



USE OF THE SHOCK INDEX TO PREDICT MATERNAL OUTCOMES IN WOMEN WITH OBSTETRIC HAEMORRHAGE FROM A TERTIARY CARE TEACHING HOSPITAL IN MAHARASHTRA, INDIA

Obstetrics & Gynaecology

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ABSTRACT

BACKGROUND: To assess usefulness of shock index and the different vital signs in predicting the maternal outcomes in the cases of obstetric haemorrhage. **METHODS:** A prospective descriptive cross-sectional study was carried out in cases of obstetric haemorrhage. Data of vital signs; systolic and diastolic blood pressure, pulse rate, pulse pressure, mean arterial pressure and shock index at time of arrival was recorded. Maternal outcome in the form of morbidity, mortality, need for admission to intensive care unit, massive transfusion and invasive procedures was observed and analysed. **RESULTS:** The mean age of participants in years (SD) was 24.27 (± 3.09). The mean value of HR 108.52.1 $\pm$ 21.03, SBP 101.26 $\pm$ 13.55 mmHg, DBP 59.28 $\pm$ 18.30 mmHg, SI 1.22 $\pm$ 0.36 and mean blood loss 1452.03 $\pm$ 727.56. There was a significant association between shock Index and pregnancy outcomes, level of consciousness, amount of blood loss, unit of blood transfusions required and ICU admissions. **Conclusion:** Shock index value is a reliable and consistent marker to predict the adverse maternal outcome and requirement of amount of blood transfusion and need for intensive care due to obstetric haemorrhage.

KEYWORDS

Obstetric haemorrhage, shock index, vital signs, blood loss, ICU.

INTRODUCTION

The shock index (SI), HR/SBP, has been proposed as an earlier marker of compromise than conventional vital signs. The normal Shock index (SI) range is 0.5–0.7 for healthy adults. Shock index (SI), defined as the ratio of heart rate (HR) to systolic blood pressure (SBP), and has been suggested as a marker for shock, persistent decreased central venous oximetry, and lactic acidosis in patients.¹ The normal range for SI in non-obstetric patients has been considered to be 0.5 to 0.7.² However, most of the studies have proposed the upper limit of SI for PPH patients as 0.9 in both low- and well-resourced facilities to predict adverse outcomes.^{3,4} This study aimed to determine the predictive value of the shock index (SI) with conventional vital signs in Obstetric haemorrhage and to calculate the relationship of shock index with adverse maternal outcome in Obstetric haemorrhage.

MATERIAL AND METHODS

A prospective descriptive cross-sectional study was carried out with all women who were diagnosed and treated for obstetric haemorrhage in the department of Obstetrics and Gynaecology of Pravara Rural Hospital (PRH), Loni – a tertiary care teaching hospital in Western Maharashtra were included as study subject from 1st September 2019 to 31st March 2021. Data of vital signs like systolic and diastolic blood pressure, pulse rate, pulse pressure, mean arterial pressure and shock index (heart rate divided by systolic blood pressure) at the time of arrival were recorded. Adverse outcome like, death, admission to the intensive care unit, massive transfusion and invasive procedures were analysed.

Information on outcome variables like age, education, socio-economic class, symptoms, signs, condition at the time of admission, ultrasonography findings, intra-operative findings, complications, modality of treatment, type of surgery, need for blood transfusion, need for intensive care treatment, duration of hospitalization, maternal outcome was collected in a structured pre-tested and pre-validated pro forma. A total of 42 women who were diagnosed and treated for obstetric haemorrhage were included in the study.

Statistical analysis was performed by SYSTAT program for windows, version 12 (Cranes Software, Bangalore – a licensed copy). Chi-square test of association was used to test the association between various variables and shock index. The sensitivity and the specificity were calculated to analyse the diagnostic accuracy of all markers. For all statistical tests, a p value less than 0.05 was taken to indicate a significant difference.

Table 1-Demographic characteristics

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Age in years	Number	Percentage
Below 20 years	6	14.29%
21-25 years	20	47.62%
26-30 years	14	33.33%
Above 30 years	2	4.76%
Mean $\pm$ SD	24.27 years $\pm$ 3.09 years	
Occupational status		
Housewives	39	92.86%
Socio Economic (SE) classification		
Lower	16	14.29%
Lower middle	8	19.05%
Middle	18	42.86%
Gestational age (wks)		
Below 30 wks	10	23.81%
31-36 wks	23	54.77%
37-40 wks	9	21.42%
Mean $\pm$ SD	34.00 wks $\pm$ 6.63 wks.	

Table No.2: Showing distribution of clinical vital parameters :

Characteristics	Number	Percentage
Pulse (per minute)	121.24±16.61	
DBP (mm of Hg)	58.28±18.30	
SBP (mm of Hg)	101.26±13.55	
Heart (beats per minute)	108.52±21.03	
Shock Index		
≤ 0.70	02	4.76%
0.7-1.0	13	30.95%
≥1.0	27	64.29%
Mean ± SD	1.22 ± 0.32	
Unit of blood transfused		
1	07	16.67%
2	18	42.86%
≥ 3	17	40.47%
ICU admission		
Yes	19	45.24%
No	23	54.76%
Blood Loss (ml)		
500-999ml	11	26.19%

1000-1499ml	19	45.24%
1500-1999ml	14	33.33%
2000-2499ml	08	19.04%
Mean $\pm$ SD	1697.26 $\pm$ 673.97 ml	

Table No. 3: Performance of SI (Shock index) and other vital signs:

Vital signs	Shock Index			'p' value*
	<0.70	0.7-1.0	≥ 1.0	
Pulse (per minute)	90.26 $\pm$ 14.63	119.68 $\pm$ 18.57	122.32 $\pm$ 21.03	p=0.0526, significant
DBP (mm of Hg)	78.26 $\pm$ 14.23	62.98 $\pm$ 12.44	61.01 $\pm$ 11.99	p=0.0339, significant
SBP (mm of Hg)	96.25 $\pm$ 14.06	100.50 $\pm$ 11.68	110.58 $\pm$ 14.06	p=0.0564, significant
ICU admissions (days)	2.63 $\pm$ 0.22	3.38 $\pm$ 0.69	3.49 $\pm$ 0.31	p=0.0947, significant
Gestational age (weeks)	33.0 $\pm$ 6.32	34.00 $\pm$ 5.69	34.00 $\pm$ 4.55	p=0.0271, significant
Blood Loss (ml)	1347.29 $\pm$ 633.8	1502.14 $\pm$ 657.88	1606.99 $\pm$ 701.67	p=0.0041, significant
Hospital stay (days)	3.66 $\pm$ 0.87	5.89 $\pm$ 1.03	8.98 $\pm$ 1.67	p=0.0662, significant
Death	0	1	2	p=0.0247, significant

Table No. 4: Performance of SI ≥ 0.7 and SI ≥ 0.9 in predicting adverse outcome in PPH:

Outcome	Sensitivity	Specificity	Positive predictive value	Negative predictive value	Accuracy
ICU admission					
SI ≥ 0.7	95.60%	11.00%	25.60%	67.70%	27%
SI ≥ 0.9	95.30%	54.20%	34.61%	94.67%	58%
Blood transfusion					
SI ≥ 0.7	92.50%	18.20%	93.7%	45.0%	91%
SI ≥ 0.9	65.40%	66.00%	97.5%	16.9%	72%
Blood loss					
SI ≥ 0.7	95.20%	10.40%	72.6%	42.00%	71%
SI ≥ 0.9	95.20%	56.40%	78.3%	44.10%	68%
Mortality					
SI ≥ 0.7	91.50%	53.10%	19.1%	79.80%	22%
SI ≥ 0.9	59.10%	81.70%	29.3%	96.52%	51%

RESULTS

During the study period, a total of 42 cases with obstetric haemorrhage took place. 36(85.71%) of these patients received a blood transfusion due to anaemia during the antepartum period, the demographic characteristics of the patients were summarized in **Table No.1**. The mean age (in years) of the patients was 24.27 $\pm$ 3.09, 39(92.86%) patients were housewives, 26(61.90%) patients was in lower and lower middle economic class. The mean gestational age (in weeks) was 34.00 $\pm$ 6.63. The values of vital signs of the patients are shown in **Table No.2**, the mean value of HR 108.52 $\pm$ 21.03, SBP 101.26 $\pm$ 13.55 mmHg, DBP 58.28 $\pm$ 18.30 mmHg, SI 1.22 $\pm$ 0.32 and mean blood loss 1697.26 $\pm$ 673.97 ml. 17(40.47%) patients received ≥ 3 units and 19(45.24%) patients required admission in ICU. **Table No. 3** shows the performance of SI (Shock index) and other vital sign parameter in predicting the adverse clinical outcomes. There is a significant association found in between SI and death (p=0.0247), SI and pulse rate (p=0.0526), SI and ICU admissions (p=0.0947), SI and SBP (p=0.0564), SI and DBP (p=0.0339), SI and gestational age (p=0.0271), SI and blood loss (p=0.0041), and SI and hospital stay (p=0.0662) **Table No. 4** shows the convenience of SI ≥ 0.7 and SI ≥ 0.9 has early predictors of adverse outcome of postpartum haemorrhage. Out of 42 women included in this study, there were 14 (33.33%) with SI ≥ 0.7 and 28 (66.67%) with SI ≥ 0.9 . Sensitivity for all adverse outcomes of SI ≥ 0.7 varies from 95 to 90.0, which is high specifying that approximately all positives are exactly recognized as such while several negatives are categorized as false positives. For death prediction SI ≥ 0.7 had very low specificity: 0.6 {0.2-1.3} and of SI ≥ 0.9 ; 6.4 {2.8-7.1}.

DISCUSSION

Present study evaluated the predictive ability of SI in Obstetric haemorrhage according to multiple clinical outcomes. The

performance of the upper limits of SI ≥ 0.7 and SI ≥ 0.9 were tested. SI ≥ 0.9 was the superior predictor and thus may be a valuable threshold, where mortality is highest and often related to delays in complication recognition, transportation, and level of care of the facility. Two potential SI thresholds indicating a high risk of adverse events: SI ≥ 1.5 and SI ≥ 1.7 were selected to compare the results with the other studies found that; the shock index was ominously useful for prediction of massive transfusion but for invasive procedures and ICU admission; shock index and pulse rate had higher values than blood pressure.^{2,3} Present study established that; SI for ICU and massive blood transfusion ≥ 3 Unit had more significant prediction than SBP, DBP and PR. As regard the pulse rate; SI had the same significance. About surgical interference; SI had more significance than SBP and PR and the same significance of DBP. Sohn et al stated that the shock index is a predictor of massive bleeding and the initial shock index is individually associated with massive transfusion, but they did not study other adverse outcomes, for example ICU admission or invasive procedures.⁵ These results are similar to those results of Nathan et al.² Predictable vital signs have been revealed to be late markers of hemodynamic compromise in obstetric and even non-obstetric people. SI may aid observing such cases with modify management to reduce the adverse outcomes via resuscitation and referral at time. The current study examined the performance of the upper limits of SI ≥ 0.7 and SI ≥ 0.9 . Lee et al suggested that SI ≥ 0.9 expects adverse events like massive transfusion and invasive procedures So, can take right decisions of the management (time and type). This agreed with our results. El Ayadi et al found that SI ≥ 0.9 indicates a need for referral, as this study was directed in a tertiary care teaching hospital where necessary resuscitation for emergency patients with obstetric haemorrhage are sufficient.⁶

CONCLUSION

Shock index compared favourably with conventional vital signs in predicting ICU admission and other outcomes in PPH, even after adjusting for confounding; SI < 0.9 provides reassurance, whereas SI ≥ 1.7 indicates a need for urgent attention. In low-resource settings this simple parameter could improve outcomes. Shock index is an effective indicator of outcome in PPH. It is superior to all other conventional vital signs in early recognition of PPH and prompt treatment. We propose thresholds of SI > 0.9 for indicating the need for referral to a higher-level facility.

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