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'SURGICAL APGAR SCORE: EFFICACY IN PREDICTING SURGICAL OUTCOME'

General Surgery

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ABSTRACT

The prime goal of every surgeon is his patient's uneventful recovery. To ensure that goal, it is very important to identify patients who are likely to develop complications, and to treat them promptly. Many scores such as the APACHE-II and POSSUM scores have been developed to predict surgical outcomes, but they require acquisition of clinical and laboratory data that's both tedious and expensive. The Surgical APGAR score includes three simple intra-operative parameters to predict the risk of post-operative morbidity for the patient. Such a score can be readily adopted in hospitals where sophisticated equipment may not be available. The aim of this prospective study was to evaluate the efficacy of this score in predicting outcomes in 100 patients undergoing laparotomy for various indications at our hospital.

INTRODUCTION:

The Surgical APGAR score was designed[1] with the objective of developing a simple score that can predict complications in surgical patients. Taking its name from the Virginia APGAR[2] score for newborns, it includes three intra-operative clinical parameters: estimated blood loss, lowest recorded mean arterial pressure and lowest recorded heart rate. Other scores like the APACHE II score[3], POSSUM[4], SAPS II[5], E-PASS[6], TRIOS etc, are very cumbersome to evaluate, and expensive to carry out in a government hospital like ours. Also, even in patients with no co-morbidities, variables in the operative period strongly influence the outcome. Hence, the need for the validation of a simple score to predict surgical outcomes so that patients at higher risk are identified early and can be monitored appropriately to prevent excessive morbidity and mortality.

PATIENTS AND METHODS:

The current study is a prospective study involving 100 patients undergoing laparotomy in both elective and emergency settings at Osmania Medical College, Hyderabad, between April 2015 and March 2016, with 30-day post-operative follow up, and to correlate the Surgical APGAR scores calculated intra-operatively with their post-operative progress.

Inclusion criteria:

Patients between the ages of 15 and 85 undergoing laparotomy for major abdominal surgeries like: hemicolectomy, gastrectomy, abdomino-perineal resection, splenectomy, major small bowel resection, cholecystectomy, common bile duct exploration, Whipple's procedure. Both emergency and elective procedures done under general, epidural or spinal anesthesia are included.

Exclusion criteria:

- Surgeries performed under local anesthesia
- Minor small bowel resections, Minor surgeries
- Laparoscopic surgeries

- Patients undergoing elective surgeries were optimized for their respective co-morbidities before surgery.

The **Surgical APGAR score** is calculated as the sum of points allotted to three intra-operative parameters, i.e., i) ESTIMATED BLOOD LOSS, ii) LOWEST RECORDED HEART RATE AND iii) LOWEST RECORDED MEAN ARTERIAL PRESSURE, as shown in the following table:

Surgical APGAR score	No. of points				
Variables	0	1	2	3	4
Estimated blood loss (mL)	> 1000	601 - 1000	101 - 600	100	---
Lowest mean arterial pressure (mm Hg)	< 40	40 - 54	55 - 69	70	---
Lowest heart rate/min	> 85*	76 - 85	66 - 75	56 - 65	55*
* Occurrence of pathologic bradyarrhythmia, including sinus arrest, atrioventricular block or dissociation, junctional or ventricular escape rhythms, and asystole also receive 0 points for lowest heart rate.					

- The cumulative scores are separated into 5 categories as follows: 0-2, 3-4, 5-6, 7-8 and 9-10. The lower the cumulative score, higher is the risk of morbidity predicted.

- We have calculated approximate blood loss by weighing the surgical sponges and gauze pieces before and after the surgery, and from the blood collected in the suction apparatus. The other two intra-operative parameters were taken from the anesthesiologists' records.

- Patients were followed up for 30 days post-operatively for occurrence of any major complications or death with regular visits to the OPD, especially those with low surgical APGAR scores. Investigations were performed wherever required to evaluate complications.

- The following are considered as major complications: Acute renal failure, Bleeding requiring transfusion of 4 units or more of blood within 72 hours after surgery, Cardiac arrest requiring cardiopulmonary resuscitation, Coma of 24 hours or longer, Deep vein thrombosis, Myocardial infarction, Unplanned intubation, Ventilator use for 48 hours or more, Pneumonia, Pulmonary embolism, Stroke, Wound dehiscence, Deep or organ-space surgical site infection, Sepsis, Septic shock, post-operative complications of Clavien[7] Class III and greater.

- Superficial surgical site infection and urinary tract infection are not considered major complications.

- Patients are grouped according to age and nature of the procedure (emergency/ elective) for better analysis.

RESULTS:

A hundred patients were included in the study with 35% of them

female, and 65% male. 59% were in the age group of >40 years & the remaining 41% under 40.

- 42.4% of patients in age group >40 had surgical APGAR score of <4, whereas only 12.2% in the age group of <40 had a score of <4.
- 28% of surgeries were elective in nature; whereas 72% were emergency cases.
- The most common complications noted in our study were, in descending order: acute renal failure, sepsis and shock, post-operative pneumonia, wound dehiscence and cardiac arrest requiring resuscitation.
- Overall occurrence of major complications at 30 days of post-operative period was 27% & 30-day mortality was 9%.
- There was a progressive increase in the number of major complications from 8.33% in score 9-10 category to 66.6% in score 0-2 category. 30 day mortality was 0% for 9-10 and 33.3% for 0-2 category.
- Among the 28 elective surgeries: Major complications were noted in a total of 17.8% of cases, with incidences of 50% in 0-2 score group, 40% in 3-4 group, 16.6% in 5-6 group, 0% in the 7-8 and 9-10 score groups, which were not statistically significant (p>0.05). 30-day mortality was 25% in 0-2 group, 20% in 3-4 group and 0% in 5-6, 7-8, 9-10 score groups, which were also statistically not significant (p>0.05).
- Among the 72 emergency surgeries: Major complications were noted in a total of 30.5% of cases with incidences of 50% in 0-2 score group, 62.5% in 3-4, 33.3% in 5-6, 20.5% of 7-8 and 16.6% in 9-10 score groups. 30-day mortality was 37.5% in 0-2, 25% in 3-4 and 33.3% in 5-6, 2.94% in 7-8, and 0% in 9-10 score groups and was statistically significant (p<0.05).

DISCUSSION:

The Surgical APGAR score was developed by Gawande et al after assessing multiple pre-operative and intra-operative variables and analyzing post-operative performance in various cohorts of patients undergoing colonic, vascular and general surgical procedures. They had concluded that predictive ability of three intra-operative variables, i.e., estimated blood loss, lowest recorded mean arterial blood pressure and lowest recorded heart rate, was more significant than with other models utilizing pre-operative parameters[8] or other intra-operative variables[9]. This score also predicted outcomes better in patients who did not have any pre-operative co-morbidity[10] but had difficult surgeries thus putting them at a higher risk of complications.

In our study, we have noted that in every 2-point surgical APGAR score category, the incidence of both major complications and death was significantly greater than that of patients in the next-higher category. A similar result was noted in the study by Gawande et al.
A study by Regenbogen et al[11] showed an incidence of major complications in 14.1% in major surgeries and death rate of around 2%. Among major surgeries, patients with scores of 4 or less were 6.5 times more likely to have a major complication (95%CI, 4.7-8.9, p<0.001) and 112 times more likely to die (95% CI, 15.32-819, p<0.001) within 30 days of surgery.

A plan of action regarding post-operative care based on surgical APGAR score has been proposed by another group[12] as follows:

- Score of 9 or 10: no additional actions required.
- Score 5-8: prescribe antibiotic, stress ulcer and venous thromboembolism prophylaxis if considered beneficial, review the patient in eight hours (specifically including review of vital signs, urine output and pain) and then plan twice daily review for the next two days.
- Score 0-4: in addition to the above actions, consider admission to critical care unit and plan an additional review in four hours.

In our study, the Surgical APGAR score has been shown to correctly predict morbidity in patients undergoing abdominal surgeries, especially in the emergency setting. Patients more than 40 years old had lower surgical APGAR scores and were hence at higher risk for major complications including mortality.

Patients with low surgical APGAR score would require intensive care unit monitoring or would require admission in the hospital even if undergoing a day care procedure. Further studies with larger numbers of patients may be required to correctly evaluate its utility in the elective setting.

CONCLUSION:

In a government hospital like ours, where it is not feasible to carry out expensive investigations required for the calculation of other surgical scores like APACHE-II, POSSUM, SAPS, etc, the Surgical APGAR score can function as a handy tool for the surgeon to predict outcomes and identify patients who may need intensive monitoring early in the post-operative course. Surgeons working in district or primary health care centers may also be able to identify patients who need early referral to tertiary care centers, with the help of this score.

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