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Laparoscopic Cholecystectomy: The State of the Art. A Report on 700 Consecutive Cases

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Born in secret in 1987, developed in an atmosphere of skepticism and even hostility throughout 1988, the laparoscopic cholecystectomy triumphed in 1989–90 and caused a veritable revolution in the world of general surgery. The 700 consecutive cases that we report here reflect the spirit of these various periods. From prudently restrictive, our indications widened to include 90% of all patients with gallbladder lithiasis. Sclero-atrophic gallbladders constitute the greatest challenge for endoscopic maneuvers. This group of patients should be treated by the most experienced operators only. The figures for mortality (0.1%) and complications (3%) are very comparable and even better than those for traditional cholecystectomy. The quality of recovery is infinitely better; there is absence of pain, a short period of hospitalization, return to normal physical activity within 10 days, rapid return to work, and total preservation of the abdominal muscles for participation in sports activities. All these advantages are assets of the laparoscopic cholecystectomy which are not available to the 6% of patients for whom an intra-operative conversion to open surgery is necessary. These patients recover within the conditions of a traditional cholecystectomy which are far from being poor. The large multicenter studies, such as those carried out in France and Belgium recently involving 3,708 patients, arrive at identical conclusions. The laparoscopic cholecystectomy is on its way to becoming the gold standard of treatment for gallbladder lithiasis. It is the first successful step towards surgical techniques of the 21st century which will be carried out inside the musculo-cutaneous envelope of the unopened human body.

The laparoscopic cholecystectomy (LC) was born in secret in March 1987 [1]. Its first instigators developed the techniques throughout 1988 in an atmosphere of skepticism and even hostility. The excellent quality of their results, however, ensured that the technique triumphed in 1989, both in Europe [2, 3] and in the United States [4, 5], and then rapidly throughout the rest of the world. Suddenly LC opened the eyes of general surgeons to the fact that the addition of endoscopy to their operating techniques was of the highest interest for their future and that of their profession. What term can one use other than "revolutionary" to describe this sudden awareness which exploded on the scene, giving the innovators a new found freedom, impetus, and enthusiasm, showing the way forward in a discipline which was slowly seeing its field of application being whittled away. As with all revolutions, this one could have led to unconsidered, untimely, or even extreme action. The pioneers of the LC no longer have to convince their entourage, but rather try to temper some rash impulses.

We started our laparoscopic approach to the lithiasic gallbladder in November, 1988. We rounded the cape of 100 cholecystectomies in December, 1989 [6]. Since then new instruments have been made available to us, new results have been published, and numerous teams have started working in the field. By June, 1991 we had carried out 700 consecutive LC. The aim of the present article is to report on these operations and draw some conclusions regarding evolution of our techniques, our indications, and our results.

Patients

From November, 1988 to June, 1991 704 patients underwent LC. Sex and age are indicated in Table 1. These patients are a heterogenous group since they span the entire time period during which our criteria for selection and our operating techniques evolved. They can be divided into three groups.

Group I consisted of our first 100 patients. Since we were in practically unknown territory, we deliberately selected patients suffering from biliary colic for this new procedure and excluded those with acute cholecystitis or numerous previous acute infectious attacks. We also excluded patients with common bile duct lithiasis, patients presenting a cardiorespiratory risk, however small, and pregnant women. However, we did not eliminate obese patients. The pre-operative evaluation included cardiorespiratory assessment, hepatic assessment including hepatic function tests based on cholestasis (bilirubin, transaminases, alkaline phosphatase, gamma-GT), ultrasonography of the liver and the biliary tracts, and intravenous cholangiography with tomography. In case of poor image (with obese patients in particular) we also carried out cholangiography by endoscopic retrograde cholangiopancreatography (ERCP). This group of patients comprised our activity from November, 1988 to December, 1989.

Group II consisted of 547 patients. The only absolute contraindications to LC were the existence of an unstable cardiac state and previous surgical operations at the sub-mesocolic

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Table 1. Patients undergoing laparoscopic cholecystectomy, November, 1988–June, 1991 (n = 704).

Clinical characteristic	
Age (yrs, range)	13–83
Sex	
Male	168
Female	536
Mortality (%)	1 (0.13)
Laparotomy conversions (%)	41 (5.8%)
Complications (%)	26 (3.7)
Common bile duct injuries (%)	3 (0.4)

level having involved the stomach, the liver, and the pancreas. In this group, 150 patients underwent surgery semi-urgently for acute cholecystitis. Sixty-three patients had long history of bouts of acute cholecystitis treated medically. None of these patients presented symptoms, either in the past or more recently, that might have suggested the presence of common bile duct (CBD) stones. However, we did systematically look for the presence of just such asymptomatic stones. Pre-operative evaluation included cardiorespiratory assessment, hepatic assessment including hepatic function tests and counts for bilirubin, transaminases, alkaline phosphatase and gamma-GT, and morphological assessment including ultrasonography of the biliary tract. This assessment was completed by cholangiography in certain specific circumstances. If ultrasonography showed a CBD caliber of ≥8 mm, cholangiography by ERCP was carried out. If ultrasonography was normal but the hepatic function tests showed anomalies (alkaline phosphatase and gamma-GT higher than normal either in an associated or disassociated manner), an intravenous cholangiogram with tomography was carried out or, in the case of an overweight patient, an ERCP was carried out since the intravenous cholangiogram can often be misinterpreted with this kind of patient.

Group III consisted of 53 patients who were referred to us for treatment of biliary lithiasis and whose principal symptoms were the presence of one or several CBD stones. These patients also presented gallbladder lithiasis. All these patients underwent the same cardiorespiratory and hepatic-biliary function assessment tests as the Group II patients. In addition they all underwent cholangiography by ERCP.

Operating Techniques and Their Evolution

Instrumentation

Instrumentation has varied somewhat from our first publication, given the development of a number of new instruments [6]. We prefer to use an axial vision laparoscope, either at 0° or inclined at 30° for carrying out the laparoscopy. For dissection, hemostasis, and control of the bile duct we continue to use an electrocoagulation hook which uses monopolar current with variable intensity, mixing sectioning and coagulating. We also use bipolar current. We tend to use scissors increasingly for dissection purposes. We no longer use Filchee clips, preferring instead to use titanium clips. The automatically rechargeable clip-holders represent a considerable gain in time and in operating comfort.

When the gallbladder contains stones >10 mm in diameter

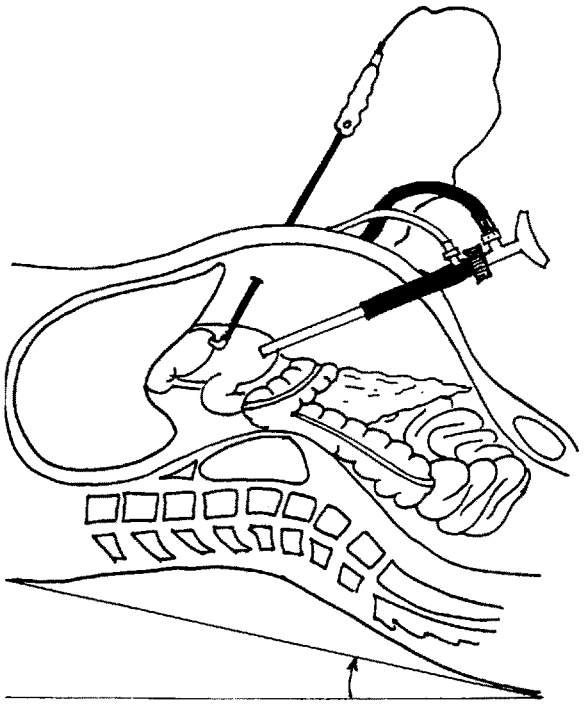

Fig. 1. Operative space.

intracorporal lithotripsy is always required, the gallbladder either remaining in place or being detached from the hepatic attachments and partially withdrawn at the umbilicus. To avoid a loss of small particles of calculi into the peritoneal cavity during these maneuvers, we sometimes use what we call the "extracting bag" technique. This consists of a sterile, resistant, plastic bag folded and inserted through a 10 mm trocar. The bag is unfolded inside the abdomen. The gallbladder containing the stone is placed in the bag. The strong walls of the plastic bag enable a firmer grasp for extraction. If, in spite of this, extraction is not possible, a lithotriptor is introduced inside the bag (an ultrasonic lithotriptor or strong forceps used as a lithotriptor) to break up the calculi and evacuate them separately, thus keeping the bag to a size that can then be easily removed.

The instrument tray always includes special probe-holder forceps for catheterization of the cystic duct. One or several endoligatures should also be included for suturing the stump of the cystic duct instead of using clips. We prefer suturing of the cystic stump in this manner when the tissue of the stump is weakened by infection and very fragile.

The Operation

Layout of the Operating Theatre, Operating Personnel, and Installation of the Patient

We continue our original installation of the patient in the decubitus dorsal position, legs apart, the surgeon positioned between the legs. The layout of equipment and positioning of operating staff also remain identical to previous descriptions when we performed intracorporal lithotripsy with the aid of two assistants (Fig. 1). With a small team (a single assistant), the

television screen is placed to the right of the patient, the assistant to the patient's left, the scrub nurse to the patient's right. An articulated bracket holding the laparoscope and camera can be used instead of a second assistant.

Insufflation of the Peritoneal Cavity and Insertion of Instruments

Insufflation is always done by puncturing the peritoneal cavity with a special Surgineedle (USSC, Norwalk, CT, USA) in the left hypochondrium about 3 to 4 cm from the costal margin on the mid-clavicular vertical line. It is at this point that the least viscero-parietal adherences are to be found. Once the peritoneal cavity is filled with CO_2 and has a pressure of between 8 mm and 12 mm mercury the needle is passed around under the abdominal wall to see if the umbilical region is free. If so, the laparoscope is introduced through the umbilicus by means of a trocar 10 mm in diameter. If not, another insertion point through a free zone higher up on the median line must be found and the laparoscope introduced.

The various instruments for grasping, irrigation, suction, and dissection are then introduced as originally described. We prefer this disposition because it permits us to work with the penetration axis of the instruments at right angles to the visual axis. Moreover, inserting the dissecting instrument through the left hypochondrium enables us, in the case of a large left liver lobe, to raise the liver up or, on the contrary, to lower it and pass over it. The raising of the interior face of the liver by the irrigation-aspiration device, the upward and outward pull of the grasping forceps inserted through the right hypochondrium, enables the Calot triangle to be better exposed.

In this way there is no risk of having the cystic duct and the CBD going in the same direction in the case of a long cystic duct, descending behind the common hepatic duct. There is no risk either, in the case of a short cystic duct, of pulling too hard on the CBD, of bending it, and of bringing the cystic-choledocal junction into contact with the dissecting and clamping instruments.

Dissection and Control of the Cystic Artery and Duct

With the instruments arranged as mentioned above, the right hand grasping forceps grasps the gallbladder fundus, pulls it upward and to the right, away from the duodenum and the CBD. The instrument inserted to the left, scissors, dissecting hook, or grasping forceps, enables the connective tissues between the body of the gallbladder, the right colic flexure, and the duodenum to be sectioned. This enables the cystic duct to be reached first, especially when it is short, and does not enable the Calot triangle to be properly opened. Dissection here should be carried out with the scissors or the electrocoagulating hook. The electric scalpel should be used sparingly close to the CBD. There is a risk of electric current causing secondary burns to the CBD which can be responsible for intraperitoneal leakage later when the scab from the burn falls off. Control of the hemostasis of the cystic artery or of its branches should always be carried out from the neck of the gallbladder, as far as possible from the CBD.

Catheterization of the cystic duct, in the case of intra-operative cholangiography, is always carried out after dissection, clamping, and sectioning of the cystic artery or arteries. This is the most dangerous moment for the CBD.

Thou shalt not fix any clamp, nor section any ductal structure without first being absolutely sure of its identification. This is the golden rule of surgery in general and should be that of coelioscopic surgery, too. An intra-operative x-ray can be some help. If in doubt, the abdomen should be opened and traditional surgery performed. Separating the gallbladder from its hepatic bed is done by means of either the electrocoagulating hook or scissors. If the gallbladder is very distended, making a grasp by forceps dangerous or even impossible, a puncture should be made and a bile specimen removed for bacteriological analysis, and the gallbladder irrigated and washed. If the wall is breached during dissection there is a lesser risk of an eventual intraperitoneal infection. However, the puncture weakens the wall of the gallbladder and when the time comes to remove it, there can be a leak at the point of puncture or small stones may fall into the peritoneal cavity.

Intra-Operative Cholangiography

Intra-operative cholangiography is undertaken each time the pre-operative inventory of the contents of the CBD is not able to be carried out and each time the cystic duct appears to be larger than 2 mm under the laparoscope. Such a size could enable stones to migrate towards the CBD. It also usually enables easier insertion of the catheter. However, if insertion of the catheter is difficult, we believe that there is no point in persisting. If insertion into the cystic duct remains impossible after trying to dilate it with a balloon catheter, we prefer to occlude it in a healthy area and not risk fissuring which could unfortunately continue to the cystic-choledochal junction and on into the CBD. An x-ray can eventually be used to detect a biliary leak at the dissection level of the cystic artery or arteries. This is one of the major arguments in favor of systematic intra-operative cholangiography. We believe that this argument is questionable. Either the CBD has been opened by mistake and one doesn't need to wait for a cholangiography to confirm it, or there has been a burn from the electric current used for coagulation purposes and this type of lesion is not visible on an intra-operative cholangiography. On the other hand, an intra-operative x-ray should be taken when recognition of the elements around the gallbladder neck is difficult. In these circumstances it is very dangerous to perform intubation of a duct downstream from a clip without being sure that it really is the cystic duct. In this case it would be better to perform the x-ray by a small puncture in the gallbladder to determine the length and direction of the cystic duct or by a small puncture in the CBD with a very fine needle if the gallbladder is excluded from the bile flow. Various well-known anatomic anomalies of the biliary tracts which are always a formidable pitfall for the surgeon can thus be detected. In these exceptional circumstances the risk of damage to the CBD is such that we think it wiser to perform a laparotomy.

Extraction of the Gallbladder

There are three options for extraction of the gallbladder. First, if the gallbladder has solid walls and contains only a few very

Table 2. Patients undergoing laparoscopic cholecystectomy, November, 1988–June, 1991 (n = 704).

Patient group[a]	Mortality	Laparotomy conversions	Complications	Common bile duct injury
Group I (n = 104)	0	3	3	0
Group II (n = 547)	1	34	23	3
Group III (n = 53)	0	4	0	0

[a] See text for definition of patient groups.

small stones, it is freed from its hepatic attachments and extracted through the trocar in the left hypochondrium, the maneuver being controlled through the laparoscope inserted in the trocar in the umbilicus. Second, if the gallbladder has very fragile walls due to infection or dissection, it contains large stones and will be difficult to extract. In this case we resort to our "extracting bag" technique, as mentioned earlier. The very large gallbladder containing very large stones can be opened inside the bag, the stones fragmented and everything extracted. Third, if the gallbladder has strong walls which do not show any inflammation and contains large floating stones, intracorporeal lithotripsy is performed with the gallbladder in place as described above [7]. When the gallbladder is emptied of its lithiasic content, it is reduced to a small pocket which can be easily extracted through the jacket of the cholecystoscope inserted into the right hypochondrium.

Washing and Drainage of the Abdominal Cavity and Optional Postoperative Drainage

After extraction of the gallbladder we always check that the clips on the cystic artery and canal are correctly positioned. We proceed to extensive washing with isotonic saline solution at 30°C until the liquid becomes clear. With our first 100 patients we drained almost systematically with a sub-hepatic suction drain. At present we are much more selective with our drainage. This is done in patients with gangrenous cholecystitis where the cystic duct is very fragile or very large and very inflamed and clamping would not prove reliable. Here we use a ligature instead of a clip. Once the washing process has been completed we proceed to remove the various trocars after having evacuated most of the gas from the pneumoperitoneum. Self-adhesive steristrips are applied to the cutaneous orifices made by the trocar insertions to ensure the least scarring possible.

Postoperative Management

The operation takes place under general anesthesia. All our patients remain in hospital at least overnight. The following day they can eat and walk normally. They are allowed to leave the hospital at their own request and when we know that there will be good medical follow-up at home from their family doctor. Quite a lot of patients prefer to spend an extra night in hospital and therefore return home only on the second day after the operation.

We advise a convalescence period of a week before resuming normal physical activities, and an additional week before returning to work. However, some patients, the most active and the most highly motivated, have been known to go back to work 8 days after their operation.

Table 3. Laparotomy conversions of laparoscopic cholecystectomies: Group II (34 of 547 patients).

Cause (n)	Diagnosis: Acute cholecystitis (n = 150)	Inflammatory GB (n = 63)	Non-infected GB (n = 334)
Bleeding (7)	3	3	
Adhesions (15)	4	10	1
CBD injury (2)	1	1	0
CBD stones (4)	3	0	1
GB perforation (1)	1	0	0
Confusing anatomy (1)	0	0	1
Device failure (1)	1	0	3
Total	11 (7.3%)	14 (22.2%)	9 (2.6%)

GB: Gallbladder; CBD: Common bile duct.

Results

Group I

We will discuss the results for this group briefly since they have already been published. Mortality was nil. We were obliged to convert the laparoscopy into a laparotomy in 3 patients and we had 3 patients with postoperative complications, none of which required open surgery. In this very highly selected group of patients where the only symptom was hepatic colic with no infectious syndrome, either recently or in the previous case history, the pre-operative assessment detected asymptomatic lithiasis of the CBD in 3 patients and this was treated by endoscopic sphincterotomy before LC. Table 1 shows that the majority of patients operated on had a postoperative subhepatic drain for 24 hours. These excellent results, the fact that we had gained in operating experience and that new instruments, more specific to coelioscopic biliary surgery, had been perfected enabled us to widen the indications for LC.

Group II

There was one death after 48 hours of an 82-year old woman operated on semi-urgently for acute cholecystitis (Table 2). The patient died suddenly without warning 48 hours after the operation while sitting in her chair. No autopsy was performed. We do not know the cause of this sudden death.

We were obliged to convert the laparoscopic procedure into open surgery in 34 patients. It should be noted that 25 of these 34 conversions took place in the group of patients who presented with either acute cholecystitis or a gallbladder profoundly altered by previous bouts of infection (sclero-atrophic gallbladder) (Table 3). The most frequent reasons for conversion were uncontrolled bleeding and tight adhesions around the gallbladder. There were 2 patients with bleeding of the cystic artery or arteries, 3 patients with bleeding in the gallbladder bed, and 2 patients where conversion was due to the existence

Table 4. Post-operative complications following laparoscopic cholecystectomy: Group II (23 of 547 patients).

Complication	No. of pts.
Time postoperatively	
Immediate	6
Secondary	15
Late	2
Treatment	
Medical	12
Endoscopy	8
Open surgery	2
Sonographically-guided drainage	1

Table 5. Post-operative complications following laparoscopic cholecystectomy: Group II (23 of 547 patients).

	Diagnosis		
Complication (n)	Acute cholecystitis (n = 150)	Inflammatory GB (n = 63)	Non-infected GB (n = 334)
Bleeding (3)	1	2	0
Bile leak (5)	2	3	1
CBD stenosis (1)	0	0	1
Intra-abdominal abcess (6)	2	3	1
Acute pancreatitis (1)	0	0	1
Acute ascitis (1)	1	0	0
Unexplained fever (2)	0	1	1
Other (4)	1	2	1
Total	7 (4.5%)	11 (17.4%)	5 (1.4%)

GB: Gallbladder; CBD: Common bile duct.

of hypertension of the portal vein in cirrhosis which had gone undetected during the pre-operative assessment. The gallbladder can be buried under tight adhesions made up of the great omentum, the right angle of the colon, and the duodenum, and this makes it very difficult to free. There is a great danger of damaging the colon and/or the duodenum. Dissection by electrocoagulation should be kept to a minimum in these cases and bipolar current only used. In 11 patients we gave up because of the quantity of these adhesions. In 4 patients the hepatic attachments of the sclero-atrophic gallbladder incrusted into the liver made us retreat. Two lesions to the CBD were made and detected during the operation, 1 lateral and 1 complete sectioning of the choledochus duct which was mistaken for a cystic duct. A conversion to laparotomy enabled these patients to be treated by the insertion of a T-tube, for the lateral cut, and by suturing of the two ends, in the case of the section. In 1 patient, an attempted lithotripsy with the gallbladder in place, in the presence of gangrenous cholecystitis, ended with multiple perforations to the gallbladder wall by the grasping forceps, and infected stones escaping into the peritoneum. We had to carry out a laparotomy in order to terminate the cholecystectomy and a complete clean up of the peritoneum. The postoperative results were straightforward. Four patients with asymptomatic stones in the CBD led us to do conversions, 3 times in an emergency operation for acute cholecystitis where a thorough pre-operative assessment had not been possible. In the other patient a stone was suspected prior to surgery and was confirmed by an intra-operative cholangiography. In these 4 patients it was not possible to remove the stone by transcystic laparoscopic techniques. One confusing aspect of the Calot triangle and 4 device failures obliged us to convert.

We had 23 postoperative complications in this group. Two patients required a second open surgery operation. In 1 patient a partial stenosis of the CBD was revealed due to a hemostatic clip on the cystic artery laterally overlapping the hepatic duct proper. On the fifth day after the operation, and in view of the onset of jaundice, the patient had to undergo repeat surgery to remove the clip. The compressed region showed a loss of serous substance but no opening of the mucosa. However, we preferred to open up the CBD and insert a small T-tube. The postoperative results were straightforward. The second patient requiring open surgery developed very heavy bleeding with cardiovascular collapse 2 hours after the laparoscopic operation. This patient had cirrhosis. Hemostasis required the placing of gauze strip packing in the gallbladder bed by laparotomy. The postoperative course was uneventful. The remaining complications are summarized in Tables 4 and 5.

We sorted the complications according to their appearance in time in the postoperative period, immediate complications (48 hours after the operation), secondary (appearing from Day 2 to Day 20), and late (after Day 20) (Table 4). The immediate complications included serious bleeding, mentioned above, and two biliary leaks well contained by a sub-hepatic drain placed at the time of the operation of acute cholecystitis. The leak spontaneously resolved after 5 to 7 days from an initial bile flow of 400 ml per day, so no attempt was made to find out the origin of the leak since that would have entailed ERCP which is not without risk. Acute pancreatitis also occurred within 48 hours in a patient with a microlithiasis of the gallbladder and a very thin CBD with no stones revealed on the intra-operative x-ray. We don't know the reason for the onset of this acute pancreatitis which was treated with simple medication. One hematoma around a trocar orifice and the CBD stenosis by clip mentioned above complete the immediate complications.

The secondary complications were bleeding, biliary effusions, and intra-abdominal abscess. Two cases of secondary bleeding were suspected when pains occurred around day 5 after the operation and the patients had already returned home. The existance of severe anemia and a mass of sub-hepatic effusion which showed up on the ultrasonography confirmed the diagnosis of secondary bleeding. We did not undertake treatment and the symptoms resolved spontaneously. The residual aftereffects show up as an image of sub-hepatic micro-collection on the ultrasonography. Three biliary effusions occurred as secondary symptoms manifested by pains in the right hypochondrium and a temperature of between 37.5° and 38°C appearing after a week free of symptoms and after the patients had returned home. Effusion was diagnosed in all 3 patients by ultrasonography. An ERCP was carried out in 1 patient and showed the origin of the leak. A closing clip on the cystic duct was not hermetic. In this particular patient the choledochus duct was large in size and showed no signs of lithiasis but did show a stenosis of the sphincter of Oddi. In 1 patient the treatment consisted of the evacuation of the collected bile by means of an echo-guided puncture and a drain was left in place. There was no further biliary discharge and it was removed in the 24th hour. In another patient an additional laparoscopy

revealed a sub-hepatic biliary effusion but we were unable to find the origin. With simple draining it resolved in a week. In the last patient who had a leak in the cystic duct, recovery was obtained by combining a laparoscopic drain to collect the fluid and an endoscopic sphincterotomy enabling the biliary fistula to resolve in a week. Four patients developed intra-abdominal abscess localized in the sub-hepatic region in the 10 days following the operation and after the patients had been at home at least a week. The picture was always the same: the appearance of throbbing pains in the right hypochondrium accompanied by a fever. The diagnosis was made using ultrasonography and on the appearance of an increase in the white blood cell count. Treatment consisted of a second laparoscopy followed by the evacuation of the collected fluid, washing, and insertion of a suction drain which resolved the abscess in 48 hours. All the patients had a straightforward recovery. The abscesses occurred in 1 patient who underwent cholecystectomy for acute cholecystitis and in 3 other patients who had a very inflamed sclero-atrophic cholecystitis. In all these cases, the patients had not had drainage at time of operation. The remainder of the secondary complications in Group II were more diverse. One patient with cirrhosis developed acute ascites 2 weeks after the cholecystectomy and 3 patients developed medical complications of a general nature (heart failure, pulmonary infection, and fever which lasted 10 days and disappeared as suddenly as it had started).

There were 2 late complications, both the development Douglas abscess which appeared at day 20 and day 24 after the operation. The clinical picture was quite evident with pelvic pain, the onset of fever, and the diagnosis was confirmed by ultrasonography. The 2 patients were treated by a second laparoscopy which enabled the washing and draining of the suppurated fluid. Both abscesses contained lithiasic debris which had escaped the gallbladder at the time of its extraction. Recovery was straightforward. It is not as harmless as one is led to believe to leave debris from stones in the abdomen. We should underline the fact that out of the 23 complications in the 547 patients treated, 18 appeared in the group of 213 patients operated on for acute or very inflamed cholecystitis (Table 5).

Of the stones associated with these cases, clinically asymptomatic stones of the CBD, 35 were discovered in Group II patients. In 28 patients the stones were diagnosed in the pre-operative assessment. They were all treated by endoscopic sphincterotomy, generally before the LC. In 3 patients the extraction was accomplished by endoscopic sphincterotomy during the LC. However, since the patient was in the decubitus dorsal position, it was difficult to gain access to the papilla by duodenoscopy so we had to abandon the idea of combining the two techniques. In 6 patients we decided to do the LC first (Table 6). A trans-cystic drain was fixed in the cystic duct and the endoscopic sphincterotomy carried out 2 days after the LC. In 7 patients the stone was found during the LC by intra-operative cholangiography. In 6 of these cases the patients had undergone an emergency operation for acute cholecystitis and had not had a pre-operative assessment. In the remaining case, the patient had undergone elective procedure with no symptoms of cholestasis and ultrasonography of the CBD was normal. Since the size of the cystic duct was >2 mm an intra-operative cholangiography was carried out and this revealed the stone. In 3 patients we deliberately left the stone in place and it was extracted 48 hours later by endoscopic sphincterotomy. In the 4 other patients, using the same sequence of operation, we decided to convert the laparoscopy into a laparotomy in order to be able to treat a lithiasis of the CBD by choledochotomy followed by a temporary trans-cystic drain. A sub-hepatic drain was installed for 84 patients. In 3 patients a biliary effusion was able to be transformed into a fistula and a choleperitoneum thus avoided. In 1 patient, massive bleeding was able to be detected rapidly, leading to laparotomy. The 6 secondary or late intra-abdominal suppurations appeared in patients without a drain.

Table 6. Common bile duct stones in patients undergoing laparoscopic cholecystectomy: Group II (n = 547).

Diagnosis	No. of pts.
Asymptomatic	35
Detected prior to LC	28
Treated by	
ERCP + ES	28
Prior to LC	19
During LC	3
After LC	6
Detected during LC	7
Treated by ERCP + ES	3
Conversion into open surgery	4

LC: Laparoscopic cholecystectomy; ERCP: Endoscopic retrograde cholangiopancreatography; ES: Endoscopic sphincterotomy.

The patients with no complications or conversions to laparotomy had a recovery period free from pain and were able to resume normal physical activity <1 week after the operation. Average postoperative stay in hospital was 2.8 days (range 1 to 7 days). All the patients operated were seen in again 4 weeks after the LC for those with no complications, and 4 weeks after the last treatment in the case of complication requiring surgical or endoscopic treatment. There was no evidence of medium-term complications. In this series, 132 patients were monitored 1 year after the operation during a visit which included ultrasonography and the hepatic function tests mentioned earlier. No complications were diagnosed either locally (at the point of insertion of the trocars) or on the biliary level (no residual CBD stones).

Group III

This group consisted of 53 patients who all had clinical symptoms suggesting the presence of a stone in the CBD, either at the time of admission or shortly before (1 to 2 weeks previously) (Table 7). Four of them presented a severe angiocolitis without kidney failure and which did not show a positive hemoculture. Of these, 2 patients had hyperamylasemia compatible with a bout of acute pancreatitis. All 53 patients underwent ERCP.

In 41 patients we found a stone in the CBD associated with a dilated biliary tract and a syndrome of cholestasis. In 1 patient the stone was situated in a normal size biliary tract although there was no sign of cholestasis. In 6 patients the CBD was dilated with biological cholestasis and without stones.

We carried out 48 endoscopic sphincterotomies, in 42 patients to free the CBD of its lithiasic content and in 6 patients to open a papilla which was supposedly stenosed, given the

Table 7. Patients with symptoms of common bile duct stones prior to laparoscopic cholecystectomy: Group III (n = 53).

Treatment	No. of pts.
Endoscopic sphincterotomy	48
For CBD stones	42
For papilla stenosis	6
Laparoscopic cholecystectomy	49
Open cholecystectomy	4

CBD: Common bile duct.

amount of dilation of the overlying biliary tract even though there were no associated stones.

These 53 patients were to have an LC after evacuation of the main biliary tract. In fact only 49 LCs were actually carried out, in 32 patients the day after the endoscopic sphincterotomy, in 9 patients 2 days afterwards, and in 8 patients on days 3 to 8. In 4 patients we preferred to not carry out the laparoscopic cholecystectomy and carry out a traditional cholecystectomy instead. In 2 cases the patients presented a hyperamylasemia suggesting an acute pancreatitis at the time of the onset of angiocolitis. In 1 patient there was a residual stone after the endoscopic sphincterotomy and we preferred to remove it by choledochotomy during the course of a traditional cholecystectomy. In 1 patient, since the ultrasonography showed the existence of a pyocholecyst, we preferred to perform traditional surgery.

It should be underlined here that in none of the groups did we have any complication due to the pneumoperitoneum. In some publications the rate reported is 0.019% or even more.

Comments

By June, 1991, our team had 32 months of practical experience of LC. Having originally gone into previously unexplored territory we were extremely prudent as to the selection of our first patients and carried out LC only in the simplest of cases. By the time we reached our 100th patient, we had widened our indications to such an extent that we had gone from a rate of contra-indication for LC of 40% to 18%. The results obtained in these first 100 patients were far better than those obtained by traditional cholecystectomy, but if we make an assessment of our overall results we can see that the figures and percentages of mortality and morbidity (Table 1) are identical to those obtained by traditional procedures.

The widening of the indications meant that our rate of conversion to laparotomy went from 3% to 6.2%. Postoperative complications remained stable (3–3.7%) but there were 2 lesions of the CBD and 1 death. These results must be analyzed in relation to the anatomopathological state of the gallbladders of the patients and the degree of our expertise at the point in time when the LC was carried out.

As to the patients with non-infected gallbladders (all of Group I and the greater part of Group II, see Table 5), the conversion rate remains unchanged (3%, 2.6%). This decrease in complication went down by half (3% to 1.4%). This decrease in complications for non-infected gallbladders is balanced by a higher figure for complications which appear when there is an acute infection or a very inflamed gallbladder (scleroatrophic gallbladder). It is in this last subgroup of patients that the highest percentage of complications occurred (11 of 63 patients, 17.4%) and the conversion rate reached 22.2%. Do such results cast doubt on the permissibility of the indication for LC in such patients? It is perhaps useful at this point to recall the clinical profile of such patients: they have a long history of bouts of acute cholecystitis, with a gallbladder having a wall of more than 4 mm thick, as evidenced by ultrasonography, and very little liquid around the stones. The best criteria remains the laparosopic appearance showing tight adhesions around a very small gallbladder incrusted into the hepatic parenchyma. In these circumstances it is very difficult to clearly determine the Calot triangle and to then find a cleavage point between the hepatic parenchyma and the gallbladder. It is here that one should not persist in dissecting the cystic pedicle and but should revert to open surgery without feeling one is losing face. It is relatively easy to foresee these difficulties prior to the operation from the case history of the patient and the appearance of the ultrasonography. The patients should therefore be told that one cannot give more than a 60% to 70% guarantee as to the possibility of carrying out the laparoscopic surgery through to the conclusion of the operation. In the near future we should see the rate of postoperative complications decreasing for this group of patients, but at the price of an increase in the percentage of conversions which itself will decrease as the experience of future teams increases. We believe that it is quite acceptable to begin the cholecystectomy by coelioscopic means because two-thirds of such patients have been able to benefit from the quality of postoperative recovery that this type of operation confers.

Indeed, it is on the level of the quality and swiftness of postoperative recovery that the LC is a major step to progress. Normal recovery after this operation is remarkable in that there is no pain, the abdomen wall remains soft, the digestive system returns to normal very quickly, and normal physical activity can be carried out almost immediately. The disadvantages remaining are more often than not due to eliminating anesthesiological medication which causes nausea and sleepiness for a number of hours. It is here that progress needs to be made with a better choice of anesthetics or doing away with general anesthesia altogether. If such a fast postoperative recovery after LC does not occur, a complication should be feared. Complications usually happen in the immediate postoperative period or early secondary period. Pain, tenderness of the abdominal wall, temperature, and subictarus are all signs that should prompt immediate investigation to prevent the complication or to treat it as rapidly as possible. The main examination techniques available are ultrasonography, computed tomography scan, ERCP, blood cell count, and tests for cholestasis and cytolysis. Bleeding and biliary leaks can thus be detected. One does not necessarily need to resort to open surgery to solve these problems. Often medication or a second laparoscopy is sufficient and effective, and if postoperative recovery is somewhat prolonged, the patient still has the benefit of not having the abdominal wall opened.

Quality of recovery from LC should also be offered to patients with lithiasis of the CBD associated with gallbladder lithiasis. If the stone in the choledochus duct is clinically symptomatic, this should be treated first. Currently, endoscopic

Table 8. Results of laparoscopic cholecystectomy: 3,708 patients in France and Belgium.

Result	No. of pts. (%)
Mortality	5 (0.13)
Morbidity	133 (3.5)
Laparotomy conversions	273 (7.3)
CBD injuries	7 (0.18)

CBD: Common bile duct.

sphincterotomy after ERCP gives excellent results. Once the CBD is free, the following day or a few days later, an LC is carried out. There is currently a complete treatment available to biliary lithiasis, wherever it might be located, by endoscopic means combining endoluminal endoscopy and laparoscopy. But asymptomatic stones in the CBD should also be sought systematically. Progress in pre-operative exploration is such that few stones will not be diagnosed. Here again, once the stone has been discovered it must be removed by endoscopic sphincterotomy and the LC delayed until the next day or even the day following. Our systematic pursuit of asymptomatic lithiasis of the CBD prior to LC is justified by the fact that it is not possible at present to clear out the CBD by laparoscopic means every time. In addition, in 5% to 10% of patients (depending on the experience of those operating) it has proved technically impossible to carry out an endoscopic sphincterotomy. It would be detrimental to take the patient down the following road: LC, discovery of an asymptomatic stone in the CBD impossible to remove, failure of the secondary endoscopic sphincterotomy necessitating a laparotomy for choledocotomy and removal of the CBD stone. But in this field things evolve rapidly and a regular approach of the CBD during a laparoscopy will become routine tomorrow. At that time the advantages and disadvantages of this new technique will have to be weighed and compared to those of the endoscopic sphincterotomy which until now has given the best results.

New techniques which gain a place so rapidly among the therapeutic armamentarium as the LC has done are few and far between. Over the past 2 years 3,708 cases have been gathered in the surgical community in France and Belgium [8]. The results are very similar to ours (Table 8). Fairly similar results are coming in from other European countries [9, 10], the United States of America [11–13], and Australia [14]. It can be called a revolution for, even if it is part of the move toward less invasive surgical techniques, it has given a fantastic boost and accelerated the changing of attitudes of general surgeons to endoscopic techniques. We must lead this revolution, a revolution without a negative side, by avoiding precipitation into the use of these techniques without the appropriate prerequisite training, by remaining prudent, and by duly weighing the pros and cons of their use for certain types of indications. The group of patients with sclero-atrophic gallbladder, profoundly altered by previous bouts of infection, should remain the prerogative of the best trained teams.

In the months ahead we shall certainly see a profusion of publications reporting the complications of LC, and allowance must be made for a phase of technical maturation of operators. The stakes are high, for the results of traditional cholecystectomy are already excellent. Each new operator should be determined to do at least as well as traditional surgery right from the outset. They must do so by carefully selecting their first patients. Two to 4 years hence the average results will stabilize at the level of those already obtained by the pioneering teams.

But apart from educating surgeons in these techniques, there remains the problem of getting information out to the internists and family doctors. The length of the hospital stay for LC is short but complications can occur. They can be divided into immediate, secondary, and late, depending on the period in time at which they occur. The first, bleeding and massive biliary leaks, require a rapid and accurate response. They justify keeping the patient in hospital or in a hospital structure near the endoscopic surgery center at least 24 hours. Secondary and late complications occur after a period free from symptoms and more often do not require urgent treatment. They can be detected in a patient who has already returned home. The role of the family doctor is vital so that complications are detected and treated without delay. Some, such as biliary effusions, can hide behind very insidious masks.

Other invasive techniques for treating gallbladder lithiasis may perhaps be developed in the near future and we will then be able to fix precise limits to the indications for practicing LC in patients with gallbladder lithiasis. However, as of today, we can say that LC has become the routine method of basic treatment for gallbladder lithiasis in more and more institutions [15].

Résumé

Née dans la plus grande discrétion en 1987, développée dans une atmosphère de scepticisme, voire d'hostilité, la cholécystectomie coelioscopique (CC) a triomphé dans les années 1989/90 et a été responsable d'une véritable révolution en chirurgie générale. Les 700 cas consécutifs rapportés ici reflètent bien l'esprit de ces différentes périodes. Partant d'une indication limitée par prudence, nous avons élargi nos indications pour inclure aujourd'hui 90% de nos cholécystectomies pour lithiase. La vésicule scléro-atrophique constitue encore un véritable challenge pour les manôeuvres endoscopiques. Seuls les chirurgiens les plus expérimentés doivent s'attaquer à ce type de pathologie. La mortalité (0.1%) et la morbidité (3%) sont tout à fait comparables voire meilleures que celles de certaines séries de cholécystectomie traditionelle. La qualité de la récupération est en rapport avec l'absence de douleur, la courte période d'hospitalisation, le retour à l'activité physique avec reprise rapide du travail et la préservation totale de la musculature abdominale pour les sportifs. Tous ces avantages sont malheureusêment perdus pour les 6% de patients pour lesquels une conversion en laparotomie traditionnelle est nécessaire au cours de l'acte coelioscopique. Les résultats des études multicentriques, menées dernièrement en France et en Belgique, comprenant 3708 cas, sont tout à fait semblables. La CC est en passe de devenir la technique de référence pour le traitement de la lithiâse vésiculaire. C'est un premier pas vers la chirurgie du 21ème siècle qui devrait avoir lieu entièrement à l'intérieur de l'enveloppe musculo-cutanée du corps humain laissée "intacte".

Resumen

Nacida silenciosamente en 1987, desarrollada en un atmósfera de escepticismo y de hostilidad hasta 1988, la colecistectomía laparoscópica vino a triunfar en 1988/90 y ha causado una verdadera revolución en el mundo de la cirugía general. Los 700 casos consecutivos que ahora informamos reflejan el espíritu de estos períodos. Partiendo de una posición de prudente restricción, nuestras indicaciones se han ampliado para incluir 90% de los casos de litiasis de la vesícula biliar. Las vesículas escleroatróficas constituyen el mayor desafío al manejo endoscópico, y este grupo de pacientes debe reservarse para los más expertos operadores. Las cifras de mortalidad (0.18%) y de complicaciones (3%) son comparables, o aún mejores, que las de la colecistectomía tradicional. La calidad de la recuperación es infinitamente superior: ausencia de dolor, hospitalización muy corta, retorno a la actividad normal dentro de los 10 primeros días, rápido retorno al trabajo, preservación total de la musculatura abdominal para personas que hacen deporte. Todas estas ventajas, que son patrimonio de la colecistectomía laparoscópica, no son aprovechables por el 6% de los pacientes en quienes se hace necesaria la conversión intraoperatoria a cirugía abierta; estos pacientes se recuperan en las mismas condiciones que después de una colecistectomía tradicional, que de todas maneras no son codiciones pobres. Los grandes estudios multicéntricos como los recientemente realizados en Francia y Bélgica sobre 3708 casos, han llegado a las mismas conclusiones. La colecistectomía laparoscópica está en vía de convertirse en el estándar de oro, en el patrón oro, del tratamiento para la colelitiasis, y representa el primer paso exitoso hacía las técnicas quirúrgicas del siglo XXI, que habrán de ser ejecutadas en el interior de la envoltura no abierta del cuerpo humano.

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