

Research Article

USEFULNESS OF C REACTIVE PROTEIN AND LEUKOCYTE COUNT IN MANAGEMENT OF ACUTE APPENDICITIS IN CHILDREN

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ABSTRACT

Appendicitis is one of the common clinical entities which we face in day to day clinical practice. An organ which was initially viewed to be of no surgical use is now considered to be an important organ surgically as well as immunologically. The study comprised of 100 patients under the age of 15 years admitted in the emergency department of Surgery, Government Medical College, Srinagar with a provisional diagnosis of acute appendicitis. All patients selected including both sexes were evaluated with proper history, clinical examination and laboratory tests. Majority of the patients in the study fell in the age range of 11-14 years; the youngest being a 2.4 year old kid and the oldest being children of 14 years. In our study there were more males than females (ratio M: F 58:42). 74 patients out of 79, histological positive appendicitis had clinical assessment suggestive of appendicitis (sensitivity of 93.7%). Out of 79 patients with histologically positive appendices, 64 patients had leucocytosis. Among 21 negative appendectomies only 5 had leucocytosis. 59 patients of 79, histological positive appendicitis had raised CRP levels and 10 patients out of 21 negative appendectomies had raised CRP levels. Out of 100 patients 79 patients had positive histopathology and 21 patients had negative histopathology.

Keywords: *Acute Appendicitis, Children, C Reactive Protein and Leukocyte Count*

INTRODUCTION

Acute appendicitis is still the commonest abdominal emergency in the pediatrics age group (Rothrock and Pagane, 2000). Approximately 7.0% of the population will have appendicitis in their lifetime with the peak incidence occurring between the ages of 10 and 30 years (Addiss *et al.*, 1990). The first published account of appendectomy for appendicitis was by Krönlein in 1886; however, the patient died 2 days postoperatively. Fergus, in Canada, performed the first elective appendectomy in 1883 (Ellis, 2007). Semm is credited with performing the first successful laparoscopic appendectomy in 1982 (Semm, 1983). The most common symptom is the abdominal pain with anorexia, nausea and vomiting (Schwartz, 1994).

The percentage of misdiagnosis of appendicitis is significantly higher among women than men (22.2 vs. 9.3%) (Flum and Koepsell, 2002; Douglas *et al.*, 2007). Faecoliths are found in 40% of cases of simple acute appendicitis, 65% of cases of gangrenous appendicitis without rupture, and nearly 90% of cases of gangrenous appendicitis with rupture (Schwartz, 1994; Miranda *et al.*, 1980; Fitz, 1886). Mild leucocytosis ranging from 10,000 to 18,000/mm³ is usually present, white blood cell counts above this level raise the possibility of a perforated appendix with or without an abscess (Bower *et al.*, 1981).

MATERIALS AND METHODS

The aim of the study was to see the usefulness of C reactive protein and leukocyte count in management of acute appendicitis in children among 100 patients admitted in the emergency department of Surgery, Government Medical College, Srinagar with a provisional diagnosis of acute appendicitis. All patients selected were under 15 years of age and either sex were evaluated on the basis of predetermined proforma, which included, a detailed history from patients or parents, clinical examination, laboratory investigations and high resolution sonography. The detailed history and clinical examination was done to rule out any associated co-morbid condition. For the diagnosis of acute appendicitis complete blood count, C reactive protein was done. Urine analysis was done routinely to rule out urinary tract infection.

Research Article**RESULTS AND DISCUSSION****Results**

In this study Patients of either sex under 15 years of age were included in the study. Majority of the patients in the study fell in the age range of 11-14 years; the youngest being a 2.4 year old kid and the oldest being children of 14 years. The age distribution is shown in table 1 and depicted by a bar diagram below.

In our study there were more males than females (ratio M: F 58:42) (Table 1). 74 patients out of 79 histologically positive appendicitis, had clinical assessment suggestive of appendicitis (sensitivity= 93.7%).

This was based on shifting pain, anorexia, nausea, elevated temperature, increased pulse rate, tender RIF, Rebound tenderness and guarding. This gives highest sensitivity for the diagnosis of acute appendicitis by clinical means.

Table 1: Showed age and sex distribution

Age Group (years)	Numbers	Percentage
Upto 5	09	9
6-10	33	33
11-14	58	58
Males	58	58
Females	42	42
Total	100	100

Table 2: Showed correlation between clinical assessment and histopathology

Clinical	Positive Histopathology	Negative Histopathology	Total	
Positive	74	14	88	Sensitivity: 93.7%
Negative	05	07	12	Specificity: 33.4%
Total	79	21	100	Positive Predictive Value: 84%
				Negative Predictive Value: 58.34%
				Accuracy: 81%

Table 3: Showed correlation between elevated total leukocyte count and histopathology

TLC	Positive Histopathology	Negative Histopathology	Total	
Elevated	64	05	69	Sensitivity: 81%
Normal	15	16	31	Specificity: 76.2%
Total	79	21	100	Positive Predictive Value: 92.76%
				Negative Predictive Value: 51.62%
				Accuracy: 80%

Table 4: Showed correlation between raised neutrophil count and histopathology

Neutrophil Percentage	Positive Histopathology	Negative Histopathology	Total	
Significant	63	08	71	Sensitivity: 79.75%
Normal	16	13	29	Specificity: 61.9%
Total	79	21	100	Positive Predictive Value: 88.73%
				Negative Predictive Value: 44.82%
				Accuracy: 76%

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The results are shown in (Table 2). Out of 79 patients with histologically positive appendices, 64 patients had leucocytosis. Among 21 negative appendectomies only 5 had leucocytosis, giving a sensitivity of 81%, specificity of 76.2% and accuracy 80% (Table 3). 71 patients had neutrophilia ($> 75\%$), but only 63 had histologically positive appendicitis. Out of 29 patients who had normal neutrophil percentage, 18 had appendicitis (Table 4). 59 patients of 79 histologically positive appendicitis had raised CRP levels and 10 patients out of 21 negative appendectomies had raised CRP levels (Table 5).

Table 5: Showed correlation between C reactive protein and histopathology

C Reactive protein	Positive Histopathology	Negative Histopathology	Total
Elevated	59	10	69
Normal	20	11	31
Total	79	21	100

Table 6: Shows the sensitivity, specificity and accuracy of Clinical features

	Clinical Assessment	TLC	% Neutrophils	CRP
Sensitivity	93.7	81	77.2	74.68
Specificity	33.4	76.2	61.9	52.38
Accuracy	81	80	74	70

Combined sensitivity, Specificity, and Accuracy of clinical signs, TLC, NP, CRP and USG:-The table 6 shows the sensitivity, specificity and accuracy of Clinical features, TLC, NP, and CRP.

Discussion

The establishment of a diagnosis of acute appendicitis in young children is more difficult than in the adult. The inability of young children to give an accurate history, diagnostic delays by both parents and physicians, and the frequency of gastrointestinal upset in children is all contributing factors. The more rapid progression to rupture and the inability of the underdeveloped greater omentum to contain a rupture lead to significant morbidity rates in children. Children younger than 5 years of age have a negative appendectomy rate of 25% and an appendiceal perforation rate of 45%. This is compared to a negative appendectomy rate of less than 10% and a perforated appendix rate of 20% for children 5 to 12 years of age (Flum and Koepsell, 2002). The various laboratory tests can be easily performed to establish the diagnosis. The WBC and CRP level estimations are the most commonly used laboratory parameters. Elevated leukocyte count is found in the early phases of inflammation and CRP levels rise in more advanced appendicitis (Stefanutti *et al.*, 2007; Chung *et al.*, 1996; Andersson *et al.*, 2000). The sensitivities and specificities of WBC for detecting acute appendicitis vary from 19% to 88% and from 53% to 100% (Doraiswamy, 1979). In our study leucocyte count was raised in 64 patients out of 79 who had histologically proven appendicitis and 5 patients among 21 negative appendectomies had raised leucocyte count. Total leucocyte count was more elevated in complicated appendicitis than in uncomplicated appendicitis. Thus the sensitivity and specificity of total leucocyte count in our study was 81% and 76.2% respectively. This is consistent with the study conducted by Lau (1989) which gives sensitivity and specificity of total leucocyte count of 81.4% and 77.3% respectively. The study concluded that raised total leucocyte count preferably combined with raised neutrophil percentage is useful in the diagnosis of acute appendicitis but should be interpreted in the light of clinical findings (Lau *et al.*, 1989). This was comparable with the prospective study by Norback and Harju (1988), which gives sensitivity of 78.5%. In a study conducted by Harland (1991), sensitivity and specificity of total leucocyte count in the diagnosis of acute appendicitis was 92% and 70% respectively which is comparable with our study. Andersson showed in a recent meta-analysis that diagnostic accuracy was higher for laboratory data than for clinical signs and symptoms, even when recorded by an experienced surgeon (Andersson, 2004). In our study, 63 patients out of 79 histologically proven appendicitis had neutrophil count above 75% and 8 patients out of 21 histologically negative appendectomy had neutrophil count above 75%. This gives

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sensitivity, specificity and accuracy of 79.75%, 61.9% and 76% respectively. This is comparable with the study conducted by Robert *et al.*, Up to 20% of pediatric patients with acute appendicitis can have a normal WBC with diff. (Wang *et al.*, 2007). The preoperative serum C-reactive protein levels were correlated with the histopathology. Out of 79 patients with histopathology positive, 59 patients had raised C-reactive protein level and 20 patients had normal C-reactive protein levels. Out of 21 patients with negative appendix, 10 had raised C-reactive protein level. In our study, sensitivity and specificity of C-reactive protein in the diagnosis of acute appendicitis was 74.68% and 52.38% respectively. In a study conducted by Groselj-Grenc *et al.*, (2007) sensitivity and specificity of C-reactive protein in the diagnosis of appendicitis was 73.9% and 54.5% respectively. All most similar results were found in our study. In a study conducted by Dueholm *et al.*, sensitivity and specificity of C-reactive protein was 75% and 56% respectively (Dueholm *et al.*, 1989) which is comparable to our study.

Pruekprasert *et al.*, (2004) studied the accuracy in diagnosis of acute appendicitis by comparing serum C-reactive protein measurements, Alvarado score and clinical impression of surgeons. 231 patients admitted to the hospital with suspected appendicitis were studied prospectively. CRP of > 10 mg/l had a much lower sensitivity (62%) and lower specificity (56%) (McBurney, 1889). The sensitivity of C-reactive protein in our study was higher (74.68%) this is because lower limit of C-reactive protein for positive cases was 6mg/l. In our study specificity of the C-reactive protein was 52.38% which is comparable with above study (56%).

Conclusion

Clinical examination and laboratory parameters, such as white blood cell, differential counts (percentage of neutrophil granulocytes and band neutrophil granulocytes), and C-reactive protein were the only diagnostic tools for many years. The more rapid progression to rupture and the inability of the underdeveloped greater omentum to contain a rupture lead to significant morbidity rates in children. The diagnostic accuracy of WCC is higher than CRP for uncomplicated acute appendicitis. The combined sensitivity of WCC and CRP increases for simple acute appendicitis as well as a perforated appendix.

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