Preoperative Risk Assessment and Its Impact on Post Operative Morbidity and Mortality

Essay

Submitted for Partial Fulfilment of Master Degree in Anesthesiology

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Mohamed M. Kamal

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LIST OF ABBREVIATIONS

AAA	:	Abdominal aortic aneurysm
ACC/AHA	:	American College of Cardiologists and the American Heart Association
ACS	:	Acute coronary syndrome
ADH	:	Anti diuretic hormone
AIMS	:	The Australian Incident Monitoring Study
AKI	:	Acute Kidney Injury
ALT	:	Alanine Aminotransferase
APACHE	:	Acute Physiology and Chronic Health Evaluation
APOE	:	Apolipoprotein E
ARDS	:	Acute respiratory distress Syndrome
ASA	:	American Society of Anaesthesia
AST	:	Aspartate transferase
AV block	:	Atrio-Ventricular block
BMI	:	Body mass index
BNP	:	Body mass index
BUN	:	Blood urea nitrogen
CAD	:	Coronary Artery disease
CABG	:	Coronary artery bypass graft
CEPOD (NCEPOD)	:	(National) confidential enquiry into patient outcome and death
CHF	:	Congestive heart failure
CIN	:	Contrast-induced nephropathy

CNS	:	Central nervous system
CO	:	Cardiac output
COPD	:	Chronic obstructive pulmonary disease
COX-1	:	Cycloxygenase enzyme 1
COX-2	:	Cycloxygenase enzyme 2
CPB	:	Cardiopulmonary bypass
CT	:	Computed tomography
CVP	:	Central venous pressure
CVS	:	Cerebro-vascular stroke
CXR	:	Chest X-Ray
DLco	:	Diffusion capacity
DM	:	Diabetes Mellitus
DVT	:	Deep vein thrombosis
ECG	:	Electrocardiography
ERCP	:	Endoscopic retrograde cholangiopancreatography
FEV1	:	Forced expiratory volume in 1 second
FFA	:	Free fatty acids
FFP	:	Fresh frozen plasma
FVC	:	Forced vital capacity
GCOS	:	Glasgow coma outcome scale
GCS	:	Glasgow coma scale
GFR	:	Glomerular filtration rate
GIT	:	Gastrointestinal tract
Hb	:	Hemoglobin
HDU	:	High Dependency Unit

ICDs	:	Implantable cardioverter defibrillator
ICP	:	Intracranial pressure
ICU	:	Intensive care unit
IDDM	:	Insulin dependent Diabetes Mellitus
INR	:	International normalized ratio
LAD	:	Left ant descending artery
LBBB	:	Left Bundle Branch Block
LFTs	:	Liver function tests
LV	:	Left ventricle
LVEF	:	Left Ventricular Ejection Fraction
LVH	:	Left ventricle hypertrophy
MAP	:	Mean arterial pressure
McSPI	:	Multicenter Study of Preoperative Ischemia
MELD	:	Model for End-Stage Liver Disease
MET	:	Metabolic equivalents
MG	:	Myasthenia gravis
MGFA	:	Myasthenia Gravis Foundation of America
MI	:	Myocardial infarction
mTAL	:	Medullary thick ascending limb
MVO_2	:	Measurement of exercise oxygen consumption
NYHA	:	New York Heart Association
NSAIDs	:	Non steroidal anti inflammatory drugs
OSA	:	Obstructive sleep apnea
PACs	:	Premature atrial contractions
$PaCO_2$	:	Arterial partial pressure of carbon dioxide

PaO_2	:	Arterial partial pressure of Oxygen
PCI	:	Percutaneous coronary intervention
PFTs	:	Pulmonary function tests
PH	:	Potential of hydrogen
PORIF	:	Perioperative renal insufficiency and failure
POSSUM	:	Physiological and Operative Severity Score for the enUmeration of Mortality andMorbidity
PT	:	Prothrombin time
PVCs	:	Premature ventricular contractions
PVD	:	Peripheral vascular disease
QMG Score	:	Quantitative MG scoring system
RBF	:	Renal blood flow
RPP	:	Renal perfusion pressure
RRT	:	Renal replacement therapy
SAH	:	Subarachenoid hemorrhage
SCD	:	Sickle cell disease
SCT	:	Sickle cell trait
SGOT	:	Serum glutamic oxaloacetic transaminase
SRI	:	Stroke risk index
TIA	:	Transient ischemic attack
TIPS	:	Transjugular intrahepatic portosystemic shunting
TNF	:	Tumor necrosing factor
UO	:	Urine output
UNOS	:	United Network for Organ Sharing
VOC	:	Vaso-occlusive crises
WFNS	:	World Federation of Neurological Surgeons

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Introduction

Risk is part of life whether we like it or not. All medical interventions carry risks, but anesthesia is often perceived to be especially risky ***(Calman & Royston, 1997)***.

Risk evaluation by individuals is not a purely statistical phenomenon. It is widely accepted that individuals tend to evaluate risk not solely on statistical data but on many other subjective qualitative aspects of risk. This means that the assessment and perception of risk may incorporate subconscious, subjective, personality-dependent factors and may not follow any rational or methodical pattern ***(Ferschl et al., 2005)***.

There are many ways to predict and quantify the risks associated with these hazards; the most important way is the preoperative assessment ***(Hove et al., 2007)***. Preoperative assessment is to gather information about the patient and to formulate an anesthetic plan in order to reduce perioperative morbidity and mortality ***(Calman & Royston, 1997)***.

Implementation of risk assessment scores (as the American Society of Anesthesiologists or ASA physical status score) helps in grading or stratifying patients into incremental levels of risk. Risk stratification serves several purposes as significantly reducing delays, complications, and unanticipated postoperative admissions ***(Ferschl et al., 2005)***.

When considering overall risk, one must consider the baseline risk and then add on, or superimpose, the relevant additional risk to reach the real risk. In anesthesia, the number given as baseline for death under anesthesia is 1 in 185000 & this is an artificial figure ***(Adams & Smith, 2001)***. The risk of death after surgery is much greater than this figure because the surgery, the patient, the surgeon and anesthesiologist all have a little extra risk to add on.

Importance of Pre-Operative Risk Assessment

There are numerous potential hazards affecting patients undergoing surgery, ranging from simple events as nausea and vomiting, sore throat and shivering to truly damaging events as tooth loss and nerve injury. The worst of such devastating scenarios is brain damage or death.

The risk of death in the perioperative period directly due to anesthesia has declined in modern times, but the overall incidence of death following surgery has remained either unchanged or decreased less rapidly. Thus anesthesia as a causation of perioperative death is now very uncommon, but may still be identified as a contributory factor in a larger number of cases ***(Sharma et al., 2009)***.

Braz and coworkers retrospectively studied 53718 anesthetic cases over 9 years in Brazil between 1996 and 2005. The incidence of anesthesia-related cardiac arrest was 3.35:10,000. All anesthesia-related cardiac arrests were related to airway management and medication administration ***(Braz et al., 2006)***.

The Australian Incident Monitoring Study (AIMS) database found that 11% of its reports identified inadequate or incorrect preoperative assessment (478 of 6,271) or preoperative preparation (248 of 6,271) ***(Kluger et al., 2000)***. Of adverse events, 3.1% (197) were indisputably related to inadequate or incorrect preoperative assessment or preparation. In these 197 patients morbidity was major in 23 and 7 patients died. The investigators concluded that patient factors contributed only 1% of the time. More than half of incidents were preventable; an additional 21% were possibly preventable. Unpreventable events made up only 5% of cases. Almost one quarter of the time, communication failures were cited as the most significant factor ***(Runciman & Webb, 1994)***.

Patients that present for surgery may be at increased clinical risk for a variety of reasons. These reasons can be broadly divided into the following categories:

1- **Availability of Appropriately Experienced Staff:**

The Confidential Enquiry into Peri-Operative Deaths (CEPOD) has identified the importance of training and adequate experience for medical staff. 'Board-certified' trauma surgeons improve outcome following major trauma ***(Rogers et al., 1993)***.

As regards the anesthesiologist, there have been few studies which have effectively come down to assessing the role of the *competence* of the anesthesiologist on risk and outcome. One study of patients undergoing coronary artery surgery found that the only non-patient related factors influencing outcome were cardiac bypass time and the anesthesiologist ***(Merry et al., 1992)***.

2- **Timing of Surgery:**

CEPOD has confirmed that surgery performed at night, when staff is more likely to be fatigued, is more hazardous and contributes to increased mortality ***(Campling et al., 1997)***.

3- **Availability of Equipment :**

It is clear how the absence of basic equipment (e.g. capnography or pulse oximetry) might contribute to increased risk ***(Adams, 2002)***.

4- **Patient Factors:**

Many of these may be beyond the control or influence of the clinicians but may still be associated with increased risk or worse outcome ***(Adams, 2002)***.

5- **Gender:**

Some studies have investigated the role of gender in peri-operative risk and surgical risk as well outcome:

- Females have significantly better outcomes including mortality and recurrence rates from melanomas ***(Stidham et al., 1994)***.
- The incidence of septic shock requiring intensive care is significantly less in females. No differences in outcome, however, were demonstrated ***(Wichmann et al., 2000)***.
- Aligned with this is the observation that males have a higher incidence of infection following trauma ***(Offner et al., 1999)***.
- Females have a worse outcome from mechanical ventilation but this was less important in predicting outcome than age, Acute Physiology and Chronic Health Evaluation (APACHE) scores or presence of Acute Respiratory Distress Syndrome (ARDS) ***(Kollef et al., 1997)***. Females also have a worse outcome following vascular surgery ***(Norman et al., 2000)***.

Although gender may influence risks and outcome, this must be put into perspective and is only believed to be a minor risk factor overall. Vascular surgery may be an exception in that several studies suggest gender to be an important risk factor ***(Adams, 2002)***.

6- <u>Age:</u>

In many studies on age as a factor associated with perioperative mortality, the highest rates of death after surgery occurred in the youngest and the oldest patients ***(Stephen et al., 2009)***.

As regarding pediatrics, there are few studies of anesthesia-related risk in the pediatric population. Two themes emerge from these studies: very young infants are at increased risk, and anesthesia-related risk is reduced in centers with specialized pediatric anesthesia facilities.

Graff and colleagues reported 335 operative deaths in the pediatric age group. Of these, 58 were thought to be primarily or partially attributable to anesthesia. The percentage of operative deaths attributable to anesthesia was relatively constant among age groups at 16.6% to 21.7% ***(Graff et al., 1964)***.

While in Geriatrics, Numerous studies have documented the importance of advanced age to perioperative risk. One of the issues regarding mortality rates in the geriatric population is the definition of this group. Multiple definitions have been used for advanced age, including patients older than 65, 70, 80, or 90 years ***(Fischer et al., 2009)***.