Thoracic Spinal Anesthesia: To do or not to do!

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Abstract

Regional anesthesia is advised to patients undergoing surgeries and having major medical problems that restrict the use of general anesthesia. Currently, there is significant and renewed attentiveness in the use of regional anesthesia techniques for many common surgeries. Intrathecal injection of anesthetic drugs into the preferred height of the body, even above the end of the spinal cord, has been revealed to be possibly very valued. Recently, thoracic spinal anesthesia has been shown feasible and safe for different types of surgeries. The objective of this review is to demonstrate the benefits, risks and the use of the thoracic spinal anesthesia as a sole anesthetic technique as well as a combined technique with epidural anesthesia.

Keywords: Thoracic spinal anesthesia; Regional anesthesia; Thoracic surgery; Upper abdominal surgery

Introduction

Anesthetic management for patients with comorbidities undergoing major surgeries is challenging, making regional techniques a possible option [1-3]. Neuraxial anesthesia is one of the regional anesthetic options that can be done by blocking the spinal cord neural transmission through administration of local anesthetics either via intrathecal, epidural or paravertebral approach [1]. These techniques of anesthesia provide motor and sympathetic blockade, in addition to deep sensory analgesia [1]. One of the benefits of regional anesthesia is the postoperative extension of its analgesic effect [4]. Fujii Y et al used the thoracic epidural anesthesia, as a regional technique, combined to general anesthesia, particularly to achieve an extended analgesia in patients undergoing laparoscopic cholecystectomy [4]. Some studies have shown that spinal anesthesia done at lumbar level, either alone or combined with epidural approach, is superior to general anesthesia in these patients [5].

Thomas Jonnesco was the first author to describe the thoracic approach of spinal anesthesia [6]. He was investigating the “general spinal anesthesia” for surgery on the skull, head, neck and thorax through intrathecal anesthesia at different levels [6]. From his point of view, there are two helpful and easier spinal anesthetic punctures: the upper dorsal puncture, between the first and second dorsal vertebrae which covers the skull, head, neck, and upper limb surgeries, and the dorso-lumbar puncture, between the last dorsal and first lumbar vertebrae which covers the whole lower part of the body [6]. On the opposite side, he found that the medio-cervical puncture for head and neck surgeries and the medio-dorsal puncture between the seventh and eighth dorsal vertebrae for abdominal and lower limbs surgeries are carrying a certain risk or they are useless, and very often difficult to perform [6]. He advised that the later punctures should be substituted by the two former punctures to provide the general spinal anesthesia [6]. Interestingly, recent studies of regional anesthesia have investigated the feasibility and safety of spinal anesthesia through thoracic approach [2].

On one side, Mahmoud et al has advised that thoracic spinal anesthesia is not intended for routine application [3] until more studies with larger numbers of patients can provide high-quality evidence of safety. However, on the other side, Ellakany MH and Abdelhamid SA in 2013 have shown that segmental thoracic spinal anesthesia can be used as a sole anesthetic technique in breast cancer surgery with axillary lymph node clearance [7]. One year later, a study published by the same author, reported a successful and effective use of the same technique: segmental thoracic spinal anesthesia, for open surgeries for abdominal malignancies, when delivered by expert anesthesiologists [8]. Furthermore, Imbelloni considered laparoscopic cholecystectomy as one of the surgeries that could also benefit from spinal thoracic anesthesia [9]. In another published study, Imbelloni has concluded that lower limb orthopedic surgeries can be accomplished by thoracic spinal anesthesia [10]. However, the actual scientific evidence regarding thoracic spinal anesthesia is still limited. Therefore, we have carried out an extensive review of the current literature regarding thoracic spinal anesthesia; its beneficial use, and the risks behind it.

Material and Method

Pubmed, Google Scholar and Cochrane databases were searched for relevant articles. The following keywords and
phrases were used in various combinations: ‘Thoracic Spinal anesthesia’, ‘Thoracic Intrathecal Anesthesia’, ‘Regional Anesthesia for Thoracic surgeries’ and ‘Regional Anesthesia for Laparoscopic Cholecystectomy’. All articles identified within the initial search were screened for relevance and content, and their bibliographies were searched for any additional relevant articles. The criteria for inclusion were articles considering spinal thoracic anesthesia as an individual anesthetic technique or a combined technique to thoracic epidural anesthesia. All publications up to December 2017 were considered.

Results
The initial search identified 323 articles of which 300 were excluded based on the abstract review alone. Twenty-three full-text articles were reviewed, of which 16 were related to thoracic spinal anesthesia, with 7 original articles, 3 case reports, 4 letters to editors, and 2 review articles. The articles discussed spinal thoracic anesthesia in laparoscopic cholecystectomy (3 articles), breast cancer surgeries (2 articles), abdominal cancer surgery (1 article), and orthopedic surgery (1 article). All the studies concluded that segmental spinal anesthesia can be used as an effective anesthetic technique. Concerning patient safety, most of these studies recommended this anesthetic technique to be done by anesthesiologists with considerable experience of thoracic regional anesthesia and should be restricted in application until much larger studies will publish conclusive data. However, Imbelloni and Gouveia considered thoracic spinal anesthesia as a safe technique and can be performed intentionally based on the evidence of lack of harmful effects of the accidental dural puncture that may occur with thoracic epidural technique [11].

Discussion
Thoracic spinal anesthesia has not been established yet for routine use. Some authors found it helpful while others found it harmful. For instance, Imbelloni LE concluded that the use of thoracic puncture helps to reduce the doses of hyperbaric bupivacaine in combination with fentanyl for laparoscopic cholecystectomy that led to better outcomes with less hemodynamic instability, and shorter duration of sensory and motor blockade than lumbar spinal anesthesia with conventional doses [9]. Different types of surgeries have gotten benefits from the thoracic spinal approach when compared with other anesthetic options [7, 10, 9]. Of these benefits, the decrease in length of stay in the post-anesthesia care unit, reduction of postoperative pain, and increased patients’ satisfaction have been achieved in patients with abdominal malignancies undergoing open surgeries [7]. Regarding lower limb orthopedic surgeries, Imbelloni LE, Gouveia MA have used the thoracic spinal anesthesia in two groups aiming to compare the effect of low-dose isobaric and low-dose hyperbaric bupivacaine [10]. They concluded that the low dose of spinal anesthetics in orthopedic patients allowed a faster installation, a longer sensory than the motor block, reduction of adverse effects such as hypotension and bradycardia without any neurological sequelae [10]. Furthermore, recent studies investigated the anatomy of the thoracic spinal canal with magnetic resonance of imaging (MRI) to address the potential neurological complications of thoracic spinal technique [12-15]. One of these studies has reported a lower incidence of paresthesia without any neurological sequelae in 300 patients who received a low thoracic spinal puncture [15]. The reported incidence was about half of the paresthesia incidence reported in another study on patients received lumbar puncture [16]. Additionally, during the era of the widespread use of the cervical and thoracic myelography, the spinal puncture at these levels has been reported as a regular practice by radiologists and neurologists, rendering the possibility of its use in the anesthesia practice [17,18]. Due to the more anterior position of the spinal cord at the level from mid thoracic to lower thoracic, the intrathecal space has been found wider than the epidural space at that level when measured by MRI [18]. Therefore, experienced anesthesiologist may have found intrathecal injection at that level a reasonable mode of regional block as thoracic epidural with no concerns about its safety [18].

Practically, when spinal thoracic anesthesia is considered, it can reduce the need for large doses of analgesics as it provides deep block for surgery with an optimal analgesia [18]. Considering the injection at the thoracic level instead of lumbar level, particularly for abdominal surgeries, ensures the appropriate distribution and the highest concentration of the injected opioid and local anesthetic to the pertinent dermatomal level where the surgery is carried on [19].

Despite the feasibility and safety reported in the literature, thoracic spinal anesthesia still carries major concerns in the clinical practice. One of these concerns is the fear of injuring the spinal cord at that level, making the lumbar level more suitable and dominates the practice [18]. Additionally, report of the potential spinal cord damage during spinal anesthesia at a level higher than L2–L3 increases the concern even more and interferes with the acceptance of the thoracic spinal anesthesia as an alternative regional technique in the clinical practice [20]. While performing thoracic blockades, the anatomical pattern of the vertebrae at that level may contribute to the damage of the spinal cord with subsequent severe neurological lesions and potential progress to paresis or even paraplegia [21]. The insensitivity of the spinal cord tissue to needle penetration may worsen the condition even more [21].

Another major concern about the thoracic approach of the spinal anesthesia is the interference of the ventilatory function due to the extensive blockade of spinal nerves at the thoracic level [18]. Of note, the diaphragm is the most important muscle responsible for inspiration and will not be affected due to the cervical origin of its nerve supply. Additionally, there is no concern about expiration which is a passive process. However, thoracic block will affect the anterior abdominal wall muscles which are responsible for the forceful expiration and coughing, due to the thoracic origin of its nerve supply [22, 23].
Conclusion
Thoracic spinal anesthesia carries many benefits, yet it is not devoid of risks. It should be considered for high-risk patients who cannot tolerate general anesthesia due to the associated comorbidities. An expert anesthesiologist with solid thoracic anesthesia skills should be the one who performs that technique. In other words, thoracic spinal anesthesia should be given to the right patient by the right physician.

References