Variability in scoring ASA Physical Status in Hepato-Pancreato-Biliary Surgery (MILESTONE-2): an international survey among surgeons and anesthesiologists

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Introduction:

Clinical auditing and benchmarking is increasingly used to assess and improve the quality of care in Hepato-Pancreato-Biliary (HPB) surgery.[1] To accomplish this, multicenter registries and study groups have been established all over the world. In these registries and cohorts indicators such as mortality and complications, are used to measure the quality of care.[2–5] American Society of Anesthesiologists (ASA) Physical Status Classification is seen as an important parameter for case mix adjustment, to enable a valid comparison of the indicators among countries and hospitals. However, a recent study identified great variability of ASA classification among large registries for pancreatic surgery; for example ASA III/IV was scored in respectively 77.7% (NSQIP, mostly USA), 48.2% (Germany), 22.5% (the Netherlands), and 2.7% (Sweden) of patients.[6]

The ASA Physical Status Classification System has been in use for over 60 years. The classification system does not predict the perioperative risks alone, but combined with other factors (e.g. type of surgery, frailty, level of deconditioning) it can be helpful in predicting perioperative risks.[7] It is known that there is a variability in ASA scoring among anesthesiologists. Several case-vignette studies have been performed in different countries, all showing a significant inter-rater variability.[8–11] As HPB surgery is highly complex surgery, outcomes are especially dependent on patients' preoperative performance status.[12] The ASA assessment in this group of patients are, therefore, of great importance.

International studies on ASA assessment in patients undergoing HPB surgery have not yet been performed. The aims of this study are to assess international variation in ASA classification and to gain more insight into the current opinion and clinical decision-making of anesthesiologists and surgeons regarding the ASA classification of patients undergoing HPB surgical procedures. Knowledge of the extent of the variation in ASA classification and identification of the underlying causes of this variation, will give an insight on how improvements can be made.

Methods

Study design

This is an online survey including clinical case vignettes relating to the clinical decision-making about the ASA classification of patients undergoing HPB surgery.

Data collection

Anesthesiologists and surgeons of different National and International societies will be invited to participate via email to identify world-wide variation with ASA classification. For anesthesiologists this includes the American Society of Anesthesiologists (ASA), Liver Intensive Care Group of Europe (LICAGE) and 60 national anesthesiology societies. For the surgeons, the International Hepato-Pancreato-Biliary Association (IHPBA), European-African Hepato-Pancreato-Biliary Association (EAHPBA), American Hepato-Pancreato-Biliary Association (AHPBA), International Laparoscopic Liver Society (ILLS), European Consortium on Minimally Invasive Pancreatic Surgery (E-MIPS), International Consortium on Minimally Invasive Pancreatic Surgery (I-MIPS), Association of Upper Gastrointestinal Surgeons of Great Britain and Ireland (AUGIS), Japanese Society of Hepato-Biliary-Pancreatic Surgery (JHBPS) and the European Minimally Invasive Liver Surgical Group (E-MILS). The survey will be tested among the members of the steering committee before sending it to the participants. Non-responders will receive three reminders after 2, 4 and 6 weeks. Incomplete responses will be excluded. Qualtrics survey software will be used to assess the opinions, because it is easily accessible and anonymous (to participants and study coordinators).

Survey

The survey will be conducted between October 2022 – January 2023. The survey (see appendix 1) starts with general questions and proceeds with questions regarding the considerations made in the ASA classification process, following with eight case vignettes.

Outcomes

Primary outcome will be the mean difference in ASA score among countries scored by anesthesiologist.

Secondary outcomes will be:

1. General view on the ASA classification
2. Considerations made in the ASA classification
3. Mean difference in ASA score among surgeons and anesthesiologist
4. Mean difference in ASA score between years of experience for anesthesiologists
5. Difference in ASA score per case between type of centers (academic versus non-academic, dedicated versus non-dedicated HPB unit) among anesthesiologists
6. Inter-rater variability per country
7. Inter-rater variability per case

Data analysis

Results will be processed using IBM SPSS Statistics for Windows version 22.0 (IBM Corp., Orchard Road Armonk, New York, US). Data from the survey will be entered in SPSS by the first author and will be checked for entry errors by another author.

Statistical analysis

Results of the survey and case vignettes will be reported as proportions for binary or categorical variables, and as mean with standard deviation (SD) or as median with interquartile range (IQR) for continuous variables as appropriate.

Primary analysis comprises mean difference in ASA score in the different cases among groups (country, anesthesiologists versus surgeons, experience as an anesthesiologist, type of center). Experience as an anesthesiologist will be categorized into groups using intervals 5 years or less, 6-10 years, and 11 years or more. The analysis will be done using the Chi-Square test for trends for categorical data and the

Mann Whitney U or unpaired T-test for continuous data, as appropriate. Secondarily we will analyze the inter-rater variability within all cases and per country, this will be done using the Cohen's Kappa.

A two-tailed P-value of <0.05 will be considered statistically significant.

Future perspectives

Knowledge of the extent of the variation in ASA classification and identification of the underlying causes of this variation, will give an insight on how improvements can be made. This is the first step towards a more uniform classification. Step two will be to use the results of the survey, to create a flowchart for a better classification of ASA performance status in HPB surgery. This will be created and tested in a small group (Fondazione Poliambulanza Istituto Ospedaliero and Amsterdam UMC). In the third step, the flowchart will be validated by performing an additional survey and case vignette study in the first group, including the flowchart.

Appendix 1. Survey and case vignette

Start page

Variability in scoring American Society of Anesthesiologist Physical Status in Hepato-Pancreato-Biliary Surgery (MILESTONE-2): A worldwide survey among surgeons and anesthesiologist

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Dear colleague,

Thank you for participating in this survey. Completing the survey will only take 5-10 minutes! The aim of this survey is to gain more insight into the current opinion and clinical decision making of anesthesiologists and surgeons regarding the ASA classification for patients undergoing HPB surgical procedures.

This is an online survey including clinical case vignettes. The survey starts with 21 questions about baseline characteristics and considerations made in the ASA classification process and concludes with 8 case vignettes.

Privacy: you will be asked to fill in your email address at the start of the survey, to send reminders to those who will have not completed the survey and to get in contact with those who are interested in future studies. Prior to analyzing the results, email addresses will be stored separately from the given answers.

Informed consent: by completing and sending the survey, the respondent accepts that his/her answers will be used (anonymously) in our research.

Kind regards,

On behalf of the study team.

Contact information:
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Baseline questions: participant

1. In which country do you work

- Country

2. What is your gender?

- Male
- Female

3. What is your age?

- Age

4. What is your medical specialty?

- Anesthesiologist
- Surgeon

5. How many years of experience do you have as a fully licensed medical specialist?

- Years

6. In what type of hospital do you work?

- Academic hospital (central)
- Non-Academic, teaching (peripheral)
- Non-Academic, non-teaching (peripheral)

7. What level of expertise in HPB surgery is present in your hospital?

- Dedicated HPB unit – including liver transplant surgery
- Dedicated HPB unit – excluding liver transplant surgery
- General surgery unit with interest in HPB
- No HPB surgery in my hospital

8. What level of expertise in HPB anesthesiology is present in your hospital?

- Dedicated HPB anesthesiologist – including liver transplant surgery

- Dedicated HPB anesthesiologist – excluding liver transplant surgery
- General anesthesiology unit with interest in HPB
- No HPB surgeries are performed in my hospital.

General questions: ASA classification

9. What is your overall view on the objectiveness and interobserver agreement of the ASA classification?

- 1-10
  (1: I consider ASA a poor classification system, non-objective with very poor interobserver agreement, 10: I consider ASA an excellent classification system, highly objective and excellent interobserver agreement)

10. Which specialty, typically determines a patients' preoperative ASA score in your hospital?

- Anesthesiologist
- Surgeon

11. Within this specialty, who most often, scores a patients' preoperative ASA score:

- Medical specialist
- Resident
- (Specialized) nurse
- All of the above evaluate the ASA score equally

12. Is there a preoperative assessment protocol in your hospital, and what does it include?

- Yes, it includes the ASA score
- Yes, it includes the ASA score, plus additional assessment tools → please specify what others
- Yes, it does not include the ASA score → please specify what it includes
- No there is no protocol
- Unknown

13. Do you use ASA score (as a case-mix factor) in your surgical clinical research?

- Always
- Often
- Sometimes
- Never
- Not applicable (I am not involved in research)

14.Does the ASA score assigned to a patient change your perioperative strategy (e.g., for surgeons the choice of minimally invasive versus open surgery, or for anesthesiologist choose a specialist instead of a resident leading the anesthesiology team during the operation)?

- Often
- Sometimes
- Never

Considerations made in ASA classification process

In the following questions, considerations made in the ASA classification process will be asked. A description of the ASA classification can be found below, for more information and examples, click on this link (https://www.asahq.org/standards-and-guidelines/asa-physical-status-classification-system).

ASA PS Classification*	Description
1	A normal healthy patient
2	A patient with mild systemic disease
3	A patient with severe systemic disease
4	A patient with severe systemic disease that is a constant threat to life
5	A moribund patient who is not expected to survive without the operation
6	A declared brain-dead patient whose organs are being removed for donor purposes

PS = performance score. *The addition of "E" denotes Emergency surgery: (An emergency is defined as existing when delay in treatment of the patient would lead to a significant increase in the threat to life or body part)

Questions:

15.Do you take the type of operation which will be performed (complex versus less complex operation) into account when scoring the ASA classification?

- Yes
- No
- If yes, how;

16.Do you take a malignancy (if this is the reason for the operation) into account when scoring the ASA classification?

- Yes, always

- Yes, only when the malignancy influences the clinical condition (e.g., bad nutritional status)
- No

17.Do you take an expected substantial investment of time and effort for a patient's care (e.g., fiber optic intubation) into account when deciding which ASA classification to assign a patient?

- Yes
- No

18.Is the ASA classification part of the system of financial compensation in your center/healthcare system?

- Yes
- No
- Unknown

Please read the following statements and rate on a scale of 1-5, with 1 strongly disagree, and 5 strongly agree:

19.In my healthcare system, central/academic centers in general score ASA lower (underestimate), because they are more used to sicker and more complex patients.

- 1-5

20. In my healthcare system, peripheral/non-academic centers score ASA higher (overestimate), because they are less familiar with sicker or more complex patients.

- 1-5

21.The ASA classification should be used for financial reimbursement from health insurance companies.

- 1-5

22.In your personal view, what should be the highest % of disagreement acceptable in clinical practice if 2 anesthetists or 2 surgeons during a certain period independently both judge a group of 100 patients on ASA score?

- <1%
- <5%
- <10%
- <20%

- <40%
- <60%

23.What would be important to add to the ASA classification to reduce variability and better reflect true perioperative risk:

- Open question

Case vignettes

You are presented with eight case vignettes, four patients who will undergo a pancreatoduodenectomy (PD) and four patients who will undergo an extended left hemihepatectomy without biliary reconstruction (i.e. not a Klatskin resection). In each case (1-4 and 5-8) a subsequent single aspect changes (emphasized in bold). Please choose the ASA classification you would assign to this patient.

Case 1: PD

A 55-year-old female presents with an occluding carcinoma of the distal bile duct for which she will undergo a pancreatoduodenectomy. Three months ago, she presented with biliary stasis and a general decline in condition. After stenting her condition has now recovered to the previous baseline level. Her BMI is 31 and she has no other medical history.

- ASA 1-5

Case 2: PD

A 55-year-old female presents with an occluding carcinoma of the distal bile duct for which she will undergo a pancreatoduodenectomy. Three months ago, she presented with biliary stasis and a general decline in condition. After stenting her condition has now recovered to the previous baseline level. **She underwent a CABG 2 years ago, with no current cardiac complaints and moderate left and right ventricle function on ultrasound at recent visit**. Her BMI is 31 and she has no other medical history.

- ASA 1-5

Case 3: PD

A 55-year-old female presents with an occluding carcinoma of the distal bile duct for which she will undergo a pancreatoduodenectomy**. Three months ago, she presented with biliary stasis and a general decline in condition. After stenting, her condition did not recover to the previous baseline**

level, and she developed stage 3 kidney failure (eGFR 40). Her BMI is 31 and she has no other medical history.

- ASA 1-5

Case 4: PD

A **83-year-old** female presents with an occluding carcinoma of the distal bile duct for which she will undergo a pancreatoduodenectomy. Three months ago, she presented with biliary stasis and a general decline in condition. After stenting her condition has now recovered to the previous baseline level. Her BMI is 31 and she has no other medical history.

- ASA 1-5

Case 5: Hemihepatectomy

A 73-year-old male presents with one metachronic colorectal liver metastasis, received no neoadjuvant therapy, and has no other liver disease. He will undergo an open extended left hemihepatectomy. In the pre-operative work-up an aortic valve stenosis is found (AVA 1,2 cm^2). He runs 5 miles twice a week, has no other medical history and does not use any medication.

- ASA 1-5

Case 6: Hemihepatectomy

A 73-year-old male presents with one metachronic colorectal liver metastasis, received no neoadjuvant therapy, and has no other liver disease. He will undergo an open extended left hemihepatectomy. In the pre-operative work-up an aortic valve stenosis is found (AVA 1,2 cm^2). He has no other medical history besides **insulin dependent diabetes mellitus**; he runs 5 miles twice a week

- ASA 1-5

Case 7: Hemihepatectomy

A 73-year-old male presents with one metachronic colorectal liver metastasis, received no neoadjuvant therapy, and has no other liver disease. He is scheduled for **a robotic** extended left hemihepatectomy. In the work-up an aortic valve stenosis is found (AVA 1,2 cm^2). He has no other medical history besides insulin dependent diabetes mellitus; he runs 5 miles twice a week

- ASA 1-5

Case 8: Hemihepatectomy

A 73-year-old male presents with a **hepatocellular adenoma,** and has no other liver disease. He will undergo an open extended left hemihepatectomy. In the pre-operative work-up an aortic valve stenosis is found (AVA 1,2 cm^2). He runs 5 miles twice a week, **has no other medical history** and does not use any medication.

- ASA 1-5

References

1. Bilimoria KY, Bentrem DJ, Lillemoe KD, Talamonti MS, Ko CY. Assessment of pancreatic cancer care in the United States based on formally developed quality indicators. *J Natl Cancer Inst*. 2009;101(12):848-859. doi:10.1093/jnci/djp107

2. Pitt HA, Kilbane M, Strasberg SM, et al. ACS-NSQIP has the potential to create an HPB-NSQIP option. *Hpb*. 2009;11(5):405-413. doi:10.1111/j.1477-2574.2009.00074.x

3. van Rijssen LB, Koerkamp BG, Zwart MJ, et al. Nationwide prospective audit of pancreatic surgery: design, accuracy, and outcomes of the Dutch Pancreatic Cancer Audit. *Hpb*. 2017;19(10):919-926. doi:10.1016/j.hpb.2017.06.010

4. Tingstedt B, Andersson B, Jönsson C, et al. First results from the Swedish National Pancreatic and Periampullary Cancer Registry. *Hpb*. 2019;21(1):34-42. doi:10.1016/j.hpb.2018.06.1811

5. Wellner UF, Klinger C, Lehmann K, Buhr H, Neugebauer E, Keck T. The pancreatic surgery registry (StuDoQ|Pancreas) of the German Society for General and Visceral Surgery (DGAV) - presentation and systematic quality evaluation. *Trials*. 2017;18(1):1-9. doi:10.1186/s13063-017-1911-x

6. Mackay TM, Gleeson EM, Wellner UF, et al. Transatlantic registries of pancreatic surgery in the United States of America, Germany, the Netherlands, and Sweden: Comparing design, variables, patients, treatment strategies, and outcomes. *Surg (United States)*. 2020:1-7. doi:10.1016/j.surg.2020.07.012

7. Termini E, Description FP, Street D, et al. ASA Physical Status Classification System. 2020;21(1):1-9.

8. De Cassai A, Boscolo A, Tonetti T, Ban I, Ori C. Assignment of ASA-physical status relates to anesthesiologists' experience: A survey-based national-study. *Korean J Anesthesiol*. 2019;72(1):53-59. doi:10.4097/kja.d.18.00224

9. Haynes SR, Lawler PGP. An assessment of the consistency of ASA physical status classification allocation. *Anaesthesia*. 1995;50(3):195-199. doi:10.1111/j.1365-2044.1995.tb04554.x

10. Mak PHK, Campbell RCH, Irwin MG. The ASA physical status classification: Inter-observer consistency. *Anaesth Intensive Care*. 2002;30(5):633-640. doi:10.1177/0310057x0203000516

11. Ranta S, Hynynen M, Tammisto T. A survey of the ASA physical status classification: Significant variation in allocation among Finnish anaesthesiologists. *Acta Anaesthesiol Scand*. 1997;41(5):629-632. doi:10.1111/j.1399-6576.1997.tb04755.x

12. van Wijk L, van der Snee L, Buis CI, Hentzen JEKR, Haveman ME, Klaase JM. A prospective cohort study evaluating screening and assessment of six modifiable risk factors in HPB cancer patients and compliance to recommended prehabilitation interventions. *Perioper Med (London, England)*. 2021;10(1):5. doi:10.1186/s13741-020-00175-z