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Increased lipase and amilase levels in critically ill patients. Retrospective study

Elevação da lipase e amilase no doente crítico. Estudo retrospectivo

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ABSTRACT

Objectives: Elevated lipase and amylase are commonly found in patients in intensive care unit without a previously recognized pancreatic illness, constituting a diagnostic and therapeutic challenge. The authors therefore proposed to determine the frequency of asymptomatic high serum lipase in critically ill patients, involved risk factors and outcome.

Methods: Retrospective study of patients admitted in an intensive care unit from January 1 to December 31, 2006, excluding admissions for acute pancreatitis, history of pancreatic disease, renal insufficiency or lacking of data. Patients were divided in two groups (with and without high serum lipase) that were compared for clinical, laboratory and radiological variables. Statistical analysis: SPSS 13; Student's t test and Chi-square test (CI 95%) with statistical significance if $p < 0.05$).

Results: 102 patients were included with high serum lipase was present

in 39.2% of patients, mean lipase of 797U/L. Patients with high serum lipase had longer hospital stay ($p < 0.001$), parenteral nutrition ($p < 0.001$), ventilator support ($p = 0.04$), fever ($p < 0.001$), hyperamylasemia ($p < 0.05$), hyperbilirubinemia ($p = 0.003$) and rise of transaminases ($p = 0.001$), with no significant differences in diagnosis, gender, age, APACHE II, SOFA, SAPS, mortality, hypotension, alkaline phosphatase, hemoglobin, lactate, tolerance to enteral nutrition and use of propofol. Imaging study revealed pancreatic alterations in two patients with high serum lipase.

Conclusions: Elevated lipase was commonly found in critical patients, it related with longer length of stay but was not accompanied by increased clinical severity or mortality. It was more frequent with parenteral nutrition. A minority of patients met the criteria of acute pancreatitis.

Keywords: Pancreatitis; Lipase; Amylases; Intensive care units

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INTRODUCTION

Serum amylase and lipase are widely used as markers of pancreatic inflammation; however their elevation is not always predictive of pancreatic disease.⁽¹⁾ They may be high in some situations that mimic acute pancreatitis (Chart 1), notably other intra-abdominal diseases such as of the biliary tract, processes of occlusion or intestinal ischemia, acute appendicitis among others.^(1,2) Enzyme specificity is also reduced in renal failure, hepatic disease, alcohol abuse and various extra-abdominal diseases. For instance, 80% of patients with renal failure without abdominal pain presented high serum lipase. These elevations become evident with a lower than <50 ml/

min creatinine clearance. Such lack of specificity implies that, although these two enzymes might point to diagnosis of acute pancreatitis, a definitive diagnosis is not warranted.⁽³⁾ Diagnosis of pancreatitis, assessment of severity of the condition and use of complementary imaging assays rely upon scientifically established criteria and guidelines. According to the 2006 guidelines of the American College of Gastroenterology (ACG), diagnosis of acute pancreatitis requires presence of at least two of the following characteristics: 1) typical abdominal pain, 2) amylase and/or lipase more than three times the normal and 3) characteristic findings of the image tests (ultrasound, abdominal computerized tomography (TCA), magnetic resonance).⁽⁴⁾

Chart 1 - Causes of elevation of amylase and lipase serum levels

Amylase	Lipase
Acute pancreatitis	Acute pancreatitis
Pseudopancreatic cyst	Pseudopancreatic cyst
Chronic pancreatitis	Chronic pancreatitis
Pancreatic carcinoma	Pancreatic carcinoma
Biliary tract disease (cholecystitis, cholangitis, choledocholithiasis)	Biliary tract disease (cholecystitis, cholangitis, choledocholithiasis)
Intestinal occlusion/subocclusion	Intestinal occlusion/subocclusion
Intestinal ischemia	Intestinal ischemia
Intestinal perforation	Intestinal inflammatory disease
Acute appendicitis	
Ectopic pregnancy	Renal insufficiency
Renal insufficiency (<50 ml/min)	Alcohol abuse
Parathyroiditis	Nervous bulimia/anorexia
Macroamylasemia	Malignant neoplasia
Ovarian cyst/ovarian neoplasia	Hepatitis C
Lung carcinoma	
Diabetic ketoacidosis	
HIV infection	
Intracranial trauma	

Adapted from: Forsmark CE, Baillie J; AGA Institute Clinical Practice and Economics Committee; AGA Institute Governing Board. AGA Institute technical review on acute pancreatitis. *Gastroenterology*. 2007;132(5):2022-44. Review.

HIV – Human immunodeficiency virus

Elevation of these enzymes is often found in critically ill patients in the intensive care unit. This rise may reflect pancreatic or extra-pancreatic production.^(3,5,6,7) Described next are some factors that may lead to inflammatory changes at pancreatic level of the criti-

cally ill patients: 1) ischemia due to hypoperfusion, found for instance, in circulatory shock, major surgeries (cardiopulmonary bypass or thoraco-abdominal aneurysm); 2) drugs such as some antibiotics, drugs with a cardiovascular action, propofol; 3) metabolic changes such as hyperglycemia and hypercalcemia occasionally caused by intravenous calcium administration; 5) biliary mud, an often found situation in bedridden patients and those submitted to parenteral nutrition.^(3,6,8,9) Rise of the enzyme is for instance, detected in patients with trauma, tumors or intracranial hemorrhage, patients with abdominal trauma and those submitted to cardiac surgery.^(2,10) Recurring episodes of acute pancreatitis may occasionally take place various months or years after an accident mainly by a Wirsung injury at body level.^(10,11) Hyperamylasemia in the context of cardiac surgery is essentially due to decrease of urinary output and not truly to pancreatic injury, greater relevance has increasingly been given to intravenous calcium administration.⁽³⁾ Liu et al. noted that 15% of a group of patients admitted because of trauma, infection, tumor or other intracranial injuries presented with high amylase and lipase without any clinical or radiological evidence of pancreatitis. This would recommend a routine monitoring of the enzymes in these patients.⁽⁵⁾ In another prospective study with 130 critical patients, Denz et al., verified that presence of high serum lipase was common, however, in most cases no concomitant radiological alterations of the pancreas or of clinical relevance were noted.⁽⁷⁾

To summarize, elevation of pancreatic enzymes in critically ill patients is a challenge and studies that would explain the clinical significance are scarce. As such, diagnostic and therapeutic guidance remains doubtful and requires more complementary exams, mainly radiological to change therapies or nutrition formulas, etc.

Based upon these issues, the authors proposed a study to determine the frequency of high serum lipase in critical patients in an intensive care unit and possible factors associated to their elevation, as well as assessment of the severity and clinical evolution of the patients. Levels of lipase were chosen because they are more specific and slightly more sensitive than those of amylase for diagnosis of acute pancreatitis.⁽²⁾

METHODS

A retrospective analysis of 189 medical charts relating to consecutive admissions in an intensive care unit

from January 1 to December 31 of 2006, was carried out after due authorization by the Ethics Committee. For the study a total of 102 patients were recruited. Included were admissions of a clinical, surgical and neurosurgical nature. Excluded were admissions due to acute pancreatitis, patients with a history of benign or malign pancreatic pathology, patients with serum creatinine >2mg/dl or admissions lacking clinical data. Patients less than 18 years old and admission of less than 72 hours were also excluded.

The following information was collected from the charts: 1) serum levels of amylase and lipase; the values were registered until normalization and the number of days of lipase elevation were calculated; values were considered altered when lipase was >300 UI/L and amylase >115U/L; 2) demographic and clinical data: age, gender, length of stay, mortality, tolerance to nutrition, fever (axillary temperature >38°C), arterial hypotension; systolic pressure <90mmhg), alcohol abuse or known hepatic pathology; 3) other laboratory and imaging data; glutamic oxalacetic transaminase (GOT) (>2 times normal value), pyruvic glutamyl transaminase (PTG) (>2 times normal value), alkaline phosphatase (AP) (>2 times normal value), hyperbilirubinemia >2mg/dL, anemia (hemoglobine <8g/dL), hyperglycemia >300mg/dL, high lactate >2.5mEq/L, bacteremia, pancreatic alterations suggestive of pancreatitis on abdominal ultrasound (greater pancreas volume, decrease of echogeneity, presence of peripancreatic or retroperitoneal collections) and abdominal computed tomography (CT) scan (localized or diffused edema, irregular contour, erasure of fat; heterogeneous areas with alteration in the parenchymal density, peripancreatic or retroperitoneal fluid collections); 4) indices of severity: Acute Physiological and Chronic Health Evaluation (APACHE) II, Sequential Organ Failure Assessment (SOFA), Simplified Acute Physiology Score (SAPS) II; 5) therapy and nutrition: need for mechanical ventilation, type of nutrition (enteral and parenteral) and therapeutic tolerance to propofol at 2%. Tolerance to enteral nutrition was assessed by presence of gastric stasis.

Patients were divided into two groups: 1) normal lipase; 2) high lipase. A comparison between the two groups was made for the variables studied, considering lipase as the dependent variable. Values of amylase and lipase were measured in all patients admitted to the intensive care unit in the period under study. Later, to distinguish the variables that differentiated

patients who did not develop high serum lipase from those who did, a discriminating analysis was made using the stepwise method.

For statistical treatment of the study data the SPSS (Statistical Package for the Social Science), version 16.0 of 2007 was used. Descriptive measurements were calculated (absolute and percentage frequencies, means, median and standard deviation and semi-interquartile ranges) and inferential measurements (Student's t test for difference of means, Mann-Whitney test, Chi-square, Odds Ratio coefficient and respective confidence interval of 95% and discriminating analysis), $p > 0.05$ was considered statistically significant.

RESULTS

Of the 102 patients studied, 39.2% developed high serum lipase which, in the mean, remained higher for 6.15 days (minimum (min)= 1, maximum (max)= 30 days. Of these patients, 37.5% (n=15) presented lipase values three times higher than normal. Mean of serum lipase was of 797 UI/ml (min = 13; max = 4594). The maximum value of serum lipase (4594 UI/ml) was detected in a 72 year old patient with respiratory failure in the context of a ricketsiosis, not presenting radiological changes and the elevation of lipase was noted for 5 days, with latter normalization. Elevated serum amylase was observed in 23.5% (n=24) patients.

Of these, 20.8% (n=5) did not present high serum lipase, and in this group, mean of amylase was of 64.8 U/L (min=3; max=345) and 79.1% (n=19), presented at the same time with high serum lipase and in these mean lipase was 140.6 U/L (min=30; max=703). A statistically significant difference was found in these two groups of patients ($p < 0.05$). Of patients with concomitant hyperamylasemia and high serum lipase, 52.6% (n=10) presented lipase values three times higher than normal, however the ratio was statistically non-significant. Of the patients 65.7% were male (Table 1). It was verified that the proportion of cases with or without high serum lipase was similar in both genders. Patients who developed high serum lipase presented a lower mean age, but the difference for the group of those who did not develop high serum lipase was statistically non-significant ($p > 0.05$). Patients with high serum lipase disclosed a significantly longer stay ($p < 0.001$). Diagnoses are shown in table 2, and no statistically significant differences were registered in the two groups ($p = 0.538$). A higher percentage of patients with a history of alcohol abuse and chronic

hepatopathy was found in the group with high serum lipase, however with no statistical significance in the comparison of the two groups, as shown on table 2. Groups of patients with high serum lipase presented higher results in the three severity indices studied (APACHE II, SOFA and SAPS), but differences for the group of patients who did not develop high serum lipase were statistically non-significant.

In terms of mortality no statistically significant differences were found between the two groups.

Regarding clinical and analytical characteristics of patients (Table 3), those that developed high serum lipase more often showed symptoms such as hypotension, hyperthermia, elevation of transaminases and alkaline phosphatase, hyperbilirubinemia, anemia, hyperglycemia and bacteremia. Regarding lactate increase, the proportion was higher in the group of patients who did not develop high serum lipase.

Analysis of table 3 shows that statistically significant differences were found only in the proportions of cases

Table 1 – Demographic and clinical variables

Variables	High serum lipase		Odds ratio (CI _{95%})	P value
	No (n = 62)	Yes (n = 40)		
Male gender	40 (64.5%)	27 (67.5%)	1.1 (0.5 – 2.6)	0.757
Age (years)	55.8 ± 18.5	48.7 ± 20.7	---	0.072
Length of stay (days)*	5.0 ± 3.5	13.5 ± 6.2	---	<0.001
APACHE II	18.4 ± 5.9	19.8 ± 5.2	---	0.239
SOFA	6.4 ± 3.8	7.8 ± 3.3	---	0.070
SAPS	38.9 ± 15.4	41.2 ± 15.3	---	0.476
Mortality	15 (24.2%)	5 (12.5%)	0.4 (0.1 – 1.3)	0.146
History of alcohol abuse	4 (6.45%)	4 (10%)	-	0.515
History of chronic liver disease	3 (4.83%)	2 (5%)	-	0.971

APACHE - Acute Physiology and Chronic Health Evaluation; SOFA - Sequential Organ Failure Assessment; SAPS - Simplified Acute Physiology Score

* Median ± semi-interquartile range, Mann-Whitney test

Table 2 – Clinical diagnoses

Diagnosis (n)	Lipase normal	Lipase elevated	Total
Clínical	16 (15.6%)	12 (11.7%)	28 (27.3%)
Septic shock	1	1	
Respiratory failure	14	8	
Heart failure	1	0	
Hellp syndrome	0	1	
Tetanus	0	1	
Anaphylactic shock	0	1	
Surgical	24 (23.5%)	18 (17.6%)	42 (41.1%)
Emergent surgery	2	3	
Vascular surgery	1	0	
Thoracic surgery	0	1	
Hepatic surgery	2	1	
Gastrointestinal surgery	6	3	
General surgery	7	1	
Politrauma	6	6	
Neurosurgical	22 (21.5%)	10 (9.8%)	32 (31.3%)
Brain injury	7	9	
Tumor/expanding lesion	10	1	
Aneurysm	5	0	
Total*	62 (60.7%)	40 (39.3%)	102 (100%)

p=0.538

Table 3 – Clinical and analytical characteristics

Variables	High serum lipase		Odds ratio (CI _{95%})	P value
	No (n = 62)	Yes (n = 40)		
Symptoms	5 (8.2%)	9 (22.5%)	-	0.074
SAP (<90 mmHg)	22 (35.5%)	19 (47.5%)	1.6 (0.7 – 3.7)	0.227
Creatinine (>2 mg/dl)	8 (12.9%)	8 (20.0%)	1.7 (0.6 – 4.9)	0.336
Fever (>38 °C)	21 (33.9%)	28 (70.0%)	4.6 (1.9 – 10.7)	<0.001
Transaminases (>2 times)	17 (27.4%)	24 (60.0%)	4.0 (1.7 – 9.2)	0.001
AP (>2times)	7 (11.3%)	10 (25.0%)	2.6 (0.9 – 7.6)	0.070
tB (>2 mg/dL)	3 (4.8%)	10 (25.0%)	6.6 (1.7 – 25.6)	0.003
Hemoglobin (<8 g)	12 (19.4%)	8 (20.0%)	1.0 (0.4 – 2.8)	0.936
Glucose(>300)	1 (1.6%)	1 (2.5%)	1.6 (0.1 – 25.7)	1.000
Lactate (>2.5 meq/l)	27 (43.5%)	14 (35.0%)	0.7 (0.3 – 1.6)	0.390
Bacteremia	4 (6.5%)	7 (17.5%)	3.1 (0.8 – 11.3)	0.079

SAP – systolic arterial pressure; AP –alkaline phosphatase; tB – total bilirubin

Table 4 – Therapies and nutrition

Variables	High serum lipase		Odds ratio (CI _{95%})	P value
	No (n = 62)	Yes (n = 40)		
Parenteral nutrition	12 (19.4%)	27 (67.5%)	8.6 (3.5 – 21.6)	<0.001
Enteral nutrition	32 (51.6%)	28 (70.0%)	2.2 (0.9 – 5.1)	0.065
Tolerance to enteral nutrition	29 (90.6%)	25 (89.3%)	0.9 (0.2 – 4.7)	0.863
Mechanical ventilation	50 (80.6%)	38 (95.0%)	4.6 (1.1 – 21.6)	0.040
Propofol 2%	34 (54.8%)	29 (72.5%)	2.2 (0.9 – 5.1)	0.073

Table 5 – Summary of results of discriminant analysis

Variables	Coefficient	Wilk Lambda	P value
Parenteral nutrition	1.639	0.766	< 0.001
Length of stay	1.175	0.667	< 0.001
Fever	0.694	0.652	< 0.001
Constant	-2.700	---	---
Discriminant analysis		0.642	< 0.001

of hyperthermia, of rise in transaminases and hyperbilirubinemia.

With regard to the type of nutrition administered (Table 4), patients submitted to artificial nutrition (parenteral or enteral) presented high serum lipase more often, with a statistical significance regarding parenteral nutrition, when both groups were compared. There was no statistical difference related to enteral nutrition in both groups.

Furthermore, a higher proportion of patients with high serum lipase was found in those submitted to mechanical ventilation and propofol at 2% therapy (Table 4).

There were no statistically significant differences among groups regarding mechanical ventilation (p=0.

040). Radiological studies (abdominal ultrasound or CT scan) were performed in 19 (30.6%) patients with no high serum lipase while one was found to have pancreatic heterogeneity. Of patients with high serum lipase, 17 (42.5%) were submitted to x-ray studies and radiological changes were detected in two: pseudo-pancreatic cyst in a patient submitted to emergency surgery (maximum lipase 492UI/l) and presence of peripancreatic collections in a politrauma patient (maximum lipase 1069 UI/L).

Finally, in the discriminating analysis performed (Table 5), the independent variables were those positively associated to high serum lipase, that is to say, length of stay, fever, elevation in transaminases, parenteral nutrition and mechanical ventilation. This analysis disclosed

the existence a single function with a highly significant discrimination power formed by the variables parenteral nutrition, length of stay and fever.

Considering these results it can be stated that these are the variables which more significantly differentiate patients who developed high serum lipase from those that did not. Values of the coefficient allow writing the discriminating function as follows:

High serum lipase = $1.639 \times \text{parenteral nutrition} + 1.175 \times \text{length of stay} + 0.694 \times \text{fever} - 2.700$

According to the coefficient obtained, patients with high serum lipase, more frequently receive parenteral nutrition, tend to have a longer stay and develop fever.

According to results of table 6, in overall terms the function correctly classified 75 of the 102 patients, corresponding to 73.5% of correct classifications.

Table 6 –Observed and predicted results based on the discriminant analysis

Observed results	Predicted results based on discriminant analysis		
	High serum lipase	No	Yes
	No	43 (69.4)	19 (30.6)
	Yes	8 (20.0)	32 (80.0)

DISCUSSION

Elevation of serum lipase and amylase is a common problem in clinical practice of an intensive care unit and is not exclusive of pancreatic inflammation.⁽¹²⁻¹⁵⁾ There are few studies in this domain. That is why the authors proposed to conduct a retrospective study of a series of patients in a polyvalent intensive care unit with surgical neurological or clinical admissions and assess their incidence and factors related to clinical severity of these patients. In this series we found this alteration of serum lipase in a significant number of patients, with concomitant elevation of amylase in a smaller number of patients.

As was to be expected in most patients hyperamylasemia occurred together with elevated lipase. In most cases this elevation did not reach diagnostic levels (62.5%) that is to say, 3 times higher than normal and according to the ACG guidelines this was associated to a condition of pancreatitis in only four patients. We of course, emphasize that, in the majority, these cases were intubated and sedated patients making clinical diagnosis more difficult. Indeed, a minority of patients had symptoms that could be those of acute pancreati-

tis. In these patients, imaging exams may play a very important role to reach a diagnosis. Abdominal ultrasound, even though it is a safe exam, presents limitations for study of the pancreas, notably low sensitivity for diagnosis of high serum lipase inflammation, fluid collections or necrosis. Abdominal TC scan is the gold standard technique for diagnosis of acute pancreatitis, to confirm diagnosis, exclude alternative diagnoses and determine the severity and presence of complications.⁽²⁾ Although more sensitive, it however entails some risks mainly, according to some authors, it worsens pancreatic necrosis due to microcirculation alterations caused by the intravenous contrast.⁽²⁾ In this study we found pancreas morphological alterations in a small number of patients with high serum lipase and of the two patients, only one presented an elevation higher than three times the normal value. Nevertheless we stress that the radiological study had been performed in a small percentage of patients and according to not well explained criteria, limitations inherent to a retrospective study such as this one. As previously described, in some prospective studies carried out with abdominal TC scan in a group of patients with identical characteristics, the percentage of alterations was small and with little clinical significance.^(7,11,12)

No significant difference was found in the incidence of high serum lipase in clinical or surgical patients. The patient with the highest lipase value, as already mentioned, presented a condition of respiratory failure in the context of ricketsiosis. This patient did not present a concomitant elevation of amylase. In a review of literature few reports on acute pancreatitis in ricketsiosis are found.⁽¹³⁾ In our study we further found that high serum lipase was not associated to greater clinical severity as assessed by the prognostic indices or by higher mortality. Nevertheless it was related to longer stay and presence of mechanical ventilation. High serum lipase in ventilated patients may related to ischemic phenomena in the pancreatic microcirculation and changes in the vascular tone of the body circulation, including cranial pressure, caused by alterations in blood gases and ventilation induced pressure alterations.^(14, 16-18)

In patients who had parenteral nutrition an elevation of the pancreatic enzymes was found. Such data were corroborated by literature, which may be, for instance, related to elevation of serum triglycerides or appearance of billiary mud.^(19, 20) This was not true for enteral nutrition that even in patients with high lipase was well tolerated. That is to say, no greater gastric stasis or paralytic ileus were found hindering such form of

nutrition. It is noteworthy that all patients receive this form of nutrition by nasogastric tube. No higher frequency of high serum lipase was noted using propofol possibly because this drug when used at 2% has lower lipid content than the formula at 1%.^(8,9, 21-23)

Elevation of serum lipase also disclosed a rise in transaminases and bilirubin which might be related to cholestasis phenomena, notably a higher frequency of biliary mud in these patients.

At multivariate analysis we observed the factors that most often distinguish patients with high serum lipase, longer length of stay, presence of parenteral nutrition and fever. When present, these variables focused our attention on the finding of high serum lipase and may help to select patients for whom analysis of these may be really important.

CONCLUSION

To summarize, overall results of this retrospective study were those expected and most often found in references. Although, because of the number of samples, statistically significant conclusions could not be reached, this study highlights in critically ill patients, the high frequency of high serum lipase that in the majority of cases did not add clinical severity or higher mortality, while it is related with longer stay. A minority of patients met the criteria for diagnosis of acute pancreatitis. These results might signal that in the majority of cases these elevations may be an epiphenomenon of a more severe disease.

Other studies are needed to help interpret these alterations and to answer these frequent questions.

RESUMO

Objetivos: A elevação da lipase e amilase séricas são frequentemente encontradas em doentes internados em unidade de terapia intensiva sem que exista doença pancreática prévia, constituindo um desafio diagnóstico e terapêutico. Baseados nesta evidência os autores propuseram-se a determinar a incidência de hiperlipasemia assintomática nos doentes críticos, fatores desencadeantes e evolução clínica destes doentes.

Métodos: Estudo retrospectivo dos doentes internados na unidade de terapia intensiva de 1 de janeiro a 31 de dezembro de 2006, excluídas internações por pancreatite aguda, história de patologia pancreática, insuficiência renal ou falta de dados. Pacientes foram distribuídos em dois grupos (com e sem hiperlipasemia) e feita comparação considerando diversas variáveis clínicas, laboratoriais, imagiológicas. Análise estatística: SPSS 13; testes *t* de Student e χ^2 (IC 95%), com significância estatística se $p < 0.05$.

Resultados: Incluídos 102 doentes, a hiperlipasemia esteve presente em 39.2% deles. Lipase média de 797U/L. Os doentes com hiperlipasemia tiveram mais dias de internação ($p < 0.001$), nutrição parenteral ($p < 0.001$), ventilação mecânica ($p = 0.04$), temperatura $> 38^\circ\text{C}$ ($p < 0.001$), hiperamilasemia ($p < 0.05$), hiperbilirrubinemia ($p = 0.003$) e elevação das transaminases ($p = 0.001$), sem diferença significativa em diagnósticos, sexo, idade, APACHE II, SOFA, SAPS, mortalidade, hipotensão, fosfatase alcalina, hemoglobina, lactato, tolerância à nutrição enteral e utilização de propofol. O estudo radiológico revelou alterações morfológicas do pâncreas em dois doentes com hiperlipasemia.

Conclusões: A elevação da lipase sérica foi frequente, relacionou-se com internação prolongada, mas não se acompanhou de aumento dos índices de gravidade clínica ou mortalidade. Foi mais frequente nos doentes submetidos a nutrição parenteral. Uma minoria preencheu os critérios de pancreatite aguda.

Descritores: Pancreatite; Lipase; Amilases; Unidades de terapia intensiva

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