# HOW USEFUL IS SHOCK INDEX IN THE MANAGEMENT OF RUPTURED ECTOPIC PREGNANCY

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## INTRODUCTION

Ectopic pregnancy is a classic gynaecological emergency and remains a major cause of maternal morbidity and mortality [1]. It is the leading cause of pregnancy related deaths in the first trimester usually because of intraperitoneal haemorrhage [2]. The incidence of ectopic pregnancy is increasing worldwide but its case fatality has reduced in the developed world because of early diagnosis and improved management[3]. This is not the case in developing countries, where because of socioeconomic and other reasons early diagnosis is not made, and the patients usually present with the ruptured variety with its attendant peritoneal haemorrhage [4].

The physiology of bleeding and response to haemorrhage are well-known and objective shock due to haemorrhage is categorized into four classes [5]. Class III and IV haemorrhage (loss of > 30% of patient's blood volume) can lead to multiple organ failure unless appropriate resuscitation is accomplished early [6]. Therefore, in any acute bleeding case like ectopic pregnancy; early and accurate assessment of the degree of the bleeding is crucial [7]. However, in early haemorrhage, there may not be significant changes in the vital signs and the blood pressure may even be elevated because of catecholamine-induced vasoconstrictions [6]. More over, elevation of the heart rate is said to be an insensitive predictor of hypovoleamia and hypotension with out tachycardia is not infrequent in patients with ruptured ectopic [8,9].

Shock index; the ratio of heart rate and systolic blood pressure is said to be more sensitive in the evaluation of haemorrhage than the traditionally measured vital signs [10]. In acute bleeding, shock index is also considered a better predictor of organ failure than the blood pressure and pulse rate [11]. Because the morbidity and mortality associated with ruptured ectopic pregnancy result from acute haemorrhage, shock index may prove to be a useful parameter for the evaluation of patients with this clinical condition and therefore be of value in its overall management.

The objective of this study was to evaluate the utility

## ABSTRACT

**Objective:** To determine the usefulness of shock index in the management of ruptured ectopic pregnancy.

**Method:** A retrospective review of cases of ruptured ectopic pregnancy at the University of Maiduguri Teaching Hospital over a 10-year period (January, 1995 to December, 2004) was carried out.

**Result:** During the study period there were 15, 120 deliveries and 136 cases of ruptured ectopic pregnancies, a prevalence of 0.9%. The mean age of the study population was 27.7±4.8 and the mean parity was 2.2±2.3.Majority of the patients (77.8%) had systolic blood pressure above 90mmhg but the diastolic blood pressure was =60mmhg in 50.4% of the patients. The shock index was >0.70 in 92.3% of the cases and the packed cell volume <30% in 60.7%. In 60.7% of the cases the amount of haemoperitoneum found at laparatomy was >1000mls. Majority of the patients (64.1%) had blood transfusion. The preoperative packed cell volume (PCV) had the strongest correlation with the amount of haemoperitoneum found at laparatomy (r= -0.648, p=0.000), followed by the shock index (r= 0.391, p=0.000). Only PCV <30% (P=0.000) and Shock index >0.70 (P=0.026) were significant predictors of haemoperitoneum above 1000ml.

**Conclusion:** The shock index proved to be useful in the

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of shock index in the management of patients with ruptured ectopic pregnancy.

## MATERIALS AND METHOD

The records of cases of ruptured tubal ectopic pregnancy at the University of Maiduguri Teaching Hospital (UMTH) over a 10-year period (January, 1995 to December, 2004) were reviewed. Cases included were those in which a diagnosis of ruptured ectopic pregnancy was made clinically and some amount of haemoperitoneum was obtained during the emergency laparatomy. All cases in which haemoperitoneum was not found at laparatomy were excluded. Out of the 136 cases identified, 117 had complete information for analysis.Data were extracted and transferred to a proforma already designed for the study. The data extracted included patients' demographic characteristics, pre-operative vital signs, packed cell volume, the amount of

haemoperitoneum obtained during surgery, blood transfusion, and complications.

For accurate determination of the vital signs, those recorded are those taken during the immediate pre-operative period. Where more than one packed cell volume records were found; the one closest to the surgery period was used. Because at laparatomy in our unit, any encountered haemoperitoneum is suctioned out, the amount of haemoperitoneum was therefore measured both volumetrically and through visual estimation of socked gauge and linens. For each pair of pulse rate (heart rate) and systolic blood pressure, shock index was calculated by dividing the pulse rate with the systolic blood pressure.

Numbers and simple percentages were used to report proportions of the vital signs, shock index, and packed cell volume. The correlation between these variables and the selected outcomes; amount of haemoperitoneum, blood transfusion and complications were obtained using the raw scale data and then stepwise logistic regression analysis was use to construct a predictive model for these outcomes using predefined values of the variables. As hypotension is a blood pressure of 90/60mmhg and below and tachycardia, pulse rate of 100 and above [10], these predefined values are taken as pulse rate of >100, systolic blood pressure of <90mmHg and, diastolic blood pressure of<60mmHg. The predefined value of shock index was taken as>0.70 because the normal value of shock index is 0.50-0.70. The predefined value of packed cell volume was taken as <30%. $P<0.05$ was considered as significant. All the analysis were done using the software SPSS for windows version 13.0 (SPSS, Chicago, IL, USA).

## RESULTS
During the study period there were 15, 120 deliveries and 136 cases of ruptured tubal ectopic pregnancy, a prevalence of 0.9%. The age range of the study population was 17-42 years with a mean of 27.7±4.8 and the mean parity was 2.2±2.3 (range=0 - 10).

Table 1 shows the vital signs, PCV, shock index and the outcomes of interest of the study population.

Majority of the patients (77.8%) had systolic blood pressures above 90mmhg but the diastolic blood pressure was =60mmhg in 50.4% of the patients. The shock index was >0.70 in 92.3% of the cases and the

**Table 1:** Summary of Vital Signs, Shock Index, and Outcome of Interests of the Study Population

| Characteristics | Number | Percentage |
|---|---|---|
| 1. Systolic BP | | |
| =90mmHg | 26 | 22.2 |
| >90mmHg | 91 | 77.8 |
| *Mean=105±16.6 (60-150)* | | |
| | | |
| 2. Diastolic BP | | |
| =60mmHg | 59 | 50.4 |
| >60mmHg | 58 | 49.6 |
| *Mean=65.5±13.2 (20-100)* | | |
| | | |
| 3. Pulse rate | | |
| =100 | 73 | 62.4 |
| <100 | 44 | 37.6 |
| *Mean=105±19 (70-140)* | | |
| | | |
| 4. Shock index | | |
| =0.70 | 9 | 7.7 |
| >0.70 | 108 | 92.3 |
| *Mean=1.03±0.3 (0.57-2.17)* | | |
| | | |
| 5. Packed cell volume | | |
| <30% | 71 | 60.7 |
| =30% | 46 | 39.3 |
| *Mean=26.2±7.9 (10-44)* | | |
| | | |
| 6. Amount of haemoperitoneum | | |
| =1000mls | 71 | 60.7 |
| <1000 mls | 40 | 39.3 |
| *Mean=1171.6±832.4 (100-3000)* | | |
| | | |
| 7. Blood transfusion | | |
| Yes | 75 | 64.1 |
| No | 42 | 35.9 |
| | | |
| 8. Unit of blood transfused | | |
| 1 | 15 | 20.0 |
| 2 | 29 | 38.7 |
| =3 | 31 | 41.3 |
| | | |
| 9. Complication | | |
| Yes | 11 | 9.40 |
| No | 106 | 90.6 |

**Table 2:** Correlation between shock index, vital signs, and PCV with outcomes of Interest

| 1) Haemoperitoneum | SBP | DBP | PR | SI | PCV |
|---|---|---|---|---|---|
| Correlation coefficient | - 0.201 | - 0.284 | 0.33 | 0.391 | -0.648 |
| P value | 0.030 | 0.020 | 0.000 | 0.000 | 0.000 |
| | | | | | |
| **2) Blood transfusion** | | | | | |
| Correlation coefficient | 0.238 | 0.282 | -0.336 | -0.343 | 0.729 |
| P value | 0.010 | 0.002 | 0.000 | 0.000 | 0.000 |
| | | | | | |
| **3) Complications** | | | | | |
| Correlation coefficient | 0.036 | 0.113 | -0.197 | -0.115 | 0.047 |
| P value | 0.702 | 0.226 | 0.034 | 0.218 | 0.611 |

Keys: SBP=systolic blood pressure, DBP=diastolic blood pressure, PR=pulse rate, SI=shock index.

**Table 3:** Stepwise Logistic Regression Model of Predictors of outcomes of interest.

| PREDICTORS | | P value | | |
|---|---|---|---|---|
| | | Haemoperi >1000mls | Blood transfusion | Complications |
| A) | PCV<30% | 0.000* | 0.000* | 0.881 |
| b) | Shock index>0.70 | 0.026* | 0.244 | 0.973 |
| c) | Systolic BP<90mmHg | 0.611 | 0.838 | 0.861 |
| d) | Diastolic BP<60mmHg | 0.574 | 0.113 | 0.282 |
| e) | Pulse rate>100 | 0.300 | 0.393 | 0.041* |
| | | | | |
| Model summary | | | | |
| | $R^2$ | 0.281 | 0.214 | 0.505 |
| | F | 22.24 | 117.5 | 4.290 |
| | P-value | 0.000 | 0.000 | 0.041 |

* Significant predictors.

packed cell volume <30% in 60.7%. In 60.7% of the cases the amount of haemoperitoneum found at laparatomy was >1000mls and 64.1% of the patients had blood transfusion out of which 41.3% had a transfusion of =3 units of blood. Eleven patients (9.4%) had complications, of which eight had wound infection and one each had disseminated intravascular coagulation, shock, and intestinal obstruction. There was no maternal death.

Table 2 shows the correlation of the outcomes of interest with vital signs, shock index, and packed cell volume. The preoperative PCV had the strongest correlation with the amount of haemoperitoneum found at laparatomy (r= -0.648, p=0.000), followed by the shock index (r= 0.391, p=0.000) but the correlation with systolic blood pressure was poor, although statistically significant (r= -0.201, p=0.030). The only significant correlation of the occurrence of complication was with the pulse rate (r= -0.198, p=0.034) but there was a strong correlation between blood transfusion and PCV (r= -0.729, p=0.000) and shock index (r= -0.343, p=0.000).

Table 3 shows the stepwise regression analysis model for the predictors of the outcome of interest. The only significant predictor of blood transfusion was PCV of<30% (P=0.000), and only PCV <30% (P=0.000) and Shock index >0.70 (P=0.026) significantly predict the amount of haemoperitoneum above 1000ml.

## DISCUSSION

This study showed that shock index is a useful parameter in the management of patients with ruptured ectopic pregnancy.

The mean age of 27.7 years in the study population was similar to that reported from another study [12] and probably represents the mean age of the reproductively active women and the mean parity of 2.2 is more likely a reflection of this age group. The average systolic blood pressure and pulse rate of our study population were also similar to those reported by other studies [7,13,14].

The mean shock index of 1.03 found in this study was similar to those found in other studies [7,11,14] but higher than that reported from another study [13]. Shock index above 1.00 is indicative of haemorrhage that can cause severe left ventricular dysfunction [15] and our mean shock index was above 1.00. This probably reflects the fact that most of our patients have haemoperitoneum above 1000mls. In fact, the mean haemoperitoneum of our study population was 1171.6 mls.

The morbidity and mortality in patients with ruptured ectopic pregnancy results from the haemorrhage associated with it. To prevent this morbidity and mortality physicians must identify patients likely to develop complications because of intraperitoneal haemorrhage due to ruptured ectopic pregnancy and institute prompt

treatment. Traditionally vital signs have been used in the evaluation and resuscitation of patients with hypovolaemia but clinical teaching had shown that hypotension and tachycardia although sensitive are not specific indicators of hypovolaemia [8, 16]. Shock index is an easily calculated non-invasive composite of the heart rate and systolic blood pressure that has been shown to have inverse relationship with left ventricular work [16] and because left ventricular work is dependent on cardiac output and volume status; shock index is directly affected by hypovolaemia. Shock index has been shown to be more sensitive than traditionally measured vital signs in hypovolaemia [6]. The only caveat is that previous studies used to establish normal shock index (0.50-0.70) excluded pregnant women but many recent studies have shown that shock index is a useful parameter in the evaluation of haemorrhage due to ruptured ectopic pregnancy [11, 13, 14].

Although vital signs, packed cell volume and shock index show significant correlation with the amount of haemoperitoneum in this study, the strongest correlation was with packed cell volume (r= -0.648, p=0.000) and shock index (r= 0.391, p=0.000). This was confirmed using a stepwise logistic regression analysis, which shows that only PCV below 30% (p=0.000) and shock index above 0.70 (p=0.026) are significant predictors of haemoperitoneum greater than 1000mls. This finding is similar to the reports of other studies [4, 11,13,17,18]. Our study also showed that PCV and shock index had the strongest correlation with the requirement for blood transfusion. The only significant correlation of development of complication in our study was with pulse rate (r= -0.197, p=0.034) and this was confirmed using the logistic regression analysis (p=0.041). However, shock index although not statistically significant(r= -0.115, p=0.218) correlated better with the development of complications than PCV (r=0.047, p=0.611), systolic blood pressure (r=0.036, p=0.702), and diastolic blood pressure (r=0.113, p=0.282). This is similar to the report of other studies [7, 19, 20] conducted in trauma patients with significant haemorrhage that showed shock index to be a better predictor of development of complications.

This study has shown that shock index is a useful parameter in the management of patients with ruptured ectopic pregnancy. The shock index proved to be valuable parameter for the prediction of complications and of outcome, thus warranting further clinical use. A prospective study is needed to identify the value of Shock index in the management of ruptured ectopic pregnancy to enhanced clinical usefulness.

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