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Open Cholecystectomy Post Ventral Mesh Implantation: Surgical Considerations and Case Report

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1. Abstract

We report a case of a 51-year-old male with a history of Roux-en-Y gastric bypass and ventral hernia repair with intraperitoneal onlay mesh (IPOM) requiring subsequent revision, presenting with acute calculous cholecystitis. The patient was taken to the operating room, where extensive peritoneal adhesions and inflammatory infiltrate were observed. In addition, the patient had undergone IPOM revision three weeks prior to presentation. Intraoperative findings and concern for mesh infection necessitated conversion from laparoscopic to open cholecystectomy. During the procedure, we avoided violating or disrupting the mesh and used a muscle-splitting approach in combination with local analgesia and multimodal pain control, enabling successful discharge on postoperative day one. The patient experienced no complications or readmissions over the subsequent year. This case highlights the considerations for open conversion cholecystectomy in relation to recent mesh revision and discusses the benefits of a muscle-splitting approach and multimodal pain management to reduce prolonged hospitalization.

2. Introduction

Laparoscopic cholecystectomy is the current gold standard for symptomatic gallbladder disease. Compared to a laparoscopic approach, an open cholecystectomy generally exhibits higher postoperative complications and mortality rates, prolonged length of stay by 3 to 5 days, and increased hospital costs [1-3]. Thus, open cholecystectomies are not as frequently performed. Due to limited exposure among residents, best practice guidelines supported by the American College of Surgeons recommend operating with a surgeon experienced in open cholecystectomies [4]. Nevertheless, conversion from laparoscopic to open cholecystectomy remains necessary under various circumstances, occurring in approximately 2 to 15% of cases [5]. Risk factors for open conversion include older age, male gender, emergency presentation, significant peritoneal adhesions, acute cholecystitis, bleeding, and to a lesser extent chronic cholecystitis [5]. It is important to understand when to appropriately convert and to enhance techniques aimed at reducing complications and prolonged hospitalization. We present a patient with a history of recent intraperitoneal onlay mesh (IPOM) repair and revision who presented with acute calculous cholecystitis, underwent open cholecystectomy, and was discharged on postoperative day one.

3. Case Presentation

A 51-year-old male with a surgical history of Roux-en-Y gastric bypass 18 years ago, recent IPOM repair for a ventral hernia 2 years ago and subsequent revision three weeks prior to presentation, presented to the emergency room with acute right upper quadrant abdominal pain with a Murphy's sign, nausea, and vomiting. He was afebrile and white blood cell (WBC) count was within normal limits. Alkaline phosphatase (ALP) level and total bilirubin were elevated at 240 U/L and 2.2 mg/dL, respectively. Abdominal ultrasound showed multiple gallstones, mildly thickened gallbladder wall of 3 mm, and common bile duct (CBD) dilatation of 8 mm suggestive of acute cholecystitis with possible choledocholithiasis (Figure 1). No evidence of pericholecystic fluid was found. The abdominopelvic CT showed a dilated gallbladder with layering sludge and stones (Figure 2). The patient agreed to surgery and was taken to the operating room.

The procedure began laparoscopically. One trocar was placed with careful intention to avoid introduction through the mesh. Upon laparoscope insertion, dense adhesions around the trocar site and right upper quadrant were observed. The gallbladder could not be safely visualized, necessitating conversion to open. A right subcostal Kocher incision was made, and a muscle-splitting approach was utilized to obtain access to the peritoneum. Traditional top-down dissection of the gallbladder was performed. Intraoperative cholangiogram revealed no filling defects, and cholecystectomy was completed (Figure 3). Prior to beginning layered closure, a transabdominal plane (TAP) block was performed using liposomal bupivacaine. Following closure, the patient was successfully extubated.

Postoperatively, the patient recovered with minimal use of multimodal pain control. Intravenous (IV) pain medication was successfully transitioned to oral on the first postoperative day. The patient tolerated a regular diet by postoperative day one and was passing flatus. After discussion, the patient felt comfortable and was discharged the first postoperative day. At postoperative follow-up in clinic, the patient was recovering well and had no issues with pain or his incision. Pathology report demonstrated acute cholecystitis.

Figure 1: Gallbladder wall thickening with cholelithiasis and biliary sludge, concerning for cholecystitis. Mildly dilated CBD. (A) Transverse and (B) Longitudinal ultrasound views.

Figure 2: Gallbladder densities consistent with layering sludge or tiny stones on CT Transverse Abdomen.

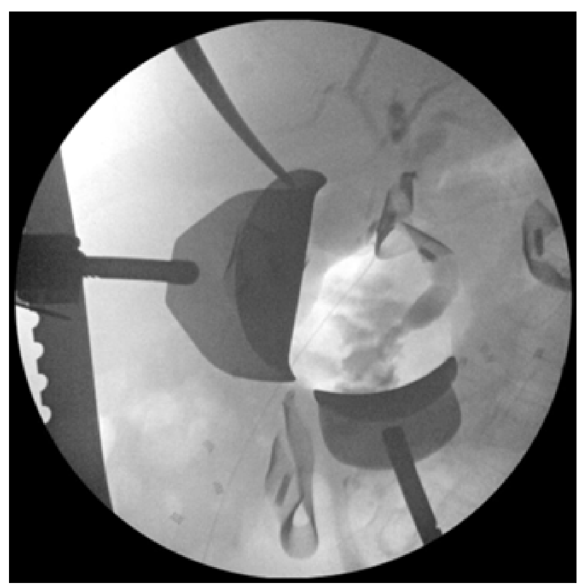

Figure 3: Intraoperative cholangiogram noting biliary tree and duodenal filling.

4. Discussion

This case demonstrates significant factors to consider when deciding to convert to an open cholecystectomy. Our patient's recent IPOM mesh revision was of particular concern given the risk of mesh infection and the need to avoid disrupting or damaging the mesh.

Mesh poses two primary challenges. The first challenge is the increased risk of forming significant peritoneal adhesions, which impedes safe laparoscopic visualization and mobilization [6]. These adhesions can be exacerbated by surrounding gallbladder inflammation, restricting the ability to identify the critical view of safety and necessitating open conversion [7, 8]. The second challenge is the risk of mesh infection, increasingly considered due to the prevalence of mesh implementation in abdominal wall repair. In fact, two of the most common risk factors for open conversion cholecystectomies are inflammatory gallbladder infiltration and significant peritoneal adhesions [9]. Mesh has associations with both factors, making it an important consideration when contemplating open conversion. This is not well-discussed in the literature despite hernia repair with mesh and cholecystectomies being two of the most common general surgery procedures.

Complications such as mesh infections have become more prominent in patient care, especially for those undergoing additional surgery, with the rate of mesh infection requiring explantation reported as 4.5% in one study [10, 11]. Most mesh infections are attributed to surgical site infections from bacteria like Staphylococcus aureus [12]. However, other intra-abdominal infectious etiologies also pose potential concerns. For example, acute calculous cholecystitis has been known to cause secondary peritonitis due to Escherichia coli, Enterococcus species, and Klebsiella species, of which the latter two have been associated with mesh infections [13].

Biliary extravasation or leakage is a potential route for infectious contamination. According to the 2018 Tokyo Guidelines, laparoscopic continuation rather than open conversion for cholecystitis was associated with increased biliary leakage risk [8, 14]. In addition, it is widely acknowledged that inflammation of the gallbladder and surrounding structures heightens complication risks such as gallbladder perforation due to tissue structure alteration [7]. These factors collectively raised our concerns for mesh and intra-abdominal infection risk with laparoscopic continuation. Cautious avoidance of mesh injury was also taken during the procedure, which may additionally reduce infection risk, though this is less clear [15].

Though specific studies on the risk of mesh contamination applicable to our patient are scarce, one study noted that concurrent ventral hernia repair with cholecystectomy did not affect the risk of infection compared to hernia repair alone (1.86% vs. 1.97%, $p = 0.57$) [16]. Moreover, patients who underwent cholecystectomy combined with either concomitant laparoscopic IPOM repair or abdominal wall reconstruction showed no significant alterations to procedural outcomes, including wound morbidity, with a mesh infection rate of only 0.8% [17, 18]. Thus, mesh infection risk with clean-contaminated procedures like cholecystectomy may not be as high as anticipated. If we can avoid operating near or through the mesh, these types of complications may be avoidable.

An additional important topic of discussion is the effort to mitigate the complications and prolonged hospital stay associated with open cholecystectomies. Patients who have undergone laparoscopic cholecystectomy are often discharged within the first or second postoperative day, whereas with open cholecystectomies, hospital stays extend by approximately 3 to 5 days, typically due to insufficient pain control [1-3]. This increases risk of complication-associated morbidities such as atelectasis due to pain-related shallow breathing or hypoventilation due to extensive opioid use [19]. Although our patient underwent open cholecystectomy, pain was well controlled as the patient was discharged on the first postoperative day.

In the early 1990s, an open cholecystectomy without conversion could cost from $5525 up to around $8896 [3, 20, 21]. A study by an insurance company estimated an open cholecystectomy cost on average $15,380 in the United States in 1996 [22]. In the modern day, most open cases are converted from laparoscopic ones except in middle to lower income countries where high equipment costs persist, and open cases may cost $600 or less, as in Rwanda and Mongolia [23, 24]. Nevertheless, an open cholecystectomy is generally associated with higher costs compared to a laparoscopic cholecystectomy. One study showed that patients who underwent laparoscopic cholecystectomy had an average risk-adjusted cost of $10,026 compared to $36,029 when converted to open, a 259% increase with an average of 4 days extra length of stay [25]. Another study comparing laparoscopic versus open cholecystectomies redemonstrated these findings, noting that mean length of stay was 1 day versus 4 days, respectively, and average hospital charges accumulated to $23,946 versus $32,446 respectively, indicating a 26% cost increase with open conversion [26]. However, even for all patients who underwent surgery within 48 hours of presentation and were later discharged within 48 hours, the average risk-adjusted cost for laparoscopic cholecystectomy was $8,670 versus $11,900 for open conversion, a 37% increase [25]. These findings indicate that while reducing hospital stay unsurprisingly lowered costs, even when length of stay was equal, costs for converting to open persistently remained higher than laparoscopic. The higher cost associated with open cholecystectomy are related to the conversion of the procedure. Although it is standard of care to initiate the operation laparoscopically, there may be a patient population where performing an open cholecystectomy as the index operation would be beneficial.

We recommend the use of a muscle-splitting approach following subcostal incision as an option to decrease postoperative pain, which has been shown to significantly reduce pain compared to a muscle-dividing approach in open cholecystectomies [27]. Muscle splitting has also been shown to be superior in reducing morbidity, hospital stay, and postoperative analgesia requirement [28]. Furthermore, our patient also received a TAP block in combination with local analgesia and multimodal pain control, which significantly reduced the need for prolonged IV opioid medication.

In a study performed by Tekeli et al., the use of subcostal liposomal bupivacaine TAP block reduced length of hospital stay for laparoscopic cholecystectomy patients by an average of 0.6 days compared to IV analgesia (1.8 days vs. 2.4 days, p = 0.001), although this difference was clinically insignificant in the study and therefore unlikely to affect costs [29]. Data on using liposomal bupivacaine TAP blocks for open cholecystectomies is scarce. A study by Cohen et al. showed that using Exparel on open colectomies reduced average hospital stay by 2.9 days and average costs by $3,084 (2 days, $8.766 cost with liposomal bupivacaine vs 4.9 days, $11,850 control) [30]. These findings suggest that liposomal bupivacaine may reduce length of stay and hospital costs when used during open cases rather than laparoscopic, although more research is needed to evaluate if this applies specifically to open cholecystectomies.

5. Conclusion

In conclusion, patients undergoing laparoscopic cholecystectomy should always be evaluated both pre- and intra-operatively for risks of open conversion. For patients with prior mesh placement and recent revision, one should be cognizant of the size and location of mesh to avoid introduction of trocars through the mesh or inadvertent enterotomies. Furthermore, as in our case, significant peritoneal adhesions and the risk of mesh infection from potential biliary leakage are also considerations that may lower the surgeon's threshold to start with an open procedure in the setting of adequate training. As mesh implantation continues to increase with hernia repair, there is a population that may benefit from open cholecystectomy as the index operation. Our muscle-splitting approach, TAP block, and use of multimodal pain control demonstrate an effective combination to reduce postoperative pain-related complications, hospital stay, and potential costs associated with open conversion. This would avoid operating through mesh as well as possible seeding of a foreign body with bacteria. We therefore recommend considering a muscle-splitting approach in conjunction with a TAP block and multimodal pain control when performing an open cholecystectomy.

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