

Beyond the Expected

Evaluating Preoperative Predictors of a Difficult Cholecystectomy Aboard the USNS Comfort

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Since 2007, the Hospital Ship US Naval Ship (USNS) Comfort has conducted multiple medical missions in Latin America and the Caribbean, in support of Operation Continuing Promise.¹ During deployment in 2019, the USNS Comfort conducted surgical missions in 12 countries over 5 months. Each mission involved 6 days of operation, with a total of 1259 surgical procedures.² The ship prioritized low-risk outpatient surgeries because of its short mission time. The most common general surgery referral was outpatient elective laparoscopic cholecystectomy, followed by inguinal hernia repair and umbilical hernia repair. Early into the 2019 mission, there was a difficult laparoscopic cholecystectomy performed aboard the ship requiring conversion to open cholecystectomy. The feedback from the host nation (HN) regarding improved management of the post-operative care stimulated efforts to mitigate complications and improve patient outcomes during short-term surgical missions.

Prior studies have identified patient factors to predict a difficult laparoscopic cholecystectomy, with some of the most common being age, male sex, body mass index (BMI), prior abdominal surgical history, concomitant comorbidities, and gallbladder wall thickness $>4\text{mm}^{3-5}$; however, this is largely based on patients within the health care systems of high-income countries. In many low- and middle-income countries, such as those visited by the USNS Comfort, there may be a lack of

imaging studies and delays in elective surgery owing to reduced surgical capacity. If surgeons on hospital ships or in austere settings can identify risk factors predicting a difficult laparoscopic cholecystectomy, they can adequately plan to optimize patient safety, appropriately manage resources, and maximize operative capacity to reduce the burden of biliary pathology in the region.

From July 2019 to November 2019, data from 87 consecutive laparoscopic cholecystectomies performed aboard the USNS Comfort were prospectively gathered. Preoperative parameters included patient age, sex, presence of pain on the day of presentation, length of right upper quadrant (RUQ) pain, history of diabetes, $\text{BMI} > 35\text{kg/m}^2$, history of gastritis, prior abdominal surgical history, prior history of pancreatitis, and American Society of Anesthesiology (ASA) classification. Pertinent operative information, including the need for intraoperative cholangiogram, case time (minutes), subtotal versus total cholecystectomy, and complications, were also recorded. In addition, an intraoperative scoring system (0 to 6, most difficult) described in the Tokyo Guidelines was employed for the determination of a difficult cholecystectomy. The patients had an average age of 37 years, the majority of whom were relatively healthy females; 85% of patients had an ASA status of 1 or 2 (Table 1). Moreover, a history of pancreatitis (3.4%), $\text{BMI} > 35\text{kg/m}^2$ (19.5%), and diabetes (4.7%) were only present in a minority of patients.

Four of the 87 patients required subtotal cholecystectomies, and 2 cases involved an unplanned intraoperative cholangiogram. None of these cases involved conversion to open cholecystectomy. However, despite the selection of elective, low-risk, outpatient cholecystectomies, more than half of the cases were found to have a difficulty score of ≥ 3 based on the Tokyo Guidelines Intraoperative Difficulty Score scale; 34.5% had a difficulty score of 3, 11.9% a score of 4, and 8.3% a score of 5. Accounts of chronic inflammation were specifically noted in 2 patients, one with a hydropic gallbladder and another patient with a cholecystoenteric fistula.

ASA status, months of preceding RUQ pain, and age were examined with a Mann-Whitney U test to determine if there was a difference between patients who underwent a more difficult cholecystectomy, as noted by the need for a subtotal cholecystectomy or an unplanned intraoperative cholangiogram. The distribution of these preoperative factors was the same across patient groups that required intraoperative cholangiogram or subtotal cholecystectomy compared with those who underwent simple laparoscopic total cholecystectomy. Similarly, categorical preoperative factors were analyzed (χ^2 tests) between patients who underwent a more difficult cholecystectomy and those who did not. There was no difference in these patient groups with regard to a history of pancreatitis, diabetes, obesity ($\text{BMI} > 35\text{kg/m}^2$), sex, prior abdominal surgical history, and presence of pain on presentation. When the intraoperative scoring

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TABLE 1.
Baseline Characteristics

| Characteristics | |
|---|--|
| Male/female | 4 male (4.6%), 83 female (95.4%) |
| Age | 17–68 yr old (average 37.3 yr old) |
| Months of RUQ pain | 0.5–180 mo (average 28.9 mo) |
| Diabetes | 4 patients (4.6%) |
| Pancreatitis | 3 patients (3.4%) |
| Prior abdominal surgery? | 45 patients (51.7%) |
| BMI > 35 kg/m ² | 17 patients (19.5%) |
| ASA status | ASA 1: 33.7%, ASA 2: 54.2%, ASA 3: 11.5% |
| Unplanned IOC | 2 patients (2.3%) |
| Subtotal cholecystectomy (fenestrated/ reconstituting) | 4 patients (4.6%), 3/4 patients (75%) reconstituting subtotal cholecystectomy |
| Total laparoscopic cholecystectomy | 83 patients (95.4%) |
| Case time | 22–115 min, average 46.4 min |

IOC indicates intraoperative cholangiogram.

guide for a difficult laparoscopic cholecystectomy was used as a marker of a difficult case and compared against the preoperative variables noted above using a Mann-Whitney *U* test, there was no significant difference. Likewise, when continuous preoperative variables of ASA status, months preceding RUQ pain, and age were analyzed for correlation with intraoperative difficulty scoring, no significant associations were noted.

Despite intrinsic differences in operating on a hospital ship versus a hospital-based environment, there does not appear to be a confounding factor that significantly impacted surgical management, as evidenced by the similar incidence of subtotal cholecystectomy to that reported in the literature.^{6–8} We reported 4 subtotal cholecystectomies, representing 4.6% of all cholecystectomies performed aboard the USNS Comfort. When the literature published after 2010 was specifically highlighted to account for the decreased use of open cholecystectomy as a bailout procedure and improvement in laparoscopic techniques and skills, the reported incidence of subtotal cholecystectomy during elective cases ranged between 3.2% and 6.2%.^{6–8} Although there was a similar incidence of subtotal cholecystectomy aboard the USNS Comfort, a significant limitation of our analysis is the small sample size, compared with retrospective studies and conventional hospital-based studies, which may limit the detection of population differences.

Nonetheless, as conventional predictive factors did not apply to the patient populations in this mission, it is crucial to prepare for unexpected complexities during surgery. Even with the intent to perform low-risk outpatient surgeries, our findings demonstrate that the majority of cases were perceived as at least moderately difficult based on the intraoperative scoring scale previously mentioned. The intraoperative difficulty scale was designed to measure the inflammatory sequelae noted in acute cholecystitis, suggesting that many in our case series had inflammatory findings consistent with chronic cholecystitis, especially considering that patients, on average, had RUQ pain for 29 months before surgery.

The burden of disease and difficulty in accessing care for the target population during this mission may explain why the studied preoperative variables failed to identify difficult cases. In Trinidad and Tobago, public hospitals had a 330-day wait time for patients undergoing elective laparoscopic cholecystectomy.⁹ This likely contributes to the higher prevalence of chronic cholecystitis than that seen in high-income countries, where studies to identify predictive factors of a difficult cholecystectomy were largely conducted. Further evidence of chronic inflammation in our treated population is highlighted by the findings of hydrops and cholecystoenteric fistula (Mirizzi Type V) within our reported cases, which demonstrates prolonged

obstruction of the cystic duct and not simply temporary obstruction. Unexpectedly, one of the patients who underwent subtotal cholecystectomy in our cohort was found to have a common bile duct stent still in place from their visit to an HN hospital 8 months prior for choledocholithiasis. The patient had significant scarring within the triangle of the calot, assigning a score of 4 of 6 on the difficulty scale.

Given the unpredictable variety of cases encountered during such missions, logistics should proportionally mimic conventional hospitals in terms of instruments, drains, catheters, and the amount of dye needed to perform a subtotal cholecystectomy, unplanned intraoperative cholangiogram, or conversion to open cholecystectomy.^{10,11} Furthermore, preparation goes beyond intraoperative care, to include management of the complication-profile associated with a subtotal cholecystectomy and even a catastrophic injury such as a common bile duct injury. A review and meta-analysis of 30 articles that captured 1231 patients who underwent subtotal cholecystectomy described the postoperative outcomes compared to total cholecystectomy. As expected, the risk of common bile duct injury was exceedingly small; 0.08% versus 0.28% for a total cholecystectomy.^{12,13} However, at the cost of avoiding this critical complication, there is an increased risk of developing a postoperative subhepatic collection or bile leak, with some retrospective analyses revealing a 58.9 increased relative risk of bile leak and 12.2 increased relative risk of perihepatic collection.⁷ It is imperative that surgical teams anticipate and plan for the complexities associated with managing surgical complications postoperatively. This includes establishing contingency measures for the management of conditions such as subhepatic collections or bile leaks, which may necessitate interventions like ERCP or imaging-guided drainage. Preplanning is critical in the setting of the hospital ship and its short time in the country, complications may not arise while the ship is in port, and the HN may not have the capability to perform minimally invasive interventions to deal with a bile leak or abscess.^{10,14}

Ultimately, when a complication inevitably arises, we must rely on lessons learned from past experiences and the recommendations of HN surgeons, who have had to help manage them. Recommendations include (1) sharing accurate and descriptive operative reports with HN physicians so that an appropriate differential can be made depending on where difficulty was encountered or where unplanned steps were taken during a procedure. If difficulty is noted during a case or any alterations are made to the standard approach, (2) the attending surgeon should give a detailed and standardized handoff to the HN surgeon who will oversee the patient's postoperative course. Furthermore, (3) a reliable method of communication should be disseminated to HN physicians overseeing postoperative care so that the surgeon of record can be contacted and involved in the management of their complications. (4) If the management of the complication exceeds the capabilities of the HN, a treatment and evacuation contingency plan should be agreed upon before patient care is initiated.

The findings in this article highlight the limitations of conventional predictive factors for difficult cholecystectomies, emphasizing the need to prepare for complications during surgery. It is crucial for surgical teams to meticulously align their logistical and operational planning with those of conventional hospitals to adeptly navigate challenges that may arise during surgery, including but not limited to performing a subtotal cholecystectomy, conducting an unplanned intraoperative cholangiogram, or conversion to open surgery. This proactive approach should also encompass preparation for potential surgical complications and formulation of detailed contingency strategies for their management. Even when low-risk patients and cases are selected, complications arise, which can undo medical relations and trust between the US and HN medical teams. Therefore, the insights and, more critically, the

recommendations presented in this article should serve as a cornerstone for shaping formal doctrines that govern both military surgical missions and nonprofit, short-term surgical endeavors.

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