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*Research Article*

# Rules and technical tricks in extremely difficult laparoscopic cholecystectomies

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**Abstract** We remind you of some technical artifices required in order to resolve difficult cases, such as: antegrade laparoscopic cholecystectomy (LC), subtotal laparoscopic cholecystectomy (SLC) and the "stairs" clipping of the cystic duct. Also we acknowledge the closing of the cystic duct. We analyzed the medical records of 15251 laparoscopic cholecystectomies performed during 1994-2015, with emphasis on: surgical technique, conversion rate, hemorrhage, postoperative bile leaking, iatrogenic MBD injuries and mortality. We divided the cases in 5 study groups, group 1 (1994-2004) N= 5138, group 2 (2005-2015) N= 10113, group 3 (fundus first cholecystectomies, N=2348), group 4 (retrograde cholecystectomies, N=12889) and group 5 (subtotal laparoscopic cholecystectomy-SLC, N=14) which we compared regarding the main parameters. We prefer to perform a "step by step" clipping each time the length of the clip does not cover all the circumference of the cystic duct. This artifices, is a simple laparoscopic gesture easy to perform and has the advantage of avoiding a large excessive and risky laparoscopic dissection in the vicinity of the main biliary duct. More seldom we appeal to the suture of the cystic stump using the intra-corporeal knots or a simple stump ligation with an extracorporeal preformed not. We did not encounter any late or early complications following the implementation of this technical laparoscopic artifice. Laborious laparoscopic cholecystectomies performed by a well-trained surgical team ensure the premises of a good performance even while adopting laparoscopic ingenious and difficile gestures that also respect the intra-operatory rules and principals.

**Keywords**: laparoscopy, cholecystectomy, rules, technical tricks, dissection, clipping, suture, incident

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## Introduction

When dealing with laparoscopy, similar to the open classical surgery, the approach difficulties in case of an acute cholecystitis are inevitable and require a good surgical laparoscopic training in order to diminish the intraoperative risk and to decide the most adequate therapeutic procedure. Fortunately, this type of pathology is a rear one in children and widely benefits from the advantages of laparoscopy.

The principles of laparoscopic cholecystectomy (LC) are well known to surgeons. Many debates concern the iatrogenic MBD (Main Bile Duct) injuries. But all agree that prevention is the most important treatment. Critical view of safety is the standard strategy for avoiding iatrogenic lesions. In difficult cases conversion to open surgery is the first back up strategy that has emerged, and the last resource in very difficult cases.

Less than complete cholecystectomy has been advocated for difficult operative conditions for more than 100 years. These operations are called partial or subtotal cholecystectomy, but the terms are poorly defined and do not stipulate whether a remnant gallbladder is created. The term partial is discarded, and subtotal cholecystectomies are divided into "fenestrating" and "reconstituting" types. Subtotal reconstituting cholecystectomy closes off the lower end of the gallbladder, reducing the incidence of postoperative fistula, but creates a remnant gallbladder, which may result in recurrence of symptomatic cholecystolithiasis. Subtotal fenestrating cholecystectomy does not occlude the gallbladder, but may suture the cystic duct internally. It has a higher incidence of postoperative biliary fistula, but does not appear to be associated with recurrent cholecystolithiasis (1).

A measure intraoperative, which could indicate some iatrogenic MBD injuries, visual cholangiography proposed by Katkhouda (2), is a technique reserved only for very skilled surgeons.

The terms antegrade and retrograde cholecystectomy have been introduced over time and with the advances in surgical practice. However, to apply these terms descriptively to the removal of the gallbladder is very enigmatic and controversial as the literature is fraught with inconsistency (3, 4). We refer to Kelly et al where a retrograde cholecystectomy is considered a fundus first approach (5). Contradictory to this, Neri et al describes a fundus first approach as antegrade (6).

## Objectives

The study is a retrospective evaluation of the last 22 years of experience in laparoscopic biliary surgery in Department of General Surgery „Sf. Ioan" Emergency Clinical Hospital, Bucharest. We established the most appropriate methods and techniques for resolving cases of extreme hardship, such as: antegrade laparoscopic cholecystectomy (ALC), subtotal laparoscopic cholecystectomy (SLC), the "stairs" clipping of the cystic duct and other closing technical knowledge of the cystic duct.

## Materials and methods

We analyzed the medical records of 15251 laparoscopic cholecystectomies performed during 1994-2015, with emphasis on: surgical technique, conversion rate, hemorrhage, postoperative bile leaking, iatrogenic MBD injuries and mortality. We divided the cases in 5 study groups, group 1 (1994-2004) N= 5138, group 2 (2005-2015) N= 10113, group 3 (fundus first cholecystectomies, N=2348) (Figure 1), group 4 (retrograde cholecystectomies, N=12889) and group 5 (subtotal laparoscopic cholecystectomy-SLC, N=14) which we compared regarding the main parameters.

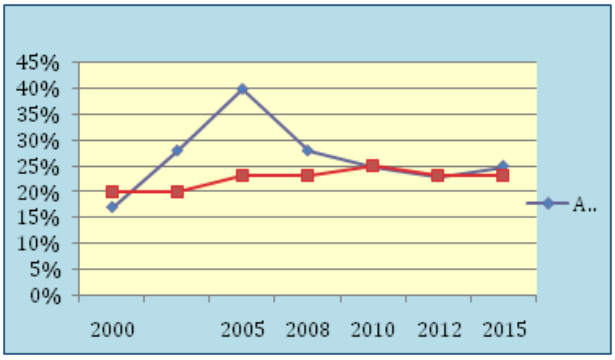


**Figure 1.** Incidence of fundus first cholecystectomy

## Results

Comparing group 1 with group 2, although there is a decrease in the incidence of MBD (Main Bile Duct) injuries (0,21% vs 0,16%) this difference is not significant. Significantly higher percentage of antegrade cholecystectomies (7% vs 23%) and lowest conversion percentage (3% vs 1.9%) (Figure 2). The rate of reinterventions and mortality are lower in the group 2 (reinterventions 0,8% vs 0,5%; mortality 0,4% vs 0,2%). Comparing group 3 and 5 of group 4 was a significant difference in the incidence of iatrogenic MBD injuries (0% - 0% vs 0,16%).

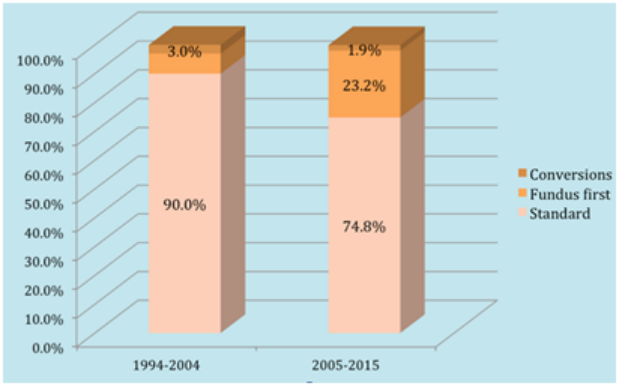


**Figure 2.** Selective use of fundus first cholecystectomy reduces coversion's rate

Remembering the obligatory laparoscopic landmarks that have to be recognized during surgery by any surgeon, the basic rules to be followed unconditionally in order to avoid major intra-operatory accidents and post-operatory complications, and also the technical laparoscopic artifices recommended for the treatment of a thick (or dilated) and inflated cystic stump in cases of acute cholecystitis with important modifications of the hilum. In particular cases the usual laparoscopic maneuvers are no longer sufficient and dealing with them implies a lot of imagination, training and experience in the laparoscopic surgery. Cases that were operated in this manner have been carefully selected and analyzed.

We have enrolled all antegrade or retrograde laparoscopic cholecystectomies (ALC, RLC) (Figures 3-4), cases with overlapped-clipping cystic duct (Figure 5) and cases of subtotal cholecystectomy (Figure 6).

**Figure 3.** Antegrade laparoscopic cholecystectomies (ALC)

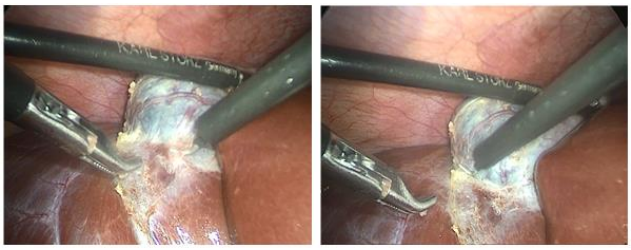

**Figure 4.** Retrograde laparoscopic cholecystectomies (RLC), *after Drăghici I MD PhD. Laparoscopic cholecystectomy in children and adults. Addleton Academic Publishers, New York 2014

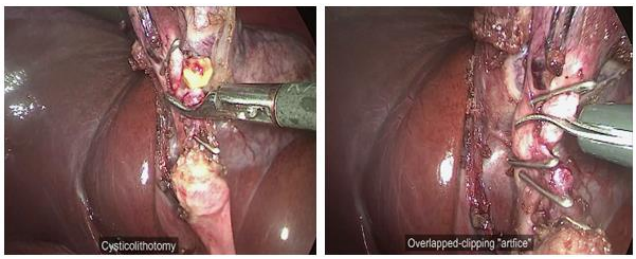


**Figure 5.** Overlapped-clipping cystic duct after cysticolithotomy

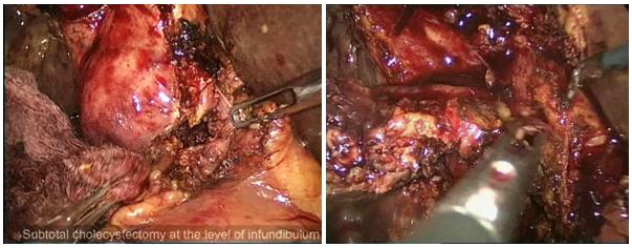


**Figure 6.** Subtotal laparoscopic cholecystectomy at the level of infundibulum

Special attention should be paid to case of gallbladder hydrops that has a large bile stone stuck in the infundibulo-cystic region. The patient presents also important inflammatory modifications of the biliary pedicle (Figure 7). In these situations we recommend the laparoscopic subtotal cholecystectomy and extraction of the stone using a Maryland forceps (Figure 8). Due to the fact that the electric hook dissection of the pedicle is considered dangerous we chose for a subtotal cholecystectomy performed in the infundibular area. Sealing the infundibular remaining is laparoscopic performed by intracorporeal knots (Figure 9). The subhepatic drainage tube is considered a safety measure in order to observe and treat eventual biliary leakages.

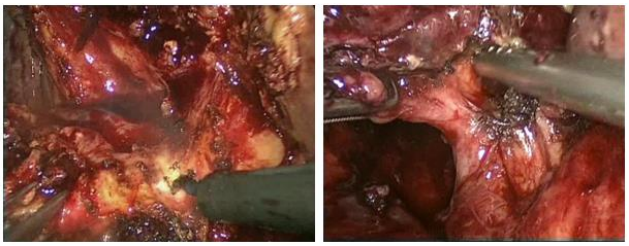

**Figure 7.** Important inflammatory modifications of the biliary pedicle


**Figure 8.** Extraction of the stone using a Maryland forceps (cholecystendesis)


**Figure 9.** Sealing the infundibular remaining is laparoscopic performed by intra-corporeal knots

## Discussions

This concept of defensive cholecystectomy is not new but it has a potential for disorientation at those surgeons who are trained in standard cholecystectomy only (7). We consider useful presentation of some rules and technical artifices of the laparoscopic approach of cholecystitis. We must admit that these rules and artifices have been imposed in the common practice due to the desire to prevent the apparition of intraoperative errors following the insufficient knowledge of the anatomy or extreme modifications of the local anatomy.

Kato et al. dissected Calot's triangle first then took the gallbladder off the liver retrograde maintaining exposure by cephalad traction via a grasper on fundic serosa, which had been left attached to the liver (8, 9). We shall sustain the fundus first strategy, including here also the subtotal cholecystectomy and defensive approach of the cystic duct.

Another consensus regarding laparoscopic surgery is that we have to do by laparoscopic means the same operation we would do in open surgery. We have to perform laparoscopic the same operation like in open surgery. The solution is not to innovate new techniques that are suitable for laparoscopy, but to improve our skills.

In pediatric surgery, the chosen surgical technique and the postoperative stay were very similar to those observed in adults (10). The perception is the same in laparoscopic era. The antegrade cholecystectomy is the best method that has emerged for avoiding ductal injury and the authors recomand this approach in all difficult cases (7).

Various authors have confirmed the feasibility RLC (retrograde laparoscopic cholecystectomy) in patients with acute or chronic inflammation and suggested it might decrease the rate of MBD (11-13). In addition, several authors have reported that RLC helps to avoid open surgery. Mahmud et al reported that the use of fundus-first dissection in difficult cases decreased the conversion rate from a potential 5.2% to 1.2% (14, 15). Similarly Gupta et al. reported a decrease in conversion rate in a small series of patients with chronic cholecystitis from 18.8% to 2.1% (16).

In the most recent study of this year, a nominal group technique (NGT) of 61 experts in Japan, Korea, and Taiwan have generated a list of intraoperative findings that contribute to surgical difficulty. This recent study shows that the criteria for conversion to an open or subtotal cholecystectomy were at the discretion of each surgeon (17).

Cholelithiasis is quite rare in children and adolescents, and the acute pathology is extremely rare. As we know, the most important moment of the surgery is the dissection of the Calot triangle, identification, dissection and treatment of the cystic artery and cystic duct, and that is not always easy to perform. However we can say that LC is safe and efficacious in children. The short-term outcome of cholecystectomy in children seems to be good. Although the specialty literature does not abound in studies of this technical artifice for cholecystectomy, ten years ago various methods for closing the cystic remaining duct were presented. As we know, during the pediatric age most of the times the biliary distress does not manifest on its own, but associated with different severe pathologies, as we have observed in our statistics: mechanical jaundice, acute pancreatitis, hemolytic anemia, hypersplenism, hepatitis, hereditary spherocytosis, minor thalassemia, obesity, diabets, hypophysis tumor, klebsiella pneumoniae infection, ADHD syndrom (Attention Deficit Hyperactivity Disorder) (18).

There are few difficulties for a study design: there is no educational program for laparoscopic antegrade or subtotal cholecystectomy, there is a lack of compliance with a dissection that evolves in the reverse mode, randomizing very difficult cases to a strategy at risk will rise ethical issues and the low incidence of the target event needs thousands of cases to achieve statistical significance.

The circumstances that oblige us intra-operatory to perform technique artifices are determined by: uncertain anatomy, important inflammation process of the gallbladder and infundibular region or the discovery of a thick cystic duct. The diagnosis of common bile duct lithiasis requires a complex therapeutic management: laparoscopic cholecystectomy, ERCP and endoscopic extraction of the bile stone (19).

Laparoscopic trans-cystic common bile duct exploration (LTCBDE) is a complex procedure requiring expertise in laparoscopic and choledochoscopic skills. The safety and feasibility of treating biliary calculi through laparoscopic trans-cystic exploration of the MBD via an ultrathin choledochoscope combined with dual-frequency laser lithotripsy have been demonstrated (20).

We remind you of some technic artifices required in order to resolve difficult cases, such as: antegrade laparoscopic cholecystectomy, subtotal laparoscopic cholecystectomy and the “stairs” clipping of the cystic duct. Also we acknowledge the closing of the cystic duct using ligation by intra or extra corporeal nots or by mechanic suture performed with Endo GIA stapler.

The trans-cystic duct operative cholangiography, is a procedure that once was mandatory in order to explore intra-operatory the common bile duct. Nowadays it has been replaced by the colangio MRI procedure or the ERCP.

Another artifice that we recommend in the practice of the “defensive laparoscopic cholecystectomy” is the “stair” clipping of the cystic duct, and that is easier to perform than the sealing of the infundibular-cystic remaining area during a subtotal cholecystectomy. Each time we encounter a large cystic duct, dilated because of stuck bile stones, we can choose this type of clipping. Also if the biliary pedicle anatomy requires stopping the dissection in the area of the infundibular-cystic junction, we suggest a safe attitude and use a staged clipping at this level, far away from the common biliary duct.

## Conclusions

All these rules and technical artifices of the laparoscopic cholecystectomy are reserved for difficult cases, thus decreasing the risk of lesions of the common biliary duct and complications. These technical "tricks" should be learned during less difficult procedures in order to maintain an efficient learning curve. Even thaw, in the future, for a pertinent conclusion we require multicentric studies concerning this subject.

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