incisional hernia repair**

Mary T. Henne, M.D., M.S.P.H.<sup>1,2</sup>, Stephen R. Gray, M.D., M.S.P.H.<sup>3</sup>, Christopher W. Snyder, M.D., M.S.P.H.<sup>4</sup>, Laura A. Graham, M.P.H.<sup>1</sup>, Kelly R. Finan, M.D., M.S.P.H.<sup>1</sup>, Catherine C. Vick, M.S.<sup>2</sup>

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### Conclusion

- Same-site Concomitant Surgery and Postoperative Surgical Site Infection Were Associated With Mesh Explantation
- Patients Undergoing Incisional Hernia Repair With Concomitant Intra-abdominal Procedures Have a Greater Than 6-fold Increased Rate of Subsequent Mesh Explantation
- Permanent Prosthetic Mesh Should be Used With Caution in This Setting

The American Journal of Surgery (2011) 202, 28-33  
 Friday February 6, 2015 Phoenix

### Prevention of Surgical Site Infections

William A. Rutala, Ph.D., M.P.H.  
 UNC Health Care System and UNC School of Medicine, Chapel Hill, NC

Friday February 6, 2015 Phoenix

### Prevention of Surgical Site Infections

William A. Rutala, Ph.D., M.P.H.  
 UNC Health Care System and UNC School of Medicine, Chapel Hill, NC

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### Challenges in the Prevention and Management of Surgical Site Infections

- Changing population of hospital patients
  - Increased severity of illness
  - Increased numbers of surgical patients who are elderly
  - Increased numbers of chronic, debilitating or immunocompromising underlying diseases
  - Shorter duration of hospitalization
  - Increased numbers of prosthetic implant and organ transplant operations performed
- Public reporting of infection rates/proportions
- Growing frequency of antimicrobial-resistant pathogens
- Non-reimbursement for "medical errors"-CMS
- Lack of compliance with hand hygiene

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### Prevention of SSIs

- Preoperative preparation of the patient
  - Preoperative showers with antiseptic agent at least the night before (IB)
  - Do not remove hair preoperatively unless it will interfere with the operation (IA)
  - If hair removed, remove just prior to surgery with electric clippers (IA)
  - Wash and clean at and around incision site prior to performing antiseptic skin preparation (IB)

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### Preoperative Showers

- Garibaldi R (J Hosp Infect 1988;11(suppl B):5)
  - Reduction in bacterial counts: Chlorhexidine 9-fold, povidone-iodine 1.3-fold
- Cruse and Foord (Arch Surg 1973;107:206)
  - Clean surgery
    - SSI rate, no shower = 2.3%
    - SSI rate, shower with soap = 2.1%
    - SSI rate, shower with hexachlorophene = 1.3%

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### Chlorhexidine: Preoperative Showers

- CDC recommends preoperative showering with antiseptic<sup>1</sup>
- CHG more effective than PI and triclocarban
- Lower rates of intraoperative wound contamination

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### Chlorhexidine: Preoperative Showers

Patients who had 2 preoperative showers with CHG 24 hours before surgery had reduced rates of wound infection compared to patients who showered with soap.

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### 4% Chlorhexidine Gluconate (CHG) Shower - Mean Skin Surface Concentration (N=60)

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### Preoperative Hair Removal

- Cruse and Foord (Arch Surg 1973;107:206)
  - SSI rate, razor-shave = 2.5%
  - Manual hair clipped = 1.7%
  - Electric hair clipper = 1.4%
  - No shave or clip = 0.9%

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### Importance of Our Skin

- Largest organ of the body
- Epidermis
- Dermis
- Subcutaneous tissue (hypodermis)

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### Importance of Our Skin

#1 Function: Protective Barrier

Microorganisms  
 80% in first 5 cell layers of epidermis

When skin is perforated integrity is compromised ↑ infection risk

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### Normal Skin Micro-Flora

Numbers of bacteria that colonize different parts of the body

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### Hand Antisepsis

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### Alcohols

Advantages	Disadvantages
Broad spectrum	Short persistence
Effective against	Potentially drying to skin
- Most gram-positive	Potentially flammable
- Most gram-negative	Spores may be resistant
- Fungus	Not applicable for mucosal membranes
- Viruses	
Rapid acting	

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### Iodine/Iodophors

Advantages	Disadvantages
Broad spectrum	Diminished efficacy by organic material (e.g. blood)
Effective against	Variable persistence on skin
- Most gram-positive	
- Most gram-negative	
- Fungus	
- Viruses	
Some activity against spores	

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### Chlorhexidine

Advantages	Disadvantages
Broad spectrum Effective against: <ul style="list-style-type: none"> <li>Most gram positive</li> <li>Most gram negative</li> <li>Fungi</li> <li>Viruses</li> <li>Yeast</li> </ul> Highly persistent Effective in the presence of organic material (e.g., blood) Minimally absorbed	Direct instillation can damage ears or eyes Direct contact with nerve tissue can be damaging Minimal activity against spores

Source: 1. An. J. Infect. Control. 2004; 29: 120-125. 2. J. Hosp. Infect. 2001; 45: 101-105. 3. J. Hosp. Infect. 2001; 45: 101-105. 4. J. Hosp. Infect. 2001; 45: 101-105. 5. J. Hosp. Infect. 2001; 45: 101-105.

### Surgical Hand Antisepsis

- Surgical hand scrubs should:
  - Significantly reduce microorganisms on intact skin
  - Contain a non-irritating antimicrobial preparation
  - Have broad-spectrum activity
  - Be fast-acting and persistent

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### Combined Agents

Active Agent	Triclore of toline	Traditional Iodophors	CHG/Alcohol
Broad Spectrum	X	X	X
Rapid Activity	X	X	X
Residual Activity			X
Activity in Blood/Organic			X
Non-irritating			X
Minimal Absorption			X

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### Surgical Hand Antisepsis

- Formulations containing 60-90% alcohol alone, or 50-95% when combined with small amounts of a QUAT, or CHG lower bacterial counts on skin post-scrub more effectively than other agents
- Next most active agents (in order of decreasing activity) are CHG, iodophors, triclosan, and plain soap
- Alcohol-based preparations containing 0.5-1% CHG have persistent activity but alcohol alone may not

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### Prevention of SSI

- Preoperative preparation of the patient
  - Use appropriate antiseptic for skin preparation (IB)
    - Alcohol (70-92%)
    - Chlorhexidine 4%, 2% or 0.5% in alcohol base
    - Iodine/Iodophors
  - Apply in concentric circles moving to periphery
  - Prep area to include incision and any drains

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### Chlorhexidine

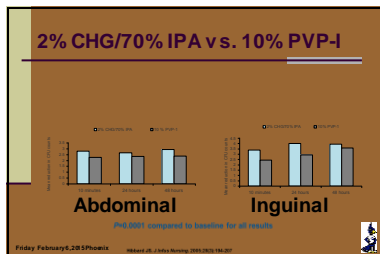
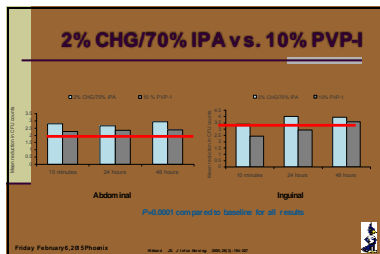
- Highly effective in studies of hand washing, preoperative showering, IV catheter care
- CHG has a broad spectrum of activity
  - Rapid
  - Persistent
  - Active w/organic material
  - Non-irritating
  - Recommended in 15 evidence-based guidelines (hand hygiene, catheter-related bloodstream infection)

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### 2% CHG/70% IPA vs. 10% PVP-I

- Randomized, parallel group, open label, healthy human volunteers
- 55 subjects
- Microbial samples: right and left abdominal and inguinal sites
- Efficacy defined as
  - $\geq 2.0 \log_{10}$  reduction from baseline CFUs/cm<sup>2</sup> on abdominal sites
  - $\geq 3.0 \log_{10}$  mean reduction from baseline CFUs/cm<sup>2</sup> on inguinal sites

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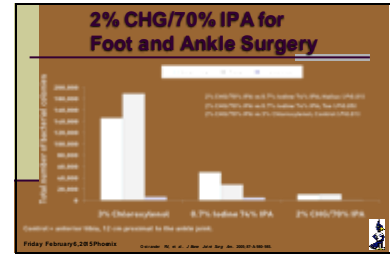
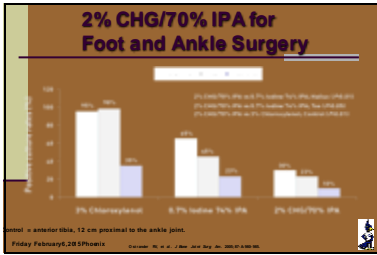




### 2% CHG/70% IPA for Foot and Ankle Surgery

- Prospective, randomized trial
- 125 evaluable patients
  - 40 subjects/group
  - 5 pre-prep baseline
- Products
  - ChlorPrep® (2%CHG/70%IPA)
  - DuraPrep® (0.7%Iodine/74%IPA)
  - Techni-Care® (3%Chloroxylenol-PCMX)
- Cultures: hallux, web spaces between toes, and control site

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### Prevention of SSIs

- Intraoperative
  - Use materials for surgical gowns and drapes that are effective barriers when wet (IB)
  - Change surgical scrubs when visibly soiled, contaminated and/or penetrated by blood (IB)

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### Prevention of SSIs

- Asepsis and surgical technique
  - Adhere to the principles of asepsis when placing intravascular devices, spinal or epidural anesthesia catheters, or when dispensing and administering IV drugs (IB)
  - Handle tissue gently, maintain effective hemostasis, minimize devitalized tissue and foreign bodies, and eradicate dead space at the surgical site (IB)

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### Prevention of SSIs

- Asepsis and surgical technique
  - Use delayed primary skin closure or leave an incision open to heal by second intention if the surgeon considers the surgical site to be heavily contaminated (IB)
  - If drainage is necessary, use a closed suction drain. Place a drain through a separate incision distant from the operative incision. Remove the drain as soon as possible. (IB)

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### Conclusions

- Surgical Site Infections Result in Significant Patient Morbidity and Mortality and Increased Hospital Cost for Abdominal Wall Reconstruction
- Reduction in the Incidence Can Be Achieved By Strict Adherence to Standard Surgical Guidelines
- Observations Have Revealed Failure To Follow Standard Guidelines
- Strict Adherence To Standard Guidelines

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### Infection: The Achilles Heel of Abdominal Wall Reconstruction

Robert J. Fitzgibbons MD, FACS  
 Harry E. Stuckenhoff Professor of Surgery  
 Creighton University School of Medicine  
 Omaha, Nebraska

Friday February6,2015Phoenix

## Four Generations and the Impact on Surgery

Clive S. Grant, MD

Phoenix Surgical

Friction between generations is not new. Over the past 10-15 years, for the first time in history, four distinct generations have co-existed in the workforce. While certain basic values of integrity, honesty, desire to be respected and recognized are shared by all generations, the priorities and attitudes regarding education, work style and work-life balance, authority, and especially communication have evolved and sometimes caused misunderstandings if not outright contempt. Discussion between members of different generations often generates more heat than light. Social science research that forms the conceptual basis for defining generations, while far different from the methodology of medical science, has generated a prolific number of papers, editorials, presentations, and even books dealing with this subject. Physicians in general and surgeons in particular are only now encountering the most recent generation (Generation Y, Millennials) as they have worked through residency, fellowships, and have just begun to enter the surgical workforce. The education and business sectors have dealt with these generational differences for more than a decade, and their assessments, experiences, and recommendations can be valuable to us. Mentoring these young adults requires us to understand the traits and characteristics of each generation, and especially to recognize striking differences that need to be bridged.

A generation is defined as an identifiable group that shares birth years and significant life events at critical development stages. This leads to mutual values, beliefs, attitudes, and behaviors. At teenage, a person's focus turns from inward to outward. This is a critical time in individual development, influenced by world events, family especially parents, peers, media, popular culture, with formation of values, priorities, and measures of success. These opinions will influence individuals for a lifetime. Even though people generally become more conservative as they age, research shows that core generational values change very little. These differences are real, striking, and mainstream—they are not confined to just a select number within each generation. However, without question, not all members of a defined age range “behave” according to the corresponding generational label. These labels are just reasonable generalizations.

### **Challenges to Harmony**

The Association of Academic Chairs of Plastic Surgery conducted a survey and 70 of 98 faculty members responded that they have difficulty relating to the residents' work ethic. Business leaders have complained that today's graduates do not have the basic critical thinking skills they need to thrive. “Yers prefer not to read, seemingly cannot sit and listen and rely too heavily on a cut-and-paste approach to assignments.” “They might be whizzes on communication devices, but their communication skills—both in writing and in person—have a long way to go.” Some educators tend to view Gen

Y as lazy, unmotivated, and selfish, and this view is shared by the business world. Older generations perceive the younger generations as having an entitlement mentality, that they are presumptuous and want to be accommodated with their demands. They want more, expect more, and are not afraid to ask for more. To counter, the younger generation's viewpoint might be summed up in this quote: "It's a whole new world out there, with new playing fields, rules and players. Your choice is either to learn this new game or continue to be the best player in a game that is no longer being played."

### **Solutions to Achieve Harmony**

I, a Boomer, typed "managing the multigenerational workforce" into Google search, and in exactly 32/100 of a second, had 2,850,000 articles to choose from.

When I have spoken to younger generation surgeons about what has, or in many cases, what would they consider most valuable from the older generations, a few recurring themes surfaced. Because access to high-quality scientific material is readily available in moments electronically, just factual knowledge is not any longer supreme. One vital edge would be to meet face-to-face with key thought and practice leaders, specifically in a setting that would allow comfortable interchange. It would build interest, trust and collegial respect regardless of age difference. It could facilitate a new level of open, unfettered dialogue for future interactions such as patient management advice, fellowship opportunities, or even professional partnerships. Along the same line, what I referred to previously as *information literacy* and *information fluency* is often gleaned by listening carefully to senior surgeons' comments that are filtered through the lens of long experience. While this may be captured at a podium, it could even better be over a cup of coffee or a glass of wine.

There is frequently a wide gulf of disparity in understanding, using, and particularly embracing newer technology between older and newer generations. I speak for the older generations, but perhaps in return for the senior-to-junior mentoring in information literacy, the Xers and Millennials can *reverse mentor* us in what we see as new, cutting edge technology, but they regard as routine daily communication. Interactive presentations, panels, podcasts, even—dare I suggest the 140-character Twitter communication could be considered. Cross-generational enthusiasm and wisdom seem ideal.

The business and educational spheres have experienced the full impact of Xers and Millennials for more than a decade. We in surgery are just now seeing this huge wave of highly educated, inspired, confident, techno-savvy young surgeons swashbuckling into our professional lives. If we are prepared to guide and manage, their advances and achievements will be awesome. Pearl S. Buck may have said it best:

"The young do not know enough to be prudent, and therefore they attempt the impossible, and achieve it, generation after generation."

**COMPLICATIONS RELATED TO PROSTHETIC PLACEMENT AT THE ESOPHAGEAL HIATUS**

Robert J. Fitzgibbons, Jr., MD, FACS  
 Harry E. Stuckenhoff Professor of Surgery  
 Creighton University School of Medicine  
 Omaha, Nebraska

43rd Annual Phoenix Surgical Symposium

Saturday, February 7, 2015 Phoenix

**Faculty Disclosure**

- Ad Hoc Paid Consultant (in the last year)
  - None
- Retainer
  - None
- Speaker's Bureau
  - None
- Grant Support (in the last 2 Years)
  - None
- Fellowship Support
  - None
- Financial Interest (> \$10,000 US)
  - None
- Royalty
  - Cook Critical: Fitzgibbons Jenkins Catheter
  - I will not Disclose Off Label Use of Products

Saturday, February 7, 2015 Phoenix

**Fact # 1**

**Elective Repair is in the Best Interest of Many Patients with Type IV Paraesophageal Hiatal Hernias**

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**WHY?**

Hiatal Hernia is a Common Anatomical Background of Pathological Gastroesophageal Reflux

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**Why**

Large Hiatal Hernias with an Intrathoracic Stomach are Associated with Significant Morbidity and Mortality when Left to Emergent Repair

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*Improved Patient Outcomes in Paraesophageal Hernia Repair Using a Laparoscopic Approach: A Study of the National Surgical Quality Improvement Program Data*

DOM KLEBANIK, MD, KEITH C. HOSKI, MD, SHAWN DALEY, MD, DANIEL J. DEZELL, MD, JONATHAN A. MYERS, MD, KEITH W. MULLIGAN, MD, BRAD JANSSEN, PhD, MENI E. LULI, MD

From the Department of General Surgery, Rush University Medical Center, Chicago, Illinois

Am Surg. 2014; Sep;90(9):984-9

Saturday, February 7, 2015 Phoenix

**Outcomes of Open and Laparoscopic Paraesophageal Hernia Repairs (PHR)**

- The National Surgical Quality Improvement Program (NSQIP) Database From 2007 To 2011
- Open and Laparoscopic PHR Included
- 4470 Patients
  - 2834 Laparoscopic
  - 1636 Open
- The Open Repair Group Had Significantly
  - ↑ 30-day Mortality
  - ↑ Incidence of Infections
  - Respiratory and Cardiac Events/Complications
  - Transfusion Requirements
  - Episodes of Sepsis, and Septic Shock

Am Surg. 2014; Sep;90(9):984-9

Saturday, February 7, 2015 Phoenix

Should Elective Repair of Intrathoracic Stomach be Encouraged?

Mark A. Fitzgibbons • Corbin E. Jones • Brian Soper • Matthew O'Connor • Mark Mendenhall • Ralf He • David P. Raymond • Virginia H. Linn • Thomas A. Warton • Jeffrey H. Peters

Journal: September 2009; Accepted: 7 November 2009; Published online: 1 December 2009  
 © 2009 The Society for Surgery of the Alimentary Tract

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**Elective Vs. Emergent Repair of an Intrathoracic Stomach**

127 Patients / 2000 To 2006

- 104 Elective
- 23 Emergent Morbidity And Mortality
- Older (79 Vs. 65 Years, P<0.0001)
- Higher Prevalence Of At Least One Cardiopulmonary Comorbidity (57% Vs. 21%, P<0.0014)

**Results**

Emergent Patients

- Mortality (23.3% Vs. 0%, P<0.0002)
- Major Complications (42.5% Vs. 19%, P<0.0003)

Regression Analysis: Emergent Repair Was A Predictor Of In-hospital Mortality, Major Complications, Readmission To Intensive Care Unit, Return To Operating Room, And Length Of Stay

J Gastrointest Surg (2010) 14:205-210

Saturday, February 7, 2015 Phoenix

### J Gastrointest Surg (2010) 14:203–210

**Conclusion**

Emergent Surgical Repair of Intra-thoracic Stomach was Associated with Markedly Higher Mortality and Morbidity Than Elective Repair, Although Patients Undergoing Urgent Surgery were Older and Had More Comorbidities. Even Those Having An Elective Procedure, These Data Suggest That Elective Repair Should be Considered in Patients with Suitable Surgical Risk.

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### Fact # 2

Repair of a Hiatal Hernia by Primary Cruroplasty is Associated with a High Recurrence Rate Especially When Large

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### Recurrence After Paraesophageal Hernia Repair in Series With Radiologic Follow-up

**Table 2. Recurrence After Surgical Treatment of PEH in Series With Systematic Radiologic Control**

Source	No. (%) of Patients With Diagnostic PEH	Recurrence No. (%)	PEH Recurrence No. (%)	Striding No. (%)	Nonstriding No. (%)	Mesh Type
Location et al. <sup>11</sup> (2008)	1402 (26)	6 (0.4)	0	4	2 (20)	e-PTFE
			<b>Open Surgery</b>			
Muller et al. <sup>1</sup> (2002)	2028 (20)	0 (0)	2	0	2 (24)	NA
Wagner et al. <sup>2</sup> (2002)	2122 (22)	0 (0)	NA	NA	0 (0)	Profil
Wachstein et al. <sup>3</sup> (2002)	4485 (22)	0 (0)	3	0	44 (10)	NA
Wagner et al. <sup>4</sup> (2002)	1420 (22)	1 (0.07)	2	0	0 (0)	Profil
Jain et al. <sup>5</sup> (2002)	2452 (20)	0	0	0	28 (11)	Profil
Wagner et al. <sup>6</sup> (2002)	3072 (22)	NA	NA	NA	12 (4)	Profil
Keller et al. <sup>7</sup> (2002)	NA	NA	0	0	10 (10)	NA
Diago et al. <sup>8</sup> (2002)	6626 (20)	7 (0.1)	7	14	42 (0.6)	NA
Nagata et al. <sup>9</sup> (2002)	2027 (21)	1	1	0	16 (0.8)	NA

Abbreviations: NA, not available; PEH, paraesophageal hernia.

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### Recurrence After Paraesophageal Hernia Repair in Series With Radiologic Follow-up

**Table 3. Recurrence After Surgical Treatment of PEH in Series With Systematic Radiologic Control**

Source	No. (%) of Patients With Diagnostic PEH	Recurrence No. (%)	PEH Recurrence No. (%)	Striding No. (%)	Nonstriding No. (%)	Mesh Type
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Muller et al. <sup>1</sup> (2002)	2028 (20)	0 (0)	2	0	2 (24)	NA
Wagner et al. <sup>2</sup> (2002)	2122 (22)	0 (0)	NA	NA	0 (0)	Profil
Wachstein et al. <sup>3</sup> (2002)	4485 (22)	0 (0)	3	0	44 (10)	NA
Wagner et al. <sup>4</sup> (2002)	1420 (22)	1 (0.07)	2	0	0 (0)	Profil
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Abbreviations: NA, not available; PEH, paraesophageal hernia.

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### Outcomes after a decade of laparoscopic giant paraesophageal hernia repair

James D. Laketch, MD, Katie S. Nason, MD, MPH, Neil A. Christie, MD, Arjun Pennathur, MD, Blair A. Jobe, MD, Rodney J. Landreman, MD, and Matthew J. Schuchert, MD

The Journal of Thoracic and Cardiovascular Surgery (JTS), 2

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**Table 3. Analysis of preservative risk factors and operative techniques and the risk of reoperation and radiologic recurrence at any time after operation**

	Radiologic recurrence (n = 46)*		Reoperation for recurrent hernia/emphases	
	No.	Crude OR (95% CI)	No.	Crude OR (95% CI)
Female	21	1.0	11	1.0
Male	25	1.0	11	1.0
Age (yr)	67.5 (10.5)	1.0	67.5 (10.5)	1.0
Striding	12	1.0	12	1.0
Nonstriding	34	1.0	11	1.0
Open	12	1.0	12	1.0
Laparoscopic	34	1.0	11	1.0
Profil	12	1.0	12	1.0
e-PTFE	34	1.0	11	1.0
Other	12	1.0	11	1.0
Striding	12	1.0	12	1.0
Nonstriding	34	1.0	11	1.0
Open	12	1.0	12	1.0
Laparoscopic	34	1.0	11	1.0
Profil	12	1.0	12	1.0
e-PTFE	34	1.0	11	1.0
Other	12	1.0	11	1.0

The Journal of Thoracic and Cardiovascular Surgery (JTS), 2

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e-PTFE	34	1.0	11	1.0
Other	12	1.0	11	1.0

The Journal of Thoracic and Cardiovascular Surgery (JTS), 2

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### Fact # 3

Hiatal Hernia Recurrences are Commonly Asymptomatic

The Journal of Thoracic and Cardiovascular Surgery (JTS), 2

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TABLE 5. Analysis of preoperative risk factors and operative techniques and the risk of respiratory and radiographic recurrence at any time after operation

	Radiographic recurrence (n = 452 <sup>a</sup> )			Respiration for recurrent hernia/symptoms		
	No.	Crude OR	P value	No.	Crude OR	P value
Hernia	71/46 (15.7%)			21/62 (32%)		

The Journal of Thoracic and Cardiovascular Surgery (1993) 2

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**Recurrence**  
**What is the Significance?**

52 Patients with Laparoscopic Hiatal Repair for Type III Hiatal Hernias  
 Esophagrams at a Mean of 37 Months  
 Esophagrams Revealed a Recurrent Hernia in 32% (11/34) of Patients of Whom 36% (4/11) were Asymptomatic

Jobe BA, Aye RW, Deveney CW, Domeick JS, Hill LD. Laparoscopic management of giant type III hiatal hernia and short esophagus: objective follow-up at three years. J Gastrointest Surg 2002; Mar-Apr;6(2):191-8. Oregon Health Sciences University

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**Recurrence**  
**What is the Significance?**

- 136 Patients Between 1993 - 1999
- 36 F/U Esophagrams > 1 Year
- 14 Anatomical Recurrences
- Only 6 With More Than Mild Symptoms

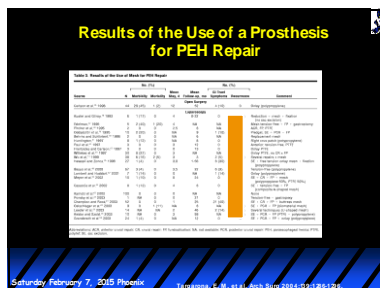
Mattar SG, Bowers SP, Galloway KD, Hunter JG, Smith CD. Long-term outcome of laparoscopic repair of paraesophageal hernia. Surg Endosc 2003; May;16(5):745-9. Emory University School of Medicine, Atlanta.

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**Fact # 3**

The Use Prosthetic Material for Hiatal Hernia Repair will Decrease the Incidence of Recurrence

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**Results of the Use of a Prosthesis for PEH Repair**

Group	Mesh	Non-Mesh
Recurrence	10%	25%
Asymptomatic	5%	15%
Operative mortality	0%	0%
Postoperative mortality	0%	0%
Postoperative morbidity	10%	15%
Postoperative hospital stay (days)	5	7

Targarona, E. M. et al. Arch Surg 2004;139:126-128.

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**Outcomes of Open and Laparoscopic Paraesophageal Hernia Repairs**

Mesh vs Non-Mesh

- No Statistically Significant Difference
- Overall Use Of Mesh In Paraesophageal Hernia Repairs Has Increased

Am Surg 2014; Sep;80(9):884-9

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Johnson JM, Carbonell AM, Carmody BJ, Jansel MK, Maher JW, Kellum JM, Demaria EJ. Laparoscopic Mesh Hiataloplasty for Paraesophageal Hernias and Funduplications: A Critical Analysis of the Available Literature. Surg Endosc 2006 Mar;20(3):362-6.

- 1,368 Laparoscopic Procedures for PEH, GERD, HH, or a Combination
  - Case series (n = 5)
  - Retrospective Reviews (N = 6)
  - Prospective Randomized (N = 4)
  - Nonrandomized (N = 4)
- Group A (N = 729) Primary Suture Repair
- Group B (N = 639) Repair With Either Prosthetic Material Interposition Only After Crural Closure

Results:

- Recurrence for Group B
- No Reports of Erosion

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**Conclusions**

The Current Data Tend to Support The Use of Prosthetic Materials For Hiatal Repair in Both Routine LF and the Repair of Large PEHS

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World Journal of Surgery  
 2007, Volume 1(1): 27-30  
 doi:10.1007/s12076-007-0010-0  
 © Springer Science+Business Media, Inc. 2007



Prosthetic mesh repair of large and recurrent diaphragmatic hernias

Y. Leshchik, B. Nigam, A. Kulkarni, A. Kulkarni

Department of Surgery and the Department of Pediatrics, The Ohio State University Medical Center and the OSU School of Medicine, The Ohio State University, Columbus, Ohio, USA (Y. Leshchik)

Received: 1 October 2006 / Accepted: 21 October 2006 / Online publication: 01 February 2007

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**Kepenekci I. Laparoscopic Fundoplication with Prosthetic Hiatal Closure 1: World J Surg. 2007 Jul 3**

551 Patients Who Underwent Laparoscopic Fundoplication For GERD

- Group 1 (N=335) March 1998- July 2002
- Group 2 (N=176) All Subsequent Patients

Simple Crural Repair  
 Mesh Reinforcement

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**Kepenekci I. Laparoscopic Fundoplication with Prosthetic Hiatal Closure 1: World J Surg. 2007 Jul 3**

Recurrence Rate @ 2 Years

- Group 1: 6.0%
- Group 2: 1.8%

Complications

- No Difference in Postoperative Dysphagia
- No Complications Related To The Use Of Polypropylene Mesh

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**Kepenekci I. Laparoscopic Fundoplication with Prosthetic Hiatal Closure 1: World J Surg. 2007 Jul 3**

**CONCLUSION**

The Results of This Study Suggest That Polypropylene Mesh Reinforcement Increases the Success Rate for Laparoscopic Hiatal Hernia Repair Without Causing An Additional Complication Burden. We Propose Routine Use of Mesh Reinforcement in Laparoscopic Antireflux Surgery

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**Laparoscopic Paraesophageal Hernia Mesh Repair Surgery. 2007 May; 141(5):692-3 (Letter To The Editor)**

The Consequences of Anatomic Recurrence (. . . of a PEH . . .) are Unknown in High-risk Patients. Therefore, The Primary Procedure to Repair The PEH has to be as Effective as Possible to Avoid a Recurrence. We Suggest That the Ongoing Discussion Should be About the Type of Mesh and The Mesh Fixation Technique.

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**Fact # 4**

Now There is Growing Concern About the Incidence of Mesh Associated Complications

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**Foreign Material In the Hiatus: A Problematic History**

- Polypropylene
- Pledgets
- Angelchik Prosthesis
- Gastric Bands
- NDO Plication

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Dutta S. Prosthetic Esophageal Erosion After Mesh Hiataloplasty in a Child, Removed by Transabdominal Endogastric Surgery. J Pediatr Surg. 2007 Jan;42(1):252-6



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**Mesh Complications in the Literature**

Author	Year	Prosthesis	Complication	Re-operation
Edelman	1995	polyp.	Stenosis	lap revision
Trus	1996	—	Stenosis	myotomy
Carlson	1998	polyp.	Erosion	esophagectomy
Kerppanen	2000	PTFE	cardiac tampon	death
Van der Peet	2000	Polyester	Stenosis	mesh removal
Castella	1996	—	Stenosis	esophagectomy
Coluccio	2000	PTFE	Erosion	esophagectomy

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**Anecdotal Cases of Mesh Erosion**

**Warnings From Experienced Esophageal Surgeons**

**29 Cases Assembled by Filipi et al**

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**Prosthetic Reinforced Surgeries for Large Hiatal Hernia**

Eng Buhac (2009) 23:1216-1220  
DOI: 10.1007/s12229-009-9058-5

Mesh complications after prosthetic reinforcement of hiatal closure: a 28-case series

Rudolf J. Studthaker · Amir El Sherif · Sameer K. Mittal · Robert J. Fitzgibbons, Jr ·  
D. Michael Brown · James G. Hunter · Tom R. DeMeester · Lou L. Swanson ·  
C. David Smith · Charles J. Filipi

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**Prosthetic Reinforced Surgeries for Large Hiatal Hernia**

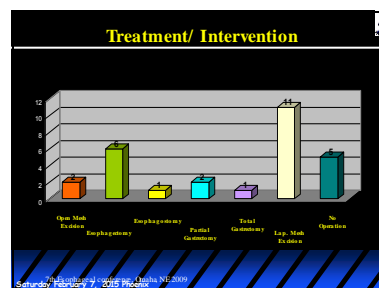
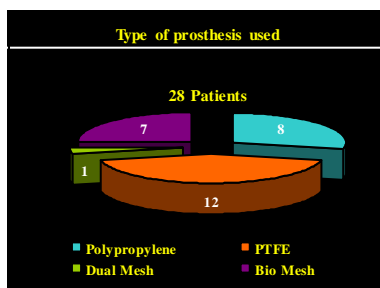
- 28 Patients (26 Laparoscopic/ 2 open surgery)
- Mesh types
  - Polypropylene (n = 8),
  - Polytetrafluoroethylene (PTFE) (n=12),
  - Biological mesh (n = 7)
  - Dualmesh (n = 1).
- Presenting Symptoms D
  - Dysphagia (n = 22),
  - Heartburn (n = 10), chest pain (n = 14), fever (n = 1), epigastric pain (n = 7), and weight loss (n = 4)
- Main Reoperative Findings
  - Mesh Erosion (N = 17)
  - Esophageal Stenosis (N = 6)
  - Dense Fibrosis (N = 5)

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**Prosthetic Reinforced Surgeries for Large Hiatal Hernia**

- Main Reoperative Findings
  - Mesh Erosion (N = 17)
  - Esophageal Stenosis (N = 6)
  - Dense Fibrosis (N = 5)
- Treatment
  - Surgical (N=23)
    - Mesh Removal with Revision (N=12)
      - revision mesh
        - Esophagectomy (N=7)
        - Partial Gastrectomy (N=2)
        - Total Gastrectomy (N=3)
      - Non Surgical (N=6)
        - dilation (N=4)
        - Endoscopic removal (N=2)
    - Outcome
      - NO Immediate Postoperative Mortality
      - Requiring Tube Feeding (N=0)
      - Mortality (n = 3) Mortality Cause Unknown
      - No Apparent Relationship Between Mesh Type

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**The Issues Concerning Mesh Repair**

- Indication
- Type of Mesh To Use
- Optimal Technique of Placement

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**The Issues Concerning Mesh Repair**

- Indication
- Type of Mesh To Use
- Optimal Technique of Placement

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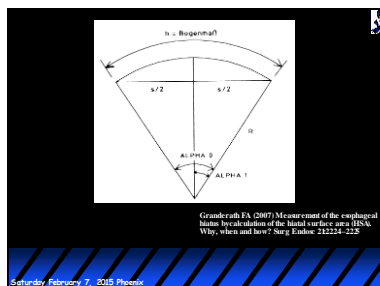
**Influence of the size of the hiatus on the rate of reherniation after laparoscopic fundoplication and reherniation with mesh hiataloplasty**

Chen C, Smith J, Kim H, Kuo J, Johnson S, et al  
Ann Surg 2007; 245: 111-116

Crainich EA (2007) Measurement of the esophageal hiatus by calculation of the basal surface area (BSA). Why, when and how? Surg Endosc 21:224-228

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$\alpha 1 = \arcsin(s/2)/R$   
 where arc = inverse function and  $\sin = s/2/R$   
 $\alpha 0 = 2 \times \alpha 1$   
 The radian measure is calculated with the formula:  
 $B = \pi \times R \times \alpha 0 / 180$   
 Then the HSA can be calculated with the formula:  
 $HSA = B \times R / 2$

Grandcrath FA (2007) Measurement of the esophageal hiatus by calculation of the hiatus surface area (HSA). Why, when and how? Surg Endosc 21:224-225

**Not So Fast!**

**The Issues Concerning Mesh Repair**

- Indication
- Type of Mesh To Use
- Optimal Technique of Placement

**Controversies about Prosthesis in 2014**

- Heavy Weight vs. Light Weight Polypropylene / Polyester
- Coated vs. Non Coated vs. Microporous
- Synthetic Vs. Biological

**Controversies about Prosthesis in 2010**


- Heavy Weight vs. Light Weight Polypropylene / Polyester
- Coated vs. Non Coated vs. Microporous
- Synthetic Vs. Biological

**Non Composite Prosthesis**

- Non Composite Heavy Weight Plastic Meshes
  - Prolene (Ethicon) Polypropylene
  - Marlex (Bard) Polypropylene
  - Surgipro (Covidien) Polypropylene
  - Parietex (Covidien) Polyester
  - Mersilene (Ethicon) Polyester
- Non Composite Heavy Weight Membranes
  - Gor-Tex (W.L. Gore) Polyfluoroethylene (ePTFE)
  - MoistMesh (Procy Biomedical)
  - DualMesh (W.L. Gore) ePTFE, One Side Roughened
  - Dulex (Bard/David) ePTFE, One Side Roughened
- Non Composite Light Weight Plastic Meshes
  - Ultrapro (Ethicon) Polypropylene
  - ProLite (Atrium) Polypropylene
  - TiMesh (GE) Polypropylene

**Ultrapro**


Polypropylene + Polydioxanone (PDS)



Johnson & Johnson (Ethicon)

**Prolite Ultra Prolite Ultra**

- Polypropylene
- Atrium



### Composite Prosthesis (ePTFE + Plastic Mesh)

- ePTFE + Heavy Weight Plastic Mesh
  - Composix EX (Bard/Davol) ePTFE + Heavyweight Polypropylene
  - Ventrio Hernia Patch (Bard/Davol) ePTFE + Heavyweight Polypropylene + Polydioxanone (PDS) Memory Ring
- ePTFE + Light Weight Plastic Mesh
  - Composix LP (Bard/Davol) ePTFE + Lightweight Polypropylene

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### Composix



Polypropylene + ePTFE  
 Non Absorbable  
 Bard/Davol

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### Dual Mesh



ePTFE  
 One Side Smooth (Visceral Side)  
 One Side Roughened (Abdominal Wall Side)  
 WL Core

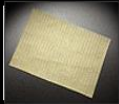
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### Coated Prosthesis

- Mid Weight (50 gm<sup>2</sup>) Polypropylene Mesh + Coating
  - Glucamesh (Brennen) Complex Carbohydrate, Oat Beta Glucan
- Light Weight Polypropylene Mesh + Coating
  - Sepramesh (Genzyme) Carboxymethylcellulose-Sodium Hyaluronate-Polyethylene Glycol
  - Proceed (Ethicon) Polydioxanone-Oxidized Regenerated Cellulose
  - C-Qur (Atrium) Omega-3 Fatty Acid
- Polyester Mesh + Coating
  - Parietex Composite (Covidien) collagen-polyethylene glycol-glycerol

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### C-Qur



Polypropylene + Omega-3 Fatty Acid Coating  
 Coating Absorbs in 120 Days  
 Atrium

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### Parietex Composite



Polyester-Collagen-Polyethylene Glycol-Glycerol Collagen-Based Hydrogel Component  
 Covidien

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### TiMesh



Titanium + Polypropylene  
 GFE

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### Sepramesh



Polypropylene + Carboxymethylcellulose-sodium Hyaluronate Coating (Sepramesh)  
 Genzyme

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### Proceed



Polypropylene + Oxidized Regenerated Cellulose + Polydioxanone (PDS)  
 Coating and Suture Absorbs in 90 Days  
 Johnson & Johnson (Ethicon)

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### Controversies about Prosthesis in 2010

- Heavy Weight vs. Light Weight Polypropylene / Polyester
- Coated vs. Non Coated vs. Microporous
- Synthetic Vs. Biological

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### Biologic Prosthesis

- Human dermis
  - AlloDerm (LifeCell): \$26.00/cm<sup>2</sup>
  - AlloMax (Bard/David): \$25.00/cm<sup>2</sup>
  - ReaD (BTR)
- Porcine dermis
  - Premax (TSL): \$8.50/cm<sup>2</sup>
  - Cotarem (Bard/David): \$15.00/cm<sup>2</sup>
  - Strattice (LifeCell)
  - XenMatrix (Biorient Medical)
- Porcine small intestine submucosa
  - Surgiss (Cook): \$3.40/cm<sup>2</sup>
- Fetal bovine dermis
  - SurgMesh (ETI Bioscience): \$22.00/cm<sup>2</sup>
- Bovine pericardium
  - Talaspis (Rüger Medical): \$26.00/cm<sup>2</sup>
  - Vealis (Synovis): \$3.60/cm<sup>2</sup>

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### Veritas® Collagen Matrix




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### The Issues Concerning Mesh Repair

- Indication
- Type Of Mesh To Use
- Optimal Technique of Placement

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### Non-tension-free Repair Without Reinforcement with Interrupted Suture



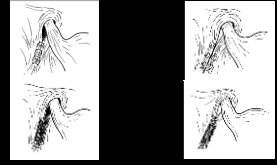
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### Non-tension-free Repair Without Reinforcement with Continuous Suture



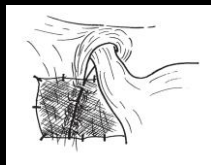
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### Non-tension-free Repairs With Reinforcement



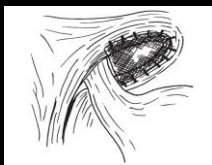
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### Reinforcement of The Crural Closure Using Buttress Mesh

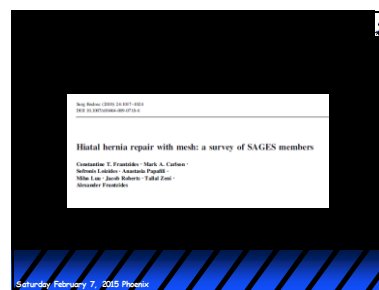
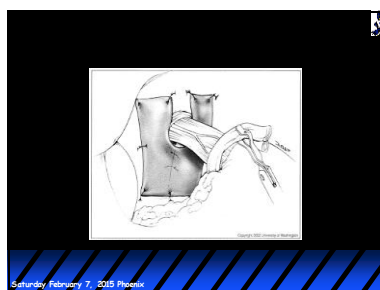
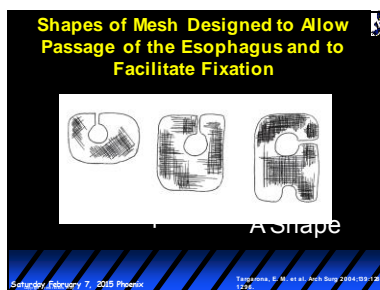
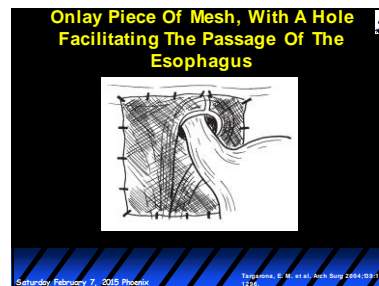
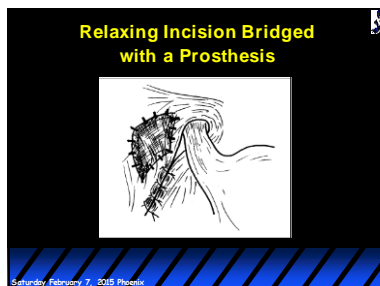
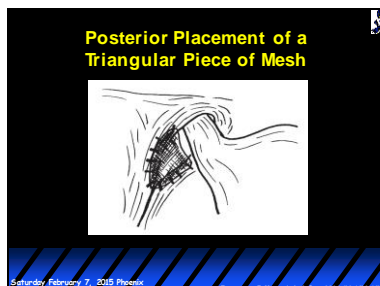


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### Anterior Placement of a Triangular Piece Of Mesh



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**Surg Endosc (2010) 24:1017–1024**

- u 275 Responses/ 5,486 Mesh Hiatal Hernia Repairs With Mesh
- u 77% Laparoscopic / 23% Open Respectively
- u Most Common Indication =Increased Size Hiatal Defect

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**Surg Endosc (2010) 24:1017–1024**

- u Prosthetic Material Types
  - Biomaterial (28%)
  - Polytetrafluoroethylene (25%)
  - Polypropylene (21%)
- u Suture Anchorage Was The Most Common Fixation Technique (56%)

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**Surg Endosc (2010) 24:1017–1024**

- u Complications
  - Failure Rate (3%)
  - Stricture Rate (0.2%)
  - Erosion Rate (0.3%)
- u Trends Noted
  - Biomaterial Associated with Failure
  - Nonabsorbable Associated with Stricture and Erosion

Saturday, February 7, 2015 Phoenix

**Surg Endosc (2010)  
24:1017-1024**

Conclusions

- u Prosthetic Material Decreased the Recurrence Rate
- u No One Mesh Type Was Clearly Superior

Saturday, February 7, 2015 Phoenix

**Our Feeling**

- Relaxing Incision With Primary Hiatal Closure and PTFE Overlay For The Defect
- Or Primary Closure With An Onlay Buttress

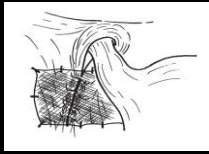
Saturday, February 7, 2015 Phoenix

**Relaxing Incision Bridged with a Prosthesis**



Saturday, February 7, 2015 Phoenix

**Reinforcement of The Crural Closure Using Buttress Mesh**



Saturday, February 7, 2015 Phoenix

Teplicka, R. M. et al. Arch Surg 2004;139:1721-1726

**CONCLUSION**

Complications Related to Synthetic Mesh Placement at The Esophageal Hiatus are More Common Than Previously Reported. Multicenter Prospective Studies are Needed to Determine the Best Method and Type of Mesh For Implantation

Saturday, February 7, 2015 Phoenix

**Pre-operative Screening and Risk Assessment:**  
Joshua Bloomstone, MD, CSSGB, CLS

Lecture one defines both the global burden of surgical morbidity and that within the United States. We will examine whether perioperative screening tests mitigate morbidity risk and assess the application of currently available, yet infrequently applied, risk prediction models to better guide preoperative shared-decision making, informed consent, and perioperative medical optimization.

# February 7, 2015 43rd Annual Phoenix Surgical Symposium

## Watchful Waiting for Inguinal Hernias: Current Status

### Robert J Fitzgibbons


### Watchful Waiting for Inguinal Hernias: Current Status.

Robert J. Fitzgibbons MD, FACS  
 Harry E. Stuckenhoff Professor of Surgery  
 Creighton University School of Medicine  
 Omaha, Nebraska

### Faculty Disclosure

- Ad Hoc Paid Consultant (In the last year)
  - None
- Retainer
  - None
- Speaker's Bureau
  - None
- Grant Support (In the last 2 Years)
  - None
- Fellowship Support
  - None
- Financial Interest (≥ \$10,000 US)
  - None
- Royalty
  - Cook Critical Care Fitzgibbons Jenting Catalyst
- I will not Discuss Off Label Use of Products

### Patrick J O'Dwyer, MCh, FRCS



### Pain Scores for Inguinal Hernia Patients Preoperatively

	At Rest	AT Activity
None(0)	26.6%	16.4%
Mild(<10)	53.9%	42.4%
Moderate(10-50)	18.0%	31.0%
Severe(>50)	1.5%	10.2%

### Pain Scores for Inguinal Hernia Patients Preoperatively

	At Rest	AT Activity
None(0)	26.6%	16.4%
Mild(<10)	53.9%	42.4%
Moderate(10-50)	18.0%	31.0%
Severe(>50)	1.5%	10.2%

### Pain Scores for Inguinal Hernia Patients at Rest

	Preop	Post-op 1 YR
None(0)	26.6%	24.5%
Mild(<10)	53.9%	62.7%
Moderate(10-50)	18.0%	10.8%
Severe(>50)	1.5%	2.0%

### Pain Scores for Inguinal Hernia Patients at Rest

	Preop	Post-op 1 YR
None(0)	26.6%	24.5%
Mild(<10)	53.9%	62.7%
Moderate(10-50)	18.0%	10.8%
Severe(>50)	1.5%	2.0%

### Pain Scores for Inguinal Hernia Patients at Activity

	Preop	Post-op (1YR)
None(0)	16.4%	21.6%
Mild(<10)	42.4%	55.9%
Moderate(10-50)	31.0%	20.1%
Severe(>50)	10.2%	2.5%

### Pain Scores for Inguinal Hernia Patients at Activity

	Preop	Post-op (1YR)
None(0)	16.4%	21.6%
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### Pain Scores for Inguinal Hernia Patients at Activity


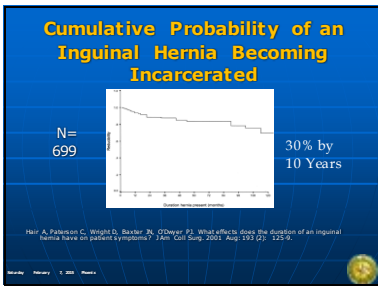
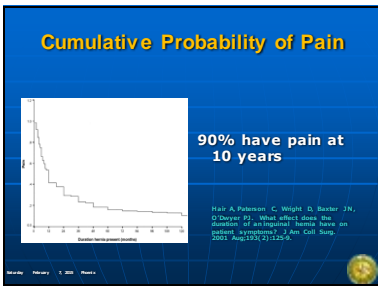
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Hair A, Peterson C, Wright D, Baxter JN, O'Dwyer PJ. Pain from watchful inguinal hernia in the elderly geriatric patient. In Surg 2002; Oct;91(10):1337-8.

### Conclusion

Watchful Waiting is a Good Strategy

Providing it is **SAFE!!**

### Cumulative Probability of Pain

- Leisure Activities Affected in Only 29%
- Only 13% of Employed Patients had to Take Time Off Work Because of Hernia-related Symptoms.

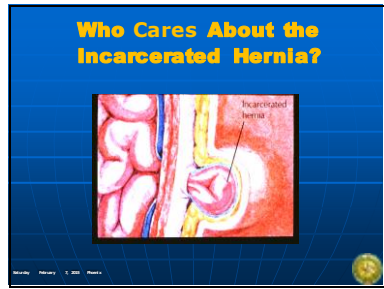
Hair A, Peterson C, Wright D, Baxter JN, O'Dwyer PJ. What effect does the duration of an inguinal hernia have on patient symptoms? J Am Coll Surg 2002; Aug;193(2):125-9.

### Cumulative Probability of an Inguinal Hernia Becoming Acutely Incarcerated

- 10 patients (of 699)
  - 1 with Infarcted Small Bowel
  - 1 with Infarcted Omentum
- No Deaths or Serious Complication

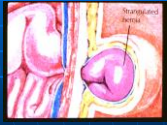
Hair A, Peterson C, Wright D, Baxter JN, O'Dwyer PJ. What effects does the duration of an inguinal hernia have on patient symptoms? J Am Coll Surg 2001; Aug; 193(2):123-9.

### So Who Cares?





### But We All Care About a Hernia Accident



- Bowel Obstruction
- Gangrene

### Yearly Probability of a Hernia Accident

“To Obtain Such a Yearly Probability, We Must Seek a Population Where Elective Herniorrhaphies Are Nonexistent”

-Duncan Neuhauser, 1977

### 2 Unique Data Bases

- Paul Berger’s Truss Clinic
  - Berger P: Résultats de l’Examen de Dix Mille Observations de Hernies. Paris, Extrait du neuvième congres francais de chirurgie 1895,1896
- Cali Colombia
  - Neutra R, Velez A, Ferrada R, Galan R. Risk of incarceration of inguinal hernia in Cali, Columbia. Chron Dis 1981;34:561-564.

### Berger’s Truss Clinic

- 1880 - 1884
- Elective Herniorrhaphy Shunned
- 8633 Patients
- 242 Hernia Accidents

= Probability of Hernia Accident Per Year Is 0.0037

### Cali Colombia

- One Year (1965 – 1966) Government Initiative To Aggressively Examine A Stratified Random Sample Of Its Civilian Population To Determine The Frequency Of Common Conditions Such As Inguinal Hernia
- Hospital Records

= Probability Of Hernia Accident Per Year Is 0.0038

### Cumulative Probability of an Accident

$$= 1 - (1 - p)^e$$

p = probability of an accident per hernia patient per year (0.00375)  
e = life expectancy\*


\*National Center for Health Statistics: Vital statistics of the United States, 1998. Life tables, 200. DHHS Publ. No. (PHS) 99-1161, 1998.  
National Center for Health Statistics: Vital statistics of the United States, 2001. Life tables, 52(14), 2004.

### The Lifetime Risk of a Hernia Accident

	Males	
	1980	2001
18 yr	1/5.49	1/5.15
72 yr	1/27.03	1/22.73


### Watchful Waiting vs Repair of Inguinal Hernia in Minimally Symptomatic Men A Randomized Clinical Trial

Fitzgibbons, R.J, et al JAMA 295:285, 2006



### Observation or Operation for Patients With an Asymptomatic Inguinal Hernia A Randomized Clinical Trial

O'Dwyer, PJ et al Ann Surg 244:167, 2006



### Study Design

Prospective, Randomized, Multicenter

- Watchful Waiting vs. Lichtenstein
- 2.5 Year Enrollment
- Average Follow-up 3.5 Years
- 753 Men
- \$5,897,401

Fitzgibbons, et al Agency for Healthcare Research and Quality R01HS1AG 09860

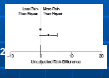
### Study Goals

To Determine if Watchful Waiting is an Acceptable Alternative to Routine Hernia Repair for Adult Men With Inguinal Hernias and No or Minimal Symptoms

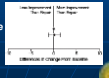
- Primary Aims (@2 Years)
  - Pain Interfering With Normal Activities
  - Physical Function (SF-36 - PCS)
- Secondary Aims
  - Complications
  - Patient-Centered Outcomes
  - Functional Status
  - Cost
  - Satisfaction With Care

### Two Year Primary Outcomes: No differences in Pain or Physical function

WW 5.1% TFR 3.2%, Difference 2.8% 95% Confidence Interval, -0.04% -5.72%, P=.52

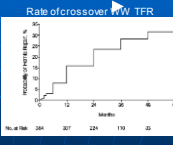


WW: 29 Points TFR: 13%, Difference .16; 95% Confidence Interval, -1.2 - 1.5



### Is Watchful Waiting Safe?

- One Hernia Accident Within Two Year Follow-up (4 Months after Randomization) (0.3%)
- One Additional Hernia Accident at 4 Years
- Overall Accident Rate 0.0018 Events Per Patient-Year



### Does Delaying Repair of an Asymptomatic Hernia Have a Penalty?

- 353 Patients Undergoing TFR
- Immediate ( $\leq 6$  mos, n = 288) vs Delayed ( $\geq 6$  mos, n = 65) Repair

Am J Surg Thompson et al in press

### No Statistically Significant Difference

- Hernia type and Characteristics
- Operative time
- Complications
- Recurrence Rates
- Patient Satisfaction

Am J Surg Thompson et al in press

### Conclusion

Delaying Repair in Asymptomatic Patients Does Not Have an Adverse Effect on Subsequent Operation and Other Outcomes

### Tension-Free Repair Versus Watchful Waiting for Men with Asymptomatic or Minimally Symptomatic Inguinal Hernias: A Cost-Effectiveness Analysis

Kevin T Stroupe, PhD, Larry M Mannheim, PhD, Ping Luo, PhD, Anita Gobbe-Hurder, MS, Denise M Hynes, RN, PhD, Olga Jonasson, MD, FACS, Domenico Resta, PhD, James O Gibbs, PhD, Dorothy O Dunlap, PhD, Robert J Fitzgibbons Jr, MD, FACS

### Conclusions:

Watchful Waiting is an Acceptable Alternative to Operation for Men With Minimally Symptomatic or Asymptomatic Inguinal Hernias

### Patrick J O'Dwyer, MCh, FRCS



**Ann Surg 2006;244: 167-173**

FEATURE

Observation or Operation for Patients With an Asymptomatic Inguinal Hernia  
*A Randomized Clinical Trial*

Patrick J. O'Dwyer, FRCSEd, John Yorlano, MSc,\* Ahmed Alami, FRCSEd, Andrew Walker, PhD,\* Felix Duff, RN,§ and Paul Horgan, FRCSEd\*

**Problems with the O'Dwyer Study**

Conclusions

Repair of an Asymptomatic Inguinal Hernia:

- Does Not Affect the Rate of Long-term Chronic Pain
- May Be Beneficial to Patients in Improving Overall Health
- May Reduce Potentially Serious Morbidity

**Comparison**

	Fitzgibbons	O'Dwyer
# Patients	720	160
Age	>18 (mean 58)	>55 (mean 70)
Symptoms	None or Min.	None
Size	Any	Visible
Crossover	23% (24mos)	26% (15mos)

**Problems with the O'Dwyer Study**

- Recruitment Problems
  - 160 Patients (Original Design = 250)
- Older Age Group
  - 55 Years or Older
  - 6.25% Overall Mortality
- More Advanced Hernia
  - Visible bulge Required
- Short Follow/Up
  - 1 Year

**Problems with the O'Dwyer Study**

Conclusions

Repair of an Asymptomatic Inguinal Hernia:

- Does Not Affect the Rate of Long-term Chronic Pain
- ~~May Be Beneficial to Patients in Improving Overall Health~~
- ~~May Reduce Potentially Serious Morbidity~~

**Problems with the O'Dwyer Study**

Conclusions

Repair of an Asymptomatic Inguinal Hernia:

- Does Not Affect the Rate of Long-term Chronic Pain  
 (But the WW Group Did Not Have to Endure an Operation!!!)

**Problems with the O'Dwyer Study**

Conclusions

Repair of an Asymptomatic Inguinal Hernia:

- ~~Does Not Affect the Rate of Long-term Chronic Pain~~
- May Be Beneficial to Patients in Improving Overall Health
- ~~May Reduce Potentially Serious Morbidity~~

**Problems with the O'Dwyer Study**

On An Intention-to-treat Analysis, There Was a Consistent Trend to Improvement of About 5 Points in All of the SF-36 Dimensions (Except Emotional Role) in the Operation Group Compared With the Observation Group

**Problems with the O'Dwyer Study**

Conclusions

Repair of an Asymptomatic Inguinal Hernia:

- ~~Does Not Affect the Rate of Long-term Chronic Pain~~
- ~~May Be Beneficial to Patients in Improving Overall Health~~
- May Reduce Potentially Serious Morbidity

#### Problems with the O'Dwyer Study

"There Were 3 Serious Adverse Events in the Observation Group : 1 Patient Had an Acute Hernia, 1 Had a Postoperative Stroke, and 1 Had a Myocardial Infarction and Died Postoperatively. The Patient With the Acute Hernia had It Reduced at Another Hospital."

#### Problems with the O'Dwyer Study

- Of the 80 Participants Randomized to Operation, 75 underwent Hernia Repair. One Patient Died Of Cancer While Awaiting Repair, 1 Had A Serious Cardiac Event And Repair Was Canceled, While 3 Refused Multiple Admission Dates For Repair.
- The Mean Time For Operation in The "Immediate Operation Group" Was 103 Days

PAPERS OF THE 133RD ASA ANNUAL MEETING

Long-term Results of a Randomized Controlled Trial of a Nonoperative Strategy (Watchful Waiting) for Men With Minimally Symptomatic Inguinal Hernias

*Robert J. Fitzgibbons, Jr. MD, FACS; Raja Bannan, MBBS; Shrip Arora, MD; Scott A. Turner, MD; Xue Li, MA, PhD; James O. Giblin, PhD; and Dominic J. Rele, PhD; Investigators of the Original Trial*

#### Methods

- Original Study Ended December 31, 2004
- Participants Were Invited To Voluntarily Enroll In a Registry For Long-Term Follow-up
- Contacted by Mail Questionnaire, Email and if Necessary, Phone, 5 Times During the Study Period
- Patients From the WW Group Were Divided Into a CO Group and a WW Group
- The Primary Outcome Variable was CO To Operation

#### Statistical Considerations

- Univariate Exploratory Analyses Were Done for Baseline Medical Comorbidities, Demographic and Lifestyle Variables to Determine Their Risk to Result in CO
  - Pearson Chi-square Test Or Fisher's Exact Test For Categorical Variables
  - Student's T- Test Or F Test For Continuous Variables
- Multivariate Analysis Using a Cox Proportional Hazards Regression Model Was Carried Out for Variable Identified on Univariate as Having a P Value of .4 or Less
- Crossover Rates Were Predicted Using Kaplan-Meier Analysis

#### Results

- 720 Patients in the Original Study
  - 366 Randomized to WW
    - 254 Enrolled in the Registry
      - 167 Complete Follow-up Data to the End of the Study
      - 9 Died
      - 3 Withdrew Consent
      - 75 Became Lost to Follow-up at Various Times

#### Univariate Analysis of Baseline Medical Comorbidities, Demographic and Lifestyle Variables

Patients In The WW Group Were:

- Significantly Younger
- More Likely to Have a Chronic Cough
- Have an Alcohol Intake of More Than Two Drinks Per Day During the Two Weeks Prior to Randomization

#### Estimated Cumulative Crossover Rates Using Kaplan-Meier Analysis

	%									
Follow-up in	1	2	3	4	5	6	7	8	9	10
Age < 65	11.83	19.53	27.39	32.53	35.25	38.93	43.60	47.60	54.31	61.58
Age > 65	22.89	36.14	41.06	51.35	58.26	59.70	61.38	66.42	70.17	79.35
Chronic Cough	15.42	24.90	31.76	38.59	42.70	45.64	49.35	53.73	59.43	67.97

#### Estimated Cumulative Crossover Rates Using Kaplan-Meier Analysis

	%									
Follow-up in	1	2	3	4	5	6	7	8	9	10
Age < 65	11.83	19.53	27.39	32.53	35.25	38.93	43.60	47.60	54.31	61.58
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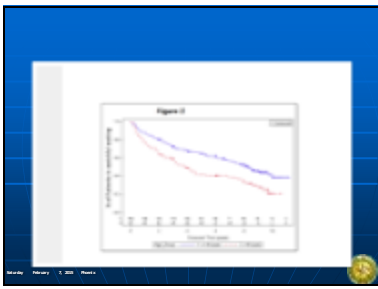
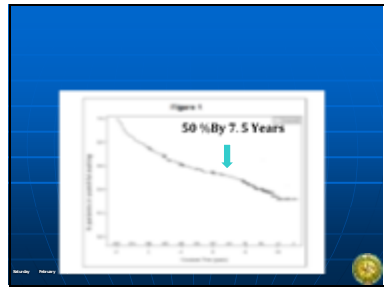
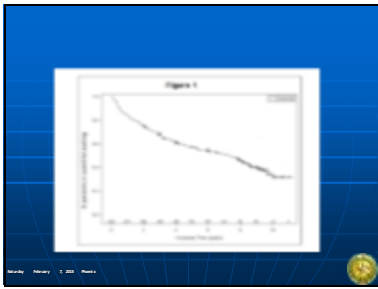
# February 7, 2015 43rd Annual Phoenix Surgical Symposium

## Watchful Waiting for Inguinal Hernias: Current Status

### Robert J Fitzgibbons

#### Estimated Cumulative Crossover Rates Using Kaplan-Meier Analysis

	1	2	3	4	5	6	7	8	9	10
<b>Follow up to 10 years</b>										
Age 0-65	11.83	19.53	27.39	32.53	35.25	38.93	43.60	47.60	54.31	61.88
Age >65	22.89	36.14	41.06	51.35	58.26	59.70	61.38	66.42	70.17	75.33
Overall	15.42	24.90	31.76	38.59	42.70	45.64	49.35	53.73	59.43	67.97



#### Reasons for crossover to surgery

Reason for crossover	%
Developed more pain	51.2
Tired of having the hernia	3.3
Advised by doctor to have it repaired	4.1
Emaciation	2.4
Employer wanted hernia repaired	0.8
Other	8.1
Combination of reasons	30.1

#### Reasons for crossover to surgery

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Combination of reasons	30.1

Original article

Long-term follow-up of patients with a painless inguinal hernia from a randomized clinical trial

L. Chung<sup>1</sup>, J. Norrie<sup>2</sup> and P.J. O'Dwyer<sup>1</sup>

<sup>1</sup>University Department of Surgery, Western Infirmary, and <sup>2</sup>Research Centre for Biostatistics, University of Glasgow, Glasgow, UK

Correspondence to P.J. O'Dwyer, University Department of Surgery, Western Infirmary, Glasgow G11 6NT, UK

doi:10.1055/s-0011-1096-9

### United Kingdom Trial Crossover

- Long Term Follow Up, 2011
- Kaplan-Meier Analysis Predicted That 72 % Of Patients Crossover To Surgery By 7.5 Years

So Why is the Crossover Rate Higher in the United Kingdom Trial?

(72% 7.5 Years vs. 68% at 10 Years)

### Comparison

	North_America	United_Kingdom
# Patients	720	160
Age	>18 (mean 58)	>55 (mean 70)
Symptoms	None or Min.	None
Size	Any	Visible Bulge
Reducibility	Not Required	Required
Incarceration	.3%	1%
Crossover	23% (24mos)	26% (15mos)

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Incarceration	.3%	1%
Crossover	23% (24mos)	26% (15mos)

- ### To Summarize:
- Based On 72% Crossover Rate at 7.5 Years in The United Kingdom Trial And The 68% Overall Crossover Rate By 10 Years in The Present Study (Rising To 79% in Patients 65 and Older)
  - The Logical Assumption is That Watchful Waiting is Not an Effective Strategy as With Time Almost Men Crossover

### United Kingdom Trial

"There Seems Little Point In Watchful Waiting Because The Majority Of Patients Will Require An Operation In The Foreseeable Future"

"Surgical Care For An Asymptomatic Hernia Should Be Recommended For Medically Fit"


- ### A Word of Caution!
- These Results Do Not Necessarily Apply to the General Population of Patients With Minimally Symptomatic Inguinal Hernias
  - Physicians Have Been Observing Elderly Patients For Years And Would Be Loath To Believe A Crossover Rate This High
  - The Answer May Lie In The Recruitment Process

- ### Recruitment Process
- The Majority of Subjects Came to the Clinic Because of Concern About The Hernia
  - At That Point They Were Invited to Participate in the Trial
  - Not Valid to Extrapolate the Conclusions to the Entire Population of Minimally Symptomatic Inguinal Hernia Patients

Nevertheless, These Two Studies Provide Overwhelming Evidence That Those Patients Who Choose to Attend Their Doctor's Office Because of Concerns About Their Hernia Even If They State That Symptoms Are Minimal or Absent Will Almost Inevitably Come to Surgery

- ### The Effect of Age
- Why do the Older Aged Patients Crossover at a Higher Rate?
  - We Speculate That Elderly Patients Have a Tendency to Minimize Their Symptoms More Than Younger Patients and Thus Become Eligible For the Trial Despite Having More Advanced Disease

### Routine Repair to Prevent a Hernia Accident



- Strangulation / Gangrene
- Bowel Obstruction

### Hernia Accident

- Only 3 Patients (2.4%) in the WW Group Developed Incarceration for Which They Underwent Surgery with No Mortality
- Similar to the 2.5% Acute Presentation Risk Found in the United Kingdom Trial
- Confirms the Finding that the Risk of a Hernia Accident Should not be Considered an Indication for Surgery
- Older Studies In The Literature Which Suggest Otherwise Can No Longer Be Considered Relevant

### Limitations

- The Registry Was Voluntary And There May Be Self-selection Bias
- The Study Participants Came From 5 Different Centers Which Included Both Academic and Community Hospitals but this does not Assure The Respondents were Representative of the General Population

### In Conclusion

- Although Watchful Waiting for Men with Minimally Symptomatic Hernias Remains a Safe Strategy Even on Long Term Follow-up
- Patients Who Present to Their Physicians to Have the Hernia Evaluated, Especially if Elderly, Should Be Informed That They Will Almost Certainly Come to Surgery Eventually
- These Results Should Not Be Extrapolated to the Broader Population of all Men with Asymptomatic or Minimally Symptomatic Hernias

### Caveats

- Be Careful With Extrapolation
  - Moderately Symptomatic Male??
  - Do Not Extrapolate to Woman!!

**Original article**

**Prospective evaluation of 6895 groin hernia repairs in women**

A. Rivett, A. Edwards\*, S. Hargreaves†, P. Stoddart and A. Kadir

\*Department of Surgery, University of Glasgow, Glasgow, †Queen's Hospital, Chester, and ‡Royal Devon, Exeter, UK; §Royal Free Hospital, London, UK; ¶Department of Surgery, University of Edinburgh, Edinburgh, Scotland; \*\*Department of Surgery, University of Liverpool, Liverpool, UK; ††Department of Surgery, University of Manchester, Manchester, UK

**Background:** Although repair rates of groin hernia repair are performed in women, there is little published literature relating specifically to women. This study compared differences in hernia between women and men after groin hernia repair.

**Methods:** Data collected prospectively in the Norfolk Study Register between 1997 and 2003 were analysed, including 6895 groin hernia repairs in women and 6171 in men.

© 2005 Blackwell Publishing Ltd, *Journal of Clinical Medicine*, 14(11): 1111-1116

### Olga Jonasson



### Watchful Waiting for Inguinal Hernias: Current Status.

Robert J. Fitzgibbons MD, FACS  
 Harry E. Stuckenhoff Professor of Surgery  
 Creighton University School of Medicine  
 Omaha, Nebraska

**Perioperative Fluid Therapies and Enhanced Surgical Recovery:**  
Joshua Bloomstone, MD, CSSGB, CLS

Nobody can “drop” a liter of fluid faster than an anesthesiologist can. Thirty-two trials over the last three decades have identified the need for a rational approach to perioperative fluid therapy. It is clear that both under-hydration and volume overload exist as two major catalysts for the development of perioperative morbidity. The commonly used one-size fits all approach to fluid administration is not supported by any physiologic model. I will review the best approaches to determining human volume responsiveness, and in so doing; I will provide a rational, physiologically sound approach to volume administration. No patient should receive a drop of fluid unless two conditions are met: they must require augmented perfusion *and* they must be volume responsive.



Note Page for  
**Care Surgery: The Evolution of a Specialty**  
Amy Sisley, MD, FACS

**TREATMENT OF CHOLEDOCHOLITHIASIS IN THE ERA OF LAPAROSCOPIC CHOLECYSTECTOMY**

Robert J. Fitzgibbons, Jr., MD,  
 FACS  
 Professor of Surgery  
 Creighton University School of  
 Medicine  
 Omaha, Nebraska

**Faculty Disclosure**


- Ad Hoc Paid Consultant (in the last year)
  - None
- Retainer
  - None
- Speaker's Bureau
  - None
- Grant Support (in the last 2 Years)
  - None
- Fellowship Support
  - None
- Financial Interest (> \$10,000 US)
  - None
- Royalty
  - Cook Critical: Fitzgibbons Javelin Outliner
- I will not discuss Off Label Use of Products

**Laparoscopic Cholecystectomy and The Common Bile Duct**

In the Developmental Stage of Laparoscopic Cholecystectomy



**Laparoscopic CBD Evaluation**



**Purpose of this Presentation**


- Surgical Decision Making
  - ❖ What are the Options?
  - ❖ Who Goes First?
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    - Cholangiogram?? Sonogram??
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**Treatment of Choledocholithiasis in Patients Undergoing L.C.**

- Laparotomy
- ERCP with Sphincterotomy
  - ❖ Preoperative
  - ❖ Postoperative
- LCBDE
  - ❖ Transcystic
  - ❖ Choledochotomy




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### Who Goes First?

Preoperative per Oral Endoscopic (ERCP)+/- Sphincterotomy with Stone Extraction  
 vs.  
 Primary Laparoscopic



### Acceptable Indications for Preoperative ERCP

- > Overwhelming Evidence of Choledocholithiasis
  - ❖ + Sonogram of Stone in CBD
  - ❖ Obstructive Jaundice
  - ❖ Dilated Extrahepatic Biliary System
- > ASA Class IV or V

### Who Goes First?

Most Important Considerations

- > Available Equipment
- > Ability of the Surgeon

### Is Cholecystectomy Always Needed After Successful ERCP with ES?

- > Randomized Trial of 120 Patients Assigned to Either WW or Routine Lap Chole after Successful ERCP + ES
  - ❖ WW Group
    - Nearly 50% Suffered a Biliary Event by Median Follow-up of 30 Months
    - 55% Required Conversion to Open at the Time of Elective Chole (Compared to 20% in the Routine Group)

Roems D et al. Annals of Surgery 2002; 195: 741-745.


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### Laparoscopic Cholecystectomy and Operative Cholangiography

Two Purposes

- > Detect CBD Stones
- > Define Anatomy




### The Selective Approach to Operative Cholangiography

When Must It Be Done?

- > When Cystic Duct is Dilated
- > When CBD is Dilated
- > When Anatomy is Unclear
- > Miscellaneous Indications

**Laparoscopic Cholecystectomy and Operative Cholangiography**


Selective  
VS  
Routine



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**Laparoscopic Cholecystectomy and Operative Cholangiography**


Common Bile  
Duct Injury



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**Laparoscopic Cholecystectomy and Operative Sonography**

Does It Have  
a Role?



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**Intraoperative Imaging of the CBD**

This Remains a Controversial  
Issue Even in 2014!

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**Laparoscopic Common Bile Duct Exploration**

Howdo You Decide?

- Choledochotomy
- Transcystic




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**Laparoscopic Common Bile Duct Exploration**

Transcystic Technique

- Balloon or Mechanical Dilatation of Cystic Duct



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**Laparoscopic Common Bile Duct Exploration**

Transcystic Technique

- Balloon or Mechanical Dilatation of Cystic Duct
- Blind Balloon Catheter/Basket Manipulation



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**Laparoscopic Common Bile Duct Exploration**

Transcystic Technique

- Balloon or Mechanical Dilatation of Cystic Duct
- Blind Balloon Catheter/Basket Manipulation
- Irrigation/Flushing +/- Glucagon (1mg)

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### Laparoscopic Common Bile Duct Exploration

Transcystic Technique


- > Balloon or Mechanical Dilatation of Cystic Duct
- > Blind Balloon Catheter/Basket Manipulation
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- > Balloon Catheter/Basket Extraction + Fluoroscopy



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- > Fine Choledochoscopic Evaluation



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- > Fine Choledochoscopic Evaluation
- > Lithotripsy

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- > Lithotripsy
- > Balloon Dilatation of Sphincter of Oddi

### Transcystic Laparoscopic Common Bile Duct Exploration

<u>Advantages</u>	<u>Disadvantages</u>
> T-Tube not Needed	> Cystic Duct Dilatation Needed
> Drain not Needed	> Bad for Proximal Stones, those 10 mm or Greater
> Applicable in 80-90%	> Expensive

### Laparoscopic Common Bile Duct Exploration

Choledochotomy Technique

### Laparoscopic Common Bile Duct Exploration

Choledochotomy Technique

- > Choledochotomy



### Laparoscopic Common Bile Duct Exploration

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# February 7, 2015 43rd Annual Phoenix Surgical Symposium

## Treatment of Choledocholithiasis in the era of Laparoscopic Cholecystectomy

### Robert J Fitzgibbons

### Laparoscopic Common Bile Duct Exploration

**Choledochotomy Technique**

- Cholelithotomy
- Blind Balloon Catheter/Basket Manipulation
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Dr. Robert J. Fitzgibbons, M.D.  
November 7, 2007 Annual Meeting

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- Lithotripsy
- Cholelithotomy +/- Robot??
- Balloon Dilatation of Sphincter of Oddi??
  - Carroll
  - Laparoscopic Antegrade Sphincterotomy
    - DePaula

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  - Laparoscopic Antegrade Sphincterotomy
    - DePaula
  - Closure of CBD with T-Tube??



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### Primary Closure Versus T-tube Drainage After Laparoscopic Common Bile Duct Stone Exploration

Table 1: Drainage versus primary closure after laparoscopic common bile duct exploration (Review)

January 15, 2013, Issue 9, Review 98



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### Primary Closure Versus T-tube Drainage After Laparoscopic Common Bile Duct Stone Exploration

**"We Have Insufficient Evidence to Recommend T-tube Drainage Over Primary Closure after Laparoscopic Common Bile Duct Stone Exploration or Vice Versa"**

Cochrane Database Syst Rev. 2007 Jan 24(1):CD005641

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### Primary Closure Versus T-tube Drainage After Laparoscopic Common Bile Duct Stone Exploration

**"Based on Currently Available Evidence, There is No Justification For the Routine Use of T-tube Drainage After Laparoscopic Common Bile Duct Exploration in Patients With Common Bile Duct Stones"**

Cochrane Database Syst Rev. 2013 Jun 21(6)

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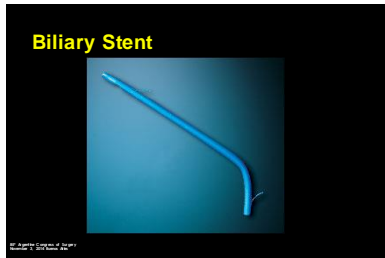
### Primary Closure is Better Than T-tube Drainage After Laparoscopic Common Bile Duct Stone Exploration

Emerging Article

Primary closure versus T-tube drainage in laparoscopic common bile duct exploration: a meta-analysis of randomized clinical trials

Xiangping Wu · Yong Yang · Ping Deng · Jun Gu · Jianhua Lu · Maolin Li · Jianping Ma · Wenqiang Wu · Jianhua Yang · Lin Zhang · Qichun Ding · Yiqun Liu

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### T-Tube Vs. No T-tube Vs. Stent

A technique for safe placement of a biliary endoprosthesis after laparoscopic choledochotomy. *Isla AM, Griniatsos J, Wan A. J Laparoendosc Adv Surg Tech A. 2002 Jun;12(3):207-11*

Advantages of laparoscopic stented choledochotomy over T-tube placement. *Isla AM, Griniatsos J, Kavounis E, Atoukhe JD. Br J Surg. 2004 Jul;91(7):862-6*

### T-Tube Vs. Stent

ORIGINAL ARTICLE

A Randomized Trial Comparing the Use of Endobiliary Stent and T-Tube for Biliary Decompression After Laparoscopic Common Bile Duct Exploration

*Fatih Mangla, MCh,\* Jagdish Chander, MS† Anshul Puri, MS† Pawanindra Lal, MS† and Vinod K. Rana, MS†*

*Surg Laparosc Endosc Percutan Tech. 2012 Aug;22(4):134-8*

### Common Bile Duct Exploration by Choledochotomy

Advantages	Disadvantages
<ul style="list-style-type: none"> <li>&gt; Best for CBD Greater than 10mm</li> <li>&gt; Large Choledochoscope</li> <li>&gt; Good for Proximal Ducts</li> </ul>	<ul style="list-style-type: none"> <li>&gt; T-Tube, Drain usually Needed</li> <li>&gt; CBD Stricture Possible</li> <li>&gt; Bypass Difficult</li> <li>&gt; Expensive</li> </ul>

### Laparoscopic CBDE

Is it for Everyone??

A cartoon illustration of a man in a suit with his arms outstretched, standing next to the text.

### Laparoscopic CBDE Limitations

- > Specialized Training of the Surgeon is Required
- > Experience is Difficult to Obtain Because Choledocholithiasis is Found in Only 5% of Laparoscopic Cholecystectomies
- > Expensive Equipment Needs Cannot be Justified by All Institutions

### Laparoscopic CBDE Potential Equipment Needs

- > Small Diameter Choledochoscope
- > Large Diameter Choledochoscope
- > Second Video System
- > Digital Fluoroscopy Unit
- > An Array of Baskets and Balloons
- > Lithotripsy System

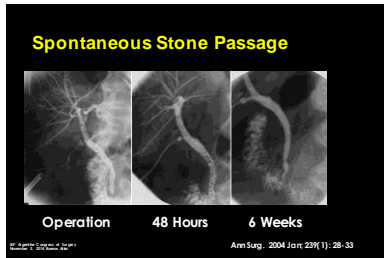
### Lithotripsy During Laparoscopic Common Bile Duct Exploration

- > Mechanical
- > Electrohydraulic
- > Ultrasonic
- > Laser
  - Conventional
  - Tunable Dye

A mechanical lithotripsy device with a hand crank and a grinding mechanism.

### Laparoscopic CBDE Additional Questions

- > Should Patients with Questionably Positive Cholangiograms undergo Videoscopic CBDE?
- > Is Prolonged General Anesthesia Best for all Patients?
- > Do Some Stones Pass Spontaneously?



### TREATMENT OF CHOLEDOCHOLITHIASIS IN THE ERA OF LAPAROSCOPIC CHOLECYSTECTOMY

Robert J. Fitzgibbons, Jr., MD,  
 FACS  
 Professor of Surgery  
 Creighton University School of  
 Medicine  
 Omaha, Nebraska

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 November 7, 2003 Volume 86#1

### Purpose of this Presentation

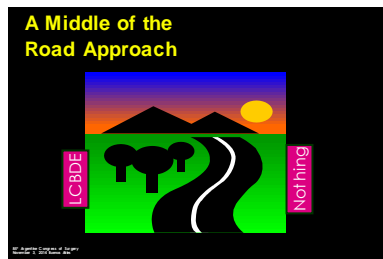
- Surgical Decision Making
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### An Alternative to Laparoscopic CBDE

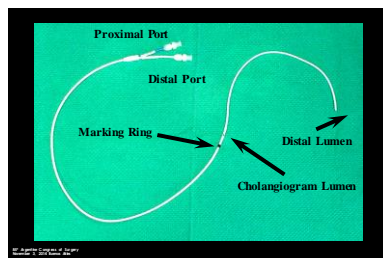
### A Double-Lumen Catheter System

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### Characteristics of the Double Lumen Catheter System

- Proximal lumen for Cholangiography
- Distal Lumen for Guidewire Placement
- Percutaneous Tear-away Introducer
- Marking Ring for Placement Guideline
  - ❖ Short-acting absorbable suture just above ring
  - ❖ Drain recommended for bile

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### Laparoscopic CBDE

### The Alternative Technique

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**Purpose of the Alternative  
Technique**

- Provides Percutaneous Access for Serial Cholangiography after Laparoscopic Cholecystectomy
- Allows Percutaneous Placement of a Transampullary Guidewire so that a Guidewire Assisted Sphincterotomy with Stone Extraction Can be Performed ("Rendez-Vous" Technique)

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