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Editorial

Paediatric Spinal Surgery: "The Essentials of Perioperative Management"

Editorial

The perioperative management of children undergoing corrective spinal surgery is challenging. The major challenges include the extensive nature of surgery, associated co-morbidities and the need for neurophysiological monitoring to diagnose any form of intra-operative neurological insult. The pre-operative functional status and the intra-operative events could dictate the requirement for post-operative mechanical ventilation.

Spine surgeries are performed for varied pathologies, including congenital or idiopathic defects, malignancy, abscesses, trauma, arteriovenous malformations (AVMs) or herniated disc. The paediatric spine is commonly operated for the surgical correction of scoliosis. Being a complex spinal deformity, scoliosis has an inherent potential to involve the cardio-pulmonary system. The anesthetic management must begin with a focused pre-operative evaluation. The major intra-operative challenges include the maintenance of safe positioning, fluid and temperature balance, blood conservation and spinal cord function monitoring. Adequate analgesia and ventilation are the primary issues of concern in the post-operative period.

A holistic approach needs to be employed while evaluating the children coming for spinal surgery, with emphasis on the pulmonary, cardiovascular, andneurological systems. Functional impairment of these systems can co-exist either as an association or as a result of the spinal pathology. The associated neuro-muscular diseases (NMD), airway difficulty and impaired nutritional status, must be taken into account. Preoperative assessment encompasses a detailed history, general physical examination, keeping in view, the associated comorbidities, syndromes. The battery of preoperative investigations should be tailor made to diagnose the presence and extent of the organ involvement, in addition to the routine investigations.

The anaesthetic management of paediatric corrective spinal surgery entails an efficient airway management, meticulous prone positioning, blood conservation and maintenance of anaesthesia, with minimal interference with spinal cord function monitoring. In case of difficult intubation, fibre-optic or other alternative methods of securing the airway should be kept in mind. Inappropriate positioning can result inneurologic injuries, involving the brachial plexus (65%) and spinal cord injury due to neck extension 19% [1]. The extensive nature and duration of surgery can lead to significant blood loss causing major hemodynamic perturbations. The resultant blood loss can constitute an even higher percentage of the total blood volume in paediatrics. Prolonged surgery and an increased number of fused segments may result in coagulopathy (consumptive and dilutional), especially in the children with neuromuscular diseases [2]. The 24 hour blood loss has been estimated to be roughly 200 ml per segment fused [3]. Invasive monitoring like Central venous pressure (CVP) and Invasive blood pressure (IBP) may be required to dictate hemodynamic management, although CVP may be misleading as a guide of ventricular filling in the prone position [4]. Various strategies have been proposed for blood conservation during spinal surgeries in the literature. Off late, there is less emphasis on deliberate hypotension to reduce blood loss and allogeneic transfusion requirements, in view of the risk of spinal cord ischemia. The recent blood conservation regimen relies heavily on the amalgamation of various pharmacological and non-phamacological modalities such as antifibrinolytic therapy and cell salvage. The children are also sensitive to the deleterious effects of temperature fluctuations, particularly infants and neonates. Preventive measures should be taken to maintain a normothermic milieu.

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Neurophysiological monitoring of spinal cord integrity is the gold standard of intraoperative care in spinal surgery [5]. The current monitoring modalities for preventing intraoperative risk of spinal cord injury are based on the measurement of somatosensory (SSEP) and motor evoked (MEP) potentials. The evoked potentials (EPs), being the electrophysiological responses of the nervous system to stimulation of either sensory or motor pathways, are essentially stimulus related and pathway specific monitoring modality. However, the interference of anesthetic agents with the EPs poses a major constraint on the reliability of the neurological monitoring. Most of the anesthetic agents depress the amplitude and increase the latencies of the EPs. Among intravenous induction agents, propofol is a preferred agent, producing a dose dependent reduction in the amplitude, but has no effect on the latency of MEPs [6]. All halogenated inhalational agents show a dose-related increase in latency and loss of value in the amplitude of cortically recorded SSEPs [7,8]. Opioid based anesthesia can reduce the dose requirements of propofol and volatile agents, thereby allowing a reliable recording of MEPs [9,10]. Among the opoids, infusions of fentanyl, sufentanil and remifentanil are compatible with the neuro-physiological monitoring. Non-depolarizing neuromuscular blocking drugs are preferred over depolarizing drugs. The excellent anesthetic technique is the one which provides quiet and perpetual anaesthetic effect avoiding bolus dosing [11], over rapid bolus doses in order to avoid marked fluctuations in recording the EPs.

The postoperative care mandates an effective analgesic and respiratory therapy. For favorable surgical outcome it is mandatory to have effective pain control at rest and during ambulation and should be titrated and individualized accordingly [12]. The multimodal analgesic therapy includes, wound infiltration, epidural catheter placed intraoperative, opioids (intravenous, intrathecal), patient controlled anesthesia in older children and NSAIDs. Considering the risk involved in surgery, the availability of high definition unit (HDU) becomes an essential part of postoperative care. The factors predicting the need for post-operative ventilation include, prolonged surgery, number of vertebrae involved (>7), major blood loss (>30ml/kg), severe cardiorespiratory involvement, obesity, high Cobb's angle and decreased vital capacity (<35% predicted). Prolonged intensive care and postoperative ventilation may be required in these children [13,14].

To conclude, the anesthetic management of the paediatric spinal surgery has seen major developments in the last decade. The extent of the major organ involvement should delineate the peri-operative management strategy. Optimal patient positioning, maintenance of spinal cord perfusion, normothermia and normovolemia are indispensable. The postoperative neurological morbidity has witnessed a major decline in the face of advanced spinal cord monitoring. An integrated intensive care and multimodal analgesic therapy are the essentials of postoperative management. A good surgical correction backed with an efficient perioperative management strategy, can improve the overall outcome after paediatric spinal surgery.

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