

General Surgery

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Chylous Drainage through Percutaneous Cholecystostomy: An Extremely Rare Complication

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Introduction: Chyle leak is a rare but potentially morbid complication of abdominal surgery. There have been six reported cases of chylous ascites following cholecystectomy, but no such occurrences are reported with percutaneous cholecystostomy tube (PCT) insertion. Presented here is a case of chyle leak following percutaneous cholecystostomy.

Case Description: We report the case of a 67-year-old female with chronic bilateral lower extremity lymphedema and stage IVb recurrent uterine papillary serous carcinoma. She had an extensive abdominal surgical history including a paraesophageal hernia repair, and a robotic hysterectomy, bilateral salpingo-oophorectomy, pelvic and para-aortic lymphadenectomy, gastrocolic omentectomy, and hepatoduodenal lymphadenectomy four years back. Recurrent cancer was identified two years ago, primarily in the peri-aortic and iliac lymph node basins and she'd been maintained on pembrolizumab and lenvima with reportedly adequate clinical oncologic control. The patient presented with a four-week history of abdominal pain and intractable nausea and vomiting. She was vitally stable on presentation without leukocytosis or abnormal liver function test. Abdominal imaging showed significant gallbladder distension, wall thickening, and pericholecystic inflammatory changes suggestive of acute cholecystitis. Given her abdominal surgical history, duration of symptoms, and extent of inflammation in the right upper quadrant, decision was made to proceed with PCT placement and defer cholecystectomy to a later date. The patient demonstrated significant symptomatic improvement, diet was advanced, and she was discharged home on hospital day five. She returned to the emergency department a few hours after discharge in septic shock. Repeat abdominal imaging revealed a dislodged PCT and she was admitted to the surgical intensive care unit for vasopressor support and mechanical ventilation. The PCT was subsequently replaced with fluoroscopic guidance. Five days later (nine days after initial placement), the drainage became whitish and milky and was confirmed to be chylous in nature with an elevated triglyceride level of 683 mg/dL. Repeat abdominal imaging revealed minimal perihepatic ascites and bilateral pleural effusions, while the PCT remained in good position. Bilateral chest drainage also revealed chylothorax as well as malignant cells. She was managed with bowel rest, parenteral nutrition, and octreotide. PCT output gradually decreased but remained chylous. Subsequent imaging and cholangiogram/PCT check revealed no fistulous connection to the thoracic cavity or lymphatic system. The remainder of her four-week hospital course was complicated by persistent distributive shock, adrenal insufficiency, and continued chyle leak. Though she was successfully extubated, her clinical status continued to decline. Per the wishes of the patient and her family, she was transitioned to inpatient hospice and died shortly after.

Discussion: To the best of our knowledge, this is the first ever reported case of chyle leak complicating PCT insertion. Whether it was caused by violation of the retroperitoneal lymphatic channels during tube insertion or exchange or erosion of the tube into the hepatic lymphatic channels, could not be clinically determined. The recurrent and progressive oncologic disease of the patient as well as her complex surgical history were likely the primary contributing factors to this complication.

Readmission With Acute Kidney Injury Following Ileostomy; Patterns and Predictors of a Common Phenomenon

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Introduction: Ileostomy is associated with various complications often necessitating rehospitalization. High output ileostomy is common and may lead to acute kidney injury (AKI). Here we describe the temporal pattern of readmission with AKI following ileostomy formation and identify risk factors.

Methods: Patients that underwent formation of ileostomy between 2008 and 2021 were included in this study. Readmission with AKI was defined as readmission with serum creatinine level $>1\text{mg/dL}$ and >1.5 -fold compared to the level at discharge, accompanied by ileostomy output $>1000\text{ml}$ in 24 hours. Patient characteristics and perioperative course were assessed to identify predictors for readmission with AKI.

Results: Of 1191 patients who underwent ileostomy, 198 (16.6%) were readmitted with high output stoma and AKI. The mean time to readmission with AKI was 98.97 ± 156.36 days. Eighty-six patients (43.4%) had early readmission (within 30 days) and 66 (33%) were readmitted after more than 90 days. Over 90% of patients had more than one readmission and 110 patients (55%) had 5 or more. Patients related predictors for readmission with AKI were age >65 , body mass index $>30\text{kg/m}^2$, and hypertension. Factors related to the postoperative course were AKI with creatinine $>2\text{ mg/dL}$, postoperative hemoglobin $<8\text{g/dL}$ or blood transfusion, albumin $<20\text{g/dL}$, high output stoma and need for Loperamide, and length of hospital stay >20 days. Factors related with early versus late readmissions and multiple readmissions were also analyzed.

Conclusions: Readmission with AKI following ileostomy formation is a consequential event with distinct risk factors. Acknowledging these risk factors is the foundation for designing interventions aiming to reduce frequency in predisposed patient populations.

Single Community Hospital Incidence and Risk factors for Fungal Infection in Patients with Perforated Diverticulitis- Preliminary Results of a Retrospective Review

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Introduction: The incidence of fungal intraabdominal infection has not been well described in patients with diverticulitis. Routine empirical antifungal therapy is not recommended for complicated diverticulitis based on currently accepted clinical pathways. Our study aims to identify risk factors and differences in clinical presentation between patients with and without fungal infections.

Methods: This is a retrospective single institution analysis of patients with complicated diverticulitis and cultures obtained between 2017 and 2021. Risk factors, including previous episodes of diverticulitis, diabetes, steroid use, smoker, chronic kidney disease, current cancer or chemotherapy were compared among patients with and without fungal infection. Clinical markers including initial heart rate, systolic blood pressure, white blood cell count, creatinine, and albumin were analyzed. Ninety-day mortality, readmission rates, and length of stay between both groups were also compared.

Results: We identified a total of 44 patients with complicated diverticulitis who met inclusion criteria. Cultures of 8 patients (18%) contained a fungal source. Multiple risk factors compared, including previous episode of diverticulitis ($p=0.175$), diabetes ($p=0.873$), steroid use ($p=0.398$), smoker ($p=0.72$), chronic kidney disease ($p=0.179$), current cancer or chemotherapy ($p=0.263$), did not demonstrate a statistically significant difference. Additionally clinical markers including initial systolic blood pressure ($p=0.57$), white blood cell count ($p=0.54$), creatinine ($p=0.35$), albumin ($p=0.14$) showed no statistically significant difference. However, patients with fungal infection had a significantly lower mean heart rate (80 vs 96.8, $p=0.016$) compared to those without fungal

source. We found no statistically significant difference in 90-day mortality ($p=0.633$), readmission ($p=0.755$), and length of stay ($p=0.551$) between the two groups.

Conclusions: Up to one-fifth of patients with complicated diverticulitis were identified to be positive for fungal infection within this community sample. Although there is no difference in risk factor profile or clinical markers, further investigation would be prudent to investigate the role of a positive fungal source in response to treatment of complicated diverticulitis and its subsequent outcomes.

Small Extracellular Vesicles in the Management of Wound Healing

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Introduction: Chronic wounds remain a major obstacle in the American surgical patient population. We have previously demonstrated that Trx-1 is a proangiogenic molecule as well as a potent anti-oxidant. Therefore, we investigated the therapeutic effect of (1) Trx-1 overexpression and (2) Trx-1 engineered exosomes (<150 nm) collected from Trx-1 transgenic mice (Trx-1^{Tg/+}) over-expressing Trx-1 on wound healing.

Methods: Study 1: Full-thickness wounds were created in the center of the dorsal ischemic skin flap of 8-12 week old wild type (WT) and Trx-1^{Tg/+} mice. **Study 2:** A similar wound was created in CD1/ICR mice and was selectively injected intradermally with exosomes acquired from WT (Exo^{WT}) and Trx-1^{Tg/+} mice (Exo^{Trx-1Tg/+}) undergoing physiologic stress (myocardial ischemia). Digital imaging was captured post-operatively (on days 3, 6, 9, 13-14) to assess the progression of wound closure. Tissue samples collected at pre-determined intervals underwent immunohistochemical analysis to assess capillary density and VEGF expression.

Results: Digital imaging demonstrated significantly increased wound closure in Trx-1^{Tg/+} mice on days 9 ($p=0.0007$) and 14 ($p=0.0042$) vs. WT ($n=5-7$). Similarly, mice treated with Exo^{Trx-1Tg/+} showed significant wound closure at all time points (day 3, 6, 9, 14; $p=0.004$, 0.0006 , $<.0001$, $<.0001$; $n=10-13$) compared to Exo^{WT}. Immunohistochemical analysis displayed increased VEGF staining in Trx-1^{Tg/+} vs. WT mice. Capillary density was also significantly increased in Trx-1^{Tg/+} mice ($n= 3-4$, $p=0.049$) compared to WT.

Conclusion: Our data suggest that Trx-1 plays a significant role in wound healing, tissue repair and regeneration. The significance of such a repair mechanism in wound healing and closure warrants further studies.

Transvaginal Repair of Small Bowel Enterotomy After Outpatient Loop Electrosurgical Excision Procedure: A Case Report

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Introduction: In recent years there has been a common trend towards minimally invasive surgery due to its various advantages. This has led to exploring different laparoscopic, robotic or even endoscopic techniques to common surgical procedures. Many of these procedures are done in the elective setting but urgent or even emergent procedures can sometimes be performed in a similar fashion. This case demonstrates a transvaginal repair of small bowel enterotomy sustained during loop electrosurgical excision procedure (LEEP) in the outpatient setting.

Case Presentation: A 69-year-old female with a past surgical history of total abdominal hysterectomy presented urgently after outpatient LEEP after she was found to have a colpotomy and enterotomy. She was undergoing the procedure due to biopsy of the vaginal cuff demonstrating high grade intra-epithelial neoplasia. Immediately after the procedure the provider evaluated the site and identified what appeared to be small bowel mucosa. A stitch was immediately placed for later identification and then the patient was transferred to the hospital for urgent evaluation and repair. Prior to surgery she was evaluated and found to be with only mild pelvic discomfort and a small amount of vaginal bleeding and succus. She reported no abdominal pain and her abdominal exam was benign. She underwent speculum exam under general anesthesia which demonstrated a 2cm colpotomy anteriorly with small bowel and 1cm enterotomy with stitch in place. The bowel was then pulled partially through the defect with

minimal tension for complete evaluation. Due to adequate visualization and exposure the decision was made to repair the enterotomy through the colpotomy. Stay sutures were placed and the bowel was closed transversely with the first layer in a running fashion followed by simple interrupted sutures for imbrication. The small bowel was then reduced through the vaginal defect and the site was closed with simple interrupted figure-of-eight sutures. The patient had an uneventful postoperative course and was passing flatus and tolerating a diet leading to discharge on postoperative day two.

Conclusion: This paper describes effective urgent repair of a small bowel enterotomy safely performed through colpotomy after injury sustained during outpatient LEEP. Natural orifice approaches to urgent operations can be safely performed under the right conditions.



Utility of Diastolic Shock Index at Admission as a Predictor of Severity in Patients with Diverticulitis

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Introduction: Diastolic shock index (DSI) represents the ratio between heart rate and diastolic blood pressure. Previous research has suggested DSI could predict severity of disease in infectious conditions where the peripheral vascular becomes dilated as a physiologic response to shock. A progressive increase in DSI greater than 2.5 has been shown to be associated with increased risk of death in patients with septic shock. Here we attempted to understand the use of DSI to predict the severity of disease in patients admitted with diverticulitis to a community hospital.

Methods: We identified patients admitted to a single community hospital from July 2017 to July 2020 with a diagnosis of diverticulitis (complicated vs uncomplicated) based on International Classification of Disease 10th edition. Patients were included if they were admitted to the hospital. The initial vitals on presentation were utilized to calculate the DSI. Demographic statistics were collected and outcomes between patients were analyzed including need for operation, intensive care unit admission, and mortality.

Results: A total of 323 patients were identified who met inclusion criteria for analysis with 224 (69.4%) classified as non-complicated. The mean DSI in the complicated group was statistically greater than the non-complicated group (1.23 vs 1.14, $p=0.0062$). Mortality was not shown to be significantly different for non-complicated and complicated groups. However, in the non-complicated group a higher DSI was significantly associated with need for operation and in the complicated group a higher DSI was significantly associated with the need for intensive care unit monitoring.

Conclusions: In a community sample of patients with diverticulitis DSI represents a useful marker for the identification of patients who may require more advanced care. We would suggest the continued investigation of DSI for patients with diverticulitis to help guide effective management of patients.

Sports Hernia: A Single Surgeon's 8-Year Experience of Athletes and Non-Athletes

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Introduction: Sports hernia, also referred to as athletic pubalgia, core muscle injury or inguinal disruption, is a major cause of chronic groin pain. Sports hernia is a leading cause of athlete loss from competitive sports. It is possible that non-athletes sustain

identical injury patterns as athletes. Sports hernias typically present as groin pain without a bulge, worsened by activity. Pain is classically suprainguinal, however adductor symptoms and findings are often reported, as is testicular pain. Concomitant hip flexor injuries and labral tears can confound diagnosis. MRI has emerged as the gold standard imaging modality. Treatment options range from physical therapy to surgical repair, however, optimal therapy for each injury pattern remains undefined. The goal of this paper is to help elucidate the spectrum of the patient population impacted and injury pattern, potential commonalities in the mechanisms of injury, the role of imaging, and finally, potentially clarify optimal treatment algorithms.

Method(s): Patients presenting with a chief complaint of “groin pain” to a single general surgeon practice between 12/3/2013 and 3/16/2021 were selected for review. Patients met the inclusion criteria if they had a physical exam suspicious for sports hernia, negative for inguinal hernia, and at least one follow-up visit. Demographic, history, physical exam, diagnostic, treatment, and resolution information was compiled. Based upon physical exam, patients were classified as having one of three types of injury pattern: posterior wall dominant, adductor dominant, and combined type. Surgical treatment involved either laparoscopic or robotic repair with Bard 3D max medium standard weight mesh. Open surgery utilized the Munich repair. Adductor therapy included steroid/Marcaine or platelet rich plasma injection and surgical lengthening or tendon release. IBM SPSS Statistics Premium was used for statistical analysis.

Results: 741 groin pain patients were seen and 230 met the inclusion criteria. Most excluded patients were diagnosed with inguinal hernia. The majority of patients were male (86%) and non-athletes (68%). The mean age was 42.8 years old, mean BMI was 27.4 kg/m², and mean time between injury and consultation was 12.8 months. Prevalent injuries were from physical activity (28%), sport-related injury (20%), and work-related injury (20%). 26% of patients were unable to recall their mechanism of injury. Testicular pain was reported among 43% of males. Common positive physical exam findings include adductor tenderness (67%), sit-up sign (66%), and straight leg raise (SLR) (64%). Injury patterns were determined to be 44% posterior wall dominant, 18% adductor dominant, and 38% combined type. Imaging modality was mostly MRI (93%), with 53% being positive. The odds of obtaining a positive MRI decreased exponentially from time of injury (1 month 1.5%, 12 months 17% [OR 1.15]). 77% of sport-related injury, 40% work-related injury, and 48% unknown injury patients had a positive MRI. 85% of athletes and 72% of non-athletes were treated. 67% of patients underwent surgery and 11% required a staged repair. The most frequent initial surgery was laparoscopic or robotic mesh repair (78%). Common staged surgeries were adductor tenotomy (56%) and adductor lengthening (20%). The most prevalent physical exam findings at the last appointment were adductor pain (20%), sit-up sign (7%), and SLR (6%). Full resolution of treated patients occurred in 53% of posterior wall dominant, 33% of adductor dominant, and 39% of combined type patients. Of patients presenting with adductor findings (adductor dominant or combined type), 73% had resolution of adductor symptoms with mesh repair alone.

Conclusion: Sports hernias can affect athletes and non-athletes alike, commonly without a known mechanism of injury. Positive sit-up sign, SLR, and adductor findings strongly correlate with the diagnosis, and guide classification of injury type. In turn, injury type can dictate optimal treatment and predict outcome. MRI is useful in the workup of groin pain patients, but utility wanes with time from initial injury exponentially. Minimally invasive mesh repair is a highly effective treatment for both athletes and non-athletes. Lastly, a staged approach may be the optimal treatment algorithm in patients with adductor symptoms.

Incidence of Venous Thromboembolism Following Ambulatory General Surgery: A State-of-the-Art Review

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Introduction: Surgical procedures in the United States are increasingly being performed on an outpatient basis. While inpatient general surgery is a well-established risk factor for venous thromboembolism (VTE) that compels routine physical and chemical prophylaxis, the magnitude of increased risk for VTE associated with ambulatory general surgery is not clear. To help assess the possible role for targeted VTE prophylaxis in patients undergoing general surgery in the outpatient setting, a state-of-the-art review of the literature on this topic was initiated. This is an interval report on the findings of the review.

Methods: A comprehensive literature search from January 1, 2000 through February 16, 2022 was performed in PubMed and Embase using search terms related to deep venous thrombosis, pulmonary embolism (PE), and outpatient or ambulatory surgery. Inclusion criteria were (1) study population of patients ≥ 18 years old undergoing elective, outpatient, general surgery procedures, (2) discussion of incidence or risk factors for VTE in the postoperative period, (3) published in English, and (4) full, peer-reviewed article. Bariatric, oncologic, orthopedic, vascular, and plastic surgeries were excluded. Case series were excluded.

Results: After review of 678 abstracts, 153 papers are currently under full-text review (Figure 1). Nearly all are retrospective in design. Several risk factors for VTE after ambulatory surgery are reported in the literature, including general anesthesia, reverse Trendelenburg positioning, pneumoperitoneum, pregnancy, active malignancy, age > 41 , BMI > 40 , and operative time ≥ 120 minutes. Large series reporting clinically apparent VTE and PE found an incidence ranging from 0.0% to 0.24%. One study reported that it was possible to risk stratify patients undergoing ambulatory surgery into high-risk (incidence of 1.18%) and low-risk (incidence 0.06%) for VTE. One study comparing VTE following inpatient versus outpatient ventral hernia repair found the incidence after outpatient surgery to be one-seventh the incidence after inpatient surgery (0.2% versus 1.4%). Reported incidence did not differ significantly across type of general surgery procedure performed.

Conclusion: The interim result showed that the overall incidence of clinically apparent VTE following outpatient general surgical procedures in the published literature appears to be less than 0.5%, similar to the baseline annual incidence of VTE in the general population. While further studies are needed to determine the incidence of asymptomatic VTE in this population, these existing data focused on symptomatic VTE reinforce current practice that VTE chemoprophylaxis in the outpatient setting is not routinely indicated. The outpatient setting appears to be a significant protective factor against VTE after general surgery. Clinical risk stratification can assist in identifying patients undergoing outpatient surgery that are at higher risk for postoperative VTE and who may be a target for intervention.