Evidence Review

Topic: On the utility of ASA scores to predict postoperative arthroplasty complications

Background

The American Society of Anesthesiologists (ASA) score is a preoperative assessment of patient physical status. Developed in 1941 [1], this classification was originally developed to allow anaesthesiologists or nurse anaesthetists to record the overall health status of a patient prior to surgery and, thereby, allow patient outcomes to be stratified by a general assessment of illness severity [2]. Nowadays, ASA scores are routinely used as a risk assessment of anaesthesia and surgery as it is the only widespread measure of overall preoperative physical condition that is consistently captured prior to surgery [2].

The ASA score (often referred to as the ASA-PS score since it is a measure of physical status) is a subjective assessment of a patient's overall health that is based on five classes (I to V, see table below). A sixth class (E) has recently been added to record emergency surgical cases.

Class	Physical Status	Example
I	Patient is completely healthy	A fit patient with an inguinal hernia
II	Patient has mild systemic disease	Essential hypertension, mild diabetes without end organ damage
III	Patient has severe systemic disease that is not incapacitating	Angina, moderate to severe COPD
IV	Patient has incapacitating disease that is a constant threat to life	Advanced COPD, cardiac failure
V	A moribund patient who is not expected to live 24 hours with or without surgery	Ruptured aortic aneurysm, massive pulmonary embolism
E	Emergency surgery, E is placed after the Roman numeral	

This classification system is simple and inexpensive to administer. It should be noted that the ASA classification does not consider the patient age, sex, weight, pregnancy, nor does it consider the nature of the planned surgery, the skill of the anaesthetist or surgeon, the degree of pre-surgical preparation or the facilities for postoperative care. Yet, in spite of these simplifications, the ASA score has been found to be a strong predictor of postoperative resource utilization and mortality in numerous surgical fields. Tiret et al [3] reported that the rate of postoperative complications is closely related to the ASA class (ASA score I = 0.41/1,000; scores IV and V = 9.6/1,000) and with emergency surgeries (ASA I = 1/1,000 increases to 26.5/1,000 in classes IV and V). Other studies have reported on the specific correlation of ASA scores with operating times, hospital length of stay, postoperative infection rates, overall morbidity and mortality rates following gastrointestinal [4,5], cardiac [6], and genitourinary surgery [7]. There are studies, on the other hand, that have found preoperative ASA scores to have no predictive quality towards postoperative complications. For example, one study [8] found that the ASA score is not a predictive factor of morbidity and mortality after major abdominal surgery.

What is the predictive ability of ASA scores on patient outcomes following elective total hip and total knee arthroplasty? Is it worthwhile to record this value for all patients prior to their joint replacement surgery? Using evidence-based medicine principles, this review attempts to answer these questions with the aim of providing guidance on the utility of ASA scores in this field.

Review of literature

A search of the Cochrane Database of Systematic Reviews found *no* relevant reviews on the predictive utility of ASA scores following elective surgery.

> Search Term: (Anesthesiologists AND ASA).mp AND (score OR grade OR classification).mp

Next, searches of EMBASE, MEDLINE and CINAHL were performed for systematic reviews and RCTs.

> Search Term: (ASA OR Anesthesiologists) AND (score OR level OR classification) AND ("systematic review" OR meta-analysis OR metaanalysis) AND English[la]
>
> Search Term: (ASA AND (score OR level OR classification OR factor)) AND (predictor OR correlation) AND English [la]

Articles selected:

(Note: RCTs that focused on the predictive ability of the ASA score were not found)

- Swanson KC et al. (2006). Perioperative Morbidity after Single-stage Bilateral Total Hip Arthroplasty: A Matched Control Study. Clin Orthop Relat Res. [Epub ahead of print]
- Ridgeway S et al. (2005). Infection of the surgical site after arthroplasty of the hip. J Bone Joint Surg Br. 87(6):844-50
- Rauh MA and Krackow KA. (2004). In-hospital deaths following elective total joint arthroplasty. Orthopedics. 27(4):407-411
- Zakriya KJ et al. (2002). Preoperative factors associated with postoperative change in confusion assessment method score in hip fracture patients. Anesth Analg. 94(6):1628-32
- Jolles BM et al. (2002). Factors predisposing to dislocation after primary total hip arthroplasty: a multivariate analysis. J Arthroplasty. 17(3):282-8
- Michel JP et al. (2002). Hip fracture surgery: is the pre-operative American Society of Anesthesiologists (ASA) score a predictor of functional outcome? Aging Clin Exp Res. 14(5):389-94
- Macario A et al. (1997). Hospital costs and severity of illness in three types of elective surgery. Anesthesiology. 86(1): 92-100
- Grosflam JM et al. (1995). Predictors of blood loss during total hip replacement surgery. Arthritis Care Res. 8:167–73

Review

No study was identified in the literature that specifically studied the predictive utility of the ASA classification system on patient outcomes following elective total hip or total knee arthroplasty. However, several studies were found that incidentally reported on the correlations between ASA scores and surgical outcomes after elective arthroplasty and hip fracture repair surgery.

Rauh et al [9] found the ASA score to be significantly related to the incidence of postoperative death in a group of 3,438 elective total hip and total knee arthroplasty patients. Specifically, these authors noted that ASA class III patients were more likely to encounter postoperative death as compared to patients with lower ASA scores. The correlation between ASA scores and mortality rates has also been identified following hip fracture repair surgery [10].

Associations between ASA scores and specific surgical complications and outcomes, although limited in this area, have also been reported in the literature. Grosflam et al [11] reported that in a prospective study with 295 consecutive THA patients that ASA scores are correlated with total blood lose during surgery. Specifically, an ASA score of III is a predictor of greater blood loss, and therefore transfusion units required, as compared to lower ASA class patients. Others have found that ASA scores correlated with postoperative surgical site infection (SSI) rates. Ridgeway et al [12] analyzed the SSI rates of 24,808 primary and revision THA patients and concluded that the ASA score is a significant, independent risk factor for SSI. Furthermore, another complication that is predictable from ASA scores is the dislocation risk following primary THA. Jolles et al [13] examined the records of 2,023 primary THA patients and reported that the dislocation risk was 10 times higher in patients with high ASA scores. These authors conclude that the ASA score should be part of the preoperative assessment of the dislocation risk for primary THA patients. Finally, a prospective study [14] of 168 patients admitted to geriatric hip fracture service found that an ASA score of III or more is a predictive factor of postoperative delirium. This finding suggests that higher ASA score patients scheduled to undergo hip fracture repair surgery should be optimized with the patient's postoperative mental status in consideration.

The predictive value of ASA scores on outcomes following arthroplasty surgery have also been reported in bilateral THA patients. In a retrospective comparison of 400 patients who had bilateral THA, Swanson et al [15] found that the ASA classification was the only independent predictor for minor

complications, major complications, and fat emboli syndrome. Based on their findings, the authors conclude that bilateral single-stage THA presents an acceptable risk for patients with ASA class I or II.

One study [10] found that the ASA score does not correlate with postoperative mobility and functional outcomes in older hip fracture patients. In this retrospective analysis of 114 patients (mean age of 82.4 years), no significant differences were found in the functional outcome and ambulatory abilities of patients that had low ASA scores (I and II) compared to high (III and IV groups) at one year after surgery. It should be noted that the mortality rate at one year was nearly nine times higher in severely impaired patients (ASA grades III-IV) than in healthy or mildly affected patients (ASA grades I-II). Marcario et al [16] reported that the length of hospital resource utilization is not predicted by the preoperative ASA scores of elective TKA patients. They found similar anesthesia costs, operating room costs, total hospital costs, and length of stay (LOS) in 100 TKA patients (ASA scores I to III only). Weaknesses of the study include lower sample size, thus statistical power, and the inclusion of only ASA grade I to III patients. Other studies [7, 17] have found ASA scores to correlate with LOS following other types of surgery.

Conclusion

The ASA score is a simple and widely used measure of patient health status. In total hip and total knee replacement patients, the ASA measure can predict postoperative mortality rates. There is also evidence to suggest that ASA scores are predictive of postoperative complications that necessitate increased resource consumption, such as higher transfusion rates, SSIs, and an increased dislocation risk. When limited to patients with low to moderate ASA scores (I to III), differences in resource utilization among different ASA groups may be reduced.

On the question of whether it is advisable to record this measure for all THA and TKA patients prior to their joint replacement surgery it would appear prudent to do so given the extreme ease and low cost of this measure and its' correlation to postoperative complications. Emphasis on assigning patient ASA scores should be greater in institutions that admit a wide variety of hip and knee replacement patients, and retrospective analysis of ASA scores and postoperative complication rates could assist healthcare providers in forecasting resource needs based on preoperative patient health status.

Reference List

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14 Zakriya,K.J. *et al.* (2002) Preoperative factors associated with postoperative change in confusion assessment method score in hip fracture patients. *Anesth. Analg.* 94, 1628-32, table

15 Swanson,K.C. *et al.* (2006) Perioperative Morbidity after Single-stage Bilateral Total Hip Arthroplasty: A Matched Control Study. *Clin. Orthop. Relat Res.*

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Enquiries and Contact Information:

Kursat Barin, Information Analyst
Email: akbarin@albertaboneandjoint.com

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