



# Surgical characteristics of appendectomy in the eastern region of the democratic republic of congo: a cross-sectional study

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**Background:** Appendectomy is a surgical procedure performed on a patient with acute appendicitis and is often performed by surgery and performed in an emergency. The authors have carried out this study, which aims to describe the surgical characteristics of appendectomies.

**Methods:** This retrospective, descriptive, and documentary cross-sectional study was conducted from October 2021 to October 2022. Within this time ~591 acute abdominal surgical procedures were performed, including 196 appendectomies performed in the general surgery department.

**Results:** This study focused on 196 appendectomies performed out of a total of 591 surgeries performed, with an incidence of 34.2%. 51 cases (26%) for the age group between 15 and 20 years, 129 cases (65.8%) of women participated in the appendectomy. 133 (67.8%) acute appendicitis, 48 (24.5%) appendicular abscess and 15 (7.7%) appendicular peritonitis were indications for appendectomies. For the American Society of Anesthesiologists (ASA) score: for the ASA I, 112 (57.1%) of the patients had no conditions other than those requiring surgery (appendectomy). For the Altemeier classification, the authors recorded 133 (67.9%) own surgeries. 56 (28.6%) surgical site infections followed by 39 (19.8%) inflammation (swelling and redness), 37 (18.8%) pain, 24 (12.4%) purulent peritonitis, 21 (10, 7%) postoperative hemorrhage and 19 (9.7%) paralytic ileus and 157 (80.1%) patients benefited from medical treatment.

**Conclusion:** The low incidence of complications related to laparotomy appendectomy has been reduced to a minimum thanks to the respect of sanitary measures and the quality of the technique.

**Keywords:** appendectomy, appendicitis surgery, appendicitis, democratic republic of the congo, postoperative complications, retrospective studies

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## Introduction

Appendectomy is an emergency surgical treatment for the patient presenting with acute appendicitis<sup>[1]</sup>, and acute appendicitis is one of the emergencies, and it is the first indication for an appendectomy<sup>[2,3]</sup>. Therefore, appendectomy is one of the most common surgeries<sup>[3]</sup>.

Appendicitis is one of the primary indications for laparotomy<sup>[4]</sup>. Appendectomy is a surgical treatment, the longest recognized since its description by McBurney<sup>[2,5]</sup>. The operation can be performed like laparoscopic surgery<sup>[4,5]</sup>, depending on the surgeon's experience and the characteristics of the hospital or the patient's factors<sup>[5]</sup>. Appendectomy can also be performed with open surgery, but laparoscopy is the most recommended of these two procedures<sup>[6]</sup>. Laparoscopic surgery is general surgery with advantages over open surgery, such as reduction of postoperative pain, shorter hospital stay, faster recovery time, scar size reduction, and immune function is preserved. Of these multiple factors, pain is the most important predictor of recovery time after laparoscopic surgery<sup>[7]</sup>. After an appendectomy, in postoperative, we can have complications such as surgical site infection (superficial), deep condition, postoperative bleeding, paralytic ileus, purulent peritonitis, wound infection, redness, and swelling (inflammation) of the stomach, which may occur if the appendix bursts during surgery (peritonitis), blocked

intestines and damage to nearby organs<sup>[2,8,9]</sup>. To best of our knowledge, no research studies were conducted in this topic in our country or region. So, we aimed to describe the surgical characteristics of appendectomies.

## Methods

### Study location

This study was carried out in the department of General Surgery of Kyeshero Hospital in Goma, in the eastern region of the Democratic Republic of the Congo.

### Study design/study type

The retrospective study was conducted from October 2021 to October 2022, for 12 months, and the survey was carried out in the general surgery department, in the eastern region of the Democratic Republic of the Congo. We conducted a retrospective, descriptive, and documentary cross-sectional study on patients with appendicitis, a survey of the epidemiological and clinical characteristics of appendectomy.

### Study population

Patients attending the surgical department with abdominal related emergencies.

### Sampling method and sample size

The convenient sampling method was used and all patients admitted during the study period satisfying the inclusion criteria were included in the study.

From October 2021 to October 2022, about 591 surgeries including 228 planned myomectomies, hysterectomies, 196 emergency appendectomies, and 167 herniorrhaphy procedures were performed in the General Surgery Department. The study included all patients aged 15–45 hospitalized for acute appendicitis, appendicular peritonitis, and appendicular abscess and appendectomy as an indication for surgery. Those without these diagnoses were excluded, and we excluded patient records with insufficient data. Regarding the variables, demographic factors included age, sex, and frequency of appendectomies compared to other surgeries. In the clinic, we find the ASA score, the Altemeier classification, the surgical complications of appendectomies, and the treatment of these complications.

### Consent

After obtaining consent from higher authorities, data was collected from the hospital patient register. The research related to human use has complied with relevant national regulations and institutional policies. It follows the tenets of the Helsinki Declaration (as revised in 2013). Informed consent has been obtained from all individuals included in this study. We have taken precautions by separating patient identification data with confidentiality codes. The information of patients who received appendectomy as a surgical indication was extracted from the admission registers of the surgery department.

### Analysis tools

The results are grouped and presented in tabular form. To analyze the results, we used Microsoft Word 2016 for Windows

(Version 19, Microsoft Inc.) and Microsoft Excel 2016 for Windows (Version 19, Microsoft Inc.).

## Results

We registered 591 patients in the general surgery department for acute abdominal emergencies, and 196 appendectomies were performed. Based on these data, the incidence of appendectomy is 34.2%.

### Demographics

According to our study, the mean age of patients who underwent appendectomy was 33, while the median age was 34, with a SD of 13.4. Among the cases, 26% belonged to the age group of 15–20 years, followed by 21–25 years with 21.4% of cases. Regarding gender distribution, 65.8% of the participants were female, and 34.2% were male. These findings are presented in Table 1.

### Clinical Information

In comparison to other surgical procedures, appendectomies accounted for the highest frequency of operations at 33.2%, with 196 cases recorded. Herniorrhaphy followed with 167 cases (28.2%), while myomectomies, hysterectomies, and other surgeries constituted 38.6% with 228 cases. The surgical indications for appendectomy were acute appendicitis (67.8%), appendicular abscesses (24.5%), and appendicular peritonitis (7.7%).

Regarding the American Society of Anesthesiologists (ASA) score distribution, 57.1% of the patients had an ASA score of I, indicating that they did not present with conditions beyond the requirement for appendectomy. 21% of patients had an ASA score of II, indicating moderate significant functional disturbance, while 10.2% had an ASA score of III, indicating severe significant functional disturbance. 8.7% had an ASA score of IV, indicating an imminent vital risk, and 3% of dying patients had an ASA score of V's, with a refreshing experience of no more than 24 h.

Furthermore, according to the Altemeier classification, 67.9% of the surgeries were classified as clean, followed by 19.9% as clean but contaminated, 11.2% as contaminated, and 1% as dirty surgeries. These findings contribute to a better understanding of the demographic and clinical characteristics of patients undergoing appendectomy and their associated surgical risks, which

**Table 1**

### Sociodemographic data

Variable	Effective (percentage %)
Age distribution	
15–20 years	51 (26)
21–25 years	42 (21.4)
26–30 years	36 (18.4)
31–35 years	32 (16.3)
36–40 years	18 (9.2)
41–45 years	17 (8.7)
Sex distribution	
Male	67 (34.2)
Feminine	129 (65.8)
Total	196 (100)

could aid in improving patient outcomes and informing surgical decision-making.

### Postoperation surgical complications

Regarding surgical complications associated with appendectomies, our study recorded 56 cases (28.6%) of surgical site infections (SSIs), followed by 39 cases (19.8%) of inflammation, 37 cases (18.8%) of pain, 24 cases (12.4%) of purulent peritonitis, 21 cases (10.7%) of postoperative bleeding, and 19 cases (9.7%) of paralytic ileus. The hospital stay of many patients ranged between 4 and 6 days, as depicted in Graph 1. Of the patients, 136 (69.4%) were discharged fully cured from the hospital, as illustrated in Graph 2. Furthermore, 157 patients (80.1%) received medical treatment, while 39 (19.9%) required surgical intervention to manage complications related to the appendectomy.

### Discussion

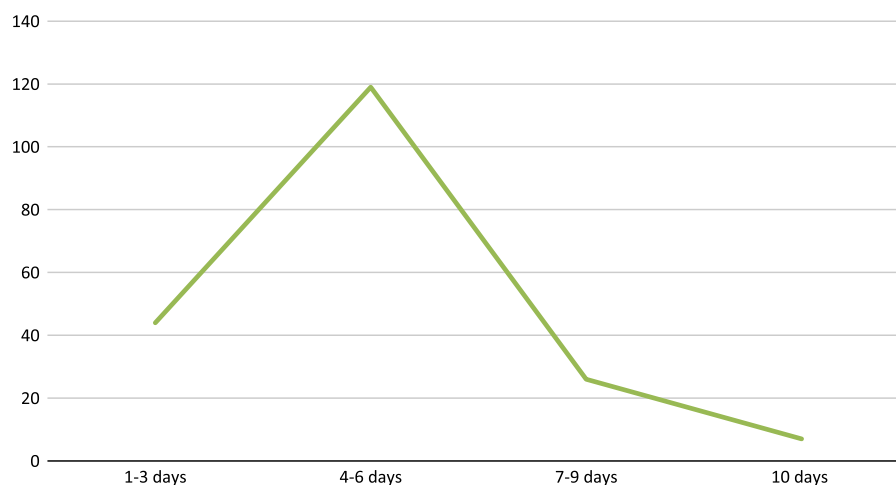
The aim of this study was to understand the surgical characteristics of an appendectomy. We were able to undergo this by 12 months retrospective descriptive and documentary cross-sectional study. Also, from the study conducted we were able to study the demographics, pathologic indications, ASA classifications which was used to assess the general wellbeing of the patients, the Altemeier classification was made of the surgical wounds and then finally we studied the pattern and prevalence of SSIs.

From October of 2021 to October of 2022, 591 patients were operated. From these about 196 were appendectomy, with a prevalent rate of 34.6% amongst the surgical procedure done. The two most prevalent age ranges who had appendectomy within the time frame of the study were those between 15 and 20 years (26%) and 21 and 25 years (21.4%), respectively. While the median age was 33 years and the median was 34 years, it had a SD from the mean of about 13.4 (Table 1). These findings were similar to a global study conducted by Yang Y., *et al*<sup>[10]</sup> in a 20 years study amongst 204 countries where he found the incidence peaked in the age range between 15 and 19 years in both male and females. In addition, it has been discovered that

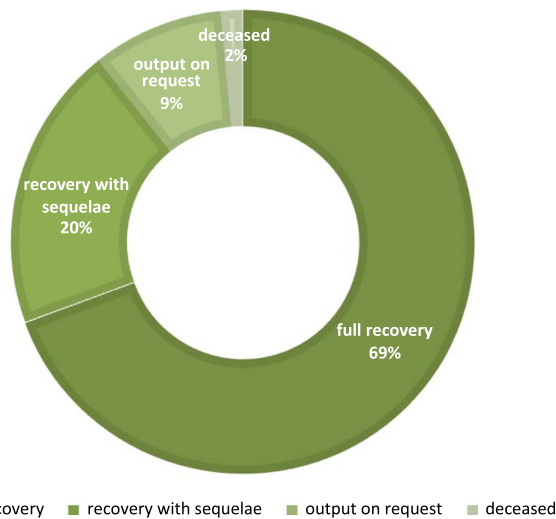
individuals who developed appendicitis by late adolescence had a decreased risk of developing Ulcerative Colitis in their life time<sup>[11]</sup>.

Furthermore, as regards the sex distribution, it was found to me a more common pathology and hence surgery amongst women. In our study, women had a prevalence of 65.8%, while men were 33.2% of the sampled population who had an appendectomy. This is in keeping with similar studies that have been conducted on a global level and regional levels<sup>[10]</sup>. As regards the common indications for appendectomy, the pathologies that were implicated were acute appendicitis, appendicular abscess, and appendicular peritonitis. About 7 in 10 people presented with acute appendicitis, 2 in 10 presented with appendicular abscess, and 1 in 10 presented with appendicular peritonitis. This made acute appendicitis the most common indication for appendectomy in our study. This was in keeping with a study conducted in an emergency center in Saudi Arabia that found that acute appendicitis was the most common indicator for appendectomy<sup>[12]</sup>.

The ASA scoring system was also used to classify the patients prior to their surgical procedures. It was discovered that more than half (57.1%) of the patients presented in an ASA class I, as they had no other conditions besides the indication for the appendectomy for which they came. 21% of the patients were ASA II, having some moderate functional disturbance. While 10% of them were classified into the ASA III, as they had more significant disturbances. Whereas, 8.7% were grouped into the ASA class IV, as they had destabilized vital signs and showed imminent risk. Finally, about 3% of our patients were grouped into the ASA class V. We also went further to study the type and care of the surgical wounds made using the Altemeier classification. About 7 in 10 of the incision sites were clean wounds, 2 in 10 were clean contaminated, 1 in 10 were contaminated, and less than 0.2 in 10 were classified as dirty wounds. All these are very vital in regards wound healing and possible SSIs. SSIs are some of the most commonly occurring complications in surgery<sup>[18,91]</sup>. In our study, when we took a look at the postoperative complications that were experienced by the patients, we discovered that SSIs and surgery site inflammation were the most common at 28.6 and 19.8%, respectively. These were followed in prevalence by



Graph 1. Duration of hospitalization of patients who have undergone an appendectomy.



**Graph 2.** The condition of patients leaving the hospital.

pain (18.8%), purulent peritonitis (12.4%), postoperative bleeds (10.7%), and paralytic ileus (9.7%). These occurred withstanding the fact that the operative health staff practiced careful preoperative hygiene protocols before every surgery. Now, following these complications, medical interventions were sufficient in managing about 80.1% of all those who experienced complications, while 19.9% had to have surgical management to manage their postoperative complications<sup>[8–10]</sup>.

Finally, as regards length of hospital stay, most patients spent a mean duration of 5 days (4–6 days) (Graph 1). With about 7 in 10 patients living the hospital more satisfied than they came in, with no health complains (Graph 2). The shortcoming of this study was our inability to account for and document the long-term postoperative complications of these patients, as well as try to trace a possible familiar of genetic correlation in family members from the patients' history<sup>[13]</sup>.

### Recommendations for future research

Based on the findings of this study, there are several recommendations for future research in the field of appendectomy. Firstly, it would be useful to conduct a longitudinal study that tracks the long-term postoperative outcomes of patients who have undergone appendectomy. This would provide valuable insights into the efficacy of the surgical procedure and could help to identify any potential long-term complications that may arise. Secondly, it would be beneficial to investigate the role of genetics in the development of appendicitis. This could involve studying the medical history of family members of patients who have undergone appendectomy, in order to identify any potential genetic correlations or predispositions to the condition. Thirdly, further research could be conducted to explore the optimal surgical techniques and wound care protocols for appendectomy. This could involve comparing the outcomes of different surgical approaches and wound care strategies, in order to identify best practices for minimizing the risk of SSIs and other postoperative complications.

Our study can also be used as a stepping stone and future researchers can dwell into further detail of surgical descriptors for appendectomy procedures. One aspect that we recommend specifically is the comparison of these surgical descriptors in open

and laparoscopic appendectomy procedures and their efficacy in terms of patients benefit.

### Clinical implications for health managers and policymakers

The findings of this study have important clinical implications for health managers and policymakers. First, the high prevalence of appendectomy in young adults highlights the need for effective preventive measures and early detection of acute appendicitis. Health managers and policymakers should focus on promoting healthy lifestyles and educating the public on the signs and symptoms of appendicitis to facilitate early detection and prompt medical attention.

Second, the high prevalence of SSIs and postoperative complications underscores the importance of implementing effective infection control measures and improving surgical techniques. Health managers and policymakers should prioritize the provision of adequate resources, including equipment and supplies, to ensure optimal surgical outcomes. Health managers and policymakers should emphasize the use of standardized assessment tools to ensure optimal patient outcomes and improve resource allocation.

This study can serve as a good model for health managers and assist them in policy making, the descriptors presented in our study can be used to facilitate in diagnosis, effective treatment, handling postoperative care and complications.

### Limitations of the study

This was because during our study, some additional problems we faced were the lack of sufficient information on the files of the patients but also the lack of the results of the examinations of the laboratory.

Since this study was conducted in a very specific environment that too retrospectively some problems that were faced included lack of sufficient information on patient's files and less detailed record of patient investigations. Another shortcoming of this study was our inability to account for and document the long-term postoperative complications of these patients, as well as try to trace a possible familiar of genetic correlation in family members from the patients' history<sup>[13]</sup>. Since the participants belonged to a single medical center more studies are required further add or solidify surgical characteristics of appendectomies.

### Conclusion

The appendectomy is one of the most common surgeries and is an emergency surgical treatment for the acute appendicitis. In our study, we found that laparotomy appendectomy is still effective because it is a technique that has been improved over the last century and the complications have been reduced to a minimum thanks to the respect of sanitary measures and the quality of the technique.

### Ethical approval

This study protocol was approved. This study was performed in accordance with the ethical standards as laid in the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards.

**Consent of participation**

As the information used in this study does not include any identifying information from the patients; thus, written consent from the patients was not required.

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No funding was received for this work.

**Author contribution**

A.A.: conception and administrative support; H.C.: design and supervision; A.A. and J.O.: provision of study materials or patients, Collection and assembly of data, data analysis, and interpretation; G.M., D.D.O., and M.O.O.: manuscript preparation; H.C. and F.K.: manuscript editing; A.A., S.B., and M. O.O.: manuscript review. Final approval of manuscript is done by all authors.

**Conflicts of interest disclosures**

The authors declare that they have no conflicts of interest.

**Research registration unique identifying number (UIN)**

1. Name of the registry: not applicable.
2. Unique Identifying number or registration ID: not applicable.
3. Hyperlink to your specific registration (must be publicly accessible and will be checked): not applicable.

**Guarantor**

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**Data availability statement**

Not applicable.

**Provenance and peer review**

Not commissioned, externally peer reviewed.

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