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Case Report

Tetralogy Scalp Block Anesthesia without Opioid for Anesthetic Management in Children Underging Frontal Reconstruction

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Abstract

Traumatic brain injury (TBI) is one of the leading causes of death in developing countries, especially Indonesia. The incidence of TBI in Indonesia between 6% and 12% and has a mortality rate of 25% to 37%. Treatment of traumatic brain injury is done as soon as possible to improve quality of life and prevent further damage to brain cell and function. A 13-year-old child sustained mild traumatic brain injury and frontal fracture due to a fall from a motorcycle. The patient underwent frontal reconstruction in the operating room. The surgery was performed under regional anesthesia using a scalp block with an ultrasound device and without using opioid drugs. The surgery lasted about two hours without hemodynamic disturbances. The post-surgery Visual Analogue Scale (VAS) was 2-3. The patient was observed in the regular ward for four days and discharged without any disability. Scalp block was chosen to enhances analgesic quality without opioid, reduce requirement of ICU as well as hospitalization time, and save treatment costs. Opioids may cause respiratory and gastrointestinal depression and Postoperative Nausea and Vomiting (PONV).

Key words: Anesthetic management, opioid, scalp block, traumatic brain injury, ultrasonography

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I. Introduction

Traumatic brain injury is a disorder of brain function that occurs due to stimulus from outside the body, such as blows, shocks, collisions, and others. Traumatic brain injury is one of the health problems with the most deaths in developing countries, especially Indonesia. In developed countries, traumatic brain injury often occurs in geriatric patients due to falls and may be accompanied by comorbidities. The incidence of traumatic brain injury in Indonesia ranges from 6% to 12% and has a mortality of 25% to 37%.[1] Treatment of traumatic brain injury is carried out as soon as possible to improve quality of life and prevent further damage to brain function. Brain tissue damage due to trauma causes disruption of cerebral blood flow autoregulation so that the brain can experience edema due to the accumulation of lactic acid and increased cell membrane permeability.[2] Opioids are drugs that are often used as analgesics in surgery, especially head and brain surgery. However, opioids have undesirable side effects.[3,4] This case report will describe a scalp block anaesthetic technique without opioids in the anaesthetics management of a children undergoing frontal reconstruction surgery.

II. Case Illustration

History

A 13-year-old boy, weighing 25kg, had a traffic accident six hours before admission to the hospital.

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The patient was riding a motorcycle without a helmet and fell while avoiding a hole. The patient fell and hit his head on a stone. The patient did not experience vomiting, unconsciousness, or seizure after the incident. The patient was rushed to the nearest community health center before being referred to Cilacap Regional Public Hospital.

Physical Examination

The primary survey found a free airway with no oropharyngeal airway, a respiratory rate of 20 breaths/minute with no retraction between the ribs and impingement in both chest fields. Breath sounds were vesicular in both lung fields and there were no additional rales or wheezing sounds. Oxygen saturation was 99% without supplemental oxygen. The patient's peripheral perfusion was warm and not pale. Capillary refill time was less than two seconds. Blood pressure was 106/70mmHg, pulse rate was 96 beats/minute, and radial pulse was strong. The patient was fully conscious and responsive to sound and pain.

Laboratory Examination

Laboratory results and thoracic imaging were within normal limits. Computerized tomography showed a frontal impression fracture, but no mass, intracranial haemorrhage, epidural, subdural, and increased intracranial pressure.

Figure 1. Head Computerized Tomography Bone 3-D

Intraoperative Management

The patient was having scalp blocked using an isobaric levobupivacaine 0.25%. Before the scalp block, the patient was given premedication of midazolam 2mg, propofol 20mg, and a loading dose of dexmedetomidine 1mcg/kgbw within 15 minutes. Scalp block was performed using ultrasonography and a 25G needle at several points, i.e. supraorbital nerve fibers (3cc), supratrochlear (3cc), zygomaticotemporal (5cc), auriculo-temporal (5cc), occipital major (5cc), occipital minor (5cc), and auricular major (3cc). The anaesthesia regimen used dexmedetomidine 0.4mcg/kgbw which was started after the loading dose ended and lidocaine 1.5mg/kgbw/hour.

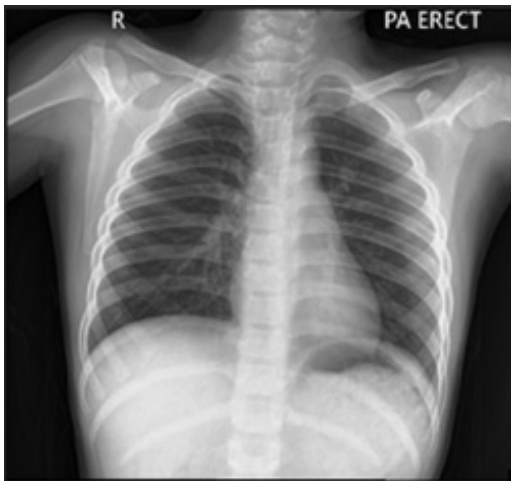

Figure 2. Chest X-ray

Table 1. Preoperative Laboratory Results

Laboratory	Result	Range
Hemoglobin	13.6 g/dL	10.9-14.9 g/dL
Hematocrit	40.8 %	34-45 %
White blood cell	8500/mm3	4790-11340/mm3
Platelet	315000/µL	216000-451000/µL
Blood glucose	121 mg/dL	80-139 mg/dL
Ureum	28.4 mg/dL	15-40 mg/dL
Creatinin	0.68 mg/dL	0.0-0.9 mg/dL
Sodium	141 mmol/L	135-145 mmol/L
Potassium	4.4 mmol/L	3.5-5.1 mmol/L
Chloride	105 mmol/L	97-107 mmol/L
Bleeding Time	4 s	2-7 s
Clotting Time	9 s	8-15 s

The patient was not intubated prior to surgery. The patient was monitored for blood pressure with Non-invasive Blood Pressure (NIBP), heart rate, oxygen saturation, and ECG. During surgery, the patient received 65cc/kgbw/hour lactated ringer's fluid without colloid or blood. Bleeding during surgery was 50cc and the patient was haemodynamically stable. The patient was transferred to the recovery room after surgery for two hours and been observed for one hour.

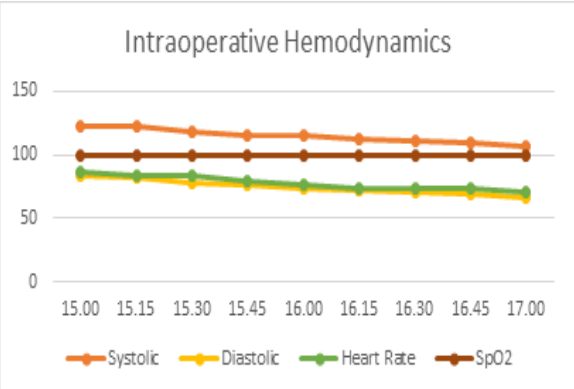

Chart 1. Intraoperative Hemodynamics

Postoperative Management

The patient's condition was stabilized during observation in the recovery room, including consciousness, hemodynamic, and pain scale using VAS assessment. VAS score is 2–3. The patient was transferred to the regular ward to continue recovery. The patient received dexmedetomidine 0.4 mcg/kgbw/hour for two days, paracetamol 15 mg/kgbw/8 hours for three days, and ibuprofen 10mg/kgbw/8 hours for three days. During post-surgical care, the patient was able to eat and drink by himself and light mobilisation. The VAS score during treatment ranged from 1–2. The patient was discharged three days after the surgery.

III. Discussions

The use of scalp block in craniotomy surgery is useful to prevent hemodynamic disturbances during the scalp incision. Hemodynamic disturbances that occur in the form of pain can cause an increase in blood pressure and pulse rate. Pain during a skin or scalp incision causes intracranial pressure to increase. This causes brain tissue damage and increases mortality and morbidity.[5] Scalp block can detect neurological deficits during surgery.[6] Moreover, scalp block reduces opioid consumption during the first 48 hours after surgery. [4,7]

Scalp block is performed at four main nerve, reffered as tetralogy of scalp block, including branches from cervical spinal rami and trigeminal nerve. The supraorbital and supratroclear nerves are branches of the ophthalmic nerve that innervate the forehead region. The zygomaticotemporal nerve is a branch of the maxillary nerve that innervates the forehead and temporal part. The auriculotemporal nerve is a branch of the mandibular nerve that innervates the temporal part, lower face, ear, and skin above the ear. The greater occipital nerve is a ramification of the posterior C2 nerve that inervates the back of the scalp and the skin below the ear. The minor occipital nerve is a branch of the anterior C2 and C3 nerves that innervate the lateral scalp to the back of the head and ear.[8] Ultrasound helps with this as the nerve fibers can be seen clearly and accurately.[14] Additionally, the use of ultrasound helps the anaesthesiologist visualize the vasculature so that the drugs enter the nerve fibers.[15]

Opioids have long been used for post-surgical pain management. The analgesic effect of opioids has been shown to reduce the conversion of acute pain to chronic pain post-surgery. Opioid have side effects, such as opioid addiction, respiratory depression and gastrointestinal depression, andincreasing the risk of PONV.[3] The incidence

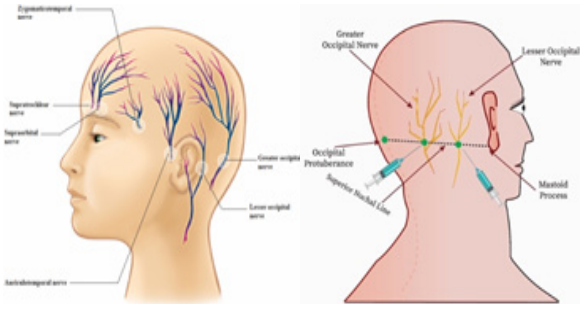

Figure 3. The Punctures of Local Anesthetic in Scalp Block.[8]

of nausea and vomiting after craniotomy surgery is 22% to 70% if no prophylaxis is given, but the incidence decreases to 6% to 60% in the prophylaxed population.[9] Post-craniotomy nausea and vomiting is a concern as it causes an increase in intracranial pressure. In addition, post-surgical nausea and vomiting may result in hematoma due to increased venous blood pressure.[5] Anaesthetic agents used for craniotomy under general anaesthesia such as isoflurane, sevoflurane and opioids have the potential to cause postoperative nausea and vomiting.[11]

The use of drugs similar to opioids, such as α-2 agonists, N-methyl-D-aspartate (NMDA) receptor blockers, non-steroidal anti-inflammatory drugs (NSAIDs), and propofol, reduces the incidence of post-surgical nausea and vomiting. The risk of nausea and vomiting after brain surgery is 70% if no prophylactic nausea and vomiting medication is prescribed.[12] Dexmedetomidine, one of the α-2 agonist drugs, reduces the side effects of postoperative nausea and vomiting in addition to functioning as a sedative, anxiolytic, sympatholytic, and analgesic.[13] Dexmedetomidine has eight times greater potentiation than clonidine. The use of dexmedetomidine in combination with corticosteroids and 5-HT3 antagonists reduces the risk of postoperative nausea and vomiting during the first 24 hours post-craniotomy by 16%.[9,12] Dexmedetomidine is also beneficial for reducing oxygen consumption of body cells, especially the brain, by decreasing the brain metabolic rate.[4,13] Furthermore, dexmedetomidine has a hypotensive effect that should be cautioned if the dose is not titrated so monitoring is necessary during the administration of the loading dose.[9,13]

Lidocaine was established as an antiarrhythmic drug and local anaesthetic in 1942 and used for humans from 1948 until now. Lidocaine is a local anaesthetic drug that functions to block sodium channels in the transduction phase. In addition, lidocaine also functions as a blocker of nicotinic and acetylcholine receptors, a presynaptic calcium channel blocker in the dorsal ganglion, and opioid receptors. Lidocaine has anti-inflammatory properties by restricting inflammatory mediators, such as macrophages, monocytes, and polymorphonuclear granulocytes. A dose of lidocaine of 1.5 mg/kgbw/hour decreases proinflammatory agents, such as IL-1, IL-6, TNF-α, and IFN-γ. However, the use of lidocaine should be avoided in patients with heart failure, incomplete heart block, impaired liver function, and renal impairment.[16]

NSAIDs are one of the alternative analgesics to opioids that do not cause addiction. However, usage of NSAIDs must be carefully done since there are possible side effects, such as platelet dysfunction, allergic reactions, and gastric irritation. The use of NSAIDs is recommended in traumatic brain injury patients because it has a neuroprotector effect on brain cells.[17] The use of paracetamol with other NSAIDs can reduce morphine consumption during the first 24 hours post-surgery and prevent hyperthermia during surgery.[18] Combination of paracetamol and ibuprofen decrease postoperative pain scores and rescue narcotic requirements in children undergoing craniotomy surgery.[19]

IV. Conclusions

Opioid-free anaesthesia with scalp block, dexmedetomidine, and lidocaine, is one of the alternatives in craniotomy surgery. In addition to minimizing post-surgical nausea and vomiting, this technique reduces the intensity of post-surgical pain, reduces ICU care as well as hospitalization time, and saves treatment costs. This technique can be used in a variety of surgeries, especially craniotomy, but we must consider the patient's characteristics to avoid side effects during anaesthesia until post-surgery.

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