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Utility of serum pancreatic enzyme levels in diagnosing blunt trauma to the pancreas: A prospective study with systematic review

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ABSTRACT

Introduction: Reliability of serum pancreatic enzyme levels in predicting pancreatic injuries has been a parameter of interest and the present recommendations on its utility are based primarily on anecdotal observations. The aim of this study was to evaluate the utility of serum pancreatic enzyme assessment in predicting blunt pancreatic injury with imaging and surgical correlation and compare our results with a systematic review of literature till date.

Methods: A prospective cohort study conducted over 4 years in a tertiary care referral centre with 164 consecutive patients who presented to the emergency department with a history of blunt abdominal trauma and had serum pancreatic enzyme assessment, USG and subsequent diagnostic CECT were analyzed. The CT findings and AAST grade of pancreatic injury, various intra-abdominal injuries and time elapsed since injury and other associated factors were correlated with serum pancreatic enzyme levels. For systematic review of literature MEDLINE database was searched between 1940 and 2012, also the related citations and bibliographies of relevant articles were analyzed and 40 articles were included for review. We compared our results with the systematic critique of literature till date to formulate recommendations.

Results: 33(21%) patients had pancreatic injury documented on CT and were graded according to AAST. Statistically significant elevated serum amylase levels were observed in patients with pancreatic and bowel injuries. However, elevated serum lipase was observed specifically in patients with pancreatic injury with or without bowel injury. Combined serum amylase and lipase showed 100% specificity, 85% sensitivity in predicting pancreatic injury. Elevated ($n = 28$, 85%) vs. normal ($n = 5$, 15%) serum amylase and lipase levels showed sole statistically significant association with time elapse since injury to admission, with a cutoff of 3 h.

Conclusions: Based on our results and the systematic review of the literature till date we conclude, persistently elevated or rising combined estimation of serum amylase and lipase levels are reliable indicators of pancreatic injury and is time dependent, nondiagnostic within 6 h or less after trauma. In resource constrained countries where CT is not available everywhere it may support a clinical suspicion of pancreatic injury and can be reliable and cost-effective as a screening tool.

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Introduction

The incidence of pancreatic injury is very low and routinely CT based AAST scoring has been used to grade the pancreatic injury and for planning management [1–8]. Reliability of predicting pancreatic injury by serum/peritoneal (DPL)/urine pancreatic enzyme level assessment has been a parameter of interest [1–5]. However, the published reports of data on value of serum

amylase analysis in patients with blunt abdominal trauma have shown mixed results [3]. A few of them have shown it to be of little value in the diagnosis of acute pancreatic injury, while the others have clearly shown the significance and the limitations of the serum amylase level in diagnosing pancreatic injury [1,3,5]. Very few previous reports have evaluated the combined role of serum amylase and lipase levels in predicting acute pancreatic injury with imaging and surgical correlation and the factors that might influence the serum amylase and lipase levels on admission in patients with pancreatic injury, such as demography, time elapsed since injury to admission, grade of pancreatic injury and other associated intra-abdominal injury [3].

Methods

This was a prospective cohort study conducted over 4 years at tertiary care referral centre. 164 consecutive patients who presented to the emergency department with a history of blunt abdominal trauma and underwent diagnostic CECT in Department of Radiodiagnosis were considered for the current prospective analysis.

Based on the presenting complaints, mode/mechanism of injury, haemodynamic status, general and abdominal physical examination the patients were triaged for need for:

- Immediate management of the specific trauma (head injury/ fractures, etc.),
- Exploratory laparotomy for unstable patients,
- Further radiological examinations (FAST/complete ultrasonography examination and CT if indicated) and lab investigation,
- Clinically stable and to be observed.

The study population in the present study included patients who underwent CT examination.

We excluded from our analysis patients who had sustained abdominal injury due to penetrating trauma, who underwent surgical exploration prior to CT and also in whom time elapsed since the injury to admission was more than 48 h after injury. Informed consent for ultrasound and written consent for CT study were taken according to department and hospital ethics policy.

Diagnostic work-up

In all patients, baseline serum amylase and lipase levels were done at our institution at the time of admission and patients were grouped under three categories (1) category I: serum levels ≤ 100 IU, (2) category II: serum levels between 100 and 250 IU, (3) category III: serum levels ≥ 250 IU. Information collected at the time of the examination included demographic data, mechanism of injury and Revised Trauma Score. Time elapsed since the injury to admission was recorded. Blood investigations were performed at the arrival of the patient in the emergency room. Baseline emergency ultrasonography (USG) was employed as a tool to triage the patients in the emergency department. The ultrasound was performed on Logiq 700 ultrasound system by GE and on Voluson Expert. Ultrasound examination, was done with a 3–5 MHz curvilinear probe, included initial Focused Assessment with Sonography for Trauma (FAST) examination and then complete abdomen-pelvic to rule out injury/free fluid.

CT examination at admission was performed in all the patients and comments were documented. CT scans were performed on Multidetector CT scanner (MDCT scanner 64 slice brilliance). The CT protocol included plain and contrast images acquired at 5 mm thickness and 5 mm intervals. Thin reconstruction 1.5–3 mm thickness and interval were obtained wherever required. Coronal and sagittal reformatted images were reconstructed wherever

required. Bowel loops were opacified using 750 ml of ionic contrast media [Angiografin], of 2% concentration, depending on the urgency of the situation and if time permitted, either orally or by nasogastric tube 30–40 min before the scan and/or 250 ml just before scanning. 100 ml of nonionic contrast media (Ultravist 300 mg/ml) was administered intravenously by power injector at the rate of 4 ml/s in adults and 2 ml/s in children. Children received 2–3 mL of contrast material per kilogram of body weight. Locator placed at level of D10–12. Tracker was placed in the abdominal aorta. Threshold set at 150 and pre-delay of 8 s was given for arterial phase and 35 s for venous phase.

Patient records were reviewed for a reason for laparotomy, missed injuries and complications. Laparotomy findings were compared with both initial and final preoperative CT results. The scans were scored for grade of pancreatic injury by using the modified criteria of the American Association for the Surgery of Trauma (AAST) (Table 1) [8]. The patients were finally categorised into only pancreatic injury, only bowel injury and combined pancreatic and bowel injury and no intra-abdominal injury or any other intra-abdominal organ injury. Based on pancreatic injury AAST score the patients were divided into two groups: group 1 (grade I and grade II injuries) and group 2 (grade III, grade IV and grade V injuries).

Statistical data analysis

All the relevant data was entered into SPSS version 16.0 data sheet for statistical computation. The relationship between serum amylase and lipase values and age, sex, time elapsed since the injury; grade of injury and concomitant intra-abdominal injury was also assessed for statistical significance. The statistical significance of the results was determined by using Fisher's exact test and p value, generated by SPSS version 16.0 software [9]. A p value of <0.05 was considered to indicate a statistically significant result for all analysis. Intragroup multiple comparisons were determined by Welch ANOVA Test and Post hoc multiple comparison test: Tamhane/ Tukey HSD, assuming unequal variance between samples, and were always confirmed by nonparametric Kruskal–Wallis tests. If a statistically significant difference between groups was detected, post hoc Tamhane's t tests ($p < 0.05$), assuming a non-normal distribution and unequal variances, were executed. Because of the skew distributions of serum amylase and serum lipase, these variables were analyzed after a logarithmic transformation. As well as showing means and SDs, geometric means and 95% confidence intervals for the geometric mean are also presented for these variables. Sensitivity, specificity and predictive values were calculated using standard 2×2 tables.

Systematic review methodology

We also performed a systematic review till date. To capture as many relevant citations as possible, a wide range of medical and scientific databases was searched to identify primary studies for the value of serum amylase/lipase in predicting pancreatic injury. The MEDLINE database between 1940 and 2012 at the National

Table 1
CT grading of blunt pancreatic injury (Moore et al.) [8].

Grade	Criteria
I	Minor contusion or laceration without duct injury
II	Major contusion or laceration without duct injury or tissue loss
III	Distal transaction or parenchymal injury with duct injury
IV	Proximal transaction (to the right of mesenteric vein) or parenchymal injury involving ampulla
V	Massive disruption of pancreatic head