

# Laparoscopic Surgery in Low-income and Limited-resource Settings: Does It safely add Value? A Review of 2,901 Laparoscopic Gynecologic Procedures

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## ABSTRACT

**Objectives:** Of the 234 million surgeries conducted yearly worldwide, only 3.5% are carried out in low-income countries. Known advantages exist to laparoscopic surgery, and it is widely utilized in high-income countries; however, many barriers exist to uptake in low-income countries. Since 1992, laparoscopic surgery has been successfully undertaken in various rural public hospitals in Kenya. We sought to review outcomes of laparoscopic surgeries performed by our group in these facilities.

**Materials and methods:** Between 1992 and 2015, 3,119 laparoscopic procedures were performed at 17 rural hospitals in Kenya as a part of the Round Table's "Week of Healing Project." The medical and operative records of all patients who underwent gynecological laparoscopic surgery were retrospectively reviewed for outcomes.

**Results:** During the reporting period, 2,901 cases performed were gynecologic procedures; the mean age of patients was 34.2. Forty-one complications were encountered (1.41%), and one death (0.03%) occurred secondary to hemorrhage

following conversion to laparotomy for an ovarian tumor. The mean hospitalization was 1.9 days.

**Conclusion:** Laparoscopic surgery is feasible, safe, and cost-effective, and it has important advantages in low-income countries with limited resources. Laparoscopic surgery does add value in low-resource settings, and our activities demonstrate that it is a safe alternative to traditional open modalities of surgery.

**Keywords:** Global surgery, Gynecologic surgery, Laparoscopic surgery, Low- and middle-income country surgery.

**How to cite this article:** Parkar RB, Pinder LF, Wanyoike JG, Patel Y, Otieno D, Palkhi Y, Baraza R, Rogo K. Laparoscopic Surgery in Low-income and Limited-resource Settings: Does It safely add Value? A Review of 2,901 Laparoscopic Gynecologic Procedures. *World J Lap Surg* 2016;9(2):82-85.

**Source of support:** Nil

**Conflict of interest:** None

## INTRODUCTION

Until recently, access to surgical interventions has been a neglected global issue despite up to 30% of the world's disease burden requiring surgical intervention.<sup>1</sup> Almost 2 billion people in the world have no access to needed interventions, and of the 234 million surgeries conducted worldwide each year, only 3.5% are conducted in low-income countries.<sup>2</sup> For almost 35 years, there has been a rapid spread and evolution of laparoscopic surgery in the developed world, where this modality is largely regarded as the first choice in 98% of all surgical interventions by adequately trained surgeons.<sup>3</sup>

In low-income countries, restricted access and availability of equipment and lack of adequate training of surgeons have been barriers to establishing successful laparoscopic surgery programs.<sup>3</sup> Gawande reported that lack of clean water, sanitary living conditions, depleted blood facilities, lack of sufficient infection control, and diagnostic imaging techniques have further delayed the uptake of laparoscopic surgery in rural areas.<sup>4</sup> The notable advantages to laparoscopic surgery include smaller, cosmetically acceptable incisions; less scarring and postoperative pain; less utilization of antibiotics and analgesics; reduced overall hospital stay; and less ward congestion.<sup>5</sup>

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Faster recovery and quicker return to work make these procedures less expensive in the long run<sup>6,7</sup> which is particularly important in low-income settings.

The cost-effectiveness of laparoscopy continues to be an important consideration in low- and middle-income countries (LMICs) countries and generates regular debate; however, Sculpher et al<sup>8</sup> in their review determined that laparoscopy was in fact significantly (25–30%) cheaper when compared to laparotomies. Chao et al<sup>9</sup> in their systematic review of laparoscopic surgery in LMICs reviewed 1,101 abstracts from 25 LMICs and concluded that laparoscopic surgery was particularly advantageous in LMICs. In the presence of poor sanitation, limited diagnostic and imaging facilities, crowded hospital beds, lack of blood banks, and single-income households, laparoscopy is safe, effective, feasible, and cost-effective when offered in LMICs.

The principal author started his laparoscopic surgery career in 1992, at the Kilifi District Hospital along the Kenyan Coast and with the collaborative efforts of a general surgeon, carried out biannual surgical camps performing 200 surgeries per year. By 2000, The Kenya Society of Endoscopic Specialties (KESES) partnered with Round Table, a young men's charitable club, and laparoscopic surgery was offered as a surgical option for treatment in various rural hospitals in Kenya. Since then, laparoscopy has been successfully undertaken in 17 rural hospitals in Kenya, with more than 3,000 procedures performed. Given the need to expand access to all modalities of surgery including laparoscopy in LMICs, and given the extensive laparoscopy experience in this setting, this assessment was designed to test the hypothesis that laparoscopic surgery, when performed by experienced surgeons, can be successfully and safely implemented as an alternative to laparotomy in rural settings in LMICs.

## MATERIALS AND METHODS

The laparoscopic surgery program began with the receipt of laparoscopic tubal ligation kits from Johns Hopkins Program for International Education in Gynecology and Obstetrics (JHPIEGO) in the 1990s. Laparoscopic surgical interventions continued in various rural hospitals with support from Round Table, providing logistics, supplies, preoperative advertising, and patient screening. Additionally, transport and accommodations were provided to all volunteer surgeons through this organization. The laparoscopic surgical camps or "Week of Healing Projects" were organized biannually, and two laparoscopic surgeons – one specializing in Gynecology and the other in General Surgery – performed the procedures.

The patients were screened to determined candidacy for laparoscopic surgical intervention by various clinicians at each hospital hosting the Week of Healing

Project. Patients were determined to be a candidate for laparoscopic intervention if they were not obese, had simple pathologies, no previous laparotomies, or any preexisting comorbidities. On average, 400 to 450 surgeries were conducted each year.

The charts of all patients who underwent laparoscopic surgery during the Week of Healing Project surgical camps between 1992 and 2015 were retrospectively reviewed for demographic data, procedure performed, length of hospital stay, morbidity, and mortality. All of the de-identified data were compiled into a secure database and the data categorized and analyzed using Numbers for Mac (Apple Inc., Cupertino, CA, USA). All General Surgery cases were excluded from the analysis to focus on the use of laparoscopy for gynecologic procedures in this setting. Approval was obtained from the Bomu Hospital's Institutional Review Board.

## RESULTS

Seventeen rural, low-income, and resource-limited public hospitals in Kenya were visited between 1992 and 2015, and 2,901 laparoscopic gynecological procedures were undertaken between these institutions. The mean age of patients undergoing a laparoscopic procedure was 34.2, with the majority of patients (70.5%) ranging between ages 18 and 50 (Table 1). The surgeries performed over the reporting period are identified in Table 2. The most common gynecologic procedures performed were ovarian surgery and myomectomy, with 704 (22.8%) and 582 (17.4%) cases respectively. Gynecological laparoscopic

**Table 1:** Demographic data

	<i>n</i>	%
<i>Gender</i>		
Female	2,901	100
<i>Age</i>		
Under 18	39	1.34
18–50	2,046	70.5
Over 50	816	28.1

**Table 2:** Gynecologic procedures

	<i>n</i>	%
Ovarian biopsy, cystectomy, drilling	704	22.8
Myomectomy	676	20.0
Total/subtotal hysterectomy	582	17.4
Adhesiolysis, tuboplasty, salpingectomy	527	17.0
Bilateral tubal ligation	322	11.1
Radical hysterectomy	31	0.99
Oophorectomy	22	0.8
Sacrocolpopexy	21	0.67
Bilateral tubal ligation reversal	14	0.1
Metroplasty	2	0.001
Total gynecology cases	2,901	

**Table 3:** Laparoscopic surgery growth

Year (n)	0–5	6–10	11–15	16–20	21–23	Total
Total surgeries performed (n)	875	997	1,789	2,013	1,874	7,548
Laparoscopic procedures performed (n)	29	98	684	1,296	1,012	3,119
Laparoscopy percentage	3.3	9.8	38.2	64.4	54.0	41.3

**Table 4:** Complications

	n	%
Sepsis	9	0.31
Ureteral injury	1	0.03
Secondary hemorrhage	22	0.75
Vesicovaginal fistula	3	0.10
Port site herniation	4	0.14
Intestinal obstruction	2	0.07
Conversion to laparotomy*	211	7.27

\*Not considered as a complication

procedures increased from 3.3% of total procedures performed at these facilities in 1992 to 41.3% in 2015 (Table 3).

The mean length of hospital stay for laparoscopic surgery patients was 1.9 days. There were 41 known complications out of the 2,901 procedures performed (1.41%). Complications included sepsis, wound dehiscence, secondary hemorrhage, port site herniation, intestinal obstruction, ureteric injuries, and vesicovaginal fistulas (Table 4). Secondary hemorrhage was the commonest complication occurring in 22 (0.75%) cases. One mortality was reported, resulting from uncontrollable hemorrhage during a converted laparotomy for an ovarian tumor. Conversion to laparotomy occurred in 211 (7.2%) cases.

## DISCUSSION

The value of laparoscopic surgery in low-income and resource-limited settings has been debated for some time; however, large-scale studies are limited. In an 8-year retrospective analysis of gynecological laparoscopic surgery in a resource-limited setting, Mboudou et al<sup>10</sup> reviewed 9,194 surgeries where only 633 (6.9%) were performed laparoscopically at the University of Yaounde's Teaching Hospital in Cameroon. The mean duration of hospitalization was  $3.4 \pm 1.8$  days and a complication rate of 5.9% was reported.<sup>10</sup> In our review of data from 17 rural hospitals in Kenya, a total of 7,548 surgical procedures have been performed since 1992. Of these, 2,901 gynecologic cases were completed laparoscopically with a complication rate of only 1.41% and a mean hospital stay of 1.9 days. In our series, the complication rate was much

lower, which may be attributable to the years of expertise and the number of surgical cases performed.

The costs associated with laparoscopy are a relevant concern in the discussions of laparoscopy in LMIC settings. We note that patients paid a nominal fee equivalent to USD 200 to 600 per procedure to the hosting hospital; however, this fee was waived when it was considered unaffordable. The cost of each surgical case (logistics, expendable supplies) to the organizers did rise from USD 35 per patient in 1992 to USD 386 per patient in 2015; however, all surgeons volunteered their time and expertise at no cost. All of the support for the laparoscopic equipment was provided by local industry partners, while the host hospital provided all additional equipment and supplies and managed postoperative care and follow-up.

The above illustration suggests that lack of equipment and costs should no longer be accepted as limitation to patients having access to minimally invasive surgery. Various adaptations can decrease costs and surmount barriers allowing for more widespread acceptance of laparoscopic surgery in low-income settings including team work, sourcing of donated equipment, training of theater and support staff, encouraging local universities to incorporate laparoscopic surgery in their postgraduate teaching curriculums, developing safe clinical guidelines, and the use of reusable instruments.<sup>11,12</sup> The argument that laparoscopic surgery is expensive is no longer acceptable since the cost-effectiveness of laparoscopic surgery has been reported to be superior in numerous publications.<sup>8,9,11,13</sup>

Laparoscopic surgery has unlimited advantages in resource-limited settings;<sup>14,15</sup> therefore, surgeons have to be encouraged to undergo the required sustained training for safe laparoscopic surgery, which is now available. Concomitant incorporation of skills training in laparoscopic surgery at our existing universities will motivate the younger surgeons to develop a sense of professional accomplishment and confidence to provide this essential service to the community. Additionally, laparoscopic outreach programs can act as a tool for skills training, giving new surgeons an opportunity to refine their skills.

This retrospective assessment provides unique insight into the use of laparoscopy in rural LMIC settings; however, the assessment has some limitations. An attempt was made to see all patients postoperatively during the week of the surgical camps, and continued follow-up was left to the host hospital; nonetheless, we made every effort to be informed of subsequent complications. This analysis is retrospective; albeit, given the volume of cases completed each year, a prospective study with defined characteristics will provide improved insight into the successes and challenges of laparoscopy in this setting.

**CONCLUSION**

Laparoscopic surgery is a feasible undertaking in low-income countries with all of the known added value of minimally invasive surgeries in this setting. Investment into access to this important surgical intervention by key stakeholders is paramount, and many challenges encountered can be easily overcome by making persistent, standardized training of surgeons and theater support staff a priority. Furthermore, a surgical outcome registry, maintained at the national level, with regular audits conducted by institutions offering laparoscopic surgery in low-resource settings is critical, and a best-practice, safe-oriented clinical guideline should be developed and implemented on a larger scale. Laparoscopic surgery does add value in low-resource settings and is a safe alternative to the traditional open modalities of surgery.

**REFERENCES**

1. Shrime MG, Bickler SW, Alkire BC, Mock C. Global burden of surgical disease: an estimation from the provider perspective. *Lancet Glob Health* 2015 Apr 27;3(Suppl 2):S8-S9.
2. Weiser TG, Regenbogen SE, Thompson KD, Haynes AB, Lipsitz SR, Berry WR, Gawande AA. An estimation of the global volume of surgery: a modelling strategy based on available data. *Lancet* 2008 Jul 12;372(9633):139-144.
3. Gnanara JJ, Xiang X, Khiangte H. High quality surgical care at low cost: the diagnostic camp model of Burrows Memorial Christian Hospital. *Indian J Surg* 2007 Dec;69(6):243-247.
4. Gawande A. World Health Organization. Patient safety, WHO guidelines for safe surgery 2009: safe surgery saves lives. Geneva (Switzerland): World Health Organization, Patient Safety; 2009. p. 1 [online resource (1 PDF file (124p))].
5. Agha R, Muir G. Does laparoscopic surgery spell the end of the open surgeon? *J R Soc Med* 2003 Nov;96(11):544-546.
6. Raiga J, Kasia JM, Bruhat MA. Laparoscopic surgery in the Cameroon. *Int J Gynaecol Obstet* 1999 Apr;65(1):65-66.
7. Murphy AA, Nager CW, Wujek JJ, Kettel LM, Torp VA, Chin HG. Operative laparoscopy versus laparotomy for the management of ectopic pregnancy: a prospective trial. *Fertil Steril* 1992 Jun;57(6):1180-1185.
8. Sculpher M, Manca A, Abbott J, Fountain J, Mason S, Garry R. Cost effectiveness analysis of laparoscopic hysterectomy compared with standard hysterectomy: results from a randomised trial. *BMJ* 2004 Jan 17;328(7432):134.
9. Chao TE, Mandigo M, Opoku-Anane J, Maine R. Systematic review of laparoscopic surgery in low- and middle-income countries: benefits, challenges, and strategies. *Surg Endosc* 2016 Jan;30(1):1-10.
10. Mboudou E, Morfaw FL, Foumane P, Sama JD, Mbatsogo BA, Minkande JZ. Gynaecological laparoscopic surgery: eight years experience in the Yaounde Gynaeco-Obstetric and Paediatric Hospital, Cameroon. *Trop Doct* 2014 Apr;44(2):71-76.
11. Tintara H, Leetanaporn R. Cost-benefit analysis of laparoscopic adnexectomy. *Int J Gynaecol Obstet* 1995 Jul;50(1):21-25.
12. Clegg-Lampsey JN, Amponsah G. Laparoscopic cholecystectomy at the Korle Bu Teaching Hospital, Accra, Ghana: an initial report. *West Afr J Med* 2010 Mar-Apr;29(2):113-116.
13. Galukande M, Jombwe J. Feasibility of laparoscopic surgery in a limited resource setting: cost containment, skills transfer and outcomes. *East Cent Afr J Surg* 2011 Jul/Aug;16(2):112-117.
14. Ryder RM, Vaughan MC. Laparoscopic tubal sterilization. Methods, effectiveness, and sequelae. *Obstet Gynecol Clin North Am* 1999 Mar;26(1):83-97.
15. Bendinelli C, Leal T, Moncade F, Dieng M, Toure CT, Miccoli P. Endoscopic surgery in Senegal. Benefits, costs and limits. *Surg Endosc* 2002 Oct;16(10):1488-1492.