http:// ijp.mums.ac.ir
Original Article (Pages: 7213-7217)

The Study Of Diagnostic Value of Elevation of Serum Amylase as a Predictive Factor for Appendiceal Perforation in Children with Acute Appendicitis

*Omid Amanollahi[1], Sakineh Tat[1]

[1]Department of Surgery, School of Medicine, Kermanshah University of Medical Sciences, Kermanshah, Iran.

Abstract

Background

Recent studies indicate increased serum amylase in children with acute appendicitis. The objective of the current study was to determine the diagnostic accuracy of raised serum amylase level in prediction of perforated appendicitis in children with acute appendicitis.

Materials and Methods

In this cross-sectional study, 61 children (aged 3 to 15 years) who underwent appendectomy surgery due to acute appendicitis at two university hospitals in Kermanshah, Iran, from 2015 to 2016 were included. The diagnosis of appendicitis was confirmed with histopathologic examination. Before surgery, venous samples were obtained and serum amylase, lipase, alanine aminotransferase (ALT), aspartate aminotransferase (AST), and alkaline phosphatase were assayed. The patients were divided into two groups: perforated appendicitis (18 cases) and non-perforated appendicitis (43 cases). The laboratory tests were compared between the two groups.

Results

The mean (±standard deviation) serum amylase level was 69.2 (±28.9) mg/dL in perforated group and 29.9 (±11) mg/dL in non-perforated group (P< 0.001). At serum level of 46 mg/dL, serum amylase had a sensitivity of 89% and its specificity was 100% in prediction of acute perforated appendicitis.

Conclusion

The serum amylase level in perforated appendicitis was significantly higher compared to patients with non-perforated appendicitis. Serum amylase has good diagnostic value in prediction of perforated appendicitis.

Key Words: Appendicitis, Children, Perforation; Serum amylase.

*Please cite this article as: Amanollahi O, Tat S. The Study Of Diagnostic Value of Elevation of Serum Amylase as a Predictive Factor for Appendiceal Perforation in Children with Acute Appendicitis. Int J Pediatr 2018;6(2):7213-17.DOI:**10.22038/ijp.2018.28307.2457**

Corresponding Author:

Omid Amanollahi, Dep. of surgery, School of Medicine, kermanshah University of Medical Sciences, Kermanshah, Iran.

E-mail: oamanollahi@gmail.com

Received date: Oct.27, 2017; Accepted date: Dec.12, 2017

1- INTRODUCTION

Abdominal pain is one of the most prevalent encountered symptoms in emergency services. The causes of abdominal pain in children are diverse and include simple causes such as constipation to more dangerous one including volvulus and appendicitis. However, appendicitis is the most common cause of abdominal pain among children who present outpatient clinics or emergency units (1, 2). The diagnosis of acute appendicitis is not easy, especially in younger children who cannot talk and describe the pain accurately. Therefore, appendicitis becomes perforated in about one-third of such patients before the diagnosis is made (3, 4). In fact, the probability of appendix perforation is highest in extreme ages (children < 5 years and elderly older than 65 years) compared to other age groups (3). The high prevalence of appendicitis perforation in children is due to limitations in using imaging devices owing to the risk of irradiation (CT- scan), no access to experienced staff all the day (24 hours) in ultrasound services, and high costs. Therefore, it is likely that definitive treatment of the appendicitis faces delay due to the mentioned limitations (5).

The evidence demonstrates that acute appendicitis is the second common condition in children (following meningitis) that the correct diagnosis may not be made in emergency units (6). Some studies have reported perforated appendicitis as high as 80% to 100% in children younger than 4 years (7-9). In contrast, the rate of this condition reaches 10 to 20% in the age range of 10 to 17 years (4, 7, 10, 11). In the case of appendicitis perforation, severe complications such as bacterial peritonitis, sepsis, small bowel obstruction, and intra-abdominal abscess can develop. Even bacterial peritonitis can have a mortality rate of 80 to 100% (12).

Regarding the importance in making the diagnosis of appendicitis, in particular perforated appendicitis and to enhance the ability of medical personnel accordingly, laboratory methods have been investigated recently. One of these methods is the serum amylase assay. Amylase is an enzyme which causes hydrolysis of carbohydrates chains such as starch. This enzyme is secreted in saliva, pancreatic enzymes, and the small bowel. The serum level of amylase is raised when pancreatic tissue injury occurs as in pancreatitis and pancreatic duct obstruction (13).

Some studies have noted raised serum amylase level in patients firstly observed for pancreatitis. However, later it was found that they had acute appendicitis which became perforated and resulted in serious complications (14). However, limited studies have been done so far to evaluate the diagnostic accuracy of serum amylase in the diagnosis of perforated appendicitis with controversial results. On the other hand, no study has been done to assess the diagnostic accuracy of serum amylase among children with acute appendicitis. Therefore, the current study was done to determine the diagnostic accuracy of serum amylase level in prediction of perforated appendicitis in children.

2- MATERIALS AND METHODS

All children within the age range of 3 to 15 years who were admitted due to acute appendicitis and received appendectomy were included. The patients were admitted to Imam Reza and Mohammad Kermanshahi hospitals, Kermanshah, Iran, from 2015 to 2016. The study protocol was approved by the university ethics committee. The parents of the patients were informed about the study objectives and consent was obtained prior to venous blood sampling. The study protocol was in conformity with Declaration of Helsinki. Inclusion criteria consisted of patients for

whom diagnosis of acute appendicitis was made and underwent appendectomy as well as the age range of 3 to 15 years. Exclusion criteria were other causes of acute abdomen such as invagination, hernia, and pancreatitis, previous history of hepatitis, hemolytic diseases, liver diseases, renal diseases, and accidental appendectomy due to other causes of acute abdomen. The diagnosis of acute appendicitis was made by the surgery resident using clinical examination and laboratory tests.

Venous samples were obtained from all patients before transfer to the operation room. The serum levels of amylase, lipase, alanine aminotransferase (ALT), aspartate aminotransferase (AST), and alkaline phosphatase were assayed. Age and gender of the patients were also documented. After the appendectomy, the surgical samples were sent to the pathology laboratory to confirm the diagnosis of acute appendicitis. If the pathological examination did not confirm the diagnosis of appendicitis, the patient was excluded. The data were analyzed by SPSS software (ver. 18.0) using the chi-square test, t-test, Leven's test, and the Mann-Whitney U test. In order to determine the sensitivity and specificity of serum amylase, the Receiving Operating Characteristic (ROC) curve was applied.

3- RESULTS

A total of 61 patients were studied. There were 18 patients with perforated appendicitis and 43 with non-perforated appendicitis. Mean (±standard deviation [SD]) age of perforated and non-perforated appendicitis patients were respectively 9.5 (±3.1) years and 7.8 (±3.6) years, P= 0.195. The male-to-female ratio was 12 to 6 in perforated group and 27 to 16 in non-perforated group (P= 0.774).

No statistically significant difference was observed between the two groups regarding ALT, AST, alkaline phosphatase, and lipase. However, mean serum amylase level in perforated group (69.2± 28.9 mg/dL) was higher than in non-perforated group (29.9± 11 mg/dL); P< 0.001 (**Table.1**). According to the ROC curve analysis, at serum level of 46 mg/dL, serum amylase had a sensitivity of 89% and specificity of 100% in prediction of acute perforated appendicitis.

Table-1: The comparison of the laboratory tests studied in children with perforated appendicitis vs. those with non-perforated appendicitis.

Laboratory assays	Perforated group (n= 18)	Non-perforated group (n= 43)	P-value
AST, mg/dL	27.1 (±6.6)	25.8 (±8.9)	0.733
ALT, mg/dL	16.6 (±7.2)	14.6 (±4)	0.416
ALkP, mg/dL	590 (±99)	489 (±125)	0.283
Amylase, mg/dL	69.2 (±28.9)	29.9 (±11)	< 0.001
Lipase, mg/dL	38 (±20.2)	27.5 (±17)	0.092

AST: aspartate aminotransferase; ALT: alanine aminotransferase; AlkP: alkaline phosphatase.

4- DISCUSSION

In this study, we decided to evaluate the diagnostic accuracy of serum amylase level in the diagnosis of perforated acute appendicitis in children. The results showed that serum amylase level was higher in perforated appendicitis vs. non-perforated group. In the case of perforated appendicitis, some serious complications can occur such as bacterial peritonitis,

sepsis, small bowel obstruction, and intra-abdominal abscess formation (12). Therefore, timely diagnosis of acute appendicitis is of paramount importance to avoid such complications. Even though raised serum amylase level is generally reflective of acute pancreatitis, in some conditions such as small bowel perforation amylase can also elevate. In a previous study on 1,000 patients with perforated peptic ulcer disease, it was reported that besides pancreatitis, raised serum amylase level was also observed in conditions such as obstruction, carcinoma, renal diseases, liver diseases, and in particular small bowel perforations (13). In another study, the authors mentioned increased serum amylase level in acute appendicitis (14).

A former case report mentioned considering acute appendicitis in patients with increased serum amylase level. The authors added that sometimes acute appendicitis may be misdiagnosed in the setting of increased serum amylase level. If the diagnosis is made promptly, the patients are treated faster and will have better recovery period (15). Although some case reports (16, 17) have indicated acute appendicitis with elevated serum amylase level without acute pancreatitis, some other studies showed controversial results. For instance, a previous study that evaluated ischemia-related indices in 200 patients with acute appendicitis showed that only elevated white blood cell count was a reliable marker in the diagnosis of acute appendicitis. However, other markers including ALT, AST, Alkaline phosphatase (ALKP), Lactate dehydrogenase (LDH or LD), and amylase were not useful for the diagnosis of acute appendicitis (18).

5- CONCLUSION

The serum amylase level in perforated appendicitis was higher than non-perforated group among children with acute appendicitis. Serum amylase can have high diagnostic accuracy in the diagnosis of acute appendicitis. Further studies to evaluate this elevated serum amylase in children with acute appendicitis in order to understand better the role of serum amylase is necessary.

6- CONFLICT OF INTEREST: None.

7- REFERENCES

1. Reynolds SL, Jaffe DM. Diagnosing abdominal pain in a pediatric emergency department. PediatrEmerg Care. 1992; 8(3):126-28.

2. Scholer SJ, Pituch K, Orr DP, Dittus RS. Clinical outcomes of children with acute abdominal pain. Pediatrics. 1996; 98(4):680-85.

3. Smink DS, Fishman SJ, Kleinman K, Finkelstein JA. Effects of race, insurance status, and hospital volume on perforated appendicitis in children. Pediatrics. 2005; 115(4):920-25.

4. Bratton SL, Haberkern CM, Waldhausen JH. Acute appendicitis risks of complications: age and Medicaid insurance. Pediatrics. 2000; 106(1):75-8.

5. Bundy D G, Byerley JS, Liles EA, Perrin EM, Katznelson J, Rice HE. Does This Child Have Appendicitis? JAMA 2007; 298(4):438-51.

6. Selbst SM, Friedman MJ, Singh SB. Epidemiology and etiology of malpractice lawsuits involving children in US emergency departments and urgent care centers. PediatrEmerg Care. 2005; 21(3):165-69.

7. Addiss DG, Shaffer N, Fowler BS, Tauxe RV. The epidemiology of appendicitis and appendectomy in the UnitedStates.AmJEpidemiol. 1990; 132(5): 910-25.

8. Horwitz JR, Gursoy M, Jaksic T, Lally KP. Importance of diarrhea as a presenting symptom of appendicitis in very young children. Am J Surg. 1997; 173(2):80-2.

9. Grosfeld JL, Weinberger M, Clatworthy HW Jr. Acute appendicitis in the

first two years of life. J Pediatr Surg. 1973; 8(2):285-93.

10. Luckmann R. Incidence and case fatality rates for acute appendicitis in California: a population-based study of the effects of age. Am J Epidemiol. 1989; 129(5):905-18.

11. Rothrock SG, Pagane J. Acute appendicitis in children: emergency department diagnosis and management. Ann Emerg Med. 2000; 36(1):39-51.

12. Schwarz A, Bolke E, Peiper M. Inflammatory peritoneal reaction after perforated appendicitis: continuous peritoneal lavage versus non lavage. Eur J Med Res 2007; 12:200 –5.

13. Rogers F. Elevated Serum Amylase: A Review and an Analysis of Findings in 1,000 Cases of Perforated Peptic Ulcer. Annul Surg. 1960; 153 (2): 228-40.

14. Swensson EE, Maull KI. Clinical significance of elevated serum and urine amylase levels in patients with appendicitis. Am J Surg. 1981; 142(6):667-70.

15. Ganesh M, Salam I. Lessons to be learned: a case study approach--acute appendicitis masquerading as macroamylasaemia. J R SocPromot Health. 2008; 128(3):140-2.

16. Forster MJ, Akoh JA. Perforated appendicitis masquerading as acute pancreatitis in a morbidly obese patient. World J Gastroenterol 2008; 14(11): 1795-96.

17. J W Um, Kim KH, Kang MS, Choe JH, Bae JW. Macroamylasemia in a patient with acute appendicitis: a case report. J Korean med sci. 1999; 14: 679-81.

18. Menéndez-Arzac R, Cárdenas-Lailson E, Sanjuán-Martínez CA, Rebolledo-López G, Parraguirre-Martínez S, Léon L, Mata-Miranda Mdel P. Acute intestinal ischemia serum markers for the diagnosis of acute appendicitis Cir Cir. 2005;73(6):449-52.