Should Laparoscopic Cholecystectomy be Practiced in the Developing World?

The Experience of the First Training Program in Afghanistan

Richard G. Manning, MD, and Abdul Qayoume Aziz, MD

Objective: We address the controversial issue of whether or not it is wise to perform and train laparoscopic cholecystectomy (LC) in a developing nation by reviewing the results of the first large series done in Afghanistan. Afghanistan has been devastated by 3 decades of war leaving it with deficiencies in training programs, medical technologies, and overall medical infrastructure that are among the worst in the developing world.

Methods: We retrospectively reviewed 137 consecutive cholecystectomies, 102 laparoscopic and 35 open, performed by 4 senior and 3 junior surgeons trained at our hospital in Kabul from July 2005 until February 2008. Deaths, complications, conversion rate, operative time, and hospital length of stay were compared.

Results: Unrecognized major operative injuries occurred in 4 LC patients, 3 bile leaks, and 1 duodenal perforation, although there were no such injuries in the open cholecystectomy group. Complication rates were much higher for patients operated on for acute cholecystitis for both surgeon groups. Even though junior surgeons converted to open cholecystectomy more frequently than senior surgeons, they had a higher major complication rate. Hospital length of stay was 28% shorter for the laparoscopic group.

Conclusions: The high rate of major unrecognized intraoperative complications during LC in our series underscores the difficulties inherent in performing and training LC in developing nations. Practical changes are suggested to make LC more efficient and safer in a developing world hospital.

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Laparoscopic cholecystectomy (LC) was introduced to the developed world in the late 1980s,[1–3] and within a few years many countries[4–8] had replaced open cholecystectomy (OC) as the procedure of choice for patients with symptomatic cholelithiasis. This change was made in community practice settings[9] as well as in larger university teaching hospitals. Making the switch from OC to LC requires expenditures of resources, generally not available in developing nations, and may in fact be more expensive than OC causing some to question the wisdom of establishing laparoscopic training programs in that setting.[10,11] Indeed, whether or not it is advisable to start laparoscopic surgery of any kind in a developing nation remains controversial. Chaturachinda reported their experience with a laparoscopic sterilization program in Bangkok from 1974 through 1977 and concluded that laparoscopic sterilization is not cost-effective in developing nations.[12] Others have found mini-LC to be a safe alternative to LC in developing nations[13] and have even demonstrated the feasibility of performing OC as an outpatient procedure.[14] On the other side of this controversy are published series supporting the feasibility and utility of introducing laparoscopic surgery into developing nations,[15,16] even as a day-case procedure.[17–19] The difficulties encountered with establishing LC as the standard of care with results matching those in developed nations go beyond simply lacking an available supply of laparoscopic equipment and technical support. There is also a lack of other supportive services, notably endoscopic retrograde cholangiopancreatography and percutaneous transhepatic cholangiography, which have been shown to greatly assist in the management of pre, intra, and postoperative problems encountered in patients with symptomatic cholelithiasis.[20] In addition, the devastated medical infrastructure in Afghanistan has manifested itself in many other ways not all related to lacking sophisticated technology. Most of the physicians, surgical or otherwise, who have never left Afghanistan for education or other reasons have lived their entire lives amid the pressures and chaos of varying degrees of war. They have been trained in medical schools and hospitals by doctors and surgeons subjected to the same pressures. It is difficult to quantify the effects this scenario had on Afghanistan's medical and surgical training programs, but there is no doubt, that the educational process has not been standardized, has not been as closely monitored, has not been evidence-based, and therefore, has not been as effective. Considering all of the above factors, it stands to reason that surgical mortality and morbidity statistics for any procedure should be higher in Afghanistan, let alone one with more dependence on technology. We review the results of the first large series of LCs done in Afghanistan, identify some of the difficulties inherent in performing and teaching LC in this setting, and try to answer the question of whether or not we should continue teaching LC in Afghanistan. We then offer practical and inexpensive suggestions regarding how to improve complication rates of LC, as it is being established in a developing nation.

METHODS

CURE International, a US-based international nongovernment organization, signed a 50-year memorandum of understanding with the Afghan Ministry of Public Health in January of 2005 when it assumed management of a damaged and nonfunctional hospital in Kabul. The operating rooms were opened 6 months later in June 2005 after major renovations, and OCs, among many other procedures, were started at that time. Laparoscopic equipment was available and the operating room staff trained in its use by September 2006 when the choice of LC or OC was based on the surgeon's training and preference. However, clinical or chemical evidence of jaundice and sonographic findings suggestive of a common bile duct (CBD) stone were considered contraindications to attempting LC. After the introduction of LC, the total number of cholecystectomies in our hospital quickly increased (Table 1). One of 4 senior surgeons trained in a developed nation with experience performing over 100 LCs independently was present for 87 of 102, or 85% of the cases. Three were short-term visitors (1–4 weeks), while the fourth has been working in the hospital since the memorandum of understanding was signed. One of 3 junior surgeons (JSs) was present for 75 of

From the Department of Surgery, CURE International Hospital, Kabul, Afghanistan.
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Reprints: Richard G. Manning, MD, 701 Bosler Avenue, Lemoyne, PA 17043. E-mail: rickmanningcure@yahoo.com.

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102 or 74% of all cases. All 3 had completed approved surgical residencies and demonstrated competence in the performance of OC. There were differences in the training of the 3 JSs before their work at CURE hospital. Two received their medical degrees and surgical training outside Afghanistan. One had minimal clinical exposure to LC before coming to Afghanistan. The number of cases performed by each JS at CURE Hospital as the first assistant or primary surgeon before being granted privileges to perform LC independently, as well as the number of cases performed as an independent surgeon was tracked (Table 2). Their participation in LC at CURE Hospital was monitored and advanced from passive observer to independent surgeon as they demonstrated increasing competence in the performance of LC. Unfortunately, the first JS returned to Pakistan shortly after being granted LC privileges and the second JS was forced to leave the country because of the Korean hostage crisis. The third JS has completed 1 year of a 2-year fellowship with us. Only 1 monitor on the patient's right side was used. There were no set protocols for preoperative or postoperative workup and/or management of medical problems. Standard blood chemistries, blood counts, bleeding times, hepatitis profiles, electrocardiogram, chest x-ray, and internal medicine consultation were ordered as needed, although clearly not as reliable to what can be obtained in the developed world. Approximately, 40% of all patients received preoperative antibiotics and 20% received subcutaneous heparin. The majority of the cases were done with reusable equipment. Our protocol for sterilizing the reusable equipment has been published elsewhere.[21] At the completion of a case, the instruments were washed with a high-level disinfectant solution of 0.1% chlorinated water and placed in sterile container. Before their use, the instruments were again soaked in a 2% glutaraldehyde solution, rinsed with sterile water, and placed on the operative field. Light cables, camera heads, and cords were wiped off with the 0.1% chlorinated water and then placed in a formaldehyde container overnight for sterilization before the next use. At the end of January 2008, by review of the operative logbooks, we identified 159 consecutive patients who had undergone cholecystectomy with or without CBD exploration. There were 105 in the LC group and 54 in the OC group. We were able to recover the medical records for 102 LC patients and 42 OC patients. Seven patients in the OC group who also underwent CBD exploration were not included in the study. There were no mortalities among these patients. One suffered a bile leak, which was successfully managed by placing a drain. The remaining 102 LC and 35 OC patients form the basis of this retrospective study. Gallstones and cholecystitis were preoperatively diagnosed in all patients by ultrasonography.

TABLE 1. Total Cholecystectomies Completed Every 6 Months

	June 2005	December 2005	June 2006	December 2006	June 2007	December 2007
Open	0	6	9	4	8	7
Laparoscopic	0	0	0	16	36	39

Patient gender, age, comorbid disease, American Society of Anaesthesiologists classification, and severity of gallbladder disease were similar between the 2 groups (Table 3). The severity of gallbladder disease was determined by review of the operative note. Postoperative complications were categorized as major if a patient required admission to our high-dependency unit where we had noninvasive monitors or a return to the operating room, whereas all others were classified as minor. Mortality, operating time, and hospital length of stay (HLOS) were also recorded.

RESULTS

There were no mortalities in the study. In the OC group, 3 of 35 or 8.6% of the patients suffered minor complications consisting of 2 wound infections and 1 urinary tract infection (UTI), while 2 of 35 or 5.7% suffered major complications including 1 myocardial infarction and 1 pneumonia. There were no bile leaks or retained stones in the OC group. In the LC group, 4 of 102 or 3.9% of the patients suffered minor complications, consisting of 1 case each of urinary tract infection, wound infection, atelectasis, and ileus. Six of 102 or 5.9% of LC patients suffered major complications. One was a patient who developed a postoperative ventricular arrhythmia with a hypertensive crisis and myocardial ischemia, and another was a case of pneumonia. The other 4 were operative complications making an overall 3.9% major technical complication rate. There were no cases of retained CBD stones. The breakdown of operative complications and conversion for the LC group as they relate to the surgeon's experience and the severity of cholecystitis are summarized (Table 4). Three of the complications were bile leaks and 1 was a duodenal perforation. None of the major technical complications was recognized at the time of LC. The 3 bile leaks were detected on postoperative day 8, 10, and 3, respectively. The first 2 patients returned to the hospital after discharge with gastrointestinal complaints, abdominal pain, and distention. Sonography indicated subhepatic fluid collections consistent with biloma and a normal-sized CBD for both patients. The first underwent an initial attempt at sonogram-guided percutaneous drainage, which was unsuccessful. On postoperative day 10, the patient underwent laparotomy, CBD exploration, and placement of a T-tube. The second patient was stabilized with IV fluids and antibiotics, and then treated with CBD exploration and T-tube placement on postoperative day 11. The third bile leak followed LC for acute cholecystitis (AC). A drain was placed in the subhepatic space at the initial operation because of gross spillage of purulence from the gallbladder during removal and moderate oozing from the liver bed. Frank bile was noted coming from the drain on the second postoperative day and continued at a rate of 600 to 800 mL per day for another week. Sonography demonstrated a subhepatic fluid collection and a normal-sized CBD. On postoperative day 9, the patient underwent CBD exploration with placement of a T-tube. All 3 patients had their T-tubes removed within 3 weeks of placement, and follow-up 1 month later revealed no sequella. With respect to the etiology of the 3 bile leaks, the first followed the second LC of a JS and came from an area of necrosis at the cystic-CBD junction. The second leak followed an LC by a senior

TABLE 2. Training and Experience of Junior Surgeons

Junior Surgeon	Surgical Residency	Prior LC Experience	Number as First Assistant	Number as Primary Surgeon	Number as Independent Surgeon
1	Pakistan	Yes*	3	7	2
2	Korea	No	5	10	8
3	Afghanistan	No	15	20	5

*6-week course in France as observer and first assistant before coming to Afghanistan.

surgeon for a gangrenous and abscessed gallbladder and came from a pinpoint hole in the CBD immediately adjacent to the cystic duct stump. The third bile leak followed LC by a senior surgeon for chronic calculous cholecystitis and came from an accessory Duct of Luschka. The duodenal perforation clearly resulted from an unrecognized electrocautery burn to the second portion of the duodenum, and was the fifth LC of a JS. Persistent abdominal distention, right upper quadrant pain, fever, leukocytosis, and sonographic evidence of massive intra-abdominal fluid prompted abdominal exploration on postoperative day 5. The injured area was debrided and closed, the area widely drained and a feeding jejunostomy placed. Persistent sepsis prompted a second exploration 3 days later when larger drains were placed. Oral feeding was started on the 22nd postoperative day and the patient was discharged on postoperative day 26. All tubes were removed from the outpatient department on the 35th postoperative day. Four patients were converted to OC. Difficulty in identifying the anatomy of the biliary system was the reason for converting all 3 cases with AC. The one without AC was converted to control bleeding from the cystic artery. Of note, this was the first LC being performed by a visiting surgeon during his week with us. Time in the operating room averaged 98 minutes for the OC group and 111 minutes for the LC group. The average HLOS for the OC group was 6.9 days and for the LC group it was 5.0 days.

DISCUSSION

Our overall morbidity and mortality rates after the introduction of LC into Afghanistan compare favorably with rates reported in the developed[22–25] and in the developing[16] world. However, our 3.9% technical complication rate after LC is higher than that reported by others, both in the developed and developing world.[16,26,27] Management of these complications required laparotomy and was made more difficult by the lack of supporting radiology and endoscopy services. It has been well documented that the location and severity of bile duct injuries after LC is highly variable[28,29] and worth defining when planning therapeutic options.[30–35] Significantly, bile leaks such as ours arising from the cystic duct stump, an accessory duct of Lucshka or a very small injury to the CBD at its junction with the cystic duct can often be managed by endoscopic retrograde cholangiopancreatography with sphincterotomy and endoscopic stenting obviating the need for laparotomy.[36–39] Another problem related to lacking fluoroscopy equipment is our inability to perform cholangiography. The value of cholangiography, whether it is performed pre, intra, or postoperatively, or routinely or selectively in the management of biliary problems has been extensively researched.[22,40–47] Although various issues concerning the ideal role of cholangiography within the realm of biliary surgery have been debated, it is clear that hospitals with the capability to visualize the biliary anatomy will be more facile at handling CBD stones and injuries. Concerning issues related to the introduction of LC into existing surgical practices and training programs, it is well-known that the bile leak rates during the early days of LC were unacceptably higher than those traditionally seen for OC, especially when operating for AC. Fortunately, complication rates of all kinds including bile leaks were subsequently improved upon as the surgical community refined its techniques.[48,49] However, it is worth noting that surgeons teaching and learning LC in developing nations do not have the same advantages than those in the developed nations had when LC was introduced. In the developed world, a massive effort, largely funded by the industry manufacturing the equipment, was quickly organized and made available to surgeons both inanimate and animate training opportunities. The same has not been done in developing nations. In addition, surgeons trained in developed nations have undergone more standardized and thorough training than those who have obtained all of their training in a system that has been devoid of a supporting medical and cultural infrastructure, such as Afghanistan. This difference was evident in our situation by the need for more structured training of our Afghan surgeon before granting him privileges to perform LC. Ironically, Afghan surgical residents finish training with much more experience in open cholecystectomy than those in the developed world. With respect to biliary reconstructions, during the time of the study, we successfully performed 2 biliary-enteric bypasses for obstructive jaundice secondary to malignancy. Two other patients underwent segmental resection of the CBD with Roux-en-Y hepaticojejunostomy, 1 with obstructive jaundice secondary to an ascariasis and 1 with a type 1 choledochal cyst. As was the case in the developed world,[50,51] for LC to become the standard of care in Afghanistan or any other developing nation, it is essential for surgeons to indicate reductions in HLOS, pain, and days away from work. Our 2-day reduction in HLOS is not particularly inspiring in this regard especially as the average HLOS was still 5 days. However, much of the reason for the longer hospital stays was related to social issues, such as not having transportation to a remote location. We anticipate being able to reduce our average HLOS by implementing protocols which emphasize better preoperative planning and counseling, more liberal use of local anesthesia and antiemetics and aggressive mobilization after surgery. Based on all of the above, it is reasonable to ask whether we should delay further training in LC until more support from the medical infrastructure is available within Afghanistan. For the present, we have chosen to continue offering LC and to implement changes that may enable us to obtain better results. One easy and very practical step is for surgeons to have a lower threshold than normal for converting to OC, especially when operating for acute cholecystitis. Several authors have identified risk factors, age over

TABLE 3. Comparison of Risk Factors

	OC Group (n = 34)	LC Group (n = 91)
Age (mean)	49	45
Female patients	89%	81%
Diabetes	6%	9%
Hypertension	22%	30%
Lung disease	6%	7%
Liver disease	9%	3%
ASA class	1.5	1.4
Acute cholecystitis	22%	25%

TABLE 4. Laparoscopic Cholecystectomy Conversions and Technical Complications

	LC to OC Conversions	Total Technical Complications	Bile Leaks	Bowel Injuries
JS = 15	2/15 = 13%	2/15 = 13%	1/15 = 7%	1/15 = 7%
Senior surgeon = 87	2/87 = 2%	2/87 = 2%	2/87 = 2%	0/87 = 0%
Acute cases = 26	3/26 = 12%	2/76 = 8%	2/26 = 8%	0/26 = 0%
Nonacute cases = 76	1/76 = 1%	2/76 = 5%	1/76 = 1%	1/76 = 1%

60 years, male gender, WBC count over 13,000/mL, ultrasound finding of pericholecystic fluid, and diabetes mellitus,[52–55] that could have easily been applied in our setting to reliably predict the chance of converting, and/or having a complication when performing LC on patients with AC. Another practical step concerns visiting surgeons or those unfamiliar with operating in a developing country. These surgeons should be properly oriented to the OR and if at all possible, should be accompanied by a surgeon more familiar with the environment during the early phases of their work. A third recommendation is a very judicious use of electrocautery because of its potential to cause remote injury, a phenomenon of particular concern in laparoscopic surgery.[56–58] Other rationales can be made for continuing LC at our hospital. We have done 4 laparoscopic appendectomies and would do more if the equipment was not so expensive. In addition, like others,[59] we have used laparoscopy as a diagnostic method in place of computed tomography scanning to diagnose and biopsy 6 cases of intra-abdominal malignancy. Laparoscopy has also shown its merit for diagnosing other conditions not normally encountered in the developed world, such as tuberculous peritonitis.[60]

CONCLUSIONS

Health care technology and training within Afghanistan is several decades behind the rest of the developed world. Although laparoscopic techniques were revolutionizing the performance of cholecystectomy throughout the developed world in the early 1990s, Afghanistan was embroiled in a decade-old war and has not known sustained peace since then. Because of this, it is prudent for relief agencies working in Afghanistan to continually assess the costs of introducing any new technology. They are confronted with choices where the issue of risking resources is pitted against opportunities to advance medical services. Agencies that adopt a more cautious approach will minimize their loss of resources. On the other hand, it is also evident that having an overly cautious approach delays reconstructive efforts and may unduly perpetuate the negative consequences of not advancing technology. It is difficult to know what the best balance should be in situations such as these. However, it would seem that organizations with plans and systems that incorporate internal repair mechanisms into their overall mission are more likely to survive some of the inevitable insults, which they will be made to endure. In this light, training the local medical community is a critical element of developing sustainability for any reconstructive effort. Thus, despite the need to proceed with LC in a less than optimal environment, the value of training young laparoscopic surgeons capable of providing leadership to the next generation of Afghans seems to ultimately outweigh its potentially negative short-term consequences.

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