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Original Research Article

Role of serum lactic dehydrogenase, glutamic oxaloacetic transaminase, creatine phosphokinase, alkaline phospatase, serum phosphorus in the cases of bowel ischemia in acute abdomen

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ABSTRACT

Background: Bowel ischemia is a life-threatening condition which may arise from a number of causes affecting the arterial and venous compartments of the mesenteric circulation. The rapid onset of acute mesenteric ischemia and the potential rapidity with which bowel infarction may occur explain the lethality of this disease. The aim of this study was to evaluate the role of serum lactic dehydrogenase (LDH), glutamic oxaloacetic transaminase (SGOT), creatine phosphokinase (CPK), alkaline phospatase, serum phosphorus in the cases of bowel ischemia in acute abdomen.
Methods: Above mentioned serum enzymes were measured preoperatively in the fifty patients of acute abdomen. Biomarker levels were compared in patients between equal two groups on the basis intra operative findings of bowel ischemia and non-bowel ischemia.
Results: Preoperative estimated serum levels of all described enzymes found to be significantly elevated in patients of group A (with bowel ischemia) in comparison with group B (with no bowel ischemia). Sensitivity and specificity for elevated levels of S. LDH were 88% and 68%, for SGOT 68% and 80%, for S. ALP 72% and 68%, for S. CPK-MB 76% and 84%, and for S. phosphorus 76% and 68% respectively.
Conclusions: Preoperative estimated serum levels of all described enzymes found to be significantly elevated in patients of group A (with bowel ischemia) in comparison with group B (with no bowel ischemia). Sensitivity and specificity for elevated levels of S. LDH were 88% and 68%, for SGOT 68% and 80%, for S. ALP 72% and 68%, for S. CPK-MB 76% and 84%, and for S. phosphorus 76% and 68% respectively.

Keywords: Bowel ischemia, Serum markers, Serum level

INTRODUCTION

Bowel ischemia is a life-threatening condition which may arise from a number of causes affecting the arterial and venous compartments of the mesenteric circulation. The rapid onset of acute mesenteric ischemia and the potential rapidity with which bowel infarction may occur explain the lethality of this disease.[1] Early diagnosis of bowel ischemia remains very difficult, primarily because the early clinical symptoms of this disease are non-specific and initially subtle. Despite the progress in the diagnosis and treatment of bowel ischemia over the past four decades, it still has a poor prognosis with an in-hospital mortality rate of 50-90%.[2] Acute intestinal ischemia can often be reversed when treatment is instituted early. Delayed diagnosis results in intestinal necrosis and multiple organ failure.[3] Radiological diagnostic tests (computed tomography (CT), mesenteric angiography) are useful, but they are costly, invasive and require significant expertise. A simple, cost-effective diagnostic tool is needed.[4-7] Many circulating biomarkers of intestinal ischemia have been evaluated in the clinical

setting.[8-10] To date, there are no reliable and easy-to-use laboratory markers available for the accurate and early diagnosis of ischemia used in clinical practice. Therefore, this study examined the value of several biomarkers i.e. serum lactic dehydrogenase (LDH), glutamic oxaloacetic transaminase (SGOT), creatinine phosphokinase (CPK), alkaline phosphatase, phosphorus sampled preoperatively in the early diagnosis of intestinal ischemia and we aimed to determine whether plasma enzyme levels would become elevated in patients of bowel ischemia and whether these elevations could be used as a predictor for bowel ischemia.

METHODS

A prospective study of 50 cases of acute abdomen admitted in various surgical unit wards of J.L.N. Hospital, Ajmer, and central Rajasthan during the period of January 2016 to January 2017 was conducted. It comprised the patients diagnosed as a case of acute abdomen. The selected cases were between age group of 15 to 90 years; they included perforation peritonitis, obstruction of intestine, bowel ischemia etc. and had undergone exploratory laprotomy. Patients with blunt trauma abdomen, strangulated external hernias, and those managed conservatively were not included in this study. Complete history was taken and physical general and local examination was done. Routine investigations like CBC, TLC, DLC, blood urea, serum creatinine, blood sugar, BT, CT, serum electrolytes, ECG, X-Ray chest and abdomen were done to make a diagnosis of acute abdomen. Blood sample was collected for biochemical estimation of following serum enzymes.

- Serum Lactic Dehydrogenase (LDH)
- Serum Glutamic Oxaloacetic Transaminase (SGOT)
- Serum Creatinine Phosphokinase (CPK-MB)
- Serum Alkaline Phosphates (ALP)
- Serum inorganic phosphorus

These patients were divided into two equal groups, Group A and Group B, on the basis of intra operative finding of presence or absence of bowel ischemia. Group A consisted the 25 patients who had intra operative finding of presence of bowel ischemia and Group B consisted of the 25 patients who did not have intra operative finding of bowel ischemia. Serum levels of above described enzymes were compared between those two groups.

RESULTS

The mean age in group A and B were 47.24±3.579 and 46.28±3.425 respectively. Forty percent patients were more than 50 years of age in bowel ischemia group. Out of 50 patients, 33 were male and 17 were females. In which 17 males and 8 females had intra operative finding of the bowel ischemia and 16 males and 9 females had no bowel ischemia.

Table 1: Comparison between bowel ischemia patients to no bowel ischemia patient in the study

		Group A (bowel ischemia patients)	Group B (with no bowel ischemia patients)
Mean age (in years)		47.24 ± 3.579	46.28 ± 3.425
Male to female ratio		2.1:1	1.7 :1
Risk factors	Smoking	56%	28%
	Alcoholism	48%	24%
	Cardiac disease	16%	8%
Mortality		56% Age >50 years 80% Age <50 years 32%	0%
Symptoms/signs	Pain abdomen	100%	100%
	Abdominal distention	80%	84%
	Vomiting	40%	48%
	Obstipation	62%	72%
	Pyrexia	44%	28%
	Diarrhea	36%	8%
	Bleeding per rectum	16%	4%
Insignificant X ray abdomen finding		48%	24%

Patients of Group A (with bowel ischemia) and Group B (with no bowel ischemia) presented with similar complaints of pain abdomen, vomiting, abdominal distention and obstipation but pyrexia, bleeding per rectum and diarrhea were more common in patients with bowel ischemia, which was significant ($p<0.05$). Higher Mortality rate (80%) was observed in older age groups i.e. aged >50 years, whereas lesser mortality was seen in

younger age groups i.e. <50 years of age among the patients of Group A (with intra operative findings of bowel ischemia). Overall mortality rate was found to be 56% in the bowel ischemia cases in Present study.

Table 2: Test results in our studies.

Test	Sensitivity	Specificity	Positive predictive value	Negative predictive value	Accuracy	Significant enzymes level for bowel ischemia in comparison to no bowel ischemia cases
Serum LDH	88%	68%	73%	85%	78%	>800 U/L
Serum SGOT	68%	80%	77%	71%	74%	>100 U
Serum ALP	72%	68%	69%	70%	66%	>140 U
Serum CPK-MB	76%	84%	82%	77%	80%	>55 U
Serum phosphorus	76%	68%	71%	73%	72%	>5.5 mg%

Most of the patients presented within 12 days of appearance of symptoms in our study and it was observed that mortality rate was increased with late appearance time. Patients presented after 8days of appearance of symptoms had 100% mortality rate (p value 0.0251). In this study, there was no death noted among patients of Group B (with no bowel ischemia). So, higher mortality rate was found to be significant (p value < 0.0001) among Group A (bowel ischemia patients). Smoking and alcohol consumption was associated with 54% and 48% of patients with bowel ischemia whereas 28% patients were hypertensive and diabetic, 16% patents were known cardiac patients (Table 1).

Preoperative estimated serum levels of all described enzymes found to be significantly elevated in group A patients (with bowel ischemia) in comparison with group B patients (with no bowel ischemia). Sensitivity and specificity for elevated levels of S. LDH were 88% and 68%, for SGOT 68% and 80%, for S. ALP 72% and 68%, for S. CPK-MB 76% and 84%, and for S. phosphorus 76% and 68% respectively (p value <0.05). No patient in Group B (without bowel ischemia) had LDH levels more than 800 U/L. fifty percent patients in Group A (with bowel ischemia) had LDH levels >800 U/L (p value <0.0001).

Among Group B patients (with no bowel ischemia) no one had SGOT levels more than 100 U. Forty four percent patients in Group A (with bowel ischemia) had SGOT levels >100 U (p value <0.0001) whereas no patient in Group B (with no bowel ischemia) had serum ALP level more than 170 U. In Group A (with bowel ischemia) 48% patients had level >140 U (p value= 0.0086). Similarly, no patient in Group B (without bowel ischemia) had serum CPK-MB level more than 70 U. In Group A (with bowel ischemia) 60% patients had serum CPK-MB level > 55 U (p value <0.0001). In this study 48% patients in Group A (with bowel ischemia) had value more than 5.5 mg% and only 12% had level <3.6 mg% where as 76% of patients in Group B (with no bowel ischemia) had serum phosphorus level <5.6 mg% (p value = 0.0255) (Table 2).

DISCUSSION

The present study was undertaken to evaluate the role of serum markers LDH, SGOT, ALP, CPK-MB, Phosphorus levels in the case of bowel ischemia. Above mentioned serum markers were evaluated in the patients preoperatively. These 50 patients grouped equally into group A with intra operative finding of bowel ischemia and group B in which no bowel ischemia was found intra operatively. Levels of serum LDH, serum SGOT, serum ALP, serum CPK-MB and serum Phosphorus were compared between both the groups to see the significant role of those serum markers in the case of bowel ischemia.

Majority of the patients were in the age group of more than 50 years in the group A i.e. with bowel ischemia (10, 40%), with male to female ratio of 2.1:1 These findings were similar to that of findings of the studies done by others, in which they were reported maximum patients of >50 years of age and male to female ratio of 2:1 in cases of bowel ischemia.[2,11-13] Bleeding per rectum (16%) and diarrhea (36%) were found more in patients with bowel ischemia (p value <0.05) in study which were similar to the findings of the other study in which they found diarrhea in 35%, bleeding per rectum in 16% in bowel ischemia patients.[11] In present study patients with bowel ischemia had over all 56% mortality rate. Patients aged more than 50 years of age (10 patients) had 80% (8 deaths) mortality in the study whereas patients below 50 years of age (15 patients) had 40% (6 deaths) mortality rate. These findings were similar to the study done by others who had reported mortality rate to be in the range

of 40-90% in bowel ischemia cases in different age groups.[2,14]

They reported that mortality rate was >50% in patients of age <50 years and mortality rate was found to be >80% in the patients of age >50 years in the cases of bowel ischemia.[2,14,15] In present study patients appeared later had increase mortality rates (50%-100%) similarly to the studies done by others in which they reported increased mortality (up to 90% to 100%) in bowel ischemia patients due to undue delay in presentation, the shorter the duration of symptoms the more likely was the chance of patient to survive after surgery.[16,17]

Forty eight percent of patients of bowel ischemia group had no significant X ray abdomen findings. These finding were similar to the findings of the study done by others in which they had reported approximately 50% patients had no significant X ray abdomen findings.[18,19] In the patients of bowel ischemia group smoking was associated with 56% of cases, 48% patients were found to be alcoholic. 28% patients were diabetic and 16% patients had history of cardiac disease in our study similar to the findings of previous studies which reported that among patients who had bowel ischemia smoking, alcoholism and diabetes were associated with 60%, 40% and 17% of patients respectively and 20% had past cardiac disease.[11-13]

In present study for elevated level of lactate dehydrogenase, sensitivity and specificity were found to be 88% and 68% respectively similar to the findings of other studies in which they reported 80% to 90% sensitivity and specificity of 60% to 70% but some studies reported low specificity of 44% for elevated level of LDH level in bowel ischemia patients.[20,21] LDH levels >800 U/L was significantly (p value <0.0001) related to bowel ischemia in comparison to without bowel ischemia patients in present study. In other studies findings, higher level (>1000 IU/L) of serum LDH indicated bowel ischemic changes.[22]

Sensitivity and specificity for elevated levels of SGOT were 68% and 80% respectively in present study whereas other studies reported higher sensitivity of 70% to 80% and same specificity of 80%-90% for elevated serum SGOT in bowel ischemia patients.[20,23] They reported serum level of >100 U significant for bowel ischemia in the comparison of non-bowel ischemic patients which was similar to our study findings, in which we found SGOT levels >100 U significantly (p value <0.0001) related to bowel ischemia patients.[20]

In present study for elevated levels of alkaline phosphates sensitivity and specificity were 72% and 68% respectively whereas others reported similar sensitivity of up to 70% to 80% but slight higher specificity of 70% to 80% in their study.[10,24,25] They stated level >140 U was specific for bowel ischemia, which was found to be similar to present study. Sensitivity and specificity for elevated level of CPK-MB was found to be 76% and 84% respectively similar to the other studies which reported similar sensitivity of up to 70% to 80% and specificity of 80% to 90%.[20,26] In present study level >55 U was significant in the patients with finding of bowel ischemia (p value <0.0001) than patient with no bowel ischemia similar to the other studies.[27] In present study for elevated serum organic phosphorus sensitivity and specificity were found to be 76% and 68% respectively similar to the findings of other studies in which they reported 70% to 80% sensitivity and but lower specificity of upto 26% to 70%.[20,2128,29] Previous studies reported that level >5.5 mg% was more related to the bowel ischemia than no bowel ischemia which was similar to what we found in our study.[29]

Limitations of this study was, this study was done at single institute level on small sample size involving certain population group near Ajmer. Estimated enzymes in the study would not be available at small centers like primary health centers and community health centers sometimes.

CONCLUSION

The elevated levels of all the serum markers done in the study for evaluation of the bowel ischemia have significant sensitivity and specificity. These serum markers are cost effective, easily available, easy to estimate and noninvasive. These can help in early diagnosis of bowel ischemia in the patients of acute abdomen and subsequently mortality can be reduced.

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