Appraisal of Laparoscopic Cholecystectomy

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This paper reports the experience of three general surgeons performing 304 laparoscopic cholecystectomies in three private hospitals between October 1989 and November 1990. Laparoscopic cholecystectomy boasts two major advantages over the conventional procedure: the remarkable reduction in postoperative pain and economic benefit, largely due to the patient's early return to work. Revealing a complication rate of 2% and no deaths, this study has shown that this procedure can offer patients these advantages with a medical risk no greater than that accompanying conventional cholecystectomy. Patient safety must be paramount, and it is the responsibility of the surgical community to ensure that all surgeons receive the highest quality training and that the technique is applied appropriately.

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MORE THAN 500,000 PATIENTS undergo traditional open cholecystectomy each year in the United States. While elective cholecystectomy now carries extremely low morbidity and mortality rates, the operation does incur sizable expense in terms of hospitalization and time lost from work. In the past several decades, research has been conducted along several avenues to develop less invasive, painful, and expensive methods of gallstone treatment. Such methods as the application of oral desaturation agents (chenodeoxycholic acid, ursodeoxycholic acid), contact dissolution agents methyl tert-butylene ether (MTBE), and extracorporeal shock wave lithotripsy are limited by stone content, size, and number. In addition they leave intact a gallbladder already known to harbor lithogenic bile. Thus these nonoperative methods are inadequate for a large proportion of gallstone patients and they cannot promise permanent cure from gallstone disease.

While embraced widely by American physicians only during the past two decades, laparoscopy was first described in Europe at the turn of the century.[1] Through the 1930s laparoscopic techniques and instruments to employ them were perfected, although the procedure was then used mostly to diagnose liver disease. Laparoscopy was first reported by Ruddock in the United States in 1933, and until the 1970s it remained largely a diagnostic procedure.[2] During that decade gynecologic surgeons developed laparoscopic tubal ligation, and in the early 1980s, Daniell[3] reported the combined use of laser and laparoscopy for the treatment of endometriosis. These laparoscopic operations produced less postoperative pain, required shorter in-hospital and outpatient recovery times, and allowed rapid return to normal activity.

The application of laparoscopy to general surgical diseases has increased in frequency and effectiveness in the past 5 years. Its use has been proposed to diagnose liver metastases and thus determine operability in pancreatic cancer. The first laparoscopic cholecystectomy was performed in May 1988 by DuBois in France.[4] In June 1988 McKernan and Saye performed a piecemeal cholecystectomy *via* the laparoscope (oral personal communication, October 1990). Reddick and Olsen,[5] however, devised the currently used method for laparoscopic cholecystectomy, performing their first case in September 1988.

Laparoscopic cholecystectomy achieves the goals of shorter recovery time, decreased expense, less postoperative pain, and improved cosmesis. It can be applied to nearly all patients with gallstones and by completely removing the gallbladder, should produce the same long-term results as standard open cholecystectomy. It has spread rapidly through the surgical world but without benefit of carefully controlled prospective studies. Thus we think it is imperative that experience with the procedure be reviewed carefully to ensure that the short-term

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gains mentioned above are not outweighed by increased deaths and long-term losses such as major common duct injuries.

We report our experience, as general surgeons, performing 304 laparoscopic cholecystectomies in three private hospitals between October 1989 and November 1990. We had the advantage of being tutored by Reddick and Olsen, the originators of the procedure.

Materials and Methods

Indications for laparoscopic cholecystectomy are the same as for the open procedure, that being symptomatic cholelithiasis. There were three asymptomatic patients in our series who underwent the closed procedure at the request of the medical service because of associated medical conditions. One patient had asymptomatic chronic myelogenous leukemia and the other two were diabetics, one anticipating pregnancy. The procedure was thought justified to eliminate the specter of possible serious situations should complicating acute cholecystitis occur in the future.

Contraindications

The early contraindications for using laparoscopic cholecystectomy were the presence of large stones, evidence of acute inflammation, common duct stones, or a history of previous abdominal surgery. The admirable cautiousness of those pioneers of the procedure is evidenced by their report of performing 25 minilaparotomy cholecystectomies during the same time frame in which they were proceeding with their first 25 laparoscopic approaches.[5] Experience has lessened the need for these dictums, but throughout the process of refining the procedure others will arise. Large stones can be removed without difficulty. Adhesions from the omentum to the anterior abdominal wall due to previous surgery usually can be taken down. Many acutely inflamed gallbladders can be removed, but each presents an individual decision. Common bile duct stones known to be present before surgery that cannot be removed by endoscopic sphincterotomy argue for an open cholecystectomy with choledocholithotomy. Although pregnancy has not been considered a firm contraindication to laparoscopic procedures by gynecologists, we think an open cholecystectomy is preferable should symptomatic cholelithiasis demand surgical intervention during gestation.

Operative Technique

It should be mentioned at the outset that good functioning equipment and trained personnel knowledgeable in its use and maintenance are of paramount importance in carrying out a laparoscopic surgical program.

General anesthesia was administered to patients throughout this series with no related complications. All patients received a broad spectrum antibiotic during induction of the anesthesia. The operative technique employed uses video monitors and instrumentation through four cannulas introduced by trocars (two 5 mm, one 10 mm, and one 11 mm) into the peritoneal cavity that has been distended by the insufflation of 3 to 4 L carbon dioxide. The insufflation is accomplished by inserting a Veress needle[6] through the umbilicus or one of the four quadrants of the abdomen, varying these locations to avoid possible bowel loops adherent to the anterior abdominal wall from previous surgery (Fig. 1). The initial video camera can locate these possible adhesions, which usually can be removed by dissection from other ports.

A Hasson cannula always can be inserted through the umbilicus to avoid adhesions from previous surgery and allow safe insufflation.[7] It has been used in six patients in this series and has been a significant aid in safely determining the status of intra-abdominal adhesions in the area of previous incisions at the umbilicus. A slightly longer incision, approximately 2 cm, is made in the umbilicus and carried carefully through the linea alba fascia. By blunt dissection with the finger and a clamp, the presence or absence of underlying adhesions or a loop of intestine is determined and, if present, pushed aside to allow finger entry into the free peritoneal cavity. The Hasson cannula then is passed into said cavity and held in place by a 0-polyglactin suture taken in either side of the fascial opening and hooked to the cannula holding it firmly in place, thus preventing the escape of pneumoperitoneum (Fig. 2). Adhesions of the omentum to the anterior abdominal wall usually can be dissected away bluntly or with cautery to allow appropriate cannula insertion and exposure of the gallbladder. Fitzgibbons has used the Hasson cannula in every case, thus avoiding any Veress needle or trochar injury (oral personal communication, October 1990).

Once the cannulas are in place, reverse Trendelenberg position is assumed and the patient tilted to the left.

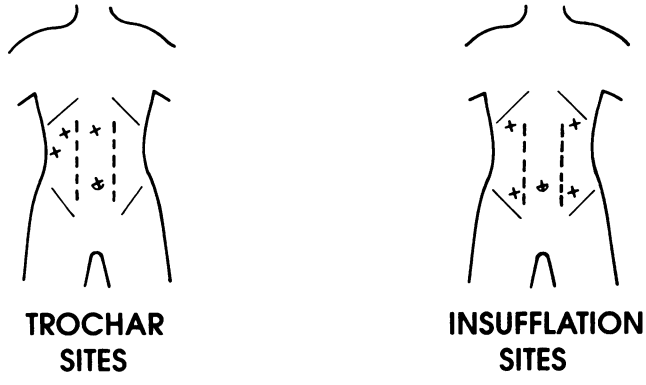


FIG. 1. Possible CO^2 insufflation sites (umbilical and right upper quadrant most frequently used) and subsequent trochar sites.

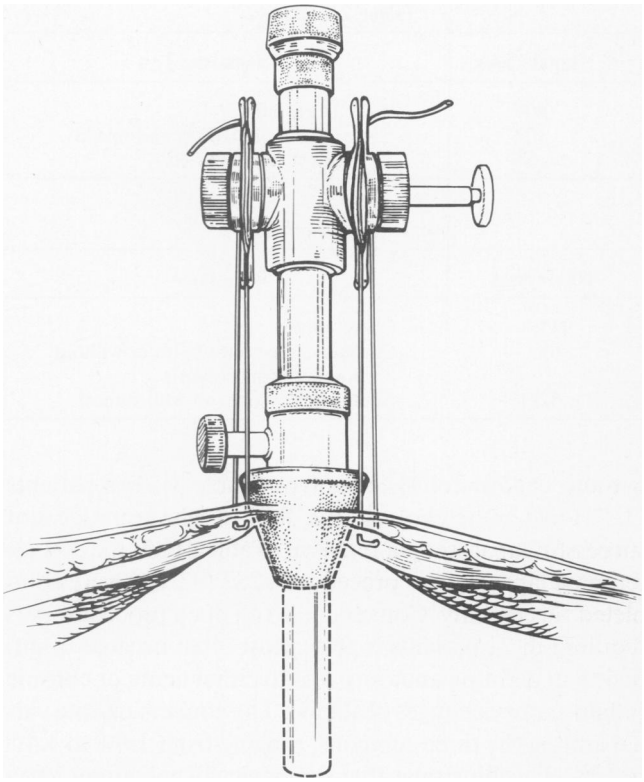


FIG. 2. Hasson cannula with sutures applied to the paraumbilical fascia and hooked to the cannula.

Graspers are then used to retract the fundus of the gallbladder laterally and cephalad and the infundibulum laterally or medially. Appropriate traction is of utmost importance, and if the graspers repeatedly slip from their purchase of a distended gallbladder, partial or complete aspiration is used at will. Acutely inflamed gallbladders are always aspirated.

It is of singular importance that the junction of the gallbladder and the cystic duct be demonstrated accurately. Accordingly dissection should begin by stripping the peritoneum and fat from Hartman's pouch down to and then from the cystic duct. Calot's triangle should not be entered first. The artery then is dissected at this time if available, but this can be delayed if the duct blocks proper visualization. At this point, a cholangiogram can be made by inserting a catheter into the cystic duct just proximal to a clip applied at the junction of the duct with the gallbladder. A catheter is held in place with an Olsen clamp around the cystic duct, and 15 mL of contrast material is injected with all structures in view before graspers are removed. An additional 5 to 10 mL of contrast is injected just before the first of two films is made (Fig. 3).

An alternate cholangiographic method being studied consists of aspirating the bile from the gallbladder and injecting 30 mL of contrast material under C-arm observation. This not only allows evaluation of the common bile duct for stones or blockage but also gives the advantage of outlining the ductal anatomy (Figs. 4 and 5). If universally employed, this technique could reduce greatly the incidence of common bile duct injuries.

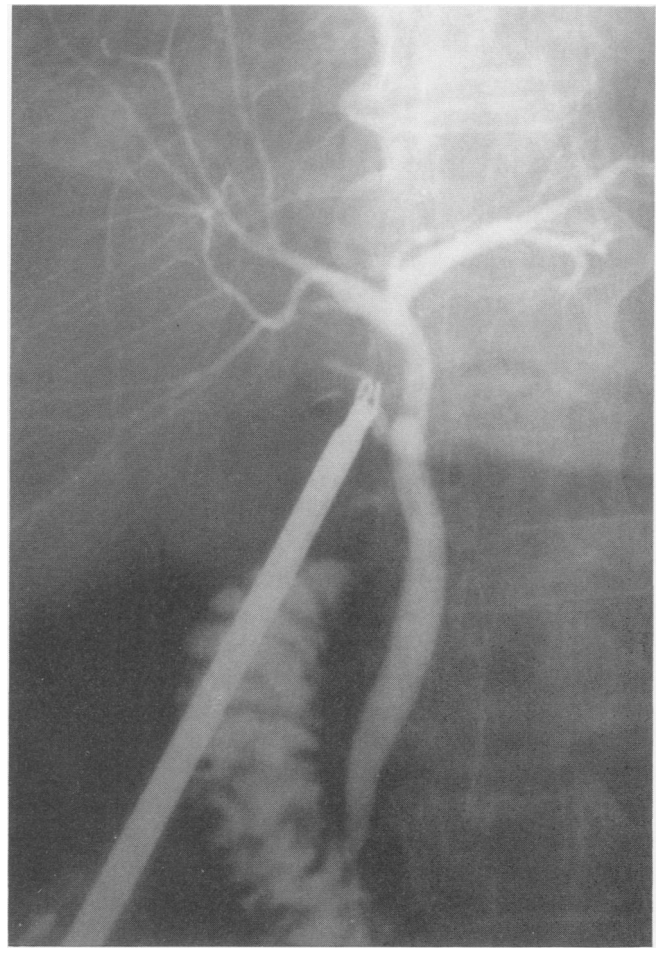


FIG. 3. Normal intraoperative cholangiogram made *via* catheter in cystic duct and held in place by an Olsen clamp.

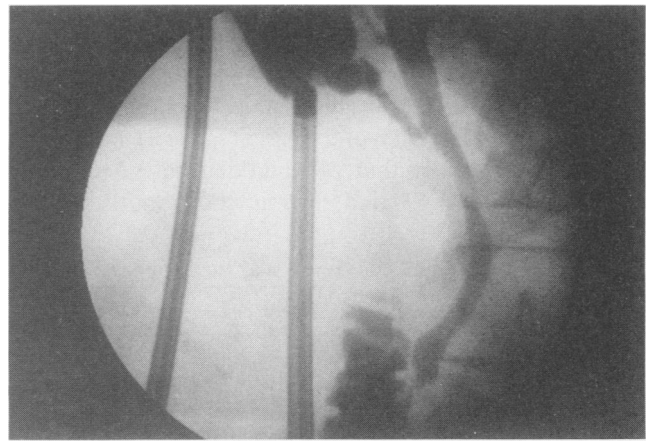


FIG. 4. Normal intraoperative cholangiogram *via* gallbladder with C-arm fluoroscopy.

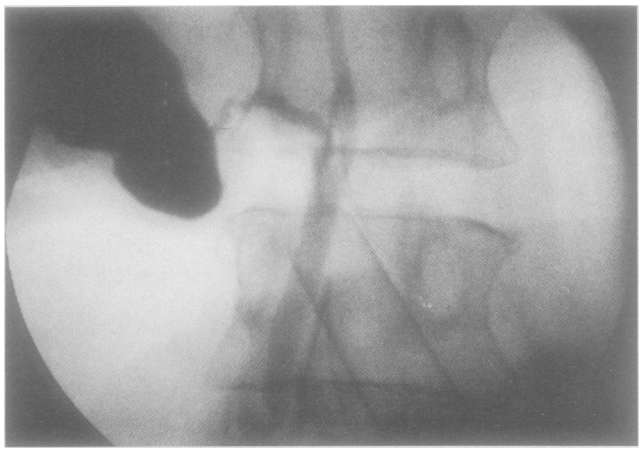


FIG. 5. Intraoperative cholangiogram *via* gallbladder C-arm revealing the cystic duct emptying into the right hepatic duct or an accessory duct.

After applying distal and at least two proximal clips to the cystic duct and artery, they are divided with scissors. The gallbladder is retracted anteriorly and the mesentery between these structures and the liver is dissected for a frequently found additional artery. The gallbladder then is dissected away from the liver with an electrocautery or laser, effecting hemostasis in the process.

Before the gallbladder finally is detached from the liver, the previously dissected liver bed and Calot's triangle area should be inspected carefully for possible bleeding. These areas are difficult to re-examine after the gallbladder has been detached from the liver. If the gallbladder is torn during the dissection, the bile and small stones can be suctioned away and the opening closed with a chromic catgut endoloop. If stones escape, however, they should be recovered as well as possible. With adequate irrigation and suction, we have experienced no complication with the escape of bile and a few stones.

Results

Of the 304 patients in this study, 82% were female, and the ages ranged from 14 to 83 years, with an average of 50 years. Weight ranged from 90 to 312 pounds, with an average weight of 164 pounds (Table 1). Ultrasound was used for diagnosis in 90% of the cases (Table 2). Pathologic examination revealed that 94% had demonstrated stones and the remaining 6% had chronic cholecystitis with or without cholesterolosis or polyps (Table 3). Ten patients (3.3%) had acute cholecystitis, four of whom underwent successful laparoscopic removal (Table 4). Of the 304 attempted laparoscopic procedures, 283 (93.1%) were completed successfully. Conversion to an open procedure was required in 21 patients (6.9%), most often because of difficulty in defining anatomy due to either acute or chronic inflammatory changes (Table 5). The conversion rate varied among the three surgeons, ranging from 1.6% to 4.4% to 12%. This illustrates that surgeons will encounter varying pathologic conditions and must manage each case in the safest possible manner. No conversions were required for uncontrolled bleeding and no subsequent laparotomies were necessary. Operative time ranged from 35 to 216 minutes and averaged 99 minutes. The laser dissection was used in 41% and cautery in 59%. Most cases in the last 4 months of this study were done with the cautery. Cholangiograms were attempted in 170 patients (56%) and successfully completed in 100 patients (Table 6). They were normal in 93% of the studies made. Postoperative endoscopic retrograde cholangiopancreatogram (ERCP) was carried out in five patients in whom intraoperative cholangiogram indicated stones. Regarding this patient group, stones were found and successfully removed by endoscopic sphincterotomy in three patients (Figs. 6 and 7) and no stones were found in two patients. Preoperative ERCP was performed in 11 patients because of suspected common duct stones. No stones were found in eight patients, and stones were found and successfully removed in three patients. It is important to note that in this 16-

TABLE 2. *Diagnosis*

Total Cases	Diagnostic Test
90%	Ultrasound
10%	OCG, CT, HIDA, and/or US
5%	No stones reported

TABLE 3. *Pathology*

Total Cases	Pathology
94%	Cholelithiasis
6%	Chronic cholecystitis (with or without cholesterolosis polyp)
3.3%	Acute cholecystitis (all with stones)

TABLE 1. *Laparoscopic Cholecystectomy*

Demographic Data	
Female	82%
Male	18%
Age	14–83 years (avg., 50 years)
Weight	90–312 lbs (avg., 164 lbs)
	29 female patients > 200 lbs
	11 male patients > 200 lbs

TABLE 4. *Acute Cholecystitis (n = 10)*

Cases	Pathology
6 Converted	3 hydrops
	2 acute and chronic
	1 empyema
4 Removed	1 hydrops
	1 acute hemorrhagic
	2 acute and chronic

TABLE 5. *Conversion to Open*

	No.
Acute cholecystitis	6
Chronic scarring	6
R/o CBD injury	2
Cystic duct stone impaction	2
Obesity	1
Difficult dissection	17
CBD injury	1
Carcinoma gallbladder	1
Benign liver tumor	1
Small intestine injury	1
Conversion to open cholecystostomy	21 (6.9%)

patient group pancreatitis developed in three of these patients and delayed surgery in two.

Complications developed in eight patients (2%), six of whom had prolonged ileus (Table 7). Ileus accounted for all three readmissions to the hospital. No secondary laparotomies were required, and no retained common duct stones have been encountered. The single common duct injury occurred when a cholangiogram was performed through a small common duct. This was recognized on the cholangiogram and successfully managed by repairing the choledochotomy over a size 8 T tube. Anterior traction of the gallbladder can straighten the angle of the cystic and common ducts and cause the surgeon to mistake a small common duct for the cystic duct (Fig. 8). There were no pulmonary complications, infections, or deaths.

Eighty-six per cent of our patients were admitted on the day of surgery, with 75% discharged within 24 hours of surgery and 89% by 48 hours (Table 8). This compares to an average hospital stay of 6.1 days for an open cholecystectomy.[8] The time for return to the patient's occupation averaged 7.35 days, ranging from 2 to 21 days. Examination of hospital costs revealed a savings, which varied at the three institutions, ranging from $1500.00 to essentially the same charges for laparoscopic cholecystectomy when compared to an open, uncomplicated cholecystectomy. The lack of more substantial savings despite shortened hospital stay appears to be related to the current expense of the equipment charges from the operating room.

Unexpected pathology was found in three instances: peritoneal implants from an asymptomatic carcinoma of the pancreas in an 83-year-old woman, carcinoma of the gallbladder in a 43-year-old man, and a benign hepatic tumor in a 40-year-old woman. An associated bilateral oophorectomy was performed on one posthysterectomy patient.

TABLE 6. *Cholangiography*

	Cases
Attempted	170%–56% (total)
Successful	100%–59% (attempted)
Normal	93
Abnormal	7–1 choledochal cyst 1 suspicion CBD injury 5 ? CBD stones

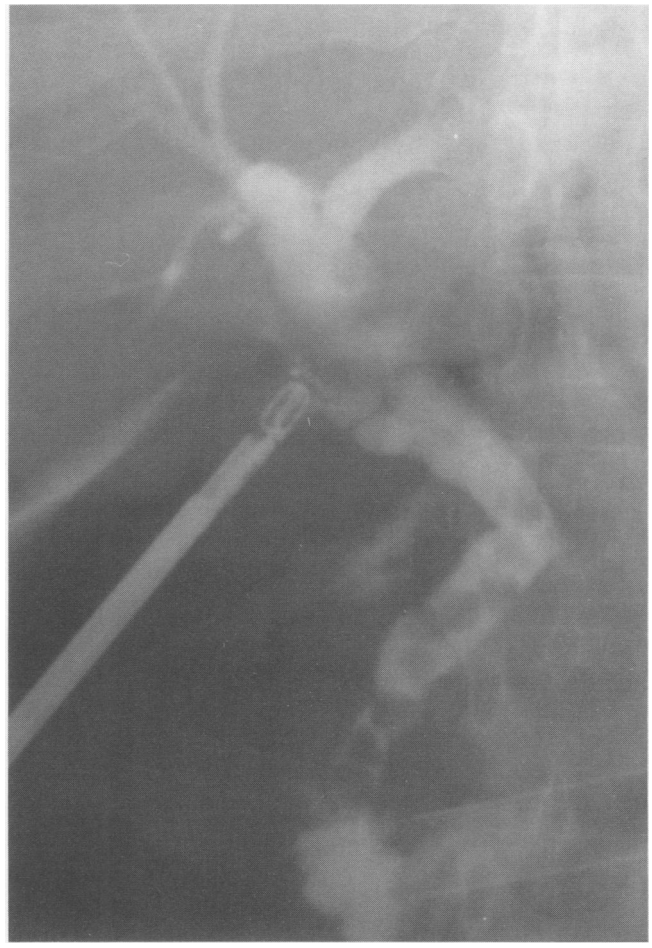


FIG. 6. Intraoperative cholangiogram *via* cystic duct catheter showing multiple common bile duct stones removed 4 days later by endoscopic sphincterotomy–balloon technique.

Discussion

The morbidity and mortality rates of elective conventional cholecystectomy have diminished to extremely low levels in the past several decades. Innovative gallstone treatment should at least match this success rate. This study was undertaken to clarify the benefits of laparoscopic cholecystectomy and to ensure that these are not accompanied by unacceptable medical risk.

Laparoscopic cholecystectomy boasts two major advantages over the conventional procedure. The first is remarkable reduction in postoperative pain, and although seemingly obvious, this has not been quantified. Patients may experience some soreness around the incisions and sometimes right shoulder pain referred from CO^2 and fluid trapped beneath the diaphragm. It has not yet been documented whether this reduction in pain will result in de-

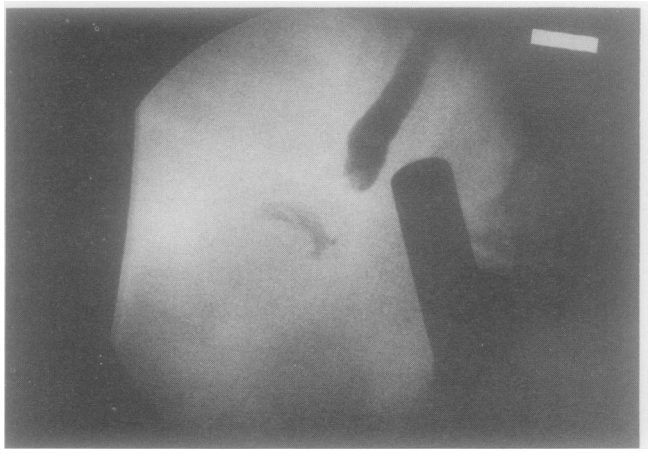


FIG. 7. Intraoperative cholangiogram *via* the gallbladder revealing a stone in ampulla of the common bile duct, removed 4 days later by endoscopic sphincterotomy–balloon technique.

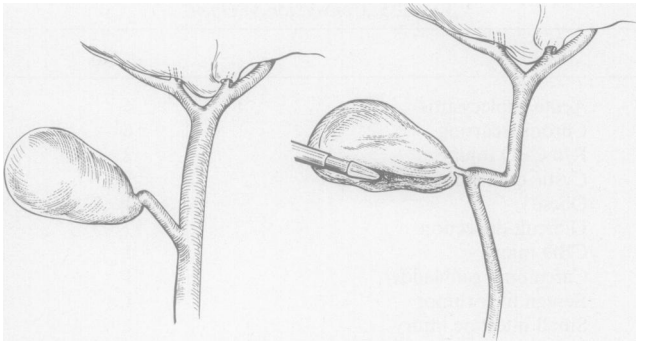


FIG. 8. Sketch illustrating relative normal gallbladder cystic duct–common bile duct relationships and sizes, and how anteriolateral traction of the gallbladder can distort this relationship and make a small common bile duct have the appearance of a cystic duct.

creased pulmonary or cardiac complication rates, but these problems have not been experienced in our series. It is an interesting concept that the pain of a procedure results mostly from the incision and not from visceral dissection.

The second major area of benefit is largely economic. Because the bowel is minimally manipulated, if at all, laparoscopic cholecystectomy results in a smaller incidence of postoperative ileus. This, along with the reduction in pain, allows a shortened hospital stay. While 77% of our patients have remained in the hospital one or two nights, 12% have been allowed, after careful screening, to leave the hospital the evening of the operative day. This compares well to a mean length of stay for conventional cholecystectomy of 6.1 days. This decreased hospitalization has not yet resulted in significantly lower hospital costs because the savings are currently offset by the high cost of the equipment and thus greater charges for its use. These costs may diminish as the equipment becomes more readily available and perhaps less expensive.

The greatest economic benefit of laparoscopic cholecystectomy comes from the rapid return to normal activity that it permits. Most patients are discharged from the hospital without activity restrictions and can return to work as soon as they feel able. Our mean return to work of 7.3 days is certainly superior to the 3 to 6 weeks usually required after the open procedure. Again, while not yet documented, this should result in great personal savings and thus overall societal gain.

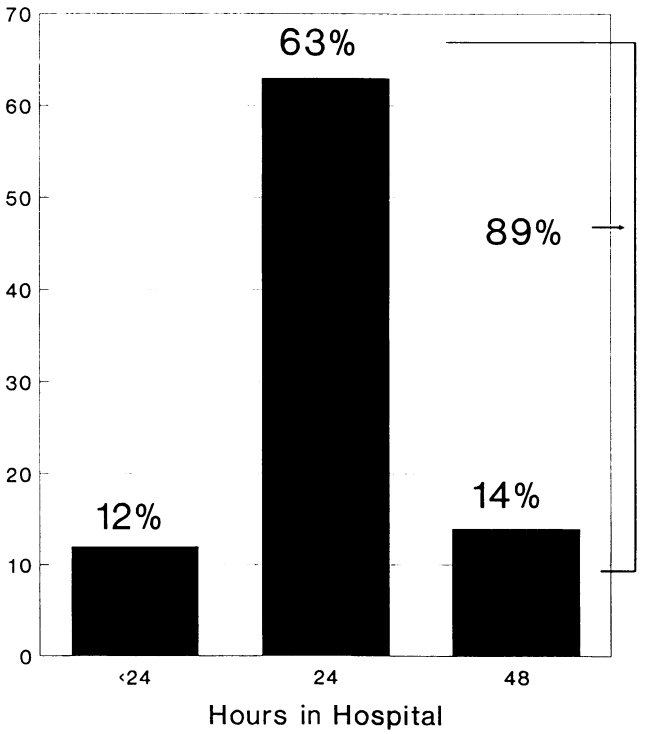
Are these benefits outweighed by undue surgical risk? From our experience, we think the answer is no. In our series we found only six episodes of ileus, three significant postoperative fevers, and one small bowel injury that occurred during dissection of an abdominal wall adhesion. One minor common bile duct injury occurred that was recognized and immediately repaired at the initial oper-

TABLE 7. *Complications*

Complication	No.
Prolonged ileus	6
CBD injury	1
Small bowel injury	1
Death	0
Bleeding	0
Trochar injury	0
Bile leak	0
Abdominal or Wd infection	0
Pulmonary	0
Total	8 (2.0%)

CBD, common bile duct, Wd, wound.

TABLE 8



ation without sequelae. We had no episodes of significant bleeding and none of our patients required reoperation. In those instances of conversion to an open procedure, we did not consider the conversion either a complication or a failure because in each instance this course was chosen by the operating surgeon as the safest for the patient. This emphasis on patient safety above all else may in part be responsible for our relatively low complication rate.

Accompanying the explosive adoption of laparoscopic cholecystectomy have been many anecdotes about unrecognized common bile duct injury, severe bleeding, and even death. Such anecdotes make it imperative that all surgeons honestly collect and review their results and that all surgeons performing the procedure be thoroughly trained and strictly credentialed. All staff surgeons at our three hospitals are certified by the American Board of Surgery. The hospitals' credentialing committees currently require the following: completion of accredited courses in laparoscopy and laser (if laser is to be used) and a preceptorship with a trained laparoscopic surgeon on at least 10 patients, with the applicant as operating surgeon in three. While these criteria are fairly easy to satisfy in a medical center where there are many trained surgeons, they are much more difficult to meet in areas where the technique is not yet practiced. A realistic solution to the problem of training has not yet been identified but is one that the surgical community must address if the procedure is to succeed for the public good.[9–11]

We have used both laser and cautery in the past but now have converted almost entirely to the cautery because it is more hemostatic, less expensive, and may be safer for the patient. We found no difference in postoperative recovery that would support the exclusive use of the modality.

Intraoperative cholangiography can be carried out in most patients undergoing laparoscopic cholecystectomy. It may evolve that it can be performed in all patients, except those with cystic duct obstruction, when the gallbladder injection with C-arm use is used. The indications for performing the study in the laparoscopic setting should be the same as for open cholecystectomy, and this is varied from specific clinical and anatomic criteria to its routine use in all patients.[12,13] Although the incidence may be small, we have encountered two patients with common duct stones without clinical history or laboratory findings suggestive of their presence (Figs. 6 and 7). The value of outlining the ductal anatomy is another strong reason for its routine use in the laparoscopic setting. Fitzgibbons advises its use in all cases of acute cholecystitis to confirm ductal position (oral personal communication, November 1990).

The need for preoperative ERCP in patients suspected of having a common bile duct stone should be evaluated carefully. There should be objective evidence by laboratory findings, ultrasonography, or radionuclear scan. If the indication is questionable, we favor waiting for an intraoperative cholangiogram confirmation. If this study indicates common bile duct stones, a postoperative endoscopic sphincterotomy then can be used. Although the incidence is low, ERCP carries a distinct risk of complication and should not be used at will.

Despite the rapid recovery and great patient satisfaction with this method of gallbladder removal, we emphasize that the indication for operation should remain symptomatic cholelithiasis. The initial contraindications to the procedure (acute cholecystitis, intra-abdominal adhesions, and suspected common duct disease) became more relative as our experience increased. While these conditions do make the procedure more difficult, they can be managed safely through the laparoscope along with patience and judgment. It may be advisable for the learning surgeon to avoid laparoscopic procedures in patients with increased technical risk until his or her experience grows, or to operate on such patients with another trained surgeon. Portal hypertension and coagulopathies should be approached with great caution.

Laparoscopic cholecystectomy can be performed with a very low morbidity rate, at least equal to that of the open procedure. The decreased operative discomfort may produce medical benefits, which remain to be identified. With adequate training, sound judgment, and highest priority given to patient safety, the risk of life-threatening or life-changing injury is minimal. Patient demand has fueled rapid dissemination of this technique throughout the country, but despite this, it is the responsibility of the surgical community to ensure that all surgeons receive the highest quality training and that the technique is applied appropriately.

Acknowledgments

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Discussions

Dr. William Meyers (Durham, North Carolina): Back in April at Vanderbilt University, the Southern Surgeons Club convened. This is a travel club of which one of the cofounders is Dr. DeBakey. At that time several participants reviewed their early preliminary experience with laparoscopic cholecystectomy. It was decided at that time to enter into, in a collaborative way, a prospective analysis of the perioperative complications.

There were 20 participants who ended up being in the study, representing 59 surgeons.

The surgeons just happened to be equally divided into academic *versus* private practice surgeons, with 10 coming from each, the definition of academic being the regular presence of residents participating in the surgery.

There were 1518 cases of laparoscopic cholecystectomy performed, with about one half performed by the private practice and one half by the academic surgeons. And the overall complication rate was 5.1%.

The number of conversions that were counted as complications was about 0.09%. That is there were conversions that were solely for the reasons of identification of anatomy and scarring that were not counted as complications.

There was one death in the series. That was a patient who underwent a laparoscopic cholecystectomy for what was thought to be subacute cholecystitis, and the patient did well initially for about 2 days and then died on the third postoperative day of a posteriorly ruptured 3 cm abdominal aneurism, which probably represented, in retrospect, a mistaken diagnosis.

The most common complication was superficial wound infection. The other complications were as listed, with 13 contributed from the conversion group, seven bile duct injuries, but there was actually an eighth injury that occurred after conversion to open cholecystectomy. There were a number of other complications, of which bowel injury is a prominent one. Four of them occurred in the series, two with the safety shield trochar and two without. We do not know the denominator of that, however. There were 31 other complications, of which many were very minor, including a delay in hospitalization of 1 day for a preoperatively arranged cardiology consultation.

As mentioned, the bile duct injury number was 7, representing 0.5% of the total group. Four of those injuries were recognized at the time of laparoscopic cholecystectomy and immediately converted and repaired with simple repairs, two of which required T-tube insertion. Three were unrecognized and represented significant complications.

The injuries occurred in cases 2, 3, 10, 12, 13, 25, and 43 in various surgeons' experiences. The exact bile duct injury rate was overall 0.47%. The unrecognized injury rate was 0.2%. The injury rate in the first 13, the unlucky 13 of anybody's series, was 2.2%. And after 13, 0.1%, which is favorable compared to the conventional rate of 0.2%.

The only difference between the academic and the private practice group was in mean operative time. Academicians were slower, averaging about 35 minutes or longer per case.

One glaring observation is the relatively low incidence of common duct disease found either before or during operation of only 1.8% compared to the expected 8% to 16%. And in the short time of follow-up, there has been a retained stone rate of 0.04% that has been recognized. I think we have to be alerted to that possible complication.

As has been shown previously in others' data, in the large group, the hospital stay is significantly shortened, with about 14% of patients discharged on the same day of hospitalization.

Dr. Randle Voyles (Jackson, Mississippi): This certainly is an important meeting, for this is the first presentation of laparoscopic cholecystectomy at the Southern Surgical Association, and I congratulate the authors in each of the three papers on their presentations.

It is particularly important that we sort out specific criteria for successful as well as a cost-effective application of this procedure across the country. For it is rapidly becoming available and it may be easier to teach someone how to do this procedure in a cost-effective fashion rather than reteach them later.

I will limit my discussion to three largely technical areas of this procedure. My data base for comments is a series of 500 patients completed in Jackson, Mississippi with no ductal injuries and no deaths.

It is increasingly clear that there is probably no patient benefit with laser dissection of the gallbladder. As many of you know, I have been doing an informal survey between sessions of this meeting. There are basically three categories of laparoscopic surgeons here.

There is the one group of surgeons who started with electrocautery and have continued with it. The second group, of which I am part, started off with laser and switched over to electrocautery and is not going back. And then there is a third group of surgeons, laser proponents who have limited experience with electrosurgical dissection.

I have also included in my informal survey the additional patient cost of laser dissection for the gallbladder. It starts at $250.00 in Nashville, where Dr. Graves is—and perhaps they have an additional benefit of cheaper costs because they got into the lasers earlier and perhaps purchased their equipment more cheaply. But it extends up to $1100 in some of the centers, where the expensive disposable fibers are used.

Again there is no claim of patient benefit by any of the surgeons using laser dissection over electrosurgical dissection.

The final question that I would raise concerns the business of operative cholangiography. Bill Meyers just noted that only 2% of patients seem to have common duct stones. So why are we going to be doing cholangiograms in the other 98%? Well one reason is to prevent injury, but Dr. Graves, I would quibble with the data supporting the case for routine operative cholangiography.

Dr. Graves I would quibble with you a bit about your own data. It appears to me that your cholangiogram might well have been the source of the injury rather than have prevented it.

Because the incidence of common duct stones seems to be so low, it seems to be important to develop more sensitive clinical parameters to determine who does not have common duct stones.

Dr. David Adams (Charleston, South Carolina): In 1987 Philippe Mouret performed laparoscopic cholecystectomy in Lyon, France. In 1988, as has already been mentioned, DuBois in Paris and Périssat in Bordeaux joined Mouret in carefully advancing the frontiers of this new technique.

The initial French experience has been analyzed recently by Professor Perisot and his additional data to support the conclusions that have been presented today. Périssat noted a 0% mortality rate, a 4.8% morbidity rate, and a 6.4% conversion rate in 2300 laparoscopic cholecystectomies, which were performed by 20 surgeons during a 3-year period.

One per cent of patients required open operations for complications of laparoscopic cholecystectomy, an issue that requires close scrutiny, as Dr. Graves and Dr. Jones have done today.

The Achilles heel of laparoscopic cholecystectomy, of course, is accidental injury of the common bile duct, and the questions I wish to ask Dr. Graves and Dr. Jones relate to this issue.

That is, does operative cholangiography prevent common bile duct injury during laparoscopic cholecystectomy and, thus, is cholangiography mandatory?