Research Article

Observed outcomes and costs of laparoscopic versus open cholecystectomy in Juba, South Sudan

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ABSTRACT

Introduction: Cholecystectomy is the standard operative treatment for symptomatic gallstone disease and may be performed using either an open or laparoscopic approach. Laparoscopic cholecystectomy is now the preferred approach in many settings, although open cholecystectomy remains common in parts of sub-Saharan Africa. This study compared observed outcomes and admission costs for laparoscopic and open cholecystectomy in a low-resource clinical setting.

Methods: We conducted a retrospective comparative study of 100 adult patients who underwent open cholecystectomy (OC) or laparoscopic cholecystectomy (LC) between January 2023 and June 2024. OC was performed at South Sudan Modern Specialist Hospital, Juba Teaching Hospital, and Juba Military Hospital. LC was performed at Nile Kings Specialist Hospital in Juba. After application of the inclusion and exclusion criteria, 50 patients were included in each group. All the patients consented to surgery. Medical records were reviewed for the cost of the operative package, medication use, complications, and length of hospital stay. Ethical approval was sought and approved for the retrospective study of the notes.

Results: The mean age was 44.9 years, 46.3 years in the OC group and 43.6 years in the LC group. In the OC group, 11 patients (22%) were male, and 39 (78%) were female; in the LC group, 14 patients (28%) were male, and 36 (72%) were female. Mean hospital stay was 6.2 days after OC and 2.1 days after LC. Complications were recorded in 5 patients (10%) after OC and in 1 patient (2%) after LC. The mean total admission cost was USD 2,553.60 for OC and USD 2,179.82 for LC, a difference of USD 373.78 in favour of LC.

Conclusion: LC was associated with shorter hospital stay, fewer recorded complications and lower observed admission costs than OC. Further prospective evaluation is recommended to confirm these findings and to inform wider implementation of laparoscopic surgery in low-resource settings.

Keywords: gallstones; laparoscopic cholecystectomy; open cholecystectomy; cost; South Sudan

Introduction

Cholecystectomy is a common surgical procedure for the management of symptomatic gallstone disease. The operation may be performed by open cholecystectomy (OC) or laparoscopic cholecystectomy (LC). In many high-income settings, LC has become the standard approach since the early 1990s.[1] However, OC remains commonly performed in many low-resource settings, including most parts of sub-Saharan Africa.[2] In settings where LC is widely performed, OC is usually reserved for patients with a contraindication to laparoscopy or for intraoperative conversion when a laparoscopic procedure cannot be completed safely. Conversion may be more frequent during the early learning curve for laparoscopic surgery, when operating times and conversion rates are often higher.[3] Published studies have reported several benefits of LC over OC, including shorter hospital stay, improved cosmesis and lower morbidity.[4]

The objective of this study was to compare observed clinical outcomes and admission costs for LC and OC in the Republic of South Sudan, a low-resource clinical setting in sub-Saharan Africa.

Method

This retrospective comparative study included 100 adult patients who underwent cholecystectomy in South Sudan between January 2023 and June 2024. All the patients were selected consecutively. OC was performed at South Sudan Modern Specialist Hospital, Juba Teaching Hospital (JTH), and Juba Military Hospital (JMH). LC was performed at Nile Kings Specialist Hospital in Juba. Eligible patients were adults with symptomatic gallstone disease who consented to OC or LC and had no clinical contraindication to surgery. Fifty patients who underwent OC and 50 patients who underwent LC.

Documented ethical approval and individual notes review consent were not necessary, as this was an audit review.

Medical records were reviewed for operation cost, length of hospital stay, postoperative medication use, conversion from LC to OC, and recorded perioperative and postoperative complications.

Results

Most procedures were performed in private hospitals. The mean age of the study population was 44.9 years: 46.3 years in the OC group and 43.6 years in the LC group. In the OC group, 11 patients (22%) were males and 39 (78%) were females. In the LC group, 14 patients (28%) were males, and 36 (72%) were females. The mean duration of postoperative analgesic use was 8.9 days after OC, at a mean cost of USD 26.70, compared with 3.6 days after LC, at a mean cost of USD 10.86. Postoperative antibiotics were given for a mean of 10.2 days after OC, at a mean cost of USD 76.80, compared with 6.4 days after LC, at a mean cost of USD 48.15.

There were no perioperative or postoperative deaths. The recorded complications occurred during the index admission, with none during the follow-up. The complication rate was 10% after OC and 2% after LC (Table 1). All included LC patients underwent surgery,

Table 1. Summary of patient characteristics, resource use and admission costs by procedure

Variable	Open cholecystectomy (n=50)	Cost (USD)	Laparoscopic cholecystectomy (n=50)	Cost (USD)
Age, mean ± SD (years)	46.3 ± 13.24		43.64 ± 15.34	
Sex ratio, M/F	11/39		14/36	
Analgesic requirement, mean (days)	8.86	26.70	3.62	10.86
Antibiotic requirement, mean (days)	10.24	76.80	6.42	48.15
Time to oral intake, mean (days)	2.28	17.10	1.12	8.40
Recorded complications, %	10		2	
Hospital stay, mean (days)	6.22	933.00	2.08	312.41
Operation fee		1,500.00		1,800.00
Total cost		2,553.60		2,179.82

Table 2. Common and recorded complications by procedure perioperatively and post-operatively N=50

Complication	OC n (%)	LC n (%)
Bleeding	1 (2.0)	0 (0.0)
Wound infection	3 (6.0)	0 (0.0)
Jaundice	0 (0.0))	0(0.0)
Bile leak	0 (0.0)	1 (2.0)
Post-cholecystectomy syndrome	0 (0.0)	0 (0.0)
Chest Complications (Pneumonia)	1 (2.0)	0 (0.0)
Total	5 (5.0)	1 (2.0)

and no LC case was converted to OC in this series.

Mean time to resumption of normal oral intake was 2.3 days after OC and 1.1 days after LC. The mean postoperative intravenous fluid cost was USD 17.10 after OC and USD 8.40 after LC.

Mean hospital stay was 6.2 days after OC, with a mean stay-related cost of USD 933.00, compared with 2.1 days after LC, with a mean stay-related cost of USD 312.41. The recorded operation fee was USD 1,500.00 for OC and USD 1,800.00 for LC. When all admission-episode costs were included, the mean total cost was USD 2,553.60 for OC and USD 2,179.82 for LC, a difference of USD 373.78 in favour of LC. All costs were charged to the patients in the study.

Table 2 shows the common and recorded complications by procedure, perioperatively and post-operatively.

Statistically, the total costs for open cholecystectomy showed a 95% confidence interval (CI) of [2472.32, 2634.88], and the CI for the length of hospital stay was [5.68, 6.76]. For the laparoscopic arm, the mean total cost had a CI of [2167.71, 2191.11], and hospital stay showed a CI of [2.01, 2.15]. These statistical calculations, despite the sample size, show that OC costs more than LC.

Discussion

This study provides an early comparative description of LC and OC in the Republic of South Sudan. Published studies from sub-Saharan Africa indicate that OC remains the most frequently performed procedure for symptomatic gallstone disease in many settings.[2] Although LC is available in some tertiary hospitals, its uptake has been slower due to limitations in infrastructure, equipment, and trained surgical personnel.[5] By contrast, LC has become the standard approach in many high-income countries over the past three decades.[1]

Gallstone disease is a significant contributor to the surgical disease burden in Africa. Over recent decades, urbanisation and changing lifestyle patterns have been associated with an increasing incidence of gallstone disease.[6]

In this series, 75 of 100 patients undergoing cholecystectomy for symptomatic gallstone disease were female. This is consistent with established epidemiological evidence that gallstone disease is more common in women than in men.[6,7]

LC was associated with fewer recorded complications than OC in this series (2% versus 10%) and no conversions to OC were recorded (Table 2). These findings are encouraging, particularly in the context of an early laparoscopic programme in South Sudan. However, the small sample size and non-randomised design mean that these results should be interpreted as descriptive rather than definitive evidence of superior safety. The shorter hospital stay observed after LC is consistent with published reports from other settings and is one of the principal advantages of laparoscopic surgery.[5,8,9,12]

The cost of OC varies across low-resource African hospitals and may differ between private and public facilities. In this study, the reported costs reflect practice in private specialist hospitals and in private-wing or public-private cost-sharing admissions in government hospitals (Table 1). The overall cost comparison is therefore best interpreted as an admission-cost comparison rather than a formal cost-effectiveness analysis. As laparoscopic surgery has become more established, costs have fallen in many settings and outcomes have improved with training, resulting in lower conversion rates and shorter hospital stays, equipment availability, and accumulated surgical experience.[5,10,11] In sub-Saharan Africa, LC is increasingly performed in well-resourced private hospitals and large tertiary teaching hospitals, but access remains uneven.[6,12] In the present study, total admission cost incorporated professional fees, hospital stay, medications, and costs associated with recorded complications (Tables 1 and 2).

Mean total admission cost was USD 2,554 for OC and USD 2,180 for LC, a difference of USD 373.78. This difference may be meaningful for patients with modest incomes. In this series, the higher total cost of OC appeared to be driven mainly by longer hospital stays, longer durations of postoperative analgesic and antibiotic

use, and management of recorded complications. These findings are consistent with reports that LC can reduce length of stay and postoperative resource use compared with OC.[13-14] However, the present study did not include indirect costs, quality-of-life outcomes, or formal economic modeling; therefore, the term "cost-effective" should be used cautiously.

In South Sudan, the main government hospitals have no clearly defined pricing policy for cholecystectomy beyond basic administrative admission fees. This study also found that laparoscopic operating sets were not available in the main government hospitals. Consequently, patients who can afford private care may seek LC in a small number of private facilities in the capital, while others may travel to neighbouring countries or further afield for surgical treatment.

The findings also highlight the need for clearer regulation of private healthcare pricing and tariffs, particularly as the number of private specialist hospitals increases in parts of sub-Saharan Africa.

This study has several limitations. The sample size was small, the design was retrospective and non-randomised, and the two procedures were performed in different hospitals. These factors introduce potential selection bias and confounding. Prices were not standardised across hospitals, and there was wide variation in cost packages, particularly for OC, between government and private hospitals. Only a limited number of surgeons performed LC in the study sample. A longer-term audit over several years, including the learning curve for laparoscopic surgery, would provide a more reliable assessment of outcomes, complications, conversion rates, and costs.

Conclusion

LC is the standard surgical approach for symptomatic gallstone disease in many countries. This retrospective series suggests that LC can be delivered in South Sudan and may be associated with shorter hospital stay, fewer recorded complications and lower observed admission costs than OC. Wider adoption would require investment in equipment, training and governance, together with clearer regulation and standardisation of hospital tariffs.

Despite the limitations of small sample size and non-randomisation of this retrospective study, LC was associated with more favourable observed outcomes and lower admission costs than OC. Prospective studies with standardised costing, longer follow-up and adjustment for case mix are needed before definitive conclusions can be drawn.

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