



Emergency Appendectomy in UK: A Single Center Retrospective Cohort Study

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Abstract

Background: Emergency appendectomy is among the most common emergency surgical procedures performed worldwide. The current study looks at the local data on how the emergency appendectomies are performed in a district general hospital in England. **Aim:** The aim of the study was to assess the current state of surgical practice of emergency appendectomy in a single center in UK and to compare with current international practice of appendectomy. **Methods:** A single center, retrospective study performed between May 2018 and October 2019. Data was collected with a protocol for 18 months with 7-day follow up period for patients who underwent emergency appendectomy. Primary outcome measures were primary surgical approach and rate of negative appendectomy. Secondary outcome measures were rate of conversion, length of hospital stay and 7-day complication rates including surgical site infections, unplanned ED returns and readmission. **Results:** A total of 226 appendectomies were performed during study period of 6 months, out of which 212 met inclusion criteria. Mean age was 32 years with a range from 6 years to 92 years. Majority of the procedures (96.6%) were performed by laparoscopic approach with 3 (1.4%) requiring conversion to open procedure during the study period. 47 (22.2%) of patients did not show evidence of appendicitis on histological examination of resected specimen. More than 72% of patients were discharged home within 48 hours of hospital admission. Rate of SSI was less than 7.5%. **Conclusion:** Laparoscopic appendectomy is the preferred and safe surgical approach for emergency appendectomy; however, the rate of negative appendectomy is high when compared against international benchmark.

Keywords: emergency appendectomy, laparoscopic appendectomy, negative appendectomy, readmission rate, imaging studies.

Introduction

Acute appendicitis one of the most common abdominal condition requiring emergency operation worldwide [1]. Annually, around 50,000 appendectomies are performed in UK [2]. Acute appendicitis affects people of all age groups and both genders. The diagnosis of acute appendicitis requires detailed history, physical examination, laboratory tests and imaging studies in certain cases [3]. The delay in diagnosis of acute appendicitis can increase the risks of serious complications including perforation and peritonitis. Similarly, a haste in rushing for operation in an attempt to minimize the complications can lead to unnecessary operation and increased rate of negative appendectomy [1]. An understanding of various factors to determine outcomes of emergency appendectomy are of particular importance to patients and hospitals providing these services [4]. Research in these areas provides a tool to investigate provision and outcomes of various surgical procedures including appendectomy and emergency abdominal surgery [5-7].

The following study is a snapshot of current practice of emergency appendectomy at a single center in a district general hospital in England. This study aims to highlight the current state of practice and outcomes of emergency appendectomy and compares it with international benchmarks.

Methods

A single center, retrospective study performed between May 2019 and October 2019. Data was collected with a protocol for 6 months

with 15-day follow up period for patients who underwent emergency appendectomy. Primary outcome measures were primary surgical approach (laparoscopic or open approach) and rate of negative appendectomy defined as the portion of histologically normal appendix removed in patients suspected of having acute appendicitis. Negative appendectomy was defined as non-incidental appendectomy with no inflammatory cells present in the submucosa or muscularis propria in the excised specimen of appendix. Secondary outcome measures were rate of conversion, length of hospital stay and 7-day complication rates including surgical site infections, unplanned ED returns and readmissions to hospital. Exclusion criteria included age less than 6 years, appendectomy performed as part of other procedures like diagnostic laparoscopy, right hemi colectomy, bowel resection or cecostomy and already diagnosed appendicular tumors. Medical records including histology report were reviewed and data entered into a database. No patient identifiable information was included in the collation and analysis. Data analysis was carried out by using JASP. $P < 0.005$ was regarded as significant.

Results

Demographic Factors

A total of 226 appendectomies were performed during study period of 6 months with an average of 37.6 appendectomy performed per month, out of which 212 met inclusion criteria. 14 patients were excluded from audit as they did not meet the inclusion criteria. 4 of them had NET of appendix, 3 of them had *Entrobium vermicularis*

infestation, 1 had chronic inflammation, 4 appendectomies were done as part of other procedure and 2 of them did not have histology report available. The average age of the patients was 32 years with a

range from 6 years to 92 years, with females (130/212, 61.6%) representing majority of the cases. The demographic characteristics are shown in Table 1 and Figure 1.

Table 1: Demographic Characteristics of Study population

		Number	% Age
Gender	Male	81	38.3
	Female	130	61.6
Age (in Years)	Mean	32	
	Median	30	
	Range	6-92	
Pre-Operative Imaging	None	141	66.8
	CT only	67	31.7
	USS only	59	27.9
	CT and USS	3	1.4
Surgical Approach	Laparoscopic	204	96.6
	Lap -> Open	3	1.6
	Open	4	1.8
Histology	Appendicitis	164	77.8
	No appendicitis	47	22.2
Length of Stay (days)	Median	2	
	Range	0-14	
Adverse Events	Unplanned ED visits	20	9.4
	Wound infection	16	7.5
	Intra-abdominal Collection	9	4.2

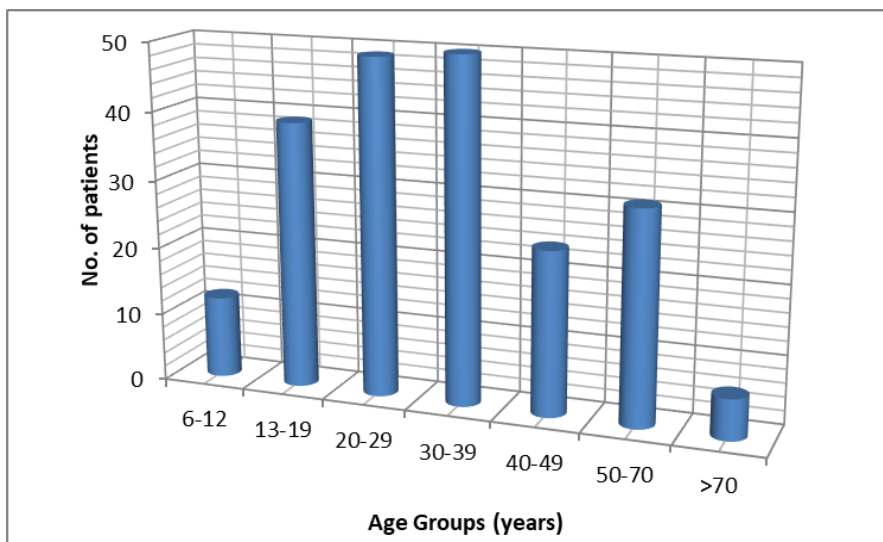


Figure 1: Distribution of Age Group

Primary Outcome Measures

Majority of the procedures (96.6%) were performed by laparoscopic approach with 3(1.4%) requiring conversion to open procedure during the study period. The negative appendectomy rate was 22.2% (47/212) as there was no evidence of appendicitis on histological examination of resected specimen. Younger age

(p=0.002), female gender (P=<0.001), normal white cell count (p=<0.001), lower value of CRP (P=< 0.001) and no evidence of appendicitis on CT scan (p=<0.001) were significantly associated with higher rates of negative appendectomy. The details are presented in the Table 2.

Table 2: Characteristics of Histologically Negative appendectomy

		Histology Positive	Histology Negative	P value
Age (in years)	Mean	34.5	26	0.002
	Range	6-92	8-50	
Gender	Female	91(55.4%)	39(82.9%)	<0.001
	Male	73(90.1%)	8(9.9%)	
WCC (x 10 ⁶ /ml)	Mean	12.4	10.2	<0.001
	Range	4.8-28.1	4.1-20.5	
CRP (mg/l)	Mean	70	37	<0.001
	Range	1 - >350	1 - 266	
Ultrasound scan	Not done	130(61.3%)	22(10.3%)	0.27
	Done	19(9%)	40(18.9%)	

CT scan	Not done	102(48.1%)	42(19.8%)	<0.001
	Done	56(26.5%)	11(5.2%)	

Secondary Outcome measures

The average length of stay in all patients is 2.1 days with median length of stay of 2 days. (Figure 2). 20(9.4%) patients had unplanned return to ED within 2 weeks of discharge from hospital. Among these, 16 (7.5%) had superficial surgical site infection, 14(6.6%) had

perforated appendicitis, 9(4.2%) developed intra-abdominal collection. Intra-abdominal collection was managed with IR drainage in 6 patients and one of them required laparoscopic wash out.

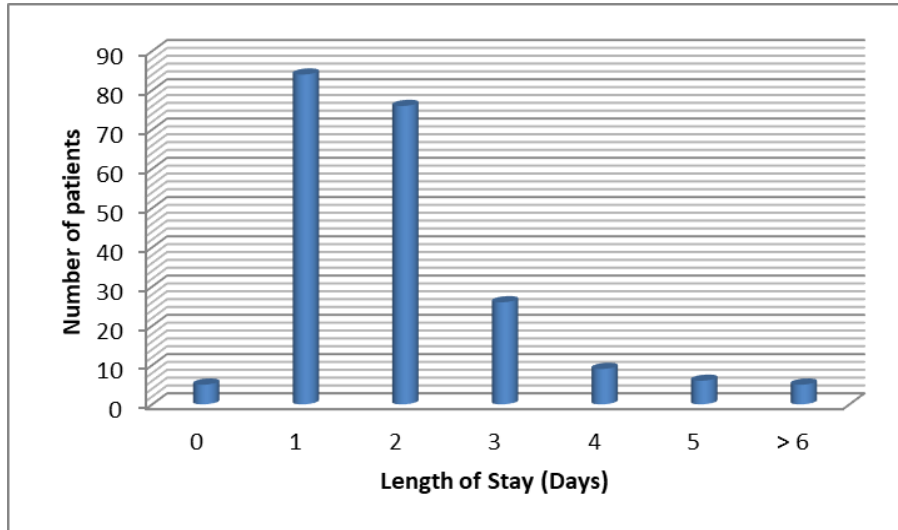


Figure 2: Post-operative length of hospital stays

Discussion

This study is a retrospective analysis of current practice of emergency appendicectomy at a district general hospital in England and to look at the outcomes of the appendicectomy in this country. The preferred surgical approach was a laparoscopic appendicectomy which is in accordance with the international guidelines on the use of laparoscopy as the primary modality [8]. Higher rates of laparoscopy in this study (98.2%) may have contributed towards higher NAR.

The rate of negative appendicectomy is one of the established metric in the management of patients suspected of having appendicitis [9]. The single centre NAR has been reported as high as 17-36% [10-14] to low as 1.7-7% [15-18] depending upon the clinical judgment alone to the increasing use of diagnostic modalities including ultrasound scan, CT scan and laparoscopy. We have found a significant association between negative appendicectomy and female gender, younger age group, normal WCC and mildly elevated levels of CRP.

The NAR found in this single centre retrospective study is 22.2%. This is slightly above the traditional measures of NAR as has been reported 20.6% in the United Kingdom [5]. A comparison of NAR with recently conducted large-scale international studies [6,19-22] has been presented in the table 3. However, all of these studies were multicentre, prospective and large scale. Higher rate of NAR in our study could partly be related to increasing use of laparoscopy in management of patients with abdominal pain.

Table 3. Comparison of NAR with International centres.

Country	NAR (%)
This study	22.2
United Kingdom	20.6
Australia	19.0
Sweden	7.9
Canada	6.8
Switzerland	6.4
Korea	4.1
The Netherlands	3.3
United States	2.5

There are around 50,000 appendicectomies are performed in UK every year [2]. A reduction in the NAR could result in reduction of potentially unnecessary operations which have a significant economic cast to the healthcare system. However, the use of NAR as indicator of quality of surgical care is doubtful as the treatment is mainly guided by patient’s symptoms, examination findings and results of available investigations.

It is evident from this study that majority of patients did not had preoperative imaging and clinical acumen adjunct by the available blood results namely WCC and CRP remain the mainstay for decision to proceed with appendicectomy. This low utilization of the imaging modalities may partly explain the higher number of negative appendicectomies in this study. This is contrary to the national guidelines in the Netherlands where all patients should have imaging investigation before being taken to operating room and hence why a low NAR 3.3% [6]. Similarly, higher utilization of CT scan in US centres corresponds to lower NAR 2.5% [23].

The postoperative length of stay was 2 days on average, however, majority of patients were discharged within 48 hours of the operation, some being on the same day. A few patients stayed in for longer duration mainly because of complicated appendicitis and associated SSI. The conversion rate was 1.6% and in patients with complicated appendicitis as assessed by operating surgeon.

Postoperative readmission rate has been used as a hospital quality metric and has been estimated to range from 1% to 19% [24-26]. Readmission rate of 9.4% was reported in this study which is well in accordance with the acceptable international bench mark. Among the patients who returned to emergency department within two weeks had complicated appendicitis and some of them required further intervention as IR drainage of intra-abdominal abscess and laparoscopic washout. This is likely a representation of more complicated pathology rather than morbidity related to the operative procedure. None of the patients with negative appendicectomy needed further intervention indicating the minimal morbidity associated with laparoscopic appendicectomy [4].

Limitations

A limitation to this retrospective study is the group of patients who underwent appendectomy for suspected appendicitis and does not include the number of patients who were managed conservatively. Moreover, the accuracy of imaging modalities (US and CT scan) cannot be assessed due to small population size. Another limitation is that only those patients were included as readmission who presented to ED at this hospital. This study does not include this group of patients who were managed in the community.

Conclusion

In conclusion, laparoscopic appendectomy is the preferred and safe surgical approach for management of acute appendicitis. Although the rate of negative appendectomy is within acceptable limits of UK standards and slightly higher than the international benchmarks, there are opportunities to reduce the number of potentially avoidable negative appendectomies by more use of imaging modalities in decision making.

Conflicts of Interest

None

Funding Statement

None

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