Clinical evaluation is still best when managing a patient with a shotgun wound.

**Background:** Shotgun wounds represent a small yet different type of penetrating injury. Various classification systems have evolved attempting to assist clinical decision making which primarily revolves around whether the patient requires surgical debridement.

**Objective:** To identify factors indicating when surgical intervention is necessary in a patient with a shotgun wound.

**Design:** Retrospective chart review.

**Participants:** 64 patients were treated for shotgun wounds over a 5.5-year period.

**Methods:** 37 patients (58%) required surgical intervention. Charts were reviewed for demographic information, distance from attacker, pellet size, pellet spread, vital signs, admission physical findings, and laboratory data. Wounds were categorized by 4 classification schemes using distance from attacker, pellet size, pellet spread, and body region injured. Primary outcomes were factors indicating a need for surgery, specific organ injuries, and mortality.

**Interventions:** Evaluation and management of each patient with >50% requiring surgical intervention.

**Results:** 5 patients required resuscitative thoracotomy and all died, but these are included in the analysis to determine factors indicating surgical need. Of patients, 17 arrived in hypotensive shock and all had surgical intervention. Indications for operative intervention in the other 20 patients included peritonitis in 13 and worsening abdominal exam in 7. Overall mortality was 25%, and 10% developed wound infections. Distance from attacker, pellet size, pellet spread, and wound classification systems were not associated with the need for surgical intervention or mortality. A low revised trauma score and low blood pressure were associated with surgical intervention. Mortality was associated with a number of factors all related to hypoperfusion or multiple organ injuries.

**Conclusions:** Clinical findings correlate best with surgical need in patients with shotgun wounds.

**Reviewer's Comments:** Shotgun wound management is not a dilemma when signs or symptoms of blood loss or enteric irritation are present. It is the patient without these signs or symptoms that is often challenging. Various wound classification systems can be helpful in this patient population although they never are absolute. The premise of this article is good, but execution is limited by the number of patients and analysis. The conclusion is safe but fairly unhelpful. Some caveats about shotgun wound management are not even mentioned. These include the need for surgical debridement secondary to tissue destruction for close range wounds and the need to search and remove wadding in these same wounds. The need for multiple debridements is noted, and I would suggest a 10% wound infection rate in this type of injury speaks to excellent wound management. Finally, CT imaging is not mentioned as a method to exclude peritoneal or thoracic penetration in the patient with no hypotension or peritonitis. (Reviewer-John A. Weigelt, MD, FACS).

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**Keywords:** Trauma, Shotgun, Wounds, Laparotomy, Thoracotomy

**Print Tag:** Refer to original journal article
A few devices are improved when silver is added to them, but silver-impregnated catheters lose their effectiveness over time.

Background: More silver products are becoming available in medicine based on the premise that its use will prevent infection. Whether all these products are able to substantiate their claims needs assessment.

Objective: To evaluate the effectiveness of silver in various medical devices.

Design: Retrospective literature review.

Methods: Current literature was assessed regarding the use of silver in implantable devices, central venous catheters, urinary catheters, and endotracheal tubes. Silver resistance is essentially unknown, and primary outcome of most studies is reduction of infection.

Results: Central venous catheters have been coated inside and out with 3 different agents: chlorhexidine/silver sulfadiazine; silver platinum/carbon; and minocycline/rafampicin. Reduction in catheter colonization and catheter-related bloodstream infection rates were achieved with chlorhexidine/silver sulfadiazine catheters. However, methodologic problems plagued all these studies, and the effect is only effective for a maximum of 10 days as the drugs are eluted from the catheter over time. Wholesale use of these catheters would not be cost effective. Urinary catheters impregnated with silver alloy did reduce catheter colonization when in place >1 week. These studies indicated a cost savings of from 3% to 35%. Endotracheal tubes (ETT) coated with silver showed a reduction in ventilator associated pneumonia (VAP) in a multi-institutional trial of 2000 patients. VAP associated with silver ETT was 5% versus 8% in VAP with no silver ETT. Other uses for silver not supported include many implantable devices: heart valves, mesh, ventriculoperitoneal shunts, peritoneal venous shunts, vascular grafts, wound dressings, and hemodialysis catheters.

Conclusions: Silver-impregnated central venous catheters and urinary catheters can reduce infection and be cost effective but only for short periods and when infection rates are high despite routine methods to reduce the risk of infectious catheter complications.

Reviewer’s Comments: Silver-impregnated wound dressings are the latest product with silver that is entering the market. This has even extended to negative pressure dressings. At this time, no data exist to support their use as well as other silver products that might seem reasonable but lack proper study. Central venous and urinary catheters have the data that they can be effective, but the limits of effectiveness must be remembered. The effect is best seen when high rates of infection persist after application of proper infection control principles for insertion and maintenance of these catheters. The effect is also short lived as the silver elutes from the catheter. When these conditions are not met, cost effectiveness of these catheters is questionable. We do not use any of these catheters presently. We subscribe more to the idea of removing catheters early as the best method of prevention. Obviously, if the duration problem is solved, these catheters may find a larger role in our daily practice. (Reviewer-John A. Weigelt, MD, FACS).

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Keywords: Silver, Dressings, Devices

Print Tag: Refer to original journal article
Procalcitonin may help identify patients with severe pancreatitis, but timing of blood sampling remains unclear.

**Background:** Pancreatitis ranges from mild to severe, acute to chronic, and edematous to necrotizing. Mortality is greatest when necrotizing infection is present. Identification of patients who have pancreatic necrosis or will progress to necrotizing pancreatitis would allow early treatment which could improve outcome.

**Objective:** To determine the value of procalcitonin in predicting severe pancreatitis or infected pancreatic necrosis.

**Design:** Meta-analysis.

**Participants:** 826 patients were included in studies that reported the severity of acute pancreatitis and 329 patients were used in studies predicting infected pancreatic necrosis.

**Methods:** Analysis began with 188 studies which were reduced to 7 that addressed pancreatic infection and 12 that addressed the severity of pancreatic infection. Papers were selected if they reported using procalcitonin as a predictor of pancreatitis severity or infected pancreatic necrosis. Severe pancreatitis was defined by pancreatic necrosis or organ dysfunction. Pancreatic necrosis was defined by aspiration or intraoperative sampling of pancreatic tissue demonstrating bacteria. Primary outcome was the ability of procalcitonin to predict severity of pancreatitis or presence of necrotizing pancreatitis.

**Interventions:** Follow procalcitonin levels in patients with pancreatitis.

**Results:** The sensitivity of procalcitonin for detecting severe pancreatitis was 0.72 and specificity was 0.86 although the studies had a significant degree of heterogeneity. When only studies using >0.5 ng/mL as the procalcitonin threshold were used, sensitivity increased to 0.73 and specificity to 0.87 without significant heterogeneity. Predicting infected necrosis with elevated procalcitonin levels had a sensitivity of 0.8 and a specificity of 0.9 without heterogeneity. Samples were obtained from admission to 14 days.

**Conclusions:** Procalcitonin may help identify patients with severe pancreatitis, but timing of blood sampling remains unclear.

**Reviewer’s Comments:** Studies in this meta-analysis date back to 1997 and yet we still do not have a proven method supporting procalcitonin as a predictor of pancreatic inflammation or necrosis. The value, >0.5 ng/mL, is accepted, but the timing continues to be controversial. Admission procalcitonin is used to predict severity while repeated measurements are suggested to predict necrosis. Intra-abdominal infections cause a pronounced rise in procalcitonin compared to chest and urinary infections. However, the authors properly remind us that procalcitonin is a nonspecific indicator of infection. Our use has been infrequent and so far it has not impressed us. (Reviewer-John A. Weigelt, MD, FACS).

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Keywords: Pancreatitis, Procalcitonin, Pancreatic Necrosis

Print Tag: Refer to original journal article
Watch Out for $H\text{ pylori}$-Negative Ulcers

High Incidence of Mortality and Recurrent Bleeding in Patients With Helicobacter Pylori-Negative Idiopathic Bleeding Ulcers.

Wong GL, Wong VW, et al:

Gastroenterology 2009; 137 (August): 525-531

Recurrent bleeding is much more common when $H\text{ pylori}$ is not present in a peptic ulcer.

**Background:** Risk of recurrent bleeding from $H\text{ pylori}$-negative ulcers is greater than for $H\text{ pylori}$ ulcers but to what degree is unknown.

**Objective:** To determine risk of rebleeding for peptic ulcers with and without associated $H\text{ pylori}$ infection.

**Design:** Prospective cohort study in 1 institution over 7 years.

**Participants:** 120 patients had $H\text{ pylori}$-negative peptic ulcer bleeding and 213 patients had bleeding associated with $H\text{ pylori}$ infection.

**Methods:** $H\text{ pylori}$-negative patients had to have no exposure to NSAIDs, aspirin, or other medications within 4 weeks of the bleeding episode, biopsies and the urease test taken during index endoscopy for bleeding were negative for $H\text{ pylori}$, and no other cause of ulceration was found. Both groups were treated appropriately. Follow-up endoscopy was done to document healing. No long-term gastroprotective therapy was used. Primary end point was recurrent bleeding. Mortality was a secondary end point.

**Interventions:** All patients had endoscopy for recurrent bleeding. Biopsies and urease test were also repeated during recurrent bleeding episodes. Drugs associated with gastric injury were prohibited during the study period.

**Results:** $H\text{ pylori}$-negative ulcer patients were older, had more gastric ulcers, and had more recurrent bleeding during the index hospitalization. Median follow-up was 30 months (range 1 to 89 months) in the $H\text{ pylori}$-negative patients and 79 months (range 1 to 89 months) in the $H\text{ pylori}$-positive patients. The 7-year cumulative rebleeding rate for $H\text{ pylori}$-negative patients was 42% compared to 11% for $H\text{ pylori}$-positive patients. When NSAID use and recurrent $H\text{ pylori}$ infection were excluded, the recurrent bleeding rate was 25% versus 3%. Mortality was higher in the $H\text{ pylori}$-negative patients and only correlated with American Society of Anesthesiology grade $>3$. $H\text{ pylori}$-negative status was an independent predictor of recurrent bleeding and mortality.

**Conclusions:** $H\text{ pylori}$-negative bleeding ulcers are associated with an increased risk of rebleeding and mortality compared to $H\text{ pylori}$-positive bleeding ulcers.

**Reviewer's Comments:** Very interesting long-term study of patients with peptic ulcers that bled. Groups were followed based on presence of $H\text{ pylori}$ infection at the time their ulcer bled. The recurrent bleeding rate was significantly higher among patients who did not have $H\text{ pylori}$ infection. The rebleeding rate was extremely low for $H\text{ pylori}$-positive patients after $H\text{ pylori}$ eradication unless recurrent infection occurred or NSAID use was documented. The shorter follow-up among $H\text{ pylori}$ is explained by the higher mortality rate. Age could be a factor for recurrent bleeding although this did not appear to be true based on their statistical analysis. The authors make a strong case that $H\text{ pylori}$-negative ulcers are different. They suggest that long-term gastroprotective treatment should be considered. (Reviewer-John A. Weigelt, MD, FACS).

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Keywords: Peptic ulcer, Bleeding, Mortality, *Helicobacter pylori*

Print Tag: Refer to original journal article
Open cholecystectomy is associated with higher maternal and fetal complications.

**Background:** Cholelithiasis complicates pregnancy in 0.05% to 0.80%. Relapses after an initial symptomatic episode may be as high as 69%. Medical management is preferred but fails in 30% of patients.

**Objective:** To compare outcomes in pregnant and non-pregnant patients with biliary disease.

**Design:** Retrospective review of the Healthcare Cost and Utilization Project Nationwide Inpatients Sample -- an administrative database.

**Participants:** 36,929 pregnant patients hospitalized with biliary tract disease; 9,714 of these patients had cholecystectomy.

**Methods:** Comparisons were done between patients treated non-operatively and operatively. Operative patients were then matched by age and primary procedure to non-operative patients. A number of variables were available in the database for comparison. These included age, race, comorbidities, funding source, type of hospital, and primary diagnosis. Outcomes examined included complications, deaths, length of stay, and hospital costs.

**Interventions:** Correlations were examined with bivariate and multivariate analyses.

**Results:** 26% of pregnant patients with biliary tract disease required a cholecystectomy. Women who had a cholecystectomy were younger, white, had more biliary diagnoses, had an urgent admission, and were treated at more rural nonteaching hospitals than women who did not have a cholecystectomy. Laparoscopic cholecystectomy was associated with fewer surgical complications (10% vs 19%). Maternal and fetal complications were also lower when the procedure was done laparoscopically. Comparing surgical treatment to no surgical treatment, length of stay and costs were lower. After adjustment, pregnancy was not a significant predictor of surgical complications. Lower volume surgeons and Medicaid insurance were associated with worse outcomes. Multivariate analysis revealed that open cholecystectomy, surgeon volume, insurance type, and more biliary diagnoses negatively impacted outcomes.

**Conclusions:** Complications of cholecystectomy during pregnancy are associated with a number of potentially modifiable variables.

**Reviewer's Comments:** Using an administrative data base is good and bad. Large numbers of patients are usually available, but detail is usually often lacking. These traits persist in this analysis and taking all conclusions at face value can be difficult. One would expect open cholecystectomy to have more complications than laparoscopic cholecystectomy. However, why the open approach was used is not known. More biliary diagnoses being associated with a poorer outcome is also easy to understand. The surgeon volume and hospital location is harder to explain although similar findings appear in other similar type of studies. While answers would be nice, the authors do not speculate. Our approach to the pregnant patients with biliary tract symptoms is to pursue a medical treatment course until recurrent symptoms or complications force a surgical intervention. Laparoscopic is always attempted and can be challenging. Cholecystectomy is recommended after delivery if medical management is successful. (Reviewer-John A. Weigelt, MD, FACS).

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Keywords: Biliary Disease, Pregnancy, Cholecystectomy

Print Tag: Refer to original journal article
Component Blood Therapy Not Always as Good as it Gets

*Fresh Frozen Plasma Is Independently Associated With a Higher Risk of Multiple Organ Failure and Acute Respiratory Distress Syndrome.*


Blood component therapy is associated with increased risk for morbidity among severely injured patients.

**Background:** Blood transfusion practices, especially for the severely injured patient requiring massive transfusion, are undergoing major scrutiny. Current observational data suggest that a ratio as low as 1:1 for fresh frozen plasma to packed red cells is appropriate to limit complications and improve outcomes. How these recommendations should alter transfusion practices in other patients is unknown.

**Objective:** To assess the effect of fresh frozen plasma (FFP) administration on morbidity and mortality in severely injured patients not requiring massive transfusion.

**Participants:** 1175 patients were included: 381 patients received blood only and 794 received blood and plasma.

**Methods:** All data were collected prospectively as part of a multicenter grant to study inflammation. Definitions were predetermined for the original study and continued for this analysis. The primary focus of this report was the amount of blood products transfused during the first 24 hours. FFP (250 mL), cryoprecipitate (60 mL), and platelets (300 mL) were recorded by volume as units. The relationship of blood product volume to acute respiratory distress syndrome (ARDS), multiple organ failure (MOF), nosocomial infection and death was calculated.

**Interventions:** Data were subjected to a Cox proportional hazard regression analysis to determine risk per unit of blood product transfused.

**Results:** FFP was given to 65%, platelets to 41%, and cryoprecipitate to 28% of patients. Median FFP volume was 4.8 units, median platelet volume was 1.3 units, and median cryoprecipitate volume was 3 units. Overall mortality was 11.5%. Nosocomial infection occurred in 49%, MOF occurred in 41%, and ARDS in 26% of patients. Median injury severity score was 32. There was no relationship between any plasma component and mortality or nosocomial infection. Platelet volumes were not associated with any increased risk of MOF or ARDS. MOF was increased by 2% for every unit of FFP and ARDS increased by 2.5% for each unit of FFP. Cryoprecipitate decreased MOF risk by 4% for each unit. When deaths within 48 hours were excluded, FFP was associated with a 3% decreased risk of mortality.

**Conclusions:** FFP increased risk for MOF and ARDS while cryoprecipitate decreased MOF risk.

**Reviewer's Comments:** An observational study which raises many more questions rather than provide us with answers. Since the study from which this data were taken was not designed for this purpose, one must take the findings with a huge grain of salt. This is mentioned in an accompanying editorial. What one can say is that transfusion practice is seriously being re-evaluated. Blood transfusion is vital when needed as is other component therapy. However, this report might be taken as a warning that proper blood component use is our goal. Overuse is not appropriate especially when so many unanswered questions continue to be raised about current practices. Again, a “stay tuned” approach is prudent. (Reviewer-John A. Weigelt, MD, FACS).

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Keywords: Fresh Frozen Plasma, Cryoprecipitate, Multiple Organ Failure, Nosocomial infection

Print Tag: Refer to original journal article
Silver Dressings Simply Cost More

Randomized Controlled Trial and Cost-Effectiveness Analysis of Silver-Donating Antimicrobial Dressings for Venous Leg Ulcers (VULCAN trial).

Michaels JA, Campbell B, et al:

Br J Surg 2009; 96 (October): 1147-1156

Silver dressings did not significantly improve healing rates for venous ulcers and were not cost effective.

**Background:** Compression dressings for venous stasis ulcers are a treatment cornerstone. Most of us have placed our share of unna boots although now most are applied by nurses or other healthcare professionals. What goes under the compression dressings remains individualized to a great degree, but silver dressings continue to be suggested. More rapid healing is claimed by some although firm data supporting this claim are lacking.

**Objective:** To determine the clinical and cost effectiveness of silver dressings for venous ulcers.

**Design:** Prospective randomized clinical trial.

**Participants:** 208 patients with lower leg venous ulcers present for ≥6 weeks.

**Methods:** Patients were randomized into 2 groups based on the use of a silver donating dressing or non-antimicrobial dressing under a compression dressing. Patients were followed 12 weeks. Primary end point was healing at 12 weeks. Secondary end points included time to healing and cost effectiveness. Of patients, 104 had a silver dressing, and 104 had a control dressing.

**Interventions:** Dressings were changed every week or more often if assessed as being needed by nursing staff. Number of clinic visits was used as a surrogate for number of dressing changes. An approved list of silver donating dressings was used at both study sites.

**Results:** Healing rate at 12 weeks was 60% for silver and 57% for control dressings. Time to healing was 67 days for the silver and 58 days for controls. Ulcers >3 cm healed more slowly than ulcers <3 cm. Silver dressings (8) required more clinic visits than control dressings (6). Significant predictors of healing included study site, male sex, and ulcer size <3 cm. Cost effectiveness analysis revealed the incremental cost-effectiveness for silver dressings was $813,000 per quality of life gained.

**Conclusions:** Silver dressings did not significantly improve healing rates for venous ulcers and were not cost effective.

**Reviewer's Comments:** Great study to complement other studies in this issue of *Practical Reviews in General Surgery*. Silver dressings were prospectively evaluated for their ability to speed healing of venous ulcers and they were found to be lacking in efficacy. Cost analysis was also well done and clearly demonstrated a significant cost factor for the dressings and their application. These combine to yield an excessive cost effective ratio for each quality of life gained. This is a British study and their National Health Service uses a figure of $50,000 per quality of life gained to indicate a cost effective intervention. Our institution is constantly being asked to evaluate a new dressing and many of them do contain silver. I am sure the industry will not like this study, but its results will be hard to dispute. (Reviewer- John A. Weigelt, MD, FACS).

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Keywords: Silver Dressings, Venous Leg Ulcers, Cost Effectiveness

Print Tag: Refer to original journal article
Fifteen key process measures were defined for colorectal surgery; compliance with these processes improves patient outcomes.

**Background:** Performance improvement is all about structure, process, and outcome. How process compliance relates to outcome is often assumed and often challenged. Best practices usually include a set of best practices and compliance with the best practices is considered to improve outcomes. How good is the support for this concept?

**Objective:** To evaluate whether compliance with a set of best practices will improve outcome.

**Design:** Prospective clinical study.

**Participants:** 370 consecutive colorectal procedures.

**Methods:** Of patients, 198 had data available. A panel of 5 surgeons evaluated a list of practices associated with colorectal surgical procedures. They identified 37 process measures, of which 15 were considered "key processes" for the prevention of acute postoperative complications. Care of each patient was reviewed and the compliance rate with the 37 process measures recorded. Primary outcome was to correlate compliance rate with complication rate.

**Interventions:** A colon resection was performed in 71% and a rectal resection in 29%. The majority of resections (54%) were for cancer followed by diverticulitis (20%) and inflammatory bowel disease (6%).

**Results:** 38 patients had ≥1 complication with the most common complication being infection. Noncompliance for 11 standards including 3 key processes was 40%. Noncompliance key process measures were unnecessary blood transfusion, preoperative venous thromboembolism prophylaxis, and timely removal of a central venous catheter. Missing key processes significantly increased the complication rate which ranged from 7% for zero to 72% for ≥4 measures missed. Thus, for each process measure missed, odds of a complication increased by 60%.

**Conclusions:** Noncompliance with process measures for colorectal surgery is associated with increased complication rates.

**Reviewer's Comments:** The proof is in the pudding and this article is pretty good pudding. Following process measures does improve outcome. We have been told this for years, but proving it has not been easy. This is not a perfectly supportive paper, but it is pretty good. You can argue about the best practice list although the 15 key processes are pretty basic. They incorporate Surgical Care Improvement Project measures and others that have a preponderance of good evidence to support their use. Following them does make a difference is what these surgeons are saying. Another interesting finding is that it is very hard to follow all best practices which only occurred in 14% of the cases. Difficult, yes. Impossible, no. Necessary, it would appear so. However, trying to reduce the number to the bare essentials is a logical next step. Good report and one we should all pay close attention to in our current safe and quality directed healthcare environment. (Reviewer—John A. Weigelt, MD, FACS).

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Keywords: Colorectal Surgery, Best Practices, Adherence Rates

Print Tag: Refer to original journal article
Core Biopsy Before Breast Surgery -- Risk or Not?

Does Preoperative Core Needle Biopsy Increase Surgical Site Infections in Breast Cancer Surgery? Randomized Study Of Antibiotic Prophylaxis.

Paajanen H, Hermunen H:

Surg Infect (Larchmt) 2009; 10 (August): 317-321

Core needle biopsy should not increase risk of surgical site infection for subsequent breast cancer surgery.

**Background:** Surgical site infection (SSI) after breast surgery has always been a controversial subject. Breast surgery for benign or malignant disease is considered a clean surgery with a low SSI rate. Risk of SSI could be influenced by numerous factors that relate to patient and surgery. However, the use of core biopsy for diagnosis is a new factor that is concerning.

**Objective:** To determine if prophylactic antibiotics would alter SSI in patients having breast cancer surgery after core biopsy.

**Design:** Randomized clinical series compared to historical controls.

**Participants:** 292 patients with breast cancer who had their surgery after a core breast biopsy and a control group of 672 patients having breast cancer surgery without a preoperative core biopsy.

**Methods:** 292 patients were randomized to antibiotics or no antibiotics. Controls were 672 patients who had breast cancer surgery without core needle biopsy. Primary outcome was the SSI rate in the 292 patients randomized to antibiotics or no antibiotics. Of patients, 144 received perioperative antibiotics and 148 did not. A historical rate of SSI without core biopsy was used as a comparative group.

**Interventions:** Procedures performed were similar among groups. Mastectomy was chosen in 58% of antibiotic and 64% of control group.

**Results:** Historical SSI rate was 7% in patients. The rate remained at 7% after core needle biopsy was introduced. SSI rate among patients receiving antibiotics was 6% versus 9% for patients not receiving antibiotics. This was not significantly different. Rate of SSI was 17% for mastectomies and 8% for lumpectomy. Patient characteristics, antibiotics, nor surgical procedure altered SSI rates. Staph aureus was the most common bacterium isolated.

**Conclusions:** Core needle biopsy before breast surgery for cancer did not alter SSI rates and perioperative antibiotics did not alter these rates either.

**Reviewer's Comments:** Does an invasive core biopsy increase the SSI rate after lumpectomy or mastectomy? The high SSI rate of mastectomy and relatively high rate for lumpectomy is reaffirmed in this study. Antibiotics lowered the SSI rate after core biopsy but did not reach significance. How does one interpret this data? I would prefer to ignore the historical controls and concentrate on the 292 patients followed prospectively. The study is not of adequate size to answer whether perioperative antibiotics reduce SSI after core biopsy and breast cancer surgery. The SSI rates are nothing to brag about, and I would suggest that perioperative antibiotics may still be indicated for a clean wound that continues to manifest a high SSI rate. If perioperative antibiotics can reduce that rate, I am all for using them as a single preoperative dose aimed at Staph. (Reviewer-John A. Weigelt, MD, FACS).

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Keywords: Surgical Site Infection, Breast Cancer Surgery

Print Tag: Refer to original journal article
Operative angiography reduces time to operative intervention and improves limb salvage rate.

**Background:** Popliteal artery injury is still associated with a high amputation rate. Speed of revascularization is a primary tenet of good care. How this is achieved is often debated especially related to when and how angiography is performed.

**Objective:** To determine if the location of angiography for evaluation of popliteal artery injuries has an effect on outcome.

**Design:** Retrospective review of patients with popliteal artery injuries over a 10-year period.

**Participants:** 35 patients with 36 popliteal artery injuries.

**Methods:** Chart review was performed to extract patient variables. Mangled extremity severity scores (MESS) were calculated. Times were calculated from ED and operative logs. Injury to ED, ED to OR, and injury to initiation of operative repair were calculated. Operative repair included diagnostic angiography. Primary outcome was limb salvage. Limb salvage was defined as a functional limb.

**Interventions:** Saphenous vein grafts were used for repair in 73% and primary repair done in 27%. Of patients, 25 required angiography: 10 in the radiology suite and 15 in the OR.

**Results:** 2 patients required immediate amputation and 5 others required delayed amputation. Overall amputation rate was 17% and amputation rate after attempted repair was 15%. Amputation was avoided in 93% of patients with a MESS score of <8 but was required in 55% of patients with a MESS ≥8. However, of salvaged limbs only 31% had normal function. Foot drop was the most frequent abnormality. Time from injury to operative intervention was shorter by 89 minutes for the 15 patients who had their angiogram in the OR. Shorter time was associated with a better limb salvage rate.

**Conclusions:** Operative angiography reduces time to operative intervention and improves limb salvage rate.

**Reviewer's Comments:** This report should surprise no one, but careful reading suggests even more conclusions to improve patient care. I find their 15% amputation rate to be acceptable but far from optimal. Their time to operative repair in the OR angiogram group was >2 hours which is certainly not quick especially when 69% had signs or symptoms of injury on arrival. The authors suggest that they do not have a formalized protocol for managing a patient with diminished peripheral pulses. I would suggest that one is needed based on their reported times and results. If their premise is true, then immediate transfer to the OR and diagnostic studies as appropriate would seem to be the next logical conclusion. Unless these patients are treated with extreme urgency, our amputation rate for popliteal injuries will continue to be unacceptable. (Reviewer-John A. Weigelt, MD, FACS).
Silver has been used as an antimicrobial since ancient times.

Background: Silver has had a role in medicine since ancient times. It was used effectively to prevent burn wound sepsis. Most recently, silver is being incorporated into many different types of wound dressings.

Objective: To review uses of silver.

Design: Literature review. Discussion: Silver containers were used to transport water during ancient military campaigns. Silver plates were applied to wounds by the Macedonians. Silver nitrate was first reported as a medical agent in the 700s. Silver was used to preserve wine, water, milk, and vinegar by the 1800s. Marion Sims used silver sutures to repair vesico-vaginal fistulas in women secondary to traumatic deliveries. This was after many failures with other types of suture material. Silver nitrate drops were used to prevent ophthalmia neonatorium caused by gonorrhea, lowering the incidence of this condition from 8.00% to 0.13% over 13 years. Halstead suggested silver foil and silver sutures to prevent infection. Silver was also used intravenously and orally from 1900 to 1940 although high doses led to convulsions and gastrointestinal disturbances. Silver’s antibacterial effects are secondary to the silver ion. Silver ion is an effective antibacterial agent against most bacteria but not molds and parasites. Argyria is the deposition of silver in normal tissues and became a recognized complication of silver therapy although no long term damage was associated with argyria.

Conclusions: Medical uses for silver relate to its antibacterial properties.

Reviewer’s Comments: Most of us know the role silver played in burn wound treatment: first as silver nitrate and then as silver sulfadiazine. Silver appears to be making a comeback. It is appearing in wound dressings and catheters as a method to reduce or treat bacterial infections. We appear to be slipping into another era of protean use for silver, but we need to be sure of the benefit before wholesale application even though the risk benefit ratio is favorable. Another article in this issue of Practical Reviews in General Surgery attempts to evaluate the many new applications of silver into medicine. (Reviewer-John A. Weigelt, MD, FACS).

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Keywords: Silver Use, Medicine, History

Print Tag: Refer to original journal article
Surgical outcomes were better than medical outcomes when treating myasthenia gravis.

**Background**: Myasthenia gravis is an autoimmune disease characterized by progressive weakness of voluntary skeletal muscles. Thymectomy is an accepted treatment for myasthenia gravis although medical management is also used. Whether one is better than another is still debated.

**Objective**: To determine long-term outcomes of myasthenia gravis patients after medical or surgical therapy.

**Design**: Retrospective clinical study.

**Participants**: 172 patients with myasthenia gravis.

**Methods**: Patients were followed with a median of 10 years and range of 1 to 27 years. Of patients, 84 had a thymectomy and 88 had conservative management. Patients with thymoma and thymic carcinoma were excluded. Demographics, symptoms, treatments, and survival data were collected. Quality of life and neurologic scores were recorded at the date of last follow-up. Primary outcomes were quality of life, remission rates, and survival.

**Interventions**: The European Organization for Research and Treatment of Cancer quality of life questionnaire and the Osserman classification for neurologic findings were used. Osserman classification was 0 for asymptomatic, 1 for ocular signs, 2 and 3 for generalized moderate weakness, and 4 for severe weakness including respiratory dysfunction.

**Results**: Thymectomy patients had a higher Osserman score. Of thymectomy patients, 81% improved compared to 36% in the conservative group. Also in the thymectomy group, 42% had remission compared to 16% for the conservative group. Median survival was 354 months for thymectomy patients and 250 months for conservative treatment. Quality of life scores were significantly improved for thymectomy patients in the domains of cognition, global ability, and vegetative score.

**Conclusions**: Thymectomy improved outcomes for patients with myasthenia gravis.

**Reviewer's Comments**: I am not sure that this study will resolve the controversy surrounding treatment for myasthenia gravis. Results with medical and surgical therapy are equivalent in some studies although the quality of life results have not been a focus of many previous studies. These data demonstrate an improvement in neurologic scores and some quality of life domains. It was interesting that the physical score in their quality of life tool did not improve significantly with surgery compared to conservative treatment. Since patient selection was not controlled in this report, the authors may be assuming too much when they conclude that thymectomy should be offered to all myasthenia patients. Our approach is certainly not consistent with this conclusion. (Reviewer-John A. Weigelt, MD, FACS).

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**Keywords**: Myasthenia Gravis, Thymectomy, Conservative Treatment

**Print Tag**: Refer to original journal article
Tissue sealants do not reduce lymphocele formation after axillary dissection in patients with breast cancer.

**Background:** Seroma or lymphocele formation after breast excision and axillary lymph node dissection remain problematic for many patients. Lymphocele formation is reported following axillary lymph node dissection in 3% to 50% of patients. Lymphoceles can result in numerous wound complications.

**Objective:** To determine if tissue sealants can reduce incidence of lymphocele formation after axillary lymph node dissection.

**Design:** Prospective clinical trial.

**Participants:** 77 consecutive patients randomized to 3 different wound management approaches after axillary dissection.

**Methods:** Of patients, 39 had suction drainage alone, 15 had Bioglue®, and 23 had COSEAL® applied in addition to closed suction drainage. Data were collected prospectively and included tumor staging, number of lymph nodes removed, and preoperative patient data. Drainage amounts were collected through postoperative day 4. This day was chosen as it represents the duration when sealants are expected to exert their maximum effect. Primary end point was the volume of drainage and time to drain removal. Secondary end points were wound complications.

**Interventions:** All patients had a level I and II axillary dissection; 4 mL of sealant was used in the wound prior to wound closure and drain placement in the appropriate groups.

**Results:** Patient groups were matched for age, body mass index, type of surgery, disease stage, and number of lymph nodes removed. Of patients, 70 had a lumpectomy and axillary lymph node dissection and 7 had axillary lymph node dissection alone. Surgical site infection (SSI) occurred in 25% and lymphocele in 12% of patients. SSIs were superficial and not different among groups. Lymphocele rate was also not different. Volume of drainage, day to drain removal, and hospital days were not different among groups. Of patients, 1 with Biogluce and 2 with COSEAL had painful axillary masses that required excision. Pathologic examination revealed a foreign body reaction in all 3.

**Conclusions:** Tissue sealants do not reduce lymphocele formation after axillary dissection in patients with breast cancer.

**Reviewer’s Comments:** Small but nice study investigating whether tissue sealants can reduce wound complications associated with axillary lymph node dissection. The idea is interesting and worth considering, as seromas and lymphoceles are significant problems following breast surgery and other areas where lymph node dissections are needed. Having a method to reduce the formation of these fluid and lymph collections would reduce the associated complications that can be very troublesome. Unfortunately, the outcome of this study is not positive. Drainage was not reduced and thus wound complications were also similar with or without tissue sealants. The exception was a foreign body reaction in 3 patients receiving tissue sealants. The lack of efficacy may be a surprise, but not the foreign body reaction. Similar reports of tissue reaction to these sealants exist. Good idea with bad results. (Reviewer- John A. Weigelt, MD, FACS).

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Keywords: Axillary Lymph Node Dissection, Breast Cancer, Wound Management, Sealant

Print Tag: Refer to original journal article
Watchful waiting is appropriate for abdominal wall hernias during pregnancy.

**Background:** Groin and umbilical hernias in males and females are managed similarly. Recurrence rates after groin hernia repairs in females are much lower. An abdominal wall hernia in a pregnant female usually presents in the second trimester and can offer some unique problems.

**Objective:** To report a series of groin hernias in pregnant women managed by watchful waiting.

**Design:** Case series.

**Participants:** 12 pregnant patients with either a groin (7) or umbilical (5) hernia.

**Methods:** Patients were seen during their pregnancy secondary to hernia symptoms. Patients were followed through their pregnancy. Medical charts were reviewed. Follow-up was by office visits, mail, or phone. Primary outcome was the safety of no repair until after delivery and recurrence after repair.

**Interventions:** Hernias were repaired primarily (3 umbilical), patch (1 umbilical), and plug and patch (1 umbilical and 7 groin). Mean follow-up was 17 months (range 0.5 to 37.0 months).

**Results:** Mean age was 35 years (range 27 to 41 years). A mass was the complaint in 92% of patients and pain in 67%. All hernias were easily reducible when first seen. No episodes of incarceration during the pregnancy occurred and all had an elective repair. Mean time of repair was 22 weeks postpartum (range 4 to 52 weeks). No recurrences were noted and 4 patients had subsequent pregnancies without complications.

**Conclusions:** Watchful waiting for abdominal wall hernias in pregnancy is safe.

**Reviewer's Comments:** I pulled this article out of my “to be reviewed” file secondary to a case recently discussed at our morbidity and mortality conference. Not a very common condition for a surgeon to face and this report provides support for a conservative approach. All patients had an uneventful pregnancy despite the hernia. It is interesting that 67% of patients reported that they noticed the hernia during their first pregnancy. While it is not stated, I assume that all patients had had a previous pregnancy. One would ask the question as to why the patient did not seek care during the first pregnancy. That question is not answered. A unique problem I have faced involves the first pregnancy. An unrecognized umbilical hernia is noticed and the request is made by the patient to "fix it now" as it is unsightly in the patient's perception. This is a slightly different scenario than the author is presenting and a lot of support is often necessary to get the patient to accept a delayed repair. Regardless, it appears that these hernias can be safely watched during pregnancy. Now the real question is whether an inguinal hernia needs to be repaired after delivery or if watchful waiting still appropriate. (Reviewer—John A. Weigelt, MD, FACS).

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Keywords: Inguinal Hernia, Pregnancy

Print Tag: Refer to original journal article
CTA Used for Diagnosis of Extremity Vascular Injuries

A Prospective Validation of a Current Practice: The Detection of Extremity Vascular Injury With CT Angiography.

Seamon MJ, Smoger D, et al:

J Trauma 2009; 67 (August): 238-244

CT angiography can be used to diagnose vascular injuries in the extremity and may replace angiography.

**Background:** Angiography has been the gold standard for the diagnosis of penetrating extremity injury. Angiography is guided by documenting an ankle pressure index (API) of <0.9. CT angiography (CTA) is slowly replacing angiography.

**Objective:** To compare angiography with CTA in patients with vascular injuries to the extremities.

**Design:** Prospective evaluation of patients with extremity injuries and a possible arterial injury.

**Participants:** 21 patients with abnormal APIs.

**Methods:** Patients had an injured extremity with an abnormal API. The first test to evaluate for a vascular injury was a CTA followed by angiography, operative exploration, or both. Findings of CTA and angiography were compared. Of patients, 22 CTA studies were performed. Complications of either procedure were followed. Contrast-induced nephropathy was defined as a <50% increase in baseline serum creatinine.

**Interventions:** CTA was done with 100 to 150 mL of nonionic contrast dye. Angiography was done with 50 to 150 mL of dye. CT scanning was done with a 16- or 64-slice scanner.

**Results:** Injury was secondary to gunshot in 82%, stabs in 9%, and blunt force in 9% of patients. Upper extremity was involved in 32% and lower extremity in 68%. CTA was diagnostic of injury in 21 studies (95%). CTA findings were confirmed by angiography in 18, operation in 2, and angiography and operation in 2 patients. Of CTA exams, 11 were negative and the angiography demonstrated spasm, but all patients were managed successfully with non-operative methods. Sensitivity and specificity for CTA was 100% for clinically significant vascular injury. There was 1 case of contrast-induced nephropathy, but it resolved before discharge.

**Conclusions:** CTA can be used to detect extremity vascular injuries and may replace angiography.

**Reviewer’s Comments:** Small study, but one that sounds convincing. Not sure I could do this study in my institution with the concern for 2 dye loads and risk of nephropathy. Most injuries were in the thigh or arm based on the results. We have had a concern for evaluating below the knee injuries with CTA. It is possible, but we believe that the 64-slice scanner is necessary when going below the knee. Certainly less than 16-slice scanning would not yield such good results. We have gone to CTA over angiography to assess the patient with a low API. Multiple views are possible and fragments are usually not a problem. The question that is not answered by the authors or questioned in the discussion is why there are so many negative studies. I count 36% for the angiography and 52% for the CTA. Given that all patients had an abnormal API, I would have expected to see only a 5% to 10% incidence of negative studies. Not sure what explains this result. (Reviewer- John A. Weigelt, MD, FACS).

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Keywords: Arterial Injury, CT Angiography

Print Tag: Refer to original journal article
Fatigue, Distress Contribute to Medical Errors

Background: Medical errors and patient safety are linked. Our training programs are dealing with work hour restrictions and information on fatigue and quality of life. One reason used to support the 80-hour work week is improved quality of life for trainees and a hope that medical errors will decrease. The latter continues to be debated and more data are being sought regarding the effect of fatigue and mental distress on medical errors.

Objective: To identify associations between resident fatigue and distress to medical errors.

Design: Prospective longitudinal study of internal medical residents.

Participants: 380 residents in a single training program.

Methods: Electronic surveys were sent to residents every 3 to 6 months. These surveys asked for self-reporting of medical errors. After medical errors were reported, validated tools to assess fatigue, burnout, depression, quality of life, and sleepiness were sent and asked to be completed. Primary outcome was to correlate medical errors and symptoms of fatigue and distress.

Interventions: Surveys were sent to trainees from July 2003 through February 2009. Response rate for residents was 88%. All surveys were completed by 32% of residents. Mean response rate for each cycle of surveys was 67%.

Results: 39% of residents reported making ≥1 major error during the study. Medical errors were associated with sleepiness, burnout, emotional exhaustion, lower personal accomplishment, a positive depression screen, and poor quality of life. With multivariate analysis, fatigue and emotional distress remained significant predictors of medical error while sleepiness did not after adjustment for burnout and depression.

Conclusions: Fatigue and mental distress are associated with higher rates of medical errors among internal medical residents.

Reviewer's Comments: A well done study with some interesting findings. One can use these data to suggest that sleepiness is not the driver of medical errors although I doubt if it will be used in this fashion. It does demonstrate that personal assessments of mental distress and quality of life do correlate with self-reported medical errors. The study limitation discussion is thoughtful and complete. A one institution study, self-reporting of errors, data collection bias, and a sleepiness tool that might not be the best are all mentioned. Suffice it to say that we have not heard the last of this topic. Reduction of work hours is again being discussed and I am sure this paper will be used by one side or the other. (Reviewer-John A. Weigelt, MD, FACS).

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Keywords: Medical Errors, Residents, Fatigue, Distress

Print Tag: Refer to original journal article
A large variation in the practice of inguinal hernia repair exists.

**Background:** Evidence-based recommendations exist for inguinal hernia treatment. How often these are followed by surgeons is an interesting question.

**Objective:** To assess compliance with evidence guidelines among surgeons performing hernia surgery.

**Design:** Survey with 10 questions regarding hernia surgery.

**Participants:** Chiefs of 16 surgical departments were sent surveys in Austria.

**Methods:** Of participants, 15 responded for a 93% response rate with 2441 hernia repairs being reported. Answers to questions were tabulated. Questions reviewed indications for repair, type of repair, mean age of patients, follow-up, and use of mesh. Primary outcome was to assess whether current recommendations are being followed. Recommendations included type of repair, use of mesh, and follow-up for recurrences.

**Interventions:** 78% of patients had a unilateral hernia repaired, 13% had bilateral hernias, 6% had a recurrent hernia and 3% a sports hernia. Laparoscopic repairs were done in 81%.

**Results:** Mean age was 58 years. Mesh was used in 79% despite recommendations that it be used routinely. Laparoscopic was the most common procedure done at 4 institutions. Only 1 center appeared to almost limit the procedure a single type of repair: Lichtenstein. Most other centers had a mix of many different types of repair. Only 6 centers attempted to follow patients for recurrences. An overall median recurrence rate of 1.6% (range 1.0% to 4.3%) was reported. No concurrence of type of procedure was found among centers.

**Conclusions:** The 16 centers surveyed in Austria do not follow evidence-based guidelines when managing patients with inguinal hernias.

**Reviewer’s Comments:** The questions could have been better designed in my opinion, but the large variances in how inguinal hernias are performed in one geographic area are disturbing to say the least. One question not pursued was whether watchful waiting is practiced. Despite recommendations that open repairs might have lower recurrence rates in recent studies, laparoscopic repairs dominated. Use of suture repair persisted despite higher recurrence rates associated with suture repair compared to mesh repair. It is clear that lots of variation persists among surgeons performing inguinal hernia repairs. One needs to consider if this report from 2007 is just the result of a slow transition of clinical findings into clinical practice. On the other hand, recurrence follow-up is something we all should have been doing for a long time. As they say, what's in your wallet or how are you doing? (Reviewer-John A. Weigelt, MD, FACS).

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Keywords: Inguinal Hernia, Evidence-Based Medicine

Print Tag: Refer to original journal article
Predicting Success in Lower Extremity PAD Revascularization

Clinical Success Using Patient-Oriented Outcome Measures After Lower Extremity Bypass and Endovascular Intervention for Ischemic Tissue Loss.


Patient comorbidities determine outcomes from revascularization techniques.

Background: Practical Reviews in General Surgery in 2007 reviewed an article emphasizing outcomes after open revascularization for lower extremity vascular disease was more associated with patient comorbidities than the surgical procedure. The question raised was whether or not endovascular techniques would alter these findings.

Objective: To determine whether technique of revascularization will alter predictors of success.

Design: Retrospective chart review.

Participants: 677 patients who had lower extremity revascularization procedures for ischemic tissue loss.

Methods: Of patients, 316 had open and 361 had endovascular procedure. Data were retrieved from the vascular surgery database. Clinically successful revascularization was defined as patency until wound healing, limb salvage at 1 year, ambulation maintained for 1 year and survival to 6 months. Primary outcome was a comparison of clinical success with open and endovascular techniques. Predictors of success were also sought.

Interventions: Open or endovascular revascularization procedures. The most common open procedures were 98 femoral popliteal and 70 popliteal tibial bypasses. The most common angioplasties were 227 infrainguinal arteries and 64 aortoiliac arteries.

Results: Overall clinical success was 41%. Success rates did not vary by surgical technique. Predictors of failure were patient based and included diabetes, ambulatory status, chronic renal failure, gangrene, and previous revascularization attempt. When all patient conditions were present, success of revascularization was only 7%. Wound healing was 47% for open and 39% for endovascular procedures. This difference was significant.

Conclusions: Patient factors, not surgical technique, predict lower extremity revascularization success.

Reviewer's Comments: Results are similar to these authors' previous work. The type of revascularization procedure had no effect on clinical success. Patient factors were more important than the revascularization technique; although, wound healing was significantly better with open techniques. These data are useful when assessing a patient's chance of a successful revascularization. They also provide us with a realistic assessment of what to expect when a patient presents for a lower extremity revascularization procedure. Patient focus is clearly the message in this report. The fact that 2 data sets provide us similar data should be a strong message. (Reviewer-John A. Weigelt, MD, FACS).

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Keywords: Peripheral Artery Disease, Lower Extremity Bypass, Ischemic Tissue Loss

Print Tag: Refer to original journal article
Informed Consent -- How Good Are We?

Informed Consent: How Much and What Do Patients Understand?

Falagas ME, Korbila IP, et al:


When it comes to informed consent, patients receive lots of information but have large gaps of understanding.

Background: There are 5 elements involved with informed consent: voluntarism, capacity, disclosure, understanding, and decision. How well informed consent is obtained from an individual patient is also related to psychological and intellectual characteristics of the patient as well as the communication skills of the physician. 

Objective: To determine the amount of information available on the informed consent process for surgical procedures.

Design: Literature review using PubMed.

Participants: 23 articles were selected based on their containing information on recall and comprehension.

Methods: Articles had study groups ranging from 16 to 3888 patients. Articles were evaluated for components: whether there was an evaluation of the provided information, whether the information was adequate, whether there was comprehension of the risk of the procedure and whether the benefits of the procedure were perceived. Data were analyzed as the percent of patients who considered the consent process satisfactory in answering these 4 components. How the consent was obtained was also tabulated as well as when the informed consent process was evaluated in relationship to the operation.

Interventions: Of studies, 9 obtained consent verbally and in written form. Verbal was used in 8 studies. Verbal, written, and video in 3 studies and verbal with a slide presentation in 2 studies. Written alone was used in 1 study.

Results: The consent process was assessed before surgery in 9 studies, after surgery in 9, either before or after in another 4 and not reported in 1. Of patients, 58% believed that they received enough information during the process, while 17% felt they did not. Of patients, 29% admitted they had a good understanding of the information, while 29% said they did not. Of patients, 36% agreed they understood the risks of the surgery after consenting and 29% said they did not. Of patients, 33% agreed they understood the benefits, while 17% said they did not.

Conclusions: The informed consent process needs to become more patient centric and evolve into an exchange of information that is useful to the patient's understanding of the surgical procedure.

Reviewer’s Comments: We all do this. We all think we do it adequately. This report would suggest that our literature says we do not do as good a job as we would like. The authors agree that many aspects of the informed consent process are difficult to measure. It would appear we are good at providing information but not so good at explaining it in terms that the patient completely understands. It is probably wise for us to remember the old adage about communication. We should tell them what we are going to tell them, then tell them, then tell them what we told them. Great advice which is worth heeding based on this report. (Reviewer-John A. Weigelt, MD, FACS).

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Keywords: Informed Consent, Patients

Print Tag: Refer to original journal article
Splenic Preservation and Immune Function

Does Splenic Preservation Treatment (Embolization, Splenorrhaphy, and Partial Splenectomy) Improve Immunologic Function and Long-Term Prognosis After Splenic Injury?

Nakae H, Shimazu T, et al:

J Trauma 2009; 67 (September): 557-563

Immune function was no different after splenectomy when compared to splenic preservation.

**Background:** Splenic preservation is practiced in anticipation that immune function is preserved over splenectomy. Maintaining adequate splenic tissue will avoid overwhelming post-splenectomy sepsis, which is rare but does occur. How much splenic tissue to maintain and how it is maintained remains debated.

**Objective:** To compare immune function in patients after splenectomy or splenic preservation following splenic trauma.

**Design:** Prospective follow-up of patients treated for splenic injury.

**Participants:** 100 patients; splenectomy had been performed in 66 and splenic preservation in 34.

**Methods:** Patients were initially contacted by telephone and answered a survey regarding their clinical course since their injury. They were also asked to consent to further evaluation with blood testing and scanning. Of patients, 58 consented to further testing. Splenectomy had been performed in 24 patients, while the other 34 had splenic preservation. Primary outcomes were assessment of various immune tests and splenic volume as estimated by scanning.

**Interventions:** Splenic preservation was defined as splenic artery embolization, splenorrhaphy, or partial splenectomy. Blood samples were examined for Howell-Jolly bodies, immunoglobulin levels, and antibodies to *Streptococcus pneumoniae*. CT was used to estimate splenic volume.

**Results:** No episodes of infection occurred in patients contacted. Howell-Jolly bodies were present in 87% of patients after splenectomy but only 3% after splenic preservation. Humoral immunity tests were similar between groups. No difference in IgM or IgG antibodies against *S. pneumoniae* was found between groups. The volume of the spleen averaged 130 mL with a range of 43 to 287 mL.

**Conclusions:** No differences in immune function were found between patients having a splenectomy and a splenic salvage technique after splenic trauma.

**Reviewer's Comments:** The authors had a great idea and an opportunity to address a question that plagues all of us: the immunologic profile in patients after splenic preservation; however, their execution left us still wondering. Their lumping of splenic embolization and splenorrhaphy and partial splenectomy together for splenic preservation confuses the results. They also do not tell us how many of their 34 preservation patients they followed had which procedure. The real question of immune function after splenic artery embolization remains unanswered. Their data do not support an immunologic difference in patients after splenectomy or splenic preservation. Given the short-comings of their design, I am not sure we can take any solid conclusion away. We still immunize all of our patients who have a splenectomy. We do not do splenic artery embolization so we do not have to decide whether we immunize this type of patient or not. (Reviewer-John A. Weigelt, MD, FACS).

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Keywords: Splenic Injury, Immune Function, Prognosis, Embolization, Splenorrhaphy, Splenectomy

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