ELSEVIER

J. of Ambulatory Surgery 12 (2005) 45–49

Ambulatory Surgery

www.elsevier.com/locate/ambsur

Preoperative predictive factors of ambulatory laparoscopic cholecystectomy

J. Bueno Lledó [a], M. Planells Roig [a,*], C. Arnal Bertomeu [b], A. Sanahuja Santafé [a], M. Guillemot Lafargue [b], R. Garcia Espinosa [a]

[a] *Instituto de Cirugía General y del Aparato Digestivo (ICAD) y, Clínica Quirón, Avda Blasco Ibáñez 14, 46010 Valencia, Spain*
[b] *Department Of Anesthesia, Clínica Quirón, Avda Blasco Ibáñez 14, 46010 Valencia, Spain*

Received 23 August 2004; accepted 22 February 2005

Abstract

Background: The aim of our study was to review our experience and to determine preoperative predictive factors for ambulatorization of laparoscopic cholecystectomy (LC).
Methods: Between January 1999 and June 2002, 305 consecutive LC were performed as outpatient procedures. We performed univariant and multivariant analysis of preoperative clinical, analytical and ultrasonographic variables. The preoperative scoring system developed allowed us to calculate the ambulatorization probability of LC in each individual patient.
Results: 265 patients were strictly ambulatory (86.8%). Thirty-five patients required overnight admission (11.4%), most of them due to social factors, and five patients were admitted. Preoperative factors related to overnight stay or admission were: age over 65 years ($p = 0.011$), past history of biliary complications ($p = 0.001$), previous admission due to complicated biliary disease ($p = 0.001$), previous supramesocholic abdominal surgery ($p = 0.011$) and ultrasonographic findings of gallbladder thickened wall and/or shrunken gallbladder ($p = 0.041$). Right classification index of the predictive system was 87.5% reaching a sensibility of 87.8% and specificity of 56.6%.
Conclusions: Outpatient LC is safe and feasible. Age, previous biliary history and ultrasonographic findings are independent preoperative factors influencing ambulatorization rate.

Keywords: Predictive factors; Cholelithiasis; Laparoscopic cholecystectomy; Outpatient surgery

1. Introduction

Laparoscopic cholecystectomy (LC) is the gold standard technique for symptomatic cholelithiasis and one of the most frequently performed procedures in surgery. LC has substituted traditional cholecystectomy due to a more comfortable postoperative period than the open approach [1,2]. Many authors have evaluated the safety and the initial results of LC in the ambulatory setting. However, ambulatory LC remains controversial. In the USA, LC is regularly performed as an outpatient procedure in patients with uncomplicated gallstone disease [5,6]. The results of LC in day-care facilities are promising, but outpatient treatment is not generally accepted in Europe, being performed only in some hospitals [3,4]. Previous publications on ambulatory LC have focussed on the need for selection criteria and in the safety of the ambulatory management.

The aim of our study was to analyze preoperative variables related to ambulatorization and to develop a scoring system to predict the individual probability of patients undergoing successful outpatient LC.

2. Methods

We prospectively analyzed 305 consecutive patients undergoing elective LC for symptomatic gallbladder disease

* Corresponding author. Fax: +34 963 931 706.
E-mail address: mplanells@bsab.com (M. Planells Roig).

0966-6532/$ – see front matter © 2005 Published by Elsevier B.V.
doi:10.1016/j.ambsur.2005.02.003

during the period January 1999 and June 2002. Patients with suspicion of choledocolithiasis, unstable ASA III or ASA IV classification, were excluded from the study. Surgical technique, postoperative management in a fast track way, and admission criteria have been previously described [3,7]. Variables included in the analysis were clinical, ultrasonographic and analytical. Clinical variables included: age, sex, obesity, previous abdominal surgery, ASA and POSSUM classification, past history of biliary complications and previous hospital admission due to biliary complications. Analytical variables included: WBC count, total bilirubin, alkaline phosphatase, GOT and GPT values. Ultrasonographic variables analyzed were: multiple or simple cholelithiasis, wall size, common bile duct diameter and gallbladder distension (distended versus shrunken gallbladder). Patients were considered ambulatory if hospital stay was less than 8 h, while overnight patients were those staying in hospital less than 23 h. Patients considered for analysis in the admitted or over night stay group included only patients with a medical or surgical reason. Social factors for unexpected stay were excluded from the analysis as these are not predictable. Statistical analysis was performed with SPSS program. The scoring system was obtained by multivariate analysis through discriminant analysis and variables were only included if $p < 0.05$.

3. Results

Demographics and past history are shown in Table 1. Of 305 consecutive patients, 265 were strictly ambulatory (86.8%), with a median postoperative in hospital stay of 5.3 ± 1.24 h. In contrast 35 patients required overnight admission, which represents an 11.4% of global series. Most of these were due to social causes: refusal of the patient or relatives, nearest hospital over 100 kms, or conclusion of the operation after 17:00 h. Only five patients (1.6%) were admitted, with a median postoperative in hospital stay of 1.6 days (Table 2).

Fifty (13.1%) postoperative complications were observed, reaching in the ambulatory group 11.6%, most of them managed on an outpatient basis. Four patients were readmitted to our hospital: two due to repeated episodes of vomiting, one due to biliary acute pancreatitis episode, and one due to a subphrenic collection. A fifth patient was readmitted to another institution due to intestinal obstruction that required surgical treatment (Table 2).

Univariant analysis results are shown in Table 3. The discriminant multivariate study found that independent variables influencing the ambulatorization rate were: age over 65 years ($p = 0.011$; $F = 6.515$), complicated biliary disease and previous admission due to biliary complications ($p = 0.001$; $F = 11.17$), previous supramesocholic abdominal surgery ($p = 0.011$; $F = 4.92$) and ultrasonographic findings of thickened wall and/or shrunken gallbladder ($p = 0.041$; $F = 4.20$). The predictive equation derived from discriminant analysis was able to classify correctly 87.5% of cases.

Table 1
Demographics and clinical findings

	Outpatient (%)	Global (%)
Gender		
Male	60 (22.6)	71 (23.3)
Female	205 (77.4)	234 (76.7)
Obesity		
Thin (BMI < 20)	17 (6.5)	19 (6.3)
Normal (BMI: 20–25)	124 (46.8)	139 (45.6)
Obese (BMI > 25)	124 (46.7)	147 (48.1)
ASA		
I	157 (59.2)	179 (58.7)
II	101 (38.1)	116 (38)
III estable	7 (2.7)	10 (3.3)
POSSUM		
20–21	129 (48.6)	148 (48.5)
22–23	118 (44.5)	134 (43.9)
24–25	18 (6.8)	23 (7.6)
Age (years)		
Median (S.D.)	53.74 (14.1)	54.35 (13.9)
Antecedents		
Biliary dyspepsia	59 (22.3)	64 (21)
Biliary cholic	175 (66)	198 (64.9)
Acute cholecystitis	16 (6)	23 (7.5)
Biliary pancreatitis	11 (4.2)	14 (4.6)
Jaundice	4 (1.5)	6 (2)
Previous hospital admission[a]	34 (12.8)	41 (13.1)

[a] Due to complicated past biliar history.

Table 2
Causes of overnight stay, admission and readmission after LC

	No.	Treatment
Outpatients	265 (86.8%)	
Overnight admission	35 (11.4%)	
"Social" cause	21	
Refusal of the patient or relatives	12	
Nearest hospital over 100 kms	5	
Conclusion of the operation after 17.00 h	4	
"Medical" cause	14	
Extended curarization	1	
Acute respiratory insufficiency	3	Symptomatic therapy
Help needed for ambulation	2	
Postoperative pain	1	NSAIDs
Thoracic pain	1	
Umbilical wound haematoma	1	Symptomatic therapy
Vomiting	2	Ondansetron
Technical complexity of operation	3	
Admission	5 (1.6%)	
Conversion to open procedure	2	
Congestive cardiac failure	1	ICU
Esquizophrenic psicosis	1	Psicotropal medication
Intraoperative pneumothorax	1	Thoracic drainage
Readmission	5 (1.6%)	
Vomiting	2	Symptomatic therapy
Subphrenic collection	1	Antibiotics
Acute biliary pancreatitis	1	Conservative
Postoperative intestinal obstruction	1	Surgery
Total	305 (100%)	

ICU: intesive care unit.

Table 3
Outpatient LC: univariant analysis

Variables	Outpatient ($n = 265$)	No outpatient ($n = 40$)	p
Clinical			
Age			
Over or equal 65 years	68 (25.7)	18 (45)	0.011*
Younger 65 years	197 (74.3)	22 (55)	
Gender			
Male	60 (22.6)	11 (27.5)	0.498
Female	205 (77.4)	29 (72.5)	
Previous abdominal surgery			
Supramesocholic	11 (4.2)	5 (12.5)	0.027*
No supramesocholic	254 (95.8)	35 (87.5)	
Obesity			
BMI > 30	124 (46.8)	22 (55)	0.333
BMI < 30	141 (53.2)	18 (45)	
ASA			
I	157 (59.2)	22 (55)	0.271
II	101 (38.1)	15 (37.5)	
III	10 (3.3)	7 (7.5)	
POSSUM score	21.8 ± 1.1	21.9 ± 1.3	0.503
Past history of biliary complications (acute cholecystitis, acute pancreatitis, jaundice)			
Yes	29 (10.9)	12 (30)	0.001*
No	236 (89.1)	28 (70)	
Previous admission due to biliary complications			
Yes	28 (10.5)	13 (32.5)	0.001*
No	237 (90.5)	27 (67.5)	
Analitical			
WBC count (/ml)	7242 ± 2224	6975 ± 2625	0.490
Total bilirrubine (mg/dl)	0.53 ± 0.26	0.51 ± 0.263	0.655
Alkaline phosphatase (mg/dl)	104.9 ± 62.2	114 ± 78.1	0.380
GOT (U/L)	25.4 ± 22.6	25.5 ± 17.1	0.983
GPT (U/L)	28.9 ± 28.4	28.8 ± 25.1	0.977
Ultrasonographic			
Cholelithiasis			
Simple	71 (26.8)	9 (22.5)	0.658
Multiple	162 (61.1)	28 (70)	
Biliary sludge	4 (1.5)	0	
Chronic acalculous Cholecystittis/gallbladder dysfunction	28 (10.6)	3 (7.5)	
Gallbladder volume			
Normal	238 (89.8)	32 (80)	0.100
Hydrops	14 (5.3)	2 (5)	
Shrunken	13 (4.9)	6 (15)	
Gallbladder wall			
Normal	231 (87.2)	30 (75)	0.041*
Thickened and/or shrunken	34 (12.8)	10 (25)	
Common bile duct size			
Normal	257 (97)	40 (100)	0.265
Increased	8 (3)	0	

Due to a low number of patients with previous supramesocholic surgery (16 patients) the variable was excluded from final classification as its inclusion would have produced two population subgroups. The definitive predictive equation, $Y = 11X^0 + 20X^1 + 11X^2 - 79$, allows easy and quick estimation of the individual probability of outpatient management; where Y represents the probability of ambulatorization of the patient; X^0, age greater of 65 years; X^1, past history of complicated biliary disease; X^2, sonographic findings of thickened or shrunken gallbladder. A cut off value over -3 achieved the higher classification index and was related to a probability of ambulatorization up to 74% (Tables 4–6) accounting for a

Table 4
Coefficients according to equation values in discriminant analysis, after removing "previous supramesocholic abdominal surgery" factor

Variable	Corrected coefficient (X10)
Age over 65 years	11
Past history of biliary complications	20
Positive sonographic findings	11
Constant	−79

Equation $p(\text{CLA}) = 11X^0 + 20X^1 + 11X^2 - 79$; ($X^0$ = age over 65 years; X^1 = past history of biliary complications; X^2 = positive; sonography findings; constant = −79).

Table 5
Scoring values and ambulatory probability

Patients	Age	Antecedents	US	N/AMB	Score	Outpatient (%)
$N = 305$	Age over 65 years 86	PHBC+ 17	US+	1/5	−37	20
			US−	8/12	−26	66.6
		PHBC− 69	US+	7/10	−17	70
			US−	52/59	−6	88.1
	Age minor 65 years 219	PHBC+24	US+	2/4	−26	50
			US−	18/20	−15	90
		PHBC−195	US+	24/25	−6	96
			US−	153/170	5	90

PHBC: past history of biliary complications; US+: sonographic findings of shrunken or thickened gallbladder wall; amb: ambulatory.

Table 6
Scoring system cut off value and outpatient probability, after removing social admission

Scoring value	Outpatient		Total
	Yes	No	
≥−3 (−3, 7)	224	13	237
%Total	73.4%	7.5%	81.0%
<−3 (−3, −39)	41	17	58
%Total	13.4%	5.6%	19.0%
Total	265	30	295

Right classification index: 87.2% of cases. Sensitivity 87.8%, specificity 56.6%, positive predictive value 94.5%, negative predictive value 29.3%.

87.8% sensitivity and 56.6% specificity (positive predictive value: 94.5; negative predictive value: 29.3).

4. Discussion

The ambulatory approach of LC has been facilitated fundamentally by use of opiate-free anaesthesia, pre-emptive analgesia and the use of intraperitoneal anesthetics [8–10]. This method results in an improvement in quality, a substantial economic saving and an increase in the availability of hospital resources [4].

The rate of unexpected admissions represents a quality index that measures the success or failure of this kind of surgery. The percentage of failure of outpatient LC in selected patients in some series varies between 2 and 19%, due mainly to uncontrolled postoperative symptoms like nausea and vomiting or abdominal pain, conversion to open surgery and patients or relatives feeling of lack of safety [6–8,11–12]. Several studies have identified preoperative factors (Table 7) that could predict unsuccessful outpatient LC [6,11–24]. Our group (18) reported the term “technically difficult LC”, in a prospective study with overnight LC patients identifying predictive factors for potentially outpatient patients (female, normal gallbladder wall). Some authors [23,24] have argued like essentials: social factors as acceptance and motivation of patients, need of preoperative detailed information with comprehensible instructions, right selection of patients, experienced laparoscopic team and successful management of postoperative symptoms, as important keys for outpatient management. In our study, age of the patient, suprameso-

Table 7
Factors predicting unsuccessful outpatient LC

Author	*N*	Preoperative factors
Reddick (1990)	83	Ancient age
		Previous abdominal surgery
Saunders (1995)	506	Associated serious illness
Sikora (1995)	150	Female gender
		Gallbladder wall thickness
Voitk (1995)	100	Ancient age
		Associated serious illness
		Acute cholecystitis
Fiorillo (1996)	149	Patient’s motivation
Jansen (1997)	738	Age > 70 years
		Cholelithiasis > 20 mm
		Gallbladder wall > 4 mm
		Common bile duct diameter > 6 mm
		Shrunken gallbladder
Voyles (1997)	605	Age > 65 years
		Previous abdominal surgery
		Acute cholecystitis
		Choledocolithiasis signs
Alponat (1997)	783	Acute cholecystitis
		Gallbladder wall inflammation in sonographic images
		Seric alkaline phosphatase elevation
		Serum WBC count elevation
Keulemans (1998)	80	Age > 60 years
		Past history of jaundice and biliar cholic
Planells (1999)		Male gender
		Past history of acute cholecystitis
Simpson (2000)	126	ASA > II
		Past history of acute pancreatitis or cholecystitis
Fatás (2000)	265	Previous abdominal surgery
		ASA III/IV
		Serum GOT, GPT and GGT elevation
		Gallbladder wall thickness > 4 mm
Lau (2001)	731	Sonographic and surgical gallbladder wall thickness
Richardson (2001)	847	Patient’s preoperative information
		Patient’s acceptation
Robinson (2002)	387	Age > 50 years
		ASA III/IV

cholic abdominal previous surgery, previous complicated biliary history (admission due to acute cholecystitis, acute pancreatitis or obstructive jaundice) and ultrasonography findings of thickened or shrunken gallbladder wall were the most important preoperative factors that determined failure in outpatient LC. We did not find significant differences with respect to admission or overnight stay in male patients, with overweight or high score of ASA or POSSUM classification. Analytical values like WBC count, liver serum parameters, and sonographic findings of increased common bile duct diameter, number of stones (multiple versus isolated) or gallbladder hydrops due to stone impactation at gallbladder neck, did not reach statistical significance in univariate analysis. The inclusion of the variable "previous supramesocholic abdominal surgery" in the predictive system, originated several sub-groups with equal score to zero, so we decided to eliminate this variable in the discriminant study although it should always be taken into account as an independent factor. Social factors that influenced overnight admission rate were mainly due to refusal of the patient or relatives based on feeling of insecurity feeling about discharge on the same day of surgery. As there is no possibility of preoperative estimation of the development of social factors in the postoperative period this outcome was not considered in the analysis.

In conclusion, age, previous abdominal surgery, past history of complicated biliary history with or without previous hospital admission and thickened or shrunken gallbladder wall in sonographic studies are independent preoperative factors that predict success or failure of outpatient LC. The preoperative scoring system developed is of clinical value, and allows discarding previously non-subsidiary patients for outpatient LC. Social factors developing mainly in the early postoperative period would be only avoidable by extensive information with patients and relatives and will remain as a non predictable factor in relation to ambulatorization.

References

[1] Berggren U, Gordh T, Grama D, Haglund U, Rastad J, Arvidsson D. Laparoscopic versus open cholecystectomy: hospitalization, sick leave, analgesia and trauma responses. Br J Surg 1994;81:1362–5.

[2] Trondsen E, Reiertsen O, Andersen OK, Kjaersgaard P. Laparoscopic and open cholecystectomy. A prospective, randomized study. Eur J Surg 1993;159:217–21.

[3] Serralta A, Bueno J, Sanhauja A, Garcia R, Arnal C, Guillemot M, et al. Learning curve in ambulatory laparoscopic cholecystectomy. Surg Laparosc Endosc Percutan Techn 2002;12:320–4.

[4] Planells M, Sanchez A, Sanahuja A, Bueno J, Serralta A, Garcia R. Total quality management in laparoscopic cholecystectomy. Perceived and clinical quality in ambulatory laparoscopic cholecystectomy. Rev Esp Enferm Dig 2002;94:319–25.

[5] Arregui ME, Davis CJ, Arkush A, Nagan RF. In selected patients laparoscopic cholecystectomy is safe and significantly reduces hospitalization charges. Surg Laparosc Endosc 1991;1:240–5.

[6] Voitk AJ. Routine outpatient laparoscopic cholecystectomy. Can J Surg 1995;84:262–5.

[7] Serralta A, Garcia R, Martinez P, Hoyas L, Planells M. Four years experience in outpatient laparoscopic cholecystectomy. Rev Esp Enferm Dig 2001;93:207–10.

[8] Lam D, Miranda R, Hom SJ. Laparoscopic cholecystectomy as an outpatient procedure. J Am Coll Surg 1997;185:152–5.

[9] Prasad A, Foley RJ. Day case laparoscopic cholecystectomy: a safe and cost effective procedure. Eur J Surg 1996;162:43–6.

[10] Mraovic B. Intraperitoneal bupivacaine for analgesia after laparoscopic cholecystectomy. Acta Anaesthesiol Scand 1997;41:193–6.

[11] Voyles CR, Berch BR. Selection criteria for laparoscopic cholecystectomy in an ambulatory care setting. Surg Endosc 1997;11:1145–6.

[12] Lau H, Brooks D. Predictive factors for unanticipated admissions after ambulatory laparoscopic cholecystectomy. Arch Surg 2001;136:1150–3.

[13] Robinson T, Biffl W, Moore E, Heimbach J, Calkins C, Burch J. Predicting failure of outpatient laparoscopic cholecystectomy. Am J Surg 2002;184:515–9.

[14] Keulemans Y, Eshuis J, de Haes H, de Wit LT, Gouma DJ. Laparoscopic cholecystectomy: day-care versus clinical observation. Ann Surg 1998;228:734–40.

[15] Jansen S, Jorgensen J, Caplehorn J, Hunt D. Preoperative ultrasound to predict conversion in laparoscopic cholecystectomy. Surg Laparosc Endosc 1997;7:121–3.

[16] Alponat A, Kum CK, Koh BC, Rajnakova A, Goh PM. Predictive factors for conversion of laparoscopic cholecystectomy. World J Surg 1997;21:629–33.

[17] Sikora SS, Kumar A, Saxena R, Kapoor VK, Kaushik SP. Laparoscopic cholecystectomy, can conversion be predicted? World J Surgdkjdot 1995;19:858–60.

[18] Planells M, García R, Anaya P, Lopez C, Ballester C, Serralta A, et al. Factors predicting technically difficult laparoscopic cholecystectomy. Cir Esp 1999;65:48–53.

[19] Fatas JA, Blanco FJ, Ara JR, Dobon MA. Criterios para la realización de colecistectomía laparoscópica dentro de un programa de cirugía mayor ambulatoria. Cirugía Mayor Ambulatoria 2000;5:25–8.

[20] Reddick E, Olsen DO. Outpatient laparoscopic laser cholecystectomy. Am J Surg 1990;160:485–7.

[21] Simpson JP, Savarise MT, Moore J. Outpatient laparoscopic cholecystectomy: what predicts the need for admission? Am Surg 1999;65:525–8.

[22] Saunders CJ, Leary BF, Wolfe BM. Is outpatient laparoscopic cholecystectomy wise? Surg Endosc 1995;9:1263–8.

[23] Fiorillo MA, Davidson PG, Fiorillo M, D'Anna JA, Sithian N, Silich RJ. 149 ambulatory laparoscopic cholecystectomies. Surg Endosc 1996;10:52–6.

[24] Richardson WS, Fuhrman GS, Burch E, Bolton JS, Bowen JC. Outpatient laparoscopic cholecystectomy. Outcomes of 847 planned procedures. Surg Endosc 2001;15:193–5.