EDITORIAL VIEW

Challenges in orthopedic surgery: an anesthesiologist’s perspective

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ABSTRACT

Orthopedic patients are different from general surgical patients in many aspects; just consider the age factor, as most of these patients report to the treating facility with age specific diseases. The patient concerns are also age specific, ranging from fear of being isolated from the parents, to pain and immobilization and even death. Both, the surgeon and the anesthesiologist have to deal with these concerns. Every age group also comes with its associated comorbid conditions and diseases. Here, it is mainly the anesthesiologist who has to face the music. Old patients have special problems related to comorbid conditions, e.g. hypertension, diabetes, heart disease and lung disease and poly-drug therapy, just to mention few. Perioperative optimization of these patients tests the professional competence of the anesthesiologists. The choice of anesthesia and successful management of perioperative complications will decide the fate of the patient. Regardless of the age, good postoperative nursing care and adequate pain relief will hasten recovery and reduce hospital stay.

Key words: Orthopedic surgery; Child; Neonate; Geriatric patient; Anesthesiologist; Spinal anesthesia; General anesthesia; Epidural anesthesia; Perioperative complications

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When you come across a patient in orthopedic department scheduled for surgery, you will feel that there are some obvious differences from other surgical patients in respect of age, co-morbidities and the medicines being taken by patient. Infants and children come for correction of congenital deformities e.g. TEV, dislocations etc. Adolescents and adults come for traumatic injuries and old people come usually for correction or replacement of disabled joints and so and so forth. The aim of treating such old patients is to enable them to have pain free movements and thus to make them mobile, so as to prevent complications due to immobility.

There is a triad of challenges, which are faced differently by the patient, the surgeon and the anesthesiologist. The patient is mostly worried for expected issues of pain, mobility and little bit due to fear of complications. The surgeon is comparatively relaxed, with the demand of less bleeding, relaxed muscles and the best outcome which means bone union or correction. A careful preoperative examination, preoperative optimization of any co-morbid condition, safe intraoperative anesthetic techniques, with plan of postoperative pain relief will give the best result. Postoperative physiotherapy by rehabilitation department will result in early recovery, early mobilization, and low morbidity and mortality.

The anesthesiologist will face challenges throughout the perioperative period i.e. pre-, intra- and postoperative period. During the preoperative period, it is essential to check for other injuries, for example of chest, head or other parts. Coexisting deformities and pre-existing medical problems, e.g. diabetes, hypertension, heart disease, renal, or endocrine disease with decreased organ function and minimal reserve, might challenge the competence of the anesthesiologist to maximum. A history of drugs taken by the patients (especially...
antiplatelet agents, anticoagulants and NSAID’s), past history of surgery (CABG, stents or permanent pacemakers etc.) pose additional problems. In some patients it may be difficult to assess the cardiorespiratory reserve due to severe pain and trauma.

The goal is to optimize the patient before taking him to operating room for surgery by bringing the elevated blood sugar, blood pressure, electrolytes and INR within normal range and take informed consent of high risk (if applicable) after thorough briefing.

Neuraxial anesthesia, if compared with general anesthesia, provides excellent intraoperative anesthesia, superior postoperative analgesia and facilitates early physical rehabilitation. It also helps reduce adverse effects of NSAIDs and other opioid sparing techniques. It is known to result in less morbidity and mortality, less bleeding and shorter hospital stay. It reduces stress response to surgery, and less incidence of postoperative hypoxia, PONV and deep venous thrombosis (DVT) due to early mobilization. Blood transfusion is avoided thus reducing transfusion related problems such as incompatible blood reaction, transfusion related acute lung injury and transfusion-associated circulatory overload.1 However, not all operations are possible with neuraxial anesthesia.

The choice of anesthetic technique depends on the type of surgery and ASA class of the patient, emergency or elective surgery etc. Many factors regarding age, comorbidities, and drugs taken by the patient have to be considered before deciding the preparation and type of anesthesia. Despite prolonged discussions and literature review in favor of regional against general anesthesia, the conflict is still alive and appears from time to time. So the decision has to be made based on risk / benefit ratio. Regional anesthesia in lower limb major surgery reduces infection rates, hospital stay, with lower postoperative cardiovascular and pulmonary complications.2

During transport special care for neck position and use of cervical collar is important to prevent the damage to the cervical cord. The position on operating table may cause nerve injuries due to stretching and compression, which can be avoided by padding the arms, legs, knees with gel or cotton or sponge, and maintaining the limbs in relaxed natural posture.

Tourniquets are very commonly applied in limb surgery to control bleeding. There are known physiological changes which take place during cuff inflation and on release of tourniquet pressure. Tourniquets must be applied after cotton padding, care should be taken for the skin folds under tourniquet which may cause bruising or pressure necrosis of the skin. Metabolic changes takes place as under:

- By eight minutes mitochondrial PO2 approaches zero
- Anaerobic metabolism decreases ATP, nicotinamide adenine dinucleotide (NAD), creatine phosphokinase (CK) and pH
- Release of myoglobin, potassium, intracellular enzymes, thromboxane
- Tissue edema develops after 60 min. and tissue temperature approaches room temperature

Exsanguination increases CVP, pulmonary arterial pressure, systemic vascular resistance and systemic blood pressure. Tourniquet pain may occur after 120 min due to C fibre firing, which can be prevented or delayed by plexus blockade or by periodic deflation and reinflation after 5 min. Metabolic changes on deflation are due to rapid washout of metabolic products, increase in serum lactate and potassium levels and equilibration of temperature. Core temperature is decreased, oxygenation saturation in mixed venous blood (SvO2) in the pulmonary artery falls to 20% and PCO2 is increased. Metabolites produce marked vasodilation and myocardial depression. There is also danger of potential embolization of distal venous clot or debris. It is advisable to give tranexamic acid 10 mg/kg after deflation.

Blood loss is controlled by applying tourniquets or neuraxial anesthesia where applicable. Anesthesia for orthopedic surgery requires an understanding and appreciation of the possibility of large intraoperative blood loss and techniques to limit the impact of this occurrence (intraoperative hypotension, salvage techniques). As already mentioned, regional anesthesia reduces blood loss during surgery and the transfusion requirement.

Bone cement implantation syndrome (BCIS) may develop in orthopedic surgery, where bone cement is used. It may present with hypoxia, hypotension, arrhythmias, pulmonary hypertension and decreased cardiac output. It is an important cause of intraoperative mortality and morbidity in patients. These fluctuations are related to the vasodilatory and mast-cell degranulating properties of the monomeric form of methyl methacrylate. During
cement packing and prosthesis insertion micro-
emboli of blood, fat or platelets are forced into the 
circulation by high intramedullary pressure. Toxic 
effects of cement can release cytokines, which are 
pulmonary vasoconstrictors. Administration of fluid 
volumes to augment right ventricular preload is 
recommended. Direct acting vasopressors, such as 
phenylephrine and norepinephrine can be titrated 
to restore adequate aortic perfusion. To improve 
ventricular contractility and function inotropes 
such as dobutamine might be used.

The patients of orthopedic surgery are at risk of fat 
embolism, especially those with multiple traumatic 
injuries and surgery involving long bone fractures, 
imtramedullary instrumentation or cementing. It 
classically presents within 72 hours with the triad 
of dyspnea, confusion and petechiae. The major 
criteria for diagnosis of fat embolism syndrome 
are: CNS depression, hypoxemia, subconjunctival 
petechiae and pulmonary edema. The criteria 
for diagnosis of fat embolism are: tachycardia, 
hyperthermia, retinal fat emboli, urinary fat 
globules, decreased platelets, increased ESR and 
DIC. Treatment includes early stabilization and 
oxygen with positive pressure ventilation.

**Thromboprophylaxis for DVT and PE:** There are 
risks factors for deep venous thrombosis and 
pulmonary embolism, like obesity, age > 60 years, 
procedure lasting > 30 min., immobilization for > 4 
days, lower extremity fracture. There are strategies 
to minimize risk/ effective prophylaxis for DVT:

- Avoiding dehydration and applying compression stockings
- Pharmacological - Aspirin, LMWH
- Intermittent pneumatic compression & early mobilization

If patient is taking antiplatelets or antithrombotic 
drugs for his/her cardiac illness, the drug 
should be withheld as per guidelines of ASRA 
(American Society of Regional Anesthesia and Pain 
Management) particularly for Regional anesthesia.

**Postoperative pain:** First of all, in July 2000, the 
Joint Commission on Accreditation of Healthcare 
Organizations (JCAHO) introduced a new standard 
for pain management, declaring the pain level to 
be the “fifth vital sign”. Furthermore, the post-
operative pain and the time of recovery are two of 
the most important patients concerns in orthopedic 
surgery. In a recent study evaluating pain during 
the postoperative days after different surgical 
techniques, prosthetic replacement surgery appears 
to be one of the most painful surgeries. Several 
recommendations have been published and serve 
as guidelines for the management of perioperative 
pain in orthopedic surgery. The principle is to 
use combined agents or analgesic to optimize the 
balance between efficiency and side effects.

**Non-opioid analgesia:** Acetaminophen and 
non-steroidal anti-inflammatory drugs are the 
mainstay of postoperative analgesia. Ketamine 
is more effective with a preoperative bolus (0.1 
to 0.5 mg/kg) followed by a continuous infusion 
during 48 hours (2 μg/kg/min or above 5 to 12 
mg/h). Currently international recommendations 
concerning postoperative analgesia propose to use gabapentin or pregabalin premedication without 
exceeding one daily dose of 800 mg to avoid side 
effects like sedation or dizziness.

**Opioid analgesia:** It is recommended, including 
the use of controlled analgesia with an opioid 
pump device.

**Intrathecal and epidural analgesia:** Epidural 
algesia provides the same analgesia and better 
than peripheral nerve blocks. The central blocks 
can induce arterial hypotension, acute retention of 
urine, infectious complications and headaches.

**Blocks and perineural catheters devices:** The 
benefit of analgesia with peripheral blocks is 
also achieved with intravenous morphine with 
patient-controlled analgesia. Indeed perineural 
bloods minimize the sympathetic response to 
surgery, reduced postoperative pain especially 
during mobilization, improve analgesia during 
the postoperative period and increase patient’s 
satisfaction.

**Infiltration of local anesthetic:** The scientific data 
support single shot injection of long acting local 
anesthetic, but not in favor of catheter placement in 
joint /cavity. There are data in favor of multimodal 
approach of local anesthetic infusions through 
perineural catheters supplemented with analgesics 
including a combination of paracetamol, tramadol, 
NSAIDs (when there is no contraindication) and 
opioids.

In conclusion better understanding of 
pathophysiology of aging, and an understanding 
of pharmacotherapeutics and neuraxial blocks may 
lead to safer anesthetic techniques. Improvements 
in monitoring, and multimodal and site specific 
algesias, physiotherapy, early ambulation and 
psychological support might help us in achieving 
our targets of safe anesthesia.
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REFERENCES


