

Regional anesthesia techniques in patients with chronic spinal cord injury

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ABSTRACT

Anesthesia-related complications, such as autonomic dysreflexia, remain an issue in patients with spinal cord injury (SCI). The use of regional anesthesia is an alternative method for the prevention of autonomic dysreflexia that may occur during surgery in SCI patients. In addition, regional anesthesia has been used against neuropathic pain and spasticity. The aim of this study was to investigate the different applications of regional anesthesia in SCI patients. A review of the current literature was performed using the online PUBMED database and using the keywords "regional anesthesia" and "spinal cord injuries". Initial search results included 183 studies. Finally, 28 studies were included in this review. The results of this study showed that regional anesthesia may be particularly useful for patients with SCI. It may be used for upper and lower limb surgery, abdominal surgery, and obstetrics and particularly for the prevention of autonomic dysreflexia. Moreover, it may be used in the management of chronic neuropathic pain and spasticity in SCI patients. However, more high-quality studies are needed to clarify the benefits of regional anesthesia in the management and rehabilitation of SCI patients.

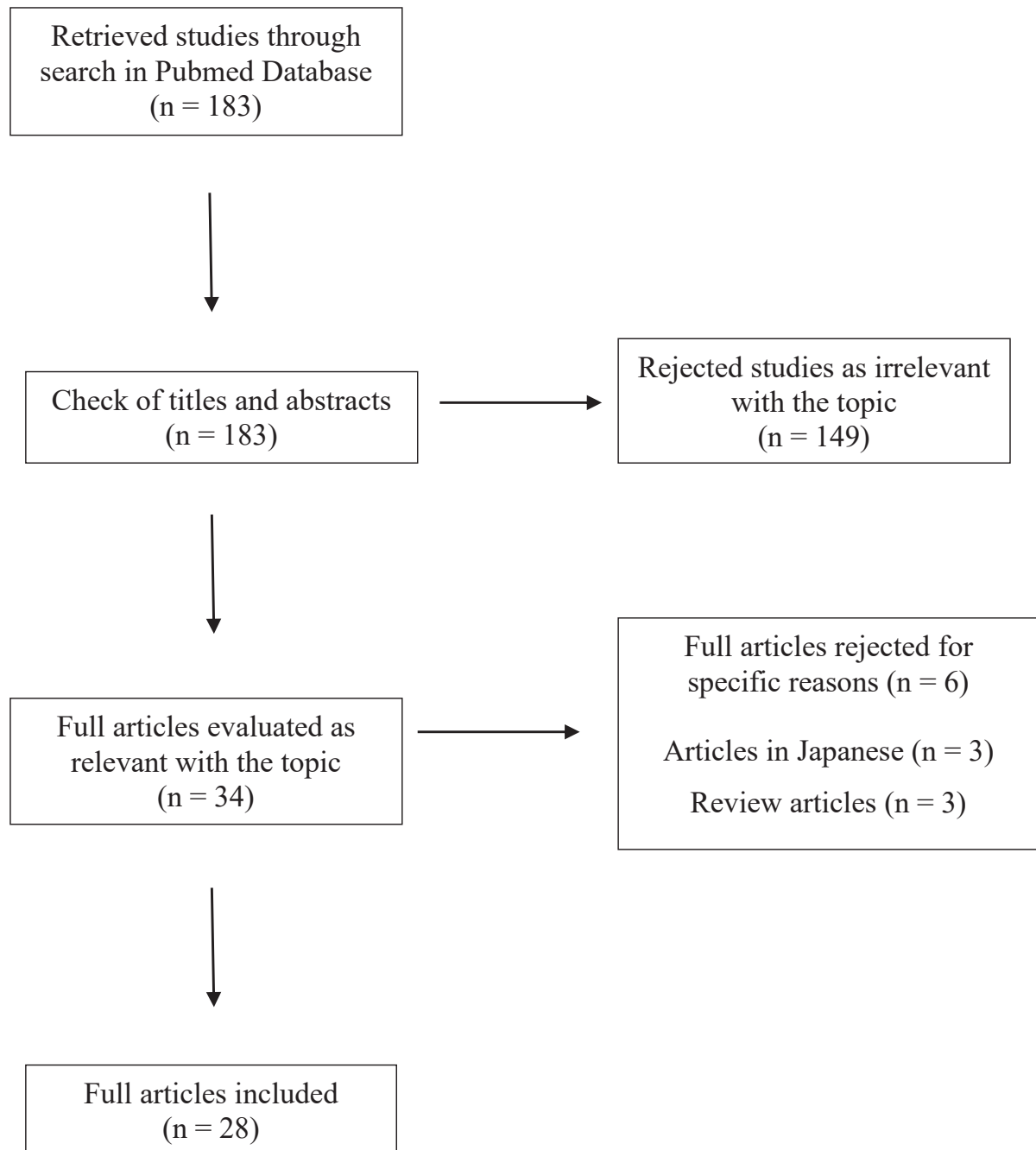
Key Words: regional anesthesia, spinal cord injuries

The human spinal cord, despite its unique cell architecture and its ability to rapidly transmit specialized information to the brain, is inherently deprived of the ability to regenerate, an ability which would allow it to restore the sequelae of an injury. Thus, the consequences of suffering a small-sized traumatic spinal cord injury (SCI) can be severe for the patient, with little chance of complete recovery of neurological function. The pathophysiological changes concern not only the injured spinal cord tissue, but also many important organs and systems of the body [1,2].

Patients with SCI may experience respiratory, cardiovascular, urological, gastrointestinal, musculoskeletal, and metabolic complications. Theoretically, in SCI patients any lower limb and abdominal surgery and delivery may be performed without anesthesia if there is no sensation at the operative site. However, especially with spinal lesions above the mid-thoracic region, autonomic dysreflexia may be provoked by situations like skin trauma and dilation or stimulation of the bladder, the intestine, the uterus, and the perineum [3]. Autonomic dysreflexia is a known emergency in SCI

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**Table 1:** Flowchart

patients. It is characterized by an acute rise in blood pressure and bradycardia, although tachycardia may also occur. It can present with a variety of symptoms and can vary in intensity, from asymptomatic to mild discomfort and headache to a life-threatening condi-

tion with blood pressure rising to 300 mmHg [4]. Autonomic dysreflexia is caused by spinal reflexes which remain intact, despite the patient's injury. A stimulus below the spinal lesion produces a centripetal impulse, which generates a sympathetic response, which in turn

produces vasoconstriction below the neurological lesion [5]. The result is peripheral and visceral vasoconstriction followed by the development of hypertension. Untreated episodes can have serious consequences including intracranial hemorrhage, retinal detachment, seizures, and even death. It has been observed that the higher the level and the severity of SCI, the greater the degree of intensity of autonomic dysreflexia [4]. Stimulation of the lower urinary system is responsible for most episodes of autonomic dysreflexia, with bladder dilation being responsible for 75% to 85% of cases. Bladder dilation and stretching may result from blockage of bladder catheter flow or insufficient frequency of intermittent catheterization. The second most common cause of autonomic dysreflexia is the dilatation of the intestine that is responsible for 13% to 19% of cases. Diseases of the gastrointestinal tract, pressure ulcers, ectopic ossification and menstruation constitute other causes of autonomic dysreflexia [4].

The use of regional anesthesia is an alternative method for the prevention of autonomic dysreflexia occurring during surgery in SCI patients but has also been used against neuropathic pain and spasticity. The aim of this review was to investigate the different applications of regional anesthesia in SCI patients.

A review of the current literature was performed using the online PUBMED database and by using the key words "regional anesthesia" and "spinal cord injuries". Primary search results included 183 papers. After reviewing titles and abstracts, 149 studies were rejected as irrelevant. Of the remaining 34 studies evaluated, 6 were rejected. Eventually, 28 studies were included in this review [6-32] (Table 1).

Discussion

Advantages of regional anesthesia

Spinal anesthesia has been recommended for SCI patients, particularly for urological and obstetrical surgery. Its advantages are the reliable prevention of autonomic dysreflexia and the avoidance of certain hazards of general anesthesia. In a recent study including twenty-five SCI patients with lesions above T7 who underwent endoscopic urologic procedures, spinal anesthesia was found to be 100% successful in preventing autonomic dysreflexia, without being associated with hypotension [8]. In another study, spinal anesthesia

with the use of hyperbaric cinchocaine was noticed to minimize the autonomic hyper-reflexic cardiovascular responses to bladder dilation and had minimal effects on cardiovascular measurements [7]. Another randomized, double-blind, placebo-controlled trial in twenty-six SCI patients with lesions above T6, showed that lidocaine anal intersphincteric block significantly reduces the autonomic dysreflexia response in SCI patients subjected to hemorrhoids ligation [10]. In addition, the topical induction of lidocaine gel immediately before rectal manipulation has been shown to minimize the rate and severity of autonomic dysreflexia in patients with cervical SCI [12].

Disadvantages of regional anesthesia

Previous spinal surgery, spinal contractures, spasticity and bony deformities may cause technical difficulties in the performance of neuraxial anesthesia and the identification of the desired sensory level [6,14]. Occasionally, the level of the nervous block can be identified by locating the level at which spastic paraparesis becomes flaccid. A case series study, suggested that the disappearance of Babinski sign and patellar tendon reflex along with the loss of spasticity may confirm the effect of spinal anesthesia in patients with cervical SCI, even though identification of the level of the block can be difficult [22].

In comparison to spinal anesthesia, epidural anesthesia has been reported to produce less satisfactory results. A few failures of prevention of autonomic dysreflexia have been reported, maybe due to distortion of the epidural space, wrong catheter position or imprecise evaluation of the effect of a test dose [14,20]. Maintenance of hemodynamic stability may not be sustained with isolated neuraxial administration of opioids. Epidural opioids such as pethidine and fentanyl, have been reported to hamper autonomic dysreflexia with conflicting results, as shown in published case reports [26-27].

Regional anesthesia for obstetrics

Spinal cord injury patients with lesions below T10 may experience pain during labor and patients with lesions between T5 and T10 may at least experience contractions. Regional anesthesia has been widely used in SCI obstetric patients [9,11,13,20-21, 28,30]. Regional

anesthesia may be more difficult to perform and have a higher failure rate in SCI patients, especially in the presence of surgical hardware and due to spasticity, deformities and difficulties with patient positioning [21]. In a case series by Sharpe et al, including 9 women with SCI, 67% had cesarean delivery [21]. Moreover, autonomic dysreflexia may be triggered by uterine contractions [26]. The prevention and control of autonomic dysreflexia during labor is based on the use of antihypertensive agents (nifedipine, hydralazine and verapamil) but the most used measure is epidural anesthesia. Epidural anesthesia may block autonomic dysreflexia during labor and after it, although its success may be variable [11,20]. Among 2 parturients with SCI, epidural block succeeded a full prophylaxis for autonomic dysreflexia [11]. Another study reported a case of a laboring SCI patient who developed autonomic dysreflexia and was successfully treated with epidural anesthesia [20]. The combination of spinal and epidural anesthesia or continuous infusion should be preferred over a single injection. The sufficiency of the anesthesia can be checked by blood pressure control [11]. The epidural catheter should be left in situ as autonomic dysreflexia may occur up to 48 hours after delivery [14].

Regional anesthesia for upper limb surgery

In case of upper limb surgery, brachial plexus block is a useful method of regional anesthesia. The axillary brachial plexus blockade is preferred over the supraclavicular block, due to decreased risk of pneumothorax. Bilateral brachial plexus block (right infraclavicular and left axillary block) has been successfully used in a SCI patient with a C5 lesion, for bilateral elbow fracture, without any respiratory complications [15].

Regional anesthesia for neuropathic pain

Chronic neuropathic pain is a serious complication of SCI, and regional anesthesia may have a role in its management. In a recent study, intrathecal administration of a combination of morphine and clonidine led to a 63% reduction of neuropathic pain in SCI patients [32]. In another study, neuraxial administration of 5% lidocaine was associated with a 37% reduction of neuropathic pain in 62% of SCI patients [17]. In a study by Glynn et al, epidural injection of morphine

(5 mg) and/or clonidine (150 mg) in 15 SCI patients led to pain decrease in five patients [33]. In a similar study including 6 SCI patients, a single epidural administration of 150 mg of clonidine reduced more than 50% the neuropathic pain in 3 patients and improved muscle spasticity [29]. However, in another study, the intrathecal administration of baclofen in 9 SCI patients had no serious effect on reducing chronic pain [31].


Regional anesthesia for spasticity

Spasticity is one of the most common and potentially disabling complications affecting patients with SCI. Injection techniques are useful for treating local spasticity and improving functional outcome, with minimal adverse effects. Diagnostic blockades, usually performed with the use of lidocaine, may identify the muscles that are responsible for the spasticity, the differences between spasticity and contracture, and predict the contribution of a therapeutic block to functional improvement. When a spastic muscle is identified, therapeutic peripheral nerve blockades can be performed. Usually, the peripheral nerves subjected to chemical neurolysis have mainly motor distribution, such as the obturator and the musculocutaneous nerve. These blocks may relieve painful contractures and spasms and thus prevent bed sores, improve gait and facilitate nursing care, hygiene and positioning [25,34]. Alcohol or phenol is used for therapeutic nerve blocks, the effect of which lasts usually for 8 to 12 months [35]. Phenol acts on the nerve sheath causing serious nerve injury and eventually muscle atrophy. Alcohol is used less frequently. Complications of both phenol and alcohol include painful paresthesias and dysesthesias up to 32% in the 10% of the patients [35]. In a case series by Ko et al, pudendal nerve block with phenol solution used as a treatment for external urethral sphincter spasticity produced excellent results in 7 SCI patients [16]. In addition, pudendal nerve block with phenol solution has been proven an effective treatment for detrusor-sphincter dyssynergia in SCI patients [23]. It has been shown that ultrasound-guided obturator nerve block may treat bilateral adductor spasticity in paraplegic patients 25 and that subscapularis motor point block is a useful technique for spastic shoulders in patients with cervical SCI [24]. In another study, epidur-

al anesthesia was used to minimize damage to a fresh tensor fasciae latae flap placed over a hip ulcer, in a SCI patient with severe muscle spasms [18].

Conclusions

Regional anesthesia techniques may be particularly useful in managing patients with SCI. They may be used in upper and lower limb surgery, abdominal surgery, and obstetrics and particularly for preventing au-

tonomic dysreflexia. Moreover, they may be used for the management of chronic neuropathic pain and the treatment of spasticity in SCI patients. However, more high-quality studies are needed to clarify the benefits of regional anesthesia in the management and rehabilitation of SCI patients. 

Conflict of interest

The authors declare no conflicts of interest

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