

WHAT IS YOUR UNDERSTANDING OF SPINAL AND EPIDURAL ATTEMPT?

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Abstract

Background: The practice of spinal and epidural anaesthesia is well established the world over for a number of years. Sighting of spinal or epidural is conducted through various approaches at various levels of the spinal column. The number of attempts has its correlation with the post-spinal and epidural complications.

Aim: The aim is to gather information about the understanding among the anaesthetists about the spinal/epidural attempt.

Materials and Methods: A pro forma comprising of nine closed-loop questions was distributed to all the participants in the study, and they were requested to fill it anonymously and placed it back in a designated sealed box in anaesthetic office.

Results: A total of 20 pro formas were distributed, and all of them received back with 100% responses. All the participants accepted universally that attempting through another space makes it a second attempt. One of the respondents thought any backward movement means 2nd attempt, the majority of the responders thought it does not count as an attempt. Almost everyone considered another attempt if a needle is completely withdrawn and enters through another puncture site whether through a midline or paramedian approach.

Conclusion: Most of the complications after neuraxial blockade are associated with the number of attempts alongside other factors that may play a role. A universal definition of a spinal and epidural attempt may decrease the complications associated with the central neuraxial blockade.

Key words: Epidural, single attempt, spinal

Introduction

The practice of spinal and epidural anaesthesia/analgesia is well established the world over for a number of years. Sighting of spinal or epidural is conducted through various approaches at various levels of the spinal column. There is a scarce evidence in the existing literature about defining and declaring spinal and epidural attempt. The number of attempts has its correlation with the post-spinal/epidural complications and concomitant administration of anticoagulants. Central neuraxial anaesthesia/analgesia involves the administration of local anaesthetic or opioid medication through spinal, epidural or caudal route. Its advantage in anaesthesia ranges from surgeries

of the lower half of the body to labour analgesia and perioperative pain control.^[1-8]

The adult vertebral column comprises 33 vertebrae: 7 cervical, 12 thoracic, 5 lumbar, 5 fused sacral and 4 frequently fused coccygeal vertebrae. The spinal column makes the central spinal canal allowing and harbouring all the important structures in it. The spinal canal comprises of structures such as the all-important spinal cord, its blood vessels and nerve roots. Meninges and spaces, cauda equina, fat, lymphatics and ligaments between vertebrae are all part of this canal.^[9,11,12]

The spinal cord is a 45-cm-long conical-to-tubular-shaped structure, starting at the base of the brain projecting from the skull through foramen magnum, tapers down into the conus medullaris and extends up to first to third lumbar vertebra. Ideally, for spinal cord

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safety, spinal anaesthesia in adults should be attempted at the lowest possible level i.e., below the imaginary Tuffier's line.^[9,12]

During the procedure, needle traverses through the interspinous space cutting through skin, subcutaneous tissue, the supraspinous ligament, interspinous ligament and ligamentum flavum [Figure 1]. The ligamentum flavum is a thick ligament composed of 2 left and right ligaments that fuse variably in the midline, and it is where the give-away or pop-off feeling is experienced by anaesthetist attempting spinal or epidural. Its thickness varies from its attachment at the skull till sacrum, and in its relation to the epidural space, it is present just posterior to it and is the final structure that the epidural needle should pierce and gives a sudden loss of resistance as soon as needle passes through it.^[1,9,11,12]

The epidural space surrounds the dura, more pronounced posteriorly, and extends from the foramen magnum to the sacral hiatus. It is related to the posterior longitudinal ligament anteriorly, pedicles and intervertebral foramina laterally and ligamentum flavum posteriorly. It accommodates nerve roots, arteries, large thin-walled veins, fat and lymphatics. Connective tissue bands and septae may exist in some patients as a result of inflammatory process causing uneven spread of local anaesthetic within the space.^[1,9,12] The average range for loss of resistance is 3–5 cm, but it may vary significantly.

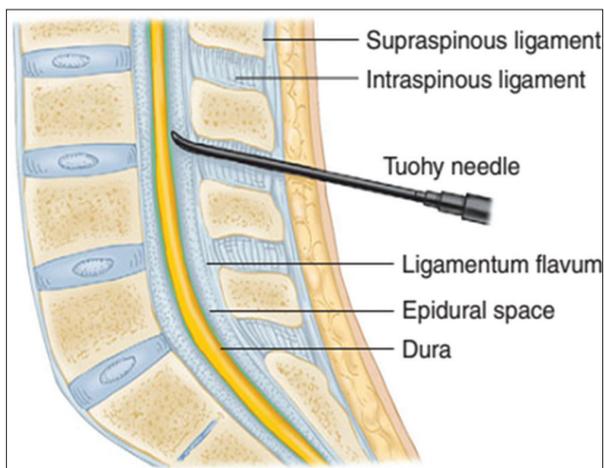


Figure 1: Structures pierced by epidural needle (Tuohy needle). By Morgan and Mikhail's Clinical Anaesthesiology, 5th edition, Ch. 45, P. 942, Fig. 45-4 (reprinted with permission from the publisher)^[12]

The overall capacity of the epidural space is much greater in comparison to the spinal space. The spinal nerves cross the entire length of epidural space before appearing out of the intervertebral foramina.^[9,11,12]

The subarachnoid space lies between the pia mater and the arachnoid mater. This layer extends from the cerebral ventricles of the brain to the termination of the dural sac at the second sacral vertebra. It comprises of the spinal cord, nerves, cerebrospinal fluid and all important blood vessels that supply the spinal cord.

There are dense venous plexuses in the epidural space and injury to the venous plexus may play a significant role in the development of most unwanted and deleterious complications, i.e., bleeding and hematoma formation.^[1-3,11,12]

The major complications associated with neuraxial blockade technique are (pharmacological features of the local anaesthetic or any other agent used are not included in the following list).^[10-12]

- Failed attempt.
- Pain on injection.
- Spinal infections (epidural abscess and meningitis).
- Spinal bleeding (vertebral canal haematoma).
- Major nerve damage (spinal cord damage, paraplegia, etc.).
- Wrong route injection.
- Death where the anaesthetic/analgesic procedure is implicated as causal (cardiovascular collapse).

We can clearly assume that the incidence of above-mentioned complications would increase if the number of attempts increases because most of the complications listed above are either because of the technique or patient-related factors such as secondary to the underlying disease condition.

Skin → Subcutaneous layer → Supraspinous ligament → interspinous ligament → ligamentum flavum [Figure 2].^[11,12]

We have conducted a prospective cross-sectional study in our institute from the majority of the members of anaesthetic division comprising of consultants, fellows and residents.

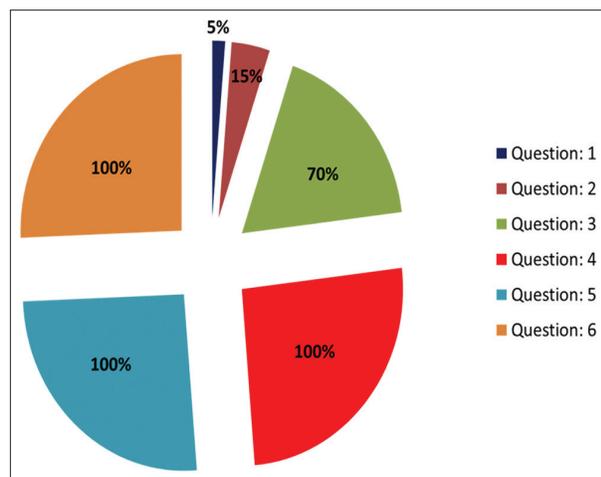


Figure 2: Positive responses toward survey-based questions

Materials and Methods

The survey pro forma (as shown in the table below) was distributed to all the participants in the study inclusive of all the residents, fellows and consultants.

Inclusion criteria for the participants were to have at least 6 months of anaesthetic experience or 30 spinal/epidural procedures attempted either independently or under supervision.

All the participants were requested to fill it up anonymously and drop it back in a designated sealed box in anaesthetic office.

Pro forma

Do you describe the following as a single attempt while performing spinal or epidural?

1. Any backward movement of the needle after insertion?	Yes	No
2. Redirect needle in subcutaneous tissue after hitting the bone?	Yes	No
3. Complete withdrawal of needle out of skin and attempt at the same puncture site?	Yes	No
4. Complete withdrawal of needle out of skin and reinsertion at the same space but through a different puncture in the midline?	Yes	No
5. Complete withdrawal of needle out of skin and reinsertion at the same space but through a different puncture of paramedian approach?	Yes	No
6. Complete withdrawal of needle out of skin and reinsertion at another interspinous space?	Yes	No
7. Kindly mention your grade, Consultant?	Yes	No
8. Kindly mention your grade, Fellow?	Yes	No
9. Kindly mention your grade, Resident?	Yes	No

Results

A total of 20 pro formas were distributed, and all of these received back with 100% responses. All the participants accepted universally that attempting through another space makes it a second attempt as shown in Figure 1. One of the respondents thought any backward movement means 2nd attempt, the majority of the responders thought it does not count as an attempt. Three anaesthetists responded that it is an attempt if they would redirect needle in subcutaneous tissue while majority i.e., $n = 17$ anaesthetists believed that complete withdrawal out of the skin would make it an attempt even though redirected through the same skin entry point, while $n = 3$ anaesthetists do not consider this as an attempt.

Almost everyone considered this as another attempt if a needle is withdrawn and enters through another puncture site whether through a midline or paramedian approach.

Discussion

The practice of spinal and epidural anaesthesia is well established but what defines an attempt for the particular procedure has not been clearly stated in the literature. The need for defining an attempt becomes even more important when the serious complications associated with the procedure are considered. It does possess some correlation with a number of attempts and certain other patient and procedure-related factors.

The concept of the neuraxial blockade is very important for an anaesthetist. The selection of patient, considering their age, past medical history and medications, is of utmost importance in the practice of spinal or epidural techniques. The skill set required for smooth and successful procedure, seniors help and use of technology such as ultrasound and fluoroscopy plays a pivotal role and cannot be emphasised more.^[1-3,12]

Regional anaesthesia is considered a very safe option but yet the adverse effects and complications associated with it have been under reported. The universal understanding among anaesthetist is that the overall risk is much higher than given in the literature, it is like an iceberg phenomenon, probably due to under-reporting.^[10-12]

As for deep vein thrombosis prophylaxis, the variety of pharmaceutical agents and the doses of these drugs are

advocated on the assumption of single spinal/epidural attempt. The lag period provided since the last dose of anticoagulants primarily depends on the pharmacokinetics of the agent used and the response of the body to it. All such durations mentioned in the literature for the regional procedures are relative, and confounding factors do play a role and are assumed to be performed by experts attempting it only once. As the number of attempts increases due to any reason, the risk for complications also increases. The incidence may increase multifold when multiple needle attempts are made either by complete withdrawal of needle or redirecting the needle by pulling out the needle at a specific depth and reinserting at different levels.^[1-3,6,7]

The actual incidence of neurological dysfunction resulting from haemorrhagic complications associated with the neuraxial block is unknown. The incidence cited in the literature ranges from <1 in 150,000 to be as high as 1 in 3000. Overall, the risk of clinically significant bleeding increases with age, associated abnormalities of the spinal cord or vertebral column, the presence of underlying coagulopathy, difficulty during needle placement and an indwelling neuraxial catheter during sustained anticoagulation.^[1-4]

Factors that may potentially lead to increased number of attempts can be related both to the patient factors, such as difficult spinal anatomy either due to disease condition or age-related degenerative changes and lack of proper positioning or cooperation from the patient. It can also be related to the person performing the procedure having a lack of familiarity with the particular equipment or either lesser experience in dealing a difficult situation. In most of the situations, help from a more experienced colleague or use of available technology such as ultrasound or fluoroscopy could be of great help.^[7,9,10]

The definition of an 'attempt' and limited number of attempts before some action is taken, like abandoning the procedure or converting it to general anaesthesia, not only helps to reduce the risk of serious complications but also increase the effectiveness of regional anaesthesia. Along with that, it may also help to ally the patient's anxiety and attenuation of unwanted systemic issues, such as tachycardia and raised blood pressure, at the time of the procedure. In the context of the above situation, the overall implication and definition of an 'attempt' make it

all that important as we may have a universally accepted and agreed on definition, and then, the guidelines and recommendations are made according to that definition.

Conclusion

Most of the complications after neuraxial blockade are associated with the number of attempts alongside other factors that may play a role. A universal definition of a spinal and epidural attempt may decrease the complications associated with the central neuraxial blockade.

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