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ASA classification – What is the real impact of the introduction of the new clinical examples?

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Abstract

Aim: The American Society of Anesthesiologists scale is used worldwide for the assessment of the physical status of patients proposed for anaesthesia interventions. This study aims to assess the level of agreement of the last updated American Society of Anesthesiologists classification version, with the introduction of examples for each class, and search for variables that could promote inconsistency.

Methods: An online questionnaire was sent to anaesthesiology specialists and residents in Portugal, describing 10 fictitious clinical cases. Sociodemographic and labour data were also correlated.

Results/findings: A total of 243 anaesthesiology physicians participated. There was a high diversity in responses. Years of practice influence this diversity ($P < 0.05$).

Discussion and conclusions: The need for a universal scale for classification of patients proposed for anaesthesia is consensual. Despite the last update in 2014, the American Society of Anesthesiologists classification continues to present limitations regarding consistency and objectivity. Efforts should be made to reduce their interpersonal variability.

Keywords

Scales / Anesthesia / Preoperative care

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Introduction and literature review

The concept of physical status classification was created in 1941 by the American Society of Anesthetists, the predecessor of the American Society of Anesthesiologists (ASA), who devised a system for collection and tabulation of statistical data in anaesthesia (Saklad 1941).

This classification has undergone multiple revisions, and examples of clinical conditions were added in its latest revision (American Society of Anesthesiologists 2014).

The ASA classification is used worldwide to classify the physical condition of patients and characterise them by risk group, both for clinical practice and research purposes. There are several examples of scientific studies that use this classification to characterise patient groups (Phan et al 2017). Despite being massively used, there is a mistrust regarding the reliability of the ASA classification and several studies have been conducted to analyse its potential variability and subjectivity (Bernard et al 2009, Moreno et al 2015, Ranta et al 1997). Most of the available studies on ASA classification variability were performed prior to its latest review. As such, the potential impact of adding clinical examples in reducing subjectivity is unknown. All efforts to reduce ASA classification subjectivity assume special relevance, improving harmonisation in the clinic (patient status interpretation) and research settings (improving result interpretation and accuracy) (Riley et al 2014).

This study aims to assess the level of agreement of the last updated ASA version, with the introduction of the clinical examples for each class, in Portugal, considering the relative homogeneity of the population in a small country, and search for variables that could promote inconsistency.

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Methods

Questionnaire

This was a cross-sectional study conducted between November and December 2015, in 50 Portuguese Anesthesia Services included in the Anesthesia Census 2014 performed by Portuguese Anesthesia Medical Council (Lemos et al 2015). This study aimed to assess the ASA classification variability among Portuguese physicians in the anaesthesiology field (residents and specialists).

The online platform LimeSurvey was used to create a questionnaire, divided in two parts.

The first part of this questionnaire collected sociodemographic and labour-related data (sex, specialist/resident, place of work (Central Hospital/ District Hospital/Private Hospital), predominant work field, training location, years of work, knowledge of last version of ASA classification (yes/no)).

Considering the place of work, hospitals were grouped in accordance with the Portuguese decree no. 82/2014 (April 10) (Assembly of the Republic 2014). Group I includes hospitals with an area of direct influence of between 75,000 and 500,000 inhabitants, with no areas of indirect influence. Hospitals from Group II have an area of direct and indirect influence for their specialties, which includes all but clinical pharmacology, genetics, paediatric cardiology, cardiothoracic surgery and paediatrics surgery. Hospitals from Group III include all medical and surgical specialties. Group IVa includes specialised hospitals in oncological pathology.

The second part of the questionnaire was composed by 10 hypothetical clinical cases subdivided by two subgroups, with five clinical cases each. The clinical cases were created based on the examples given in each class of the classification. The second subgroup only appeared after the questionnaire showed the current ASA classification, approved in 2014 (American Society of Anesthesiologists 2014). Table 1 describes each clinical case included in the questionnaire.

Questionnaire application

The questionnaire was kept online for two months. The link was sent to 50 anaesthesiology department directors in Portugal, to be resent to all anaesthesiology physicians (specialists and residents). The questionnaire was anonymous.

Statistical analysis

A descriptive analysis of the study data was performed. Categorical variables were described by counts (n) and percentages (%), while numerical variables were summarised through means and standard deviations. Statistical tests were carried out to compare numerical variables between two groups (t-test). Correlation between two variables was assessed by Pearson correlation test. P values inferior to 0.05 were considered statistically significant. Statistical analyses were conducted using SPSS® version 21.0.

Results

Of the 50 Portuguese anaesthesia services to which we sent the questionnaire, 243 responses were obtained (168 specialists and 75 residents). Most participants already knew the updated version of the ASA classification (84.4%). Most specialists did not have a predominant field of work (61.9%), while 12.5% had 1 or 2 predominant fields. Sociodemographic and labour-related details are described in Table 2.

Table 3 summarises the responses of the study participants to each clinical case in both subgroups (before and after ASA classification presentation). The highest percentage of responses matching those suggested by the authors, based on the analysis of the classification, was observed in case 2 (65.4%), while case 9 had the lowest percentage (3.3%).

To assess relationships between the studied variables, we compared the answers of the participants with the answers of the study authors. We emphasise that the 10 clinical cases in this study were created based on the clinical examples presented in the latest ASA classification. When comparing the mean number of responses equal to those given by the authors, before and after reading the ASA classification (1.85 and 1.35, respectively), the matching rate was found to be lower after the reading, and this difference was statistically significant ($t = 5.420$, $P < 0.01$). Overall, the mean number of responses equal to those given by the authors was 3.21.

The level of agreement between the participants' responses and the authors' responses was also tested by predominant area of work (1 or 2 versus none), type of physician (specialist versus resident), previous knowledge of the updated ASA classification and type of hospital, with no statistically significant differences found (Table 4).

Regarding the clinical practice time for specialists, as the number of years of practice increased, the number of responses with the classification assigned similar to that of the authors decreased ($P < 0.05$, data not presented). Regarding the year of residency, differences were not statistically significant ($P > 0.05$; Table 5).

Discussion

All clinical cases included in this study were created based on the examples provided in the 2014 version of

Table 1 Hypothetical clinical cases

Case	Description	ASA score by authors
Clinical cases shown before ASA classification visualisation		
1	• Puerperal woman, 32 years of age. • BMI: 38 kg/m^2, with no clinical relevant history. • Admitted to the OR by active haemorrhage after eutocic delivery. • Hb: 11 g/dL; Htc: 35%; platelets: 140x10^4 μL; normal coagulation study and other analytical values without relevant changes. • Stable vital signs.	IIE
2	• Woman, 60 years of age. • Uncontrolled arterial hypertension and dyslipidaemia. • Proposed to vaginal hysterectomy. • Vital signs before admission to the OR – BP: 185/110 mmHg; SpO_2 ($FiO_2$21%): 98%.	III
3	• Man, 45 years of age. • Admitted to the ED due to road accident, with traumatic brain injury (fracture of the skull and face), Glasgow Coma Scale: 6 (ocular-2, verbal-2, motor-2), hip fracture, chest trauma, haemothorax and rupture of the spleen. • Blood tests performed on ED – Hb: 8 g/dL; Hct: 28%; platelets: 145 x10^9/L; INR: 1.18; aPTT ratio: 1.2 (reference: 0.80–1.20). • Clinical examination and vital signs – unconscious; HR: 110 bpm; BP: 95/58 mmHg; SpO_2: 87% with TI and FiO_2 100%.	VE
4	• Man, 86 years of age. • Autonomous, proposed for total knee arthroplasty. • Preoperative examinations (electrocardiogram, chest X-ray and blood analysis) with no relevant changes. • Personal clinical history: no known pathology. • Minimum alcoholic habits (20 g alcohol/week). • Vital signs before admission to the OR – BP: 130/82 mmHg; SpO_2 (FiO_2 21%): 98%.	I
5	• Man, 67 years of age. • Diabetic, presented for cholecystectomy due to acute cholecystitis, with four days of evolution, with gallbladder perforation confirmed by abdominal computed tomography. • Clinical examination – conscious; disoriented in space and time; hydrated; polypnea with O_2 at 2 L/min through nasal cannula; tympanic temperature: 38.2°C; HR: 103 bpm; BP: 125/85 mmHg; urinary output: 500 mL/12 h. • Laboratory tests – leukocytes: 22x10^3/μL; CRP: 135 mg/L (reference:<5 mg/L).	IVE
Clinical cases shown after ASA classification visualisation		
6	• Male, 12 months of age. • Proposed to appendectomy, with a personal history of bronchiolitis (four episodes), the last of which two months before presentation, requiring hospitalisation for hypoxemia. • Intercrisis period without sequelae or limitations.	II
7	• Male, 65 years of age. • Congenital renal failure under haemodialysis (three days a week), with coronary stent placed 12 months ago, hypertension and dyslipidaemia, • Medicated with acetylsalicylic acid (100 mg qd), diltiazem (180 mg qd), atorvastatin 20 mg qd). • Smoking history: 20 cigarettes/day; 25 units/year. • Moderate alcohol consumption. • Proposed to urgent exploratory laparotomy due to intestinal occlusion. Stable vital signs.	IIIE
8	• Male, 35 years of age. • BMI: 36 kg/m^2 with no relevant clinical past, no toxophilic habits, submitted to plastic surgery for scarectomy and cutaneous grafts due to burning of 55% body area (thorax, upper limbs and lower limbs) by fire, with 10 days of evolution. No airway burning. • Preoperative laboratory tests: Hb: 9.2 mg/dL; platelets: 145x10^9/L; prothrombinemia: 74%; INR: 1.28; aPTT ratio: 1.25 (reference: 0.80–1.20). • Haemodynamically stable.	II
9	• Male, 76 years of age. • Obese, with controlled hypertension, diabetes (non-insulin medicated), and paroxysmal atrial fibrillation, anticoagulated with warfarin. • Proposed for subdural haematoma drainage, with one week of evolution, after cranioencephalic trauma, with midline deviation and altered state of consciousness for about 24 h.	V

(continued)

Table 1 Continued

Case	Description	ASA score by authors
10	• Preoperative blood tests after administration of phytomenadione – Hb: 12.5 mg/dL; INR: 1.25; prothrombinemia: 85%. Remaining values without relevant changes. • Glasgow scale 10 (ocular-2, verbal-3, motor-5). • Man, 29 years of age. • Admitted to the ED due to road accident. • Healthy to date, heterozygous for antithrombin III deficiency, type I (quantitative), without alcoholic or toxophilic habits. • Proposed to orthopaedics surgery for exposed tibia and fibular fracture of the right lower limb and fracture of the left femur, with active haemorrhage. • Blood analysis in the ED – Hb: 5 g/dL; Hct: 21%; platelets: 75 x109/L; INR: 1.45; aPTT ratio: 1.35 (reference: 0.80–1.20). • Clinical examination – conscious, oriented, HR: 115 bpm, BP: 105/63 mmHg, SpO_2: 98% (FiO_2 21%).	IVE

aPTT: activated partial thromboplastin time; ASA: American Society of Anesthesiologists; BMI: body mass index; BP: blood pressure; CRP: C-reactive protein; ED: emergency department; FiO_2: fraction of inspired oxygen; Hb: haemoglobin; Hct: haematocrit; HR: heart rate; INR: international normalised ratio; OR: operating room; SpO_2: peripheral capillary oxygen saturation; TI: tracheal intubation.

Table 2 Sociodemographic and labour-related data

			N	%
Sex	Woman		160	65.8
	Man		83	34.2
Specialist/resident	Specialist		168	69.1
	Resident (year of residency)	1	26	10.7
		2	23	9.5
		3	5	2.1
		4	9	3.7
		5	12	4.9
Place of work	Public hospital (Groups II and III)		86	51.2
	Public hospital (Groups I and IVa)		74	44.0
	Private hospital		8	4.8
Predominant field for specialists	No predominant field		104	61.9
	One or two predominant fields		21	12.5
	Orthopaedics		6	3.6
	Paediatrics		8	4.8
	Neurosurgery		6	3.6
	Obstetrics		3	1.8
	General surgery		4	2.4
	Intensive care		3	1.8
	Pain medicine		4	2.4
	Ophthalmology		3	1.8
	Obstetrics		3	1.8
	Oncology		3	1.8
Knows ASA 2014 version	Yes		205	84.4
	No		38	15.6

ASA: American Society of Anesthesiologists.

the ASA classification. With this work, we aimed to assess the potential subjectivity of the latest ASA classification and how the inclusion of clinical examples may harmonise interpretation.

We evaluated this subjectivity through the percentage of similar responses in each of the 10 cases.

This study relied on the participation of anaesthesiology departments across the country. We believe these results can be useful in the assessment of the potential subjectivity of the 2014 version of the ASA classification. This perspective is strengthened when compared with other studies with similar design and aim, but smaller sample sizes. (Jacqueline et al 2006, Ranta et al 1997, Riley et al 2014).

Regarding the answers given by the study participants, we highlight the great diversity of responses in each clinical case. These results are in agreement with other

Table 3 Clinical cases classification, based on ASA classification

Clinical cases shown before ASA classification visualisation				Clinical cases shown after ASA classification visualisation			
Case	Class	N	%	Case	Class	N	%
1	ASA-I	14	5.8	6	ASA-I	24	9.9
	ASA-II	96	39.7		**ASA-II**	**123**	**50.8**
	ASA-III	14	5.8		ASA-II	26	10.7
	ASA-IV	1	0.4		ASA-V	1	0.4
	ASA-V	–	–		ASA-V	–	–
	ASA-IE	19	7.9		ASA-IE	6	2.5
	ASA-IIE	**81**	**33.5**		ASA-IIE	49	20.2
	ASA-IIIE	16	6.6		ASA-IIIE	12	5.0
	ASA-IVE	1	0.4		ASA-IVE	1	0.4
2	–	–	–	7	ASA-I	1	0.4
	ASA-II	81	33.8		ASA-II	–	–
	ASA-III	**157**	**65.4**		ASA-III	84	34.6
	ASA-IV	1	0.4		ASA-IV	41	16.9
	–	–	–		ASA-V	2	0.8
	ASA-IIE	1	0.4		ASA-IIE	1	0.4
	–	–	–		**ASA-IIIE**	**57**	**23.5**
	–	–	–		ASA-IVE	54	22.2
	–	–	–		ASA-VE	3	1.2
3	ASA-I	3	1.3	8	ASA-I	12	5.0
	ASA-II	2	0.8		**ASA-II**	**99**	**40.9**
	ASA-III	7	2.9		ASA-III	102	42.1
	ASA-IV	41	17.1		ASA-IV	12	5.0
	ASA-V	18	7.5		ASA-V	1	0.4
	ASA-IE	8	3.3		ASA-IE	1	0.4
	ASA-IIE	6	2.5		ASA-IIE	5	2.1
	ASA-IIIE	11	4.6		ASA-IIIE	7	2.9
	ASA-IVE	84	35.0		ASA-IVE	2	0.8
	ASA-VE	**60**	**25.0**		ASA-VE	1	0.4
4	**ASA-I**	**122**	**50.6**	9	ASA-I	1	0.4
	ASA-II	116	48.1		ASA-II	11	4.5
	ASA-III	1	0.4		ASA-III	76	31.3
	–	–	–		ASA-IV	43	17.7
	–	–	–		**ASA-V**	**8**	**3.3**
	ASA-2E	2	0.8		ASA-IIE	9	3.7
	–	–	–		ASA-IIIE	42	17.3
	–	–	–		ASA-IVE	34	14.0
	–	–	–		ASA-VE	19	7,8
5	ASA-I	1	0.4	10	ASA-I	3	1.2
	ASA-II	30	12.4		ASA-II	20	8.3
	ASA-III	72	29.8		ASA-III	34	14.0
	ASA-IV	30	12.4		ASA-IV	25	10.3
	ASA-V	3	1.2		ASA-V	10	4.1
	–	–	–		ASA-IE	9	3.7
	ASA-IIE	32	13.2		ASA-IIE	49	20.2
	ASA-IIIE	42	17.4		ASA-IIIE	33	13.6
	ASA-IVE	**29**	**12.0**		**ASA-IVE**	**39**	**16.1**
	ASA-VE	3	1.2		ASA-VE	20	8.3

Authors' classifications are highlighted by bold texts.
ASA: American Society of Anesthesiologists.

studies carried out with previous versions of the ASA classification. A wide variation of hypothetical ASA grades in 10 clinical cases was observed among Finnish (Ranta et al 1997) and Australian anaesthesiologists (Riley et al 2014). Interestingly, a moderate agreement was observed among US paediatric anaesthesiologists, with most disagreement being generated by a tendency to assign higher ASA scores to patients (Jacqueline et al 2006). Nevertheless, these publications were made prior to the 2014 ASA update, after which, research has

Table 4 Characterisation according to the predominant area of work, career degree, knowledge of ASA classification and type of hospital

	N	Average	SD	t	P
Predominant area of work					
Not applicable	100	3.24	1.25	−1.31	0.19
One or two	64	2.95	1.53		
Specialist or resident					
Specialist	165	3.12	1.37	−1.61	0.11
Resident	72	3.43	1.33		
Knowledge of ASA classification					
Already know	199	3.21	1.36	0.02	0.98
Does not know	38	3.21	1.39		
Type of hospital					
Groups II and III	85	3.20	1.44	0.81	0.42
Groups I and Iva	79	3.02	1.30		

N: number of participants; SD: standard deviation; t: t test statistic.

Table 5 Characterisation according to the time of clinical practice and the year of residence (Pearson correlation)

	Clinical practice time (n=165)		Residence year (n=72)	
	R	P	r	P
Total of cases	−0.29	0.00	−0.03	0.83
Five clinical cases – after ASA classification reading	−0.14	0.08	−0.07	0.54
Five clinical cases – before ASA classification reading	−0.24	0.00	0.03	0.82

ASA: American Society of Anesthesiologists; r: Pearson correlation coefficient.

been limited. Our results support earlier concerns regarding the robustness applicability of the ASA classification for scientific research and medical practice purposes (Ranta et al 1997, Riley et al 2014), even after the introduction of the examples. Moreover, Portugal is a small country, with just over 10 million inhabitants and with only 10 medical schools and 27 anaesthesiology training centres, suggesting that when applied to a global scale, an even larger diversity may be observed. The importance of speaking the same scientific language is unquestionable, hence the importance of overcoming this obstacle.

By showing the ASA classification table after the first five clinical cases, we expected the classification of the remaining five cases would become more homogeneous. Surprisingly, there was an even higher variability, with statistical significance. Clinical examples must be as clear and concise as possible to minimise subjectivity.

Previous studies have tried to compare possible variables that could influence the subjectivity of the ASA classification: Riley et al (2014) found no association in their survey applied among 151 anaesthesiologists in Western Australia, between ASA class and age, level of training, sex or training region of the practitioner. Bernard et al (2009), in their study among paediatric sedation practitioners, concluded that the type of training and experience could affect the severity of ASA class assigned. In our study, we looked for any correlation between response variability and the type of hospital, predominant field of work in anaesthesia, type of physician (resident/specialist) and the previous knowledge of the 2014 update in ASA classification. None of them showed statistical significance.

Portugal is a small country with a relatively homogeneous population. This factor and the lack of impact of demographic variables seen in this study suggest that subjectivity may be more related with the interpretation of the ASA classification than with individual characteristics of the anaesthetists. This reinforces the need to clarify the examples given in the ASA classification, thus reducing subjectivity.

We found that the time of practice increases the variability in the responses, considering the clinical cases created. We attribute this significance to two possible causes: first, people with more years of clinical practice are less aware of ASA classification updates, thus, given the importance of this classification and its generalisation worldwide, all updates must be emphasised on a global scale. Second, the years of clinical practice and previous anaesthetic experiences may shape the subjective interpretation of the severity of each case and may have some weight in the decision of the class assigned to each case (Bernard et al 2009).

We also want to refer to the use of 'E', used to characterise situations of emergency surgery. It could be also a confounding factor, being omitted by some practitioners, thus contributing to the variability found in our sample. A further specification of this criterion, such as the delay time and the characterisation of what is meant by a significant life threat, could improve homogeneity of its use.

Conclusions

Our findings corroborate other studies, emphasising that even after the 2014 update, with the introduction of the new examples for each class, the ASA classification continues to present limitations. This leads us to conclude that this classification is still prone to subjectivity and thus should not be the only tool applied to describe the clinical condition of a patient, or to establish differences between study groups in a research setting. We also highlight the importance of collective work among the world's anaesthesiology entities to develop a classification system that allows greater uniformity among anaesthesiologists all over the world.

No competing interests declared.

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