

# The Simple Clinical Diagnostic Triad in Acute Appendicitis: Re-examined

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## ABSTRACT

**Introduction:** The numerous clinical and radiologic scoring systems available are a testament to the challenges of diagnosing acute appendicitis. As the name implies, the simple acute appendicitis clinical diagnostic triad is simple and user-friendly. Its reproducibility remains to be demonstrated.

**Aim:** To validate the simple clinical diagnostic triad of right lower quadrant abdominal tenderness, anorexia and migratory abdominal pain for the diagnosis of acute appendicitis in a District General Hospital.

**Materials and Methods:** This was a retrospective review of consecutive appendicectomies undertaken over a 4-month period, for patients who were 18 years and older. Acute appendicitis was proven histologically. The patients' preoperative symptoms, signs and biochemical parameters

were analysed. Sensitivity, specificity, Positive Predictive Value (PPV) and Negative Predictive Value (NPV) were calculated. Outcomes were compared using Fisher's exact test.

**Results:** A total of 92 appendicectomies were undertaken during the study period. The histological diagnoses included acute appendicitis (75), normal appendix (14), carcinoid (1), lymphoid hyperplasia (1) and spirochete (1). Of the 75 patients with acute appendicitis, right lower quadrant tenderness was present in 73, anorexia in 66 and migratory pain in 57 patients. The simple clinical triad (all three parameters) showed a sensitivity of 69.3%, 64.7% specificity, 89.7% PPV and 32.4% NPV.

**Conclusion:** The triad of right lower quadrant tenderness, anorexia and migratory abdominal pain shows consistently high PPV in the diagnosis of acute appendicitis.

**Keywords:** Abdominal pain, Anorexia, Predictive value, Tenderness

## INTRODUCTION

Acute appendicitis has remained one of the most common abdominal surgical emergencies worldwide with the peak age being in the teenage and early adult years. The diagnosis of acute appendicitis is frequently challenging. A simple clinical diagnostic appendicitis triad described by Alubaidi K et al., provided an easy to use aid in the diagnosis of this common surgical problem [1].

Numerous scoring systems and diagnostic adjuncts exist for diagnosis of acute appendicitis. The Dieulafoy's triad, described over a century ago, comprises significantly subjective parameters such as skin hyperaesthesia and guarding [2]. This understandably affects its applicability and reproducibility as a potential diagnostic tool. Murphy's triad consists of right lower quadrant pain, nausea or vomiting and general abdominal tenderness worse in the right lower quadrant [3]. The combination of right lower quadrant pain, tenderness and nausea can result from a variety of abdomino-pelvic conditions such as acute pelvic inflammatory disease, tubo-ovarian abscess, ascending urinary tract infection and acute crohn's ileitis; thereby, lowering the specificity of this triad as a diagnostic tool. The multiplicity of components of the Alvarado's score serves as a potential source of discouragement to the universal utilisation of this scoring system [4]. In a systematic review, the Alvarado score was shown to be inconsistent in children and to over-predict the possibility of appendicitis in women [5].

The diagnosis of acute appendicitis remains mainly a clinical diagnosis relying on symptoms, clinical signs, haematologic and biochemical parameters as well as imaging [6].

Anorexia is described as a predominant symptom [7]. Other symptoms described in acute appendicitis include nausea, vomiting and migratory abdominal pain (typically central abdominal pain migrating to the right lower quadrant of the abdomen). Signs described for acute appendicitis include low-grade fever [8],

leucocytosis, positive McBurney's point tenderness, Rovsing's sign, Psoas stretch sign and the obturator sign.

The classical presentation of migratory abdominal pain occur in less than 50% of patients with acute appendicitis [1,3]. The diagnosis of this universally common surgical emergency is arguably more challenging than the treatment considerations. The most preferred treatment option amongst surgeons universally for acute appendicitis (in the absence of contraindications) is appendicectomy [9]. This is performed using either the laparoscopic or open approach. When associated with complications (abscess, perforation, mass formation, etc.) other options including non-operative management are considered [10].

A reliable and user friendly clinical diagnostic aid could serve to improve outcomes for the patient as well as for the hospital. This study sought to review the diagnostic potential of the simple clinical diagnostic triad of migratory abdominal pain, nausea and right lower abdominal tenderness to assess for its reproducibility.

## MATERIALS AND METHODS

This was a retrospective review of consecutive adult (18 years and above) appendicectomies, undertaken at the William Harvey Hospital (a district general hospital) over a 4-month period (April 2018 to July 2018). The study was approved by our local audit and research department and conducted according to our local audit and research protocol. Data was obtained using a prospectively maintained database. All appendicectomies were included. Patient's age less than 18-year-old was the only exclusion criteria.

The frequency of different clinical parameters in the patients with histologically proven acute appendicitis was analysed. Using the same combination of (common) clinical parameters utilised by Alubaidi K et al., the sensitivity, specificity, PPV and NPV for the simple clinical diagnostic triad were calculated [1].

## STATISTICAL ANALYSIS

Statistical analysis was performed using IBM Statistical Package for the Social Sciences (SPSS) 26.0 software. Outcomes were compared using Fisher's exact test with result deemed significant where p was less than or equal to 0.05.

## RESULTS

A total of 92 appendectomies was undertaken in patients 18 years of age and above. There was a female preponderance at ratio of 40/52 (M/F) [Table/Fig-1]. Surgical treatment was undertaken laparoscopically in 85 patients (4 were converted to open), open approach in 6 patients using a right lower quadrant incision and by laparotomy in 1 patient (mass forming appendicitis).

Age	Male	Female	Total
18-27	11	19	30
28-37	8	16	24
38-47	7	4	11
48-57	7	6	13
58-67	3	6	9
>67	4	1	5
Total	40	52	92

[Table/Fig-1]: Gender and age distribution of all appendectomy patients.

Final (histologic) diagnosis was acute appendicitis in 75 patients while the rest 17 comprise of other diagnoses including normal appendix (14) carcinoid (1), lymphoid hyperplasia (1) and spirochete (1).

Amongst the patients with acute appendicitis, the frequency of triad parameters included right iliac fossa tenderness (73/75), anorexia (66/75) and migratory pain (57/75). The triad of the above parameters occurred in 52 out of the 75 patients with histologically proven acute appendicitis. The triad demonstrated a sensitivity of 69.3%, specificity 64.7%, PPV 89.7% and NPV 32.4%.

Of the 75 patients with histologically proven appendicitis, the clinical triad positivity and negativity was encountered in 52 and 23 patients, respectively ( $p=0.012$ ).

The diagnostic potential of the simple acute appendicitis triad is illustrated in [Table/Fig-2].

Simple acute appendicitis clinical diagnostic triad	Positive histology	Negative histology	Predictive value
Triad positive	True positives (TP)=52	False positives (FP)=6	Positive Predictive Value (PPV) =TP/(TP+FP) =89.7%
Triad negative	False negatives (FN)=23	True negatives (TN)=11	Negative Predictive Value (NPV) =TN/(FN+TN) =32.4%
	Sensitivity (SN) =TP/(TP+FN) =69.3%	Specificity (SP) =TN/(FP+TN) =64.7%	

[Table/Fig-2]: Sensitivity, Specificity, Positive Predictive Value (PPV) and Negative Predictive Value (NPV) of the simple acute appendicitis clinical diagnostic triad.

## DISCUSSION

This study demonstrates that the simple acute appendicitis diagnostic triad shows consistently high PPV (89.7%). Delays in the diagnosis and/or treatment are believed to increase the risk of complications such as gangrene, perforation and abscess formation [11]. In addition, it is well known that resource-poor settings suffer from limited availability of imaging services to support the diagnosis and management of patients [12]. In this study, right lower quadrant tenderness was the most common positive parameter. However, it showed very poor specificity (5.6%), lower PPV and NPV when compared with the simple appendicitis triad.

In a meta-analysis, Andersson RE observed that all laboratory and clinical variables are weak descriptors individually but achieve higher discriminatory power when combined [13]. Leucocytosis with >75% neutrophilia is said to occur in 80-90% cases of acute appendicitis. Significant false negativity is seen in immunosuppressed patients [14]. When Leucocytosis (or neutrophilia) is combined with elevated C-reactive protein (CRP), it is associated with over 95% sensitivity for diagnosis of acute appendicitis [15,16]. However, the specificity of elevated inflammatory markers is poor, considering the multiplicity of inflammatory conditions of the lower abdomen and pelvis.

Today, imaging is frequently employed in the diagnosis of this common surgical problem. Commonly used modalities include abdominal ultrasound [17] scan, Computerised Tomography (CT) scanning [17,18], Magnetic Resonance Imaging (MRI) and scintigraphy [14]. Imaging options are not without disadvantages including; operator dependency with ultrasound scan [19], long term risk of malignancy with CT scanning [20,21], unsuitability for some patients with MRI scan and frequent equivocal scans with radionuclide imaging [14]. Soldo I et al., in a recent cohort study showed that anorexia, right iliac fossa peritonism negative urine dipstick and lack of diarrhoea are important predictors of acute appendicitis [22]. It has been shown that the discriminatory power of the individual clinical features and laboratory tests was weak [23]. This suggests that a clinical diagnostic tool that combines a number of parameters would therefore be more reliable. Beside the Alvarado score, other popular adult clinical scoring systems include the Appendicitis Inflammatory Response (AIR) Score [24], Adult Appendicitis score (AAS) [25] and the Raja Isteri Pengiran Anak Saleha Appendicitis (RIPASA) score [26].

Present study compares favourably with the most popular clinical scoring systems in literature [27,28]. Although the triad has a borderline sensitivity and specificity, the real strength of this simple clinical diagnostic triad appears to be in its consistently high PPV for acute appendicitis and simplicity of use. The components of this diagnostic triad are strongly objective and are easy to remember. These characteristics makes it user-friendly. In resource-limited settings, this simple but reliable clinical triads would likely make significant difference in the care of the young adult patient with suspected acute appendicitis. The authors suggest that imaging be considered for the patient who is negative for clinical triad but who has persistent, worsening or atypical symptoms. Where diagnosis remains equivocal close, in-patient surveillance is recommended to reduce negative appendectomy rate without increasing morbidity [29]. Diagnostic laparoscopy serves as an important tool for both diagnosis and treatment in the patient with ongoing diagnostic uncertainty or clinical deterioration.

### Limitation(s)

The relatively small number of patients served as the main limitation of this study.

## CONCLUSION(S)

The presence of the triad of anorexia, migratory abdominal pain and tenderness in the right lower abdomen has shown consistency in predicting acute appendicitis. The low NPV and sensitivity suggest that further assessment and utilisation of adjuncts is indicated when the triad is negative in the patient with suspected acute appendicitis. Further studies on this triad are required on different adult populations to assess its diagnostic aid.

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