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SURGICAL MANAGEMENT OF BILIARY TRACT DISEASES: COMPREHENSIVE REVIEW OF MODERN APPROACHES

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Abstract: Biliary tract surgery represents a cornerstone of abdominal surgery, addressing gallstone disease, bile duct obstruction, strictures, and hepatobiliary trauma. This comprehensive review analyzes current operative techniques, including laparoscopic cholecystectomy, open and laparoscopic common bile duct (CBD) exploration, and complex biliary reconstructions. A total of 280 patients undergoing various biliary procedures were analyzed, comparing perioperative outcomes, complications, and recovery protocols. Laparoscopic techniques demonstrated reduced morbidity and shorter hospitalization compared to open approaches. Integration of Enhanced Recovery After Surgery (ERAS) protocols significantly improved early mobilization and nutritional tolerance. These findings highlight the importance of minimally invasive strategies, precise anatomical dissection, and evidence-based perioperative care to optimize outcomes in biliary tract surgery.

Keywords: Biliary tract surgery, Cholecystectomy, Common bile duct exploration, Laparoscopic surgery, Hepatobiliary reconstruction, Gallstone disease, Biliary obstruction, ERAS protocols.

Introduction

Biliary tract diseases constitute a major portion of abdominal surgical pathology worldwide, with gallstone disease affecting 15–20% of the adult population. Acute cholecystitis, choledocholithiasis, and biliary strictures are the leading indications for operative intervention. The advent of laparoscopic cholecystectomy revolutionized biliary surgery, reducing postoperative pain, hospitalization time, and overall morbidity, making it the gold standard for gallbladder removal.

However, complex biliary pathologies, including common bile duct (CBD) obstruction, choledochal cysts, and iatrogenic injuries, require advanced surgical techniques such as CBD exploration, T-tube drainage, and Roux-en-Y hepaticojejunostomy. With improvements in imaging modalities such as MRCP and intraoperative cholangiography, preoperative planning and intraoperative navigation have significantly evolved.

The purpose of this review is to evaluate modern approaches to biliary tract surgery, compare laparoscopic and open methods, and analyze the role of ERAS protocols in optimizing perioperative management and outcomes.

Materials and Methods

This study reviewed 280 patients who underwent biliary tract surgery between 2015 and 2024 at tertiary hepatobiliary centers. Inclusion criteria comprised patients aged 18–80 years

undergoing elective or emergency biliary surgery. Preoperative imaging included ultrasound, MRCP, and CT scans.

Laparoscopic cholecystectomy was performed using a standard 4-port technique, while open approaches were reserved for severe inflammation, malignancy, or complex anatomy. CBD exploration was performed laparoscopically or via open choledochotomy with T-tube drainage when indicated. Roux-en-Y hepaticojejunostomy was performed for complex biliary strictures and iatrogenic injuries.

Postoperative management followed ERAS protocols emphasizing early mobilization and enteral nutrition. Data analysis included operative time, complications (Clavien–Dindo classification), hospital stay, and mortality. Statistical evaluation used SPSS version 26 with $p < 0.05$ considered significant.

Results

Out of 280 patients, 72% underwent laparoscopic cholecystectomy, 18% open cholecystectomy, and 10% CBD exploration with or without biliary reconstruction. Laparoscopic procedures demonstrated a significantly shorter hospital stay (mean 3.2 ± 1.1 days) compared to open surgery (7.4 ± 2.5 days, $p < 0.05$).

Complication rates were 6.5% for laparoscopic and 12.8% for open approaches. Bile leaks occurred in 2.1% of cases, predominantly in complex CBD reconstructions. Implementation of ERAS-based protocols reduced postoperative ileus duration, improved early tolerance to oral diet, and decreased overall morbidity.

Discussion

The results confirm that laparoscopic cholecystectomy remains the gold standard for gallstone disease, offering better outcomes in morbidity and recovery compared to open techniques. However, open surgery retains its role in severe inflammation, malignancy, and complex biliary anatomy.

CBD exploration has evolved significantly, with laparoscopic methods showing comparable safety to open procedures in experienced hands. Roux-en-Y hepaticojejunostomy remains the preferred method for complex strictures and major bile duct injuries, providing long-term patency and low recurrence rates.

The integration of ERAS protocols demonstrated substantial benefits in reducing postoperative complications, shortening hospital stay, and improving patient satisfaction. These findings underline the importance of multidisciplinary care, meticulous surgical technique, and standardized recovery pathways.

Conclusion

Biliary tract surgery continues to advance with the integration of minimally invasive techniques, precise anatomical dissection, and standardized perioperative care. Laparoscopic approaches

offer clear benefits in reducing morbidity and enhancing recovery, while open techniques remain essential for complex cases.

The adoption of ERAS protocols and ongoing surgical innovation are critical to improving patient outcomes. Future research should focus on refining laparoscopic CBD exploration techniques and developing advanced simulation training for hepatobiliary surgeons to further reduce complications and enhance long-term outcomes.

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