Comparison of 26-gauge Atraucan® and 25-gauge Whitacre needles: insertion characteristics and complications

S.K. Sharma MD FRCA, D.R. Gambling MB BS FRCP, G.P. Joshi MD FFARCSI, J.E. Sidawi MD, E.R. Herrera MD

Ninety-six women undergoing post-partum tubal ligation under spinal anaesthesia were studied to compare 26G Atraucan® with 25G Whitacre spinal needles for ease of insertion, number of attempts at needle insertion, cerebrospinal fluid (CSF) flow characteristics through the needles, quality of subsequent analgesia, and incidence of perioperative complications. A higher rate of successful dural puncture at the first attempt (40/50 vs 27/46, $P < 0.05$) and faster (mean $\pm$ SD, 11.5 ± 2.2 vs 13.5 ± 2.4 , $P < 0.001$) CSF flow through the needle was achieved with the Atraucan® than with the Whitacre needle. The incidence of failed spinal (4% vs 5%) and post-dural puncture headache (PDPH) (4% vs 4.3%) was similar with both needles, but more patients experienced paraesthesiae during needle insertion with the Whitacre than with the Atraucan® needle (15% vs 2%, $P < 0.05$). We conclude that the use of the 26G Atraucan® needle is associated with a higher rate of successful identification of the subarachnoid space at the first

attempt, faster CSF backflow, and fewer paraesthesia when compared with the 25G Whitacre needle.

Cette étude vise à comparer les aiguilles 26G® Atraucan et Whitacre 25G auprès de 96 femmes soumises à une ligature tubaire pendant le post-partum sous anesthésie rachidienne au regard de la facilité d'insertion, du nombre de tentatives d'insertions, des caractéristiques de l'écoulement du liquide céphalo-rachidien (LCR) par l'aiguille, de la qualité de l'analgésie subséquente et de l'incidence des complications périopératoires. Un taux plus élevé de succès de première tentative (40/50 vs 27/46, $P < 0,05$) et un écoulement plus facile ont été notés avec l'Atraucan® qu'avec la Whitacre. L'incidence de rachidiennes ratées (4% vs 5%) et de céphalées postdurales (4% vs 4,3%) est la même pour les deux aiguilles, mais plus de patients ont éprouvé des paresthésies pendant l'insertion avec l'aiguille Whitacre qu'avec l'aiguille Atraucan® (15% vs 2%, $P < 0,05$). Nous concluons que l'utilisation de l'aiguille Atraucan® 26G est associée à un taux de succès plus élevé pour ce qui est de l'identification à la première tentative de l'espace sous-arachnoïdien, de la facilité de l'écoulement du LCR, et du nombre moins important des paresthésies, lorsqu'on la compare avec l'aiguille Whitacre 25G.

Key words

ANAESTHETIC TECHNIQUE: spinal;
EQUIPMENT: spinal needles;
COMPLICATIONS: headache, paraesthesia.

From the Department of Anesthesiology and Pain Management, University of Texas, Southwestern Medical Center at Dallas, 5323 Harry Hines Blvd., Dallas, Texas 75235-9068.

Address correspondence to: Dr. Shiv K. Sharma, Department of Anesthesiology and Pain Management, University of Texas, Southwestern Medical Center at Dallas, 5323 Harry Hines Blvd., Dallas, Texas 75235-9068, U.S.A.

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Pencil-point needles, such as the 25G Whitacre needle, are commonly used for spinal anaesthesia because their use is associated with a low incidence of post dural puncture headache (PDPH).^{1,2} Recently, a new spinal needle (Atraucan®) with a cutting point and a double bevel has been introduced (Figure). The use of the 26G Atraucan® needle is associated with easy insertion through the spinal ligaments, minimal trauma to the dural fibres, and a low incidence of PDPH.³ In addition, rapid CSF backflow through the Atraucan® needle allows easy identification to the subarachnoid space.³ However, insertion characteristics of the Atraucan needle and associated complications with its use have not been well established.

FIGURE Anterior view of the distal ends of 25G Whitacre and 26G Atraucan® spinal needles.

This randomized, prospective study was designed to compare the insertion characteristics and the incidence of complications of 26G Atraucan® and 25G Whitacre needles in women presenting for post-partum tubal ligation.

Methods

Following Institutional Review Board approval and informed consent, 96 women (ASA I and II) scheduled for elective post-partum tubal ligation under spinal anaesthesia were studied. Patients were assigned randomly, using computer generated numbers, to receive either 25G Whitacre (Becton-Dickinson, Rutherford, NJ. OD – 0.5 mm, length – 8.89 cm) ($n = 46$) or 26G Atraucan® (B. Braun Medical, Bethlehem, PA. OD – 0.45 mm, length – 8.89 cm) ($n = 50$) needles for spinal anaesthesia. Patients with abnormal lumbar spaces due to deformities of the spine or obesity were excluded from the study. All patients were premedicated with sodium citrate 30 ml *po* and metoclopramide 10 mg *iv*, and each received 1500 ml lactated Ringer's solution before anaesthesia.

Routine monitors included continuous ECG, pulse oximeter and non-invasive arterial blood pressure. All the blocks were performed by experienced anaesthetists who had considerable previous experience with the Whitacre

needle and also had familiarized themselves with the new Atraucan® needle for one week before the study began. A midline approach with the patient in the sitting position was used. The needles were introduced at the L₂₋₃ or L₃₋₄ interspace through a 20G introducer with ejection-port directed cephalad for both needles. Correct placement of the spinal needle was confirmed by the appearance of CSF at the hub of the needle. Any redirection of the spinal needle before appearance of CSF was classified as another attempt. Ease of needle insertion through the spinal ligaments, number of attempts at dural puncture, presence or absence of dural click, incidence of paraesthesia, and time for two CSF drops after the appearance of CSF at the end of the hub of the needle were noted. Paraesthesia was defined as a sudden electric shock-like pain, unilateral or bilateral, occurring over the buttock, thigh, or leg with appearance of CSF at the hub during needle insertion. After identification of the subarachnoid space, 70–80 mg lidocaine 5% with glucose 7.5% (Astra Pharmaceutical, Westborough, PA) was injected over ten seconds. The spread of the sensory block was evaluated using ice, by an investigator blinded to the type of needle used, at five-minute intervals until adequate surgical anaesthesia was achieved.

Any missed segments or peritoneal discomfort were treated with 5–10 ml lidocaine infiltration. In the event of failed spinal block, defined as no anaesthesia or ineffective anaesthesia after 15 min, general anaesthesia was induced. The heart rate and arterial blood pressure were recorded every two minutes for the first ten minutes and then at five minutes throughout the operation and in the recovery room.

All patients were evaluated daily throughout their hospital course by an observer blinded to group assignment and then interviewed by telephone one week after discharge from hospital for the presence of headache, backache, or any other complication. Headache was categorized as PDPH if it was exacerbated on sitting or standing and relieved or reduced by reclining. It was graded as mild: no limitation of activity, treated with oral analgesics and fluids; moderate: limited activity, oral analgesics and *iv* fluids required; severe: confined to bed, oral analgesics, *iv* fluids, or epidural blood patch required. The backache was defined as a continuous dull pain localized around the site of needle insertion. The severity, location, and duration of headache and backache were recorded.

Results are expressed as mean $\pm$ SD, mode (range) or number (%). The data were analyzed with SAS statistical software. Student's *t* test was used in comparing demographic data, local anaesthetic dose, the time for two CSF drops at the hub, and the duration of surgery. The number of attempts at dural puncture, the incidence of dural click at dural puncture, failed spinal block, PDPH,

non-PDPH, paraesthesia, and backache were compared using Fisher's exact test. The 2×6 Fisher's exact test was used to compare the upper level of the sensory blockade. The Spearman rank correlation test was used as appropriate. A P -value < 0.05 was considered significant.

Results

The two study groups were similar with regards to demographic data (Table I). The incidence of successful dural puncture at the first attempt ($P < 0.05$) and the rate of formation of two CSF drops at the hub ($P < 0.001$) were higher in the Atraucan® Group (AG) than in the Whitacre Group (WG) (Table II). The tactile appreciation of dural presentation with the needle (dural click) was higher in the WG than in the AG ($P < 0.05$) (Table II). The maximum level of sensory block during surgery (AG vs WG, mode(range)), T_4^{1-5} vs T_4^{1-6} , surgical time (mean $\pm$ SD, 32 ± 6 min vs 34 ± 5 min), and local anaesthetic dose for spinal anaesthetic (mean $\pm$ SD, 75 ± 4 mg vs 74 ± 6 mg) were similar in both groups. The incidence of failed spinal block following successful dural puncture and the requirement for supplemental lidocaine infiltration were similar in both groups (Table II). More patients in the WG felt paraesthesia than in the AG during insertion of the needle ($P < 0.05$) (Table III). The incidence of PDPH, NPDPH, and backache was similar in both groups (Table III), and no patient with PDPH required blood patch. The mild PDPH appeared between 18–24 hr and was associated with neck stiffness and dizziness, and lasted for 24–36 hr. The patient with moderate PDPH complained of dizziness, photophobia, and nausea and vomiting that occurred 12 hr postoperatively and lasted for two days. The incidence of backache had no correlation with the number of attempts at dural puncture.

Discussion

This study has shown that, despite the smaller gauge, the rate of CSF flow was higher through the Atraucan® than through the Whitacre needle. This may be attributed to the larger ejection port of the 26G Atraucan® needle (1.4 mm) which is located at the tip compared with the ejection port of the 25G Whitacre needle (0.5 mm) which is located proximal to the tip (Figure). The rapid CSF flow with the Atraucan® needle has also been demonstrated in a previous study.³ In this study, the greater incidence of successful dural puncture at the first attempt with the Atraucan® needle may be related to the design of the tip of the Atraucan® needle. Our results support a previous study which reported a similar (64%) incidence of successful dural puncture at the first attempt using the 25G Whitacre needles.¹

In this study investigators experienced relatively more

TABLE I Patient characteristics

	25-gauge Whitacre (n = 46)	26-gauge Atraucan® (n = 50)
Age (yr)	27 $\pm$ 5	28 $\pm$ 5
Weight (kg)	62 $\pm$ 4	61 $\pm$ 5
Height (cm)	154 $\pm$ 6	156 $\pm$ 8

Mean $\pm$ SD.

TABLE II Characteristics of spinal block

	25-gauge Whitacre (n = 46)	26-gauge Atraucan® (n = 50)
No. of attempts		
1	27 (59)	40 (80)*
≥ 2	19 (41)	10 (20)
Dural click	38 (83)*	28 (56)
Time for 2 CSF drops at the hub (sec)	13.5 $\pm$ 2.4	11.5 $\pm$ 2.2†
Quality of block		
- Adequate	39 (85)	44 (88)
- Supplements needed	5 (10)	4 (8)
- Failed	2 (5)	2 (4)

Values are n (%), mean $\pm$ SD.

* $P < 0.05$. † $P < 0.001$.

TABLE III Complications of spinal anaesthesia

	25-gauge Whitacre (n = 46)	26-gauge Atraucan® (n = 50)
Paraesthesia	7 (15)*	1 (2)
PDPH		
- Mild	2 (4.3)	1 (2)
- Moderate	-	1 (2)
NPDPH	10 (22)	12 (24)
Backache	12 (26)	11 (22)

Values are n (%).

* $P < 0.05$.

resistance during insertion of the Whitacre needle through the spinal ligaments than with the Atraucan® needle. The difference is due to the relatively blunt end of the Whitacre needle. However, a better sensation of loss of resistance (dural click) upon dural puncture was felt with the Whitacre needle (83%) than with the Atraucan® needle (56%). In spite of a lower incidence of dural click the successful identification of the subarachnoid space with the Atraucan needle was not affected.

The incidence of local anaesthetic supplements required for inadequate block and failed spinal block, even

after free CSF flow at the hub, indicates that the appearance of CSF in the Atraucan® or Whitacre needle hub is no guarantee that the needle ejection-port is completely within the subarachnoid space. Thus, some subdural or epidural leakage of local anaesthetic may occur, resulting in partial or complete failed spinal anaesthesia.

As in this present study, a high incidence of paraesthesia on insertion of the 25G Whitacre needle with a potential for residual areas of dysaesthesia, has been reported previously.⁴ The presence of a long conical point distal to the ejection port of the Whitacre needle (Figure) might be the cause of the higher incidence of paraesthesia. During insertion, the Whitacre needles have to travel further into the subarachnoid space before CSF is evident, and this may result in transfixation of the stretched cauda equina.

The pencil-point needle separates the longitudinal dural fibres instead of cutting them, which reduces the dural trauma and leakage of CSF, and thus decreases the incidence of PDPH.⁵ An *in vitro* study comparing transdural fluid leak has shown that the Whitacre needle causes less leak than a same gauge cutting bevel (Quincke) needle.⁶ In our study, the incidence of PDPH was low and similar in both groups. There was no difference in the severity, duration, or treatment of PDPH between Whitacre and Atraucan® groups. The Atraucan® needle, classified as a cutting-point needle, initially makes a smaller linear incision in the dura with an insertion bevel during insertion, and then a second dilation bevel separates the dural fibres without cutting (similar to pencil-point needles) as the needle is advanced. This should minimize dural trauma and CSF loss and thus decrease the incidence of PDPH. An *in vitro* study using human dura mater showed that a 26G Atraucan® caused less leakage of CSF than a 26G Quincke or a 24G Sprotte needle.¹⁷ A previous study designed to assess the performance of Atraucan® needles reported a 2.5% incidence of PDPH.³

One shortcoming of our study was that the number of patients was not large enough to determine a statistical difference in the incidence of PDPH and failed spinal between the groups. Power analysis showed that, to obtain 80% power to determine a ($P < 0.05$) decrease in PDPH from 1%, as with a Whitacre 25G needle,² to 0.5% would require more than 4,000 patients in each needle group. A similar number would be required for comparing failed spinal. However, we considered it reasonable to present data concerning a technical evaluation of this recently introduced spinal needle. Although the needles used in our study are of different diameters, they are the commonly used needles for spinal anaesthesia.

The incidence of non-dural puncture headache

(NPDPH-posture independent) in our study was comparable with previous reports.^{1,2} A high incidence of NPDPH also has been reported following spontaneous vaginal delivery without spinal anaesthesia.⁸

Postoperative backache is a common complaint after spinal anaesthesia and is not related to the size or shape of the spinal needle.⁹ Furthermore, the incidence of backache after general anaesthesia is similar to that after spinal anaesthesia.¹⁰ In contrast to a previous report we did not find any association between the number of attempts at needle insertion and the incidence of backache.¹

In conclusion, the use of a 26G Atraucan® needle is associated with a higher rate of successful identification of the subarachnoid space at the first attempt, faster CSF backflow, and a lower incidence of paraesthesia compared with the 25G Whitacre needle. Although both needles were associated with a low incidence of PDPH and failed spinal in this study, further large studies are required to better define PDPH and failed spinal rates with the Atraucan® needle. At the time of this study the cost of the two needles was similar (Whitacre: \$6.50 each, Atraucan®: \$6 each).

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