A Clinicopathological Study of Emergency Appendectomy

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Background: Acute appendicitis is one of the most frequent reasons for admission to the surgical unit and appendectomy is the most common emergency procedure performed worldwide. The accuracy of diagnosis is not straightforward at all times. A lower negative appendectomy rate (NAR) is regarded internationally as a quality indicator of the treating center.

Objective: To determine the diagnostic accuracy of appendicitis by clinical, radiological and histopathological findings.

Design: A Retrospective Review.

Setting: King Hamad University Hospital, Bahrain.

Method: Patients who had appendectomy were included in the study. Data were documented between January 2013 and December 2014. All patients above 14 years of age were included. Incidental appendectomy and appendicitis during pregnancy were excluded from the study.

Result: The medical records of 286 patients who underwent appendectomy were reviewed; 187 (65.4%) were males. The mean age was 29.3 years. The negative appendectomy rate (appendix is normal on histopathology) was 29 (10.1 %) while another pathology other than appendicitis was found in one (0.349%). Twenty-nine patients had a normal appendix, 20 were females. The total perforation rate was 28 (10%). Complications were encountered in 2 (0.69%) patients. Ultrasound was used in 86 (30.1%) patients and conventional tomography used in 67 (23.43%) cases. The overall accuracy of both clinical and radiological diagnosis was 89.16%. The mean age was 29.3 years.

Conclusion: The diagnostic accuracy, in our study, was 89.16%. Clinical diagnosis and radiological imaging, especially in females, could decrease the NAR to an acceptable rate.

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Acute appendicitis is possibly the most frequent reason for admission to any surgical unit worldwide. Approximately 5% to 8% of the population in Western countries would have appendicitis sometime during their life, with a peak incidence between 10 and 30 years of age[1]. The clinical presentation of periumbilical pain radiating to the right lower quadrant followed by anorexia and tenderness are unfortunately not a constant feature of acute appendicitis and usually present only in 37% to 53% of patients. The symptoms could be the initial complaint of other pathologies which mimic appendicitis, especially among females[2]. Atypical histories lack this typical progression and may include pain in the right-lower quadrant as an initial symptom, which could lead to a delayed diagnosis or even a missed diagnosis[3].

Ultrasound (US) and CT scan have been widely used as an adjunct to the clinical examination in atypical and complicated cases, especially in females[4]. The use of US is undermined by

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user experience, and more accurate results are produced by using CT with a sensitivity of 83.7% and a specificity of 95.9%[5].

The increased use of CT has significantly decreased the NAR, especially in females younger than 45 years of age[6-8]. Histopathology of the appendectomy specimen is routinely performed in our institution for correlation with the clinical diagnosis.

The aim of this study is to determine the diagnostic accuracy of appendicitis by clinical, radiological and histopathological findings.

METHOD

Data of patients who underwent appendectomy was reviewed from January 2013 to December 2014. The diagnosis was correlated with the histopathology report, which was revised independently by two pathologists.

Cases of lymphoid hyperplasia and fibrous obliteration of the lumen of the appendix without evidence of inflammation were not considered as appendicitis in our study[9]. The variables in the data were analyzed using IBM SPSS version 23.

RESULT

Two hundred eighty-six patients had appendectomy between 1 January 2013 and 31 December 2014. The mean age of the patients was 29.3 years; 187 (65.4%) were males and the male to female ratio was 2:1. Table 1 summarizes the patients' characteristics and the radiological results of both the US and CT scans. The histopathological findings of the patients are described in detail in table 2 and figure 1. An abdominal US scan was used in 86 (30.0%) patients and of these, 69 (80.2%) were females; in 28 (32.5%), the appendix was not visualized; 42 (48.8%) patients were histologically proven appendicitis. The number of false positive US results were 2 (2.3%) and false negative was 9 (10.5%).

CT scan was used in 67 (23.42%) patients; 28 were females. The CT identified 63 out of 67 patients (94%) and one out of 67 (1.5%) patient was false negative (chronic appendicitis in the final histopathology result). In one out of the 67 (1.5%) patients, the appendix could not be visualized. Combined abdominal US and CT scanning were used in 12 (4.2%) patients.

Table 1: Patients' Characteristics, US and CT Scan

Age	14-18	26 (9%)
	18-29	133 (46.5%)
	30-49	118 (41.3)
	≥50	9 (3.1%)
	Total Patients	**286 (100%)**
Sex	Male	187 (65.4%)
	Female	99 (34.6%)
	Total Patients	**286 (100%)**
NAR	Male	9 (31.03%)
	Female	20 (71.4%)
	Total NAR	**29 (10.9%)**
Total Ultrasounds Done		86 (30%)
	US Positive	42 (61.7%)
Total CT Done		67 (23.4%)
	CT Positive	56 (96.5%)
Clinical Diagnosis Alone		134 (47.5%)

Table 2: Histopathology Findings

	Number	Percentage
Acute Appendicitis	228	79.72%
Acute Appendicitis with Perforation	28	9.79%
Normal Appendix	29	10.13%
Carcinoid Tumor	1	0.35%
Total	**286**	**100%**

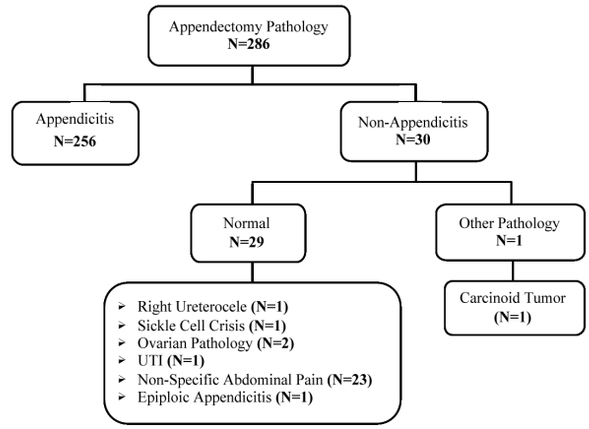

Figure 1: Histopathology Findings in 286 Patients

The sensitivity of CT scan in our study was approximately 98.2%, positive predictive value (PPV) was 91.8%, and the overall accuracy was 90.3%, see table 3.

Table 3: Diagnostic Accuracy Measures of US, CT Scan and WBC Count

	Ultrasound	CT Scan	WBC Count >10,000
Sensitivity	82.3 %	98.2%	76.8%
Specificity	33.3%	*	48.1%
Positive Predictive Value (PPV)	95.4%	91.8 %	93.2%
Negative Predictive Value (NPV)	10.0%	*	18.3%
Overall Accuracy	79.6 %	90.3 %	74.1%

* Specificity and NPV could not be calculated for CT because none of the histologically normal cases were identified as normal by the CT.

Specificity and negative predictive values (NPV) could not be calculated because none of the true negatives (identified by histopathology) were identified as negative by the CT.

WBC count value of greater than 10,000 cells/uL was considered significant. Two hundred eleven (73.8%) patients with positive pathology of acute appendicitis had WBC of greater than 10,000. However, WBC alone is not a specific marker of acute appendicitis and is commonly increased in patients with other inflammatory conditions. Table 3 summarizes the diagnostic accuracy measures of both the US and CT scans and descriptive statistics of the WBC counts.

The most frequent abdominal sign of acute appendicitis was right-iliac fossa tenderness, which was positive in 280 (97.9%)

patients. Rebound tenderness occurred in 196 (68.5%) patients, guarding occurred in 76 (26.6%) patients and rigidity of a palpable mass in 3 (1%) patients.

Acute appendicitis was diagnosed in 256 (89.5%) cases. Of the 30 remaining, one (0.3%) patient had carcinoid tumor; the remaining 29 (10.1%) cases showed relatively normal appendix including the presence of luminal fecalith and lymphoid follicular hyperplasia, but no unequivocal early or transmural acute inflammation was present.

The perforations were seen in 28 (10%) patients. Complications were seen in 2 (0.69%) patients; the intra-abdominal collection was managed by US-guided aspiration and postoperative fever of unknown cause managed conservatively with intravenous antibiotics.

DISCUSSION

Despite appendicitis being the most common emergency surgical condition, diagnosis by clinical means alone remains challenging, even for senior consultants. Missed appendicitis is one of the most common reasons for litigation against emergency department physicians in the United States; up to one-third of the claims are successful[8].

The classical presentation of periumbilical pain localized later to the RIF followed by anorexia is only present in 37% to 53% of patients[2]. The accuracy of diagnosing acute appendicitis on clinical grounds ranges from 70% to 87%[10,11]. In our study, we relied largely on the history and physical examination together with laboratory investigations and radiological examinations. The clinical diagnosis accuracy without radiological imaging was 136 (47.6%) cases.

A high rate of NAR was formerly acceptable to avoid complications, especially perforation and abscess formation[9]. A higher NAR has been reported among females[12]. Several studies now report a gradual decline of NAR due to increased use of advanced radiological tools and, accordingly, the previously reported 15% to 25% NAR is not acceptable[13]. The currently acceptable NAR is less than 10%[8]. In our study, NAR was 9.4%.

Several studies have found an increased risk of cancer associated with exposure to radiation mainly as a result of abdominal and pelvic scan[14,15]. Low-dose radiation CT has been used as an alternative to the standard one as it delivers only 25% of radiation with no difference in NAR and/or the accuracy of perforation rate[16-18].

Although US is a useful aid in diagnosing appendicitis, it is not without limitations[19,20]. US is largely operator dependent and certain body habitus might compromise the study, such as fatty body habitus and/or massively dilated bowel loops. Another important limitation is the sensitivity and specificity of perforated appendicitis is lower in non-perforated appendicitis[21]. Macroscopically normal appendix does not exclude the diagnosis of microscopic appendicitis[22].

CONCLUSION

Diagnosis of appendicitis remains largely clinical. Radiological means, especially CT scans have an important role in questionable diagnosis, notably in females. Every effort should be made to decrease NAR with judicial use of radiological investigations. Low-dose radiation CT scan could be an alternative to the standard CT scan with contrast material to decrease the exposure to high radiation.

In our experience, the accuracy of diagnosing appendicitis lies within the internationally accepted reports of NAR of 10.1%. The perforation rate is also within the accepted international rates.

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