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Case Report

Total intravenous anesthesia in patient with tuberculous myeloradiculopathy undergoing cervicosternotomy: A case report

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ABSTRACT

Total intravenous anesthesia (TIVA) has becomemore popular in neuroanesthesia over past decade. Propofol and remifentanil are the most ideal drugs for TIVA. Cases of myeloradicolopathy of tuberculosis infection are significantly increasing in Indonesia. The clinical effects of pain and impaired motor and sensory function will cause activity disorders and affect the quality of life of the sufferer. We present a patient with myeloradiculopathy due to TB infection who underwent stabilization anterior fusion surgery with a tubular cage anterior approach (cervicosternotomy). A 23-year-old woman was diagnosed with Myeloradiculopathy with *Space Occupying Lesion* Extradural at the Th2-Th4 vertebral level, suspected TB spondylitis with fracture and paravertebral abscess, with ASA (American Society of Anesthesiology) II. The patient was given induction remifentanil 50 mcg, which was given as a bolus for one minute, followed by remifentanil 25 mcg for one minute, propofol 120 mg, and rocuronium 60 mg. Anesthesia maintenance was carried out on patients by administering remifentanyl infusion 0.05-0.5 mcg/kg/minute, propofol infusion 50-150 mcg/kg/minute, and intermittent rocuronium 10 mg. Preoperative assessment, intraoperative maintenance, and postoperative evaluation were performed in these patients. Preoperative analysis, intraoperative care, intraoperative monitoring, and postoperative monitoring are essential to ensure good outcome results from cervicosternotomy with an anterior approach, which requires very good cooperation between neurosurgery, thoracic surgery, and neuroanesthesia and gives some challenges in itself.

Keywords: Anesthesia, Anterior stabilization, Cervicosternotomy, Myeloradiculopathy

Introduction

Total intravenous anesthesia in neuroanesthesia is significantly influenced by the pharmacokinetics and pharmacodynamics of anesthetic drugs. A fast onset, quick recovery, potency, fat solubility, stability in solution, and, most all, compatibility with other medicines so that mixing them together won't cause issues are the characteristics of the perfect medication for TIVA. The most suitable and optimal medications for TIVA are propofol and remifentanil. Half of the requirement for propofol can be achieved by remifentanil. Being the most used medication combination, the combination with propofol is quite successful. The analgesic effects of propofol help lower the dosage of remifentanil by minimizing the hyperalgesia that the drug causes. During spinal surgery procedures, there are specific strategies for neuroprotection of the spinal cord, including the basic ABCDE method of maintaining spinal cord perfusion [1-3].

Myelopathy is damage to the spinal cord caused by compression or irritation, while radiculopathy is caused by spinal nerve root involvement. Myelopathy manifests with paraplegia, sensory impairment below the lesion, and bladder involvement, while radiculopathy manifests with pain in the nerve root region, muscle weakness and radicular atrophy as the nerve spreads, loss

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of sensation according to the dermatome, and abnormal muscle spasm and twitching. These two problems are distinct from each other, but most patients experience both together and are called myeloradiculopathies [4, 5]. Myeloradiculopathy is caused by several factors such as cogenital abnormalities, infection, trauma, endocrine, neoplasm, degenerative, and medical abnormalities and overlapping with other cases [6]. Although the incidence of myeloradiculopathy due to infection is uncommon, particularly when it comes to tuberculosis (TB) infection, which accounts for only 1-2% of cases [6, 7], the incidence of TB infection in the spinal area is quite significant in Indonesia due to the country's high TB patient population (8.9% of all TB patients worldwide) [4]. The patient's quality of life will be impacted by the clinical description of pain and reduced motor and sensory function, which will limit their activities. Conservative treatment options for TB infection instances, including myeloradiculopathy, include medication and surgery. However, the majority of patients require surgical intervention to decompress and rectify the deformity because of delayed diagnosis and the failure of conservative treatment [8]. In this case report, we discuss the anesthetic management of a patient with myeloradiculopathy at the Th2-Th4 vertebral level who underwent spinal surgery to perform anterior stabilization with a cervicosternotomy approach that requires good cooperation from another neurosurgeon, thoracic surgeons, and neuroanesthesiologists.

Case

A 20-year-old female 50 kg, 160 cm (BMI 19.5 kg/m2) complained of weakness in her lower extremities since 5 days ago before entering the hospital and felt increasingly aggravated since 3 weeks ago. The patient sometimes complained of pain and tingling in the back to the lower extremities since 8 months ago. The patient has urinating and defecating incontinence. A history of trauma and other comorbid diseases was denied by the patient. Physical examination revealed deformity with a step-off sign on the upper back without tenderness. Neurological examination revealed lower extremity motor strength 1/1 and upper extremity motor strength 5/5 with hypesthesia at Thoracic level 2. The American Spinal Injury Association (ASIA) categorized the patient as grade B with an incomplete type of spinal cord injury.

Figure 1. MRI examination results

MRI results reveal two types of thoracic lesions: Thoracic 1 and Thoracic 2. Thoracic 1 shows an isointense lesion at the Th2-Th4 vertebral level, causing damage to the Th2-Th3 corpus, ring enhancement, and contrast-induced isointense lesion in the Th7 and Th10 vertebrae, while Thoracic 2 shows hyperintense lesions at the Th2-Th4 vertebrae. Thoracic x-ray results showed the patient's thoracic scoliosis and cobb angle were 140 (N < 100).

Pre-operative

Patient with diagnosis of Myeloradiculopathy with Space Occupying Lesion Extradural at the Th2-Th4 vertebral level, suspected TB spondylitis with fracture and paravertebral abscess, ASA 2. The patient was planned for laminectomy, debridement surgery, abscess drainage, and posterior stabilization through spinal surgery aimed at the cervical region with the anterior approach method.

Figure 2. Cervicosternotomy preoperative marker

Intra-operative

Patients were induced with remifentanil 50 mcg for one minute followed by remifentanil 25 mcg for one minute, propofol 120 mg, and rocuronium 60 mg. Maintenance anesthesia was performed with TIVA by giving remifentanil 0.05-0.5 mcg/kg/min and propofol 50-150 mcg/kg/min, intermittent rocuronium 10 mg, ETT was placed, and control ventilation. Monitoring of electrocardiogram, invasive arterial blood pressure (ABP), pulse oxymetry, capnograph, temperature, bleeding, and urine output. A central venous line (CVC) and an

arterial line were placed during surgery. The operation lasted for 6 hours and resulted in bleeding of 1200 mL. The patient was given 2000 mL crystalloid, 300 mL packed red cell (PRC), and 400 mL fresh frozen plasma (FFP). During the operation, the patient also passed urine as much as 80-100-120 mL/hour, the patient's fluid balance was +150 mL/6 hours. When sternotomy was performed, lung down (coordination with thoracic surgery), during the intraoperative procedure, hemodynamics was stable and there was no desaturation phase. Controlled hypotension management was performed during surgery. During the operation, a solid abscess was found on the sternum, debridement was performed, and a tubular cage was placed on the thoracic 2 to 4 with C-arm monitoring during the operation.

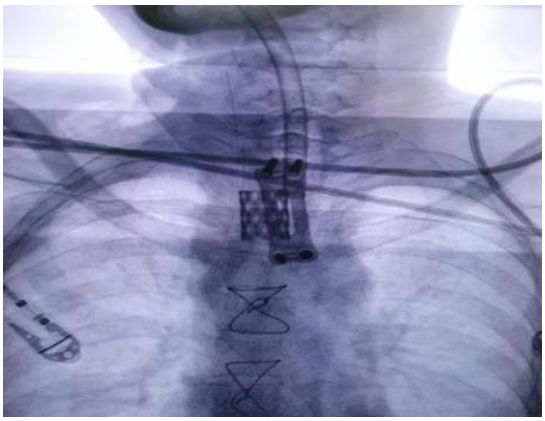

Figure 3. Tubular cage mounted symmetrically

Postoperative

The patient was admitted to the ICU with a stable vital sign and controlled ventilation with TV 8mL/kgBW RR 12 times/minute PEEP 5 and a gradually weaning ventilator. After 24 hours, the patient was extubated. Postoperative analgesics were paracetamol 1 gram intravenously per 6 hours and fentanyl 25 mcg/hour. First-line anti-tuberculosis drug therapy was given. The patient was treated in the ICU for 3 days and then moved to the HCU. Postoperative laboratory examination was performed, and Hb 10.3 g/dL was found.

Results and Discussion

Two anesthesia strategies are available for managing general anesthesia: the Total Intravenous Anesthesia method or a mix of opioids and inhalation anesthetics. The current option is propofol-remifentanil because of its advantageous pharmacokinetic and pharmacodynamic properties. TIVA is linked to a smooth induction, a quick start of the medication's effects, and a lower incidence of nausea and vomiting following surgery. The fields of pharmacology and safe anesthetic delivery procedures have seen remarkable advancements in neurosurgery anesthesia in recent years. Intravenous (IV) anesthetics reduce cerebral blood flow and intracranial pressure while preserving spinal cord perfusion, in contrast to medications inhaled [9]. Three hypnotic drugs that lessen the workload of the central nervous system are used in total intravenous anesthesia. In this instance, remifentanil was utilized as an analgesic to block pain stimuli, followed by propofol, a hypnotic drug, and lastly muscle relaxants to produce the effects of muscle paralysis via neuromuscular blockade agents [2, 10].

Choice of anesthetic drug management in neuroanesthesia provides neuroprotection. It is necessary for procedures involving the central nervous system. In this case, the use of propofol can provide neuroprotection effects even with the lowest dose and has the highest effect on the use of brust suppression doses. The neuroprotection effect is obtained from a decrease in brain metabolic rate, antioxidant activity, gamma amino butyric acid (GABA) receptor activity, inhibiting glutamate-mediated exotoxicity, preventing mitochondrial edema, interacting with the endocannabinoid system, suppressing autophagy activity, suppressing aquaporin-4 expression, and inhibiting the enzyme nicotinamide adenine dinucleotide phosphate oxidase [11].

The combined use of propofol and high-potency synthetic opioid analgesic agents like remifentanil reduces the dose requirement of propofol in achieving the target anesthesia with a synergistic effect. Duration, onset, and depth of anesthesia are significantly improved. Pain complications and cardiac events after the use of propofol and cough after the use of synthetic opioids can be suppressed [12]. The use of muscle relaxants to ensure muscle relaxation around the spinal skeleton as adjuvant therapy Rocuronium bromide, a non-depolarizing muscle relaxant, is recommended for spinal surgery due to its favorable effects on hemodynamic parameters, rapid onset of action, moderate duration of action, fast recovery, and low accumulation in vivo. Rocuronium bromide is clinically applied in spinal surgery using the minimum dose concept in order to minimize difficulties related to medication residues. Nevertheless, small dosages frequently result in inadequate muscle relaxation and a delayed start of effect [13].

Myelopathy is a disorder characterized by spinal cord compression or irritation whereas radiculopathy is caused by spinal nerve root involvement. These two symptoms are not mutually exclusive, and people may feel both simultaneously [4]. A variety of reasons can contribute to myeloradiculopathy, including congenital anomalies, infection, trauma, endocrine, neoplastic, degenerative, and medicinal problems, as well as overlap with other conditions [6]. In this case, SOL and pathological fracture were induced by a particular TB infection. Therapeutic treatment of tuberculous spondylosis can be achieved by either medicinal therapy or surgical intervention. The management is based on the severity of paraplegia; first and second degrees that are still mild can use conservative therapy; third degrees that fail conservative therapy, surgery can be considered; and fourth degree decompression surgery should be performed as soon as possible to save the patient's neurological function and correct the deformities that occur [7, 14].

The cervico-thoracic area can be accessed through anterior, anterolateral, posterior, and posterolateral approaches. The selection of the anterior approach provides more convenience, safety, and access to anterior pathological abnormalities and is in line with shortening the duration of surgery, low transfuse

requirements, early walking, and low damage to ligaments, nerve roots, and spinal cord [8]. In this case, a cervicosternotomy with an anterior approach was chosen to perform posterior stabilization of the upper thoracic region.

Spinal neuroprotection needs to be performed in the preoperative period. The ABCDE neuroanesthesia management can be performed for patients with cerebral and spinal cord disorders. A (airway) must be clear to avoid complications, and an X-Ray examination is needed to assess any airway disorder [1]. B (breathing) Control ventilation to achieve normocapnia or slight hypocapnia. In this case, there is scoliosis, which causes the patient's vital and total capabilities to decrease so that it can cause ventilation and perfusion disorders [15]. C (circulation) avoid an increase or decrease in blood pressure; avoid an increase in cerebral venous pressure; fluid management with targets of normotension, normovolemia, iso-osmoler, and normoglycemia [1]. Circulation management also needs to be done through a cardiac risk index protocol due to the risk of cardiac events after the use of anesthesia in the form of cardiac ischemia, rhythm disturbances, heart failure, and even cardiac arrest [16, 17]. Controlled hypotensive techniques are carried out by paying attention to MAP 60-70 mmHg to reduce the risk of bleeding during surgery and maintaining systolic blood pressure < 90 mmHg. D (drugs) give drugs that have a protective effect on the spinal cor; E (Environment) temperature control; mild hypothermia; prevent hyperthermia [1, 18]. The effectiveness of mild hypothermia during surgery has not been demonstrated to be neuroprotective, although during the past 20 years, advances in temperature control have been made for purposeful mild hypothermia during surgery. Maintaining the patient's body temperature during the surgery is crucial, as is allowing them to reach a state of moderate hypothermia before the major operation. Moreover, rewarming is crucial following surgery in order to obtain a precise neurological examination [19]. To prevent this, it is necessary to set the room temperature as low as <36 °C [20]. In this case, temperature control management was carried out by giving warmed fluids, considering the relatively large amount of fluid given to this patient.

The American Spinal Injury Association (ASIA) categorized the patient as grade B with an incomplete type of spinal cord injury. ASIA assessment is assessed preoperatively and postoperatively in the ICU in this patient; it takes 6 months to 1 year to assess the progress of improvement of postoperative neurological deficits [1].

In a Randomized Controlled Trial (RCT) study, Nene *et al*. found evidence that spinal tuberculosis can be given anti-tuberculosis drugs (OAT) for 6 and 12 months with the results of good clinical criteria, high cure rates after 24 months, patients without drug resistance, and radiology appearing improvement [21]. This shows that therapy can be given for up to 6 months. In this patient, the plan was to give category 1 OAT drugs 2RHZE for 2 months and 4H3R3 for the next 4 months. In the ICU, postoperatively, the patient received immediate OAT therapy and will be evaluated for OAT administration after 6 months.

The most critical aspects of postoperative treatment are extubation and pain control. Early recovery and extubation are important since they allow for clinical assessment and the detection of problems in all situations. Extubation may be delayed, however, due to an assessment of the risk of airway edema, airway blockage, and emergency airway care in patients with suspected airway complications [22]. In this patient, extubation was delayed due to the length of the procedure and the possibility of surgical complications.

Postoperative pain management is a unique challenge. Patients undergoing complex surgical procedures often experience chronic pain and dependence on opioid therapy. The existence of tolerance to opioids will also result in an increase in the dose, duration, and side effects of opioid use. And more than half of adult patients undergoing spinal surgery experience postoperative pain that lasts more than 6 months. Pain management can be done through the use of opioids, non-opioids, which include the use of NSAIDs, pregabalin, gabapentin, and other therapies with lower effectiveness, such as antidepressants, melatonin, vitamin C, and cannabinoids. Ketamine or lidocaine infusion, regional, and neuroaxial techniques can also be performed as postoperative pain management [23]. Based on the postoperative Visual Analog Score (VAS), a VAS value of 1 - 2 was found, which means that the pain scale is mild, with the administration of fentanyl 0.5 mcg / kg and paracetamol 1gr / 6 hours intravenously while in the ICU.

Conclusion

Special techniques in the administration of spinal cord protection include total intravenous anesthesia (TIVA), the fundamental ABCDE neuroanesthesia approach, particularly for hypothermia, and pharmaceutical therapy. Infections can cause myeloradiculopathy, an uncommon condition mostly brought on by tuberculosis (TB) infections in Indonesia at the moment. Medication and surgery are the most effective ways to treat myeloradiculopathy. There are a number of difficulties in doing a cervical sternotomy as an anterior route, which calls for close collaboration across thoracic, neurosurgery, and neuroanesthesia. A better result is ensured by the importance of preoperative planning, intraoperative maintenance, intraoperative monitoring, and postoperative monitoring.

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Conflict of interest: None

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authors have disclosed all relevant financial and personal relationships. The confidentiality and privacy of the participants were rigorously maintained throughout the study.

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