REVIEW ARTICLE

Use of The American Society of Anaesthesiologists Physical Status Classification in non-trauma surgical versus trauma patients: a survey of inter-observer consistency

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Background: The American Society of Anaesthesiologists-Physical Status (ASA-PS) Classification is a grading system for classifying surgical patients based on their comorbid background. Despite numerous benefits, its highly subjective nature has led to marked inconsistency when used.

The purpose of this study was to assess consistency when public sector anaesthetists score trauma and non-trauma surgical patients using the Classification.

Methods: A three-part questionnaire, with 18 clinical scenarios, was administered to 98 anaesthetists requiring them to grade the scenarios using the Classification and give their opinion on its usage.

Results: We received 97 completed questionnaires. Eighty-eight percent of respondents routinely use the Classification. Fifty-two percent had read the Classification within the last six months. Many limitations of the use of the ASA System were identified. There was a lack of consistency in the scoring of the scenarios, with each scenario receiving at least three different gradings. Scenarios involving trauma, paediatrics, neurosurgery and the airway were associated with greater inconsistency. There was a statistically significant ($p < 0.01$) difference in inter-rater variability between the trauma and non-trauma scenarios.

Conclusion: The ASA-PS Classification shows poor inter-rater consistency when trauma patients are scored compared to non-trauma patients. Anaesthetists found it an overall inadequate tool to be used perioperatively in its current state. There has been suggestion for a possible multifactorial modification with an aim to improve preoperative physical status and risk assessment of patients.

Introduction

The American Society of Anesthesiologists-Physical Status (ASA-PS) grading system is widely used for classifying surgical patients preoperatively based on their comorbid background. It is 'user friendly' and does not rely on complicated variables, making it a valuable tool in an acute setting. It aids communication between different disciplines, highlighting the anesthetists' risk assessment of the patient.

The ASA grading system, despite its advantages, has definite flaws. Its subjective nature has led to inconsistencies in the assessment of patients in multiple settings including obstetrics[1] and paediatrics[2-4] with suggestion that there should be a move towards modifying it.

The burden of disease in South Africa has a major contribution from trauma[5] and these patients are dominant players in our everyday practice of anaesthesia. The trauma patient group possess their own set of problems in the preoperative assessment. These include an altered level of consciousness, the inability to ascertain comorbid conditions and functional limitation, and language barriers. Numerous trauma scoring systems exist, each with its own merit, attempting to risk-stratify based on the severity of injury. However, the ASA-PS classification is nevertheless still widely used by anaesthetists for this purpose. Overseas studies have proven it to be reliable when grading comorbidity in trauma patients.[6] Pre-injury ASA scores

were independent predictors of mortality in trauma patients.[7] Despite this, when trauma cases were allocated to be assigned ASA scores, marked inconsistency in rating was found.[7]

There is a paucity of research into the use of the ASA-PS system in both non-trauma and trauma patients in the South African setting. It is therefore pertinent that usage of this simple but effective classification be analysed for consistency in our local setting before embarking on its deconstruction.

A quantitative study was conducted with the use of a questionnaire directed to anaesthetists in state sector hospitals in the eThekwini and Msunduzi municipalities. The questionnaire included 18 hypothetical scenarios that doctors were asked to score using the ASA-PS system.

The study aims to assess usage of the ASA scoring system in different categories of non-trauma and trauma patients. The trauma patient is a new addition to similar studies[8-13] that have been conducted overseas. It will be ascertained whether similar findings of inconsistency of rating can be found. If so, proposed solutions and possible modifications will be offered.

Methods

Biomedical Research Ethics Committee (BREC) approval was obtained (BE068/16).

Over a four-month period from May 2016 to August 2016, questionnaires were delivered directly to 98 state sector anaesthetists. The sample size was based on the ANOVA statistical test with a 95% CI, effect size F = 0.4 and alpha error probability of 0.05. Informed consent was completed by participants.

Inclusion criteria for the study were medical officers, registrars and consultants working within the department of anaesthesia, eThekwini and Msunduzi Municipalities. Respondents were required to have a Diploma in Anaesthesia (DA) degree. Exclusion criteria were medical students and interns rotating through the department of anaesthesia, as well as intensivists.

Part one of the three-part questionnaire collected demographic data, current usage of the grading system and difficulties encountered in scoring certain patient groups. Part two of the questionnaire included 18 hypothetical scenarios. For validity, we used the same 10 hypothetical clinical scenarios as a former study in 1995 by Northern England anaesthetists but with the addition of eight trauma scenarios. These eight scenarios further covered topics of sepsis, neurosurgery, the airway, obstetrics, paediatrics and geriatrics. Part three focussed on participants' concerns with grading the scenarios as well as their opinions regarding the usefulness of the scoring system in its current form.

The data collected was captured and analysed using SPSS Version 23. The intra-class correlation (ICC) was the statistical test used for assessing inter-rater reliability (IRR). Cut-offs for ratings of agreements on ICC values: poor (< 0.4); fair (0.40–0.59); good (0.60–0.74); excellent (0.75–1.0). NVIVO Software was used to analyse qualitative data. The results were presented in tables and bar charts. Fisher's exact test was used to assess if level of expertise was an independent factor when assigning ASA grading (1 to 5) to the case scenarios because of small cell sizes. Kruskal Wallis rank test was used to compare the total score over all scenarios by level of expertise. Reliability of the study was determined using the Cronbach test.

Results

Demographic data

In our study, 37% of participants were specialists, 24% were registrars and 39% were medical officers. Eighty-eight percent of anaesthetists routinely use the ASA-PS grading system. The time period since our respondents last read the ASA-PS Classification is demonstrated in Graph 1 below. A majority (93%) of anaesthetic departments expect their doctors to document the ASA grade in every case. However, only 67% were documenting the grade. Eighty-six percent of anaesthetists find it difficult applying the grading system in the trauma subgroup of patients. Ninety-five percent of participants documented that they had difficulty applying the ASA grading to obstetrics, paediatrics, trauma, vascular and geriatrics. Eighty-two percent believe that there should be modifications made to the ASA-PS Classification.

Time period since anaesthetist last read the ASA-PS Classification

- 52% < 6 months
- 31% 6 – 23 months
- 8% 2 – 5 years
- 9% > 5 years
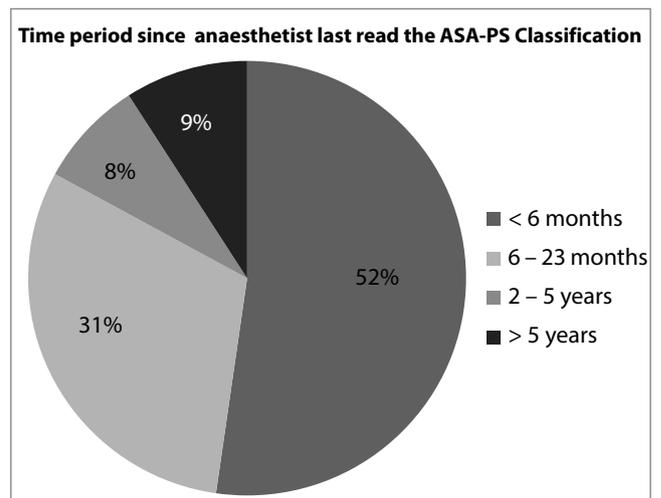
Graph 1. Time period since anaesthetist had last read the ASA-PS Classification

Case scenarios

Table I outlines an abbreviated form of the 18 scenarios used in the study, and the ASA scoring per scenario. The highlighted blocks demonstrate the most popular ASA score per scenario.

There was no statistically significant association found between level of expertise and grading the case scenarios between the individual scenarios or the total score.

Eighty-eight percent of anaesthetists routinely use the ASA-PS classification, of which 25% do not document the ASA grade in every case for several reasons (see Table II below).

The ICC for trauma patients was 0.21 and that for non-trauma patients was 0.51. When the non-trauma ICC was tested against the trauma ICC, it was statistically significant (p < 0.001). Eighty-three percent of the patients in the good/excellent category were non-trauma. However, the other two categories (fair and poor) showed no difference in terms of being trauma- or non-trauma-related. Scenarios that showed poor agreement were 3, 11, 12, 13 and 18.

Qualitative data

Table II outlines the major themes from the qualitative data analysis.

Discussion

The intention in the creation of the ASA-PS system was not to assess surgical risk, due to a lack of inclusion of the nature and severity of the surgical procedure in the scoring system. Older studies have shown that the ASA-PS system is nonetheless a useful tool for predicting short- and long-term outcome.[7,14-17] A recent study however looking at the relationship between the ASA score and postoperative mortality, has concluded that it has poor discriminatory power and is less than acceptable for widespread use.[18]

In light of this, in October 2014, The American Society of Anaesthesiologists House of Delegates approved an addition

Table I. ASA scoring per case scenario

Case scenarios	Number of respondents (n = 97) per ASA Grade				
	ASA 1	ASA 2	ASA 3	ASA 4	ASA 5
1. 56yo F, poorly-controlled HPT for varicose vein surgery	3,0	89,0	3,0	2,0	0,0
2. 66yo M, known with COPD for anterior resection Ca rectum	0,0	22,0	65,0	10,0	0,0
3. 36yo F, acute subarachnoid haemorrhage for craniotomy	31,0	18,0	29,0	17,0	2,0
4. 78yo F, septic shock secondary to a ruptured sigmoid diverticulum	2,0	2,0	14,0	53,0	26,0
5. 72yo M, stable angina and renal impairment for elective repair AAA	0,0	6,0	67,0	22,0	2,0
6. 69yo M, for TURP. Acute exacerbation of COPD preop	0,0	17,0	69,0	11,0	0,0
7. 61yo F, Ca oesophagus for oesophagectomy	1,0	18,0	57,0	19,0	2,0
8. 25yo F with limited mouth opening post-trauma for a tonsillectomy	89,0	6,0	2,0	0,0	0,0
9. 57yo insulin-dependent diabetic, elevated creatinine for knee repl.	2,0	71,0	23,0	1,0	0,0
10. 65yo M, HPT post-MVA: compound bilateral femur fractures for washout and fixation	5,0	79,0	11,0	1,0	0,0
11. 19yo M, post MVA frontal contusion with low GCS for fixation of a compound fracture of the tibia	45,0	20,0	18,0	12,0	2,0
12. 28yo F, peritonitic abdomen in septic shock for exploratory laparotomy	30,0	5,0	25,0	32,0	5,0
13. 8yo F, GCS 7/15 PVC closed head injury: insertion of external ventricular drain	25,0	17,0	20,0	23,0	11,0
14. 40yo obese M, ORIF bilateral mandibular symphyseal fracture	7,0	53,0	30,0	6,0	1,0
15. 22yo pregnant pre-eclamptic at 38/40 in labour, fractured tibia for emerg C/Sec	13,0	66,0	18,0	0,0	0,0
16. 67 yo M, smoker with COPD, poorly controlled HPT: ASDH for craniotomy. GCS 13/15	0,0	7,0	54,0	29,0	7,0
17. 5yo M with Hurler's Syndrome and mild mitral regurgitation for fixation humeral fracture	0,0	34,0	56,0	7,0	0,0
18. Unknown intoxicated M with large parietal contusion, renal impairment with oligura for neurosurgery.	19,0	12,0	23,0	31,0	8,0

yo, year old; F, female; M, male; HPT, hypertension; COPD, Chronic Obstructive Pulmonary Disease; Ca, cancer; AAA, abdominal aortic aneurysm; TURP, transurethral resection of the prostate; MVA, motor vehicle accident; GCS, Glasgow Coma Scale; PVC, pedestrian vehicle collision; ORIF, open reduction internal fixation; ASDH, acute subdural haematoma

Table II. Major themes from qualitative data analysis

#	Question	Theme
1	What is the reason for not documenting the ASA grade in every case?	Forgetfulness Not useful Unable to obtain adequate history from certain patient groups No impact on patient outcomes
2	Can you say why you have difficulty when using the ASA scoring system for	
2,1	Obstetric patients	Concurrent comorbidities Variable physiological and pathological state
2,2	Paediatric patients	Acute illness in children with no comorbidities No definition of grades of mild to severe disease in children
2,3	Trauma patients	Acute injuries not accounted for No co-morbidities but critical injuries
2,4	Geriatric patients	Multiple comorbidities Poor therapy history or control Physiological ageing process not taken into account
2,5	Vascular patients	Not enough data for open-ended analysis
3	What were some of the limitations encountered when scoring the case scenarios?	Difficult to combine acute and chronic issues Airway problems add anaesthetic risk but are not always part of a systemic disease Difficult scoring trauma cases, cancer, multiple comorbidities, paediatrics and COPD
4	What modifications, if any, should be made to the classification?	Type of trauma, haemodynamic stability, organ dysfunction and airway assessment should be added Different classification for each population group No place for ASA grading in trauma Differentiation for acute and chronic condition with or without functional limitations

Table III. 2014 Current definitions (OLD) and class-specific examples (NEW)[19]

ASA-PS Classification	Definition	Examples
ASA 1	A normal healthy patient	Healthy, non-smoking, no or minimal alcohol use
ASA 2	A patient with mild systemic disease	Mild diseases only without substantive functional limitations. Eg. Include but not limited to: current smoker, social alcohol drinker, pregnancy, obesity(30 < BMI < 40), well-controlled DM/HTN, mild lung disease
ASA 3	A patient with severe systemic disease	Substantive functional limitation; 1/> moderate to severe diseases. Eg. Include but not limited to: poorly controlled DM/HTN, COPD, morbid obesity(BMI > 40), active hepatitis,alcohol dependance or abuse, implanted pacemaker, moderate reduction of ejection fraction, ESRD, undergoing regularly scheduled dialysis, premature infant PCA < 60 wk, > 3 mo of MI, CVA, TIA or CAD/stents
ASA 4	A patient with severe systemic disease that is a constant threat to life	Eg. Include but not limited to: < 3 mo MI, CVA, TIA or CAD/stents;ongoing cardiac ischaemia or severe valve dysfunction; severe reduction of ejection fraction; sepsis; DIC; ARD; or ESRD not undergoing regularly scheduled dialysis
ASA 5	A moribund patient who is not expected to survive without the operation	Eg. Include but not limited to: ruptured abdominal/thoracic aneurysm, massive trauma, intracranial bleed with mass effect, ischaemic bowel in the face of significant cardiac pathology or multiple organ/system dysfunction
ASA 6	A declared brain-dead patient whose organs are being removed	

of class-specific examples to the Classification system (Table III). Following this, a recent study in 2016[19] found that with the use of the class-specific examples, both anaesthesia and non-anaesthesia providers alike were able to increase their ability to determine the 'correct' ASA class. Both groups were asked to assign ASA scores to 10 hypothetical cases using only the definitions. The second part of the survey involved the same scenarios, but the participants were given a table with the published class-specific examples. There was a substantial improvement in the way scores were correctly assigned.

In our study, even though 83% had read the ASA-PS within the last two years, for every case scenario, there were a percentage of people who interpreted and graded the cases differently. This is in keeping with various overseas studies.[1-4,9,19] Scenarios that posed challenges included the young healthy trauma patient with severe injuries especially if requiring neurosurgery.

In our study, six scenarios (62%) yielded conflicting results.

Scenario 1 (poorly controlled hypertensive, varicose vein surgery) was presumed to be the most likely to achieve complete consensus but did not do so. Three percent of anaesthetists classified the patient as ASA 3 and the remainder as ASA 2 which was in keeping with the Haynes and Lawler[9] study.

Scenario 9 (insulin-dependent diabetic with a raised creatinine for knee replacement) examined the boundary between ASA 2 and 3. Seventy-three percent of anaesthetists graded the patient as ASA 2 and 24% ASA 3. The distinction between these two grades has implications when it comes to considering the operative risk and allocation of anaesthetic staff or skills.

Scenarios 5 (stable angina, renal impairment for AAA repair) and 7 (Ca oesophagus for oesophagectomy) were designed to distinguish between Grades 3 and 4. In both cases, Grade 3 was the majority grading. Perhaps long-standing coronary artery disease (> 3 months) with moderate functional impairment outweighed the threat to life from the aortic aneurysm when deciding on the grade.

In Scenario 8 (limited mouth opening for a tonsillectomy) 92% of anaesthetists graded the patient as ASA 1 and the rest as Grade 2 and 3. This suggests that respondents are taking the potentially difficult airway into account.

Scenario 12 (peritonitic abdomen in septic shock for exploratory laparotomy) was one of the scenarios that posed challenges with grades ranging from Grade 1 (30.9%) to Grade 4 (33%). Participants may have felt the lack of comorbid conditions to be important despite the apparent need for surgical intervention (Grade 5).

With open-ended questions, anaesthetists were able to detail the difficulties experienced when confronted with a complex case. Scenarios that posed challenges included the young patient with no comorbid disease in the trauma setting with severe injuries (Scenarios 3 and 11) especially if requiring neurosurgery. Many felt it difficult to ignore the severity of the traumatic injury in a previously healthy patient. According to the updated classification: massive trauma and intracranial bleed with mass effect fall into ASA Grade 5 category (moribund patient not expected to survive without the operation). In scenario 11, 46% of anaesthetists graded the young man post MVA, with a frontal contusion and compound tibial fracture, as ASA Grade 1. There were a percentage of respondents that scored the patient in the rest of the ASA grades as well thereby showing the confusion with usage of the classification. This suggests that scoring is being based primarily on the patient's comorbid status as opposed to his current state of illness.

In Scenario 15 (pre-eclamptic woman in labour with fractured tibia now requiring Caesarean section), 68% of doctors graded the patient as an ASA 2 and the rest were divided between ASA 1 and 3. The ASA Classification lists 'pregnancy' as an example in the ASA 2 category, with no mention of effect on grading in

the face of pregnancy-related conditions such as pre-eclampsia. Pregnancy presents its own subset of physiological disturbances that require special anaesthetic management and can increase a patient's risk profile. These issues are not included in the ASA system. ASA 2 is very broad in its definition for mild to moderate disease. It is therefore not surprising that doctors were met with confusion when scoring the pregnant patient, with or without trauma. Barbeito et al[1] proposed the usage of a modifier for pregnancy (G for gravid, similar to the modifier E for emergency) to improve predictability of the ASA Classification. It was found that anaesthetists reduced their ratings when given the option of the G modifier. It allowed doctors to focus on the concomitant pregnancy complications or disease when communicating about preop status and classification of physical status.

Paediatrics poses a very similar problem. In the two paediatric scenarios included in the study, there was considerable inter-rater discordance. It does not address children with congenital disorders (even though congenital disorders were found to contribute to over 300 000 deaths in 2015).[20]

Aplin et al[3] in their study involving a large group of experienced paediatric anaesthetists who were familiar with the ASA-PS, displayed a significant amount of inter-rater variability in the application of the system to hypothetical patients. They concluded that the ASA-PS classification may be less reliable in paediatrics than in the adult population. Direct responses from their study population when asked about perceived problems with the classification revealed uncertainty as to where acute illness and congenital malformations or syndromes should be placed. Functional limitation in neonates and infants was also a confusing definition. Stand out comments in our study when asked about difficulties grading paediatric patients were that acute and chronic disease in children is not included in the classification.

Limitations

Some of the limitations to the study included an assumption that the responders were au fait not only with usage of the ASA scoring system, but also with the latest changes to the classification. In our setting, several doctors have completed their specialist exams but are not in consultant posts which may have skewed the demographics of the study. Even though the patient scenarios were carefully planned, a brief description and no opportunity to examine the patient may have contributed to greater inter-rater variability in grading.

Conclusion

Our study, similar to previous overseas studies, has shown that the ASA-PS Classification has poor inter-rater consistency when patients are scored. In addition, there was inter-rater variability with the trauma subset of patients, a group that has not been studied in this context before. This was not influenced by level of expertise or number of years of experience in the speciality of anaesthesia. It can be proposed that the subjectivity and

lack of detail in the ASA-PS grading system, despite the recent inclusion of examples, is still leaving anaesthetists uncertain when scoring different patient categories. Anaesthetists are not finding the classification useful and believe that there should be modifications made to it. An alarming number of respondents (88%) revealed that it should not be used at all for special populations such as in trauma, pregnancy and paediatrics. It is the feeling of the authors that, while the classification has obvious problems, its current use as a tool for assessing and communicating risk, in the face of a lack of a more reliable scoring system, is still valuable. This is especially true of the developing world with many junior doctors working in peripheral hospitals and in need of a simple-to-use risk assessment tool. It is hoped that a more comprehensive revision of the classification will be made available in the future.

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