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Overview of Laparoscopic Cholecystectomy Procedure in the Pediatric

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Abstract: **Cholelithiasis, although increasing in frequency in children, is still far less common than in the adult population. This Review was aim to focus in discussion the Laparoscopic cholecystectomy procedure in the pediatric, in addition also to determine the outcomes after LC in children through reviewing the literature. We conducted a computerized comprehensive search through the most known medical databases; MIDLINE/PubMed, science-direct, and Embase, for relevant articles discussing the Laparoscopic cholecystectomy procedure in the pediatric, that published up to December 2016, in English language, and concerning human subjects with children and adolescent**

Laparoscopic cholecystectomy (LC) is confirmed to be a safe and efficacious treatment modality for pediatric cholelithiasis. Many of these patients reported in the literature do well with laparoscopic cholecystectomy. The cause for increased occurrence of pediatric cholelithiasis and their natural history have to be additional assessed. LC is much easier in children compared with adult population, when it is carried out by an experienced pediatric surgeon.

Keywords: **Laparoscopic cholecystectomy (LC), pediatric cholelithiasis.**

1. INTRODUCTION

Cholelithiasis, although increasing in frequency in children, is still far less common than in the adult population [(1)]. In a population-based research study prevalence of gallstones in children was 1.9% [(2)]. The nature of the disease process is different in children as compared to grownups, with a greater proportion of pigment stones and less cholesterol-based stone disease in the pediatric population, especially in those younger than 10 years [(3)]. The circulation of disease procedures requiring cholecystectomy is various in children, as compared with adults, with a greater degree of hematologic issues and less cholesterol-based stone disease in the pediatric population.

Laparoscopic cholecystectomy (LC) is considered to be the 'gold standard' surgical procedure for cholelithiasis in adults, with a huge amount of released information supporting this.

Cholelithiasis is considered as an unusual condition in children, nevertheless, current research studies have actually recorded increasing incidents of this condition [(2,4)]. This may be explained by the increased accessibility and use of the abdominal ultrasonogram in children. Pediatric cholelithiasis was viewed as a disease of prematurity, normally connected to overall parenteral nutrition. Numerous risk factors for cholelithiasis in children include haemolytic disorders, obesity, family history of gallstones, stomach surgical treatment, IgA shortage, cystic fibrosis, therapy with ceftriaxone and Gilbert's disease. The number of cholecystectomies being carried out in children, however, has actually noticeably increased in the past 10 to 15 years. This is likely because of an enhanced capability to detect gallstones as a reason for stomach pain, although a real boost in the occurrence of gallstones in the pediatric population also might be a factor [(2,4)].

Numerous current research studies have found that children with gallstones are most likely to provide with signs or symptoms of choledocholithiasis and also are more likely to have complications from choledocholithiasis than has been kept in mind previously [3,5]. The best method to handle believed or validated choledocholithiasis in children is uncertain. Management typically will depend upon a specific surgeon's experience with laparoscopic common duct exploration [5].

This Review was aim to focus in discussion the Laparoscopic cholecystectomy procedure in the pediatric, in addition also to determine the outcomes after LC in children through reviewing the literature.

2. METHODOLOGY

We conducted a computerized comprehensive search through the most known medical databases; MIDLINE/PubMed, science-direct, and Emabse, for relevant articles discussing the Laparoscopic cholecystectomy procedure in the pediatric, that published up to December 2016, in English language, and concerning human subjects with children and adolescent

3. RESULTS

- ***Laparoscopic surgical procedure for cholecystectomy:***

Minimally intrusive techniques have become the standard of look after operations including the stomach and thoracic cavities for all ages, including newborn congenital anomalies. Similar to adult treatments, pediatric laparoscopy offers benefits of fewer significant wound-associated complications, less incisional pain, a shorter healing, and improved cosmesis [6,7].

Laparoscopy in children and adolescents bears significant similarities to adult treatments, but experience with adult surgical treatment does not sufficiently mean safe surgery in pediatric patients. Pediatric treatments should be performed with a complete understanding of the relevant anatomic and physiologic differences between the pediatric and adult populations [8].

Procedure: The abdominal area is ready extensively and draped in the typical sterile style. A 1.5-cm cut is made, either as a "smile" simply inside the umbilicus or through the lower margin of the umbilical ring, and a Verres insufflation needle is inserted through the skin incision and into the peritoneal cavity, directed caudally towards the hips, as for diagnostic peritoneal lavage. For kids with reasonably scaphoid abdominal areas, an alternative technique is using the Hassan trocar, which is placed through the fascia and into the peritoneal cavity under direct vision to prevent permeating any abdominal viscera or the less mobile retroperitoneal vascular structures. Another factor for direct trocar insufflation in pediatric patients is the potential or presumed presence of an umbilical hernia that may contain bowel followed the peritoneal lining. This circumstance is not a regular concern in adults. As soon as the idea of the Verres needle or Hassan trocar is within the peritoneal cavity, co2 (CO2) is insufflated to a pressure of 15 mm Hg, typically provided by a volume of -2 liters. Since of the elasticity of the abdominal wall of children, a greater insufflation pressure is usually not essential. A 10-mm non reusable trocar is placed through the umbilical cut if the Hassan trocar is not being utilized, and the running video camera is introduced into the abdominal cavity. Three additional skin incisions are then made, one in the upper midline just listed below the xiphoid procedure and two others along the subcostal margin. These incisions are put as far apart as possible to avoid overlap of the instruments throughout the dissection. Under direct laparoscopic visualization, a second 10-mm trocar is gone through the upper midline incision to the right of the falciform ligament, and 5-mm trocars are gone through the subcostal cuts (**Figure 1**). The next factor to consider is offering sufficient exposure of Calot's triangle at the neck of the gallbladder. This treatment is easily carried out in adults by retracting the body of the gallbladder up and over the edge of the liver. The small measurements of the right upper quadrant in children and the large liver in these patients, who frequently have different metabolic disturbances, may make it impossible for traction on the gallbladder fundus to supply adequate direct exposure. The gallbladder should be grasped lower, toward Calot's triangle, and withdrawed in a caudal direction (**Figure 1**) [9].

After exposure of Calot's triangle has actually been accomplished and blunt dissection of pericholecystic adhesions has been performed, the next consideration is cholangiography. Cholangiography is typically preferable [10,11] due to the fact that of the higher occurrence of typical duct abnormalities in patients with hemolytic disorders and the little portal anatomy in pediatric patients. Possible methods include percutaneous leak of the gallbladder under direct vision with an intravenous catheter (**Figure 2A**), or direct cystic duct cannulation with a cholangio-catheter travelled through Olsen forceps (**Figure 2B**) [8].

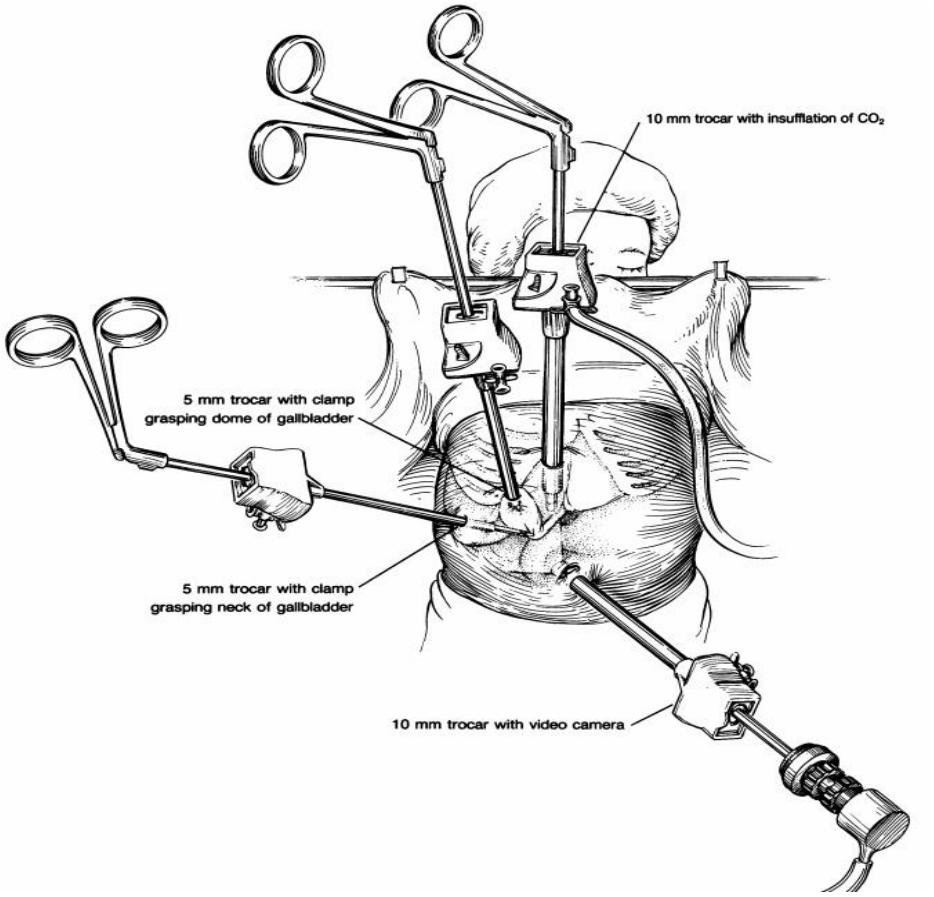

Figure 1: The positioning of the four transabdominal trocars for laparoscopic cholecystectomy. Note the limited room for instrument manipulation in the right upper quadrant due to smaller patient dimensions and enlarged liver frequently found in the pediatric population. [9]

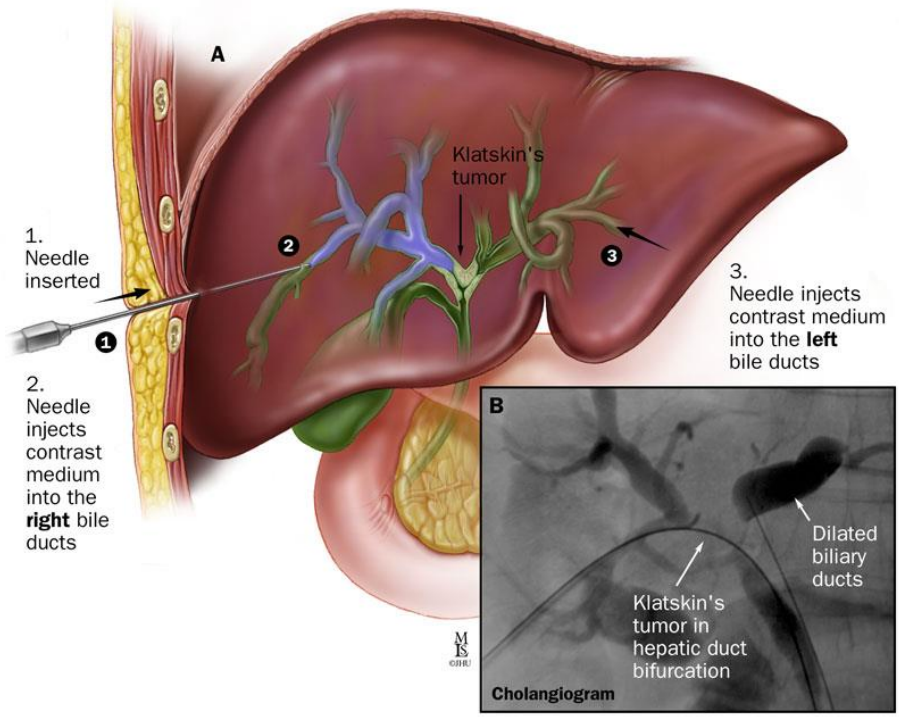

Figure 2: ***A, technique of transhepatic percutaneous cholangiography; B, corresponding percutaneous cholangiograph (after catheter is introduced)*** [8]

- ***Reviewing previous studies LC in children:***

We determined a retrospective evaluation research study [12] involving 224 patients mostly children went through a laparoscopic cholecystectomy (Figure 3) [12]. The mean age was 12.9 years (variety, 0 - 21) with a mean weight of 58.3 kg (variety, 3-121). Indicators for laparoscopic cholecystectomy were symptomatic gallstones in 166 patients, biliary dyskinesia in 35, gallstone pancreatitis in 7, gallstones and an indicator for splenectomy in 6, calculous cholecystitis in 5, choledocholithiasis in 1, gallbladder polyps in 1, acalculous cholecystitis in 1, and hereditary cystic duct obstruction in 1. The mean operative time (excluding patients with concomitant operations) was 77 minutes (range, 30 - 285). The mean operating time was 95 minutes over the first 40 cases and 64 minutes over the most recent 40 cases. There were 17 patients who had a concomitant operation. Due to preoperative issues about choledocholithiasis, a preoperative endoscopic retrograde cholangiogram was performed in 17 patients. Stones were recovered endoscopically in 8 of these patients. An intraoperative cholangiogram was carried out in 38 patients and typical duct stones were recognized in 9 patients. Common duct stones were cleared intraoperatively in 5 patients, while the other 4 patients required a postoperative endoscopy to obtain the stones. Due to a postoperative increase in direct bilirubin, there were 2 patients who went through a postoperative endoscopic retrograde cholangiography who did not have an intraoperative cholangiogram. The endoscopic cholangiogram was regular in both cases. One sickle-cell patient developed a postoperative hemorrhage, needing laparotomy. There were no open conversions, ductal injuries, bile leaks, or mortality. Biliary dyskinesia was diagnosed in 10% of the first 30 patients in this series and in 40% of the most recent 30 patients. The mean ejection fraction in these patients was 21%. All experienced enhancement in their symptoms after the cholecystectomy. There were 29 patients with hemolytic disease, of which 18 had sickle-cell disease and 11 had hereditary spherocytosis. There are no released reports of ductal issues in children and none have taken place in this study experience, as would be reasonable, provided the infrequency of severe episodes of inflammation eliminating the aircrafts of dissection [12].

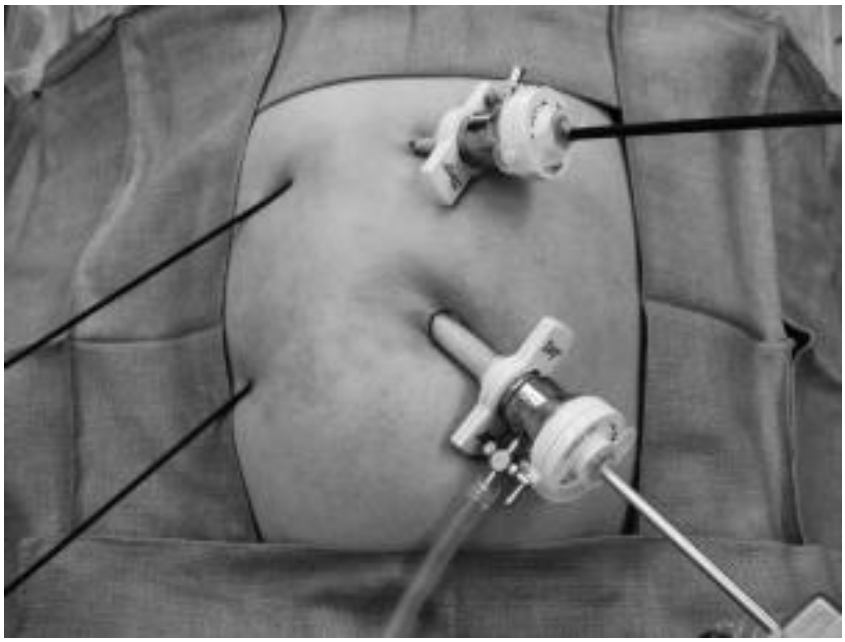

Figure 3: operative approach for laparoscopic cholecystectomy in children and adolescents [12]

Another retrospective review study [13] of 22 children underwent LC for cholelithiasis. The mean age was 9.4 years (variety 3 to 18 years). 2 children were less than five years, 14 were aged in between 5 and 12 years and 6 were teenagers. Fourteen (63.6%) children had typical symptoms of biliary system disease (right upper quadrant or epigastric pain, nausea, vomiting and food intolerance), seven (31.9%) had fever in addition to the above-mentioned symptoms (calculous cholecystitis), and one child had asymptomatic gallstones, which were diagnosed incidentally on ultrasound examination of the abdominal area, done for an unassociated cause. Duration of symptoms at diagnosis differed from one month to 12 months (mean-2.9 months). Risk factors for advancement of gallstones were present in five (22.7%) children just. Two had a family history of gallstones, 2 were overweight (BMI 30) and one child had undergone previous stomach surgery and had gotten an injection of Ceftriaxone for 14 days. After a complete workup, it was discovered that none of our patients were detected with having haemolytic conditions such as sickle cell disease, thalassemia or hereditary spherocytosis. A complete haemogram, peripheral blood smear and liver function tests were within normal limits in all the

patients. All the children underwent an abdominal ultrasound and were detected to have several or single gallstones. In addition, 10 (45.4%) children had inflammatory features around the gall bladder. Twenty-one children went through elective LC and one child was taken up for emergency LC after treating intense cholecystitis with intravenous prescription antibiotics for 2 days. The mean personnel period was 74.2 minutes (range 50-80 minutes). Personnel findings included omental or small bowel adhesions around the gall bladder (with or without edematous gallbladder) in 13 (59.1%) patients. The child who underwent emergency situation LC had empyema along with those inflammatory functions. Twenty children had pigmented stones and 2 had cholesterol stones. Among the 16 children with pigmented gallstones, two had numerous gravel-like (< 1 mm) stones[13]. Tube drains pipes were positioned in 3 (13.6%) cases, in which intraoperative bile spillage or gallbladder fossa ooze existed. 2 drains pipes were removed within 24 hours; the remaining one was kept for 96 hours, as substantial serous fluid discharge was present throughout the first two days postoperatively. The typical duration of medical facility stay was 4.1 days (variety 3-6 days). Postoperative issues happened in two (9.1%) patients. One child had considerable prolonged serous discharge from television drain as mentioned previously, which resolved spontaneously. The other child who went through emergency LC had postoperative fever for three days, which solved with intravenous prescription antibiotics. Histopathological analysis of the cholecystectomy specimen revealed chronic cholecystitis in 18 cases, chronic cholecystitis with focal ulceration in 2 cases and one each of severe cholecystitis and acute chronic cholecystitis. Follow-up period varied from four months to 35 months (typical 17 months) and there

Intraoperative cholangiography was not considered to be essential in any of thier patients. In a pediatric population the dissection around the Calot's triangle is much easier and much faster compared with adults, as the fat deposit is extremely minimal and the peritoneal covering layer is thin, permitting clear visualization of the anatomy (**Figure 4**) [13]. The patients were released when they had the ability to endure a regular diet and were ambulatory. As soon as after the discharge, they were followed up in the outpatient clinic at least.

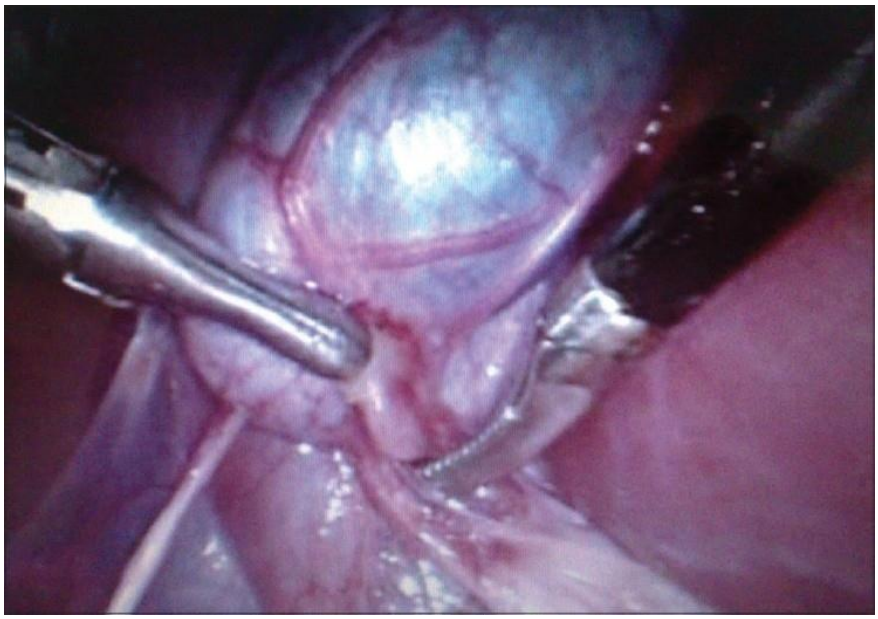

Figure 4: Laparoscopic intraoperative view of Calot's triangle [13]

LC in children differs from that in grownups in different elements. It is the restraint of space. The significance of positioning the epigastric cannula in the left upper quadrant in small children cannot be overemphasized. Likewise, the working and withdrawing ports on the right side should be put in the lumbar or iliac area in younger children. Second, as mentioned earlier, the dissection at the Calot's triangle is relatively simpler and much faster in children, as the fat deposit is less and the peritoneal covering layer is thin in children [13].

4. CONCLUSION

Laparoscopic cholecystectomy (LC) is confirmed to be a safe and efficacious treatment modality for pediatric cholelithiasis. Many of these patients reported in the literature do well with laparoscopic cholecystectomy. The cause for increased occurrence of pediatric cholelithiasis and their natural history have to be additional assessed. LC is much easier in children compared with adult population, when it is carried out by an experienced pediatric surgeon.

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