

ORIGINAL RESEARCH

**The Relationship Between Initial Hematocrit and Base Excess For Signs Of Hemorrhagic Shock In Patients With Blunt Abdominal Trauma**

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**Abstract**

**Introduction:** Trauma abdominal and pelvic part of the largest causes of death and, if diagnosed early, the deaths could have been prevented. By increasing the capacity for early detection and prompt and appropriate action, will produce a satisfactory outcome. In patients with bleeding, hemodilution appear within a few minutes to obtain a decrease in hematocrit. BE decline is the result of pyruvic acid metabolism occurring anaerobic tissue hypoperfusion due to bleeding unresolved. There is a strong correlation between the decrease in hematocrit and BE with shock because of intra-abdominal haemorrhage. To analyze the relationship between decreased hematocrit and BE in bleeding patients we investigated the relationship between the initial value of hematocrit and BE against any signs of shock because of intra-abdominal hemorrhage in patients with blunt abdominal trauma.

**Methods:** cross-sectional of the 34 subjects. The research data obtained from history taking, physical examination, investigation, and medical records. Conducted a comparative analysis of Kruskal-Wallis. Test for normality by Kolmogorov-Smirnov test. A p value <0.05 indicates a significant relationship between variables. Data were analyzed using SPSS version 19.

**Result:** It was found an average increase in the pulse (P) frequency with decreasing hematocrit (Ht) is  $92.67 \pm 6.43x / \text{min}$  for group  $Ht > 40\%$ ,  $95.5 \pm 16.52x / \text{min}$  for group  $Ht 37-40\%$ , and  $112.89 \pm 19.23x / \text{min}$  for group  $Ht < 37\%$ . Obtained an average increase of P frequency with decreasing Base Excess (BE) is  $88.0 \pm 0x / \text{min}$  for groups  $BE > 2$ ,  $92.33 \pm 7.84x / \text{min}$  for BE Group 2 - (- 2), and  $112.81 \pm 19.22x / \text{min}$  for groups  $BE < -2$ . This means that there is a significant relationship between hematocrit decrease with increased of P frequency as one of the signs of hemorrhagic shock with p value = 0.046 and significant correlation between the

*decrease in BE with increased P frequency as one of the signs of hemorrhagic shock with p value = 0.028.*

**Conclusion:** *There is a significant correlation between the value of the initial hematocrit and BE with signs of hemorrhagic shock due to intra-abdominal hemorrhage in patients with blunt abdominal trauma.*

**Keywords:** *hematocrit, base excess, signs of hemorrhagic shock, pulse frequency, blunt abdominal trauma*

## Introduction

Trauma is the leading cause of death 4th largest in the United States and the cause of death at the age under 45 years old. Abdominal trauma can be a blunt trauma, sharp trauma, and trauma deceleration, which can result in morbidity and mortality. Abdominal and pelvic trauma is part of the largest causes of death and, if diagnosed early, the deaths could have been prevented. Therefore quick and precise diagnosis is crucial to reduce morbidity or mortality. Most of the deaths were preventable (preventable death) caused by not knowing there was intra-abdominal bleeding. 15-20% of all patients with blunt abdominal trauma requiring laparotomy, especially solid organ hemorrhage caused by traffic accidents, require accurate diagnostic to avoid negative laparotomy.<sup>1</sup>

Bleeding affect the balance of the needs and the intake of oxygen in our body, when bleeding more and more and not offset the decreased oxygen intake. Base excess (BE) describes the amount of strong acid or base to be added to make the pH of the blood to normal. BE decline is the result of pyruvic acid metabolism occurring anaerobic tissue hypoperfusion due to bleeding that is not controlled.<sup>2</sup>

In addition, the previous value of the initial hematocrit not be an accurate marker of the blood loss and shock in trauma patients. Assuming that the compensation mechanism of absorption of fluid into the intravascular space is relatively slow, it means that the initial hematocrit values remained within normal limits after bleeding.<sup>3,4</sup>

Those facts prompted the authors to examine the correlation value of the initial hematocrit and value Base Excess against any signs of shock due to bleeding intra-abdominal trauma patients blunt abdominal either do the surgery or not that is expected to detect at an early stage of shock and bleeding and can also useful as investigations are replacing checks especially in the Excess Base Hospital with limited facilities.

## Materials and Methods

### Subject Selection

Subjects were blunt abdominal trauma patients who come to the Emergency Surgical Hospital. Hasan Sadikin and hematocrit checked at the beginning comes, BE, signs of hypovolemic shock due to intra-abdominal hemorrhage that meet the inclusion and exclusion criteria.

Inclusion criteria

The inclusion criteria of this study is adult patients with blunt abdominal trauma diagnosis is confirmed by ultrasound FAST accompanied by signs of hypovolemic shock due to intra-abdominal hemorrhage

#### Exclusion criteria

The exclusion criteria of this study are patients with blunt abdominal trauma with other concomitant trauma, penetrating abdominal trauma patients, patients moving other hospitals who have received blood transfusions and resuscitation

#### Type and Design Research

This research was conducted cross sectional correlation is to determine the initial value of hematocrit and BE against any signs of shock due to intra-abdominal hemorrhage in patients with blunt abdominal trauma.

#### identification of variables

##### The independent variables

- Signs of hypovolemic shock by increasing the pulse rate and systolic blood pressure reduction because of intra-abdominal haemorrhage

##### Dependent variable

- The initial value of hematocrit
- Value Base excess

##### Operational definition

###### 1) Shock

Shock is defined by inadequate his blood perfusion and oxygen to the tissues characterized by circulatory changes, and inadequate its tissue perfusion are causing cellular damage and dysfunction or failure of organ systems as a whole is characterized by increased heart rate and a decrease in systolic blood pressure.<sup>20</sup>

###### 2) Hematocrit

Hematocrit value is the large volume of cells erythrocytes entirely in 100 mm<sup>3</sup> of blood and expressed in%. Hematocrit value is affected by the replacement fluid or bleeding. Normal hematocrit reference value by Dacie for adult males is 40-54% and for adult females is 37-54%.<sup>23</sup>

###### 3) Base Excess

BE decreased levels resulting in increased anaerobic metabolism due to inadequate tissue oxygenation. Metabolic acidosis with a value of less than -2 BE is estimated there are still bleeding and tissue hypoperfusion in patients with bleeding. BE can be assessed quickly to show the relation with bleeding.<sup>2</sup>

###### 4) Blunt Abdominal Trauma

Blunt trauma can be caused by a direct collision, the deceleration force, rotational force and a shearing force. Direct collision can cause significant injury and the severity of the injury can be predicted by knowing

the mechanism of trauma and also the surface area of the body part contacted.<sup>15</sup>

How it Works and Engineering Research  
Data Collection

1) Taken data on gender, age, time between the incident and arrived at the hospital, the diagnosis of blunt abdominal trauma and intra-abdominal bleeding with ultrasound FAST, action.

2) Do a physical examination for signs of shock and intra-abdominal bleeding is by measuring the pulse and systolic blood pressure of the patient.

3) In calculating the initial value of hematocrit and BE when the patient arrives

4) Once fulfilled, the data were analyzed and prepared statements.

Data analysis

To determine the relationship between the initial value of hematocrit and BE, the existence of signs of shock as a result of intra-abdominal haemorrhage conducted a comparative analysis of Kruskal-Wallis. Test for normality by Kolmogorov-Smirnov test of normal distribution of data obtained. A p value <0.05 indicates a significant relationship between variables. Data processing was performed using SPSS Statistics v19.0 at the level of 95% (5% significance level).

Location and Time Research

The study was conducted at the Division of Digestive Surgery Department of Surgery Hospital. Hasan Sadikin Hospital and Department of Clinical Pathology. Hasan Sadikin were implemented starting in January 2016 until the number of samples met.

Aspects of Research Ethics

This study uses the subject of research in the form of blunt abdominal trauma patients in the Division of Digestive Surgery Hasan Sadikin Hospital in Bandung. The ethical issues that may arise is the discomfort of patients due to blood sampling and the risk of bleeding. This study was conducted upon the approval and recommendation of the Health Research Ethics Committee of the Faculty of Medicine, University of Padjadjaran / Hospital Dr.HasanSadikin Bandung, number : **LB.04.01 / A05 / EC / 025 / I / 2016**

As for the ethical issues that may arise in this study prevented through informed consent to blood sampling procedures correctly.

**Results**

Blunt abdominal trauma patients who come to the ER Surgical Hospital. Hasan Sadikin

during January - March 2016 who meet the inclusion and exclusion criteria as many as 34 patients with an age range of 16-55 years with the ratio of male and female patients 26 : 8 patients.

In Table 1, we see that the average age based on a hematocrit  $> 40$  is  $18:33 \pm 1:15$  is smaller than 37-40 Ht categories namely  $21:25 \pm 4:11$  and is lower than the category Ht  $< 37$  is  $27.11 \pm 11.96$ . However, the results obtained are not significant difference (p-value = 0.243). It can be concluded that there is no significant relationship between age of respondents with Ht

In Table above obtained as many as three men and 0 women have a category Ht  $> 40$ , 3 men and 1 woman had Ht category 37-40 and as many as 20 men and 7 women have a category Ht  $< 37$ . Based on statistical test, the difference not significant (p-value = 0.611). It can be concluded that there is no significant relationship between gender with Ht.

In table 2, we see that the average age by BE  $\ln > 2$  is  $19:00 \pm 0$  smaller than BE category 2 - (-2) is  $19.83 \pm 3:31$  and much lower than the BE category  $< -2$  is  $27.18 \pm 11.93$ . These results are not obtained a significant difference (p-value = 0.232). It can be

concluded that there is no significant relationship between age of respondents with BE.

In table 3, we see that the average SBP based Ht  $\ln > 40$  is  $103.33 \pm 15:27$  higher than category Ht 37-40 is  $102.5 \pm 17:08$  and higher than Ht categories  $< 37$  is  $87.41 \pm 31.45$ . However, the results obtained are not significant difference (p-value = 0.468). It can be concluded that there is no significant relationship between SBP respondents with Ht.

In Table 3 it is found that the average P on Ht category  $> 40$  is  $92.67 \pm 6:43$  smaller than Ht 37-40 category is  $95.5 \pm 16:52$  and smaller when compared Ht categories  $< 37$  is  $112.89 \pm 19:23$ . Based on test results obtained statistically significant difference (p-value = 0.046). So it can be concluded that there is a significant relationship between P with Ht.

In table 4 found that the average SBP by BE  $\ln > 2$  is  $100.0 \pm 0$  is lower than the category BE 2 - (-2) is  $103.33 \pm 13.66$  but higher than the BE category  $< -2$  is  $84.81 \pm 29.27$ . However, the results obtained are not significant difference (p-value = 0.232). It can be concluded that there is no significant relationship between SBP respondents with BE

In table 4 also the average P in BE at  $> 2$  is  $88.0 \pm 0$  smaller than BE category  $2 - (-2)$  is  $92.33 \pm 7.84$  and smaller also than BE category  $< -2$  is  $112.81 \pm 19:22$ . Based on test results obtained statistically significant difference (p-value = 0.028). So it can be concluded that there is a significant relationship between P with BE.

### Discussion

This study was conducted to see how the relationship between hematocrit and BE in blunt abdominal trauma patients with hemorrhagic shock due to intra-abdominal haemorrhage. Signs of shock was assessed by measuring the systolic blood pressure and pulse frequency of the patient and examination hematocrit and BE at the beginning of the patient come before resuscitation. Assessment of the source of bleeding and carried exclusion in patients with bleeding source other than the intra-abdominal hemorrhage. In this study, hematocrit classified each into 3 groups, ie  $> 40\%$ ,  $37-40\%$  and  $< 37\%$ . BE respectively  $> 2$ ,  $2 - (-2)$ , and  $< -2$ . Where the division into three groups this means that the first group is a group that has a value of hematocrit and BE above normal, the second group was normal, and the third group is that under

normal that each of these groups have medical implications are different so its distribution were with the aim of getting the analysis and statistical calculations that are more specific and accurate. Medical implications mentioned example is that patients with a hematocrit above 40 have a tendency to hypercoagulability, and in this study, some patients with a hematocrit above normal.

P relationship with Ht obtained an average increase in the frequency P with decreasing hematocrit is  $92.67 \pm 6.43x / \text{min}$  for group Ht  $> 40\%$ ,  $95.5 \pm 16.52x / \text{min}$  for group Ht  $37-40\%$ , and  $112.89 \pm 19.23x / \text{min}$  for groups Ht  $< 37\%$ , which means there is a significant relationship between hematocrit decrease with increased frequency P as one of the signs of hemorrhagic shock with p value = 0.046.

This is in line with research conducted by Blackmore, et al (2006) who said that the decrease in hematocrit can be a predictor of bleeding in patients with pelvic fractures in the context of increased frequency P which signifikan.<sup>27</sup> Then Snyder, et al (1998) studied 524 patients to trauma, it was found that the initial value of hematocrit  $< 35$  had a high specificity (90%) as a predictor of bleeding in patients tersebut.<sup>28</sup> In another study Ryan, et al (2011) conducted a series

Ht examination and concluded that in patients with bleeding Ht significant impairment compared with no bleeding, this examination can be useful to identify bleeding in patients who require surgery emergensi.<sup>26</sup> Research on Ht decline was first performed by Jacobs, et al which describes usability Ht value for detecting acute blood loss, diagnose the occurrence of hypovolemia, and determine the need for transfusions.<sup>14</sup>

As for relations with BE P obtained an average increase of P with decreasing frequency is  $88.0 \pm 0x$  BE / min for groups  $BE > 2$ ,  $92.33 \pm 7.84x$  / min for BE Group 2 - (- 2), and  $112.81 \pm 19.22x$  / min for groups  $BE < -2$ , which means there is a significant correlation between the decrease in BE with increased frequency P as one of the signs of hemorrhagic shock with p value = 0.028. This is also consistent with research that has been done by Ryan, et al (2011) concluded that the occurrence of acidosis is indicated by a decrease in BE are closely related to the occurrence of bleeding with p value = 0,003.<sup>26</sup> Previously, Bruns, et al (2007) have examined the relationship of significant among bleeding in trauma patients with hemoglobin values, tachycardia, and decreased BE.<sup>29</sup>

In this study, SBP does not have a significant association with acute bleeding conditions when compared to the increase in the frequency of P. SBP did not decline until the occurrence of blood loss as much as 30-40% .<sup>17</sup> SBP has less sensitivity to the occurrence of acute bleeding that is only 13% when compared to the increase P frequency that is 45% .<sup>29</sup>

This is consistent with the theory that the initial response of shock to the cardiovascular system is the increase in heart rate due to increased myocardial contractility and peripheral vasoconstriction of blood vessels due to an increased release of norepinefrin.<sup>21</sup> So the association remained significant decrease in hematocrit and BE is to increase the frequency P at the beginning hemorrhagic shock occurs.

### **Conclusion**

There is a significant correlation between the value of the initial hematocrit and BE with signs of hemorrhagic shock due to intra-abdominal hemorrhage in patients with blunt abdominal trauma.



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Figure 1. Research Management Flow

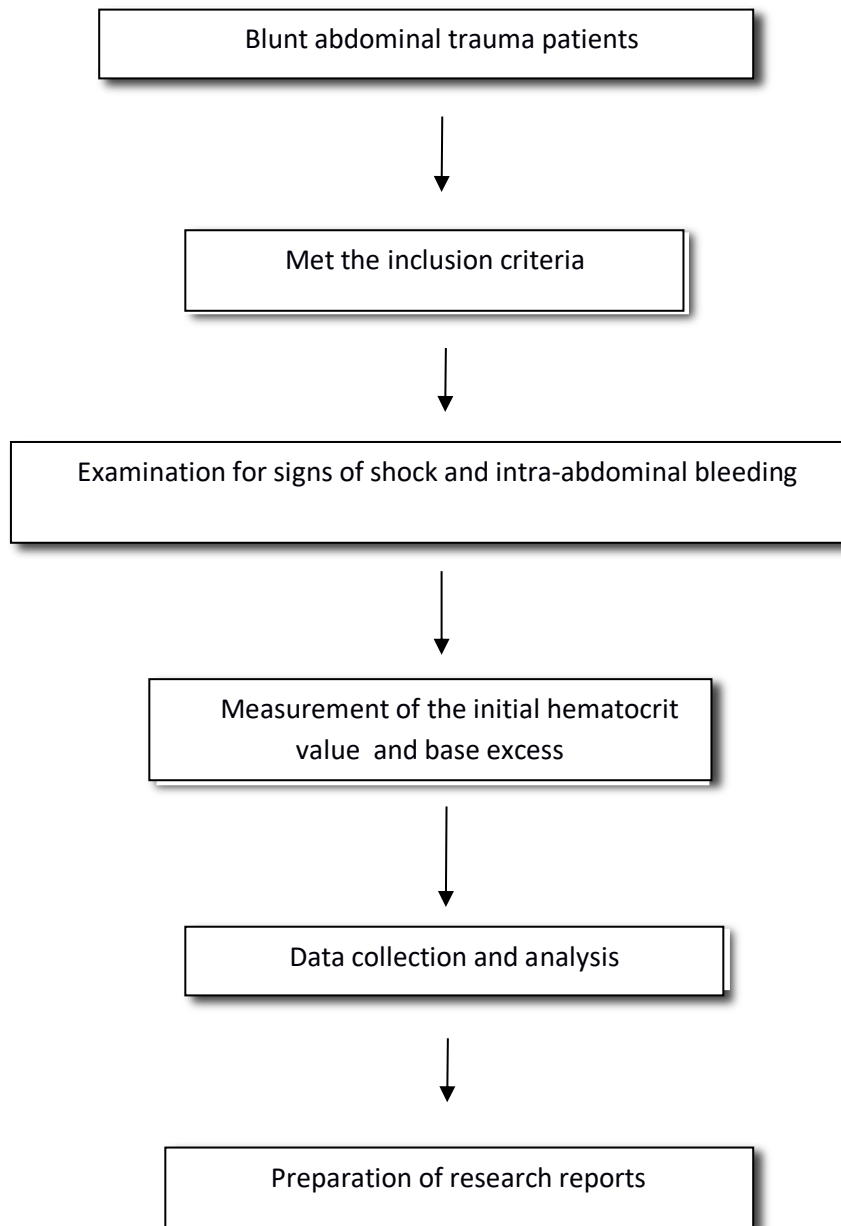


Table 1. Demographics Table group Hematocrit (Ht)

Variable	Ht			Total (n = 34)	p- value
	> 40	37 – 40	< 37		
Age	18.33 ± 1.15	21.25 ± 4.11	27.11 ± 11.96	25.65 ± 11.10	0.243
<b>Gender</b>					
Male	3	3	20	26	
Female	0	1	7	8	
Total	3	4	27	34	0.611

Table 2. Demographics Table Base Excess group

Variabel	BE			Total (n = 34)	p- value
	> 2	2 - (- 2)	< -2		
Age	19.00 ± 0	19.83 ± 3.31	27.18 ± 11.93	25.65 ± 11.10	0.232

Analysis using the Kruskal-Wallis test, p> 0.05

Table 3. Table Data Ht and vital signs group

Variabel	Ht			Total (n = 34)	p- value
	> 40	37 – 40	< 37		
<b>SBP</b>	103.33 ± 15.27	102.5 ± 17.08	87.41 ± 31.45	90.59 ± 29.33	0.468
<b>P</b>	92.67 ± 6.43	95.5 ± 16.52	112.89 ± 19.23	109.06 ± 19.43	0.046

Normal data distribution using the Kolmogorov-Smirnov test.

Data analysis using the Kruskal-Wallis test.

SBP = Systolic Blood Pressure

P = Pulse

Table 4. Table Data BE and vital signs group

<b>Variabel</b>	<b>BE</b>			<b>Total (n = 34)</b>	<b>p- value</b>
	<b>&gt; 2</b>	<b>2 - (- 2)</b>	<b>&lt; -2</b>		
<b>SBP</b>	100.0 ± 0	103.33 ± 13.66	84.81 ± 29.27	88.53 ± 27.54	0.232
<b>P</b>	88.0 ± 0	92.33 ± 7.84	112.81 ± 19.22	108.47 ± 19.39	0.028