

## Laparoscopic cholecystectomy (LC): predictive role of preoperative ultrasounds

V. MINUTOLO\*, G. GAGLIANO\*, C. RINZIVILLO, O. MINUTOLO, B. SCILLETTA, G. LI DESTRI

**SUMMARY: Laparoscopic cholecystectomy (LC): predictive role of preoperative ultrasounds.**

V. MINUTOLO, G. GAGLIANO, C. RINZIVILLO, O. MINUTOLO,  
B. SCILLETTA, G. LI DESTRI

**Aim:** we studied several ultrasounds patterns concerning gallbladder, biliary tract and gallstones to identify some predictive signs of difficulties during LC.

**Patients & methods:** 112 patients (24 females), 25-75 years old, upper abdomen operated patients not included. From 7 ultrasounds patterns 4 degrees of potential intra-operative difficulty (0-3) were obtained. During the operation 7 conditions of true intra-operative problems were also classified.

**Results:** patients showing grade 0: regular gallbladder wall, stones < 20 mm, regular Main Biliary Tract (MBT) = 62 LC and 2 open surgery conversion (OSC); grade 1: wall < 4 mm, stones > 20 mm = 24 LC and 7 OSC; grade 2: hydrops, wall > 4 mm, infundibular stone = 6 LC and 6 OSC; grade 3: wall > 4 mm, stones > 20 mm, empyema of gallbladder, MBT  $\geq$  6 mm = 3 LC and 0 OSC.

Flogosis near gallbladder and wall > 4 mm were mainly responsible for transition of LC in OSC.

**Conclusion:** several predictive conditions for intraoperative difficulties are often detectable by accurate preoperative ultrasounds examination, with the aim of best surgical planning and to select those patients to entrust to surgeons during their learning phase.

**RIASSUNTO: Colecistectomia videolaparoscopica: ruolo predittivo dell'ecografia preoperatoria.**

V. MINUTOLO, G. GAGLIANO, C. RINZIVILLO, O. MINUTOLO,  
B. SCILLETTA, G. LI DESTRI

**Scopo:** abbiamo esaminato diversi quadri ecografici onde predire difficoltà chirurgiche della videolaparocolecistectomia (VLC).

**Pazienti e metodi:** 112 pazienti (24 donne, 27-75 anni) esclusi quelli operati all'addome inferiore. Combinando 7 aspetti ecografici abbiamo stilato 4 gradi di potenziale difficoltà e condizioni.

**Risultati:** grado zero se parete regolare e calcoli < 20 mm e via biliare principale inalterata (62 VLC e 2 open); grado 1 con parete colecisti < 4 mm e calcolo > 20 mm (24 VLC e 7 open); grado 2: idrope con parete > 4 mm e con calcolo infundibolare (6 VLC e 6 conversioni open); grado 3: parete > 4 mm, calcolo > 20 mm, empiema, via biliare da 6 mm in su (3 VLC). I maggiori responsabili di conversione 'open' sono stati: la flogosi pericolecistica e l'ispessimento della parete maggiore di 4 mm.

**Conclusioni:** un'accurata ecografia preoperatoria può rilevare diverse condizioni di difficoltà intraoperatorie allo scopo di una migliore pianificazione del tipo di intervento e anche per selezionare quei pazienti da affidare ai chirurghi in formazione.

KEY WORDS: Laparoscopic cholecystectomy - Predictive preoperative ultrasound.  
Colecistectomia videolaparoscopica - Ecografia preoperatoria predittiva.

### Premessa

Laparoscopic Cholecystectomy (LC) actually represents the treatment of choice for lithiasis of the gallbladder (LoGB). The success of this 'minimally invasive' technique is surely due to more comfort and nevertheless same results and safety in comparison with the 'open' surgery. Today LC is seen in the world

as the golden surgical approach because of the advantages for the patient and of the favorable cost-benefits ratio. Such method offers a great advantage in respecting both the aesthetical aspect and, above all, the integrity of the abdominal wall: therefore it reduces the risk of intra-abdominal adhesences and of laparocoele, as well as it reduces the postoperative pain (1). The absence of wider wounds involves besides small suffering and precocious mobility for the patient and, especially for the elderly, this reduces thromboses and respiratory complications; the hospitalization has a duration of two - three days and the convalescence has lowered to a week.

Nevertheless in the last years many Authors report

University Policlinic of Catania - Italy  
First Surgical Department  
\* Clinical Division of General Surgery  
(Chief: Prof. A. Di Benedetto)  
Hospital of Vittoria (AG)  
(Chief: Prof. V. Minutolo)

© Copyright 2005, CIC Edizioni Internazionali, Roma

an increase of the biliary complications, particularly in patients with an history of acute cholecystitis. In fact cholecystectomy can be made difficult by the presence of peri-cholecystic adherences or thickened wall or peri-cholecystic sclerosis. The operation can become dangerous when sclerosis is located in the peduncle where the various adhering elements, not easily recognizable, can easily be injured or lacerated during their isolation.

In the recent years literature reports that complications from LC have increased respect to the traditional approach, in spite of a decreased rate of biliary complications due to better learning of the laparoscopic technique. Sometimes it's necessary to convert LC in open surgery. Many recent Authors (2-11) reported their experience concerning risks factors and/or predictive conditions of the Open Surgery Conversion (OSC) from initially LC. Some Authors (12-16) dwelt upon the role of preoperative ultrasound to predict technical difficulties and/or complications during/after LC. In several clinical series the percentage of OSC during laparoscopic surgery is ranging from 2% up to 23,3% (2). Kama and coll. (2) in a series of 1000 cases report a total percentage of conversion of 4,8% (of which 16,7% are due to the wall thickness and 50% to an actual acute or past cholecystitis).

Because physical examinations and clinical history of patients don't allow to always foresee the intraoperative difficulties, we thought of giving a contribution by testing our system based upon these US (UltraSounds) signs capable to foretell the difficulties during LC, with the aim to plan the surgical approach and to select these patients to entrust to the young surgeon in formation.

## Patients and methods

We studied 112 patients (88 female and 24 male, age 25-75) treated in First Surgical Department of University of Catania (Italy) from January 2001 to December 2002. We included patients (22 of 112: 20%) undergone to lower abdominal surgery but not these patients undergone to upper one.

Before operation we performed an accurate US examination, to obtain an uniformity of data; during US we particularly annotated the following patterns and conditions:

- the thickness of the walls of the gallbladder;
- the dimensions and the mobility or position of the gallstones (particularly if stuck in the infundibulum);
- the presence of hydrops or empyema;
- the diameter of the common bile duct (CBD);

Based upon these signs we established four ordinal degrees of difficulty from 0 up to 3 (Table 1).

During operation, we verified the correspondence between regional anatomical pattern and preoperative US signs and noted the followings aspects and conditions too:

- adherences between omentum and gallbladder;
- difficulty for the isolation of Calot's triangle;
- difficulty in the dissection of the gallbladder from the liver bed;
- bleeding during surgery;
- perforation of the gallbladder with outgoing of bile;
- duration of the operation;
- conversion in open cholecystectomy.

## Results

Table 1 (see legend) shows our results concerning relationship between US grade and rate of OSC. Grade 0 present a significant lower rate of OSC respect to all grade and OSC rate in grade 0 is less respect to grade 1 and 2. Grade 2 has a the higher rate of OSC respect to OSC distributed in all cases. Grade 3 has non statistically evaluated because small size of sample. These grade 3 patients with CBD more than 6 mm presented at colan-

TABLE 1 - GRADING BY US EXAMINATION AND RESULTS.

<i>US grade</i>	<i>Pattern of grade</i>	<i># patients in the grade/all cases</i>	<i>LC only LC pts./pts. of grade</i>	<i>OSC OSC pts./pts. of grade</i>	<i>p</i>
0	Regular wall, < 2 cm mobile stones; CBD normal dimensions	64/112 (57%)	62/64 (97%)	2/64 (3%)	<0,05
1	< 4 mm tickened wall, stones < 2 cm, CBD normal caliber	31/112 (28%)	24/31 (77%)	7/31 (23%)	Not significant
2	Hydrops, > 4 mm tickened wall, infundibolar stone, CBD normal dimensions	14/112 (12%)	8/14 (57%)	6/14 (43%)	< 0,01
3	Empyema, > 4 mm tickened wall, >2 cm stones, CBD diameter > 6 mm	3/112 (3%)	3/3 (100%)	0/3 (0%)	Small size of sample
<i>ALL GRADES</i>		<i>112 (100%)</i>	<i>97/112 (87%)</i>	<i>145/112 (13%)</i>	<i>=</i>

*Legend* : US = UltraSounds examination; LC = Laparoscopic Colectectomy; OSC = Open Surgery Conversion; CBD = Common Bile Duct; pts = patients.

gio-MR stones in CBD and therefore an endoscopic sphincteroclipstomy was performed before LC. Then LC was performed without particular difficulties but only with a great attention in setting the clips on the cystic duct that appeared enlarged. It wasn't necessary OSC because no empyema neither pericolectic flogosis were present in these 3 patients. Nevertheless we have not encountered in our series patients with empyema, we include empyema as a predictive criterion in grade 3 of our US preoperative classification, because of thinking that it's an important factor of OSC, if present.

In patients with regular wall of gallbladder or with its thickness less than 4 mm the mean duration of the operation has been 66 minutes: we found small difficulties in individualization and isolation-preparation both of the cystic region and of the cystic artery as well as during dissection of gallbladder from hepatic bed. We noted only a case of outgoing of bile (due to perforation of the gallbladder) and another case of a (well controlled) bleeding. Dimensions and number of the stones affect very little the duration of the intervention and the intraoperative problems. When gallbladder presents thickened wall more than 4 mm or with presence of an infundibular stone and related hydrops (grade 2), the mean duration of the intervention has been 102 minutes. The adherences between omentum and gallbladder (present in sixteen patients) has not been conclusive for the difficulties of the intervention because they were easily removable. In three cases with sclerosis at the level of the peduncle, we found greatest difficulties during individualization and isolation of its elements, during visualization of the CBD and during dissection of the gallbladder from the hepatic bed; it was consequent an important bleeding and a perforation of the gallbladder and related outgoing of bile, responsible of post-operative fever that lengthened the hospitalization for a few days.

In a patient of the three cases with hydrops of the gallbladder, but without thickness of the wall, a great difficulty was due to the stretched and tensioned gallbladder and it was necessary to empty it before its removal. In other two cases, we reduced gallbladder tension by emptying it, but there were intra-operative difficulties due to the thickness of the wall and to the inflammation around the gallbladder.

## Discussion and conclusion

LC has been performed for the first time in Lyon (France, 1987) by Mouret, then in Paris by Dubois and in Bordeaux by Perissat; it was introduced in the United States by Barry McKernan and it has quickly spread in the whole world.

When LC was introduced many patient suffering from LoGB could'n parte advantage of this new

methode; now almost all these patient can benefit by this technique, thanks to continuous improvement of the surgical instrumentation (e.g. systems for the transmission of the image; specific or better tools for this surgery), as well as thanks to the evolution of the surgical ability of the operators. Actually LC represents the golden standard treatment of LoGB. The indications for the laparoscopic cholecystectomy don't differ from open surgery; in fact acute cholecystitis is laparoscopically operable also, with the condition of an immediate surgical aggression but, in alternative, we can wait for the cooling of the inflammatory process.

Nevertheless, it's necessary to perform an open conversion of LC or open surgery from the beginning when laparoscopic surgery doesn't ensure guarantees of safety for some particularly complexe patients, whose number is inversely proportional to the ability and the experience of the operator. Our preliminary results and literature suggest that preoperative US can be useful for information about an intraoperative difficulty that can lead to the OSC. These data are very important to correctly inform a patient that pretends to know both the percentages of failure of a technique and the probable complications. In our experience thickness of gallbladder caused more duration of the operation and a great percentage of conversions (22,6%): for patient with thickness more than 4 mm the percentage of conversion has arisen up to 42,9%.

We have not observed a correlation between dimensions of the stones and intraoperative problems; so we did not note an influence of the previous surgical intervention on lower abdomen or of the presence of an enlarged CBD. We think that the inflammation (cause of an increase of parietal thickness), the adhering parts as well as the peri-cholecyctic sclerosis are the principal risk factors increasing both intraoperative difficulties and complications and, therefore, the rate of OSC.

Particularly, the peri-cholecyctic inflammation and a wall > 4 mm appear to be most important factors responsible of OSC from LC in our experience.

From our data we infer the following statements:

- 1) the principal conditions responsible of OSC and/or of difficulties during LC can be foreseen by means of the awareness to these clinical and US patterns (US grading);
- 2) it's possible a selection of the fitter surgical procedure and with less risk for the patients.

If difficulties are not foreseen we can entrust the patient to the surgeon during his learning curve, under the supervision of a more expert surgeon. The forecast of possible difficulties during LC allows a more complete information to the patient and the knowledge both of the possibility of an OSC and of the possible complications, so that the operator himself could take the decision of a conversion more precociously during

LC or of an laparotomic intervention of principle.

We expect in mind to study more patients and more parameters, including others clinical and laboratory data, for a better evaluation of the several factors before and after LC, to compare patients with/without OSC during LC and with/without complications.

The open conversion of a laparoscopic procedure,

whereas it results necessary, constitutes an eventuality that we doesn't considered as a technical error; on the contrary, it is a sign of clinical maturity and adroitness of judgment to avoid useless risks for the patient and ethical/legal problems for the surgeon.

## References

1. Vecchio R, Murabito P, Panascia E, Di Martino M, Rinzivillo C, Cunsolo V, Zappala M, Sambataro L, Alongi G. Postoperative pain in laparoscopic surgery *G Chir* 2002; 23 (1-2): 13-7.
2. Kama NA, Kologlu M, Doganay M, Reis E, Atli M, Dolapci M. A risk score for conversion from laparoscopic to open cholecystectomy. *Am J Surg* 2001; 181 (6): 520-5
3. Schrenk P, Woisetschlager R, Wayand WU. Laparoscopic cholecystectomy. Cause of conversions in 1,300 patients and analysis of risk factors. *Surg Endosc* 1995; 9 (1): 25-8.
4. Alponat A, Kum CK, Koh BC, Rajnakova A, Goh PM. Predictive factors for conversion of laparoscopic cholecystectomy. *World J Surg* 1997; 21 (6): 629-33.
5. Parra Blanco JA, Bueno Lopez J, Madrazo Leal C, Farinas Alvarez C, Torre Carrasco F, Farinas MC. Laparoscopic cholecystectomy: analysis of risk factors for predicting conversion to open cholecystectomy. *Rev Esp Enferm Dig* 1999; 91 (5): 359-64.
6. Sikora SS, Kumar A, Saxena R, Kapoor VK, Kaushik SP. Laparoscopic cholecystectomy-can conversion be predicted? *World J Surg* 1995; 19 (6): 858-60.
7. Kum CK, Eypasch E, Lefering R, Paul A, Neugebauer E, Troidl H. Laparoscopic cholecystectomy for acute cholecystitis: is it really safe? *World J Surg* 1996; 20 (1): 43-8; discussion 48-9.
8. Fried GM, Barkun JS, Sigman HH, Joseph L, Clas D, Garzon J, Hinchey EJ, Meakins JL. Factors determining conversion to laparotomy in patients undergoing laparoscopic cholecystectomy. *Am J Surg* 1994; 167 (1): 35-9; discussion 39-41.
9. Hutchinson CH, Traverso LW, Lee FT. Laparoscopic cholecystectomy. Do preoperative factors predict the need to convert to open? *Surg Endosc* 1994; 8 (8): 875-8; discussion 879-80.
10. Jorgensen JO, Hunt DR. Laparoscopic cholecystectomy. A prospective analysis of the potential causes of failure. *Surg Laparosc Endosc* 1993; 3 (1): 49-53.
11. Sanabria JR, Gallinger S, Croxford R, Strasberg SM. Risk factors in elective laparoscopic cholecystectomy for conversion to open cholecystectomy. *J Am Coll Surg* 1994; 179 (6): 696-704.
12. van der Velden JJ, Berger MY, Bonjer HJ, Brakel K, Lameris JS. Can sonographic signs predict conversion of laparoscopic to open cholecystectomy? *Surg Endosc* 1998; 12 (10): 1232-5.
13. Corr P, Tate JJ, Lau WY, Dawson JW, Li AK. Preoperative ultrasound to predict technical difficulties and complications of laparoscopic cholecystectomy. *Am J Surg* 1994; 168 (1): 54-6.
14. Jansen S, Jorgensen J, Caplehorn J, Hunt D. Preoperative ultrasound to predict conversion in laparoscopic cholecystectomy. *Surg Laparosc Endosc* 1997; 7 (2): 121-3.
15. Daradkeh SS, Suwan Z, Abu-Khalaf M. Preoperative ultrasonography and prediction of technical difficulties during laparoscopic cholecystectomy. *World J Surg* 1998; 22 (1): 75-7.
16. Gharaibeh KI, Qasaimeh GR, Al-Heiss H, Ammari F, Bani-Hani K, Al-Jaberi TM, Al-Natour S. Effect of timing of surgery, type of inflammation and sex on outcome of laparoscopic cholecystectomy for acute cholecystitis. *J Laparoendosc Adv Surg Tech A* 2002; 12 (3): 193-198.