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American Society of Anesthesiologists Score: still useful after 60 years? Results of the EuSOS Study

O escore da American Society of Anesthesiologists: ainda útil após 60 anos? Resultados do estudo EuSOS

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ABSTRACT

Objective: The European Surgical Outcomes Study described mortality following in-patient surgery. Several factors were identified that were able to predict poor outcomes in a multivariate analysis. These included age, procedure urgency, severity and type and the American Association of Anaesthesia score. This study describes in greater detail the relationship between the American Association of Anaesthesia score and postoperative mortality.

Methods: Patients in this 7-day cohort study were enrolled in April 2011. Consecutive patients aged 16 years and older undergoing inpatient non-cardiac surgery with a recorded American Association of Anaesthesia score in 498 hospitals across 28 European nations were included and followed up for a maximum of 60 days. The primary endpoint was in-hospital mortality. Decision tree analysis with the CHAID (SPSS) system was used to delineate nodes associated with mortality.

Results: The study enrolled 46,539 patients. Due to missing values, 873 patients were excluded, resulting in the analysis of 45,666 patients. Increasing American Association of Anaesthesia scores were associated with increased admission rates to intensive care and higher mortality rates. Despite a progressive relationship with mortality, discrimination was poor, with an area under the ROC curve of 0.658 (95% CI 0.642 - 0.6775). Using regression trees (CHAID), we identified four discrete American Association of Anaesthesia nodes associated with mortality, with American Association of Anaesthesia 1 and American Association of Anaesthesia 2 compressed into the same node.

Conclusions: The American Association of Anaesthesia score can be used to determine higher risk groups of surgical patients, but clinicians cannot use the score to discriminate between grades 1 and 2. Overall, the discriminatory power of the model was less than acceptable for widespread use.

Keywords: Anesthesiology; Reproducibility of results; Mortality; Postoperative period

INTRODUCTION

In 1940, the American Society of Anaesthesiology (ASA) asked a committee of three physicians to develop a system for the collection and tabulation of statistical data for anesthesia that could be applicable under any circumstances. The ASA score[1] that originated from this project has since developed into one of the most commonly used clinical scoring systems in the world. The score was originally designed to focus only on the preoperative comorbid state of the patient and not the surgical procedure or any other factors that could influence the outcome of surgery.

The score was originally described by four categories[2] that ranged from a healthy patient (class 1) to one with an extreme systemic disorder that is an imminent threat to life (class 4). Subsequently, two further classes were added, classes 5 and 6, which were subsequently collapsed so that they could be applied to moribund patients who were not expected to survive 24 hours, with or without surgery. A sixth class has since been described to be used exclusively for declared brain-dead organ donors.

Despite its apparent simplicity, this score is conceptually complex because it combines elements from the patient status before surgery (in classes 1 to 3) together with elements from the subjective opinion of the anesthesiologist (classes 4 and 5). Some authors add a sixth class for patients who are anesthetized just for organ retrieval (Table S1, no electronic supplementary material). The ASA score is not the only score that has followed this approach, but the relative merits of a purely objective score based solely on patient characteristics versus the incorporation of the subjective opinion of physicians remains controversial.[3] For these reasons, we decided to analyze the performance of the ASA score after almost 60 years of use in clinical practice in a large multicenter, multinational database.

METHODS

The European Surgical Outcomes Study (EuSOS) database[4] was used in this study. The primary objective of EuSOS was to describe mortality rates and patterns of critical care resource use for patients undergoing non-cardiac surgery across several European nations. The design of the study and the results of the EuSOS have been described elsewhere.[4] In brief, the European cohort study was performed between 0900 (local time) on April 4, 2011 and 0859 on April 11, 2011. All adult patients (older than 16 years) admitted to participating centers for elective or non-elective inpatient surgery commencing during the 7-day cohort period were eligible for inclusion in the study. Patients undergoing planned day case surgery, cardiac surgery, neurosurgery, or radiological or obstetric procedures were excluded. Participating hospitals represented a voluntary convenience sample that was identified based on the membership of the European Society of Intensive Care Medicine (ESICM) and the European Society of Anaesthesiology (ASA) and by the direct approach from national study coordinators. Ethics requirements differed by country. The primary study was approved in the coordinating center (Barts and The London School of Medicine and Dentistry, Queen Mary University of London - London, United Kingdom).

Cohort description

For this sub-study, all of the patients within the EuSOS database were included. Patients lacking a description of their ASA status were excluded from the study (92 patients). Other exclusion criteria derived from the sensitivity analysis of the EuSOS score and defined to exclude the effects of very small centers or extreme deviations regarding the reported mortality were as follows: (1) any site that enrolled less than 10 patients during the study week, (2) any site with a hospital mortality rate either above the 95th centile or below the 5th centile, and (3) any patient with missing data for hospital mortality.

Outcomes

The primary outcome used in this study was survival at the time of hospital discharge. Patients were followed until hospital discharge, death or 60 days after hospital admission.

Statistical analysis

The data were analyzed using SPSS, version 19.0 (SPSS Inc, Chicago, USA). Categorical variables are presented as numbers (%), and continuous variables are presented as means (SD) when normally distributed or medians (IQR) when not normally distributed. the Chi squared and Fisher's exact tests were to compare categorical variables, and the *t* test or ANOVA was used to compare continuous variables. Significance was set at $p < 0.05$. Because the rate of missing values was very low (< 0.05%), no imputation procedures were performed, and all of the variables were analyzed case wise. Discrimination of the score was assessed by the area under the receiver operating characteristics curve (aROC) and computed as suggested by Hanley and McNeil.[5] To further characterize the effect of the ASA score on the vital status at the time of hospital discharge, we used regression trees with the CHAID procedure in SPSS v 19 (SPSS Inc, Chicago, USA) and Kaplan-Meier curves with vital status at hospital discharge as the dependent variable and patient censoring at hospital discharge.

A logistic multi-level regression analysis was used to determine whether the effect of the ASA score on hospital mortality was affected by other variables. To minimize the correlation with variables that were already included in the ASA score, comorbid diseases that were present at hospital admission were not used in the model because they are included in the definitions of the first 3 classes of the ASA score. The first step was to identify factors that were independently related to hospital mortality in the multivariate analysis. The following factors were entered into the model based on their relationship to the outcome in the univariate analysis: age, gender, urgency of surgery (reference urgent), laparoscopic surgery, seniority of the surgeon, seniority of the anesthesiologist, grade of surgery and surgical procedure category. Due to the multiplicity of tests performed and to avoid spurious associations and over-fitting, only p values less than 0.01 were considered significant and included in the model to allow for a more robust and consistent result. All of the entered factors were biologically plausible and had a sound scientific rationale and a low rate of missing data (see main paper). The results of the univariate analysis model are reported as odds ratios (OR) with 95% confidence intervals (CI).

RESULTS

A total of 45,666 patients from 366 centers in 28 European countries were included in the study. The basic characteristics of the analyzed patients are presented in table 1. Among the patients, 11,431 were classified as ASA I (25.0%), 21,193 as ASA II (46.4%), 11,411 as ASA III (3.4%), 1,543 as ASA IV and 88 as ASA 5 (0.2%).

As expected, the majority of the physiologic derangements were positively and significantly correlated to the ASA score. The ASA score presented a very good relationship with survival at the time of hospital discharge, as presented in figure 1A and 1B (Figure 1A: raw numbers; Figure 1B: percentages). It should be noted, however, that given the very large differences in the numbers of patients in each class, with most patients concentrated in classes I and II, the clinical utility of this relationship is low.

Complete data for the sensitivity, false positive rate, specificity (true negative rate), predictive value for dying in the hospital, predictive value for surviving and overall correct classification are described in detail in table 2. Discrimination for the ASA score was poor, with an aROC of 0.658 ± 0.008 (95% confidence interval of 0.642 to 0.675) (Figure 2).

In the univariate analysis, several variables were significantly associated with the ASA score (Table S2 in the electronic supplementary material). In the multivariate analysis, only the ASA score, age, surgical procedure category, grade of surgery, urgency of surgery and country remained significant (Table 3). The adjusted odds ratios for the ASA classes were 0.007 [0.005 - 0.011], 0.794 [0.659 - 0.958], 1.416 [1.151 - 1741], 5.267 [4.123 - 6.727], 18.393 [11.056 - 30.600] for classes I to V, respectively.

When the regression trees (CHAID) were applied to this cohort, the results demonstrated that ASA classes I and II should be collapsed together (Figure 3). By merging ASA categories I and II, the percentage of correct classifications increased to 97%, and the score predicted 0.20% of the survivors and 99.8% of the deaths.

These results were confirmed by the Kaplan-Meier curves, again using survival at hospital discharge as the dependent variable and patient censoring at hospital discharge, although the results must be considered with caution given the large number of censored patients. The survival function (Figure S1 A in the electronic supplementary material), log survival function (Figure S1 B in the electronic supplementary material), and hazard function (Figure S1 C in the electronic supplementary material), all of which utilized vital status at hospital discharge as the outcome variable, are presented below.

Table 1 - Basic demographic characteristics according by the American Society of Anesthesiologists

	ASA					p value
	1	2	3	4	5	
N	11431	21193	11411	1543	88	
Age	40.38 ± 11.53	58.20 ± 15.96	68.49 ± 13.92	70.80 ± 14.62	66.30 ± 32	< 0.001
Sex (male)	5391	9686	6145	888	58	< 0.001
Ethnicity (black)	250 (2.2)	148 (1.3)	122 (1.1)	11 (0.7)	1 (1.2)	< 0.001
Urgency of surgery						
Elective	8292 (24.1)	17308 (50.4)	8119 (23.6)	619 (1.8)	7 (0.0)	< 0.001
Urgent	2446 (27.8)	3059 (34.8)	2644 (30.1)	618 (7.0)	21 (0.2)	
Emergency	689 (27.3)	824 (32.7)	644 (25.5)	306 (12.1)	60 (2.4)	
General anesthesia	9615 (84.1)	16497 (77.8)	8288 (72.6)	1141 (73.9)	84 (95.5)	< 0.001
Spinal anesthesia	1366 (11.9)	3775 (17.8)	2384 (20.9)	256 (16.6)	3 (3.4)	< 0.001
Epidural anesthesia	236 (2.1)	989 (4.7)	738 (6.5)	100 (6.5)	1 (0.1)	< 0.001
Sedation	455(4.0)	1322 (6.2)	953 (8.4)	132 (8.6)	1 (0.1)	< 0.001
Local anesthesia	407 (3.6)	776 (3.7)	504 (4.4)	86 (5.6)	1 (1.1)	< 0.001
Regional anesthesia (other)	631 (5.5)	1323 (6.2)	712 (6.2)	86 (5.6)	2 (2.3)	< 0.001
Grade of surgery						
Minor	3754 (31.7)	5294 (44.8)	2529 (21.4)	245 (2.1)	4 (0.0)	0.032
Intermediate	5919 (27.1)	10324 (47.3)	5002 (22.9)	557 (2.6)	19 (0.1)	< 0.001
Major	1729 (14.5)	5532 (46.4)	3861 (32.4)	737 (6.2)	65 (0.5)	
LEE cardiovascular score						
0	5574 (32.1)	9294 (53.5)	2332 (13.4)	164 (0.9)	5 (0.0	< 0.001
1	2199 (16.6)	6402 (48.3)	4162 (31.4)	456 (3.4)	31 (0.2)	
2	38 (0.9)	1255 (29.5)	2508 (59.0)	432 (10.2)	19 (0.4)	
3	2 (0.2)	96 (7.9)	861 (71.0)	241 (19.9)	12 (1.0)	
4	2 (0.7)	11 (3.6)	186 (61.6)	95 (31.5)	8 (2.6)	
5	1 (1.6)	1 (1.6)	29 (47.5)	29 (47.5)	1 (1.6)	
6	1 (8.3)	1 (8.3)	2 (58.3)	7 (58.3)	1 (8.3)	
WHO surgical checklist used						
Yes	7759 (68.2)	14245 (67.5)	7573 (66.6)	998 (64.8)	52 (59.1)	0.008
Urgency of surgery						
Elective	8292 (24.1)	17308 (50.4)	8119 (23.6)	619 (1.8)	7 (0.0)	< 0.001
Urgent	2446 (27.8)	3059 (34.8)	2644 (30.1)	618 (7.0)	21 (0.2)	< 0.001
Emergency	689 (27.3)	824 (32.7)	644 (25.5)	306 (12.1)	60 (2.4)	< 0.001
Cirrhosis	7 (0.1)	99 (0.5)	280 (2.5)	94 (6.1)	7 (8.0)	< 0.001
Congestive cardiac failure	7 (0.1)	270 (0.3)	1421 (12.5)	403 (26.2)	15 (17.0)	< 0.001
COPD	102 (0.9)	2248 (10.6)	2348 (20.6)	368 (23.9)	14 (15.9)	< 0.001
Coronary disease	20 (0.2)	1591 (7.5)	3859 (33.9)	638 (41.4)	28 (31.8)	< 0.001
Diabetes mellitus insulin dependent	10 (0.1)	532 (2.5)	1229 (10.8)	250 (16.2)	13 (14.8)	< 0.001
Diabetes mellitus non-insulin dependent	25 (0.2)	1426 (6.7)	1763 (15.5)	216 (14.0)	6 (6.8)	< 0.001
Metastatic cancer	69 (0.6)	801 (3.8)	1048 (9.2)	204 (13.2)	7 (8.0)	< 0.001
Stroke	11 (0.1)	449 (2.1)	1258 (11.0)	256 (16.6)	5 (5.7)	< 0.001
Laparoscopic-assisted surgery	224 (2.0)	423 (2.0)	196 (1.7)	25 (1.6)	2 (2.3)	0.406
Laparoscopic surgery	1789 (15.7)	2647 (12.5)	910 (8.0)	73 (4.7)	3 (3.4)	< 0.001
Senior anesthesiologist						
Attending	7883 (25.0)	14686 (46.6)	7807 (24.8)	1076 (3.4)	64 (0.2)	
Middle grade	2424 (25.2)	4390 (45.7)	2438 (25.4)	337 (3.5)	18 (0.2)	
Junior	1072 (24.6)	2026 (46.5)	1124 (25.8)	128 (2.9)	5 (0.1)	

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Senior surgeon						
Attending	8849 (24.4)	17060 (47.0)	9087 (25.0)	1208 (3.3)	80 (0.2)	0.365
Middle grade	2333 (27.8)	3682 (43.8)	2082 (24.8)	296 (3.5)	6 (0.1)	
Junior	241 (25.6)	428 (45.4)	233 (24.7)	39 (4.1)	2 (0.2)	
CO monitor cardiac ultrasound	33 (0.3)	121 (0.6)	108 (0.9)	28 (1.8)	3 (3.4)	< 0.001
CO monitor arterial waveform	109 (1.0)	544 (2.6)	593 (5.2)	169 (11.0)	21 (23.9)	< 0.001
CO monitoring by PAC	2 (0.0)	10 (0.0)	21 (0.2)	27 (1.7)	7 (8.0)	< 0.001
CO monitoring - other	138 (1.2)	272 (1.3)	192 (1.7)	41 (2.7)	2 (2.3)	< 0.001
CO monitoring - none	276 (11.9)	906 (39.0)	868 (37.3)	246 (1§0.6)	30 (1.3)	< 0.001
CVC	176 (1.5)	974 (4.6)	1428 (12.5)	466 (30.2)	60 (68.2)	< 0.001
NIV in the 24 hours after surgery	32 (0.3)	142 (0.7)	177 (0.6)	58 (3.8)	1 (1.1)	< 0.001
Invasive MV in the 24 hours after surgery	104 (0.9)	319 (1.5)	622 (5.5)	402 (26.1)	61 (69.3)	< 0.001
Admission to intensive care	186 (1.6)	1071 (5.1)	1597 (14.0)	568 (36.8)	64 (72.7)	< 0.001
LOS OR	101 (55 - 125)	116 (60 - 145)	125 (60 - 160)	129 (62 - 165)	182 (90 - 218)	< 0.001
LOS OR -> HOS discharge	3 (1 - 4)	5 (1 - 6)	9 (2 - 10)	14 (4-18)	13 (2 - 18)	< 0.001
Hospital mortality	11209 (1.9)	20784 (1.9)	10960 (4.0)	1276 (17.3)	42 (52.3)	< 0.001

LEE score - Revised Cardiac Risk Index (RCRI); WHO - World Health Organization; COPD - chronic obstructive pulmonary disease; CO - cardiac output; PAC - pulmonary artery catheter; CVC - central venous pressure; NIV - non-invasive ventilation; MV - mechanical ventilation; LOS - length of stay; OR - operative room: The results are expressed as the mean ± standard deviation, number (%) or median [25% - 75%].

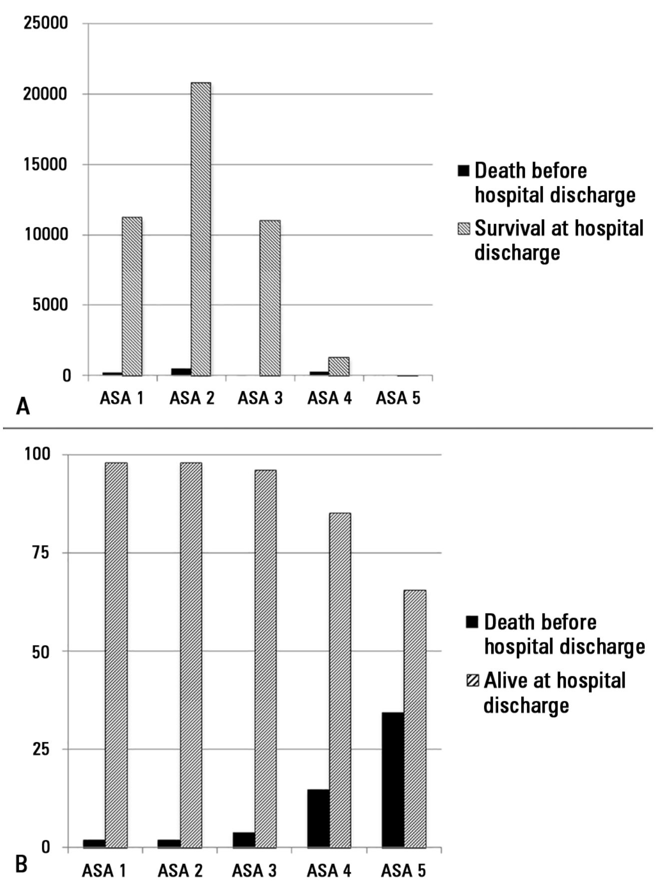

Figure 1 - American Association of Anaesthesia and vital status at hospital discharge (as numbers on the top, and as % of patients by class on the bottom). Striped bars represent survival at hospital discharge, and black bars are death before hospital discharge.

Table 2 - Sensitivity, false positive rate, specificity (true negative rate), predictive value for dying in the hospital, predictive value for surviving and overall correct classification

	(%)	95%CI
ASA I		
Sensitivity (true positive rate)	15.91	13.99 - 17.83
False positive rate	25.32	24.91 - 25.72
Specificity (true negative rate)	74.68	74.28 - 75.09
Predictive value for dying	1.94	1.69 - 2.20
Predictive value for surviving	96.57	96.38 - 96.77
Overall correct classification	72.89	72.48 - 73.29
ASA II		
Sensitivity (true positive rate)	45.23	42.62 - 47.84
False positive rate	72.27	71.85 - 72.68
Specificity (true negative rate)	27.73	27.32 - 28.15
Predictive value for dying	1.93	1.78 - 2.08
Predictive value for surviving	94.14	93.74 - 94.55
Overall correct classification	28.27	27.86 - 28.68
ASA III		
Sensitivity (true positive rate)	34.98	32.78 - 37.18
False Positive rate	49.18	48.79 - 49.56
Specificity (true negative rate)	50.82	50.44 - 51.21
Predictive value for dying	1.93	1.78 - 2.08
Predictive value for surviving	96.57	96.38 - 96.77
Overall correct classification	50.39	50.02 - 50.77
ASA IV		
Sensitivity (true positive rate)	53.49	51.54 - 55.44
False positive rate	57.22	56.88 - 57.57
Specificity (true negative rate)	42.78	42.43 - 43.12
Predictive value for dying	2.96	2.80 - 3.12
Predictive value for surviving	96.48	96.38 - 96.57
Overall correct classification	43.11	42.77 - 43.46
ASA V		
Sensitivity (true positive rate)	0.10	0.07 - 0.13
False positive rate	0.09	0.07 - 0.12
Specificity (true negative rate)	99.91	99.88 - 99.93
Predictive value for dying	52.27	41.84 - 62.71
Predictive value for surviving	50.00	49.67 - 50.33
Overall correct classification	50.00	49.67 - 50.33

CI - confidence interval; ASA - American Society of Anesthesiologists.

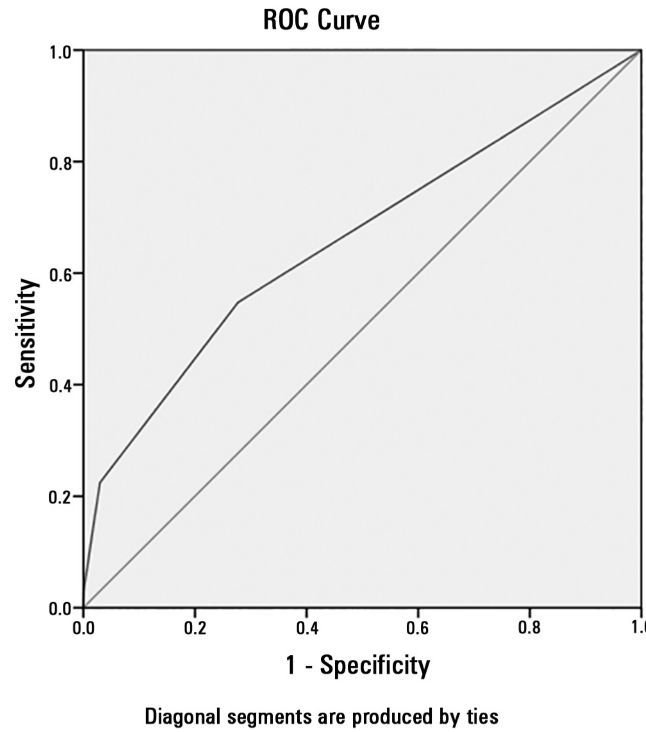

Figure 2 - Area under the receiver operating characteristic (ROC) curve for the 5 categories of the American Association of Anaesthesia score. The aROC was 0.656 with a standard error of 0.008 (95% confidence interval of 0.642 - 0.675). The asymptotic significance of the curve was < 0.001.

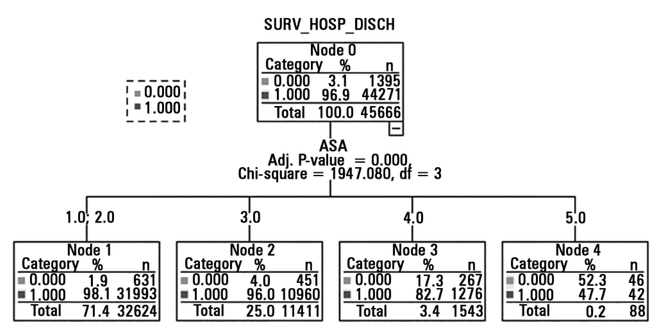

Figure 3 - Regression trees (CHAID) for the different classes of the American Association of Anaesthesia score.

Table 3 - Multivariable analysis of outcome determinants (American Society of Anesthesiologists and its variables purposefully excluded)

	OR	95%CI	p value
ASA score			
1	Reference	-	-
2	0.794	0.659 - 0.958	0.016
3	1.416	1.151 - 1.741	0.001
4	5.267	4.123 - 6.727	< 0.0001
5	18.393	11.056 - 30.600	< 0.0001
Age	1.014	1.010 - 1.018	< 0.0001
Surgical procedure			
Orthopedics	0.763	0.591 - 0.983	0.037
Breast	1.063	0.694 - 1.627	0.78
Gynecology	1.057	0.769 - 1.451	0.734
Vascular	0.906	0.673 - 1.20	0.515
Upper gastrointestinal	1.701	1.274 - 2.271	< 0.0001
Lower gastrointestinal	1.155	0.888 -1.503	0.283
Hepatobiliary	1.203	0.872 - 1.660	0.26
Plastic/cutaneous	0.916	0.646 - 1.301	0.626
Urology	0.77	0.573 - 1.033	0.081
Kidney	0.374	0.168 - 0.835	0.016
Head and neck	1.077	0.809 - 1.433	0.611
Other	Reference		
Grade of surgery			
Minor	Reference		
Intermediate	0.796	0.681 - 0.930	0.004
Major	1.261	1.066 - 1.493	0.007
Urgency of surgery			
Elective	Reference		
Urgent	1.891	1.643 - 2.176	< 0.0001
Emergency	3.339	2.757 - 4.046	< 0.0001

ASA - Society of Anesthesiologists.

DISCUSSION

The principal finding of this analysis was that ASA was a poor predictor of survival until hospital discharge in a large population of patients undergoing in-patient non-cardiac surgery. However, by collapsing ASA categories I and II, the performance of the score improved in low risk patients, for whom the performance of the score was less accurate.

Almost 60 years after its original description, and despite the fact that it is one of the most used models to assess risk in patients submitted to surgery, the overall performance of the ASA score as a tool to predict in-hospital deaths following surgery was found to be poor. This result is in contrast to those obtained for other, more modern, severity scores that are designed to forecast vital status at hospital discharge after admission to the intensive care unit (ICU), such as the APACHE II,[6] the SAPS II,[7] and the SAPS 3 systems.[8] In this case, a direct comparison between the ASA scores and these other scores is not possible because the latter scores have been ascertained only in patients who have been admitted to the ICU (thus, in principle, more severely affected patients) and not in all of the enrolled patients.

A surprising number of deaths were classified as ASA I. This result has a number of possible explanations, including the following: incorrect scoring of the patients, or a mortality rate that is much greater than that anticipated in this class or classification rules that are not easy to apply. Table S1 shows that the patients were classified with significant comorbidities, e.g., metastatic cancer was classified as ASA I. We do not believe that ongoing attempts to subdivide ASA III[9] or to add additional categories[10] will improve the performance of the score, as very clearly demonstrated by the regression trees. At a time when economic constraints and the pursuit of quality of care and maximization of patient safety are a priority, care should be taken when using this instrument to detect such cases.

This study has many strengths but also some limitations. First, a very large population of patients who were submitted to non-cardiac surgery in 28 countries in Europe were studied, using real life data registered by professionals in a heterogeneous sample, and a score with questionable reliability.[11] However, by design, we did not perform a serious intra and inter-observer reliability analysis, thus hampering the significance of the results.

However, the simplicity of the ASA system - which was potentially one of the keys to its success - may be less relevant to modern practice. The poor discrimination, which indicates the absence of forecasting a precise mortality rate for patient populations (thus making it impossible to assess its calibration) during an important historical period, had a crucial impact on the development of modern methods.

In a specialty like anesthesia, in which the mortality rates have been reduced by a log factor from 1 anesthesia-related death in 5000 procedures in the 1980s to less that 1 in 250.000 in 1998,[12] it is time to move forward.

CONCLUSION

In conclusion, in the present study, the American Association of Anaesthesia score was able to determine higher risk groups of surgical patients, but clinicians cannot use this score to discriminate between lower risk groups (grades 1 and 2). Overall, the discriminatory power of the model was less than acceptable to recommend its widespread use.

RESUMO

Objetivo: O *European Surgical Outcomes Study* foi um estudo que descreveu a mortalidade após a cirurgia de pacientes internados. Em uma análise multivariada, foram identificados diversos fatores capazes de prever maus resultados, os quais incluem idade, urgência do procedimento, gravidade e porte, assim como o escore da *American Association of Anaesthesia*. Este estudo descreveu, com mais detalhes, o relacionamento entre o escore da *American Association of Anaesthesia* e a mortalidade pós-operatória.

Métodos: Os pacientes neste estudo de coorte com duração de sete dias foram inscritos em abril de 2011. Foram incluídos e seguidos, por no máximo 60 dias, pacientes consecutivos com idade de 16 anos ou mais, internados e submetidos à cirurgia não cardíaca e com registro do escore da *American Association of Anaesthesia* em 498 hospitais, localizados em 28 países europeus. O parâmetro primário foi mortalidade hospitalar. Foi utilizada uma árvore decisória, com base no sistema CHAID (SPSS), para delinear os nós associados à mortalidade.

Resultados: O estudo inscreveu um total de 46.539 pacientes. Em função de valores faltantes, foram excluídos 873 pacientes, resultando na análise 45.666. Aumentos no escore da *American Association of Anaesthesia* se associaram com o acréscimo das taxas de admissão à terapia intensiva e de mortalidade. Apesar do relacionamento progressivo com mortalidade, a discriminação foi fraca, com uma área sob a curva ROC de 0,658 (IC 95% 0,642 - 0,6775). Com o uso das árvores de regressão (CHAID), foram identificadas quatro discretas associações dos nós da *American Association of Anaesthesia* com mortalidade, estando o escore *American Association of Anaesthesia* 1 e o escore da *American Association of Anaesthesia* 2 comprimidos em um mesmo nó.

Conclusões: O escore da *American Association of Anaesthesia* pode ser utilizado para determinar grupos de pacientes cirúrgicos de alto risco, porém os médicos não podem utilizá-lo para realizar a discriminação entre os graus 1 e 2. Em geral, o poder discriminatório do modelo foi menos do que aceitável para uso disseminado.

Descritores: Anestesiologia; Reprodutibilidade de resultados; Mortalidade; Período pós-operatório

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