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Cost and outcomes of open versus laparoscopic cholecystectomy in Mongolia



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ARTICLE INFO

Article history:

Received 1 December 2017

Received in revised form
24 January 2018

Accepted 15 March 2018

Available online xxx

Keywords:

Laparoscopy
 Global surgery
 Cost-effectiveness
 Outcomes
 Mongolia
 Quality of life

ABSTRACT

Background: Laparoscopic cholecystectomy (LC) is the standard of care for biliary disease in developed countries. LC in resource-limited countries is increasing. This prospective, observational study evaluates costs, outcomes, and quality of life (QoL) associated with laparoscopic versus open cholecystectomy (OC) in Mongolia.

Methods: Patient demographics, outcomes, and total payer and patient costs were elicited from a convenience sample of patients undergoing cholecystectomy at four urban and three rural hospitals (February 2016–January 2017). QoL was assessed preoperatively and postoperatively using the five-level EQ-5D instrument. Perioperative complications, surgical fees, and QoL scores were evaluated for LC versus OC. Multivariate regression models were generated to adjust for differences between these groups.

Results: Two hundred and fifteen cholecystectomies were included (LC 122, OC 93). LC patients were more likely to have attended college and have insurance. Preoperative symptoms were comparable between groups. Total complication rate was 21.8% (no difference between groups); LC patients had less superficial infections (0% versus 10.8%). Median hospital length of stay (HLOS) and days to return to work were shorter after LC. QoL improved after surgery for both groups. Mean total payer and patient costs were higher for LC, but not significant (P -value 0.126). After adjustment, LC had significantly less complications, shorter HLOS, fewer days to return to work, greater improvement in QoL scores, and no increase in cost.

Conclusions: LC is safe and beneficial to patients with biliary disease in Mongolia, and cost effective from the patient's and payer's perspective. Although equipment costs for LC may be more expensive than OC, there are likely significant cost savings related to reduced HLOS, shorter time off work, fewer complications, and improved QoL.

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<https://doi.org/10.1016/j.jss.2018.03.036>

Introduction

Laparoscopic cholecystectomy (LC) was first performed in the mid 1980's and underwent significant technical refinement over the early 1990s and into the 2000s.¹ Today the minimally invasive approach is first line for surgical management of simple and complex biliary disease in high-income countries (HICs). Its use is associated with reduced hospital length of stay (HLOS), lower perioperative morbidity and mortality, more rapid return to work, and reduced total hospital costs.² Despite the need for expensive specialized equipment, as compared with open cholecystectomy (OC), these benefits make this technique especially attractive for low- and middle-income countries (LMICs).

Laparoscopy was first introduced to Mongolia in 1994. Biliary diseases are the second most common disease managed by Mongolian surgeons, and the demand for this minimally invasive approach has grown both among the medical community and the general public.³⁻⁵ By 2005, only 2% of cholecystectomies were performed laparoscopically because of deficits in training, lack of awareness about the procedure, and skepticism about the safety of LC.^{6,7} As a result, its adoption has been limited to larger cities and well-funded facilities. Surgeons at the Mongolia National University of Medical Sciences (MNUMS), recognizing the benefits of LC and an opportunity for systemic surgical advancement, responded to slow uptake by creating an ambitious long-term plan for countrywide expansion of LC using a train-the-trainer model. Starting in 2006, didactic courses were implemented in the capital city, Ulaanbaatar, and in rural Regional Diagnostic and Training Centers to address these barriers to adoption and dispersion.⁸ Early LC courses and subsequent laparoscopic training programs were supported by partnerships between MNUMS, Dr W C Swanson Family Foundation since 2005, University of Utah, and the Society of American Gastrointestinal and Endoscopic Surgeons since 2008.^{4,7-9}

As a result of these significant investments, by 2011, LC exceeded OC surgeries and laparoscopic surgery became requisite in the resident surgical curriculum.³ Data from the Ministry of Health also indicated that morbidity and mortality from postsurgical complications of LC decreased over a 9-y period from 2003 to 2012. However, high initial capital costs, infrastructure deficits, and poor diffusion of sustained training into secondary-level regional hospitals remained barriers to practice despite patient and surgeon preference for LC over OC.¹⁰ This study sought to better understand the frequency, outcomes, and patient and payer costs associated with LC and OC in secondary- and tertiary-level hospitals in Mongolia in the hopes of better addressing barriers for further expansion of laparoscopic surgery.

Methods

This study was approved by the Institutional Review Board at the University of Utah (IRB 00086141), the research review committee at MNUMS, and the administration of each participating hospital. Both urban and rural hospitals in

Mongolia were selected to participate in this study: four urban hospitals in Ulaanbaatar that performed laparoscopic and open surgery and three rural hospitals in relatively close proximity to Ulaanbaatar (because of the poor winter road conditions). Selection of hospitals aimed to allow for similar numbers of laparoscopic and open procedures. The four urban tertiary care centers in Ulaanbaatar included Friendship Nomun Hospital, General Hospital of Law Enforcement Personnel (Military Hospital), First Central Hospital of Mongolia, and Second Central Hospital of Mongolia. The three rural sites included secondary level hospitals (aimags): General Hospital of Arkhangai Province, Govi Altai General Hospital, and Uvurkhangai Hospital.

Patients were consented to participate during the preoperative visit. The perioperative survey was completed on the day of surgery and captured demographics and preoperative quality of life (QoL), operative procedure, intraoperative complications, and out-of-pocket and insurance costs—associated with cholecystectomy. The follow-up survey assessed operative outcomes and current QoL. QoL was assessed preoperatively and postoperatively using the validated five-dimension, five-level EuroQoL instrument (EQ-5D-5L), which had been translated into Mongolian by our co-investigators. The EQ-5D-5L quantitates the degree of difficulty patients have in five domains of their daily life: mobility, self-care, activity, pain/discomfort, and anxiety/depression.¹¹ These domains are used to calculate the EQ visual analog scale (VAS) score, a 0-100 measure of overall health (100 = perfect). Operative and patient and payer cost data was supplied by an on-site physician through review of the patient's medical record. Thirty days after surgery, patients were called to complete the follow-up survey over the phone with one of our Mongolian co-investigators (S.E.).

Data collection occurred concurrently at the seven sites from February 2016 through January 2017. For inclusion, nonpregnant patients 18 y and older with confirmed ultrasound findings of polyp, common duct stone, gallstone, wall thickening, pericholecystic fluid, or emphysematous cholecystitis had to have either LC or OC at one of the participating sites during the study period. Although physicians were instructed to approach all patients undergoing LC or OC for participation, it became apparent that not all patients undergoing LC or OC at each site were being recruited. Unfortunately, there is no data regarding the total number of LCs and OCs performed at each facility during the study period. Choice of surgery was based on the availability of surgery type, the discretion of the surgical team, and patient preference.

Income and cost data were retroactively converted from Tugriks to USD using the average monthly exchange rate found on <http://www.xe.com/currencyconverter/>, corresponding to the surgery date. Secondary outcomes included mortality, morbidity, HLOS, and QoL measures, including time to return to work (TRW). Data were collected on paper forms, and later entered into REDCap (Research Electronic Data Capture), a secure browser-based software program for compiling and organizing research data. The data were then assessed for accuracy by one Mongolian (S.E.) and one American co-investigator (J.S.R.), and analyzed using STATA 11.0 (Stata-Corp LP, College Station, TX). Student t-test, chi-squared, and

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