

Analysis of the Predictive Factors for Conversion of Laparoscopic Cholecystectomy to Open Cholecystectomy

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Abstract

Background: Laparoscopic cholecystectomy is the gold standard treatment for most gallbladder diseases.

Identification of group of patients who are at increased (risk) for conversion from laparoscopic (LC) to open cholecystectomy (OC) has proven to be difficult.

The purpose of our study is to identify factors that may be predictive of cases that will require conversion.

Identifying these factors will help the patient, the surgeon, and the hospital.

Objective: To identify the group of patients who are at increased risk for conversion from laparoscopic to open cholecystectomy.

Patients and Methods: In this prospective study, we reviewed 85 patients undergoing laparoscopic cholecystectomy during the last three years (January 1, 2005 to January 31, 2008) at Al-Kadhimiya teaching hospital and Al-Husseiny hospital in Kerbala and recorded reasons for conversion to OC. Statistical analysis was then performed to identify factors predictive of increased risk for conversion.

Results: Of the 85 LC initiated, 18 (21%) required OC for completion. The significant

risk factors for conversion to OC were: little experience of the surgeon, male sex patient, increasing age of patients and gall bladder wall thickness >4 mm by preoperative ultrasound image.

Conclusion: The need for conversion to laparotomy is neither a failure nor a complication, but an attempt to avoid complications.

We conclude that no factor alone can reliably predict unsuccessful LC, but that combinations of factors (multifactorial) result in high conversion rates. Patients with the defined risk factors may be counseled on the increased likelihood of conversion. However, LC can be safely initiated for gallbladder removal with no excess morbidity or mortality should conversion be required.

Keywords: Laparoscopic cholecystectomy, Open cholecystectomy, Conversion, Predictive factors.

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Introduction

Currently, over 90% of cholecystectomies are performed laparoscopically; making it the most common procedure performed in general surgery practice^(1,2).

The indications for laparoscopic cholecystectomy are identical to those for open cholecystectomy.

However, the absolute contraindications include inability to tolerate general anesthesia and uncorrectable coagulopathy^(1,2).

The complexity of the preoperative evaluation is a function of patient age, co morbidities, and suspected pathology. The appropriate course of diagnostic tests should be determined on an individual basis after discussion between the patient and his/her physician^(3,4,5).

Conversion to open cholecystectomy is appropriate and should not be considered a complication in cases where the key technical points of the procedure are not possible. If laparoscopic dissection

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leaves uncertainty about the patient's anatomy, or if concern for injury exists, the surgeon should convert to laparotomy without hesitation ^(6, 7). If the surgeon encounters anatomic anomalies, or if inflammation, adhesions, intra-abdominal fat or bleeding makes visualization of the gallbladder difficult, conversion is in the best interests of the patient when the situation cannot be made clear laparoscopically ^(6, 8, 9, 10).

Identification of group of patients who are at increased (risk) for conversion from laparoscopic (LC) to open cholecystectomy (OC) has proven to be difficult.

The purpose of our study is to identify factors that may be predictive of cases that will require conversion. Identifying these factors will help the patient, the surgeon, and the hospital ^(6, 8, 11).

Patients & Methods

A prospective study, we reviewed 85 patients undergoing laparoscopic cholecystectomy during the last three years (January 1, 2005 to January 31, 2008) at Al-Kadhimiya teaching hospital and Al-Husseiny hospital in Kerbala.

Patient's files were reviewed for clinical parameters including age, gender, diagnosis, history of previous upper abdominal surgery.

Results of imaging including ultrasonography were reviewed. For those patients requiring conversion to open cholecystectomy reason for conversion & complications were reviewed.

Definition of variables:

Age was evaluated as (<20 years, 20-50 years, >50 years)

Diagnosis was either sub acute or chronic cholecystitis. Acute cholecystitis cases were excluded from laparoscopic cholecystectomy in our study.

In past surgical history, we did not include cases with previous abdominal incisions (especially upper abdominal surgery).

In ultrasonography findings we included gall bladder wall thickness (≤ 4 mm versus > 4 mm).

Statistical Analysis:

We used the Chi-square test, P value and Simple charts & figures were initiated to see the effect of proposed factors on conversion.

Results

Conversion to open cholecystectomy:

18 patients (21.2%) required conversion from laparoscopic to open cholecystectomy, as shown in (Figure1).

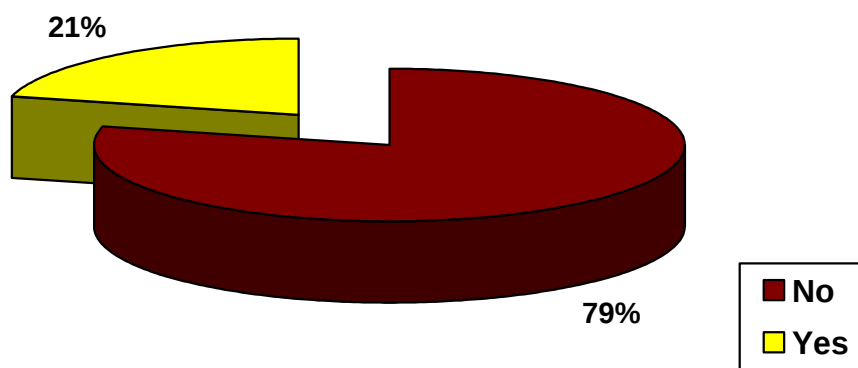


Figure 1: Conversion rate.

Reason for Conversion to Open Cholecystectomy:

The conversion was either due to failure of identification of anatomy of the Calot's triangle, common bile duct

injury with bile leak and or bleeding or equipment failure(lack of Co2 gas and poor light source), as shown in (Figure 2).

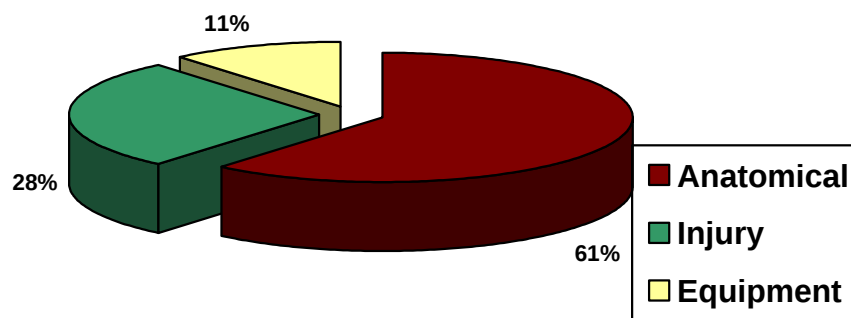


Figure 2: Reasons of conversion.

Age and conversion to open cholecystectomy:

88.9% of the converted cases were in age group of 20-50 years old, while 11.1% of converted cases were older than 50 years. No conversion was

found in patients younger than 20 year. (Table 1) and (Figure 3) (A, B, & C) show the conversion rate in different age groups.

Table 1: The frequency and percentage for each age group with respect to conversion.

Age	Conversion to open		Total
	No	Yes	
Age <20Y	count 3		3
	%within age 100%		100%
Age 20-50Y	count 61	16	77
	%within age 79.2%	20.8%	100%
Age >50Y	count 3	2	5
	%within age 60%	40%	100%
Total	count 67	18	85
	%within age 78.8%	21.2%	100%

Chi-square =1.87 (invalid because of the small sample group).

P value = 0.4

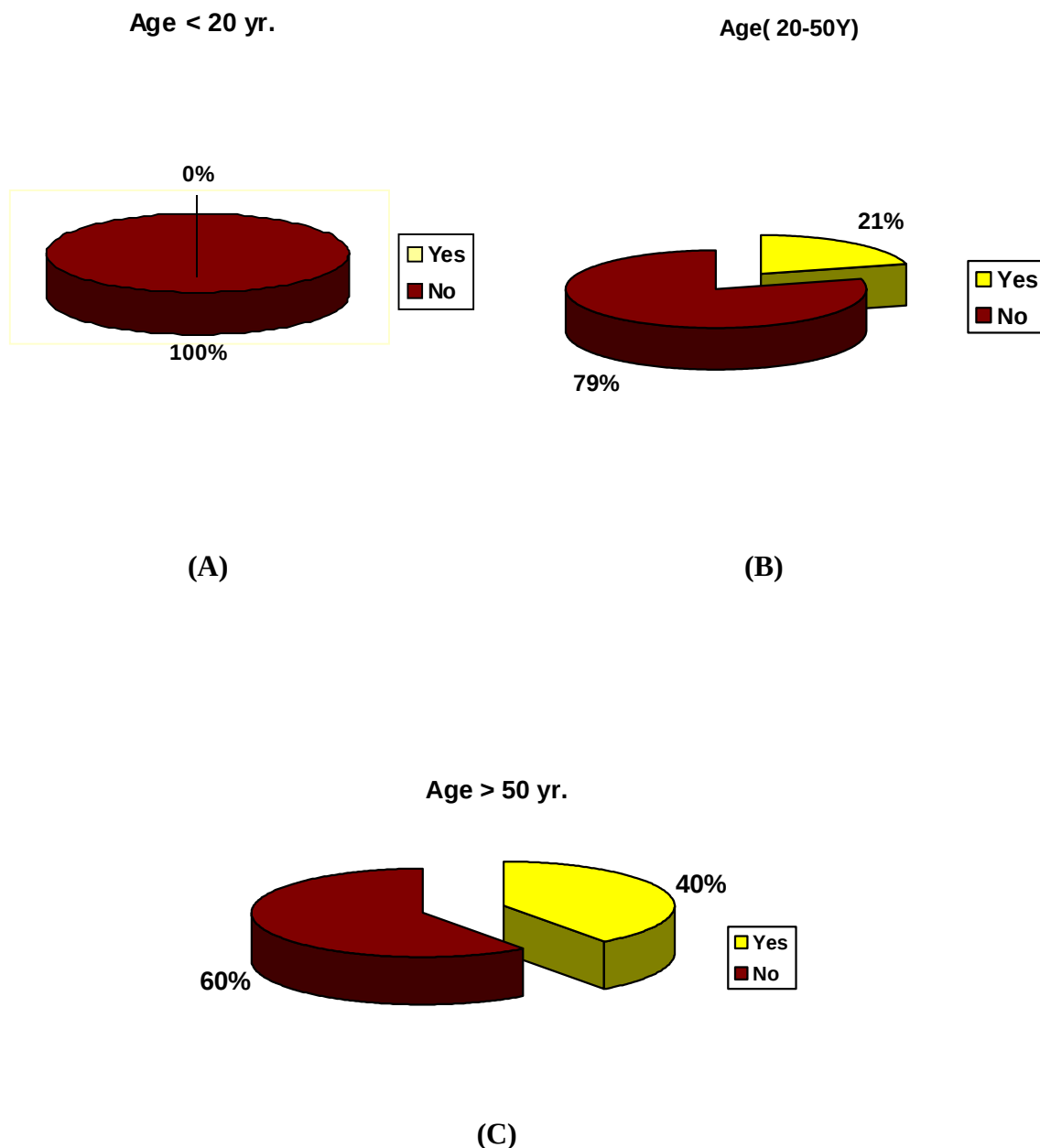


Figure 3 (A, B, C): The conversion rate in different age groups:

Gall bladder wall thickness and conversion to open cholecystectomy:

77.8% of converted cases were with gallbladder wall thickness more than 4mm by ultrasound and the remaining percent of the converted cases(12.2%) were with wall thickness

less than or equal to 4mm. Table 2 and Figure 4 show the percentage and frequency for each group of gallbladder wall thickness and conversion rate for each.

Table 2: Gallbladder wall thickness and conversion rate.

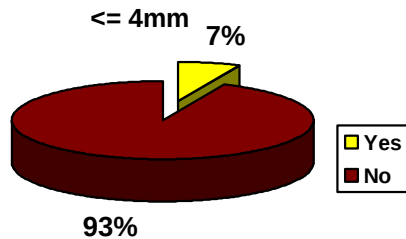
		Conversion To Open		Total
		No	Yes	
Thickness $\leq 4\text{mm}$	count	55	4	59
	%within thickness	93.2%	6.8%	100%
Thickness $>4\text{mm}$	count	12	14	26
	%within thickness	46.2%	53.8%	100%
Total	count	67	18	85
	%within thickness	78.8%	21.2%	100%

Chi-square = 23.95

p value = 0.003

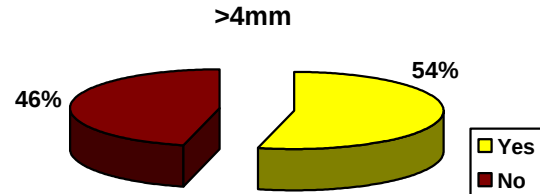
Relative risk = 2.02

Conversion In GB Wall Thickness



(A)

Conversion in GB Wall Thickness



(B)

Figure 4 (A, B): The conversion rate for each GB wall thickness groups.

Conversion With Respect To Time of the Study:

66.7% of converted cases (12) were performed during the first one and half

year of the study, as shown in (Table 3) and (Figure 5).

Table 3: Conversion with respect to time of the study.

Time of the study		Conversion To Open		Total
		No	Yes	
First half	count	23	12	35
	%within period	65.7%	34.3%	100%
Second half	count	44	6	50
	%within period	88%	12%	100%
Total	count	67	18	85
	%within period	78.8%	21.2%	100%

Chi-square test = 6.13

p value = 0.002

Relative risk = 2.06

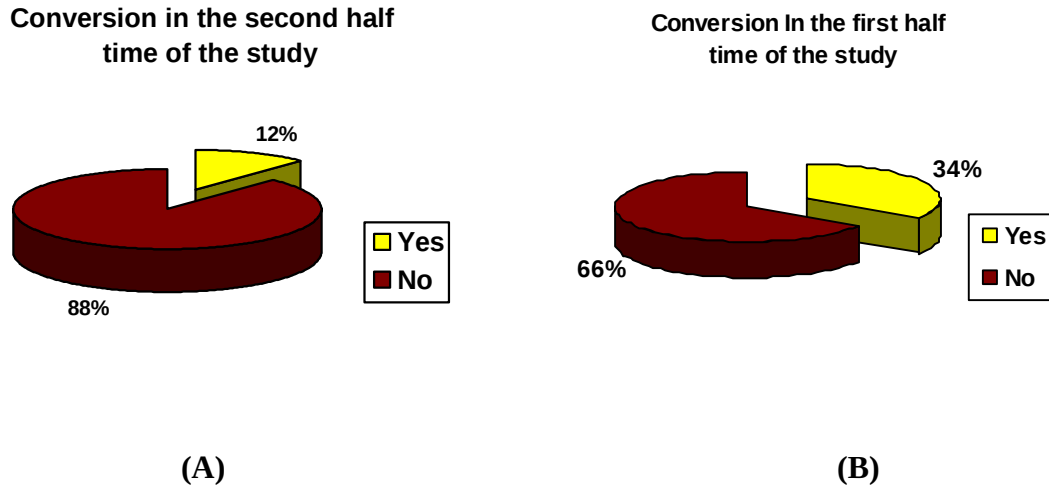


Figure 5 (A, B): Conversion with respect to time of the study.

Discussion

Conversion to open cholecystectomy is required in 21% of patients undergoing laparoscopic cholecystectomy, this result is higher in comparison with Wiebke EA⁽⁶⁾ 8%, Ishizaki Y⁽⁷⁾ 7.5% while it was 10.3% in Ibrahim S study⁽⁸⁾ and 11.4% in Zacks SL study⁽¹²⁾ and this higher result in our study probably due to our little experience in this largely expanding and rapidly growing field and due to emergence of other unique factors in our study as the equipment failure which is not present in other mentioned studies.

The reason for conversion was either due to failure of identification of anatomy of the Calot's triangle (adhesions) 61% of cases which agrees with Zacks⁽¹²⁾ (59%) or due to injury (bile leak and or bleeding) in around 28% of cases which was less than other studies^(9, 13, 14, 15) (around 34%) and this was mainly due to our early conversion in cases of dense adhesions (making identification of anatomy is difficult) resulting in lower injury rate (we did avoid excessive dissection in difficult

cases). Equipment failure was a unique factor for conversion in our study and was not mentioned by other studies.

While adhesions cannot be used as a preoperative predictive factor for conversion, they can be used to indicate a need for early conversion intraoperatively⁽¹⁴⁾.

We have found that increasing age (>50 years) is associated with increasing rate of conversion (the rate of conversion in this age group is more than 40%) which agrees with Wiebke EA⁽⁶⁾ (38%) and Ibrahim S⁽⁸⁾ (39%), this may be due to long period of irritation of the gallbladder wall resulting in frequent attacks of cholecystitis with subsequent increase in gallbladder wall thickness and due to associated co-morbid medical diseases. Insignificant statistical relationship was found because of the small sample group.

More than 33% of males underwent conversion to open cholecystectomy and only 19% of females underwent the conversion, we found the conversion rate to be higher among our male

patients and this could be due to severe briskly inflammatory response in male for unknown reason and subsequent dense fibrosis and adhesions which obscure Calot's triangle anatomy. This has previously been reported by Joel JR⁽¹⁶⁾ (35%) and other studies^(8, 13, 17). But in our study insignificant statistical relationship was found.

The edema and inflammation associated with acute cholecystitis is believed to contribute to the significant amount of adhesions and anatomical distortion seen at the time of surgery that renders laparoscopic dissection difficult⁽¹⁸⁾.

We found that gallbladder wall thickness measured by preoperative ultrasound is an important predictive factor for conversion, around 54% of patients with gall bladder wall thickness >4 mm underwent conversion to open cholecystectomy. This result is also found by Zacks⁽¹²⁾ (55%) and Ishizaki Y⁽⁷⁾ (56%). The sonography was done by more than one sonographer and this may affect our result, because the ultrasonic picture is operator dependent. Increased thickness of the wall make it difficult to be grasped by laparoscopic grasper and is usually associated with fibrosis and adhesion with subsequent narrowing of Calot's triangle^(7, 17), the main causes of increased thickness of the wall are previous attacks of cholecystitis^(19, 20) and thus may reflect difficulty in delineation of the anatomy during surgery.

It was found that conversion rate is higher during the first half time of the study (about 67%) and we suggest that it was related to building up of experience of our surgical teams with increasing number of cases operated and this was similar to other study^(6, 17) (about 63%).

The need for conversion to laparotomy is neither a failure nor a complication, but an attempt to avoid complications. It may be helpful to determine the risk of conversion of LC

to OC beforehand. This may allow the patients to be better prepared for surgery and to plan their absence from work.

Also, such prediction may allow a surgeon to be better prepared, to take extra precautions to reduce intra-operative complications, and to convert from LC to OC at an earlier stage⁽¹⁷⁾.

The significant risk factors for conversion to OC are: increasing age, male gender, gall bladder wall thickness >4 mm and little experience in laparoscope.

We conclude that no factor alone can reliably predict unsuccessful LC, but that combinations of factors (multifactorial) result in high conversion rates. Patients with the defined risk factors may be counseled on the increased likelihood of conversion. However, LC can be safely initiated for gallbladder removal with no excess morbidity or mortality should conversion be required⁽⁶⁾.

Identifying risk factors will help the surgeon to plan and counsel the patient and introduce new policies to the unit⁽⁸⁾.

The identification of factors that reliably predict the likely need to convert LC to an open procedure would provide short-term benefits in terms of patient education and postoperative expectations⁽⁷⁾.

Patients with a high predicted risk of conversion could be operated on either by or under the supervision of a more experienced surgeon. Surgeons in the early phase of their training could operate on patients with low risk of conversion, especially if they are not operating under the supervision of an experienced laparoscopic surgeon. Also, a high predicted risk of conversion may allow the surgeon to take an early decision to convert to OC when difficulty is encountered during dissection; this may shorten the duration of surgery and decrease the associated morbidity⁽¹⁷⁾.

References

1. Nathaniel J. Soper, St. Louis: Laparoscopic general surgery-past present and future. *Surgery* 133:1-3, January 1993.
2. Vandenbergh HC, Wilson T, Adams SE, Inglis MJ. Laparoscopic Cholecystectomy: Its Impact on National Health Economics. *Med J Australia*. 1995; 162: 587-90.
3. Soper NJ. Effect of Nonbiliary Problems on Laparoscopic Surgery. *Am J Surg*. 1993; 165: 522-526.
4. Curet MJ. Special Problems in Laparoscopic Surgery. Previous Abdominal Surgery, Obesity, and Pregnancy. *Surg Clin North Am*. 2000; 80: 1093-110.
5. Grace PA, Quereshi A, Coleman J, Keane R, McEntee G, Broe P, Osborne H, Bouchier-Hayes D. Reduced Postoperative Hospitalization After Laparoscopic Cholecystectomy. *Br J Surg*. 1991; 78: 160-2.
6. Wiebke EA, Pruitt AL, Howard TJ, Jacobson LE, Broadie TA, Goulet RJ Jr, Canal DF. Conversion of laparoscopic to open cholecystectomy. An analysis of risk factors. *Surg Endosc*. 1996 Jul; 10(7): 742-5.
7. Ishizaki Y, Miwa K, Yoshimoto J, Sugo H, Kawasaki S. Conversion of elective laparoscopic to open cholecystectomy between 1993 and 2004. *Br J Surg*. 2006; 93(8): 987-91.
8. Ibrahim S, Hean TK, Ho LS, Ravintharan T, Chye TN, Chee CH. Risk factors for conversion to open surgery in patients undergoing laparoscopic cholecystectomy. *World J Surg*. 2006; 30(9):1698-704.
9. Liu CL, Fan ST, Lai EC5, Lo CM, Chu KM. Factors affecting conversion of laparoscopic cholecystectomy to open surgery. *Arch Surg*. 1996; 131: 98-101.
10. Fried GM, Barkun S, Sigman HH, et al. Factors determining conversion to laparotomy in patients undergoing laparoscopic cholecystectomy. *Am. Surg*. 1994; 167: 35-41.
11. Phillips H, Carroll BJ, Fallas MJ, Pearlstein AR. Comparison of laparoscopic cholecystectomy in obese and non-obese patients. *Am Surg*. 1994; 60: 316-21.
12. Zacks SL, Sandler RS, Rutledge R, Brown RS Jr. A Population-Based Cohort Study Comparing Laparoscopic Cholecystectomy and Open Cholecystectomy. *Am J Gastroenterol*. 2002; 97: 334-40.
13. Cpt. Andrew J. Shapiro, MD, Cpt. Corey Costello, MD, Lt. Michael Harkabus, MD, Lt. James H. North Jr, MD. Predicting Conversion of Laparoscopic Cholecystectomy for Acute Cholecystitis. *JSLs* (1999)3: 127-130.
14. Lujan JA, Parrilla P, Robles R, et al. Laparoscopic cholecystectomy in the treatment of acute cholecystitis. *ACS*. 1995; 181: 75-77.
15. Garber SM, Korman J, Cosgrove M, Cohen JR. Early laparoscopic cholecystectomy for acute cholecystitis. *Surg Endosc*. 1997; 11: 347-350.
16. Joel J. Roslyn: Open cholecystectomy. A contemporary analysis of 42,474 patients. *Annals of surgery* 218:129-137, August 1993.
17. Nachnani J, Supe A. Pre-operative prediction of difficult laparoscopic cholecystectomy using clinical and ultrasonographic parameters. *Indian J Gastroenterol*. 2005 Jan-Feb; 24(1): 16-8.
18. Bakr AAM, Khalil ME, Esmat GE. Acute cholecystitis is an indication for laparoscopic cholecystectomy: a prospective study. *ISIS*. 1997; 1: 119-123.
19. Daradkeh SS, Suwan Z, Abu-Khalaf M. Preoperative ultrasonography and prediction of technical difficulties during laparoscopic cholecystectomy. *World J Surg*. 1998; 22: 75-7.
20. Santambrogio R, Montorsi M, Bianci P, Opocher E, Schubert L, Verga M, et al. Technical difficulties and complications during laparoscopic cholecystectomy: predictive use of preoperative ultrasonography. *World J Surg*. 1996; 20: 978-82.