Comparative Study of Serological Markers in Patients Presenting With Acute Abdomen to a Tertiary Care Hospital in Western Rajasthan

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Abstract: *The term acute abdomen refers to signs and symptoms of abdominal pain and tenderness, a clinical presentation that often requires emergency surgical therapy.[1] This challenging clinical scenario requires a thorough and expeditious workup to determine the need for operative intervention and initiate appropriate therapy. The most difficult challenge is making a timely diagnosis so that treatment can be initiated and morbidity preserved. The total and differential leukocyte counts are being used as an adjunct to clinical and radiological signs and CRP levels as prognostic indicators in patients with acute abdomen. Plasma Procalcitonin is a highly specific marker for the diagnosis of bacterial infection and sepsis. Initiating a step in this direction, this study aims to compare the various serological markers of acute inflammation in patients presenting with acute abdomen to a tertiary care hospital in Western Rajasthan.*
Keywords: *Acute abdomen, Morbidity, Total Leucocyte Count, CRP level, plasma Procalcitonin*
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I.   Introduction

Initiating a step in this direction, this study aims to compare the various serological markers of acute inflammation in patients presenting with acute abdomen to a tertiary care hospital in Western Rajasthan. The majority of cases of acute abdomen arise from the conditions of the gastrointestinal tract. As different conditions of the gastrointestinal tract present with similar clinical features, accurate diagnosis by clinical methods often a very challenging task. Frequently an urgent and important decision has to be reached by the surgeon, repeated examination at hourly intervals usually solves the problem.

Clinical assessment remains the most important first step in evaluating patients with acute abdomen. However, clinical examination has been found to be only accurate in 47 – 76 % of patients with acute abdominal pain[2-5].

The total and differential leucocyte counts are used as an adjuvant in establishing a diagnosis. CRP is an acute-phase reactant, and CRP level measurements are frequently used to aid in the diagnosis of bacterial infections. Normal level being less than 5ng/ml [6]. Procalcitonin has been introduced as an early marker of severe systemic bacterial infection and inflammation. Normal levels in healthy individuals are very low (<0.1 ng/mL). Its level is related to the severity of infection. In patients with sepsis, the levels increase to more than several hundred ng/ml. Its half-life is approximately 24hours in serum[7].

Several Studies such as Kaya Bet al[8], Gavela T et al[9], Grönroos JM, Grönroos P[10] concludes that CRP makes a better marker than TLC alone for early diagnosis and management of patients with acute abdomen. PCT is a very good test as a marker for the diagnosis and management in cases of acute abdomen as in line with various studies conducted by Harbarth S[11] et al., Simon L[12] et al., Christ-Crain M[13] et al., Rau B et al[14].

II.   Aims Of Study

1. Compare total and differential counts, CRP and plasma procalcitonin levels in patients presenting with acute abdomen.
2. Assess the diagnostic and prognostic efficacy of plasma procalcitonin levels in patients presenting with acute abdomen and compare it with other serological markers of inflammation.
3. Assess the role of plasma procalcitonin as an independent indicator for intervention in patients presenting with acute abdomen.
4. Assess the ability of serum CRP and plasma procalcitonin assay to differentiate nonspecific abdominal pain from a surgical abdomen.

III.   Material & Methods

SOURCE OF DATA: Patients presenting with abdominal pain of acute onset to OPD or to the General Surgery Department of Mahatma Gandhi Hospital under Dr S N Medical College and Associated Hospitals, Jodhpur.

Sample Size: A total of 100 patients.

Inclusion Criteria: Patients presenting with abdominal pain characterised by:
1. Sudden onset.
2. Patients aged >12 years and both sexes.

Exclusion Criteria:
1. Chronic long standing history of pain abdomen.
2. Patients aged <12 years.

Study Design: Prospective study

IV.   Methodology

1. Leukopenia was defined as leukocyte count <4000/mm^3. Leukocytosis was defined as leukocyte count>11000/mm^3. CRP was measured in a qualitative method as either as >6µg/ml or <6µg/ml. PCT was considered normal if its value was <0.046ng/ml.
2. The serum sample for estimation of procalcitonin and CRP levels will be stored at -70 deg. C immediately after centrifugation.
3. Data is statistically analysed using the software SPSS version 16 to assess the mean, standard deviation, sensitivity, specificity, positive predictive value, negative predictive value and odds ratio.

V.   Observations & Results

TABLE 5.1 Case Distribution

Diagnosis	No. of Patients	Percentage
Acute Appendicitis	32	32
Appendicular Peritonitis	13	13
Peptic Perforation Peritonitis	12	12
Acute Cholecystitis	10	10
Mesenteric Adenitis	6	6
Acute Alcoholic Pancreatitis	4	4
Biliary pancreatitis	4	4
Non Specific Abdominal Pain	4	4
Meckel's Diverticulitis	3	3
Enteric Perforation Peritonitis	3	3
Acute Intestinal Obstruction	3	3
Ureteric Colic	3	3
Sigmoid Perforation Peritonitis	2	2
Urinary Tract Infection	1	1

Case Distribution: In our study, acute appendicitis formed 32% of the cases, followed by appendicular peritonitis which was 13%. The next most frequent cause of acute abdomen was peptic perforation peritonitis which was found in 12% cases, followed by acute cholecystitis.

TABLE 5.2 Cases and Age Distribution

Diagnosis	Age (in years)					
	16-25	26-35	36-45	46-55	56-65	>65
Acute Appendicitis	16	13	2	1	1	0
Appendicular Peritonitis	5	0	2	2	3	1
Peptic Perforation Peritonitis	1	2	4	2	2	1
Acute Cholecystitis	0	3	4	2	0	0
Mesenteric Adenitis	5	1	0	0	0	0
Acute Alcoholic Pancreatitis	1	1	2	0	0	0
Biliary pancreatitis	1	1	0	1	1	0
Non Specific Abdominal Pain	2	1	0	1	0	0
Meckel's Diverticulitis	3	0	0	0	0	0
Enteric Perforation Peritonitis	1	2	0	0	0	0
Acute Intestinal Obstruction	2	0	0	0	1	0
Ureteric Colic	2	0	0	0	1	0
Sigmoid Perforation Peritonitis	0	0	0	1	0	1
Urinary Tract Infection	1	0	0	0	0	0

Among the 100 patients presented to us, highest incidence was observed in patients in the age group of 16-25 years, followed by 26-35 years, and we noticed a decreasing trend in the number of cases of acute abdomen as the age advanced. The mean age of all the patients was 34.08 ± 15.06 years.

TABLE 5.3 Total Leucocyte Count Distribution

TLC /cumm	No. of Patients	Percentage
≤5000	5	5
5001-10000	13	13
10001-15000	46	46
15001-20000	27	27
20001-25000	3	3
>25000	6	6

This was found to be varying from $2370/mm^3$ – $29000/mm^3$. Most cases (n=46) falling between the $10000/mm^3$ - $15000/mm^3$ range. The mean$\pm$SD for TLC was $14123\pm5877.73/mm^3$ and for neutrophil percentage the value was $75.73\pm9.83/mm^3$. In cases that were operated had $14337.1\pm4590.43/mm^3$ and $75.73\pm9.83/mm^3$ respectively. It was found that the test had high sensitivity (79.78%) but lacked specificity (60%), with a PPV 88.87% and NPV of 40%.

TABLE 5.4 Neutrophil Count Distribution

Neutrophil Count	No. of Patients	Percentage
51-60	9	9
61-70	21	21
71-80	38	38
81-90	26	26
>90	6	6

This shows that in cases with leukocytosis and neutrophilia the patients underwent surgery more often than the patients lacking them. This implies that the patients with these parameters increased had poor general condition and there was an indication for an intervention to be made. It also shows that TLC or DLC alone cannot be considered to be good indicators for the need of intervention.

Table 5.5 Crp Distribution

CRP (µg/ml)	No. of cases	Surgery Done	
		Yes	No
≤6	18	6	12
>6	82	74	8

CRP Distribution: This test had a significant 'p' value of <0.0001, odds ratio of 0.05405. It also had a 95% confidence interval of 0.01593-0.1835, sensitivity of 92.5% and specificity of 60%. PPV and NPV were 90.24% and 66.67% respectively. The test has a high positive predictive value and can be used as a marker for need for intervention and prognosis.

Table 5.6 Procalcitonin Distribution

Procalcitonin (ng/ml)	No. of Patients	Surgery Done	
		Yes	No
<0.05	10	2	8
0.051-0.5	16	14	2
0.51-2.0	28	25	3
2.1-10	37	32	5
>10.1	9	7	2

PCT Distribution: The mean value of the PCT in this study was 3.61 ± 4.46ng/ml. It had a 'p' value of <0.0001 and a Chi square test value of 25.57. This suggests that the test has high significance in predicting the need for surgery or intervention in patients with acute abdomen at the time of admission. This test had a high PPV and NPV of 86.67% and 80% respectively which again signify the importance of this test.

Table 5.7 Duration of Hospital Stay

Hospital Stay (in days)	Total No. of patients	Procalcitonin (ng/ml)		TLC (cu./mm)	
≤4	14	2.22	4.62	9240.7	3825.28
5-8	47	1.53	2.37	13171.7	4162.53
9-12	24	6.57	5.43	14381.2	4351.24
13-16	12	6.59	3.77	19879.1	6465.99
≥17	3	6.9	3.23	26726.6	11949.9

Duration of Hospital Stay: In our study, irrespective of the diagnosis most of our patients stayed for a period of 5-8days (n=47), with shortest duration being 2 days and longest stay extending up to 24days depending on their course in the hospital. It was interesting to note that with increasing PCT and TLC of the patients, their stay in the hospital also prolonged. With majority of patients coming in the 5-8 days interval, the PCT was 1.53±2.37ng/ml, and TLC was 13171.7±4162.53/mm^3.

TABLE 5.8 Comparison Between The Serological Markers

Characteristics	All patients (n=100)	Operated	Not Operated
Age	34.08±15.06	34.78±14.98	30.85±15.34
Sex (M:F)	52:48	38:42	10:10
TLC	14123±5877.73	14337.1±4590.43	13267.5±9562.07
Neutrophil Count	75.73±9.83	75.73±9.83	71.15±12.46
CRP	18:82	6:74	12:8
PCT	3.61±4.46	3.74±4.42	3.07±4.70

Comparison between the serological markers: In our study considering the results that we deduced, the mean TLC of all the patients were 14123±5877.73/mm^3, CRP was increased in 82 patients of whom 74 underwent a surgical procedure signify the high sensitivity of the test. Whereas PCT had a mean value of 3.61±4.46ng/ml for all cases, and in operated cases the value was higher compared to non - operated patients irrespective of the cause for not operating the case.

VI.   Conclusion

Acute abdominal pain is more common in the age group between 16-25 years. Relatively more common in males at early age, but changes its preponderance to females at later ages. The leading cause of acute abdomen being acute appendicitis, followed by appendicular peritonitis and peptic perforation peritonitis. Leukocytosis and neutrophilia is present in patients with acute abdomen who required surgery. C reactive protein is increased in patients with acute abdomen who required surgery, and has a significant diagnostic efficacy with high sensitivity. Plasma procalcitonin levels are increased in patients with acute abdomen who underwent surgery. This marker has a significant diagnostic and prognostic efficacy. Plasma procalcitonin is a sensitive, reliable and independent indicator for need of an intervention in patients with acute abdomen. Additional measure of CRP may increase the specificity. CRP and procalcitonin together can effectively differentiate between surgical and non-surgical acute abdomen with high accuracy.

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