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Original Research Article

Role of procalcitonin in predicting the bowel gangrene and ischemia in acute intestinal obstruction

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ABSTRACT

Background: Acute intestinal obstruction being the most common presentation on intestinal ischaemia and bowel gangrene. This study mainly concentrated on need for new marker for early prediction mesenteric ischaemia. Procalcitonin as a marker for stoppage of conservative management in intestinal obstruction.
Methods: Out 70 patients 45 underwent conservative and 25 eventually underwent surgery (midline laparotomy). Procalcitonin levels in both are observed at regular intervals and compared and analysis done using appropriate statistical tests.
Results: Level of procalcitonin was found to be higher in patients who need surgery consistantly when compared with those who were in conservative line of management with mean PCT level 2.19 and 2.23 in conservative line with mean PCT of 3.68 and 6.58 for surgical need at presentation and after 48 hrs respectively with p value <0.0001 which is significant.
Conclusions: PCT at presentation can be a very good tool for predicting the bowel ischaemia and gangrene as an early indicator and also it can be used as a marker for need for surgery in patients managing conservatively for intestinal obstruction.

Keywords: Intestinal obstruction, Serum procalcitonin, Bowel gangrene, C-reactive protein

INTRODUCTION

Intestinal obstruction is a common surgical emergency in abdominal surgery. It is a severe condition needing prompt diagnosis and immediate treatment. Surgeons are mainly concerned with bowel obstruction because accurate and early recognition of bowel strangulation still remains a difficult problem and is associated with high morbidity and mortality.

And management of intestinal ischemia is difficult because the clinical symptoms associated with this condition (mild but sudden pain, diarrhoea, low gastrointestinal bleeding, abdominal distension with vomiting, fever, tachycardia, and tachypnoea) are not specific enough to rule out a number of other differential diagnosis.

With a view to improving the preoperative diagnosis, some researchers have suggested measuring several biomarkers: L- and D-lactate, leukocytes, α glu-tathione S-transferase (αGST), diamine oxidase, trehalase, alcohol dehydrogenase, intestinal fatty acid binding protein, and D-dimer. Whilst most of these markers prove to be accurate in preclinical studies, their use in clinical practice has been limited by several shortcomings (lack of sensitivity and specificity; poor as say reproducibility and the presence of species-specific metabolites). Hence, a clinical consensus on the use of these substances has not been reached.

Pro calcitonin is a useful marker of inflammation and and useful as an early predictor and prognostic tool on infections, sepsis, acute pancreatitis like conditions including the post-operative complications.[1-5]

In this series we showed that serum procalcitonin could discriminate on the one side between the conservative and the surgical management. The objective of this prospective study was to evaluate the predictive value of PCT on presentation at the emergency department for the diagnosis of intestinal ischaemia and necrosis in patients with acute bowel obstruction.

METHODS

A randomized prospective study was done in patients admitted in department of general surgery for a period of 1 year from August 2018 to August 2019 in Bangalore medical college, Bangalore.

Inclusion criteria

Patients admitted in Bangalore medical college with diagnosis of acute intestinal obstruction.

Exclusion criteria

Patients with known cases of tuberculosis or diagnosed abdominal tuberculosis

The study is conducted in 70 patients admitted between the study period were distributed according to age, sex, and duration of obstruction, associated previous surgery.

All the patients admitted in general surgery department with acute intestinal obstruction were evaluated using clinical examination, all routine investigations, serum procalcitonin at admission, C-reactive protein, and ultrasonography and X-ray and managed conservatively.

Patients examined at timely intervals regarding the condition of patient, need for surgery, Indra operative findings of cause of obstruction all are recorded.

Patients were then divided accordingly in to those managed conservatively and those managed with surgery. C-reactive protein and procalcitonin levels observed in both the patients, and followed postoperatively.

RESULTS

Data collected is used and variables used for analysis are age, sex, type of obstruction, history of smoking, history of previous surgery, duration of stay in the hospital, etc. and all the data is entered as mean, standard deviation, and compared using t test. P value of less than 0.5 is considered as significant.

In patients underwent surgery for obstruction were categorized according to history of previous surgery.

Male proportion was found to be more in both the group out of total 70 patients 45 patients were managed conservatively, and 25 were managed with surgery out of which 15 were in adhesive obstruction and 10 were found to have gangrenous bowel and in all patient's level of procalcitonin was found to be higher than normal >0.01 mcg.and is much higher in patients with bowel gangrene. Again procalcitonin was done after 48 hrs in which case it was found to on decreasing trend in conservatively managed patients rather than in those who need surgical care.

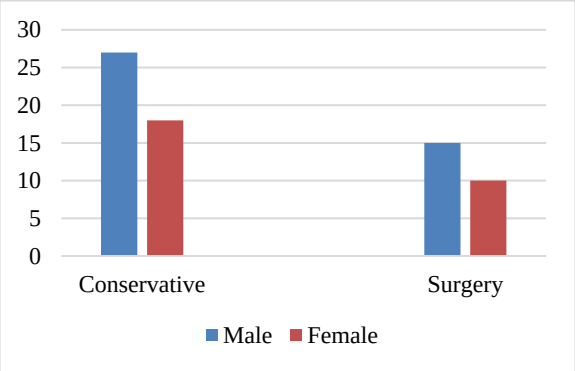

Figure 1: Obstruction categorization.

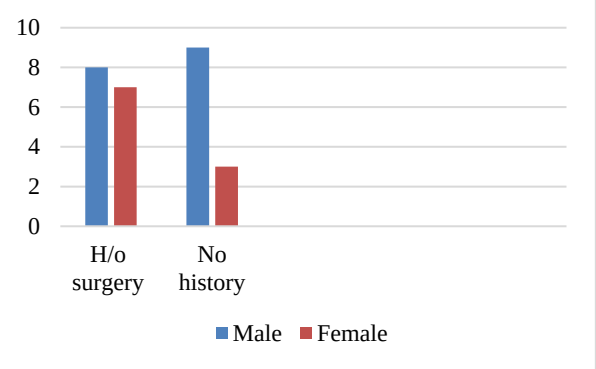

Figure 2: History of previous surgery.

Table 1: Procalcitonin level.

	Conservative	Surgery
At presentation	2.0	3.6
After 48 hrs	2.2	6.5
After 72 hrs	1.0	7.68

From Table 1 it is concluded that procalcitonin level in mcg/l persistently increasing in patients need surgical intervention and with bowel ischaemia patients.

Above Table 2 also indicates the rapid increase in procalcitonin levels in mcg/l levels in ischaemia group when compared to non-ischemia group.

And also level of procalcitonin was compared with that of c reactive protein and serum lactate levels periodically

which also shows proven increase with the infection and sepsis.

Table 2: Levels in ischaemia group when compared to non-ischemia group.

	Ischaemia with gangrene	No ischaemia
Presentation	6.7	3.3
48 hrs	8.5	4.5
72 hrs	9.87	4.98

Table 3: Comparison of c reactive protein and serum lactate levels.

	PCT (mean)	CRP (mean)
24 hrs	3.5	13.2
48 hrs	10.4	32.1

Table 4: Symptoms of patients who underwent surgery eventually.

		PCT @presentation	
		Mean	**Standard deviation**
Pain abdomen	Nil	-	-
	+	2.73	1.30
	++	2.74	1.31
	+++	2.61	2.25
Guarding	Nil	1.77	.62
	+	2.79	1.34
	++	2.77	1.31
	+++	4.40	-
Rigidity	Nil	2.32	1.46
	+	2.75	1.08
	++	3.40	1.27
	+++	4.50	-

Table 5: Serum PCT levels.

	Outcome				P value
	Conservative		Surgery		
	Mean	Standard deviation	Mean	Standard deviation	
PCT @ presentation	2.19	0.94	3.68	1.34	<0.0001
PCT@ after 48 hrs	2.23	1.08	6.58	1.97	<0.0001

Table 6: Comparision among patients with bowel gangrene intraoperatively.

	Bowel gangrene				P value
	No		Yes		
	Mean	Standard deviation	Mean	Standard deviation	
PCT @ presentation	2.51	1.22	4.07	1.00	<0.0001
PCT@ after 48 hrs	3.04	1.86	8.28	1.06	<0.0001

Pain abdomen being the predominant symptom of the total 70 patients 45 were treated conservatively and 25 (36%) underwent surgery eventually.

With the serial mesurement of procalcitonin was showing higher Serum PCT levels at presentation and on serial measurement at presentation and 48 hrs subsequently in patients who underwent surgery than in patients who managed conservatively successfully, with mean procalcitonin value of 2.19, 2.23 and 3.68 ,6.58 accordingly indication higher the pct levels at presentation and persist at higher levels indicating the grave prognosis and need for emergency surgery with significant p value (0.0001).

With comparision among patients who underwent surgery the procalcitonin levels noted to be highest among those who has bowel gangrene than that of normal bowel with other causes of obstruction, which is found to be true in our study when followed up intraoperatively, with the mean pct 4.07 and 8.28 at presentation and after 48 hrs in patients who has bowel gangrene intraoperatively.

DISCUSSION

Procalcitonin

It's a precursor of harmone calcitonin produced by cleavage of preprocalcitonin by endopeotidase.

It is composed of 116 amino acids produced by parafollicular cells of thyroid and neuroendocrine cells of lung and intestine. Normal level is below the limit of detection (0.01 mcg/l). But the level will rise in pro inflammatory stimulus especially in bacterial origin. It is therefore considered as an acute phase reactant protein. The half-life of procalcitonin is between 18 to 24 hours with a peak at 24 hours. In kidney failure patients it lies between 24 to 30 hours.

In our study we found that there was significant elevation of plasma PCT levels on obstruction patients. Assicot et al. First described the elevated PCT levels in patients with bacterial infection. Hepatocytes are the predominant source of and this release in stimulated by endotoxins and

TNF-alpha, IL1, and IL6 as a response to bacterial infection.and interferon gamma in viral infection.[8]

Role of procalcitonin can also be explained by understanding the Patho physiology of ischaemia. Ischaemia is defined as decreased blood flow through the vessels inflammatory reaction then triggers the release of reactive oxygen species which in turn promotes the releases of inflammatory mediators like interferon. interleukins, resulting oxidative stress damage the mucosa of intestine increasing the permeability of the intestinal wall then indigenous bacteria then proliferate and produce the endotoxinsthat ultimately promote the release of procalcitonin from the liver.[11]

Procalcitonin level in serum begins to rise in first 4 hours and peaks at around 6 hour.But PCT levels in intestinal obstruction is not related to infection in early but is due to locally increased release of inflammatory mediators released by leukocytes on the other hand increased of PCT in the late stages are due to bacterial translocation mucosal injury and ischaemia increse in the procalcitonin levels will be parallel with degree of mucosal injury and ischaemia especially in the first week 3 levels of injury.there was an increasing oedema, capillary dilatation, and inflammatory Cell infiltrate in these stages of injury.[9] The level of procalcitonin is measured by kryptor TRACE assay after the surgery also procalcitonin level can be increased as much as 1 ng/ml (in case of minor and aseptic surgery) and even 2 ng/ml (in cardiac surgery). As shown by Meistersinger et al the kinetics of procalcitonin are not influenced by age, gender, or renal function as only a small proportion of it is excreted by the kidneys.[10]

Limitations

The limitation of the study is that it cannot be applicable in obstruction due to abdominal tuberculosis.

CONCLUSION

Procalcitonin levels at presentation and followed up at timely intervals of 24 48 and 72 hrs regularly is a very good tool for managing the patients with acute intestinal obstruction.

As known from our study the level of procalcitonin correlates with the level of CRP in monitoring the severity of the disease and predicting the mortality in intestinal obstruction cases and it also can have used as an early marker for predicting the severity and by taking the timely surgical intervention in selected patients can reduce the morbidity and mortality of the patients.

It also helps us to decide on when to operate and continue the conservative treatment for obstruction cases is decided by timely monitoring of procalcitonin levels.

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Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Meisner M. Pathobiochemistry and clinical use of procalci- tonin. Clin Chim Acta. 2002;323:17-29.
2. Assicot M, Gendrel D, Carsin H, Raymond J, Guilbaud J, Bohuon C. High serum procalcitonin concentrations in patients with sepsis and infection. Lancet. 1993;341:515-8.
3. Rau BM, Frigerio I, Bu¨chler MW, Wegscheider K, Bassi C, Puolakkainen PA, et al. Evaluation of procalcitonin for pre- dicting septic multiorgan failure and overall prognosis in secondary peritonitis: a prospective, international multicen- ter study. Arch Surg. 2007;142:134-42.
4. Castelli GP, Pognani C, Meisner M, Stuani A, Bellomi D, Sgarbi L. Procalcitonin and C-reactive protein during sys- temic inflammatory response syndrome, sepsis and organ dysfunction. Crit Care 2004;8:R234-42.
5. Mimoz O, Benoist JF, Edouard AR, Assicot M, Bohuon C, Samii K. Procalcitonin and C-reactive protein during the early posttraumatic systemic inflammatory response syn- drome. Intens Care Med. 1998;24:185-8.
6. Hensel M, Volk T, Do¨cke WD, Kern F, Tschirna D, Egerer K, et al. Hyperprocalcitonemia in patients with noninfectious SIRS and pulmonary dysfunction associated with cardiopul- monary bypass. Anesthesiology. 1998;89:93-104.
7. Assicot M, Gendrel D, Carsın H, Raymond J, Guilbaud J, Bohoun C. High serum procalcitonin concentrations in patients with sepsis and infection. Lancet 1993;341(8844):515-8.
8. Schuetz P, Albrich W, Mueller B. Procalcitonin for diagnosis of infection and guide to antibiotic decisions: past, present and future. BMC Med. 2011;22(9):107.
9. Maruna P, Frasko R, Gulrich R. Plasma procalcitonine in patients with ileus. Relations to other inflammatory parameters. Physiol Res. 2008;57(3):481-6.
10. Meisner M, Schmidt J, Hüttner H, Tschaikowsky K. The natu- ral elimination rate of procalcitonin in patients with normal and impaired renal function. Intensive Care Med 2000;26(2):S212-6.
11. Stolberg L, Rolfe R, Gitlin N, Merritt J, Mann L, Linder J, Fine- gold S. d-Lactic acidosis due to abnormal gut flora: diagnosis and treatment of two cases. N Engl J Med. 1982;306:1344-8.

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