Randomized Trial

Comparison of Intravascular Uptake Using Touhy or Quincke Needle During Lumbar Medial Branch Block

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Disclaimer: There was no external funding in the preparation of this manuscript.

Conflict of interest: Each author certifies that he or she, or a member of his or her immediate family, has no commercial association (i.e., consultancies, stock ownership, equity interest, patent/licensing arrangements, etc.) that might pose a conflict of interest in connection with the submitted manuscript.

Manuscript received: 11-23-2021
Revised manuscript received: 01-03-2021
Accepted for publication: 01-16-2021

Free full manuscript: www.painphysicianjournal.com

Background: Inadvertent intravascular injection of local anesthetics can lead to false negative results following a lumbar medial branch block (MBB) performed to diagnose facet joint origin pain. A previous study demonstrated that the type of needle could affect the incidence of intravascular injection rates.

Objectives: The primary endpoint of this study was to compare the incidence of intravascular injection during lumbar MBB between the Quincke and Touhy needles. The secondary endpoint of this study was to compare the injection time, radiation dose, and patient discomfort during lumbar MBB between the needle types.

Study Design: Prospective randomized trial.

Setting: An interventional pain management practice in South Korea.

Methods: The incidence of intravascular uptake of contrast medium was compared using the Touhy and Quincke needles under real-time fluoroscopy during lumbar MBB. Injection time, radiation dose, and patient discomfort during lumbar MBB were also compared.

Results: The incidence of intravascular injection was 21.8% (21/102) in the Touhy needle group and 21.2% (22/99) in the Quincke needle group. The odds ratio for the association between the needle types and intravascular injection was 1.1. The injection time, radiation dose, and patient discomfort during lumbar MBB were similar between the Touhy and Quincke needle groups.

Limitations: This study was performed from L2 to L4 MBB of the unilateral lumbar region. Although the type of needle assigned to the patient was randomized, 3 needles, which are used for 3 levels of MBB, were identical.

Conclusions: The overall incidence rate of intravascular injection during lumbar MBB was nearly 20% under real-time fluoroscopy for both types of needle. Use of the Touhy needle did not reduce the intravascular injection rate nor the injection time, radiation dose, and patient discomfort.

Key words: Quincke needle, Touhy needle, intravascular injection, medial branch block

Pain Physician 2022: 25:305-311

The causes of chronic axial low back pain are diverse. Among these causes, 10% to 15% of patients have low back pain due to facet joint arthropathy (1). Medial branch block (MBB) has been used widely to diagnose or alleviate low back pain caused by facet joint arthropathy (2,3). For the purpose of correct diagnosis of facet joint origin pain, the use of 2 comparative local anesthetics with different action duration times has been suggested to reduce the incidence of false positive results and to increase the successful procedure of radiofrequency ablation (2,4-6).

Reducing the incidence of false-negative blocks is important to avoid withholding effective treatment from the patient (7). Undetected intravascular (IV) injection of local anesthetics is one of the most common reasons among many possible false-negative results (7,8). During lumbar or cervical MBB, inadvertent IV injection has been reported to range from 3.7% to 13.9% (7,9-11). If physicians only depend on spot fluoroscopic images without real-time contrast injection to confirm IV injection, inadvertent IV injection can be missed during lumbar MBB despite the needle tip being placed in an anatomically correct position (7,10,12,13).

In previous reports (7,14), the use of a blunt needle could reduce the overall incidence of IV injection. A blunt needle could have less risk of penetrating a vessel during needle advancement compared with the beveled-tip Quincke needle. The Touhy needle has been used widely for interlaminar epidural blocks or catheter placement. The distinct shape of the Touhy needle consists of a tip with a curved part on one side and a sharp bevel on the other. A previous report (12) showed that using a Touhy needle during lumbar transforaminal epidural injection could reduce inadvertent IV injection by as much as 4 times compared with the Quincke needle (2.9% vs 12.7%). There is no study that addresses whether a Touhy needle used during lumbar MBB can significantly reduce the incidence of IV injection, as a previous study (12) performed in lumbar transforaminal epidural injection had shown.

The primary endpoint of this study was to compare the incidence of IV injection during lumbar MBB between the Quincke and Touhy needles. The secondary endpoint was to compare the injection time, radiation dose, and patient discomfort during lumbar MBB between the 2 needle types (Table 1).

Table 1. *Demographic data of the patients.*

	Quincke Needle Group (n = 34)	Touhy Needle Group (n = 33)	*P* value
Age, mean (SD)	71.2 (7.8)	71.2 (9.1)	0.99
Men, n (%)	15 (44.1)	14 (42.4)	0.89
Women, n (%)	19 (55.9)	19 (57.6)	
Right, n (%)	20 (58.8)	20 (60.6)	0.88
Left, n (%)	14 (41.2)	13 (39.4)	
History of Previous Spine Surgery	8 (23.5)	3 (9.1)	0.19
Body Mass Index (kg/m^2)	24.2 (3.5)	23.8 (4.9)	0.74
Numerical Rating Scale	5.1 (1.2)	5.0 (0.7)	0.72
Pain Duration (mo)	4.3 (4.0)	5.2 (11.0)	0.64

Abbreviation: SD, standard deviation.

Methods

This prospective, open-label, and randomized study was approved by the Institutional Review Board (IRB #2021-07-014) of our institution. The potential benefits and risks of this study were fully explained before patient enrollment, and all patients provided informed consent. We registered this study before patient enrollment at clinical trials.gov (NCT05020509, date of registration: August 19, 2021).

Inclusion and Exclusion Criteria

Inclusion criteria were patients with longer than one-month duration of subacute axial low back pain and suspicious for facet joint arthropathy based on a physical examination and magnetic resonance imaging findings. The physical examination suspicious for facet joint arthropathy includes unilateral severe paraspinal tenderness overlying the lumbar facet joints. Five patients declined to participate in this study. Therefore, final included patients were 67 patients between 20 and 79 years of age (August to October, 2021).

Exclusion criteria were patients with coagulopathy, an allergy to local anesthetics or contrast medium, spine deformity, infection at the needle insertion site, or neurological abnormality requiring prompt surgical treatment due to pain aggravation, weakness, hyperreflexia, or bowel or bladder dysfunction.

Randomization

For the comparison of 2 types of needles, we used Quincke needles (22-gauge (G), 9 cm, Taechang Industrial Co, Kongju, Korea) and Touhy needles (22 G, 9 cm, Taechang Industrial Co, Kongju, Korea). According to a random number table, which type of needle should be used was determined for each procedure. The random numbers were contained in a sealed envelope. A physical assistant, who was not involved in this study, prepared the needle according to a random number before the procedure of lumbar MBB.

All patients in this study received 3 unilateral levels of MBB from L2 to L4. Three levels of MBB were performed using either the Quincke or the Touhy needle. If MBB should be

performed on both sides of the back, the MBB on only one side using the assigned needle type was included for this study.

Medial Branch Block Procedure

All MBBs were performed by a single pain physician who was board certified in pain intervention and fully equipped with fluoroscopically guided spine injections. After positioning the patient in the prone position with a pillow under the abdomen, a sterile drape and skin infiltration with 1% lidocaine were done at the right or left side of the lower back. We rotated the C-arm 20° to 25° over the lumbar spine to visualize clearly the facet joint and junction between the transverse process and the superior articular process. The targeted medial branch level was determined by counting upward from the sacrum. The Quincke or Touhy needle (Fig. 1) was advanced under C-arm guidance using a tunnel view to the junction of the superior articular process and the transverse process (Fig. 2).

When the needle was positioned at the appropriate target level of the medial branch, an aspiration test was performed. In cases of positive blood aspiration, this event was recorded as a positive IV injection. If no blood was aspirated, 1 mL of contrast medium (Bonorex, 300 mg I/ mL, Daehan Medical Co, Korea) was injected slowly under real-time C-arm guidance. If the injected contrast medium demonstrated characteristic fleeting and serpiginous nature under real-time C-arm guidance, this injection was considered to be a positive IV injection. In cases of a positive IV injection, the needle was repositioned until vascular uptake was not observed in fluoroscopic images. Any IV injections appearing after needle repositioning were not included in this study.

Outcome Measurement

The primary endpoint of this study was the comparison of the incidence of IV injections between the Quincke and Touhy needle groups under real-time C-arm guidance. The presence or absence of IV injection during lumbar MBB was determined by a physician who was blinded to the assigned needle group.

The secondary endpoint of this study was to compare the injection time, radiation dose, and patient discomfort during lumbar MBB between the 2 needle types. The injection time refers to a time required from the needle insertion into the skin to the final contact of the needle tip into the targeted bony landmark of the medial branch. If 3 levels of MBB were performed, the measured injection time refers to the required time to complete the 3 levels of MBB. The radiation dose was measured during the period from the needle insertion into the skin to the final contact of the needle tip into the targeted bony landmark of the medial branch. Patient discomfort refers to the pain intensity during the procedure of MBB. The pain intensity was graded as no pain, mild pain, moderate pain, and severe pain during lumbar MBB.

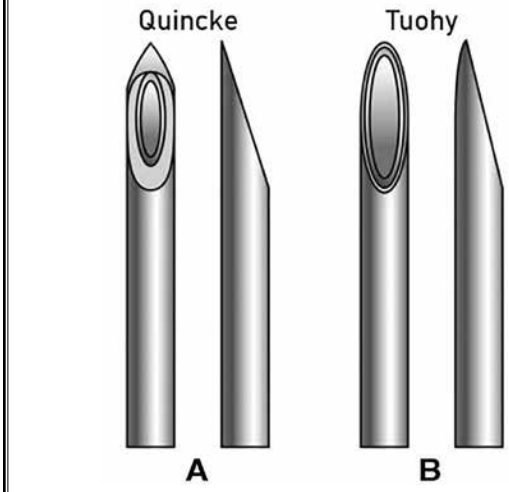

Fig. 1. *Illustration showing Quincke* (A) *and Touhy* (B) *needles.*

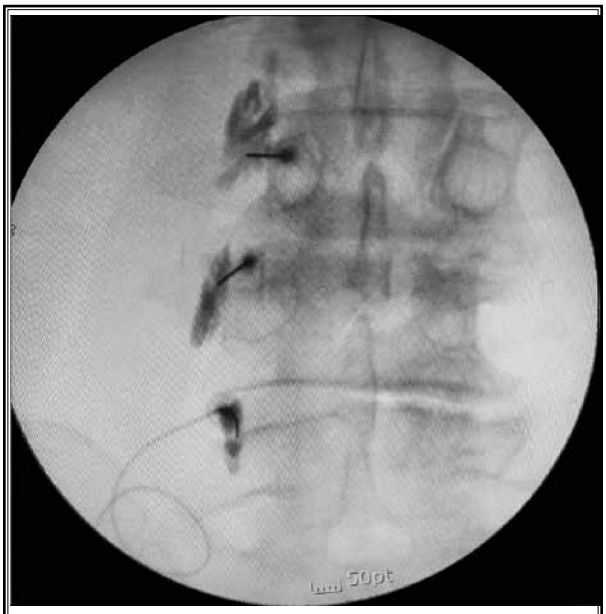

Fig. 2. *Fluoroscopic image showing anatomical target of medial branch block.*

The patient data collected during the study included age, gender, body mass index, side of the injection, and history of previous spine surgery.

Statistical Analysis

Sample size calculation was based on the results of a preliminary study showing a 5.2% and 18% incidence of IV injection with the Touhy or Quincke needle type, respectively. Assuming a difference of IV incidence rate between the Quincke and Touhy needle groups to be 0.12, an α error level of 0.05, and a β error level of 0.02, a 2-sided chi-squared test revealed that at least 95 injections of MBB were required in each group to achieve a power of 80%.

Comparisons of clinical characteristics for demographic data were made using the independent t test, chi-squared test, or Fisher's exact test, as appropriate. The incidence of IV injection was analyzed using the chi-squared test. The injection time, radiation dose, and patient discomfort during lumbar MBB were analyzed using the independent t test and the chi-squared test (SPSS Version 20, IBM Corporation, Armonk, NY, USA). A *P* value of < 0.05 was considered statistically significant.

Results

A total of 72 patients who received 216 C-arm-guided lumbar MBBs were assessed for eligibility. Among them, 5 patients refused to participate in this study. Finally, 67 patients with a total of 201 MBBs were enrolled in this study; Quincke needles were used in 34 patients (99 MBBs), and Touhy needles were used in 33 patients (102 MBBs) (Fig. 3).

Significant differences were not found in the demographic data (Table 1).

The overall incidence rate of IV injection was analyzed when 2 types of needles were used.

The incidence of IV injection was 21.8% (21/102) in the Touhy needle group and 21.2% (22/99) in the Quincke needle group. The incidence of IV injection between the needle types did not show any statistically significant differences (*P* = 0.78, Fig. 4). The OR for the association between the needle types and IV injection was 1.1 (*P* = 0.78, Table 2).

The injection time and the amount of radiation dose required to complete 3 levels of MBB were similar between the Touhy and Quincke needle groups. Regarding patient discomfort, most of the patients felt a mild degree of pain during lumbar MBB. The injection time, the amount of radiation dose, and the patient discomfort values did not show any statistically significant differences between the groups (Table 3).

Discussion

This study is the first showing that the Touhy needles related with IV injection rates during the lumbar MBB procedure. This study demonstrated that using the Touhy needle during MBB did not show any significantly different IV injection rate compared to the Quincke needle. The overall IV injection rate was over 20% in both types of needle, which was higher than previous reports (9,10,15). The incidence of inadvertent IV injection during lumbar MBB was 3.7% as confirmed under static radiography rather than real-time imaging (9). When the Quincke needle was used during lumbar MBB under real-time imaging or digital subtraction imaging, the IV injection rate was 6.1% and 13.9%, respectively (7,10). The higher injection rate found in this study can be attributed to 2 factors. First, the use of real-time imaging of fluoroscopy enhanced the sensitivity of detecting IV injection over that of static or spot fluoroscopy alone. Second, this study used real-time imaging (9) to detect inadvertent

Table 2. *OR for the association between needle type and IV injection.*

	OR	95% CI	*P* value
IV Injection			
Quincke Needle (vs Touhy)	1.1	0.56 to 2.16	0.78

Abbreviations: OR, odds ratio; CI, confidence interval; IV, intravascular.

Table 3. *Comparison of injection time, radiation dose, and patient discomfort between the needle groups.*

	Quincke Needle Group (n = 34)	Touhy Needle Group (n = 33)	*P* value
Injection Time (sec)	50.2 (16.4)	46.0 (14.0)	0.26
Radiation Dose (cGy/cm^2)	31.9 (13.9)	27.7 (11.1)	0.17
Patient Discomfort			0.55
No Pain During MBB	4	1	
Mild Pain During MBB	24	25	
Moderate Pain During MBB	6	6	
Severe Pain During MBB	0	1	

Abbreviation: MBB, medial branch block.

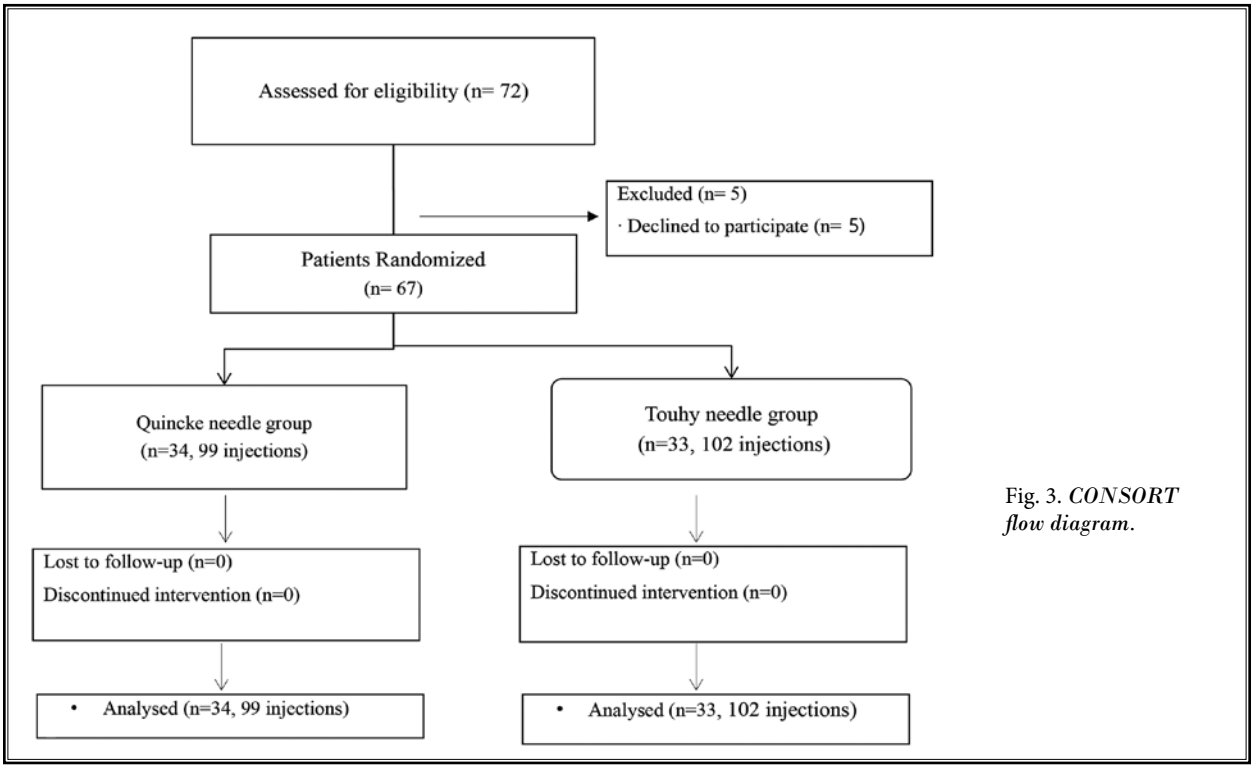

Fig. 3. *CONSORT flow diagram.*

IV injection. However, the incidence of IV injection was higher than a study using digital subtraction imaging (7). In Joo et al (7), which determined the inadvertent IV injection with digital subtraction imaging, 5 pain physicians with less than one year of clinical experience performed the lumbar MBB. Therefore, the physician's shorter experience could affect the IV uptake rate, and there is a probability of missing an IV injection due to the higher number of performing physicians. In contrast to the study by Joo et al (7), all the MBBs in our study were performed by one pain physician with more than 10 years of clinical experiences.

The Quincke needle (12), a sharp beveled spinal needle, has been used widely in many pain injections due to the advantage of easy steering and advancement. In contrast to the Quincke needle, the Whitacre needle (BD Medical Systems, Franklin Lakes, NJ) or Touhy needle does not have any bevel. Due to this point, the Whitacre and Touhy needles have some difficulties during needle advancement and manipulation. However, previous studies (7,12,14) showed a significantly reduced IV injection rate when the Whitacre or Touhy needle was used during lumbar MBB or transforaminal epidural injection. Moreover, when the Touhy needle was used during lumbar transforaminal injection, the incidence rate of IV injection was 4 times

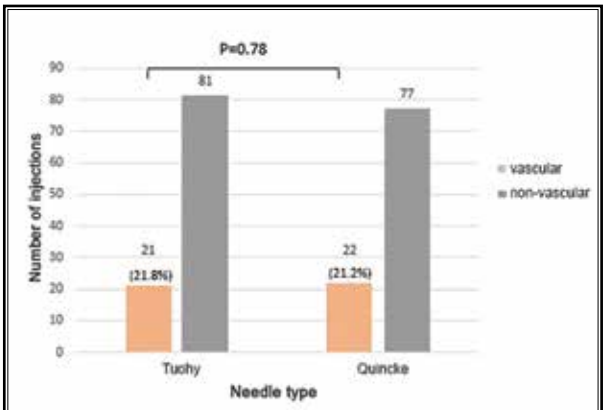

Fig. 4. *IV injection rates of the 2 needle groups.*
IV, intravascular

lower compared to that of the Quincke needle (12). Nonetheless, when the Touhy needle was used during lumbar MBB, there was no reduction in the incidence rate of IV injection. The lack of difference in IV injection incidence rates could be attributed to several factors. In contrast to transforaminal epidural injections, the final target of lumbar MBB is the bony surface, which is the junction between the transverse process and superior articular process. A previous study (16) demonstrated

that the probability of IV injection increases when the needle contacts the bony surface between the posterior and anterior sacral foramens during S1 injections. Although one side of the Touhy needle has a rounded curved side, when this needle makes contact with the bony surface, the advantage of the rounded curved side Touhy needle might be reduced. Therefore, we suspect that the needle contact with the bony surface could generate greater impact, which leads to vessel tearing regardless of the needle type, than that of injections performed at the intervertebral foramen.

A previous cadaveric study (17) demonstrated the presence of blood vessels coursing along the posterior ramus next to the medial branch. The vertebral venous plexus of the lumbar region is assumed to be the source of blood during lumbar MBB. This venous system forms a highly complex system with interconnecting channels. This venous system is comprised of the internal and external venous system. The posterior external venous system contributes to the venous system along with the facet joints. Degenerative process of spine associated with aging or reduced venous return due to heart disease could contribute to the increased uptake of IV injections during lumbar MBB (18).

We expected that the procedure time of the Quincke needle, which has the advantage of easy steering, would be significantly shorter compared to the Touhy needle. However, no difference in procedure time was found between the groups. One side of the Touhy needle shows a rounded curved shape. while the other side shows a sharp side. When the Touhy needle advances through the tissue, needle steering becomes easier because the rounded curved side acts like the bevel of a sharp needle (12). As a result, during the procedure of lumbar MBB, it could be easier to change the direction and advance the needle in a forward direction. Moreover, we observed no difference in the procedure time between the Touhy and Quincke needles. In contrast to the result of this study, the Touhy needle showed shorter procedure time than the Quincke needle during the lumbar transforaminal injection (12).

Given that the blunt needle does not have any bevel, steering and tissue penetration can be difficult (14,19). Due to such reason, patient discomfort could increase during the procedure. During needle advancement, tissue traction might develop due to the blunt tip, leading to greater soft tissue injury. A previous study (19) had reported that local low back pain was higher with a blunt-type needle. However, this study did not show any differences in patient discomfort during lumbar MBB between the 2 types of needle.

This study includes several limitations. First, the MBB was performed from L2 to L4 of the unilateral lumbar region. Although the type of needle assigned to the patient was randomized, the 3 needles used for the 3 levels of MBB were identical. Second, we included patients who had low back pain due to facet arthropathy. However, facet arthropathy eventually leads to foraminal or central spinal stenosis. Therefore, there is a probability of inclusion patients with low back pain due to foraminal or central spinal stenosis. Moreover, we do not think that the inclusion of these patients affected the occurrence of IV injection rates.

Conclusions

The overall incidence rate of IV injection during lumbar MBB was nearly 20% under real-time fluoroscopy in both types of needle. The use of the Touhy needle could not reduce the IV injection rate nor the injection time, radiation dose, and patient discomfort.

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