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CASE SERIES

A Case Series on Cholecystectomy for Cholelithiasis in the Paediatric Population – A 5-Year Study

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Abstract

Greater access to ultrasonography and advanced imaging has facilitated earlier diagnosis, yet consensus on the optimal timing and indications for asymptomatic cholecystectomy in children remains limited. This lack of standardisation may influence operative complexity and postoperative outcomes. Symptomatic cholelithiasis remains the primary indication for surgery, with patients typically presenting with recurrent upper abdominal pain. In most cases, gallstones are confirmed on ultrasound, which remains the diagnostic modality of choice. Early surgical intervention helps prevent progression to acute cholecystitis, perforation, abscess formation, and recurrent biliary colic.

Keywords: Elective Cholecystectomy, Cholelithiasis, Laparoscopic Cholecystectomy

1. Introduction

Cholelithiasis in children, once considered uncommon, has shown a marked increase in incidence over the past decade, accompanied by an aetiological shift away from predominantly haematological causes. Symptomatic gallbladder disease is now most frequently related to gallstones, and the rising prevalence of obesity, prolonged parenteral nutrition, chronic medication exposure, gastrointestinal anomalies, and hemolytic disorders has broadened the spectrum of affected patients[1,2]. In parallel, the incidence of biliary dyskinesia has increased significantly, contributing further to the overall rise in paediatric gallbladder pathology[2]. Predisposing factors range from idiopathic origins to well-defined haematological conditions, reflecting the evolving clinical profile of this disease.

Greater access to ultrasonography and advanced imaging has facilitated earlier diagnosis, yet consensus on the optimal timing and indications for cholecystectomy in children remains limited[3]. In children with hemolytic disorders, even asymptomatic stones may lead to significant biliary complications, supporting the role of elective cholecystectomy[4]. However, the management of incidentally detected asymptomatic gallstones in otherwise healthy children remains controversial, as many remain clinically silent[3]. This study aims to evaluate the outcomes of elective cholecystectomy in paediatric cholelithiasis.

2. Aim and Objectives

- To assess the clinical profile, etiological causes, safety and outcomes of laparoscopic cholecystectomy in

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the paediatric age group over the years in a tertiary care institute.

- To assess the complications and future outcomes of the procedure in the paediatric age group.

3. Review of Literature

3.1 Outcomes of Laparoscopic Cholecystectomy in Children

Several single-centre cohort studies and multi-institutional database analyses consistently report that Laparoscopic Cholecystectomy (LC) in children is safe, with a short hospital stay and rapid recovery[5,6]. Early series from high-volume centres described median hospital stays of 1–3 days and good postoperative recovery, even when performed for complicated gallstone disease[5]. More recent data from national surgical quality improvement programs indicate overall morbidity rates of approximately 3–4%, with low readmission rates (≈1–2%) and reoperation rates (<1%)[7]. Outpatient or short-stay LC has also been shown to be safe in carefully selected pediatric patients, with no increase in major adverse events compared with inpatient procedures[7].

A recent systematic review and meta-analysis focusing specifically on pediatric LC (38 studies; >3,000 children) reported an overall postoperative complication rate of 3.4%, with a conversion to open surgery rate of 2%[1]. Elective and emergency LC showed similar overall complication rates, although emergency procedures were associated with longer operative times and length of stay in some series. These data support the view that LC offers excellent outcomes in children when performed in appropriately selected cases and experienced units[1].

More recent analyses have evaluated the impact of case volume and centre type on outcomes. Sinha *et al.* compared outcomes between paediatric and adult centres and found that LC in children had low overall complication and conversion rates in both settings[8]. However, paediatric centres tended to have more complex cases and slightly higher bile duct injury and reoperation rates, likely reflecting referral bias and case mix rather than intrinsic procedural risk[9]. A 2025 review on indications and timing for pediatric cholecystectomy similarly emphasised the favourable profile of LC: Reduced postoperative pain, shorter hospital stays, faster return to normal activities, and low complication rates, reinforcing its role as first-line surgical treatment for symptomatic gallstone disease in this age group[4].

3.2 Postoperative Complications after Pediatric Laparoscopic Cholecystectomy

Although LC is generally safe, postoperative complications do occur and range from minor wound issues to major biliary and vascular injuries.

3.3 Overall and Minor Complications

Minor complications such as transient postoperative fever, mild ileus, nausea/vomiting, or superficial wound infections account for the majority of adverse events[10]. Early large series reported complication rates around 10–15%, largely driven by minor issues including gallbladder perforation with bile spillage and trocar-site infections[5]. With increasing experience, standardised perioperative care, and improvements in instrumentation, more recent series and meta-analyses show much lower overall complication rates (3–4%), with minor complications predominating[1,10].

Systematic reviews of LC in children describe wound-related problems (infection, hematoma, seroma), transient pyrexia, and minor bleeding as the most frequent postoperative events, each occurring in approximately 1–3% of cases[10]. These complications are typically self-limited or managed with simple bedside interventions and rarely prolong hospital stay significantly.

Major complications: bile duct injury, bleeding, and bile leak. Major complications after pediatric LC are rare but potentially serious. In the 2023 systematic review by Mattson *et al.*, the pooled rate of bile duct injury was approximately 0.4%, while intra- or postoperative bleeding requiring intervention occurred in about 0.9% of cases[1]. Large database analyses and

multicentre studies report similarly low rates, generally <1% for bile duct injuries and major haemorrhage[7]. Bile leak from the cystic duct stump or gallbladder bed is another recognised complication, but in children, it appears infrequent and usually amenable to conservative management, Endoscopic Retrograde Cholangiopancreatography (ERCP), or image-guided drainage[1,10].

Conversion to open surgery is often used as a surrogate marker of operative difficulty and impending complications. In contemporary pediatric series, conversion rates range from 1–5%, with pooled estimates around 2%[1]. Dense adhesions, severe inflammation, unclear anatomy, or suspicion of bile duct injury are the typical reasons for conversion. Predictors of conversion include acute cholecystitis, associated choledocholithiasis, obesity, and previous upper abdominal surgery, although the evidence is heterogeneous[11].

3.4 Emergency vs Elective Cholecystectomy and Impact of Disease Severity

The increasing number of children presenting with complicated gallstone disease—such as acute cholecystitis, gallstone pancreatitis or choledocholithiasis—has prompted interest in the relative safety of LC in urgent versus elective settings[6]. Multiple studies and meta-analyses indicate that overall complication and conversion rates are comparable between urgent and elective LC, though emergency operations are often associated with longer operations and hospital stays[1]. Children presenting emergently tend to be older, more symptomatic, and more likely to have obesity or comorbidities, factors that may independently increase the risk of adverse outcomes and resource use[11].

3.5 Comparison with Open Cholecystectomy

Comparative studies between open and laparoscopic cholecystectomy in children consistently favour the laparoscopic approach. Systematic reviews show that LC is associated with lower overall complication rates, reduced postoperative pain, shorter hospital stay, earlier return to normal activities, and comparable or lower rates of major complications and bile duct injury[1,5]. These advantages have led most contemporary guidelines and expert reviews on pediatric gallstone disease to recommend LC as the preferred approach for symptomatic and complicated cases, including children with hemolytic disorders, provided expertise and appropriate equipment are available[4,6].

3.6 Summary

The literature supports laparoscopic cholecystectomy as a safe and effective procedure in the pediatric population, with low overall morbidity (≈3–4%), rare major complications (bile duct injury.

<1%, major bleeding <1%), and short hospital stay. Outcomes appear favourable in both elective and emergency settings when performed by experienced teams, although severe disease, comorbidities, and emergency presentation are associated with longer hospitalisation and a slightly higher risk of adverse events. These data provide an important benchmark against which institutional series can be compared and underscore the need for ongoing efforts to standardise indications, timing, and technical aspects of pediatric LC.

4. Materials and Methods

4.1 Study Design and Patient Selection

A retrospective analysis was conducted on all patients admitted to the paediatric surgery department with signs and symptoms of gallbladder disease between January 2020 and January 2025. Children aged 0–16 years were eligible for inclusion. Asymptomatic patients were considered for surgery if they had associated haematological disorders or multiple gallstones detected on ultrasonography. Clinical variables collected included age, sex, presenting complaints, history of prior cholecystitis or medical treatment, medication history, and liver enzyme levels.

4.2 Radiological Assessment

All patients underwent abdominal ultrasonography as the primary diagnostic modality for gallbladder

and biliary tract evaluation. In cases with suspected complications, cross-sectional imaging— Computed Tomography (CT) and/or Magnetic Resonance Cholangiopancreatography (MRCP) was performed to further delineate biliary and vascular anatomy. Ultrasonographic assessment documented:

Specific findings: presence of gallstones (single or multiple)

Non-specific findings: gallbladder wall thickening ≥3 mm, stone size >3 mm, gallbladder distension, and pericholecystic fluid.

4.3 Surgical Technique

All procedures were performed using the standard four-port laparoscopic cholecystectomy technique. A trans-umbilical open access approach was employed, followed by placement of three additional trocars (two operative and one accessory). The cystic duct and artery were ligated using non-absorbable polymer clips (knots or Hem-o-lok), and the gallbladder was retrieved through the umbilical port. Operative details—including surgical approach, duration, intraoperative events, and technical difficulties—were recorded. Postoperative outcomes, complications, and recovery parameters were systematically documented.

4.4 Statistical Analysis

Data were compiled and analysed using Microsoft Excel. Descriptive statistics, including totals, counts, means, and medians, were used to summarise demographic variables, clinical features, operative details, and outcomes.

5. Results (Including Observations)

During the 5-year study period (January 2020–2025), 52 children underwent cholecystectomy. The cohort comprised 37 males (71%) and 15 females (29%), with a median age of 10 years. Concomitant haematological disorders were identified in 3 patients (5%).

5.1 Indications and Preoperative Findings

Cholelithiasis was the predominant indication for surgery in all patients, confirmed by ultrasonography. Three children required additional preoperative interventions: one child with acute necrotising pancreatitis and cholelithiasis underwent Endoscopic Ultrasound (EUS) guided cystogastrostomy, while two children with choledocholithiasis underwent Endoscopic Retrograde Cholagiopancreatography (ERCP) with sphincterotomy. The other indications included gall bladder dyskinesia (n=2), GB polyp (n=1) and mucocoele of the gall bladder (n=1)

All of them underwent cholecystectomy and had uneventful postoperative recovery.

5.2 Operative and Postoperative Outcomes

There were no conversions to open laparotomy. One child with hereditary spherocytosis underwent planned open cholecystectomy combined with splenectomy and recovered without complication. Postoperative outcomes were favourable overall, with only one significant complication observed: a case of post-cholecystectomy interstitial pancreatitis with associated hemorrhagic ascites on postoperative day 8. This patient required diagnostic laparoscopy and drain placement for a subhepatic collection and had a prolonged hospital stay of 20 days.

Recovery and Length of Stay: The mean duration of hospitalisation was 3.25 days. Oral intake resumed on postoperative day 1 in 90% of children, and by day 2 in the remaining 10%. The majority of patients were discharged by the third postoperative day following an uncomplicated recovery.

6. Discussion

The growing incidence of paediatric gallbladder disease over the past two decades has prompted extensive research into the safety, efficacy, and long-term outcomes of cholecystectomy in children. Contemporary literature consistently identifies LC as the standard of care due to its favourable safety

profile, rapid recovery, and low complication rates. Overall morbidity in large paediatric series remains low, and major complications such as bile duct injury are rare[1]. The procedure is considered both safe and effective when performed by experienced surgeons, and outcomes are comparable—or superior—to adult populations when performed in specialised paediatric centres[8,9].

Changing epidemiology has also shaped the recent literature. Historically, gallstone disease in children was closely associated with hemolytic disorders, especially sickle cell disease and hereditary spherocytosis[4,6]. However, many modern cohorts report a shift toward obesity-related cholesterol stones, with obesity also associated with more advanced gallbladder inflammation at presentation[6,11]. This epidemiological shift has broadened the age range, demographics, and clinical characteristics of children undergoing cholecystectomy.

Several studies highlight the influence of surgical volume and centre expertise on outcomes. High-volume surgeons and institutions consistently report lower complication rates, reduced conversions to open surgery, shorter operative times, and shorter length of stay[8]. In contrast, low-volume settings or centres without paediatric surgical expertise demonstrate higher variability in operative difficulty and postoperative events[9].

The complication profile of paediatric LC is well described. Minor complications such as port-site infections or transient bile leaks constitute the majority of adverse events[10]. More serious complications, including bile duct injury, haemorrhage, and retained stones, are infrequent but clinically significant. Retained or spilt gallstones have been reported in 2–4% of cases, occasionally resulting in abscesses or delayed presentations requiring intervention[1,10]. These complications are more common in patients presenting with severe inflammation, acute cholecystitis, or difficult anatomy[11].

Outcomes in children with hemolytic disorders are favourable when elective cholecystectomy is timed appropriately, and prophylactic surgery in select cases is associated with reduced emergency admissions and biliary complications[4]. Biliary dyskinesia represents a more controversial indication; although many children report postoperative pain improvement, the variability in reported success rates and the lack of standardised diagnostic criteria limit the strength of conclusions[2]. Long-term prospective data remain sparse.

The management of asymptomatic gallstones is an area of ongoing debate. Several cohort studies suggest that most incidentally detected stones remain clinically silent, supporting a conservative approach in otherwise healthy children[3]. Conversely, in high-risk groups—such as hemolytic patients or those requiring splenectomy—elective cholecystectomy is often recommended[3,4]. The absence of consensus guidelines reflects the variability in the natural history of paediatric gallstones and the limited availability of long-term outcome data.

Emerging literature also describes the successful implementation of enhanced recovery protocols in paediatric LC, demonstrating reductions in length of stay and opioid use. However, these data remain limited to small single-centre series.

Overall, contemporary evidence supports LC as a safe and effective procedure in children, with outcomes strongly influenced by indication, timing, and surgeon or institutional experience. Key gaps include robust long-term data on biliary dyskinesia, clearer management pathways for asymptomatic gallstones, and multi-centre prospective trials to standardise care and refine risk stratification.

7. Summary and Conclusion

Laparoscopic cholecystectomies can be performed safely in children with minimal postoperative complications.

8. References

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