

## EDITORIAL VIEW

# Can ultrasonography help in reducing post spinal headache?

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### ABSTRACT

The advent of ultrasonography (USG) did not remain restricted to diagnostic radiology only, and during the last one decade it has wholeheartedly been adopted by anesthesiologists. First employed for central venous access only, it soon trespassed into the domains of peripheral nerve and nerve plexus blocks, and now made inroads in general as well as central neuraxial anesthesia. In this editorial three techniques used for USG guidance in regional anesthesia have been introduced and special groups of patients have been indicated in which it may particularly be useful. Its positive role to detect abnormal sonoanatomy and decrease the incidence of postdural puncture headache following intentional or unintentional dural puncture has been discussed.

**Key words:** Ultrasound; Anesthesia, Spinal; Post-Dural Puncture Headache; Myelography

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The last two decades have seen numerous advancements in the field of regional anaesthesia with continuous refinement of techniques. However, the advent of ultrasonography (USG) in the last one decade has propelled the regional anaesthesia techniques to greater heights with respect to safety and accuracy. USG has definitely reduced the incidence of multiple needle attempts in subarachnoid blocks as well as minimizing the chances of dural puncture in epidural anaesthesia. The USG guided accurate methods have reduced the incidence of various complications associated with regional anaesthesia like trauma to neuraxial structure, post dural puncture headache, epidural hematoma. Recently ultrasound has been proposed as a preoperative assessment tool predicting the feasibility of neuraxial blockade and definitely has the potential to become a necessary pre-operative investigation for neuraxial blockade especially in anticipated difficult cases.

Current indications for dural puncture include but are not limited to various procedures like diagnostic

lumbar puncture, myelography, intrathecal chemotherapy and neuraxial anaesthesia. Accidental dural puncture (ADP) can also occur while performing epidural anaesthesia or analgesia indicated for postoperative and labour pain relief.

Post dural puncture headache (PDPH) was first described by Carrie and Collins as “headache occurring after dural puncture which continues for more than 24 hours at any level of intensity, or so severe at any time that the patient is unable to maintain upright posture. Most distressing aspect associated with it is the discomfort caused during recovery period and lack of patient’s satisfaction. The pain is invariably throbbing which may or may not be associated with photophobia, double vision, blurred vision, dizziness, tinnitus, decreased hearing, nausea and vomiting and mainly occurs due to stretching of 3rd, 4th, 6th, 7th and 8th cranial nerves.

Surprisingly, a century has passed when the first report of PDPH in literature was reported but exact mechanism of PDPH is still not known. Leakage of

CSF (more than 15 ml) through dural puncture, resulting in fall of CSF volume and pressure, appears to be the main cause of PDPH and was first proposed in 1902.<sup>1</sup> Studies have shown that the dura mater is heavily innervated and abnormal distension of intracranial nerves and extracerebral blood vessels activate the trigeminal neurons that were assumed to be the origin of headache.<sup>2,3</sup>

Risk factors associated with PDPH include patient and procedural factors. Among patient factors, patients between 30-50 years are more susceptible while in older age reduced incidence is seen probably due to decrease in elasticity of cranial structures and reduction in pain sensitivity. Higher incidence is seen in females. BMI (body mass index) has been shown to have an inverse relationship, higher intra-abdominal pressure and thus high intra-epidural pressure prevents CSF leakage. Taller individuals, history of depression and chronic recurrent headaches, minimal pre-procedural intravenous hydration and lower systemic blood pressures are other risk factors. These can be termed as non-modifiable.

While performing the procedure, the insertion of spinal needle with bevel direction oriented in parallel/longitudinal fashion resulted in significantly lower incidence of PDPH compared to that oriented in a perpendicular/transverse fashion as has been observed in one meta-analysis.<sup>4</sup> Pencil point, non-cutting Whitacre and Sprotte needles have lesser incidence of PDPH because they produce irregular tear in dura and subsequent inflammatory reaction reduces CSF leakage more effectively than clean U shaped puncture seen with cutting bevel needle as has been observed by electron microscopy. Multiple punctures not only cause increase anxiety and patient's discomfort but also increases incidence of PDPH as has been claimed by various studies.<sup>5-7</sup>

USG has potentially modified the procedure related risk factors over the last few years. Median or longitudinal, transverse or horizontal and coronal plane are mainly used for visualization of spine with USG, however, the convenient and best plane is PMOSS (paramedian oblique sagittal scan). Here the transducer is placed 2-3 cm lateral to the midline in the sagittal axis and is tilted.

Pre-procedural labelling,<sup>8</sup> real time ultrasound guided<sup>9</sup> and real time ultrasound guided Sonix GPS<sup>®</sup> needle tracking system<sup>10</sup> are the main methods for insertion of spinal needle using USG. Pre-procedural technique is useful only if accurate skin markings are made of the optimal lumbar puncture

location whether in transverse or in longitudinal plane.

Real time ultrasound guided technique is performed by obtaining a PMOSS view. The advantage of this view is that simultaneous needle handling can be done because more room is created between the needle entry point and the bed surface. This approach is quite similar to the traditional paramedian technique. The real time ultrasound guided technique helps in advancement of 90 mm spinal needle to the interlaminar space until it enters ligamentum flavum when 'give way' is felt and entry into the thecal space lies in less than one cm.<sup>9</sup>

In the third technique, a special Sonix GPS system 19G/80 mm proprietary needle is used in place of standard spinal needle. The tip of the needle is placed on the insertion site, the hub is manipulated in three dimensions until needle beam alignment is obtained and a trajectory is formed and is indicated by the graphic overlay on the ultrasound screen of the Sonix GPS system. The 19G introducer needle is inserted until the tip reaches the interlaminar space. The needle beam alignment and correct trajectory is maintained by observing the indicator on the Sonix GPS ultrasound screen. Once the 19G introducer needle is in position 120 mm, 25G Whitacre spinal needle is inserted through the introducer needle to achieve a successful dural puncture for which redirection or reinsertion of spinal needle may be required. The unique merits of this technique include clear visibility of the adequacy of needle beam alignment as the location of the needle and its tip are displayed at all times as an overlay on the ultrasound screen. Also, it has greater precision which allows operator to make necessary adjustments during needle advancement.<sup>10</sup> However, availability issue of needles specifically compatible with Sonix GPS needle tracking system, is a major limitation.

Positive aspects related to use of USG in central neuraxial blockade includes its safety profile, non-invasiveness and provision of real time images. The immense benefit can be seen in certain special populations like patients with obesity with BMI >35 kg/m<sup>2</sup>, deformities of bones as in scoliosis, previous surgery on spine, degenerative changes of ageing and patients with deranged coagulation profile.

Literary evidence and various clinical studies have shown that accurate identification of the subarachnoid space is important as multiple attempts at needle placement may cause patient

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discomfort, higher incidence of spinal hematoma,<sup>11</sup> post dural puncture headache<sup>6,7</sup> and trauma to neural structures.<sup>12-14</sup> A number of clinical trials few decades ago have shown interest of physician for the use of ultrasound for spinal and/or epidural anaesthesia. In one of the study, Grau T et al while attempting to see the benefits of USG guided blockade, observed a higher satisfaction scores, an improved visual analogue scale of pain score and fewer puncture attempts in patients administered USG guided blocks<sup>15</sup> Lee et al have shown that ultrasonography makes it possible to detect abnormal sonoanatomy and decrease the incidence of unintentional dural puncture complication in patients, undergoing labour analgesia that had previous unintentional dural puncture.<sup>16</sup> The preoperative ultrasound imaging can provide easier, clinically feasible and more accurate access which facilitates spinal anaesthesia with higher first needle attempt and lesser chances of additional needle attempts as has been observed by Sherif A. Abdelhamid et al. They observed a higher patient satisfaction score with USG.<sup>17</sup>

Accurate measurement of the depth of the subarachnoid space by USG facilitates the smooth performance of spinal anaesthesia and thus decreases the rate of complication especially in

those patients with difficult surface landmarks.<sup>18-22</sup>

Attempts have been carried out to reduce the incidence of various complications like PDPH, paraesthesia and epidural hematoma mainly by easing the technical difficulty in neuraxial blockade by minimizing multiple needle insertion attempts.<sup>11,23-26</sup> Globally, the success rate of spinal needle insertion in first attempt is 61-64%.<sup>23,27,28</sup> Working on a similar pattern of minimizing spinal needle insertion attempts, it was observed during one study in patients undergoing total joint replacement, a success rate of 84% with a single needle insertion attempt was achieved using ultrasound imaging, majority of whom had difficult surface landmarks.<sup>29</sup> The incidence of PDPH will definitely decrease with increasing use of USG technique. However, the use of ultrasonography is as such limited at present in developing nations due to economic constraints. The larger studies with USG guided neuraxial blockade will show a definite path towards minimizing the incidence of PDPH if not eliminating this commonly feared complication altogether. At present, we can only assume that incidence of PDPH can possibly be minimized by controlling the modifiable factors associated with the procedure of neuraxial blockade.

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Don't take rest after your first victory because if you fail in second, more lips are waiting to say that your first victory was just luck."

*Dr. A.P.J Abdul Kalam*