Gallbladder Duplication: Case Report of a Rare Congenital Anomaly Treated by Single-Incision Laparoscopic Cholecystectomy in a Pediatric Patient

Jairo A. Espinosa¹, Peter White², and Michael J. Leinwand³*

¹Department of General Surgery, Western Michigan University Homer Stryker M.D. School of Medicine, USA
²Western Michigan University Homer Stryker M.D. School of Medicine, USA
³Children’s Hospital, Western Michigan University, Homer Stryker; M.D. School of Medicine, USA

Abstract

Introduction: Gallbladder duplication is a rare congenital anomaly. Preoperative diagnosis is essential for prevention of intra operative complications. Based on our review of the literature, this is the second description of gallbladder duplication treated with single-incision laparoscopic surgery (SILS).

Case Presentation: A 14 year-old girl presented to the pediatric surgery clinic with a 4-month history of right upper quadrant abdominal pain, nausea, and low-grade fevers. Preoperative imaging revealed gallbladder duplication. The single incision laparoscopic technique was employed. Intra operative findings included two gallbladders that appeared to share a common wall. There were two parallel cystic ducts that inserted separately into the common hepatic duct. Gross pathology revealed two adjacent gallbladders separated by a thin septum, each with its own cystic duct. The postoperative course was unremarkable, and the patient was without symptoms at the 1 month follow-up visit.

Conclusion: Gallbladder duplication is a rare congenital anomaly. This case report demonstrates successful treatment by excision using the single incision laparoscopic approach.

ABBREVIATIONS

SILS: Single Incision Laparoscopic Surgery; SILC: Single Incision Laparoscopic Cholecystectomy

INTRODUCTION

Gallbladder duplication is seen in 0.026% of autopsy patients, with an incidence of 1 in 3,800-5,000 individuals [1,2]. It is nearly twice as common in females as in males [3]. Review of surgical specimens and limited cadaveric studies form the basis of our understanding of this interesting anomaly [1,2]. The gallbladder and extra hepatic biliary ducts arise from an out pouching in the ventral wall of the primitive mid gut during the 4th week of gestation. An inappropriate bifurcation of this out pouching, or hepatic diverticulum, in the ensuing two weeks results in gallbladder duplication. The degree of duplication is determined by the developmental stage of the fetus at the precise moment of bifurcation [1]. Gallbladder duplication has a variable presentation. About half of the cases are diagnosed with preoperative imaging, and half are discovered incidentally at surgery [4]. Patients often present with typical symptoms of biliary colic, the most common symptom being epigastric or right upper quadrant abdominal pain [5].

CASE PRESENTATION

A 14 year-old girl presented to the pediatric surgery clinic...
with a 4 month history of right upper quadrant abdominal pain, nausea, and low-grade fevers. She had no family history of gallbladder disease or congenital anomalies. On physical exam, her abdomen was soft, non-distended, and mildly tender to palpation in the right upper quadrant. One year previously, she had been evaluated for abdominal pain by Computed Tomography (CT) scan which was consistent with gallbladder duplication, showing adjacent gallbladders and parallel cystic ducts (Figure 1). Ultrasonography done during the current presentation was similar (Figure 2). Laboratory examination including complete blood count and liver function tests were within normal limits. A single incision laparoscopic cholecystectomy was performed.

**Operative technique**

A 2 cm vertical skin incision was made through the center of the umbilicus. The umbilical stalk was divided sharply, and skin flaps were created. This provided access to a 3 cm diameter of fascia. Two low profile 5 mm trocars were placed via separate fascial incisions in the midline. One trocar was placed more deeply than the other to avoid collision of trocar heads. An additional grasper was then placed directly through the fascia to the right of the trocars.

A 30 degree laparoscope with a right-angled light adaptor was used in order to help avoid external collisions with the other instruments. Gallbladder retraction was achieved with the EndoGrab® device (Virtual Ports, Caesarea, Israel) which grasps the fundus with one arm and the anterior/superior abdominal wall with the other arm. This device requires a 5mm non disposable instrument that only uses a trocar temporarily for purposes of deployment and retrieval. Thus, the trocar is free to be used for other instruments throughout the procedure. The critical view of safety was obtained. As expected, we encountered two parallel cystic ducts separately attached to the common hepatic duct (Figure 3). Due to the small caliber of the cystic ducts, a planned intraoperative cholangiogram could not be performed. Many attempts were made to cannulate the cystic ducts for a cholangiogram, and this was largely responsible for the prolonged total operative time of 1.8 hours. The cystic ducts and cystic artery were divided between 5mm clips (Ethicon Endo-Surgery, Cincinnati, OH). The gallbladders were then dissected from the liver using electrocautery applied through an L-hook. The EndoGrab® device was then retrieved. The gallbladders were then removed via a laparoscopic pouch. Gross pathology displayed two adjacent gallbladders separated by a thin septum with separate cystic ducts (Figure 4). On histology, no inflammatory infiltrate or cholesterolosis was present, and the muscularis of both gallbladders was not hypertrophied or inflamed. No other anatomical abnormalities were encountered intraoperatively or discovered on the pathological specimen. The postoperative course was remarkable, and the patient was discharged home on the first postoperative day. She was without symptoms at the 1 month follow-up visit.

**DISCUSSION**

Gallbladder duplication is a rare congenital malformation first described in ancient Roman text but not formally classified until 1929 by Dr. Boyden at Harvard University. The differential diagnosis for gallbladder duplication includes folded gallbladder (also known as a Phrygian cap), choledochal cyst, periholecystic fluid, intra-peritoneal fibrous bands, focal adenomyomatosis, and gallbladder diverticula [6] Classically, gallbladder duplication has been confirmed when both specimens demonstrate valves at the neck, a tunica muscularis, and the ability to concentrate bile [7]. Gallbladder duplication was first documented over 2,000 years ago in a sacrificial victim of the Roman Empire under the rule of Emperor Augustus [8]. In 1911, Mr. James Sherren, a Fellow of the Royal College of Surgeons of England, described the first instance of a cholecystectomy involving a duplicate gallbladder [9]. In 1926, Boyden described the first system to classify gallbladder duplications including “vesicalfelleadivisa” (bilobed or bifid gallbladder that has one
cystic duct) and “vesicalfellea duplex” (double gallbladder with two cystic ducts). The second category is further subdivided into a Y-shaped type (cystic ducts fuse before joining the common bile duct) and an H-shaped type (cystic ducts join the biliary tree independently) (Figure 5) [1,8]. In 1977, Harlaftis introduced a new classification system based on gallbladder morphology and embryogenesis (Table 1, Figure 6) [3]. This system is most widely cited today. Type 1, the split primordial group, occurs when the hepatic diverticulum bifurcates late in utero giving off multiple buds that fail to regress spontaneously. This group consists of an array of biliary anatomical configurations that share the common feature of a sole cystic duct entering the biliary tree. Type 2, the accessory gallbladder group, describes true gallbladder duplication anomalies in which both a main and secondary or “accessory” gallbladder and their respective cystic ducts unite with the biliary tree independently of one another. Type 2 gallbladder duplications develop from a duplicate cystic primordium of the biliary tree. A Modified Harlaftis Classification system that accounts for a left trabecular variant (superior cystic duct enters the left hepatic duct) has also been proposed [4].

Many imaging modalities are useful in the diagnosis of gallbladder duplication. Typically, ultrasonography is the initial study in the evaluation of right upper quadrant abdominal pain. CT scanning offers additional details which may help delineate gallbladder duplication from other similar entities. Endoscopic Retrograde Cholangio Pancreatography (ERCP) has been considered the gold standard for diagnosing biliary anomalies; however, this has commonly been replaced by Magnetic Resonance Cholangio-Pancreatography (MRCP). MRCP is excellent at distinguishing biliary anatomy and has the advantage of being less invasive without exposing the patient to radiation [11-13]. Laparoscopic cholecystectomy has long been considered the gold standard treatment for gallbladder disease. Single Incision Laparoscopic Surgery (SILS) is a contemporary form of laparoscopy in which the entire operation is performed via a natural scar, the umbilicus. Only 20 of the 210 cases of gallbladder duplication published in the literature have been managed by laparoscopic cholecystectomy [10,14]. In the pediatric literature, gallbladder duplication has been shown to be diagnosed by prenatal ultrasound, and has been treated laparoscopically in children ranging in age from 9 months to 15 years [7,15]. To date, there has been only one published case report of the use of the SILS technique for gallbladder duplication, and another that utilized the single incision robotic-assisted approach [10,16]. This is the first case report of SILS cholecystectomy for gallbladder duplication in a pediatric patient.

**CONCLUSION**

Duplicate gallbladder is a rare congenital anomaly with just over 200 cases published in the literature. Preoperative diagnosis is essential for decreasing the risk of intraoperative complications. In this case report, we safely performed SILS cholecystectomy in a 14 year-old girl with gallbladder duplication with excellent results.

**ACKNOWLEDGEMENTS**

The authors wish to acknowledge Karla K. Dunning, MD and Nathan A Knash, PA (ASCP) for their pathological expertise and photographs.
REFERENCES


