

# The Trend and Outcomes of Laparoscopic Appendectomy for Complicated Appendicitis in Nepal: A retrospective study from 2014 to 2018 in a University Hospital

Shakya YR,<sup>1</sup> Shakya S,<sup>2</sup> Napit D,<sup>1</sup> Dahal S,<sup>1</sup> Malla BR<sup>1</sup>

<sup>1</sup>Department of Surgery

Kathmandu University School of Medical Sciences

Dhulikhel, Kavre, Nepal.

<sup>2</sup>Department of Health Behavior and Health Education,

Fay W. Boozman College of Public Health,

University of Arkansas for Medical Sciences,  
Arkansas, USA.

## Corresponding Author

Yagya Ratna Shakya

Department of Surgery

Kathmandu University School of Medical Sciences

Dhulikhel, Kavre, Nepal.

E-mail: shakyayr7@gmail.com

## Citation

Shakya YR, Shakya S, Napit D, Dahal S, Malla BR. The Trend and Outcomes of Laparoscopic Appendectomy for Complicated Appendicitis in Nepal: A retrospective study from 2014 to 2018 in a University Hospital. *Kathmandu Univ Med J.* 2019;68(4):306-10.

## ABSTRACT

### Background

Globally, appendicitis is the most frequent emergency surgical procedure. Laparoscopic Appendectomy (LA) is recommended as a standard surgical procedure to remove appendix. In Nepal, studies showed improved outcomes of Laparoscopic Appendectomy than Open Appendectomy (OA) in treating acute appendicitis. However, effectiveness of in Complicated Appendicitis (CA) has not yet studied in Nepal.

### Objective

This study aims to assess the temporal trend of Laparoscopic Appendectomy in management of Complicated appendicitis and to compare outcomes with Open Appendectomy.

### Method

The study is a retrospective descriptive study. The outcome measures in the study are age, sex, ethnicity, length of postoperative stay (LOS), and conversion rate. Secondary data of 174 patients with complicated appendicitis were extracted and reviewed from the operation theater records and the discharge summary from the period of 2014 to 2018.

### Result

The mean age of the patients is 33.2 (SD ±19.4). Predominantly increased incidence is observed among male patients (66%). Mean Length of stay was 4.07(SD±2.1) days. Laparoscopic Appendectomy had shorter hospital stays than open and converted cases. The conversion rate was 10.92% for the observation period, and it was in a decreasing trend with the latest of 4.54%. The temporal trend for the percentage of patients who underwent Laparoscopic Appendectomy was increasing in the observation period.

### Conclusion

The utilization of laparoscopic appendectomy in complicated appendicitis is growing in Nepal, and has decreasing conversion rate.

## KEY WORDS

*Appendicitis, Conversion rate, Laparoscopy*

## INTRODUCTION

Laparoscopic appendectomy (LA) and Open appendectomy (OA) are two standard procedures to surgically remove appendix in acute appendicitis.<sup>1</sup> These days, LA has been preferred over OA because of many benefits, for example, decreased wound infection, minimal pain, reduced hospital stay, minimize the cost of procedure and reduced length of operation time.<sup>2-6</sup> Studies from Nepal also found similar effectiveness of LA over OA.<sup>2,7,8</sup> However, there is a lack of study on effectiveness of LA in complicated appendicitis.

Studies from high-income countries demonstrate that LA is also safe and feasible for Complicated Appendicitis (CA) with better postoperative outcomes in terms of shorter operative time, lower incidence of wound infection, and shorter hospital stay.<sup>9,10</sup> A systematic review and meta-analysis of effectiveness of LA over OA in complicated appendicitis by Athanasiou et al., found LA is better over OA, but the study has not included studies from low and middle-income countries.<sup>11</sup>

This study from Nepal aims to assess the temporal trend of LA in complicated appendicitis and to compare outcomes (demographic characteristics, hospital stay, and conversion rate) between LA and OA. This study will facilitate gastrointestinal surgeons, particularly working in a low- and middle- income countries, to make an evidence based decision to operate complicated appendicitis.

## METHODS

This study is a retrospective study of 174 patients who were admitted to Dhulikhel Hospital (DH) with the intra-operative diagnosis of complicated appendicitis from 2014 to 2018. This study aims to assess the trend of LA over time in managing complicated appendicitis and outcomes of LA in complicated appendicitis in comparison to OA.

Measured outcomes of the study are demographic information (age, gender, ethnicity), length of postoperative stay (LOS), conversion rate of LA to OA, and temporal trend of LA over the observation period. LOS in the study is defined as number of days study subjects stayed in the hospital after the surgery. The conversion rate in the study is defined as percentage of LA converted to OA.

### Case definition of complicated appendicitis

Complicated appendicitis in this study is defined as a case of gangrenous or perforated appendicitis with or without peri-appendicular abscess and early forming appendicular lump. The cases of complicated appendicitis combined with full blown peritonitis were excluded in this study.

The study used secondary data from operation theatre notes and discharge summaries of the patients with complicated appendicitis. The investigators extracted the data from the electronic database of DH by using the keywords: complicated appendicitis, perforated appendicitis, and

gangrenous appendicitis. All the cases which had gone through surgical management are included. Patients with appendicular lump, generalized peritonitis, and previous history of laparotomy were not included in the study. A total of 174 cases have resulted from the search. Further, details of their discharge summaries and operational notes are obtained from the electronic database. The principle investigator reviewed each of the surgical records and discharge summaries.

The data was then entered into Microsoft Excel (version 2013, Microsoft Corporation, Redmond, WA, USA). Descriptive analysis was performed, also in the Microsoft excel. Descriptive data analysis is deployed using simple statistics. Mean, median, and standard deviation are calculated for continuous variables that age and length of stay. The Standard of Error of Mean (SEM) is calculated for the length of postoperative stay. Frequency and percentage were obtained for categorical variables. The proportion of LA for each observation period is calculated and deployed into a trend chart to assess the temporal trend of LA. Conversion rate is calculated by using the formula total number of LA converted to OA divided by total numbers of LA.

Ethical approval was taken from the Institutional Review Committee of Kathmandu University School of Medical Sciences (KUMS). Written consent from the individual patients for the study was not taken, but none of the personal details are disclosed in the study. Data in the study is presented in an aggregated form based on the group average.

## RESULTS

There were total of 174 patients in the study. The recorded youngest patient was five years, and the oldest patient was 90 years. The mean age of the study participants was 33.2 (SD  $\pm$  19.4), and median age was 29 years. The highest incidence of complicated appendicitis is observed among 11 to 20 years (26.44%) of age group followed by 21 to 30 years (18.97%) (fig.1). By gender, the incidence of complicated appendicitis was found predominantly higher in males than females (66% Vs 34%). By ethnicity, majority of the study subjects were Tamang (30%), followed by Brahmin (25%), Chhetri (14%), Newar (23%), and Dalits

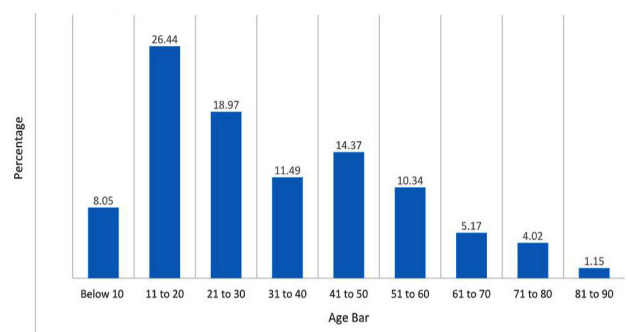


Figure 1. Age Distribution of the Study Subjects (n=174)

(8%).

Duration of postoperative stay is one of the indicators of quality of the care reflecting efficiency of the medical/surgical management, quality of care, and complication rate.<sup>12</sup> In this study, overall mean LOS is 4.07 (SD±2.10). LOS ranges from 1-16 days. Noteworthy, two cases of OA has 13 and 16 days of hospital stay. Subjects underwent LA has the shortest length of post-operative hospital stay 3.46 (SD ±1.51) among study subjects, followed by cased underwent OA 4.81 (SD±2.71) and conversion 5.69 days (SD ±1.31) (fig. 2).

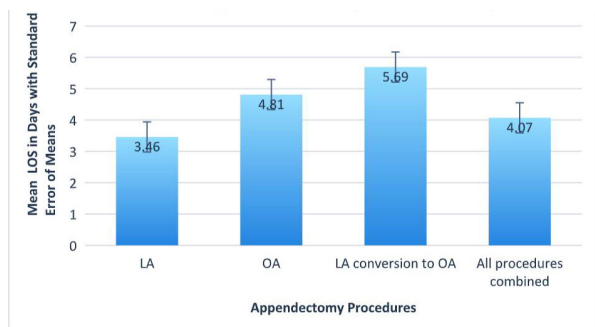


Figure 2. Mean Length of Post-operative Stay

Majority of study subjects have gone through laparoscopic appendectomy (62%), followed by OA (31%) and LA conversion to OA (7%). In the four years of observation period, LA is noticeably increasing over OA each year (fig. 3). In 2014, 42% of LA was performed which was more than doubled by 2018 (88%).

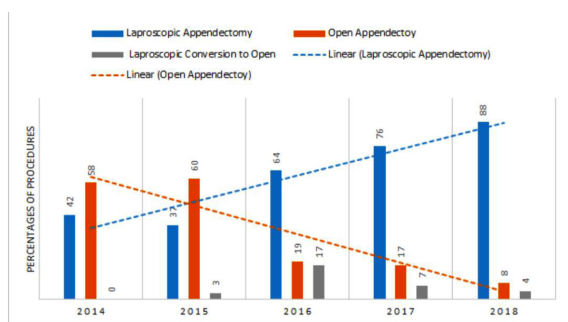


Figure 3. Total Procedures by Observation Years

In 2014, few cases (n=11) of complicated appendicitis were operated with LA, and there was no conversion on that year. In 2015, the conversion rate of 7.14% which dramatically spiked up in 2016 (21.14%) and dropped down in 2017 (8.57%). In 2018, twenty-two cases of complicated appendicitis were operated by LA, and only one claim had to convert to OA, yielding the new conversion rate of 4.54%. The increasing temporal trend of using LA and the learning curve is observed in the graph below (fig. 4).<sup>13</sup>

DISCUSSION

Demographic findings show the highest incidence of complicated appendicitis among subjects within an

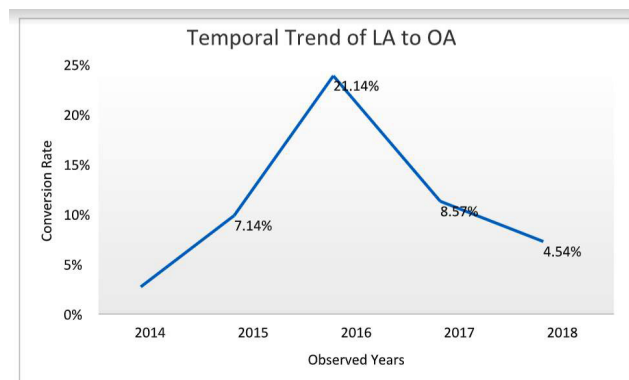


Figure 4. Temporal Trend of Laparoscopic Appendectomy Converted to Open Appendectomy

age group of 11-20 years, followed by 21-30 years. The outcome is comparable with studies from Bhangu et al. and Lohar et al.<sup>14,15</sup> By gender, incidence of CA among males is predominantly higher than female (66% Vs 34%) in the study. Our finding is supported by the study of Padankatti et al., but two studies from Nepal found higher incidence among females.<sup>7,8,16</sup> This gender differences in studies could be because of sample size variation among studies. By ethnicity, Tamang has the highest rate of complicated appendicitis (30%) which can be justified with a population structure of the study area in which most of the residents are Tamang.<sup>17</sup> It would be interesting to know in other study that if race and ethnicity impacts on selection of procedure.

The length of hospital stay (LOS) is an important indicator to evaluate quality of care.<sup>12</sup> Shorter hospital stay has many benefits; it decreases wound infection, cost, and complications.<sup>12</sup> In this study, LA has lower mean LOS than OA (3.46 Vs 4.81). The finding is comparable to other studies done in Nepal.<sup>7,8</sup> Pradhan et al. found mean LOS less for LA compared to OA (2.75 Vs 3.19 days).<sup>7</sup> Batajoo found the LOS 2.69 days for LA vs 4.03 days for OA.<sup>8</sup> Thomsom et al., compared the LOS of LA and OA among complicated appendicitis and found decreased LOS among patients who underwent LA (4.5 days) than OA (5.0 days).<sup>6</sup>

In the study, the temporal trend of LA is increased over the observation period from 42% in 2014 to 88% in 2018. This finding is comparable with a study from the United States in which LA was almost doubled from 2003 (41.7%) to 2011 (80.1%).<sup>18</sup> Likewise, the temporal trend is also comparable with a study from a low-income country, Taiwan.<sup>19</sup>

A meta-analysis on the effectiveness of LA in CA demonstrates variability in conversion rate ranges from 0% to 18% with few exceptions.<sup>11</sup> Garg et al. found conversion rate of 4.1% in their study.<sup>20</sup> In our research, conversion rate has been improving in the study period. In 2015, the conversion rate was 7.14%, which dramatically spiked up in 2016 (21.14%) and dropped down in 2017 (8.57%). This high peak of conversion rate in 2016 could be justified by learning curve theory because new surgeons had joined DH

in 2014.<sup>13</sup> In 2018, 22 LA was performed for complicated appendicitis in which one case had to be converted to OA, yielding the new conversion rate of 4.54%.

The study has few limitations. First, the study has a chance of selection bias because it is based on only admitted patients. Also, total participants are not an exhausted list of complicated appendicitis in Dhulikhel Hospital. Second, the findings of the study cannot be generalized for all Nepalese population as it is based on a single site study. Despite few limitations, this study will be useful for practicing surgeons in Nepal and similar countries to make a piece of evidence based treatment surgically manage complicated appendicitis. This study provoked few new research questions on the field. First, racial and gender disparity in complicated appendicitis has to be further explored to deeply understand variation in incidence by gender and ethnicity, for example, Zogg et al.<sup>21</sup> Next, it would be essential to explore access to LA in complicated appendicitis by gender, ethnicity, and distance to healthcare service in Nepal to figure out the health disparities in accessing LA.<sup>18</sup>

The study consists some of the limitations because study subjects are not an exhaustive list of complicated appendicitis who attended Dhulikhel Hospital for the surgery in the given study period. Cases with full blown peritonitis and comorbidities with complicated appendicitis had been excluded which could have alter the current

outcomes of the study. In addition, the study subjects have wide range of age variation from 9 to 90 years, but authors are unable to assess the age attribution in the outcomes in this study. However, it opens up a further research question to observe the outcomes of complicated appendicitis among children, adults, and elderly.

## CONCLUSION

Acute appendicitis is the commonest surgical procedure performed in surgical settings worldwide. Because there are more than one treatment options for acute appendicitis, evidence based recommendations are crucial to make a right treatment decision. In conclusion, the findings of the study are encouraging to perform LA in complicated appendicitis. Our results show a higher incidence of appendicitis among teenagers and youths, the male gender, and Tamang ethnic group. The length of postoperative stay is sufficiently low among LA than OA. The temporal trend of LA overtime is increasing in managing complicated appendicitis. The conversion rate of LA to OA in complicated appendicitis has been in a decreasing trend except a peak in 2016 justified as a learning curve. This study will be helpful for the fellow surgeons from Nepal and similar areas to take an evidence-based decision in managing complicated appendicitis.

## REFERENCES

- Bailey HH, Love RJM. Bailey & Love's Short Practice of Surgery. 27<sup>th</sup> ed. (Williams NS, Ronan OP, McCaskie AW, eds.). Boca Raton, FL: CRC Press, Taylor and Francis Group; 2018.
- Sk S, Ums D, Pb T, Sk S. A 5 year clinical experience of Laparoscopic Appendectomy. *J Nepa*. 2010;8(2):91-4.
- Talha A, Haddad H El, Ghazal AE, Shehata G. Laparoscopic versus open appendectomy for perforated appendicitis in adults: randomized clinical trial. *Surg Endosc*. 2019;(0123456789).
- Romano A, Parikh P, Byers P, Namias N. Simple Acute Appendicitis versus Non-Perforated Gangrenous Appendicitis: Is There a Difference in the Rate of Post-Operative Infectious Complications? *Surg Infect (Larchmt)*. 2014 Oct;15(5):517-20.
- Minutolo V, Licciardello A, Stefano B Di, Arena M, Arena G. Outcomes and cost analysis of laparoscopic versus open appendectomy for treatment of acute appendicitis: 4-years experience in a district hospital. *BMC Surg*. 2014;14(14):1-6.
- Thomson JE, Kruger D, Jann-Kruger C, Kiss A, Omoshoro-Jones JA, Luvhengo T, et al. Laparoscopic versus open surgery for complicated appendicitis: a randomized controlled trial to prove safety. *Surgical endoscopy*. 2015 Jul 1;29(7):2027-32.
- Pradhan S, Shakya YR, Batajoo H, Malla B, Joshi HN, Thapa LB, et al. Laparoscopic versus open appendectomy: a prospective comparative study. *Journal of Society of Surgeons of Nepal*. 2015;18(2):29-32.
- Batajoo H, Nk H. Laparoscopic versus Open appendectomy in Acute Appendicitis. *J Nepal Health Res Counc*. 2012;10(3):239-242.
- Yau KK, Hk M, Gen F, Siu WT, Gen F. Laparoscopic Versus Open Appendectomy for Complicated Appendicitis. *jamcollisurg* 2007: 60-65.
- Soltan HM, El AG, Alsegaey AHM. Laparoscopic versus open appendectomy in complicated acute appendicitis. *mmj*. 2018:554-9.
- Athanasios C, Lockwood S, Markides GA. Systematic Review and Meta-Analysis of Laparoscopic Versus Open Appendectomy in Adults with Complicated Appendicitis: an Update of the Literature. *World J Surg*. 2017.
- Baek H, Cho M, Kim S, Hwang H, Song M, Yoo S. Analysis of length of hospital stay using electronic health records: A statistical and data mining approach. *PLoS One*. 2018:1-16.
- Dholakia A. Learning Curve Theory. In: Advanced Management Accounting. [https://www.academia.edu/29731351/Learning\\_Curve\\_Theory\\_Final\\_Course\\_Paper\\_5\\_Advanced\\_Management\\_Accounting\\_Chapter\\_16?auto=download](https://www.academia.edu/29731351/Learning_Curve_Theory_Final_Course_Paper_5_Advanced_Management_Accounting_Chapter_16?auto=download).
- Bhangu A, Søreide K, Di Saverio S, Assarsson JH, Drake FT. Acute appendicitis: modern understanding of pathogenesis, diagnosis, and management. *The Lancet*. 2015 Sep 26;386(10000):1278-87.
- Lohar HP, Ali M, Calcuttawala A, Nirhale DS, Athavale VS, Malhotra M, et al. Epidemiological aspects of appendicitis in a rural setup. *Med J Dr DY Patil Univerity*. 2014;7(6):753-7.
- Padankatti L, Pramod R, Gupta A, Ramachandran P. Laparoscopic versus open appendectomy for complicated appendicitis: A prospective study. *J Indian Association Pediatr Surg*. 2008;13(3): 104-6.

17. Nepal Map. Kavrepalanchok District Profile. 2014. <https://nepalmap.org/profiles/district-24-kavrepalanchok/>.
18. Bliss LA, Yang CJ, Kent TS, Chau S, Jonathan N, Tseng JF. Appendicitis in the modern era: universal problem and variable treatment. *Surgical Endoscopy*. 2014. doi:10.1007/s00464-014-3882-2
19. Lin KB, Lai KR, Yang NP, Wu KS, Ting HW, Pan RH, et al. Trends and outcomes in the utilization of laparoscopic appendectomies in a low-income population in Taiwan from 2003 to 2011. *International Journal for Equity in Health*. 2015 Dec 1;14(1):100.
20. Garg CP, Vaidya BB, Chengalath MM. Efficacy of laparoscopy in complicated appendicitis. *Int J Surg*. 2009;7(3):250-252. doi:10.1016/j.ijisu.2009.04.007
21. Zogg CK, Scott JW, Jiang W, Wolf LL. Differential access to care : The role of age , insurance , and income on race / ethnicity-related disparities in adult perforated appendix admission rates. *Surgery*. 2016:1-10. doi:10.1016/j.surg.2016.06.002