

Treatment outcomes of Acute Appendicitis and associated factors among admitted patients with a diagnosis of Acute Abdomen in Debre Markos referral hospital, Amhara region, North West Ethiopia

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Abstract

Introduction- Acute abdomen is a sudden onset abdominal disease condition which often requires an immediate surgical intervention. Appendicitis is an inflammation of the vermiform appendix and is one of the most common causes of an acute abdomen in young adults. Appendicitis can cause severe periumbilical pain that radiates to the right lower quadrant, nausea, vomiting and anorexia. If left untreated, it can also cause appendiceal abscess, perforation and peritonitis. **Objective -** To assess treatment outcomes of Acute Appendicitis and associated factors among admitted patients with a diagnosis of acute abdomen in Debre Markos referral hospital from September 11/2018 to March 9/2019. **Methods and materials -** Institutional based cross sectional study was employed among 169 patients using a census sampling method. Data were collected from patient medical records, registration books and anesthesia charts available in the hospital by using checklist. Data was entered using Epi-data version 4.2 and analyzed by SPSS version 25 software. Logistic regression analysis was employed to describe the relationship between outcome and predictor variables. **Results -** Among 303 patients with a diagnosis acute abdomen, 169(55.7%) were developed acute appendicitis, of whom, 107(63.7%) were males and 62 (36.7%) were females. Among 169 patients who underwent appendectomy for treatment of acute appendicitis, 45(26.6%) of them were developed unfavorable treatment outcomes. The odds of unfavorable treatment outcomes for acute appendicitis was higher among patients who had elevated WBC count at the time of presentation [AOR=4.7; 95% CI (1.95, 11.35)] as compared with their counterparts. Similarly, those patients who had an intraoperative appendiceal abscess were more likely to have unfavorable treatment outcome for acute appendicitis [AOR= 3.8; 95% CI (1.61, 9.07)] as compared to those who didn't have appendiceal abscess. **Conclusion and recommendation-** Nearly one-fourth of patients who underwent appendectomy for appendicitis treatment were developed unfavorable treatment outcomes. Elevated WBC count at the time of presentation and presence of intraoperative appendiceal abscess were the factors associated with unfavorable treatment outcome of acute appendicitis. Therefore, immediately evaluate patients having similar features with laboratory investigations is crucial.

Introduction

Acute abdomen is a condition of sudden severe abdominal pain, usually requiring emergency surgery, caused by acute diseases of or injury to internal organs. The commonest symptoms in patients with acute abdomen were abdominal pain, vomiting, abdominal distension and constipation. Acute appendicitis is one of the major causes of acute abdomen. The other causes of acute abdomen include cholelithiasis, intestinal obstruction, peptic ulcer perforation, acute pancreatitis and obstetric and gynecological related diseases (1-4).

The appendix is an immunologic organ that participates in the secretion of immunoglobulin, such as immunoglobulin A. Appendicitis is defined as inflammation of the vermiform (worm-shaped) appendix, a narrow blind ending pouch approximately 5- 9 cm long opening off the caecum. Acute appendicitis is the most common cause of an acute abdomen in young adults. Appendicitis is thought to result from obstruction of the appendiceal lumen, typically by lymphoid hyperplasia, but occasionally by a fecalith, foreign body, or even worms. Obstruction of the lumen by fecalith or lymphoid tissue results in distention of the appendix, bacterial overgrowth, and infection, venous and lymphatic congestion, ulceration and transmural spread of infection through the appendicular wall. The inflammation and infection may result in thrombosis of blood vessels causing ischemia, necrosis and perforation. If untreated, necrosis, gangrene, and perforation occur. If the perforation is contained by the omentum, an appendiceal abscess results (5-7).

Appendectomy, which is the gold standard in the management of acute appendicitis, is the most frequently performed urgent abdominal operation and is often the first major procedure performed by a surgeon in training. Advances in modern radiographic imaging have improved diagnostic accuracy; however the diagnosis of appendicitis remains essentially clinical, requiring a mixture of observation, clinical acumen and surgical science and as such it remains an enigmatic challenge and a reminder of the art of surgical diagnosis(5, 8).

Appendicitis can occur at any age but is most common in adolescents and young adults. It causes vague abdominal pain that starts at periumbilical area that progress to right lower quadrant and is usually accompanied by low grade fever, anorexia, nausea, and sometimes by vomiting. Similarly, the abdomen is tense, and the client usually flexes the right hip to relieve the discomfort. Generally, the location of the appendix may also influence the type of pain. For example, if the tip of the appendix is against the rectum, the client may experience pain with defecation. If the tip is near the bladder or against a ureter, the client may experience pain with urination and if the appendix perforates, clients experience more diffuse abdominal pain. The abdomen may also be distended secondary to paralytic ileus(9, 10).

Extreme age, delay in presentation, stage or duration of acute appendicitis, intake of antibiotics outside health care institutions, presence of comorbid condition and immunologic status of the patient can affect treatment outcomes of acute appendicitis. Morbidity and mortality rates after surgical treatment of acute appendicitis is still a major challenge in developing world (3, 11).

The commonly encountered complications in surgical practices related to acute appendicitis can be preoperative like perforation which can lead to local or generalized peritonitis, appendiceal abscess and mass or post-operative complications such as superficial and deep wound infections and wound dehiscence, prolonged ileus, and pneumonia, bowel obstruction and intra-abdominal abscesses(12, 13).

Therefore, assessing the treatment outcome and the factors associated with acute appendicitis is crucial to prevent related complications.

Methods And Materials

Study design, area and period

Institutional based cross sectional study was employed among patients who have had appendectomy in Debre Markos referral hospital (DMRH). The hospital is located in Debre Markos town in the North West part of Ethiopia 299 Km from the capital, Addis Ababa and 263 Km away from Bahir Dar. It serves as a referral hospital for east Gojjam administration region and the residences around. The study was conducted by reviewing records from September 11/2018 to March 9/2019 in Debre Markos referral hospital.

Sample size determination and sampling procedure

All patients, who had operative management for acute appendicitis and admitted at Debre Markos referral hospital from September 11 /2018 to March 9 /2019, were included in the study. However, patients with acute appendicitis who had incomplete data record over the variable of interest were excluded from the study. The sample size were determined by census sampling method, in which all acute appendicitis cases operated in Debre Markos referral hospital from September 11/2018 to March 9/2019 were included in the study giving a total sample size of 169 patients.

Study variables and operational definitions

The outcome variable of the study was treatment outcomes of acute appendicitis (favorable and unfavorable) whereas the predictor variables of the study were patient related variables (age, sex, residence), diseases related variables (clinical sign and symptoms, duration of illness, intraoperative findings, preoperative WBC count and index of abdominal ultrasound) and treatment related variables (type of abdominal incision, procedure done, intake of preoperative antibiotics and length of hospital stay).

The following terms were described in such away in this study.

Length of hospital stay-Number of days elapsed while the patient is in the hospital

Outcome -Condition of the patient at discharge (either improved with no postoperative complication/s or developed one or more complications.

Favorable outcome:-Patients who underwent appendectomy for the clinical diagnosis of acute appendicitis, improved and discharged from the hospital without developing postoperative complications following appendectomy.

Unfavorable outcome: Patients with a clinical diagnosis of acute appendicitis who developed one or more postoperative complication(s), e.g. wound infection, intestinal obstruction, or patients with a clinical diagnosis of acute appendicitis who have died in the intra- or postoperative period.

Data collection procedure, quality assurance and analysis

Data were collected from patient medical records, registration books and anesthesia charts available in the hospital by check lists using two trained data collectors who are both 4th year B.Sc. nursing students. First medical record number (MRN) of patients in the study period was identified from registration books (logbooks). Then their charts were retrieved from card office and those tools including socio demographic characteristics, signs and symptoms, physical findings, out comes, complications encountered, and other relevant items related to the disease were reviewed. Finally data was summarized, analyzed, interpreted and edited. The data were checked for completeness, cleaned coded and entered into Epi-data version 4.2 and then analyzed using statistical product and service solution (SPSS) version 25 statistical software. Bivariate and multivariable logistic regression models were used. Crude odds ratios with 95% confidence intervals were estimated in the bivariable logistic regression analysis to assess the association between each predictor variable and outcome variable. In the bivariable logistic regression, variables with P-value < 0.2 were fitted into the multivariable logistic regression analysis. Finally, adjusted odds ratios with their 95% confidence intervals were estimated to assess the strength of association, and variables with P-value < 0.05 were considered statistically significant factors. Model fitness was checked using Hosmer-Lemeshow goodness fit test, which was 0.6. Data quality were assured by training of data collectors, collecting and cross matching of patient charts and surgery registration logbooks before data collection, preparing checklists and supervising and assisting data collectors closely.

Results

Socio-demographic characteristics

Out of all 303 patients admitted with a diagnosis of acute abdomen, 169(55.7%) patients were undergone operative management for a clinical diagnosis of acute appendicitis. Among those having operative management for the clinical diagnosis of acute appendicitis and fulfil the eligibility criteria, 107(63.3%) were males and 62 (36.7%) were females. Moreover, 69(40.8%) of patients were urban and 100(59.2%) were rural dwellers and their mean age was 24.6 ± 11.8 SD years (Table. 1).

Clinical and investigation profile of patients with Acute Appendicitis

Clinical Symptoms

Abdominal pain was invariably the main presenting complaint of patients with acute appendicitis. Among the participants, 119(70.4%) had an initial periumbilical pain that latter shifted to the Right Lower Quadrant (RLQ) of the abdomen, 33(19.5%) had right lower quadrant abdominal pain, 14(8.3%) had generalized abdominal pain, 2(1.2%) had pelvic pain and 1 (0.6%) had flank pain. Moreover, 156 (92.3%), 151(89.3%) and 149(88.2%) of the study participants had a presentation of nausea/vomiting, anorexia and fever respectively. Out of the respondents, 7(4.1%) mentioned constipation, 7(4.1%) mentioned diarrhea and 11 (6.5%) mentioned dysuria as their presenting complaints (Table 2).

Clinical Signs

The physical examination finding of the patients revealed that, 50 (29.6%) patients had temperature $>37.5^{\circ}\text{C}$ and 153 (90.5%) of them had RLQ abdominal tenderness. The rest, 13(7.7%), 3 (1.8%) and 1(0.6%) of patients had generalized abdominal tenderness, pelvic tenderness and flank tenderness respectively. Only one patient was presented with RLQ abdominal mass. Out of 15(8.8%) patients who presented peritonitis, 13(7.7%) were having generalized peritonitis (Table 2).

Investigation findings

CBC was done for all patients. Of whom, 71(42%) had raised WBC count ($>11,000$ cells/nl). Similarly, abdominal ultrasound was done for 157(92.7%) patients and the imaging result of these patients indicated that 97 (57.4%) had acute appendicitis, 35(20.7%) had perforated appendix, 22(13%) had appendicial abscess, and 1(0.6%) had gangrenous appendicitis (Table 2).

Management procedures for Acute Appendicitis

All patients (100%) were given preoperative IV antibiotics. The most common type of abdominal incision was RLQ transverse incision (89.3%; $n=151$) followed by midline vertical incision (6.5%; $n=11$). Moreover, the commonest operative procedure done was appendectomy (74.6%; $n=126$) followed by appendectomy with abscess drainage (18.9%; $n=32$). Majority of patients, 112 (66.3%) stayed in the hospital for \leq three days (Table 3).

The most common intraoperative findings was an inflamed/phlegmonous appendix (39.1%; $n=66$) followed by perforated appendix (28.4%; $n=48$). The other intra operative findings were appendicular abscess (24.9%; $n=42$), gangrenous appendix (5.9%; $n=10$), fecalith (1.2%; $n=2$), appendicular mass (0.6%; $n=1$), normal appendix (0.6%; $n=1$) and other findings such as inflammatory peritoneal fluid collection, ectopic kidney, cecal mass and edematous pancreas (3%; $n=5$). The position of appendix, in almost all of the patients, was retrocecal (99.4%; $n=168$) (Figure 1).

Among 169 patients who underwent appendectomy for acute appendicitis treatment, 45(26.6%) of them were developed post-operative complications (unfavorable treatment outcomes). The major post-operative complications (unfavorable treatment outcomes) were wound infection (13.6%; $n=23$), pneumonia (7.02%; $n=12$) intraperitoneal fluid collection (4.7%; $n=8$) and death (1.1%; $n=2$)/Figure 2.

Factors affecting treatment outcomes of Acute Appendicitis

In bivariable logistic regression analysis, elevated WBC count, presence of intraoperative appendicial abscess, peritonitis, temperature and duration of illness before reaching to hospital were statistically associated with treatment outcome of acute appendicitis. However, only two variables were statistically associated with treatment outcome of acute appendicitis after adjusting possible confounders. These were elevated WBC count at the time of presentation and intraoperative appendicial abscess (Table 4). Patients who had elevated WBC count (>11000 cells/nl) at time of presentation were 4.7 times more likely to develop unfavorable acute appendicitis treatment outcome as compared to those who had no elevated, 4000-1100 cells/nl, WBC count [AOR=4.7; 95% CI(1.95, 11.35)]. Similarly, those patients who had an intraoperative appendicial abscess were 3.8 times more likely to have unfavorable acute appendicitis treatment outcome as compared to their counterparts[AOR= 3.8; 95% CI(1.61, 9.07)].

Discussion

In this study, nearly one-fourth (26.6 %) of the patients were developed unfavorable treatment outcomes of acute appendicitis with postoperative complications. The most common unfavorable outcomes were wound infection, pneumonia, intraperitoneal fluid collection and death. This finding is lower than a studies conducted in Kumasi, Ghana (43.1%)(14) and Edendale Hospital in Pietermaritzburg, South Africa (44%)(15). However this study is comparable with study done at Nottingham, UK that ranges from < 5% in simple appendicitis to 20% in cases with perforation and gangrene(16). The possible explanation for the above discrepancy could be the difference in socioeconomic and organizational setup among countries.

Elevated WBC count at the time of presentation and presence of intraoperative appendiceal abscess were the factors associated with treatment outcome of acute appendicitis in this study. Patients who had elevated WBC count (>11000 cells/nl) at time of presentation were more likely to develop unfavorable acute appendicitis treatment outcome as compared to those who had no elevated WBC count. This was supported by a study done in Kathmandu, Nepal(17). Similarly, those patients who had an intraoperative appendiceal abscess were more likely to develop unfavorable acute appendicitis treatment outcome as compared to their counterparts. The possible explanation might be due to the fact that the presence of infections can trigger the body's immune system and cause inflammation and tissue damage or delay wound healing.

The most common intraoperative findings was an inflamed/phlegmonous appendix followed by perforated appendix. The other intra operative findings were appendiceal abscess, gangrenous appendix, fecalith, appendicular mass, normal appendix and other findings such as inflammatory peritoneal fluid collection, ectopic kidney, and cecal mass and edematous pancreas. This finding is in line with the study conducted at Iran(18), Nottingham(UK)(16) and USA(19). This might be related to the duration of illness prior to admission to hospital as 95% of patients with an intra-operative appendiceal abscess came after three days of onset of their illness.

Consistent with studies done in Tikur Anbessa teaching hospital (52%), (2), Gondar University hospital (34.6%) (3), Yirgalem hospital (44% for simple appendicitis and 45.5% for perforated appendicitis)(20), Goba referral hospital(21), Suhul general hospital(54.2%)(22), and Sina hospital, Iran (56.8%)(23) acute appendicitis is the leading (55.7%) cause of acute abdomen in this study.

In this study, majority of patients were developed acute appendicitis in the first and second decades of their life. This age group is consistent with studies conducted at Glemso zonal hospital, Eastern Ethiopia(24) and different parts of united kingdom (5, 6). However, majority of cases (42.8%) occurred at the third decade of life in Lagos, Nigeria(25).

In this study, abdominal pain which started at periumbilical area and then radiating to the right lower quadrant of the abdomen was the commonest symptom followed by vomiting, anorexia and fever whereas tenderness at Mc Burney's point was the commonest sign followed by elevated temperature. This finding was in line with studies conducted at United Kingdom (6, 16), Brazil (26), Thailand(27) and Portugal (28) . This might be due to the inflammatory process at the appendix.

All patients who were diagnosed as acute appendicitis were given preoperative IV antibiotics. The most common type of abdominal incision was RLQ transverse incision followed by midline vertical incision. Moreover, the commonest operative procedure done was appendectomy followed by appendectomy with abscess drainage.

Limitation of the study

Since the study depend on medical records, treatment outcomes of acute appendicitis may be underestimated due to exclusion of incomplete records.

Conclusion

Among patients who underwent appendectomy for the treatment of acute appendicitis, nearly one-fourth of them were developed unfavorable treatment outcomes. The most common unfavorable outcomes were wound infection, pneumonia, intraperitoneal fluid collection and death. Elevated WBC count at the time of presentation and presence of intraoperative appendiceal abscess were the factors associated with unfavorable treatment outcome of acute appendicitis. Majority of patients were developed acute appendicitis in the first and second decades of their life. In all patients abdominal pain was invariably the main presenting complaint and the most common physical finding was RLQ tenderness.

Recommendation

Health care providers should immediately evaluate patients with abdominal pain for acute appendicitis and further validate it by using proper history, physical examination & investigations such as CBC and abdominal ultrasound to support the clinical diagnosis is very important.

Early appendectomy after confirmatory diagnosis of acute appendicitis is recommended especially for those having features of peritonitis, raised WBC count and delayed presentation to reduce the risk of developing unfavorable treatment outcomes.

Declaration

Competing interests

The authors declared that they have no any competing of interest

Ethical approval

The study was conducted after obtaining official permission to undertake this study from, Debre Markos University, College of Health Sciences Research and Ethical Review Committee. Then support and permission letter were provided to Debre Markos referral hospital (DMRH). Staffs at the Card room, surgical ward and operation room were informed about the purpose of the study and verbal consent was obtained. Confidentiality of patient's information were assured and information was recorded anonymously.

Consent for publication

Not applicable

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Availability of data

All relevant data are within the paper and its Supporting Information files.

Authors' contributions

AD: conceived, designed the study, supervised the data collection, and performed the data analysis, interpretation of the result, and drafting the manuscript. AM and BK participated in designed the study, data analysis and data interpretation, editing the manuscript. All authors read and approved the final manuscript

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Tables

Table 1: Socio-demographic characteristics of patients operated for a clinical diagnosis of acute appendicitis at Debre Markos referral hospital from September 11/2018 to March 9/2019 (n=169).

Variables	Frequency	Percentage
Sex		
Male	107	63.3
Female	62	36.7
Residence		
Urban	69	40.8
Rural	100	59.2
Age group		
<=20 years	66	39.1
21-30 years	64	37.9
31-40 years	25	14.5
41-50 years	9	5.3
>50 years	5	3

Table 2: Clinical and investigative findings of patients operated for a clinical diagnosis of acute appendicitis at DMRH from September 11/2018 to March 9/2019 (n=169).

Variables	Frequency	Percentage
General symptoms		
Abdominal pain		
Periumbilical pain shifting to the RLQ	119	70.4
RLQ abdominal pain	33	19.5
Generalized pain	14	8.3
Pelvic pain	2	1.2
Flank pain	1	0.6
Nausea and vomiting		
Yes	156	92.3
No	13	7.7
Anorexia		
Yes	151	89.3
No	18	10.7
Fever		
Yes	149	88.2
No	20	11.8
Constipation		
Yes	7	4.1
No	162	95.9
Diarrhea		
Yes	7	4.1
No	162	95.9
Dehydration		
Yes	11	6.5
No	158	93.5
Duration of illness before reaching DMRH		
<=3days	90	53.3
>3days	79	46.7
Physical signs		
Temperature		
<=37.5 °C	119	70.4
>37.5 °C	50	29.6
Abdominal tenderness		
RLQ tenderness	153	90.5
Generalized tenderness	13	7.7
Pelvic tenderness	2	1.2
Flank tenderness	1	0.6
Right mass		
Yes	1	0.6
No	168	99.4
Ritonitis		
Generalized	13	7.7
Localized	2	1.2
Investigations		
WBC count		
5000-11000 cells/nl	98	58
>11000 cells/nl	71	42
Abdominal ultrasound		
Done	157	92.9
Not done	12	7.1
Diagnosis of abdominal ultrasound		
Perforated	35	20.7
Appendicular abscess	22	13
Acute appendicitis	97	57.4

angrenous	1	0.6
thers	2	1.2

Table 3: Management related profiles of patients operated for a clinical diagnosis of acute appendicitis at DMRH from September 11/2018 to March 9/2019 (n=169).

Variables	Frequency	Percentage
Type of incision		
RLQ transverse incision	151	89.3
Gridiron incision	2	1.2
Midline vertical incision	11	6.5
Both gridiron and midline vertical incision	5	3.0
Type of operative procedure		
Appendectomy only	126	74.6
Appendectomy and abscess drainage	32	18.9
Drainage only	1	0.6
Appendectomy and drainage	9	5.3
Other procedure	1	0.6
Duration of hospital stay		
Less than or equal to 3 days	112	66.3
4-7 days	49	29.0
>7 days	8	4.7
Status of patient at discharge		
Improved	167	98.8
Dead	2	1.2

Table 4: Factors affecting treatment outcome of acute appendicitis at Debre Markos referral hospital from September 11/2018 to March 9/2019 (n=169)

Variables	Acute Appendicitis treatment outcome		COR [95%CI]	AOR [95%CI]	P-value
	unfavorable	Favorable			
C count					
1000 cells/nl	35(20.7%)	36(21.3%)	8.5(3.83,19.09)	4.7(1.95,11.35)	0.001
00-11000cells/nl	10(5.9%)	88(52%)	1	1	
perforated abscess					
Yes	25(14.7%)	17(10%)	7.8(3.6, 17.15)	3.8(1.61, 9.07)	0.002
No	20(11.8%)	107(63.3%)	1	1	
peritonitis					
Yes	10(5.9%)	5(3%)	6.8(2.18,21.21)	2.8 (0.82,9.55)	0.098
No	35(20.7%)	119(70.4%)	1	1	
temperature					
7.5	16(9.4%)	103(60.9%)	1	8.8(4.1,19.1)	1
>7.5	29(17.1%)	21(12.4%)		1.7(0.58,5.50)	
duration of illness before hospital					
<=3days					0.928
>3 days	12(7.1%)	78(46.1%)	1	1	
	33(19.5%)	46(27.2%)	4.6(2.19,9.91)	0.9(0.31,2.86)	

Figures

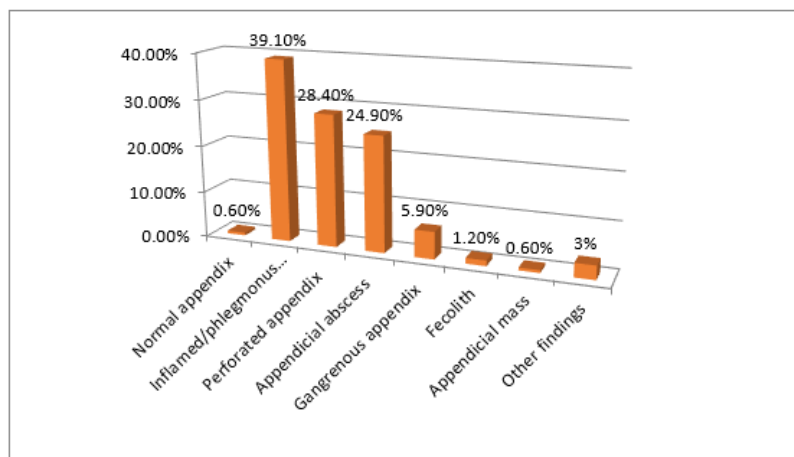


Figure 1

Intraoperative findings of patients operated for a clinical diagnosis of acute appendicitis at Debre Markos referral hospital from September 11/2018 to March 9/2019 (n=169).

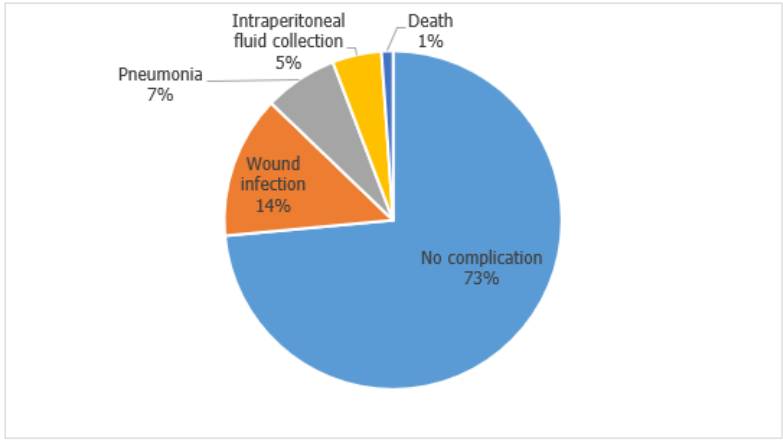


Figure 2

Post operation complications of patients operated for a clinical diagnosis of acute appendicitis at DMRH from September 11/2018 to March 9/2019.