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## Comparison of the 25, 26 and 27 Gauge Needles for Spinal Anesthesia

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### ABSTRACT

Spinal anesthesia is one of the widely used methods of anesthesia which is done by injection of local anesthetics in the cerebrospinal fluid in the L3-L4 region with spinal needles. Our purpose was to compare several adverse effects of the three mostly used needles for spinal anesthesia; 25, 26 and 27 G. Two hundred surgery patients enrolled in the study to randomly receive spinal anesthesia with a 25, 26 or 27 G needle with Marcaine and were studied for the incidence of hemodynamic instability, paresthesia, tremor, nausea or vomiting, headache, backache one and six months after the procedure regarding the number of attempts to have a successful spinal anesthesia. The 25 G needle was of greater success in performing spinal anesthesia in the first attempt which happened to have the least incidence of paresthesia, tremor, nausea or vomiting, headache and backache one month after the procedure. However, there was no substantial difference between the adverse effects of these three needles according to the Chi-Square tests ( $p$  value  $> 0.05$ ). The systolic and diastolic blood pressures were all declined after the induction of spinal anesthesia in all the three groups. The thinner the needle, the harder the induction of spinal anesthesia. The more the number of attempts to induct spinal anesthesia, the higher is the incidence of side effects. Consequently, performing spinal anesthesia with the 27 G needle, which is the thinnest of all the three gave rise to a higher incidence of most of the adverse effects. Further large-scale studies with perhaps the help of highly skilled and experienced anesthesiologists, decreasing the failure rates of the first insertion, could provide us with a better deduction about which needle has the least adverse effects.

**Key words:** Spinal anesthesia, needle, side effects

### INTRODUCTION

Spinal Anesthesia (SA) has been widely used as a method of anesthesia for surgeries beneath the umbilicus level since its invention by August Bier in 1898 (Shah and Bhosale, 2010; Wulf, 1998).

Spinal anesthesia is done by injection of small amounts of local anesthetics in the cerebrospinal fluid (CSF). This anesthetic should be able not only to block the nervous pathways but also be nontoxic in nature, meaning that it should not delay the mechanism of bulbar centers or interfere with the vital metabolic processes of the body (Imbelloni and Gouveia, 2012).

Spinal anesthesia should be done below the surface where the spinal cord ends (L2) and therefore, is usually performed in the L3-L4 region (Imbelloni and Gouveia, 2012).

However, spinal anesthesia is one of the most common techniques in anesthesia, it has always been accompanied by adverse effects, one of which is postdural puncture headache (PDPH) (Srivastava *et al.*, 2010; Tabedar *et al.*, 2003), which is more seen in young patients and can result in the patient's distress, longer hospital admissions and more expenses (Lybecker *et al.*, 1995; Shah and Bhosale, 2010).

The etiology of PDPH as an iatrogenic effect of SA lies in the puncture of the dura matter which results in the loss of a large amount of the CSF in the epidural space, which causes

the tension of the cerebral vessels and therefore their vasodilation (Shaikh *et al.*, 2008; Hawkins *et al.*, 1997; Norris *et al.*, 1989; Greene, 1926).

The PDPH usually presents as a bilateral frontal or occipital headache 24-48 h after the puncture of the dura matter (Evans, 1998).

The risk factors of PDPH are as follows: young age (Reid and Thorburn, 1991; Flaatten *et al.*, 1987), female gender (Flaatten *et al.*, 1987), pregnancy (Reid and Thorburn, 1991; Flaatten *et al.*, 1987), previous history of PDPH (Lybecker *et al.*, 1990), the size of the needle (Lybecker *et al.*, 1990; Halpern and Preston, 1994), the number of attempts for lumbar puncture (Lybecker *et al.*, 1990), the type of needle (Halpern and Preston, 1994; Ross *et al.*, 1992), the type of the anesthetic (Naulty *et al.*, 1990), the skill of the anesthetist (Shnider and Levinson, 1987), the position of the patient (Halpern and Preston, 1994; Carson and Serpell, 1996) etc.

The size and the type of the needle are the most important risk factors (1, 4). The needles are classified according to their gauge and shape. A number is indicative of the needle gauge. The bigger the number, the thinner is the needle. The needles available are 18, 20, 22, 23, 25, 26 and 27 G. The needles ideal for spinal anesthesia are 25, 26 and 27 G (Kang *et al.*, 1992). These needles are also named after their constructor. The very first needle was made by and named after Corning in 1885. The other examples are Quincke, Bier, Brainbridge, Whitacre, Sprotte, Atraucan and Ballpen. The studies have shown the thinner the needle, the less risk for PDPH. However, it can give rise to increased failure rates of the SA as, the procedure would be more difficult (Shutt *et al.*, 1992; Sayeed *et al.*, 1993). The needles are also classified into two categories regarding their shape; cutting-point needles and pencil-point needles. The cutting-point needles result in disruption of the longitudinal fibers of the dura matter. On the other hand, the pencil-point needles just separate the fibers without cutting them resulting in a decreased rate of PDPH (Greene, 1926; Hart and Whitacre, 1951).

Other adverse effects of SA are: postoperative back pain, hemodynamic change, paresthesia, shivering and vomiting.

The most common anesthetics used in SA are lidocaine, tetracaine, marcaine (bupivacaine).

Lidocaine is generally used for surgeries shorter than 1 h. Tetracaine and bupivacaine are ideal for surgeries that take 2-5 h. Tetracaine causes a longer anesthesia compared to bupivacaine. On the other hand, bupivacaine is associated with a lower incidence of hypotension. Bupivacaine is also considered the ideal anesthetic for orthopedic surgeries due to less tourniquet pain (Saenghirunvattan *et al.*, 2008).

Considering how the needle gauge affects the consequences of SA and how these consequences can interfere with one's quality of life, we intend to compare the adverse effects of the 25, 26 and 27 G needles with Marcaine. Thus, we can choose the ideal needle according to the state of the patient, the anesthetist's preference and the available facilities.

## MATERIALS AND METHODS

This study was approved by the research and ethics committee of Jahrom University of Medical Sciences. All the participants were notified about the study and signed an informed consent prior to the investigation. This clinical trial included 200 male and female patients who were admitted in Jahrom Peymanieh Hospital and were scheduled to undergo a surgery. The patients were randomized into three groups, each receiving one of the 25, 26 or 27 G needles for SA regardless of their gender. The participants of this study were non smokers, who were candidates for a surgery and did not have these sorts of problems prior to the surgery; low back pain, chronic headaches such as migraine headaches, cardiovascular diseases such as hypertension or ischemic heart disease and motion sickness. The participants are classified as ASA I and II regarding the ASA classification. All the patients were hemodynamically stable before entering the operating room and the hemodynamic changes during the surgery were recorded as systolic and diastolic blood pressures before SA and 5, 10, 15 and 30 min after the induction of SA. After being transferred to the recovery room, the patients were asked whether or not they were experiencing shivering, nausea, vomiting and paresthesia at the moment. The participants were also visited 24-48 h after the procedure to discover whether or not they were suffering from headache of any degree. Last but not least, the patients were contacted both one and six months after the procedure to find out if they were experiencing backache of any degree.

**Data analysis:** All these items were filled in a questionnaire belonging to each patient. The data was recorded in and analyzed with the SPSS version 19.

## RESULTS

This study included 200 participants (148 men and 52 women) which were randomized into three groups of sixty-seven patients each receiving one the 25, 26 or 27 G needles for SA. The sixty-seven participants receiving the 25 G needle with the mean age of  $38.58 \pm 2.02$  (76.1% male and 23.9% female) had mean systolic and diastolic blood pressures as follows; mean systolic blood pressure before the procedure (sBPb):  $134.61 \pm 2.21$ , mean diastolic pressure before the procedure (dBPb):  $84.77 \pm 2.08$ , mean systolic pressure 5 min after the induction of SA (sBP5):  $125.74 \pm 2.51$ , mean diastolic pressure 5 min after the induction of SA (dBP5):  $77.08 \pm 1.96$ , mean systolic pressure 10 min after SA (sBP10):  $120.64 \pm 2.15$ , mean diastolic pressure 10 min after SA (dBP10):  $73.55 \pm 1.61$ , mean systolic pressure 15 min after SA (sBP15):  $117.1 \pm 1.72$ , mean diastolic pressure 15 min after SA (dBP15):  $72.46 \pm 1.43$ , mean systolic pressure 30 min after SA (sBP30):  $116.68 \pm 1.97$ , mean diastolic pressure 30 min after SA (dBP30):  $73.02 \pm 1.95$ . The sixty-six patients receiving the 26 G needle with the mean age of  $38.24 \pm 1.67$

(70.8% male and 29.2% female) indicated the following results; sBPb: 148.64±15.61, dBPb: 84.72±1.85, sBP5: 119.52±2.49, dBP5: 78.47±1.99, sBP10: 115.73±1.88, dBP10: 74.75±1.46, sBP15: 120.76±1.60, dBP15: 76.32±1.33, sBP30: 122.15±2.55, dBP30: 76.87±1.82. The sixty-seven participants receiving the 27 G needle with the mean age of 35.13±1.38 (74.6% male and 25.4% female) showed the following results; sBPb: 129.35±1.71, dBPb: 81.38±1.44, sBP5: 116.52±1.96, dBP5: 75.62±1.57, sBP10: 112.94±1.83, dBP10: 73.05±1.31, sBP15: 115.32±1.56, dBP15: 74.00±1.18, sBP30: 121.04±1.59, dBP30: 75.41±0.96. Of all the sixty-seven patients in the 25 G group, only 19.4% experienced paresthesia, 23.1% in the 26 G group and 28.4% in the 27 G group making a total of 23.5% of all the two hundred participants. Tremor rates were 25.4% in the 25 G group, 36.9% in the 26 G group and 34.3% in the 27 G group making a total of 32.0%. Nausea or vomiting rates were 13.4% in the 25 G group, 44.6% in the 26 G group and 29.9% in the 27 G group making a total of 29.0%. Of all the patients in the 25 G group 29.9% suffered from headache 24-48 h following the surgery, 33.8% in the 26 G group and 34.3% in the 27 G group making a total of 32.5%. The results also indicated that 26.9% of the 25 G group, 35.4% in the 26 G group and 29.9% in the 27 G group suffered from backache after one month which after six months turned to be 25.4% in the 25 G group, 21.5% in the 26 G group and 17.9% in the 27 G group. The first attempt to insert the needle was successful in 94.0% of the 25 G cases, 73.8% of the 26 G cases and 61.2% of the 27 G cases making a total of 76.5%. Of all the participants, 37.5% had a general surgery procedure, 30.0% had an orthopedic procedure, 29.0% underwent a urologic surgery and only 3.5% had a surgery regarding the OB-GYN field.

## DISCUSSION

This clinical trial suggests that both systolic and diastolic blood pressures drop up to 30 min after the induction of SA regardless of the type of the needle. The patients in the 27 G group experienced paresthesia most (28.4%) compared to the 26 G (23.1%) and 25 G group (19.4%). The participants in the 26 G group experienced tremor most (36.9%) compared to the 27 G (34.3%) and 25 G group (25.4%). Also, the group experiencing nausea or vomiting most was the 26 G group (44.6%) compared to the 27 G (29.9%) and 25 G group (13.4%). The groups suffering from headache most were the 27 G (34.3%) and the 26 G group (33.8%) compared to the 25 G group (29.9%). The number of patients suffering from backache after one month was largest in the 26 G group (35.4%) compared to the 27 G (29.9%) and the 25 G group (26.9%). However, backache after six months was most frequent in the 25 G group (25.4%) compared to the 26 G (21.5%) and 27 G group (17.9%). The first attempt to insert the needle was most successful in the 25 G group (94.0%) in

contrast to the 26 (73.8%) and 27 G group (61.2%) which can explain the reason why in this study PDPH turned out to be more frequent in the 27 G group in contrast to the 26 and the 25 G group and in the 26 G group compared to the 25 G group in spite of other studies. However, none of the items mentioned above (blood pressure, paresthesia, tremor...) appeared to have a significant difference in incidence between the three groups according to the Chi-Square tests ( $p\text{-value}>0.05$ ).

The 27 G Quincke needle to be of greater success in the first try than the 25 G Pajunk needle. This study also emphasized on the effectiveness of the pencil-point needles in comparison to the cutting-point needles particularly in the patients, who have the side effects of CSF leak (Concepcion, 1989).

The 26 G Autracan needle to be more successful in the first try of performing dural puncture in comparison to the 25 G Whitacre needle as owing to a faster flow of CSF and a lower incidence of paresthesia (Sharma *et al.*, 1995).

Two another studies stated the 25 G needle (cutting-point) to cause a lower incidence of PDPH and an approximately equal rate of paresthesia in comparison with the 27 G needle (pencil-point) (Landau *et al.*, 2001; Kokki *et al.*, 2000).

Two other studies did not indicate a significant difference in the occurrence of PDPH following SA performed with the 27 G Quincke and 27 G Whitacre needles (Lynch *et al.*, 1994; Srivastava *et al.*, 2010).

In 1992, an investigation was done comparing the adverse effects of the 26 and 27 G needles, which revealed a substantial decline in the rate of PDPH initiated with the 27 G needle in comparison to the 26 G needle, however the incidence of backache did not differ in the two groups (Kang *et al.*, 1992).

An investigation in 1992 measured the incidence of PDPH, backache and the failure rate of SA regarding the size and the shape of the needles coming to the conclusion that the thinnest needles as well as the non-cutting ones should be used in the patients at high risk for PDPH (Halpern and Preston, 1994).

Tabedar *et al.* (2003) performed a comparative study between the 25 G Quincke and 26 G Eldor needles in SA of the elective cesarean sections with bupivacaine, reaching the conclusion that the 26 G Eldor needle is associated with a lower incidence of PDPH, however not all the insertion characteristics such as the success rate of the technique were in favor of the 26 G Eldor needle (Tabedar *et al.*, 2003).

Another two studies comparing 25 G Whitacre, 27 G Whitacre, 25 G Quincke and 27 G Quincke needles, announced the 27 G Whitacre needle to be associated with the least incidence of PDPH with a noteworthy difference from the others. However, the success rate of SA in the first try with the 27 G needle was lower and the CSF detection time was higher (Shah and Bhosale, 2010; Shaikh *et al.*, 2008).

## CONCLUSION

Performing SA is more difficult with thinner needles (27 G in comparison to 26, 25 and 26 G compared to 25 G). Therefore, the failure rates increase in the first attempt to insert the thinner needle making the PDPH rates fallaciously higher. As a result, the more the number of attempts to induct spinal anesthesia, the higher is the incidence of adverse effects. To sum up, no significant difference was indicated between the 25, 26 and 27 G needles in regards to several adverse effects of SA such as hemodynamic instability, paresthesia, tremor, nausea or vomiting, headache and backache one and six months after the surgery. Further large-scale studies with perhaps the help of highly skilled and experienced anesthesiologists, decreasing the failure rates of the first insertion, could provide us with a better deduction about which needle has the least adverse effects.

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