

## 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 patients 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.<sup>1</sup> 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.<sup>2</sup>

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  $PO_2$  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 ( $SvO_2$ ) in the pulmonary artery falls to 20% and  $PCO_2$  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, intramedullary 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 risk 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.<sup>3</sup>

*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”.<sup>4</sup> 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.<sup>5</sup> 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 analgesia 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 blocks 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 analgesia, physiotherapy, early ambulation and psychological support might help us in achieving our targets of safe anesthesia.

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