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Difficult Gallbladder Surgery, Improving Patient Outcomes Through Appropriate Surgical Decisions.

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Background: Cholecystectomy is becoming a common operation in Africa. The right upper quadrant is regarded by many as the most difficult area of the abdomen because of the variable anatomy, small sized ducts and the irritant nature of bile. The fact that patients present late also adds to the difficulty with identification of structures in this area. A good working knowledge of the incidence and types of anatomical variations is key to a safe cholecystectomy. About 50% of patients presenting with gallbladder pathology show a significant anatomical variations. This study aimed to improve awareness amongst surgeons, both consultants and those in training to improve patient outcomes with gall bladder pathology.
Case presentations: Four patients who had re-do surgeries at three different private hospitals in Nairobi are presented and discussed. None of the primary surgery in the four cases was done any of the authors. The re-do surgery in the four cases was performed by the principal author. The four patients respectively had a bile duct injury post open cholecystectomy, cholecystostomy done for gall bladder empyema, a stricture from a previous biliary-enteric anastomosis and obstructive jaundice from chronic pancreatitis.
Conclusion: The large number of variations in the anatomic structure of biliary tree imposes an imperative need for surgeons to have an adequate knowledge and understanding of those variations, in order to control the safety of the surgical procedure in this field. A large number of postoperative complications seen in this surgical area result from iatrogenic injuries incurred by a variation of anatomic elements. The role of the medical boards should change to confer consultant status only after a surgeon is capable of independent decision-making and after a reasonable number of cases with recorded good outcomes.

Introduction

Laparotomy is like opening a pandora's box, with a range of differentials and surprises encountered. There are difficult areas of the abdomen like the right upper quadrant and left iliac fossa. Approximately 50% of anatomy of the hepato-pancreatico-biliary system is abnormal[1]. This further warranting sound working knowledge of the incidence and types of anatomical variation is key to a safe cholecystectomy. Ignorance of these anomalies may well be responsible for catastrophic injuries of the bile duct during laparoscopy. The onus is therefore on the surgeon to be versed in the possible anatomical variations that he might encounter during surgery and to ensure that this knowledge is passed on to surgical trainees. Not only must the surgeon be aware of these anomalies, but the radiologist should also possess a thorough knowledge of normal and abnormal anatomy of this area, if he is to correctly interpret the images provided by the new and older diagnostic imaging techniques, such as endoscopic cholangiography, enhanced CT, Magnetic resonance cholangiopancreatography (MRCP) and isotope scanning of the liver.
Intrahepatic interductal communication occurs only rarely, if at all[2-6], and is of clinical significance: in the event of a bile duct obstruction, the corresponding segment or sub-segment is not shunted through collaterals. Each bile duct drains only the part of the liver that it serves[7], though there are occasional reports of intercommunication between the extra-hepatic ducts in the liver hilum[8]. In contrast, accessory bile ducts are commonly described in the literature[9]. The term *aberrant,* which is accessory (implies a duplication in structure or function) when describing "extra" ducts found in the porta hepatis[10] . Anomalous ducts have been reported in 1.7% to 28% of cases, with an average of 12.1%[11]. These anomalous ducts are encountered most frequently (85%) in the triangle of Calot[12] where most

surgical injuries to bile ducts occur. The ducts may differ in diameter from just filamentous, serving only tiny lobules of liver, to a considerable duct draining of most or all of a liver segment. These aberrant ducts are also referred to as *segmental* or *sub-segmental duct*[13]. The right lobe of the liver, mostly the posterior segment, engenders most of these ducts[14]. They commonly unite the common hepatic duct or cystic duct but may also enter the gallbladder or common bile duct.

Intraoperative cholangiography is the best method of identifying these ducts, thus avoiding injury. The visualization of an aberrant duct entering the cystic duct depends on the placement of the cystic duct catheter and its retention clip. If the position is too close to the common bile duct, an aberrant duct joining the cystic duct between the gallbladder and the catheter tip will not be revealed. A slight bile duct (described by Luschka) rising from the right lobe of the liver in the gallbladder fossa and draining into the right hepatic duct or common hepatic duct[15] , measures 1 to 2 mm in diameter and is found in 1% to 50% of the cases. Hepatocholecystic ducts draining directly from the liver into the gallbladder have been confirmed[16] and may also be the source of postoperative bile leaks. There are at least six variations of aberrant (accessory) of extrahepatic duct near porta hepatis as these structures empty in various positions of common hepatic duct or elsewhere. The surgical significance of an aberrant or accessory hepatic duct lies in its vulnerability during an operation[1]

The consequences of its ligation or division will depend upon its size, for instance, if we ligate an accessory duct similar in size to a cystic duct, a significant biliary obstruction could ensue. Dividing a small unrecognized accessory duct will result in bile leakage, biloma, biliary peritonitis, biliary fistula and, possibly, late stenosis of the common bile duct due to the sclerotic action of the leaking bile duct. The aim of this study is to create awareness amongst surgeons, both consultants and those in training and hence improve patient care and also to improve patient outcomes with gall bladder pathology.

Patients and Methods

We selected four interesting patients who had re-do surgery in three different private hospitals in Nairobi. All the four had primary surgery done by other surgeons. The re-do operations were then done by one of the authors, PGJ. Patients presented for second opinions over failed previous surgeries. Consultations were done, history taken, previous surgical records reviewed and new investigations done. Their operative notes and imaging studies were reviewed.

Case Presentations

Case 1.

M.M, a 65-years old female had a bile duct injury post open cholecystectomy. She had acute on chronic cholecystitis and had an open cholecystectomy in May 2010. Two months post-operatively she developed jaundice and features of cholangitis. She had a CT scan of the abdomen and an MRCP that confirmed intra and extra hepatic ductal dilatation, Common Bile Duct (CBD) 20mm, abrupt cut-off of the Common Hepatic Duct (CHD) and a normal pancreatic duct.

She had a re-do laparotomy by a second surgeon, where the common hepatic duct leak was identified and primarily repaired. This then complicated by bile leak in the first week. Subsequently a second re-do laparotomy was done where the duodenum was kockerized opened and the CBD was stented with a short stent. This also complicated by a bile leak, in a few days, necessitating a third re-do laparotomy and the CBD was stented with a longer stent. The stent was later noted to have gone through the CBD into the left lobe of the liver causing bile leakage, intraperitoneally which was followed by percutaneous drainage. She had an ERCP post-operatively which failed followed by a percutaneous transhepatic cholangiography (PTC) and an ERCP at the same sitting called the rendezvous procedure at a later stage.

An endoscopic "rendezvous" procedure is commonly performed when access to the biliary tree cannot be established during the initial ERCP examination. The patient is then sent to the interventional radiologist to undergo percutaneous cholangiography with placement of a transhepatic guide wire, with the distal tip of the wire exiting the major papilla into the duodenum. During a repeat ERCP, the endoscopist can then identify the wire and use it as a guide into the common bile duct[17]. She was then referred with deep obstructive jaundice. A PTC was done, which showed a 2 cm common hepatic duct stump, dilated intrahepatic and CHD, with no flow of contrast into the duodenum. This was then followed by a fourth re-do laparotomy by the principle author, where she had a roux-en-Y hepatico-jejunostomy done with no further complications. In patient hospital stay was 7 days.

Case 2.

L.R, was a 72- year old obese a visitor from another country, who had a cholecystostomy done for gall bladder empyema. He presented to us with a history of right upper quadrant pain and fever for over a week. He had no jaundice. Laboratory tests gave normal amylase, renal functions and mild leucocytosis.

An abdominal ultrasound showed a distended gallbladder with cholelithiasis. There was no intra or extra hepatic ductal dilatation. Since he was not feeling so sick he opted for an interval cholecystectomy when he would be back in his country. However his clinical picture deteriorated over two days and he had an urgent operation.

The cholecystectomy was started laparoscopically and later converted to open because of dense adhesions. The anatomy was also difficult to define due to the inflammation around the gallbladder and Calot's triangle. A decision was taken not to operate any further to prevent bile duct or duodenal injuries. A cholecystostomy was performed at which all the pus was drained and the gall bladder cleared of all stones and a tube drain was left in place in the gallbladder. The cholecystostomy was made at the fundus of the gallbladder, all the pus and stones drained and a Foley's catheter was inserted into the gall bladder via the abdominal wall. A purse string suture was used to hold the Foley's catheter in place, and the bulb inflated with 5ml of water. In hospital stay was 5 days.

When the patient was apyrexic and improved, he was allowed to fly back to his country for an elective open cholecystectomy.

Case 3.

D.I, a 62-years old, who had a stricture from a previous biliary-enteric anastomosis. He had a laparotomy in 2004 for obstructive jaundice where the cause was not very clear. The patient had a cholecystectomy and a choledochojejunostomy done. Histology of the gall bladder diagnosed Kaposi's sarcoma. In October 2010 he developed features of obstructive jaundice. Liver function tests also revealed an obstructive picture. His CA 19-9 CEA levels were normal. He had an MRCP which showed a dilated CBD 11.2 mm, no stones and a smooth tapering stricture at the previous choledochojejunostomy site. An ERCP was attempted unsuccessfully due to technical reasons of failing to pass a guide wire.

Subsequently a laparotomy with a Roux-en-Y (TWIN) Hepatico-Jejunostomy was fashioned. The left hepatic duct was noted to lie posterior to the right hepatic duct without joining it. There was no evidence of any tumor and the CBD was clear with no stones.

Case 4.

C.D, a 73-year old, had obstructive jaundice from chronic pancreatitis. She had cancer of the proximal stomach in 1998 and had a curative total gastrectomy and a Roux-en-Y esophago-jejunostomy by the one of the authors. He had uneventful post-operative period. In 2002 she developed acute cholecystitis and had a successful laparoscopic cholecystectomy again by the author. She presented again in January 2011 with epigastric pains radiating to the back. No history of alcohol

use. MRCP showed no stones in the CBD and CT scan in January were normal showed features of pancreatitis. CT abdomen in April revealed peripancreatic fat stranding with no calcifications. A diagnosis of pancreatitis was made, the cause probably being autoimmune.

She had a laparotomy with a choledochoduodenostomy. There were numerous adhesions with the the Y limb of the Roux loop being adherent to the abdominal wall. No tumour was found. A choledochoduodenostomy was fashioned in view of the numerous adhesions but unfortunately, the patient succumbed to septiceamia a month later.

Discussion

Cholecystectomy is becoming a common operation in Africa. Technical difficulties during laparoscopic cholecystectomy (LC) occur mainly in patients with acute cholecystitis, especially in those where surgery is delayed after the acute onset[18,19] and in those who have had previous attacks[20], a common presentation in sub-Saharan Africa. LC is also purported to be more difficult in elderly males, associated bile duct stones[20], gallstone pancreatitis, those with the Mirizzi's syndrome and, in the presence of portal hypertension[21].

Dissection of Calot's triangle in the presence of acute and chronic inflammation may be difficult and an increased risk of bile duct injury exists. Dissection of the gallbladder from the liver bed may also be challenging when the posterior wall of the gallbladder wall is destroyed by severe inflammation. Attempts at total removal of the gallbladder may result in bleeding or a bile leak from the gallbladder bed.

When dealing with a difficult gallbladder, there is a fine balance between proceeding with a standard LC and choosing an alternative approach in the interest of the patient's safety bearing in mind that this is a benign disease[22]. Much of the decision will depend on the surgeon's experience or the availability of expert back-up. But it should be noted that 50% of bile duct injuries occur after 300 LC presumably as surgeons perform more difficult cases[23]. LC is inherently a dangerous operation and cannot always be completed safely, even by the most experienced surgeon.

Apart from seeking expert help, other options when running into technical difficulties are to convert, perform a cholecystotomy or, resort to a subtotal cholecystectomy. While adopting a low threshold to convert to an open cholecystectomy is strongly recommended, this may not turn out to be an easier or safer procedure for surgeons who received their training during the laparoscopic era. Neither would an operative cholangiogram necessarily be helpful in the presence of inflammation and distorted anatomy. Operative cholangiography is no substitute for careful exposure of Calot's triangle which is the Achilles Heel to safe removal of the gallbladder. No structure should be divided until the Hartmann's /cystic junction and "the critical view of safety" have been clearly identified[24].

Cholecystostomy[25]

With improvements in anesthesia and surgery, cholecystostomy is undertaken infrequently and, when it is required, is a performed generally using radiologic technique. It is a procedure that should be considered when cholecystectomy is deemed unsafe in patients at high risk related to multisystem organ failure; severe pulmonary, renal, or cardiac disease; and recent myocardial infarction. Safe cholecystectomy may be precluded by a local condition such as cirrhosis with portal hypertension; acalculus cholecystitis after severe trauma, burns, or surgery; and where there is empyema or gangrene of the gallbladder. With radiologic advances, cholecystostomy can be performed as a percutaneous technique under local, regional, or general anesthesia.

Open cholecystostomy under local anesthesia should not be considered a minor procedure, and a skilled anesthetist should be present and the patient should be well sedated and oxygenated. Preoperative or operative localization of the gallbladder using ultrasonography is invaluable in

selecting the most appropriate incision site. Ample local anesthetic with 0.5% lidocaine is used to infiltrate the skin muscle and peritoneum. A transverse muscle-splitting incision is preferred and, if the incision site has been well chosen, the gallbladder will be seen immediately on entering the peritoneum.

A purse-string 3-0 polydioxanone suture is placed in the fundus of the gallbladder. Having placed packs or swabs around the isolated gallbladder, a trocar is used to decompress the gallbladder. A disposable 5-mm laparoscopic port is ideal as the sharp trocar avoids unnecessary trauma to the operating field. The contents of the gallbladder are aspirated and a sample of bile is obtained for culture. In the absence of empyema or gangrene, an attempt should be made to remove the stones with forceps or a scoop. A stone impacted in the neck of the gallbladder or cystic duct can be dislodged usually by external digital manipulation, stone forceps, or a Foley catheter. Removal of the obstructing stone is important to prevent a subsequent mucous fistula.

On removal of the stones, a No. 20 to 24 French gauge Foley or similar catheter is placed through a separate stab incision in the abdominal wall and is secured within the fundus of the gallbladder, using the purse-string suture[25]. Injudicious attempts at securing the gallbladder to the abdominal wall should be avoided, although this may be achieved frequently by inflating the catheter balloon, which allows the fundus of the gallbladder to be opposed against the parietal peritoneum. The incision is closed using 0 polydioxanone to peritoneum and sheath. If there has been considerable contamination of the wound, it may be elected not to close the skin edges.

Given the circumstances under which cholecystostomy is performed, it is not surprising that the procedure carries a higher morbidity and mortality than cholecystectomy. In those patients who recover from the procedure, the cholecystostomy tube can be removed by 6 to 8 weeks if patency of the biliary tract can be demonstrated. For those patients with residual stones in the gallbladder, these may be removed through the tract by percutaneous maneuvers using image intensification or 5-mm flexible choledochoscope. Dissolution techniques are not well tolerated and, in those patients who make a satisfactory recovery, cholecystectomy should be considered. In the elderly, infirm patient or those with comorbid disease, it may be wise to defer cholecystectomy indefinitely. Subtotal cholecystectomy is a useful alternative in dealing with the difficult and inflamed gallbladder. Developed during the open cholecystectomy era[26], the feasibility and safety of performing this laparoscopically has been confirmed[27,28] and in most instances, conversion to open cholecystectomy can be avoided.

Technical hints

High resolution video optics are essential to facilitate the safe performance of a difficult LC, as are optimal port placements to allow two-hand dissection at 90° which facilitates lateral traction of Hartmann's pouch to expose Calot's triangle. To this end robust instruments are often required to allow effective grasping of the gallbladder fundus and Hartmann's pouch. A suction-irrigation (hydro-dissection) dissection technique is a very useful and safe manoeuvre in the presence of acute and acute on chronic inflammation. The cystic duct must be divided and secured close to its junction with Hartmann's pouch and only when the "critical view of safety" is confirmed[8] or, the entire biliary system including the intrahepatic ducts is demonstrated on an operative cholangiogram. The use of an Endoloop or lockable PDS clip is preferred over standard clips for large and inflamed cystic ducts.

In cases of stone impaction in Hartmann's pouch, the gallbladder is incised at this level and divided circumferentially which then allows pro-grade dissection and isolation of the cystic duct with an endoloop. When isolation of the cystic duct is not feasible, this can be secured with a purse-string suture. Subtotal removal of the gallbladder (leaving part of the posterior wall intact) is reserved for:

i) Difficulty in finding a dissection plane [thus avoiding bleeding or a bile leak from the gallbladder bed) or
ii) Inadvertent perforation.

The use of a Harmonic scalpel facilitates this part of the operation. Great care is taken to retrieve all dropped gallstones. A subhepatic closed drainage system is placed in selected cases. As a general rule, laparoscopic removal of the gallbladder is contraindicated in the Mirizzi's syndrome.

Bile duct obstruction

Obstruction of the biliary tree is common during the advanced stages of chronic pancreatitis (CP), particularly when associated with calcification and an inflammatory mass in the head of the pancreas. Obstruction can be caused by oedema, an intrapancreatic pseudocyst or fibrosis. The natural history of the obstruction will vary according to the underlying pathology. The clinical presentation varies from an incidental discovery to overt jaundice, with or without associated cholangitis. Jaundice which occurs during acute exacerbations is often transient and may resolve completely without requiring intervention. The risk of developing secondary biliary cirrhosis is low, particularly in non- jaundiced patients who present with raised alkaline phosphatase (ALP) or a dilated biliary system on imaging.[30] Persistent jaundice occurs when there is progressive fibrosis, with or without calcification.

Diagnosis

Liver function tests: A disproportionately-raised ALP and gamma GT is typically seen in patients with low grade obstruction. In jaundiced patients, liver function tests frequently improve, which is useful to distinguish benign from malignant obstruction. **CA 19-9** may be elevated in CP with biliary obstruction, although levels seldom exceed 100-120 U/ml.[29]

Imaging:

While ultrasound is usually the first imaging to identify biliary obstruction, CT scan is required to define the nature and extent of the disease, and to help differentiate CP from a pancreatic cancer. MRCP is the preferred imaging to delineate the bile duct stricture and pancreatic duct anatomy. Although a smooth tapering of the distal bile duct is suggestive of CP, this finding is not reliable enough in its own right to distinguish it from a carcinoma. ERCP is reserved in the main when intervention is required. Endoscopic brush cytology has a very good specificity but poor sensitivity in the diagnosis of malignancy, yet is a valuable adjunct to diagnosis and should be considered in patients undergoing ERP.[31]

Management:

Management is largely dictated by the clinical presentation and morphological changes of the pancreas. Clinical factors to consider include the presence and severity of associated pain, the occurrence of jaundice and duration thereof, concern about malignancy and co-morbid diseases. Surgical strategy will depend on the presence of an inflammatory mass in the head of the pancreas and the degree of bile duct and pancreatic duct dilatation.[28]

Recommendations.

- Patients with asymptomatic bile duct strictures, including those with an isolated raised ALP, should be treated conservatively with regular follow-ups.
- Endoscopic interventions and stenting should be discouraged, as this may cause secondary infection, particularly when the stents occlude. There is no need to perform regular liver biopsies to detect the development of secondary liver cirrhosis in this group of patients.
- Patients who present with jaundice should initially be treated conservatively, unless associated with cholangitis when a temporary stent should be placed. If jaundice resolves, no further intervention is required, but the patient will require follow-ups.
- A surgical bypass, preferably a hepatico-jejunostomy, is acceptable in the relatively uncommon scenario when jaundice persists in the absence of any other sequellae of the CP.

- A Frey procedure with a hepatico-jejunostomy is the preferred operation when there is an inflammatory mass in the head of the pancreas associated with a dilated pancreatic duct. In the absence of a dilated duct, a pylorus-preserving pancreatico-duodenectomy could be performed, as well as in those patients where a malignancy is suspected.
- The current recommendation for stenting is in patients who present with cholangitis and those unfit for surgery due to severe co-morbid diseases. The indications for stenting may expand with the development of removable expandable stents in those patients where jaundice is the predominant clinical presentation.

Conclusion

The large number of variations in the anatomic structure of biliary tree imposes an imperative need for surgeons to have an adequate knowledge and understanding of those variations, in order to control the safety of the surgical procedure in this field. A large number of postoperative complications seen in this surgical area results from iatrogenic injuries incurred by a variation of anatomic elements. Nowadays, given the rich and modern diagnostic armamentarium, the surgeon must be conversant with any potential problem. The significant improvements in the outcome from the procedures ranging from a simple cholecystectomy to the liver transplantation are due to the increased awareness of surgeon.

In Africa a trainee sees a minimum number of cholecystectomies being performed and at times the trainers themselves are junior surgeons. After an Master of medicine the surgeon usually becomes a consultant in 2 years with powers of independent decision making and operating difficult cases.

The role of the medical boards should change to confer consultant status only after surgeon is capable of independent decision-making and after a reasonable number of cases recorded with good outcomes.

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