

FINANCIAL ANALYSIS OF ELECTIVE CHOLECYSTECTOMIES IN A COMMUNITY HOSPITAL

BİR DEVLET HASTANESİNDE ELEKTİF KOLESİSTEKTOMİLERİN FİNANSAL ANALİZİ

Dr. Serdar Topaloğlu¹, Dr. Fatih M. Avsar¹, Dr. Suha Danisman¹, Dr. Hakan Ozel¹, Dr. Huseyin Berkem¹, Dr. Yigit Yildiz¹, Dr. Bulent C. Yuksel¹, Dr. Erdem Karabulut², Dr. Suleyman Hengirmen¹

RESEARCH

ABSTRACT

Aim: Financial aspects of laparoscopic cholecystectomy (LC) and their comparison with open cholecystectomy (OC) were evaluated in a community hospital.

Patients and Methods: We retrospectively reviewed 156 consecutive patients underwent LC (n=103) or OC (n=53) from January 2001 to September 2002. Data from clinical charts, hospital charges and salaries of the personnel involving in treatment of patients were evaluated. Disability costs were also estimated.

Results: Operating time for OC and LC were 69 and 70 minutes; postoperative stay was 8 and 4 days; and total cost of hospital stay was 1341 and 1118 US \$ respectively. The median hospital stay in patients with complications was prolonged to 14 days. Additional disability cost secondary to unnecessarily longer sick-leave periods for 14 servants amounted to 5129 \$.

Conclusions: The cost, hospital stay and recovery periods of both operations were found to be comparable with the literature.

Key words: Laparoscopic cholecystectomy, open conventional cholecystectomy, financial analysis, disability cost saving

INTRODUCTION

As in the other part of the world, laparoscopic cholecystectomy (LC) becomes the first choice for the treatment of symptomatic cholelithiasis in Turkey (1,2). The cost-effectiveness of LC has been estimated with the studies from the United States and the Europe (3,13). Most of the reports have emphasized lower costs of LC compared to open cholecystectomy (OC). However, others have found no significant cost savings or even an increase in the hospital costs for LC (5,12).

İletişim:

Serdar Topaloğlu, MD

Kılıç APT. No: 10/4, 6. Cadde, Öveçler, 06450-1, Çankaya, Ankara, Turkey

Tel: +90 312 478 61 09 **Fax:** +90 312 418 27 60 • **e-mail:** serdardtopaloglu@hotmail.com

¹ First Department of Surgery, Ankara Numune Training and Research Hospital, 06100, Sıhhiye, Ankara, Turkey.

² Department of Biostatistics, Hacettepe University, School of Medicine, 06100, Sıhhiye, Ankara, Turkey.

ARAŞTIRMA

ÖZET

Amaç: Laparoskopik kolesistektominin (LC) ile açık kolesistektominin mali yönlerinin (OC) karşılaştırılması bir devlet hastanesinde değerlendirildi.

Hastalar ve Yöntem: Ocak 2001-Eylül 2002 arasında LC (n = 103) veya OC (n = 53) uygulanan 156 hasta retrospektif olarak gözden geçirildi. Klinik çizelge verileri, hastane masrafları ve hastaların tedavisinde yer alan personel maaşları değerlendirildi. Engellilik masrafları da hesaplanmıştır.

Bulgular: OC ve LC için ameliyat süresi 69 ve 70 dakika idi; hastanede kalış süresi 8 ve 4 gün oldu ve hastanede kalış toplam maliyeti 1.341 ve 1.118 ABD \$ idi. Komplikasyonları olan hastalarda medyan hastanede kalış süresi 14 güne kadar uzamış oldu. 14 memurun gereksiz istirahat süresinden kaynaklanan ilave engellilik maliyeti 5.129 \$ tutarındadır.

Sonuç: Maliyet, hastanede kalış ve her iki operasyonun iyileşme dönemleri literatür ile benzer olduğu saptanmıştır.

Anahtar kelimeler: Laparoskopik kolesistektomi, açık konvansiyonel kolesistektomi, finansal analiz, engellilik maliyet tasarrufu

The studies cited as the basis for the economic analysis of LC were mostly performed during the learning period of the technique. Today, LC is generally performed by well-experienced surgeons, and more ergonomic equipments than the previously employed are used. Therefore, the assessment of the financial analysis of LC remains as a subject to be revised. To the authors' knowledge, there is no published study on the examination of economic aspects of LC in Turkey. The financial analysis of elective cholecystectomies (OC and LC) in a community hospital was reported in this retrospective study.

PATIENTS AND METHODS

Patients

Clinical charts of 209 patients who underwent a cholecystectomy operation between January 2001 and September 2002 in First Department of Surgery, Ankara Numune Training and Research Hospital were evaluated retrospectively. To ensure comparability of groups, exclusion criteria were defined in such a way that elective open conventional cholecystectomy could be compared with elective laparoscopic cholecystectomy. Patients with any malignancies, acute cholecystitis, choledocholithiasis and pancreatitis were excluded from the study population. Rest of patients (n=156) were called with phone by the same physician, and data of 131 patients that were adequately replied our questions were finally analyzed. Questions for surveillance were created to learn about the subjective recovery time after the operation and the required time for return to work. Moreover, the questions were modified according to socioeconomic status of the patients. It was thus possible to record the recovery time approximately.

Routine application of the LC operation for symptomatic gallstone disease has been started in our clinic since July 1994. Before that, LC had only been performed sporadically between 1991 and 1994. Since the first application of LC, disposable instruments have been used for operation in our hospital. To prevent false cost comparisons as a result of learning curve, the time range for this analysis was limited to abovementioned interval. Indications of our clinic on OC in the study period were constricted with previous upper abdominal operation and patients' preference. The reason for conversion from LC to OC in the study period is limited with the surgeons' preference secondary to operative difficulties and the presence of operative complications. The present analysis, therefore, compares the 53 (34%) open conventional cholecystectomies with the 91 (58%) laparoscopic cholecystectomies performed between January 2001 and September 2002. During this period, 12 patients (8%) who underwent laparoscopic cholecystectomy were converted to OC during the operation.

Demographics of the Study Group

Most of the patients were female (n=123; 78.8%), with median age 52.7 (range 23-83). There were 33 males (21.2%) in the study group, with median age 61.3 (range 31-87). There were no statistically significant differences between LC and OC groups in any of variables according to American Society of Anesthesiologists (ASA) classification, except age. The median age of the patients who underwent OC (58, range 45-87) was significantly higher than those who underwent LC (53, range 25-83) (p=0.024).

Socioeconomic Status of the Study Group

Most of patients in the study group belonged to lower socioeconomic status in the community. Only 14% (n=22) of patients had a regular occupation. Housewives constituted 68% (n=92) of patients that were not employed. Forty patients were retired government employees (29%), and 2 patients were unemployed in this group. Patients with a proper employment were classified into three categories; civil servants (n=15), workers (n=2), and self-employed persons (n=5).

Financial Analysis

During the assessment of costs, data obtaining from the Ministry of Health, the Ministry of Finance, State Institute for Statistics (DİE), State Planning Organization (DPT) and from Purchasing and Paymaster departments of the Ankara Numune Training and Research Hospital were used.

Hospitalization Costs

Because of the operation of our hospital was affiliated with the Ministry of Health, price quotation for all hospital services (originally designed from the Ministry of Finance) is authorized and organized by the Ministry of Health. Therefore, the data for analysis of hospital charges (admission, diagnostic (laboratory-radiologic), anaesthetic, operative, care and miscellaneous documentation) were used according to the declared list of the Ministry of Health (Table 1). The difference in anesthesia charges between LC and OC in the Table 1 are independent from duration of operation, and is determined by Ministry of Finance. Operating room wearing costs and other indirect (uncontrollable) costs such as cleaning, maintenance and depreciation costs of the permanent LC equipments (cameras, insufflators, etc.) were also included to the analysis. The personnel who made the

Table 1– Quoted charges in our hospital.

Parameters	Prices (US \$)*
Ward charges for a day	12.1
Examination	4.6
Consultation	4.6
Routine preoperative laboratory tests	84.8
ECG	3.2
Posterior-anterior chest x-ray	6.4
ICU bed charges for a day	49.8
Operative charges for OC	196.5
Anesthesia charges for OC	58.9
Operative charges for LC	321.5
Anesthesia charges for LC	96.4

ECG: Electrocardiography, OC: Open Cholecystectomy, LC: Laparoscopic Cholecystectomy, ICU: Intensive Care Unit

*Salaries were calculated under the guidance of data obtained from Department of Paymaster, Ankara Numune Training and Research Hospital, the Ministry of Health, and the Ministry of Finance.

Table 2— Staff salaries classified into professions.

Profession	Estimated salary per day (US \$)*	Estimated working hours for LC ¥ (for elective patient)	Estimated working hours for OC ¥ (for elective patient)
Surgeons	19.6	220 min	340 min
Anaesthesists	19.6	100 min	100 min
Senior surgeon (resident)	15.9	410 min	630 min
Nurse	10.7	365 min	595 min
Technician (operation room)	10.7	90 min	90 min
Other hospital staffs	5.3	150 min	270 min

*Salaries were calculated under the guidance of data obtained from Department of Paymaster, Ankara Numune Training and Research Hospital, and the Ministry of Finance.

¥ Total working time for each personnel (shown in Table) was calculated according to median hospital stay of elective patients.

physical examination on admission, who gave the anaesthesia, who did the operation, and who conducted bed visits were taken into account in the analysis. Personnel salaries and wages are paid by the Ministry of Finance in Turkey. So, the salary data of the responsible personnel during the hospitalization of patients were obtained from the Ministry of Finance (Table 2). For calculation of personnel costs for cholecystectomy, the total working time (hour) required for elective cholecystectomy procedure for professional groups (surgeons, physicians, anaesthesists, nurses and other hospital staffs required during the hospitalization) was determined (Table 2). Personnel costs were calculated for each patient by using the personnel salaries calculated on the basis of per working hour.

Disability Costs

Full-recovery time for adequate occupational performance was determined and recorded for each patient who had an occupation. Determined period of disability was compared to previously given sick-leave period (upon discharging).

The disability costs were calculated according to salaries of the patients, surgeons' and employers' responsibilities on the disability cost savings were evaluated. The disability costs of house wives, an important part of house economy, were not calculated. Great variety on economic productivity within housewives in Turkey impedes healthy evaluation of disability costs.

All values about charges were converted from Turkish liras to American dollars in order to allow easy comparisons with previous studies. The variations in the exchange rate according to years were also taken into account during the analysis. The 2001-2002 costs were applied in all cases in order to avoid any inflation cost bias.

Statistical Analysis

Obtained data were classified and loaded into the computer with the assistance of staff from Department of Biostatistics, Hacettepe University. Data were analyzed using Student's *t*-test, Fisher's Exact Test, the Mann-Whitney U test, and Kruskal Wallis test.

Table 3— Clinical data are presented according to groups.

Parameters	Open cholecystectomy (n=53)	Laparoscopic cholecystectomy (n=91)	Laparoscopic to open conversion (n=12)
Operation time (min)	69 (45-110)	70 (40-121)	110 (70-160)*
Operative complications	-	2 (2.2)	-
Biliary tract injury		1	
Bleeding from omentum		1	
Wound infection	8 (15.1%)	4 (4.4%) ?	2 (16.7%)
Adequate oral resumption (day)	2 (1-3) (n=45/53)	1 (1-2)# (n=76/91)	3 (1-4) (n=10/12)
Duration of hospital stay (day)	8 (2-20) (n=45/53)	4 (2-14)¥ (n=76/91)	7 (2-19) (n=10/12)
Subjective recovery time (day)	5 (2-60) (n=45/53)	2 (0-8)i (n=76/91)	4.5 (2-10) (n=10/12)

Data were expressed as median (minimum-maximum). * P<0.01 (conversion group versus OC and LC group); # P<0.05 (LC group versus OC and conversion groups); ¥ P<0.001 (LC group versus OC and conversion groups); - P<0.001 (LC group versus OC and conversion groups) (Student's *t* test); - P<0.05 (LC group versus OC and conversion groups) (Fisher's Exact Test).

Tablo 4– Cost analysis of LC and OC procedures. All values are expressed as median (min.-max.).

Parameters	Open cholecystectomy	Laparoscopic cholecystectomy	Laparoscopic to open conversion
Hospital Charges (US \$)	854 (580-1370)	878 (755-1280)	896 (790-1395)
Total Charges (including personnel charges)	1341 (635-1650)	1118 (782-1460)	1471 (653-1725)

RESULTS

Clinical data for patients treated by OC or LC are presented in Table 3. The median operation time (incision to close) for LC procedure was not significantly different from the open procedure. Operation time was prolonged in cases with LC-OC conversion. During the study period, 2 (2.2%) patients re-operated due to operative complications (common bile duct injury and bleeding from omentum). Both complications were determined in the early postoperative period. There were no operative or postoperative deaths. Postoperative complications (the unique complication was wound infection) were determined in 14 patients (9%). The median hospital stay of patients with complication was 14 days (range 6-25), compared to others (median 4 days, range 2-14) ($p=0.02$). The difference of wound infection rates between LC, OC and LC-OC conversion was found insignificant. Inspected recovery parameters (adequate oral resumption, duration of hospital stay, subjective recovery time) improved significantly after LC compared to OC procedure and LC-OC conversion (Table 3).

Hospital expenses of procedures were summarized on Table 4. Sum of operating room and equipment wearing costs were 110 \$ (90 to 140) for OC and 200 \$ (165 to 220) for LC. Without taking into consideration of personnel salaries, LC procedure was more but insignificantly expensive than OC. If, personnel charges were added to analysis, the mean cost of LC would come out less but insignificantly expensive than OC. Conversion during the LC procedure caused an increase in the operation-related costs to 1471 US dollars ($p>0.05$, as compared to LC or OC patients).

All patients have an occupation were operated with the laparoscopic technique. All workers and self-employers in the study group were re-started to their jobs at the end of the subjective recovery period. However, the observed period in civil servants for complete recovery to their occupation was prolonged compared to other profession groups. If subjective recovery time was subtracted from the previously given sick-leave period, the sum of resting days without disability of these servants ($n=14/15$) would reach to 367 days. The sum of additional disability costs of these servants to government would reach to 5129 US dollars.

DISCUSSION

During the last decade, financial aspects of laparoscopic cholecystectomy have been evaluated with detail in studies from developed countries. Factors affected to cost analysis of the LC which described in exclusion criteria are considered into analysis in most of these series. However, bias secondary to higher costs due to additional interventions are not eliminated in these studies.

Early reports during learning curve of the laparoscopic cholecystectomy are permitted relatively optimal patient selection for examination (3,5-8,12,14). In the current approach to cholelithiasis, optimal comparison of open cholecystectomy versus laparoscopic one does not make easily. Priority on surgical treatment of gallbladder disease belongs to laparoscopy. In a recent analysis from Germany, authors were tried to solve this problem by historical comparison of LC and OC patients (4). However, cost differences between revealed periods in this study are not eliminated yet. To eliminate alterations dependent to economic period, our study designed in the same interval for each technique.

Conditions hinder to laparoscopic cholecystectomy are diminishing day by day with intensive efforts of laparoscopic surgeons. Dependent to our clinical policy, only history of previous abdominal operation and patients' preference hinder laparoscopic cholecystectomy. These contraindications are generally accepted within the literature. Abovementioned factors reflect to our study with an age bias. All patients in the OC group were older than 53 years (median 58). In the LC group, however, median age was 53 years which means that half of the LC patients were younger than the youngest patient in the OC group. This significant difference may be explained by two factors. The median age of patients exposed to previous abdominal surgery in OC group was 54 (44-65). Second, patients preferred to open cholecystectomy (despite, have an adequate information about laparoscopic procedure) were generally older than fifth decade (median age; 63, 51-87). Dependent to our observations, patients older than fifth decade in study population are generally prejudiced to laparoscopic procedures when compared to classic approach.

Complications reported in open and laparoscopic cholecystectomy series is not comparable objectively because of the differing exclusion criteria, periods of hospital stay and

the definition of the term 'complication', as discussed by Bosch et al.(4) Dependent to small sample size in our analysis, bile duct injury in LC found higher (1.09%) than generally acceptable range (0.3-0.5%) (15). Open conventional cholecystectomy accompanied lower severe operative complication rate in our patients, as indicated in literature (15).

Advantages of LC on the clinical outcome were proved together in our series. Each of the recovery markers were improved in our patients who underwent LC, rather than OC, similar to other series (3-5,11,13,16). Depending on the increasing experience in laparoscopic procedures, the operation time for LC is closer to the required time for OC. Postoperative stay of patients underwent LC is longer than those in western countries. This difference may be explained by surgeons' and patients' conservative opinion on early discharge after cholecystectomy. Hospital stay was affected negatively in the presence of complications.

The costs of open and laparoscopic approach to the gallbladder disease are still a subject of controversy. The inclusion criteria of patients in studies for financial analysis of cholecystectomies are not easily comparable with each other. The reported costs for LC range from 1516 US \$ to 8095 US \$ in literature (17,18). Those for OC range from 2221 US \$ to 9857 US \$ (13,14). In a recent analysis, estimated costs for LC and OC are reported to be 2808 and 3434 US dollars, respectively (4). Higher costs of disposable laparoscopic equipments in our country, and, determined anesthetic and operative status of the LC (Table 1) are accounted for more expensive hospital charges in LC. When the personnel charges added to the analysis, estimated costs for OC turn out to be more than LC. This difference between costs is chiefly attributable to the considerably shorter postoperative stay after the laparoscopic procedure.

Compared to presenting results from the developed countries, our estimated costs for both procedures are less. There are so many reasons responsible for these cost gaps. First of all, the foundation aim of our hospital, as determined by the Ministry of Health, is to meet every need about health problems of people who are at lowest socioeconomic status in Turkey. As clearly observed in our patient profile, majority of the patients were concerned into this group. Estimation of prices for health expenses is made by the Ministry of Finance according to lower socioeconomic section of Turkish population. Therefore, previously quoted charges in our hospital are less than university and private hospitals in our country, as they are lower than to rates in developed country hospitals. Salaries and wages of health personnel, another concern of financial analysis, are also lower than those in developed countries.

Despite limited numbers of persons have an occupation in our study population, the recovery period of working patients to their jobs gives important information about the distribution of disability costs in Turkey. More controlled professions like workers in the private companies or self-

employers return to their jobs within expected periods. Profit and loss rates dependent to disability of workers are a matter of concern by their employers. However, among government servants and their officers, the same reason is not taken into consideration adequately. It seems that officers of government servants do not supervise the sick leave period given by clinicians to patients during discharge yet. Doctors and chiefs of clinics, main determiners of sick leave period, additionally, do not pay special attention to developing gap between the real recovery time and given sick leave period prescribed.

In conclusion, costs involved in LC procedure in our hospital are found to be less expensive than those associated with OC procedure. Recovery parameters among the patients were also found better in LC group compared to patients who underwent OC. Lower personnel salaries, lower hospital charges and status of our hospital, all affect estimated cholecystectomy costs. Disability cost savings within the working population requires the full responsibility of doctors, employers and officers of the patients who have a regular occupation.

REFERENCES

1. Legorreta AP, Silber JH, Costantino GN, et al. Increased cholecystectomy rate after introduction of laparoscopic cholecystectomy. *JAMA* 1993;270:1429-32.
2. Topcu O, Karakayali F, Kuzu MA, et al. Comparison of long-term quality of life after laparoscopic and open cholecystectomy. *Surg Endosc* 2003;17:291-5.
3. Bass EB, Pitt HA, Lillemoe KD. Cost-effectiveness of laparoscopic cholecystectomy versus open cholecystectomy. *Am J Surg* 1993;165:466-71.
4. Bosch F, Wehrman U, Saeger HD, Kirch W. Laparoscopic or open conventional cholecystectomy: Clinical and economic considerations. *Eur J Surg* 2002;168: 270-7.
5. Fullarton GM, Darling K, Williams J, et al. Evaluation of the cost of laparoscopic and open cholecystectomy. *Br J Surg* 1994;81:124-6.
6. Jordan AM. Hospital charges for laparoscopic and open cholecystectomy. *JAMA* 1991;266:3425.
7. Kelley JE, Burrus RG, Burns RP, et al. Safety, efficacy, cost, and morbidity of laparoscopic versus open cholecystectomy: A prospective analysis of 228 consecutive patients. *Am Surg* 1993;59:23-27.
8. Kesteloot K, Penninckx F. The costs and effects of open versus laparoscopic cholecystectomies. *Health Economics* 1993;2:303-12.
9. Orlando II-R, Russell JC. Managing gallbladder disease in a cost-effective manner. *Surg Clin North Am* 1996;76:117-28.
10. Schimer B, Dix J. Cost effectiveness of laparoscopic cholecystectomy. *Gastroenterology* 1991;100 (5 Part 2): A17
11. Stevens HPJD, van de Berg M, Ruseler CH, Wereldsma JCJ. Clinical and financial aspects of cholecystectomy: Laparoscopic versus open technique. *World J Surg* 1997;21:91-7.
12. Stoker ME, Vose J, O'Mara PO, Maini BS. Laparoscopic cholecystectomy. A clinical and financial analysis of 280 operations. *Arch Surg* 1992;127:589-95.
13. Wenner J, Graffner H, Lindell G. A financial analysis of laparoscopic and open cholecystectomy. *Surg Endosc* 1995;9:702-5.

14. Cagir B, Bangraj M, Mafucci L, et al. A retrospective analysis of laparoscopic and open cholecystectomies. *J Laparosc Surg* 1994;4:89-100.
15. Strasberg SM, Hertl M, Soper NJ. An analysis of the problem of biliary injury during laparoscopic cholecystectomy. *J Am Coll Surg* 1995;180:101-25.
16. Fisher KS, Reddick EJ, Olsen DO. Laparoscopic cholecystectomy: cost analysis. *Surg Laparosc Endosc* 1991;1:77-81.
17. Goodman GR, Hunter JG. Results of laparoscopic cholecystectomy in a university hospital. *Am J Surg* 1991;162:576-9.
18. Grace PA, Quereshi A, Coleman J, et al. Reduced postoperative hospitalization after laparoscopic cholecystectomy. *Br J Surg* 1991;78:160-2.