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Original Research Article

Can preoperative serum lactate dehydrogenase levels predict postoperative pulmonary complication following an emergency abdominal surgery? An observational study

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ABSTRACT

Background: Postoperative pulmonary complications (PPC) are one of the commonest complications following gastrointestinal surgery. They lead to increase in morbidity and mortality. Lactate dehydrogenase (LDH) is an enzyme present in essentially all major organ systems. Studies have shown measurement of its activity levels and its isoenzyme pattern may provide additional information about lung and pulmonary endothelial cell injury. The objectives of the present study were to study the levels of serum LDH in patients with and without post-operative pulmonary complications following emergency abdominal surgery.
Methods: The study was designed as an observational study. All patients ≥18 years of age undergoing gastrointestinal surgery, excluding those with prior lung pathology were included in the study. The demographic parameters, clinical parameters and laboratory parameters along with details of pulmonary complications were recorded. Serum LDH level were assessed on admission. Levels of serum LDH were compared between patients with and without post-operative pulmonary infections and were assessed for significance.
Results: Incidence of PPC was 28% in our study. There was significant difference in the mean age in the group with and without PPC (p=<0.001). Smoking habit, serum albumin total protein and upper abdomen incision surgery were associated with increased incidence of PPC. Pleural effusion was the commonest PPC seen in patients. Serum LDH was not significantly associated with the incidence of PPC.
Conclusions: Pre-operative serum LDH level is not a predictive factor for occurrence of postoperative pulmonary complication. Age, smoking, total protein, serum albumin, upper abdomen incision were found to associated with increased risk of PPCs.

Keywords: PPC, Serum LDH, Laprotomy

INTRODUCTION

Postoperative pulmonary complications (PPC) are one of the commonest complications following gastrointestinal surgery. They lead to increase in morbidity and mortality, the time spent in the intensive care unit (ICU), length of hospital stay and a substantial increase in the costs and use of health care resources cause increased mortality, increased length of ICU stay, prolonged of hospital stay and higher cost of treatment.[1,2]

The incidence of PPC following gastrointestinal surgery varies widely in the literatures, 20-69% for postoperative atelectasis and 9-69% for postoperative pneumonia, which is due to the difference in type of pulmonary complication included, clinical diagnostic criteria and the

target population.[3] Even in minor surgeries, the incidence can be 1-2%.

Cytoplasmic cellular enzymes, like lactate dehydrogenase (LDH), in the extracellular space, although of no further metabolic function in this space, are still of benefit because they serve as indicators suggestive of disturbances of the cellular integrity induced by pathological conditions. Since LDH is an enzyme present in essentially all major organ systems, serum LDH activity is abnormal in a large number of disorders. Although the increase in total serum LDH activity is rather nonspecific, it is proposed that measurement of LDH activity levels and its isoenzyme pattern in pleural effusion and, more recently, in bronchoalveolar lavage fluid and serum may provide additional information about lung and pulmonary endothelial cell injury.[4] Also previous studies have shown that serum LDH-activity is also directly proportional to the extent of diffuse inflammatory pulmonary disease.[5] Studies have shown that preoperative serum levels predict pulmonary complication in patients undergoing lung surgery.[5-7]

There are no studies on use of LDH in predicting post-operative pulmonary complication in general surgery patients. So, in this study the usefulness of serum LDH as a predicting tool for post-operative pulmonary complication is to be studied.

Objectives

The objectives of the present study were to study the levels of serum LDH in patients with and without post-operative pulmonary complications following emergency abdominal surgery and to study the other risk factors for post-operative pulmonary complications in patients undergoing emergency abdominal surgery.

METHODS

Study was designed as an observational study in the Department of Surgery, JIPMER from May 2019 to August 2019. Institute ethics committee approval was obtained prior to the commencement of the study. Study participants included all patients above the age of 18 undergoing emergency abdominal surgery among which patients with pre-existing pulmonary pathologies like tuberculosis, chronic obstructive pulmonary disease, lung or pleural malignancy were excluded. The sample size was estimated by comparing 2 independent means using the software Open Epi version 3.01. Based on the prevalence of pulmonary infection in the study population and to get a difference in mean level of serum LDH of about 100 units, the sample size was calculated to be 75. Consecutive sampling was planned. Demographic details (age, gender, smoking, alcohol), disease characteristics (diagnosis, duration of illness, pre-operative chest x-ray) and details regarding the surgery undergone (site, type of surgery) were collected baseline preoperative hematological (hemoglobin, total counts), and biochemical parameters (total protein, albumin, urea, creatinine) were collected. Blood sample were collected from all patients for estimation of serum LDH level on admission. All patients were observed until they are discharged from the hospital for the development of Post-operative pulmonary complications like atelectasis, pneumonia, acute respiratory distress syndrome (ARDS), pleural effusion, pneumothorax and the time of onset of the complication is also noted. The diagnosis of PPC was done by the treating physicians, after consulting the pulmonologist. Levels of serum LDH were compared between patients with and without post-operative pulmonary infections and were assessed for significance. Difference in all other hematological and biochemical parameters was also assessed for significance.

Statistical analysis

The data was entered into Excel and analysis was done using STATA14, continuous variables were summarized as Mean±SD or Median±IQR based on the normality of the distribution. Categorical data was summarized as frequency and proportions. The outcome variable was summarized as frequency and proportion with 95% confidence interval. Association between outcome variable and categorical independent variables was done using Chi-square test or Fischer exact test. The association between outcome variable and continuous independent variables was analyzed using Students' t test. Any p value of less than 0.05 is taken as significant.

RESULTS

In the study a total of 57 patients underwent various gastrointestinal surgeries during the study period. Out of these, 16 patients developed PPC. Incidence of PPC was 28% in our study.

Mean age of the population included in the study was 38.4. Mean age in the group with PPC was 58.6. Mean age in the group without PPC was 30.51. This difference was statistically significant (p=<0.001). Distribution of male and female patients in both the groups was not statistically different. Smoking habit was found to be present in 7 (87.50%) patients with PPC as compared to 1 (12.50) patient without PPC. The difference in incidence of smoking habit between the two groups was statistically significant (p=<0.001) (Table 1).

Mean serum LDH was 219 mg/dl in patients who developed PPC as compared to 195 mg/dl patients without PPC. The difference between the two means was statistically insignificant (p=0.08) (Table 2). Mean serum total protein and Mean serum albumin levels showed statistically significant difference between the two groups (p=0.002 and p=0.04) (Table 3).

Table 1: distribution of demographic parameters between the two groups.

Parameter		PPC present (%)	PPC absent (%)	P value
Age (in years)	<25	1 (4.55)	21 (95.45)	<0.001
	26-50	1 (5.88)	16 (94.12)	
	>50	14 (77.78)	4 (22.22)	
Gender	Male	6 (26.09)	17 (73.910	0.784
	Female	10 (29.41)	24 (70.59)	
Smoking	Yes	7 (87.50)	1 (12.50)	<0.001
	No	9 (18.37)	40 (81.63)	
Alcohol consumption	Yes	6 (35.29)	11 (64.71)	0.429
	No	10 (25.00)	30 (75.00)	

Table 2: Distribution of pre-op LDH between two groups.

Serum LDH	PPC present (%)	PPC absent (%)	P value
<150	1 (16.67)	5 (83.33)	0.691
151-250	12(27.91)	31 (2.09)	
>250	3 (3.50)	5 (62.50)	
Mean LDH	219 (57.01)	195 (41.6)	0.08

Table 3: Distribution of pre-op laboratory parameters between two groups.

Parameter	Mean PPC present (SD)	Mean PPC absent (SD)	P value
Hemoglobin	11.29 (2.81)	11.73 (3.2)	0.70
Total protein	6.04(1.01)	6.98 (0.75)	0.002
Serum albumin	3.21 (0.68)	3.79 (0.87)	0.04
Serum urea	44.9 (39.73)	25.55 (15.01)	0.075
Serum creatinine	0.91 (0.34)	0.82 (0.06)	0.44

Table 4: Type and nature of surgery done in the two groups.

Parameter		PPC present (%)	PPC absent (%)	P value
Laparotomy	Upper abdomen incision	11 (50)	11 (50)	0.002
	Lower abdomen incision	5 (16.67)	30 (83.33)	
Pathology	Non malignancy	15 (28.85)	37 (71.15)	0.566
	malignancy	1 (20)	4 (80)	

Overall laparotomy involving upper abdominal incision was the commonest surgery performed (61%). Incidence of PPC in patients who underwent lower abdomen incision and upper abdomen incision was 14.28% vs. 85.7% (Table 4).

Table 5: Distribution of PPC in the study population.

Diagnosis	Number (%)
Pneumonia	4 (25)
Pleural effusion	8 (50)
Basal atelectasis	1 (6.25)
ARDS	3 (18.75)

Pleural effusion was the commonest PPC seen in 8 (50%) of patients followed by pneumonia in 4 (25%) of patients. ARDS was present in 3 cases (Table 5). None of the patients had 2 complications. Mean time period for incidence of PPC was 2.43 days.

DISCUSSION

Age of the patient has been documented to be one of the commonest risk factor for developing PPCs.[8-10] The overall incidence of PPC increased by 9% in patients over 59 years old. Age ≥60 years have been found to be a risk factor for PPCs. In our study the age more than 50 years was found to be significantly associated with PPC and comparable to previous studies. This finding may be attributed to the higher incidence of associated co-morbidities in the elderly age group patients, like chronic heart disease, respiratory diseases and poor compliance to early rehabilitation.

Smoking is an important risk factor for PPCs. The risk of PPC in smokers was found to be 4 times higher than that in non-smokers in this study. The results of our study were also comparable to the previous similar studies.[8-10] In this study there was no significant difference in the alcohol drinking habit between the two groups. It is found

that patients with low serum albumin were associated with increased chance of PPCs. Several other similar studies also demonstrated the same findings.[11-14] Low serum albumin increases the possibility of developing PPC by decreasing the healing capacity and being associated with other co-morbidities like heart and kidney diseases. Preoperative hemoglobin level has been identified as a marker for nutritional status. Low levels have been found to be associated with poor recovery in the post-operative period. But in our study we found that serum hemoglobin levels were not significantly associated with increased chance of PPC. This finding is may be due to the fact that most of the patients had good hemoglobin levels (mean=11.64). In our study the percentage of lower abdomen incisions done were more than the upper abdomen incisions. We found that the incidence of PPC was significantly high in patients with upper abdomen incisions compared to patients with lower abdomen incisions patients. Few studies have shown that upper abdomen incision surgeries had higher risk of PPCs as compared to Lower abdomen incision surgeries.[15-17] Poor lung expansion and pain in the upper chest preventing lung expansion have been shown to be the reason for development of PPC.

Pleural effusion was identified as the commonest postoperative pulmonary complication in our study. This finding is comparable to other similar studies done in the past. In a study by Jiang pneumonia was found to be the commonest PPC followed by tracheobronchitis.[18] Imbalance in the fluid management, poor post-operative chest physiotherapy leading on to poor lung drainage can be identified as the pathogenesis behind the development of pleural effusion in these patients.[19,20] In our study the average time taken to develop PPC was 3.43 days. This finding was found to be similar to other similar studies.[19,20]

Though pathogenesis behind development of PPC is fluid imbalance and poor chest physiotherapy in the post-operative period, most of the PPCs are identified only after a substantial period of time. This may be due to the non-availability of a definitive investigation to detect early stage of PPC. Chest X-ray has poor sensitivity in picking up early stage PPCs.

Earlier studies have shown that serum LDH values are high in diffuse lung injuries.[5] This study was designed to find out if pre-op LDH values are high in patients who develop PPC. The association between pre-op serum LDH and PPC was found to be insignificant from this study. The possible reasons could be low incidence of PPC in the study population and very narrow time period to achieve the sample size required for the study. Since the study population included patients who were posted for emergency surgery, the possibility of sepsis and hemolysis could not be ruled out, so their LDH were already on the higher side. So the sample size of 75 was not sufficient to prove the significant association.

CONCLUSION

Pre-operative serum LDH level is not a predictive factor for occurrence of postoperative pulmonary complication. Age, smoking, total protein, serum albumin, upper abdomen incision were found to associated with increased risk of PPCs.

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