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ORIGINAL ARTICLE

The clinical characteristics and outcomes of appendicitis in a population with a high HIV-infection prevalence

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ABSTRACT

Introduction: In Botswana, the prevalence of HIV-infection is high (20.1%). Literature on characteristics of appendicitis in a high HIV-infection prevalence is limited.

Method: A retrospective medical records review was conducted in patients admitted with a diagnosis of appendicitis and known HIV-infection status to adult surgical wards at Princess Marina Hospital from 2013 to 2019. Patients' demographics, clinical characteristics, laboratory data, management and outcomes were analysed.

Results: A total of 601 appendicitis patients with known HIV-infection status were identified. Males contributed 51.9%. The overall median age was 29-year: 25-year for HIV-negative patients (HIV-NP) and 36-year for HIV-positive patients. HIV-NP had significantly higher rate of WBC count >10,000/μL, p=0.034. Appendectomy was performed in 92.8% of the cases. Non-operative treatment failure rate in one year was 35.4%. A total of 58 complications were recorded including 20 surgical site infections (SSIs) and one mortality in HIV-NP and 11 SSIs and six mortalities in HIV-positive patients (HIV-PP). HIV-PP had significantly higher mortality than HIV-NP, p=0.010. The overall hospital stay between operated and non-operated patients, p=0.996 and hospital stay between HIV-NP and HIV-PP were not different, p=0.223. Female patients had a significantly higher normal appendix and chronic appendicitis rates than males, p=0.032 and p=0.018 respectively. Complex appendicitis was associated with longer pre-hospital symptom duration, p=0.008 and longer hospital stay, p= 0.001, but it was not related to mortality, p=1.000. Among operated HIV-PP, patients with CD4 count <200 had a significantly higher mortality rate than those with ≥200, p=0.043.

Conclusion: In Botswana, the prevalence of HIV-infection in patients with appendicitis was higher than the rate in the general population. HIV-infection and low CD4 count had an adverse effect on the mortality of patients with appendicitis. The higher HIV-infection rate in appendicitis patients and the impact of antiretroviral drug and viral-load on the outcomes in HIV-PP worth investigating.

Introduction

Appendicitis is one of the most common abdominal emergencies [1,2]. A lifetime risk of developing appendicitis is about 7-8% [1,3–5]; highest in South Korea (16%) and lowest in Africa (1.8%) [1]. Appendicitis is more common in males [1,3]. The peak incidence of appendicitis is in the second and third decade of life [1,3]. A higher median age is reported in HIV-positive patients (HIV-PP) [6]. The full range of causes of appendicitis is not known; luminal obstruction, genetic factors, environmental influences, and infections are among the factors described [1,2,4].

Clinical assessment remains the cornerstone of the diagnosis of appendicitis [1], though an accurate diagnosis is a challenge. In patients with equivocal signs, interval clinical re-evaluation increases the diagnostic accuracy without increasing the risk of perforation [1]. HIV-associated opportunistic infections that may directly affect appendix and immune reconstitution inflammatory syndrome associated with initiation of antiretroviral drugs further confound the differential diagnosis in HIV-PP [7]. The clinical course of appendicitis might be self-limiting or responds to antibiotics treatment or gets complicated and requires operative intervention [1]. In addition to assisting in the diagnosis of appendicitis, ultrasound and CT-scan may identify alternative diagnoses including malignancy in older patients and pelvic/ovarian pathologies in females [1].

Appendicitis has a different disease profile in low- and middle- income countries (LMICs); it is associated with a late presentation, significant morbidity, and a high constraint to the health care system [2,8]. A significantly higher rate of complicated appendicitis was reported dur-

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ing COVID-19 pandemic which may be related to limited access to health facilities and fears generated by the novel virus which could indicate a late presentation or delayed care. This increased in complex appendicitis was not translated to prolonged hospital stay [9]. Still others found absence of difference in the rate of complex appendicitis in pre- and during COVID-19 pandemic; however, they found increase rate of non-operative management [11]. Significant morbidity and mortality including longer hospital stay and complex appendicitis were reported in HIV-PP, where the HIV-infection prevalence was reported to range from 6.7% to 10.0% [6]. Appendectomy is a curative treatment for appendicitis; non-operative treatment of appendicitis is associated with a potential in-hospital treatment failure and recurrence [11].

HIV-infection prevalence is high in Africa [6], 20.1% in Botswana [12]. In Botswana, antiretroviral drugs are freely available and most HIV-PP, 79%, are virally suppressed [12]. This study was designed to elucidate the clinical characteristics and outcomes of appendicitis in HIV-negative patient (HIV-NP) and HIV-PP and the impact of CD4 count on the outcomes of HIV-PP. The Ministry of Health and Wellness of Botswana granted permission for the study (REF:HPDME: 13/18/1 Dated 17th December 2019).

Materials and methods

This is retrospective cross-sectional study that reviewed the medical records of patients admitted with a diagnosis of appendicitis and known HIV-infection status from January 2013 to December 2019.

Princess Marina Hospital, 567-bed capacity, has a catchment area of about a million populations. It is the largest tertiary and the only teaching public hospital in Botswana. Eighty beds are designated for adult surgical patients.

All patients with a diagnosis of appendicitis and known HIV-infection status admitted to adult surgical wards, 13-year-old and older (hospital policy), were included. The diagnosis of appendicitis was made by six general surgeons based on clinical grounds. Few ultrasound studies were performed in childbearing age group female patients with an equivocal clinical presentation. Patients who had no peritonitis on clinical evaluation were treated non-operatively (antibiotics). Antibiotics regimen includes a combination of intravenous cefotaxime and metronidazole for the first few days till the temperature becomes normal and the patient tolerates oral intake. Up on discharge oral Augmentin or cefril and metronidazole tablets were prescribed for a total duration of 7 to 10 days. All patients who undergone appendectomy had pre-operation prophylactic antibiotics. Further antibiotics treatment was dictated by intraoperative finding.

The data were collected from patients' medical records and electronic Integrated Patients Management System (IPMS). Demographics, clinical presentations, white blood cell count, HIV-infection status, hospital stays, and outcomes were collected. Complex appendicitis was defined as gangrenous or perforated appendicitis based on a histopathology report.

Data were analysed for all patients, comparing HIV-NP and HIV-PP, and HIV-PP considering their CD4 count, <200 vs. ≥200. Categorical variables were described using percentages; while continuous variables were described using median [interquartile range] and mean (SD). Chi-square, Mann-Whitney *U* test, Fisher's exact test and, student t-test were used to compare groups. P-value <0.05 was considered statistically significant. Few imaging studies were retrieved from the medical records and they were not included in the analysis. IBM SPSS version-27 was used to analyze the data.

Results

During the seven-year study period, 601 patients had documented HIV-infection status and treated for appendicitis. Overall, males contributed 312 (51.9%). The overall median [IQR] (Range) age in years was 29[22-38](13-90): 25[20-33](13-90) in HIV-NP and 36[28-43](13-68) in HIV-PP. Most patients were in their third (34.8%) and fourth (25.6%) decade of life. HIV-PP contributed 232 (38.6%). Females had a higher HIV-infection rate than males, 128/289 (44.3%) vs. 104/312 (33.3%) respectively, p=0.006. Females in age group 30-49 were HIV-positive in 78/116 (67.2%); while males in age group ≥40 had HIV-infection rate of 89/112 (79.5%). There was no statistically significant difference in HIV-infection rate between the age groups 13-19 year and 20-29 year, p=0.113. Age group 30-39 year, 40-49 year, and ≥50 year were significantly affected by HIV-infection than age group 13-19 year and 20-29 year, p=0.001 each. There was no significant difference in HIV-infection rate between age groups 30-39 year and ≥50 year, p=0.391, and between 40–49 year and ≥50 year, p=0.426. Age group 40-49 year was more affected by HIV-infection than 30-39 year, p=0.029 (Fig. 1).

Table 1
Clinical characteristics of HIV-NP and HIV-PP, PMH, 2013–2019.

Clinical characteristics	HIV-NP	HIV-PP	p-value
Anorexia	330 (89.4%)	213 (91.8%)	0.196
Nausea/Vomiting	292 (79.1%)	180 (77.6%)	0.260
Pain-shift	295 (79.9%)	201 (86.6%)	**0.002**
PR >100	139 (37.7%)	85 (37.1%)	0.892
Temp >37.4C	110 (29.9%)	75 (33.2%)	0.400
Tenderness	353 (95.7%)	223 (96.1%	0.688
Percussion tenderness	279 (75.6%)	170 (73.3%)	0.313
WBC >10,000	242 (65.9%)	130 (57.3%)	**0.034**

The mean(SD) onset of symptoms for all patients was 2.8(2.7)-day: 2.8(3.0)-days for HIV-NP and 2.8(2.8)-day for HIV-PP, p=0.879. Though not clinically significant HIV-PP had a higher rate of pain-shift to the right lower quadrant than HIV-NP, 86.6% vs. 79.9% p=0.002. HIV-NP had a significantly higher rate of WBC count >10,000/μL, 65.9% vs. 57.3%, p=0.034 (Table 1).

A total of 558 (92.8%) patients underwent appendectomy: 345 (93.5%) in HIV-NP and 213 (91.8%) in HIV-PP, p=0.435. There were only two laparoscopic appendectomies, both were HIV-negative. No patient had re-operation. HIV-NP had an inpatient non-operative treatment failure rate of 11/37 (29.7%) and a post discharge recurrent appendicitis rate of 3/26 (11.5%); while HIV-PP had an inpatient nonsurgical treatment failure rate of 8/28 (28.6%) and a post discharge recurrent appendicitis rate of 1/20 (5.0%), p=0.919 and 0.435 respectively. The three recurrent appendicitis in HIV-NP occurred in first, third, and 12th months post-discharge; while in HIV-PP (CD4 count 349) the recurrence occurred in the second month after discharge. All four patients underwent appendectomy during their second admission and discharged home uneventfully. The overall non-operative treatment failure rate in one year was 23/65 (35.4%): 14/37 (37.8%) in HIV-NP and 9/28 (32.1%) in HIV-PP, p=0.919.

A total of 58 complications (9.7%) were recorded in 56 patients: 36 (9.8%) in 34 HIV-NP (two patients each had two complications) and 22 (9.5%) in HIV-PP, p=0. 912. In HIV-NP there were 20 surgical site infections (SSIs), six wound gaping, four intestinal obstructions, three recurrent appendicitis, and one each pneumonia, enterocutaneous fistula (ECF), and mortality. In HIV-PP there were 11 SSIs, six mortalities, two intestinal obstructions, and one each acute renal injury, premature labour, and recurrent appendicitis. There was no difference in infection complications between HIV-NP and HIV-PP, 5.4% vs. 4.7% respectively, p=0.714. There was no significant difference in mortality between operated and non-operated appendicitis patients, 1.1% vs. 2.3% respectively, p=0.407. The patient who developed ECF was a 17-year-old, HIV-negative, female patient who presented to the hospital after 14 days of the onset of her symptoms with generalized peritonitis. She had a very difficult appendectomy. ECF was diagnosed on fifth post operation day. The ECF was managed non-operatively and she was discharged home following spontaneous closure of the fistula after 56 days of her appendectomy.

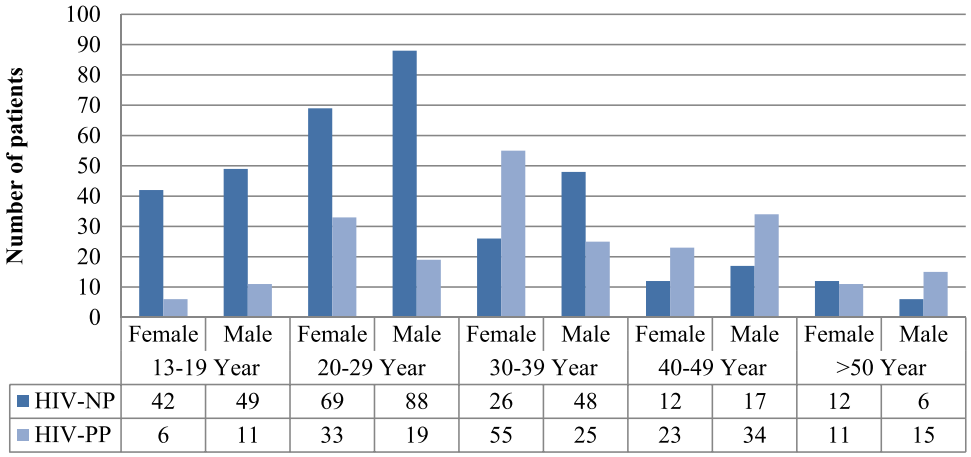

Fig. 1. Demographics and HIV-infection status of appendicitis patients, PMH, 2013–2019.

Table 2
Patient characteristics and mortality, PMH, 2013–2019.

Age in years	Sex	HIV-status	Onset of symptoms in days	CD4 count	Treatment	Cause of death	Hospital stay in days
33	F	Positive	1	177	Appendectomy	Sepsis	7
34	F	Positive	5	467	Appendectomy	Not documented	9
37	F	Positive	2	607	Antibiotics	Sepsis	6
38	F	Positive	1	149	Appendectomy	Sepsis	16
40	M	Negative	7	NA	Appendectomy	Not documented	16
53	M	Positive	2	203	Appendectomy	Sepsis	33
54	M	Positive	4	132	Appendectomy	Sepsis	3

Table 3
Complications and histopathology report in HIV-NP and HIV-PP, PMH, 2013–2019.

	HIV-NP	HIV-PP	p-value
Overall complications	34 (9.9%)	21 (9.9%)	0.999
SSI	20 (5.8%)	11 (5.2%)	0.751
Mortality	1 (0.3%)	5 (2.3%)	**0.032**
Normal appendix	25 (7.2%)	16 (7.5%)	0.907
Simple appendicitis	172 (49.9%)	107 (50.2%)	0.931
Complex appendicitis	85 (24.6%)	45 (21.1%)	0.341
Chronic appendicitis	14 (4.1%)	10 (4.7%)	0.719

The overall mortality rate was 7/601(1.2%): 6/232 (2.6%) in HIV-PP and 1/369 (0.3%) in HIV-NP, p=0.010. Among HIV-PP mortalities one patient was treated non-operatively. In two cases (one each HIV-NP and HIV-PP) the cause of death was not documented, while in the remaining five cases (all HIV-PP) the cause of death was sepsis. Among the six HIV-PP mortalities three had CD4 count <200 (Table 2).

The overall mean hospital stays in days for operated (5.34) and non-operated patients (5.30) were not statistically different, p=0.966. Similarly, the mean hospital stays in days for HIV-NP (5.1) and HIV-PP (5.7) were not statistically different, p=0.223.

Histology report was retrieved in 475/558 (85.1%) patients: 296/345 (85.8%) HIV-NP and 179/213 (84.0%) HIV-PP. Among operated patients the rate of overall complication (p=0.999), SSIs (p=0.751), and results of histopathology reports were not significantly different between HIV-NP and HIV-PP. The commonest complication among operated patients was SSI, 5.6%. Complex appendicitis contributed 130/558 (21.6%): 24.6% in HIV-NP and 21.1% in HIV-PP, p=0.897; while negative appendectomy rate was 41/558 (7.3%): 7.2% in HIV-NP and 7.5% in HIV-PP, p=0.704. Complex appendicitis was associated with longer mean(SD) pre-hospital symptom duration, 3.4(2.1) vs. 2.2(3.0), p=0.001 and hospital stay 7.2(6.8) vs. 4.1(3.4), p=0.001 (Table 3).

A 54-year-old patient, HIV-PP (CD4 count,132) presented to the hospital four days after the onset of symptoms; on histopathology report he had a complex appendicitis and a benign adenoma. He died in the intensive care unit three days after admission due to sepsis.

On histopathology result, female patients had a significantly higher normal appendix and chronic appendicitis than males, 26 (9.8%) vs. 15 (5.1%), p=0.032 and 17 (6.4%) vs. 7 (2.4%), p=0.018 respectively. Males had a higher complex appendicitis than females, 77 (26.2%) vs. 53 (20.1%), p=0.088. Complex appendicitis is associated with longer pre-hospital symptom duration, mean 3.3 days vs. 2.5 days, p=0.008 and longer hospital stay, mean 7.0 days vs. 4.8 days, 0.001, but there was no statistically significant difference in mortality, 1 (0.8%) vs. 5 (1.2%), p=1.000.

HIV-PP and CD4 counts

The CD4 count was known in 208/232 (89.7%) HIV-PP. Considering CD4 count <200 to indicate immunodeficiency, there was no statistically significant difference in the overall duration of onset of symptoms (p=0.252), hospital stay (p=0.932), infectious complications (p=1.000), and mortality (p=0.098) between HIV-PP with CD4 count <200 and ≥200. Among non-operated HIV-PP, there was no significant difference in inpatient failure (p=0.742) and recurrent appendicitis (p=0.705) in the two groups. Among operated patients, patients with CD4 count <200 had significantly higher mortality (8.6%) than those patients with CD4 count ≥200 (1.3%), p=0.043; but there was no statistically significant difference in the two groups in the duration of onset of symptoms (p=072), total number of complications (p=0.105), SSIs (p=0.639), rate of normal appendix (p=0.077), complex appendicitis (p=0.221), and hospital stay (p=0.871) (Table 4).

Discussion

In most studies a higher rate of appendicitis is reported in the second and third decades of life [2,8], with a male predominance [1]. In this study most of the patients were in their third decade (34.8%), and this is in agreement with the previous studies [2,8]. The second most common age group affected in our study was tricenarians (25.6%).The overall

Table 4
HIV-PP clinical characteristics and CD4 count, PMH, Jan 2017–Dec 2019.

		CD4 Count <200	CD4 Count ≥200	p-value
All HIV-PP	Onset of symptoms, Mean(SD)	3.2 (3.0)	2.6(2.6)	0.252
	Hospital stay, Mean(SD)	5.7 (4.4)	5.7(4.9)	0.932
	Infectious complication, n(%)	2 (4.8%)	7 (4.2%)	1.000
	Mortality,n (%)	3 (7.1%)	3 (1.8%)	0.098
Non-Operated HIV-PP	Inpatient failure	2 (5.7%)	5 (3.2)	0.742
	Recurrent appendicitis	0 (0.0%)	1 (0.6%)	0.705
Operated HIV-PP	Onset of symptoms Mean(SD)	2.8 (2.7%)	5.4 (2.6%)	0.720
	Total number of complication	6 (17.1%)	12 (7.6%)	0.105
	Surgical Site infection	2 (5.7%)	6 (3.8%)	0.639
	Mortality	3 (8.6%)	2 (1.3%)	**0.043**
	Normal appendix	0 (0.0%)	14 (8.9%)	0.077
	Complex appendicitis	11 (31.4%)	67 (42.7%)	0.221
	Hospital Stay Mean(SD)	5.4 (4.4)	5.5 (4.8)	0.871

median age in this study (29-year) is in agreement with the previous studies (18-44 year) [8,10].

The similarity in pre-hospital symptoms duration between HIV-NP and HIV-PP [11] and a higher median age in HIV-PP in this study concurs with previous reports [6]. In this study female patients contribute 55.2% of HIV-PP. A higher rate of HIV-infection in our females in this study corresponds to the higher rate of HIV-infection in our female population [12]. This is in contrast to a report from Tanzania that documented a male predominance (61.5%) in their HIV-PP [6]. Though not clinically significant we found a significantly higher rate of pain-shift to the right iliac fossa in HIV-PP; while studies from South Africa, where the HIV-infection prevalence was about 11.1%, and Turkey reported no difference in the clinical presentations between HIV-NP and HIV-PP [13,14]. Leucocytosis was significantly higher in our HIV-NP; this is similar to a report from Tanzania [6]. The average CD4 count in our HIV-PP was 482.8, this is higher than 209-284 reported from other countries [6,13]. This could be due to the fact that Botswana provides a free antiretroviral treatment for all HIV-PP and adopted a “treat all” policy [12].

In uncomplicated appendicitis, antibiotics (non-operative) treatment is considered as safe as appendectomy with a success rate of 72.7%-100% [15–17]. Compared to appendectomy, non-operative treatment was reported to have an advantage of lower cost [5,18], lower complication rate [4,5,15–17], shorter hospital stay [17], and quicker recovery [18]. But a potentially increased antibiotics resistance [16,18], 5.8%-14.9% in-hospital failure rate [15,18], longer hospital stay [4], 4.5%-35.0% lower rate of cure at 1 year [1,4,5,15,17,18], more complication in non-operative group [19], return trips to emergency department [16], multiple expensive cross-sectional imaging studies in subsequent visits [16], and a possibility of missing a malignancy in older patients [1] reduce the real advantage of non-operative treatment. The overall non-operative treatment failure rate in one year in our study was 35.4%: 37.8% in HIV-NP and 32.1% in HIV-PP. This is higher than 19.2%–27.3% reported by others for the same duration [20]. This difference could be due to the use of CT scan in their diagnosis and different exclusion criteria including exclusion of patients below 18-year-old and above 60-year-old, and patients with other serious illness [20]. The use of imaging modalities in patients with a planned non-operative management may reduce the recurrence rate of appendicitis. Interestingly their five-year cumulative recurrent appendicitis rate was 34.0% [20]. This may cast a shadow on the advantage of non-operative management of appendicitis. Appendectomy with its high efficacy and low complication rates remains the more effective treatment for patients with simple and complex appendicitis [5,17,18].

The overall complication rate in this study was 9.7%; this is within the reported range, 8.2%-31.4% [1,20]. In agreement with previous studies [13,21] the overall post-operation complication between HIV-NP and HIV-PP was not statistically different. In patients operated for appendicitis the commonest complication was SSI and it ranges from 3.3%-25.3% [1,8]. In this study SSI occurred in 5.6%, and it was the commonest postoperative complication. Unlike a study from United States that showed a higher rate of infection complication in HIV-PP [21] we found non-statistically significant infection complications in HIV-NP. This could be partly due to a “treat all” policy in Botswana and subsequently a high CD4 count in our patient population.

The mortality rate (1.2%) in our study was at the lower end of the range that was reported from LMICs, 1-4% [1,2,8]. This could be partly due to a well-organized inter-hospital ambulance transport system and a free health care services for the citizens of Botswana. In contrast to other studies [6,13,21,22], we found significantly higher mortality in HIV-PP. This could be partly due to far higher number of HIV-PP in our study than in the other studies.

Studies from United States and Tanzania reported a longer hospital stay in HIV-PP than in HIV-NP [6,21]. Similar to a study from South Africa we did not find such significant difference [13]. Similar to a report by Salminen et al. we did not find significant difference in hospital stay between non-operated and operated patients [20]. Interestingly we had no re-operation in this study; while Mills et al. reported an overall further operation rate of 40.0% in public and none in private hospitals from South Africa [23]. This could be due the different in the characteristics of the three populations under study.

Our overall negative appendectomy rate of 7.3% was in the acceptable range, 3.0%-10.6% [24]. Female patients have higher negative appendectomy rates this could be due to pelvic organ pathologies in females that mimic the clinical picture of appendicitis. Some reported a higher rate 21.9%: 28.0% in females and 18.3% in males [25]. Our negative appendectomy rate was close to the lower end of the report from sub-Saharan African countries, 9%-27% [1,26]. Our females had a higher rate of negative appendectomy which is similar to other studies [2,20,24,25]. Various factors are described in association with complex appendicitis: extreme ages, male gender, immunosuppression, comorbidities, pregnancy, previous abdominal operation, and barriers to accessing health care. Most of these factors are associated with delays in assessment and treatment [22]. The rate of complex appendicitis (23.3%) in this study was similar to other studies, 24.0%-43.6% [2,22], and its positive correlation with longer hospital stay in our study was reported similarly in the previous studies [1.8]. Higher rates of complex appendicitis were reported in HIV-PP from Tanzania and Japan [6.22]. In this study HIV-NP had a higher rate of complex appendicitis but this did not reach statistical significance. A systematic review from South Africa depicted that males had a significantly higher rate of complex appendicitis [2]. In this study we found a higher rated of complex appendicitis in males but it did not reach a statistically significant level.

A study from Tanzania found no difference in the composite complications and infection complication rates in HIV-PP with CD4 count <200 and ≥200. But they found a higher hospital stay among HIV-PP with CD4 count <200 [6]. Though not statistically significant we found a higher infection complication rate in CD4 count <200, and a longer

hospital stay in patients with CD4 count ≥200. This could be due to the large number of HIV-PP in our study and a higher average CD4 count in our population (483) than the Tanzanian HIV-PP (209) [6]. We found a significantly higher mortality in patients with CD4 count <200. Contrary to the report from Japan where complex appendicitis was reported in HIV-PP with CD4 count <200 22], we found more complex appendicitis in patients with higher CD4 count ≥200, though not statistically significant.

The retrospective design of this study with some missing data, lack of adequate documentation of antiretroviral treatment status in HIV-PP, and absence of follow-up data are the shortcomings of this study. Though the diagnosis of appendicitis in this study was based on clinical evaluation by specialist general surgeons, the low negative appendectomy rate in histopathology report may serve as an indirect evidence for a reasonable accuracy of the clinical diagnosis. A relatively large proportion of HIV-PP from a single centre, scrutinizing the clinical presentations and outcomes of HIV-NP and HIV-PP and exploring the impact of CD4 count in HIV-PP are the strengths of this study.

Conclusions

The prevalence of HIV-infection in appendicitis patients was higher than the prevalence in the general population. The clinical presentations in HIV-NP and HIV-PP were similar. HIV-NP had significantly higher WBC count. Inpatient non-operative treatment failure and post discharge recurrence rate were not different between HIV-NP and HIV-PP. HIV-PP had significantly higher mortality than HIV-NP. Operated HIV-PP with CD4 count <200 had significantly higher mortality than those with CD4 count ≥200. The overall non-operative treatment failure in one year was high, 35.4%. Further study is recommended to elucidate the potential factors contributing to a higher mortality in HIV-PP including the type of antiretroviral drugs and the viral load. The higher HIV-infection rates in our appendicitis study population compared to the HIV-infection rate in our general population mandates further study.

Dissemination of results

The results in this study will be shared with the Princess Marina Hospital department of surgery clinical staff members and the leadership and the Ministry of Health and Wellness, Botswana.

Authors' contribution

Authors contributed as follow to the conception or design of the work; the acquisition, analysis, or interpretation of data for the work; and drafting the work or revising it critically for important intellectual content: AGB contributed 75% and ABE 25%. All authors approved the version to be published and agreed to be accountable for all aspects of the work.

Declaration of Competing Interest

The authors declare no conflict of interest.

References

[1] Bhangu A, Søreide K, Di Saverio S, Assarsson JH, Drake FT. Acute appendicitis: modern understanding of pathogenesis, diagnosis, and management. Lancet 2015;386(10000):1278–87.
[2] Yang E, Kahn D, Cook C. Acute appendicitis in South Africa: a systematic review surgery. S Afr J Surg 2015;53(3_4):1–8.
[3] Talan DA, Di Saverio S. Treatment of acute uncomplicated appendicitis. NEJM 2021;385(12):1116–23.
[4] Baird DL, Simillis C, Kontovounisios C, Rasheed S, Tekkis PP. Acute appendicitis. BMJ 2017;357:j1703.
[5] Poprom N, Numthavaj P, Wilasrusmee C, et al. The efficacy of antibiotic treatment versus surgical treatment of uncomplicated acute appendicitis: systematic review and network meta-analysis of randomized controlled trial. Am J Surg 2019;218(1):192–200.
[6] Giiti GC, Mazigo HD, Heukelbach J, Mahalu W. HIV, appendectomy and postoperative complications at a reference hospital in Northwest Tanzania: cross-sectional study. AIDS Res Ther 2010;7(1):1–6.
[7] Mahmood A, Raza SH, Elshaikh E, Mital D, Ahmed MH. Acute appendicitis in people living with HIV: what does the emergency surgeon needs to know? SAGE Open Med 2021;9:2050312120982461 Jan.
[8] Kong VY, Sartorius B, Clarke DL. Acute appendicitis in the developing world is a morbid disease. Ann R Coll Surg Engl 2015;97(5):390–5.
[9] Köhler F, Müller S, Hendricks A, Kastner C, Reese L, Boerner K, Flemming S, Lock JF, Germer CT, Wiegering A. Changes in appendicitis treatment during the COVID-19 pandemic–a systematic review and meta-analysis. Int J Surg 2021;95:106148.
[10] Moris D, Paulson EK, Pappas TN. Diagnosis and management of acute appendicitis in adults: a review. JAMA 2021;326(22):2299–311.
[11] Mai DV, Sagar A, Menon NS, Claydon O, Park JY, Down B, Keeler BD. A local experience of non-operative management for an appendicitis cohort during COVID-19. Ann Med Surg 2021;63:102160.
[12] HIV and AIDS in Botswana (accessed on 13th October 2021), https://www.avert.org/professionals/hiv-around-world/sub-saharan-africa/botswana
[13] Gigabhoy R, Cheddie S, Singh B. Appendicitis in the HIV era: a South African perspective. Indian J Surg 2018;80(3):207–10.
[14] Barlas SU, Günerhan Y, Palanci Y, Işler B, Çağlayan K. Epidemiological and demographic features of appendicitis and influences of several environmental factors. Turk J Trauma Emerg Surg 2010;16(1):38–42.
[15] Talan DA, Saltzman DJ, DeUgarte DA, Moran GJ. Methods of conservative antibiotic treatment of acute uncomplicated appendicitis: a systematic review. J Trauma Acute Care Surg 2019;86(4):722.
[16] Griggs CL, Masiakos PT. When it comes to uncomplicated appendicitis, it's getting complicated. Surgery 2021;170(1):222–3.
[17] Brook I. Treating appendicitis with antibiotics. Am J Emerg Med 2016;34(3):609–10.
[18] Werner S, Grock A, Mason J. Antibiotics only for appendicitis? Ann Emerg Med 2017;70(1):12–14.
[19] The CODA CollaborativeA randomized trial comparing antibiotics with appendectomy for appendicitis. N Engl J Med 2020;383(20):1907–19.
[20] Salminen P, Tuominen R, Paajanen H, Rautio T, Nordström P, Aarnio M, Rantanen T, Hurme S, Mecklin JP, Sand J, Virtanen J. Five-year follow-up of antibiotic therapy for uncomplicated acute appendicitis in the APPAC randomized clinical trial. JAMA 2018;320(12):1259–65.
[21] Smith MC, Chung PJ, Constable YC, Boylan MR, Alfonso AE, Sugiyama G. Appendectomy in patients with human immunodeficiency virus: not as bad as we once thought. Surgery 2017;161(4):1076–82.
[22] Kitaoka K, Saito K, Tokuuye K. Significance of CD4+ T-cell count in the management of appendicitis in patients with HIV. Can J Surg 2015;58(6):429.
[23] Mills RP, Clarke DL, Kong VY. Appendicectomy in private practice in KwaZulu-Natal Province, South Africa. S Afr Med J 2018;108(10):836–8.
[24] Shahmoradi MK, Zarei F, Beiranvand M, Hosseinnia Z. A retrospective descriptive study based on etiology of appendicitis among patients undergoing appendectomy. Int J Surg Open 2021;31:100326.
[25] Pooria A, Pourya A, Gheini A. Appendicitis: clinical implications in negative appendectomy. Int J Surg Open 2021;29:45–9.
[26] Jolayemi OO, Moodley NB, Kong VY, Tlou B, Bruce JL, Clarke DL. The usefulness of routine histological examination of appendicectomy specimens in a South African tertiary centre. S Afr Med J 2018;108(4):342–6.