Cholelithiasis, Cholecystitis and Cholecystectomy – their relevance for the African surgeon

1. Introduction
Cholecystectomy is the most common major general surgical operation performed in North America and Europe. (1) In the 1990s laparoscopic cholecystectomy LC swept through the countries of this region totally transforming the approach to biliary tract...
disease. Review of the history of this technological change provides insights into how medical care develops. The clinical conditions resulting from cholelithiasis have a marked geographical distribution (see 3. Epidemiology) and are not common problems facing African surgeons. This may change, as diet, activity and longevity change with development. Knowledge of the surgical approach to the gallbladder and biliary ducts is a fundamental skill of general surgery. Moreover, there is enormous pressure to introduce laparoscopic cholecystectomy in low-income countries. This Review will deal with these questions as they relate to surgeons in the developing world. Subsequent reviews will discuss other complications of cholelithiasis such as choledocholithiasis and biliary pancreatitis in greater detail.

2. Surgical Anatomy and Physiology
Oddsdottir and Hunter give a succinct summary of gallbladder anatomy in their chapter in Schwartz’s Principles of Surgery. (2) Understanding the anatomy and its variants are key principles of general surgery. The relationships of cystic artery, cystic duct and common duct in the triangle of Chalot, as well as the recognized anomalies, are crucial to preventing bile duct injury.

The gallbladder stores and concentrates bile and excretes it into the duodenum at the ampulla of Vater upon stimulation by cholecystokinin released from the duodenum. Bile contains water, electrolytes, lipids, bile salts and bile pigments. The bile salts conjugated with amino acids are important in the digestion and absorption of fats. They are, in turn, reabsorbed in the terminal ileum.

3. Epidemiology
There is a large variation in the prevalence and type of gallbladder stone disease throughout the world and ethnicity plays a major role. (3) Age, diet, obesity and female sex are also important factors. Ten to fifteen percent of white adults in developed countries harbor gallstones. In North American Indians the disease is epidemic with up to 60% of women in these populations being afflicted. The prevalence of cholelithiasis in Asians and Afro-Americans is lower in the range of 5-10%, with brown stones predominating in Asians. In sub-Saharan Africa the prevalence is even lower, less than 5%. The prevalence in pregnant women in Nigeria was 2%. (4) South Americans, particularly Amerindian populations, have a high prevalence of gallstones. Coelho in a study from Brazil found that age, female sex and number of pregnancies all were strongly correlated with gallstones. (5) Interestingly, fasting and acute weight loss are both associated with symptomatic cholelithiasis. (6) The genetic profiles leading to the development of cholelithiasis are just now being worked out. (7)

4. Pathophysiology
The pathogenesis of gallstones is complex. (8) The secretion of lithogenic bile, with ratios of bile acids, cholesterol and phospholipids favoring cholesterol precipitation, abnormal gallbladder motility and delayed large bowel transit times favoring re-absorption of deoxy-cholic acid have all been implicated in gallstone formation. Local factors in the gallbladder are important. (9)

The majority of gallstones form in the gallbladder. Choledocholithiasis (bile duct stones) occur in about 10% of cases of cholelithiasis in the West. (10) Stones in the bile duct may be either primary (forming de novo in the bile duct) or secondary (passing from the gallbladder into the bile ducts). (11) Common duct and intra-hepatic stones are more common in Asia (20%), where they are more commonly primary in origin (30%).
Primary common bile duct CBD stones may also form as a result of biliary strictures and tumours.

4.1. Chemistry of Gallstones

Gallstones are traditionally divided into black pigment, brown pigment and cholesterol stones. (8) Black pigment stones are composed of bilirubin and calcium and are found in patients with hemolysis or jaundice. These occur in sickle cell disease. Brown pigment stones contain, in addition to the above, amorphous material and mucous glycoprotein. They are more common in Asia. Cholesterol stones having, by definition, 70-90% cholesterol by weight predominate in the West. By contrast, in Cameroon, the majority of patients had less than 25% cholesterol in their stones and a higher percentage of amorphous material. (12) In another report from Ghana, 34% of patients had cholesterol stones. (13) Microlithiasis and sludge are real clinical entities in the West requiring similar treatment to macroscopic stones. (14)

4.2. Gallbladder Motility

The role of impaired gallbladder motility in the development of cholesterol stones is being elucidated. (15) Erythromycin is a powerful inducer of gallbladder contraction. (16) Its value in conditions, such as prolonged fasting and total parenteral nutrition, which are associated with cholelithiasis, is being studied.

5. Diagnostic Studies

5.1. Imaging

Historically a wide variety of tests have been used to detect gallbladder function and stones. Today the transabdominal ultrasound US is the gold standard for diagnosis of cholelithiasis. (17) It has sensitivity and specificity of over 95% for stones greater than 1.5 mm in size and provides important information on burden and mobility of stones, gallbladder volume, wall thickness and size of the common duct. Other intra-abdominal organs can be scanned at the same time. US is more sensitive than CT or MRI for gallstones. (18) The US features of specific clinical entities will be discussed below. While US is sensitive for common bile duct size, it may miss the presence of small common duct stones (sensitivity <50%). Therefore alternative imaging may be necessary. Endoscopic retrograde choledochopancreatography ERCP is a highly sensitive and specific imaging modality, but is invasive and its acquisition requires considerable training. It is not without morbidity which is related to experience of the operator. Complications, such as pancreatitis, bleeding and perforation of duodenum, occur each in 5-8% or patients particularly after endoscopic sphincterotomy ES and the mortality rate is 0.5-0.8%. It is unlikely to be available in low-income countries outside of major teaching institutions for some time. Similarly Magnetic-resonance-choledochopancreatography MRCP, which has slightly lower accuracy and no therapeutic capability, but significantly lower morbidity than ERCP and is vying for dominance with it, is unlikely to be available. (19) Nuclear medicine imaging, such as HIDA scans, can accurately identify a blocked cystic duct often associated with acute cholecystitis.

5.2. Haematology/Biochemistry

Blood tests play an important role in biliary tract disease. Elevated WBC may be indicative of infection with cholecystitis or cholangitis. Jaundice is determined by direct and indirect bilirubin. Liver function can be assessed biochemically: cholestasis is indicated by elevated alkaline phosphatase and gama-glutamyltransferase GGT; other aminotransferases will be normal unless there is cholangitis. With biliary colic alone
these tests are often normal. (2) Biliary pancreatitis may be detected by elevated serum amylase. (20)

6. Clinical conditions
A wide variety of clinical conditions exist as a result of gallstones. These can be divided into uncomplicated and complicated disease.

6.1. Uncomplicated Disease
6.1.1. Asymptomatic Gallstones
Asymptomatic gallstones are those found incidentally at US or other diagnostic procedure. In the West, where large numbers of such patients have been identified, the natural history of asymptomatic gallstones is understood. The majority of patients with silent gallstones will remain asymptomatic. Only 10% of patients will become symptomatic at 10 years and 20% at 20 years. (17) Moreover the majority of patients developed symptoms before progressing to more complicated disease. This information, developed in the period when open cholecystectomy OC was the main surgical procedure, resulted in a consensus that asymptomatic gallstones were not an indication for cholecystectomy. In the 15 years since laparoscopic cholecystectomy LC has become the standard of practice in North America, questions have been raised whether the indications for surgery should be broadened. (21;22) There is no question that the number of cholecystectomies has increased since the introduction of LC. Possible candidates for prophylactic LC include: young patients, females less than 60 years, those on waiting lists for transplant, patients with sickle cell disease, diabetics, those with porcelain gallbladders or in populations with a high incidence of gallbladder cancer. However, a recent systematic review for the Cochrane Collaboration revealed that there were simply no randomized controlled trials RCT comparing observation and cholecystectomy in patients with asymptomatic gallstones.(23) There is therefore little evidence on which to base a change in recommendations. Only morbidly obese patients undergoing bariatric procedures would seem clearly to benefit from prophylactic cholecystectomy.

6.1.2. Symptomatic Gallstones
The primary symptom of symptomatic gallstones is recurrent attacks of pain, often referred to as biliary colic. The pain is usually epigastric, but may be in the right upper quadrant and may radiate through to the back or shoulder. It is often severe and may be confused with a myocardial infarction. Nausea and vomiting may occur and the symptom complex may be precipitated by a fatty meal. (2) Recurrent pain of this character together with gallstones on US make the diagnosis of symptomatic cholelithiasis. Pathologic findings of chronic cholecystitis are invariably found. In the West with its high prevalence of asymptomatic gallstones it is prudent to rule out other diseases which may be causing symptoms. Sludge, cholesterolosis and adenomyomatosis all may cause symptoms and can be diagnosed on US. (18) Whereas prior to the introduction of LC there was debate as to the appropriate treatment for symptomatic gallstones (see 7.1. Medical Treatment); today there is fairly uniform consensus advocating LC.

6.2. Complicated Disease
6.2.1. Acute cholecystitis
When the gallbladder pain lasts for more than 24 hours, an obstructing stone is usually present, either in the cystic duct or in Hartmann’s pouch. A hydrops or mucocele of the...
gallbladder may develop. In some cases the pain may settle. In others, infection of the obstructed gallbladder may subsequently develop leading to acute cholecystitis AC. (24) Bacteria can be cultured from 50% of patient gallbladders in early AC. Fever and leukocytosis may be present, but their absence does not rule it out. US is diagnostic; identifying stones, often with a hypoechoic and thickened wall (>3mm) and a positive sonographic Murphy’s sign. There may be pericholecystic fluid. Fever, leukocytosis and mild elevation of alkaline phosphatase may be indicative of more severe disease. Antibiotics are usually prescribed. Cultured bacteria range from enteric gram-negative aerobes to facultative anaerobes like strep faecalis and anaerobes including clostridia and bacteroides flagilis. Broad spectrum antibiotics are indicated. Most attacks resolve, but the disease may progress to empyema of the gallbladder, gangrene, perforation or cholecystoenteric fistula. These latter complications are more common in diabetics and in the elderly. Cholecystoenteric fistula may be diagnosed by the appearance of air on the biliary tree.

Older evidence favored early OC in acute cholecystitis. (24) 72 hours of symptoms were felt to constitute the window of opportunity, after which edema and inflammation made OC more difficult. In the early years after introduction of LC, acute cholecystitis was taken as a contraindication to this procedure, but subsequent experience allows advocacy of early intervention. However, it should be noted that the majority of patients with AC will settle on bedrest, analgesia, intravenous fluids and broad spectrum antibiotics and that this approach with interval cholecystectomy is a very acceptable management practice. Patients, who arrive late or appear unfit for surgery, should be treated in this manner; however 20% may require surgical intervention for complications.

6.2.1.1. Acute acalculous cholecystitis
Acute acalculous cholecystitis is a recognized entity, occurring classically in diabetic patients, but also in the acutely ill and injured. (25) Children may rarely also be affected. In Ameh’s study from Nigeria, 6 out of 7 children with cholecystitis had no gallstones. (26) The disease may be very severe with marked toxicity, progression to gangrene, perforation and high mortality rates. Modern treatment in the West uses percutaneous cholecystostomy under ultrasound control, if perforation or gangrene can be ruled out.

6.2.2. Choledocholithiasis
While a detailed discussion of this condition can be left to a subsequent review on obstructive jaundice, a number of points are warranted here. In the West, common bile duct CBD stones are found in between 6-12% of patients with cholelithiasis. Their presence increases with age to about 20% after age 60. They may be silent in a majority of cases. GGT is felt to be the most sensitive biochemical indicator of their presence. However, the consequences of common duct stones, cholangitis, obstructive jaundice and biliary pancreatitis, may be severe. During the period when OC was the most common surgical procedure performed these facts led to the recommendation of routine intra-operative cholangiography IOC. (27) During this period, ERCP with endoscopic sphincterotomy ES was less widely available and it seemed prudent to rule out CBD stones which might cause significant morbidity and require re-operation. With both the widespread use of LC and the availability of ERCP and ES this practice has been questioned. (10) (See 7.2.3.1.) The risk in any particular patient of harboring silent CBD stones can be classified. Patients with large stones, no history of jaundice or pancreatitis, and no liver function abnormalities have a low <5% risk. Patients with moderate (10-
50%) risk have a small stones and/or any of the above. Patients with high (>50%) risk of CBD stones have jaundice or cholangitis, dilated CBD or evidence of choledocholithiasis on US. Management of these last two classes can include pre- or post-operative ERCP with ES or LC with IOC and trans-cystic exploration of the CBD, depending on local resources and expertise. (28) A recent meta-analysis of studies comparing ES and endoscopic removal versus surgical removal showed no advantage to either approach. (29)

6.2.3. Biliary Pancreatitis
As with choledocholithiasis, the discussion of biliary pancreatitis awaits a fuller review of pancreatitis in general. However, gallstones are the most common cause of pancreatitis in the West. The immediate management of the gallstones depends very much on the severity of the pancreatitis. (30) Those with mild pancreatitis may receive LC with IOC on their first admission. If choledocholithiasis is found, transcystic CBD exploration may be undertaken or ERCP and ES post-operatively. Those with more severe pancreatitis require ICU monitoring and treatment directed at early recognition of sepsis and pancreatic necrosis. In the past, ERCP was considered contraindicated in pancreatitis. Today it is indicated to detect and remove obstructing calculi, if there is cholangitis or in severe cases which fail to resolve.

6.2.4. Carcinoma Gallbladder
Carcinoma of the gallbladder, while relatively uncommon in the West, is a highly lethal condition with most cases being diagnosed late. (31) It is more common in women and has marked geographical variability being most common in India. (32) 75-90% of cases are associated with gallstones and the risk rises with gallstones size. (33) This finding has led some to recommend prophylactic cholecystectomy in patient with asymptomatic gallstones from populations with a high incidence of gallbladder carcinoma. The porcelain gallbladder, which is characterized by mural calcification, has a high (11-33%) association with gallbladder carcinoma. Most cures occur in Tis and T1 cancers discovered incidentally at cholecystectomy. Stage II and IIIA cancers warrant extended cholecystectomy with excision of the surrounding liver bed and CBD lymphadenectomy.

7. Treatment
7.1. Medical
Prior to the introduction of LC there were significant discussions in the literature about alternative methods of treating gallstones, particularly oral administration of bile salts and lithotripsy. (34) Bile salt administration, primarily ursodeoxycholic acid UDCA, has been used to dissolve cholesterol stones. There are considerable restrictions to this therapy: patients with frequent symptoms are excluded, the gallbladder must function, stones must be primarily cholesterol without significant calcification. Stones greater than 5 mm have only a 50% chance of dissolution after 9 months of therapy. For these reasons alone, gallstone dissolution is unlikely to be practical in low-income countries. Extra-corporeal shock wave lithotripsy ESWL has been considered as an alternative to surgery. (35) Again there are restrictions in terms of patient selection. With the introduction of LC these approaches have languished and no scientific studies have been conducted comparing their efficacy to surgery. However with the proliferation of LC procedures issues of cost effectiveness need to be considered. (36) All non-surgical approaches to gallbladder disease suffer from their inability to eliminate the gallbladder itself, the site of gallstone formation and therefore recurrences are a problem.
7.2. Surgical procedures
Surgical extirpation of the gallbladder has been the gold standard of treatment for symptomatic and complicated gallbladder disease for over 100 years.

7.2.1. Cholecystostomy
Cholecystostomy has been used in the past as a salvage operation when cholecystectomy appears too dangerous or when a skilled operator is unavailable. (37) Today it is used primarily in the West as a percutaneous drainage procedure for acalculous cholecystitis.

7.2.2. Open cholecystectomy
The first open cholecystectomy (OC) was carried out by Langenbuch in 1882. Since then the procedure achieved predominance as the most appropriate treatment for symptomatic cholelithiasis, acute cholecystitis with or without gallstones, gangrene of the gallbladder, after initial cholecystostomy, after trauma to gallbladder or cystic duct and for carcinoma of the gallbladder. The various technical details are well described by Ellis in Maingot’s Abdominal Operations. (37) The mortality rate in large series has been well below 1%. During most of the 20th century certain principles were associated with OC - routine intra-operative cholangiography (IOC) and routine drainage of the gallbladder. The latter has clearly fallen into disrepute except in difficult procedures where the risk of bile leak is considerable high or where there is a peri-cholecystocholic abscess. (38) Routine drainage has in fact been shown to be associated with higher risk of fever and wound infection. The rationale for routine IOC has been discussed above. It was considered important not only for the recognition of CBD stones, but also of inadvertent injury to the bile ducts. Large series show a 0.2% risk of bile duct injury with OC. The results of OC in large series have been excellent with only 5-10% of patients having residual symptoms. Some of these are a result of misdiagnosis; some the result of retained, missed or recurrent CBD stones and to bile duct injury; some to the “post-cholecystectomy syndrome” – probably biliary dyskinesis in many cases. All this changed with the introduction of laparoscopic cholecystectomy.

7.2.3. Laparoscopic cholecystectomy
Laparoscopic cholecystectomy was first performed in Germany in 1985 and subsequently spread throughout the developed world. (39) This technique has effectively displaced OC in the West for the last 15-20 years. Its proven advantages are: less pain, shorter hospital stay, faster routine to work and fewer incisional hernias. Initially acute cholecystitis was felt to be a contraindication to LC, but with experience it is no longer felt to be an impediment. (40) Conversion to OC is related to a number of factors and falls with experience, but 5% conversion rates are acceptable. Complications specific to or of increased frequency with LC have, however, emerged. (41) Injury, either to bowel or vessels, may result from establishing the pneumoperitoneum and these represent one-half of all complications with LC. This has resulted in a general advocacy of open establishment of the pneumoperitoneum with a Hasson blunt trocar, rather than the “blind” Verres needle approach. The most serious complication is bile duct injury (BDI), which may be minor or major. Early series indicated a marked increase in BDI, up to 2% which would be 10 times that of OC. Even with improved experience after a learning curve of 50 LCs, the BDI rate plateaus at 0.8%, 4 times the rate of OC, in most series. Some of these can be controlled with percutaneous drainage and ERCP with ES; some require laparotomy to ligate the leaking cystic duct; others require major biliary reconstruction and have significant implications for long term health. Despite the
increased risk of biliary leak, routine drainage after LC has been discouraged. An algorithm of management of these cases has been developed. (42) Spillage of gallstones is more frequent during LC and infrequently causes complications. (43) The entire displacement of OC by LC in the West occurred without any scientific verification. As Strasborg noted in 1997, of the 700 references published over 5 years, almost all were local case reports. (24) Part of this transformation was patient-driven – without doubt, LC provides an improved cosmetic result, less pain and faster recovery; part of it was surgeon-driven. Having personally carried out hundreds of LC over 10 years, I can attest to a subjective impression of improved patient recovery. Only recently has scientific evidence been available to compare these procedures. Keus et al. published several systematic reviews for the Cochrane Collaboration comparing LC, standard OC and mini-OC. (44-46) In the randomized trials they studied, comprising 2338 patients, they could find no differences in mortality, overall complications or operative time. LC patients had a shorter hospital stay and faster return to work. Similar overall conclusions can be drawn for the small incision cholecystectomy which has a shorter operating time than LC, a shorter hospital stay and faster return to work than OC. Surprisingly the risk of bile duct injury was identical in these studies – prompting one to wonder how reflective these are of the general experience.

7.2.4. Routine intra-operative cholangiography

Despite the proven value of intra-operative cholangiography IOC in identifying CBD stones and biliary injuries, its routine use, long advocated in OC, has been abandoned in LC. (27) With more widespread stratification of risk of CBD stones and the availability of pre- or post-operative endoscopic techniques for diagnosis and management, selective IOC has become the standard.

7.2.5. Is laparoscopic cholecystectomy appropriate in low-income countries?

As explained above (see 3. Epidemiology) gallbladder disease is not a common condition in most communities of Africa. A Medline literature search of 1996-2007 database combining Laparoscopic cholecystectomy (4570 citations) with Africa or the developing world (49976 citations) yielded only 13 citations. Despite this, there is enormous interest/pressure to introduce LC in low-income countries. Surgeons in these countries naturally want to apply the most modern techniques. Thomson in a series from South Africa was able to enroll 50 patients per year, in a study, comparing OC and LC retrospectively. (47) Major duct injuries were actually more common in the OC group and mortality rates were equivalent. The conversion rate was a high 17%. Chauhan in a report of 373 patients operated on in India in 1 year demonstrated the feasibility of day care LC. (48) In a report from Mexico in 2004, the LC rate in public hospitals was 50% compared to 90% in private hospitals. (49) In this author’s opinion the following factors should be considered before introducing LC:

Technical questions: LC is dependent on a number of high grade technological systems: an optical system using high energy light sources, digital microprocessors and 3 chip video cameras, high flow CO2 insufflators for pneumoperitoneum, specialized instrumentation and hemostatic devices such as electrocautery and clips. (50) It goes without saying that the technical support to maintain this equipment, not to mention a continuous source of electricity for their safe operation, need to be assured. These
conditions are certainly not consistently available in low-income countries, especially the last two. Reports of gasless LC speak volumes about attempts to surmount technical problems. (51) Furthermore LC, as currently practiced in the West with selective IOC, relies on ancillary interventions like ERCP which may not be available in low-income countries.

**Education programs and learning curve:** Teaching programs for LC in high-income countries are now incorporated into standardized resident training programs and use a combination of didactic methods, simulation, animal models and graded operative responsibility. (52) There appear to be a number of Western surgeons who are interested in teaching LC to surgeons in the developing world. However, where the surgical caseload is low; the learning curve for acquisition of skills may be prolonged. This may not hold true in countries of South America or in India, with intermediate or high prevalence of gallbladder disease; as much as it does in sub-Saharan Africa. Maintenance of quality assurance is essential. Considering the issue of teaching surgical skills of an uncommon clinical problem, it is imperative that the skills of open surgery for gallbladder disease be maintained and transmitted to the next generation. Recognizing this, the 2005 Syllabus for Fellowship status of the College of Surgeons of East, Central and Southern Africa COSECSA require practical acquisition of open cholecystectomy skills as opposed to those for LC.

**Cost and Efficacy:** While Western donors of various kinds may be interested in donating laparoscopic equipment to low-income countries, it remains to be seen whether sustainable programs can be developed. Previous reviews in this course (see March and April 2006) have indicated other surgical procedures, such as video-assisted thoracic surgery VATS for thoracic empyema and diagnostic laparoscopy for abdominal pain in women, where there might be a sufficient caseload for safe acquisition of new skills which would have a positive impact on patient care. Cost analyses showing reduced costs with LC always rely on shortened hospital stays and reduced time off work. (53) Procedural costs are always higher. (54) Small-incision cholecystectomy has been promoted as a procedure equivalent to LC but more suitable for low-income countries. (55) Since infrastructure is one of the major challenges in low-income countries, it is reasonable to ask whether LC is an efficient use of scarce resources for surgical care. (36)

**7.2.6. Exploration of the Bile Duct: Open, Trans-cystic, Endoscopic and Transduodenal**

While it is not the intention of this Review to consider in detail the various approaches to choledocholithiasis, a number of management issues need to be discussed. Because of their potential for serious complications, all CBD stones should be removed. (56) The options are: open choledochotomy via laparotomy (either at the same time or subsequent to cholecystectomy); trans-cystic exploration of the CBD at the time of LC (an advanced skill); endoscopic spincterotomy ES at the time of ERCP and open transduodenal spincterotomy/plasty for otherwise irremovable stones. Csendes et al. from Chile discuss their approach to CBD stones and the role of open choledochotomy. (57) Boerma from the Netherlands discusses a less invasive approach. (28) Martin in a systematic review for the Cochrane Collaboration showed that open choledochotomy was superior to ERCP with a lower primary treatment failure (retained stones). (58) In the same report trans-cystic laparoscopic CBD exploration was found to be generally equivalent to ERCP and ES. Clearly, even in the countries with highly developed, multiple approaches to CBD
exploration, open choledocotomy may still play a role. The technical details are described by Ellis in Maingot’s Abdominal Operations. (59) Exploration should be carried out by saline irrigation with soft rubber catheters. The use of rigid Bates dilators is to be condemned. Choledoscopy is extremely useful to assess residual stones. T-tube insertion, even after clearance of stones, has in the past been considered mandatory. Recently Gurusamy reviewed randomized studies comparing T-tube versus primary closure after both open and laparoscopic CBD exploration and concluded that primary closure was safer. (60;61) T-tubes, however, play a role in the approach to residual stones if ERCP is not available.

8. Conclusions
Clearly the approach to gallstone disease has undergone a profound development in the West during the last 30 years with a proliferation of minimally-invasive procedures, many of which have been shown to be equivalent or superior to older techniques. These approaches cannot simply be applied to the conditions facing surgeons in low-income countries without thoughtful consideration.

9. Recommendations
1. The gold standard for the diagnosis of gallstones is the trans-abdominal ultrasound. Gallbladder thickness and CBD diameter and presence of stones should be assessed at the same time.
2. Patients with gallstones should have pre-operative bilirubin and liver function tests including alkaline phosphatase and GGT.
3. Asymptomatic patients with gallstones should be observed for the development of symptoms.
4. All patients with symptomatic or complicated gallbladder disease should be considered for cholecystectomy.
5. Early cholecystectomy should be considered in cases of acute cholecystitis if seen within the first 72 hours of symptom onset.
6. Open cholecystectomy and choledochotomy are indispensable surgical skills.
7. Routine intra-operative cholangiography is appropriate when open cholecystectomy is being undertaken.
8. Before the introduction of any minimally invasive approaches to gallbladder disease, the technical, educational, cost and sustainability implications should be thoroughly explored.

Brian Ostrow MD, FRCSC
Office of International Surgery
University of Toronto

Reference List


