

Accuracy of Base Deficit in Diagnosis of Intra-Abdominal Injury in Pediatrics with Blunt Abdominal Trauma

Hojjat Drakhshanfar¹, Mojtaba Sanji Rafsanjani¹, Majid Shojaee¹,
Hamid Reza Hatamabadi^{1,2}

¹Emergency Medicine Department, Imam Hossein Hospital, Shahid Beheshti University of Medical Sciences, Tehran, Iran

²Safety promotion and injury prevention research center, Shahid Beheshti University of medical sciences, Tehran, Iran

ABSTRACT

Background: Blunt trauma is one of the leading cause of mortality among pediatrics. Finding sensitive, rapid and non-invasive diagnostic tests for trauma pediatrics is always a challenge in emergency medicine. metabolic acidosis after blunt trauma resulted in base deficit (BD). The aim of this study is evaluating of the accuracy of BD in diagnosis of blunt trauma injuries in pediatrics.

Method: this descriptive analytical study was done on patients (<18 years) in Imam Hossein hospital in 2012. Demographics, blood pressure, palpitation rate, BD and need to blood transfusion was registered in patients check list. CT and sonography was performed for diagnosis of intra abdominal injures.

Results: totally 127 patients participated in this study. The mean \pm SD of the year was 9.5 ± 5 years. Cut of point for BD was -4.5 with sensitivity of 91% and specificity of 86%. Positive and negative predictive values were 71% and 97.7% respectively. 30.7% (n=39) of patients with intra abdominal injures had BD<-4.5. significant difference was seen between BD with total condition of patients ($P<0.05$). 80% of hospitalized patients had BD<-4.5 ($P<0/01$). There was no significant difference between BD and need to blood transfusion.

Conclusion: Our data showed that BD among pediatrics population with blunt abdominal trauma can predict intra abdominal injuries. More prospective and retrospective studies should be done for validation of the findings.

KEYWORDS: blunt abdominal trauma, pediatrics, accuracy, diagnosis, prediction.

1. INTRODUCTION

Trauma is the most common cause of death in people under 50 years and is the third leading cause of death (1-5). The prevalence of abdominal trauma was still rising and abdomen is the third part of the body that requires surgery following abdominal trauma. Given the risks and dangers of abdominal CT scan in children and high prevalence of abdominal trauma in children finding out the non-invasive, safe, sensitive, and rapid diagnostics in the emergency department has utmost importance(6-11).

In the previous studies the sensitivity of base deficit in diagnosis of intra abdominal injuries has been confirmed, but in the field of evaluating this subject in children, only few studies have been conducted. Base deficit is the amount of base in term of mMol per liter of whole blood for a titer to completely saturate the blood with oxygen conditions at pH = 7.4 at 37 ° C (12).

Studies have shown that an intensive deficiency of base, most patients with trauma face with bleeding shock (13). Inadequate tissue perfusion leads to metabolic acidosis due to anaerobic metabolism. In previous studies, base deficit was reported as a critical factor in the diagnosis of blunt abdominal trauma injuries as well as the only significant predictor of mortality in elderly patients with traumatic injuries.(14-16). In addition, in one study it was observed that base deficit has been a predictor factor of mortality and severe head trauma among children(17). The aim of this study was to evaluate the diagnostic accuracy of base deficit in order to determine intra abdominal injury in children with blunt abdominal trauma.

*Corresponding Author: Dr.Mojtaba Sanji Rafsanjani, Resident of Emergency Medicine. Imam Hossein Hospital, Shahid Beheshti University of Medical Science, Tehran, Iran.
Email: dr.msanji@yahoo.com, tel: +989133913383

METHOD

This study was done in 2012 on children aged 1 to 18 years who suffered blunt abdominal trauma and referred to Imam Hossein hospital and Shohada e Hafte Tir hospital. Patients with penetrating abdominal trauma, with head trauma, inability to track individual or parental consent to participate in the study, the presence of confounding experimental diabetic acidosis Base deficit as Ketoacidosis , alcohol use, burns, chronic inflammatory disease, acute myocardial infarction, fracture , poisoning, or taking certain medications such as bicarbonate infusion were excluded. Also, if there is an interval of 45 minutes between the times of the accident until the blood taking (due to the influence of base deficit), the samples were excluded from the study.

Demographic and clinical data of patients including age, sex and underlying diseases, vital signs, mechanism of trauma, physical examination, and medical tests and diagnostic procedures (sonography, CT scan, laparotomy) and outcome of patients at the time of getting out by the medical emergency assistant were completed. In addition to measuring compliance with sterilization and heparinated Base deficit to one milliliter of peripheral venous blood was taken ill at the time of admission. Data was analyzed by SPSS software versio 20. $P < 0.05$ were considered significant.

RESULTS

A total of 127 patients participated in the study, of whom 104 were male (81.9%) and 23 patients (18.1%) were female. The mean age of the patients was 9.5 ± 5 years and duration of patients presence in the emergency department was 4.7 ± 2.5 hours. 84 patients (66.1%) were hospitalized in the ED and 43 patients (33.9%) were hospitalized in the ward. 39 patients (30.7%) suffered Intra abdominal injuries and 88 (69.3%) were diagnosed without abdominal injuries.

Type of injury was diagnosed as follows: 9 cases of hematoma of the liver, spleen hematoma in 3 cases, 2 cases of renal hematoma, 23 cases of liquid, 3 cases of liver laceration and two cases of spleen laceration. Also 8 patients (6.3%) needed blood transfusions.

Finally, 82 patients (64.6%) were discharged, 24 patients (8.9%) were admitted to the surgical ward, 7 patients (5.5%) were admitted to the intensive care unit, 11 patients (8.7%) were transferred to the operating room and 3 patients (2.4%) died.

Clinical data are summarized in Table 1. The cut point for the amount of base deficit or BD was obtained -4.55 with a sensitivity of 91% and specificity of 86%; positive predictive value (PPV) was 71.05 and negative predictive value (NPV) was 97.70.

Logistic regression analysis: In this section, the relationship between the blood transfer, final condition and base deficit with IAI were evaluated. From variables in the regression model only base deficit and the patient's condition were significant. Results of logistic regression model showed that base deficit in patients who have been admitted to one of the above reasons is 49.5 times more than the patients who were discharged. Furthermore, the chance of base deficit for patients with IAI is 14 times more likely than the other patients. The blood transfusion was not significant in this model and so this factor does not affect the base deficit. There was a significant correlation between base deficit and intra-abdominal injury ($P < 0.05$)

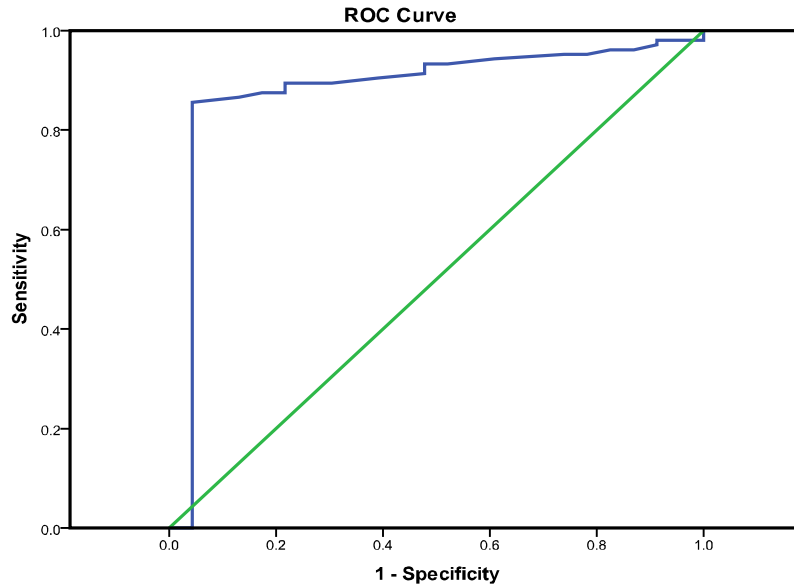
Of the 39 who had intra abdominal injury, 34 persons had base deficit of less than -4.5 and 5 persons had greater than -4.5. Totally 86 persons were detected without injuries of whom 83 persons had base deficit more than -4.5 and only 3 persons had base deficit of less than -4.5.

Table 1 Measured variables of patients

Variables	Result
Age (y), mean \pm SD	34.8 ± 17.1
Sex	male: 104(81.9) Female: 23(18.1)
SBP (mm Hg), mean \pm SD	10 ± 1.7
DBP (mm Hg), mean \pm SD	6 ± 0.9
Pulse rate, mean \pm SD	95 ± 26.8
PcO ₂ (mm Hg), mean \pm SD	40 ± 0.5
Abdominal injury	39 (30.7)
Blood transfusion	8 (6.3)

DBP indicates diastolic blood pressure; SBP, systolic blood pressure

Figure 1: ROC curve



Also a significant difference was observed between the conditions of patients with base deficit ($p < 0.05$) (Table 2).

Table 2: the relation between base deficit and patients' conditions.

Final condition	Base Deficit	
	< -4.55	≥ -4.55
discharge	2	80
Hospitalization in surgery	18	6
Hospitalization in ICU	6	1
Under operation	10	1
death	1	2

DISCUSSION

This study was conducted regarding the accuracy level of base deficit diagnosis in abdominal injuries in children who suffered blunt abdominal trauma in Imam Hussein and Haft eTir educational Hospitals.

The results showed that base deficit is less than or equal to -4.5 and it can greatly show intra-abdominal injury among children; In a way that in the current study, we observed that among the 39 persons who had injuries, 34 patients had base deficit less than or equal to -4.5. The use of base deficit criterion in the evaluation of patients with trauma is so effective especially to estimate the frequency of shock performance, efficiency of rehabilitation and organizing the health care resources (18). Despite of this, only few studies have been done in the field for the use of this criterion among the children that in each of these studies a different cut point has been obtained for the amount of base deficit.

Several studies have shown that base deficit has a significant relation with shock intensity and it is a predictor of organ damage (19), death (20), intra-abdominal injury (21), and hemorrhage (22,23).

Rutherford in a study examined the accuracy of base deficit in the adult population. They found that base deficit of -15 indicates the likelihood of death by 25 percent in patients younger than 55 years without a closed head injury(24). In another study, the cut point of -11 with the risk of mortality of 25 % was obtained in these patients(25). In a similar study the likelihood of death of 25 % with the base deficit of -8 was stated in a population of patients who suffered a closed head injury(26). For the population less than 12 years reported the base deficit of -6.

(27-30). In the study that was conducted by Mofidi about the diagnostic accuracy of blunt abdominal trauma, it was found out that the base deficit greater than -6 shows the lack of intra-abdominal injury. While that the base deficit less than or equal to -6 has a strong relation with the risk of abdominal bleeding. In the current study, the amount of base deficit of less than -4.5 indicates the occurrence of intra abdominal injuries which this amount is so close to the above result, although Mofidi et al conducted their study in the adult population and the findings of the current study was done for population of children.

In another study (31), base deficit of less than 11.8 indicated a 50 percent chance of death. Randolph (32) in his study concluded that base deficit is a predictive factor which can be used for post-traumatic shock, and the base deficit less than or equal to -5 is followed by 37 percent of the deaths. In another study that was performed about evaluating base deficit as a predictor factor for the transfusion need and death among the children with intensive trauma (except head trauma), in case of base deficit less than or equal to -8, the mortality chances is equal to 13.6 %. Also in this study, blood transfusion was not a predictor of mortality.

In the study of Mofidi, base deficit was significantly associated with the need for blood transfusions so that 68% of patients required less than or equal to -6 base deficit of blood transfusions. However, the present study showed no correlation between the need for blood transfusions and the base deficit. Our findings in this case are inconsistent with the study of Mofidi and Dawis (33). In the study of Mofidi, the children and pregnant women taking part in the study that their base deficit was less than or equal to -6, all had intra abdominal bleeding and they required blood transfusion. In this research, there was a significant relation between the levels of base deficit with the patients' final condition. This finding indicates that the base deficit less than -4.5 has been able to predict patient deterioration so that 80 percent of patients who were not discharged and required hospitalization and surgery or died, their base deficit was less than 4.5. Of course it is necessary to note that the base deficit higher or equal to -4.5 can not predict the lack of intra-abdominal injury.

CONCLUSIONS

The findings of this study suggest that base deficit with the normal amount does not indicate the lack of intra abdominal injury in children, while the base deficit less than -4.5 can strongly predict the intra abdominal injuries. However, there was no significant relation with patient need for blood transfusions.

Good values of sensitivity 91% and specificity values of 86% for the cut point (base deficit of -4.5) indicates that this indicator can predict the injuries in the patients with blunt abdominal trauma. Further prospective and retrospective studies should be undertaken to validate and extend these findings.

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