Letters to the editor: Distance of Catheter Tip Dislocation in Continuous Interscalene Brachial Plexus Block

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Running title: DISTANCE OF CATHETER TIP DISLOCATION

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- Letter to the Editor -

To the editor:

Shoulder joint surgery is associated with severe postoperative pain, and continuous interscalene brachial plexus block (cISBPB) using a catheter is an effective treatment modality. Despite proper catheterization, cases with inadequate analgesia for postoperative pain in the brachial plexus innervation area with cISBPB are occasionally encountered. Several studies have been conducted in an effort to reduce inadequate analgesia, such as the comparison of insertion approach of the catheter [1-3,5], but there is no consensus on the best approach. Inadequate analgesia may be associated with postoperative catheter tip dislocation from the interscalene groove, and it would occur during and after surgery. The frequency of catheter dislocation has been reported [4] and Aoyama et al.[5] recently reported that catheter tip dislocation decreased the analgesic effect of cISBPB. However, we still have less information on how far the inserted catheter for cISBPB traveled after surgery. In this study, we simply examined the amount of movement of the inserted catheter after surgery.

The study population included all patients who underwent shoulder surgery and cISBPB by the same anesthesiologist at Saiseikai Niigata Hospital from June 1, 2017 to December 31, 2017. The ethics review board of Saiseikai Niigata Hospital approved this study (registration number E 17-12).
and all enrolled patients provided written informed consent. Exclusion criteria were contraindication to continuous interscalene block, body mass index \( \geq 30 \text{ kg/m}^2 \), American Society of Anesthesiologists Physical Status \( \geq 3 \). Preoperatively, the cISBPB catheter (Perifix® Soft Tip Catheter, B. Braun, Melsungen, Germany) was inserted between the C5 and C6 nerve roots using a posterior in-plane ultrasound-guided approach. Subsequently, a mixture of 0.5 ml of air and 3 ml of saline was injected through the catheter to identify the catheter position by the hyperechoic flush on the proximal catheter pore in the interscalene space (Figure 1a) and the images were stored in the internal hard disk of the US. The insertion length of the catheter at the skin was recorded and the catheter was sealed using 2-octyl cyanoacrylate (Aron Alpha A, Daiichi Sankyo, Tokyo, Japan) and draped using sterile transparent tapes (3M Tegaderm™ Film, 3M health Care, St. Paul, MN). On postoperative day 1 in the ward, the position of the catheter was identified by observing the hyperechoic flush using the same method, and the distance traveled from the preoperative proximal catheter pore position was measured as the dislocation distance by comparing the images stored on the hard disk (Figure 1b). When measuring the distance, the preoperative proximal catheter pore position was set as a reference to the surrounding anatomical structures such as the anterior scalene muscle. Movement of the catheter toward the skin was expressed as a positive direction and the opposite direction as a negative direction. The dislocation rates and the distance of the catheter tip dislocation were the main outcome parameters. Dislocation was defined as when the catheter was
shallower than the initial placement. Data are shown as median (interquartile range). The correlation between the distance of catheter tip dislocation and basic patient information, such as age, height, weight, and the catheter insertion length were also analyzed using Spearman rank correlation coefficient. P values were two-sided and statistical significance was defined as $p < 0.05$.

A total of 27 patients were included in the study. No patients were excluded from the study. The median age, height, weight, and the catheter insertion length were 59 (38.5–72) years, 167 (160–170.5) cm, 70.6 (62.1–77.7) kg, and 70 (67.5–80) mm, respectively.

The catheter insertion length itself did not change before and after surgery in all the cases. Catheter tip dislocation was observed in 22 of 27 cases (81.5%) and the catheter tip was shallowed by 11 (3.5–20.5) mm. Only the insertion length was negatively correlated with the distance of catheter tip dislocation ($r = -0.66$, 95% Confidence intervals [CI] -0.84 to -0.37, $p < 0.001$) (Figure 1c).

We observed that catheter tip dislocation occurred frequently, and the mean distance of the dislocation was about 1 cm. We also found that there is a negative correlation between the distance of catheter tip dislocation and catheter insertion length. From the results of our research, it is expected that the catheter will be more likely to stay in the proper position if the catheter is inserted about 1 cm deeper than the catheter insertion position that has been performed so far to secure a margin for catheter movement. However, it should also be noted that this could lead to over-
insertion of the catheter, which may increase the risk of complications or even dislodge the catheter tip from interscalene space. It is safer to perform the above procedure while visualizing the catheter tip with ultrasound to avoid straying. The dislocation rates were 81.5%, which is more frequent than in previous studies [1,4,5]. However, this is due to the definition of dislocation. We included even the slightest movement of the catheter as dislocation, which may be due to the more sensitive assessment of our study. But we do not want to emphasize the size of the number itself, but to convey the fact that catheters can easily move inside the body even if the insertion length remains the same.

The main limitation of this study was the lack of standardization of various factors that may be associated with catheter dislocation, such as surgical procedures or patient rest levels since shoulder and neck movements during and after surgery are considered to be related to catheter tip dislocation. The method of measuring the dislocation distance was also one of the limits. Since the ultrasound images of the interscalene region changed before and after surgery, there is no guarantee that the pre-and post-operative comparison was made accurately. In addition, it may not accurately reflect dislocation since this is an indirect assessment that measures the hyperechoic region.

In conclusion, we must consider the catheter tip moves easily and approximately 1 cm in cISBPB. This study suggests that a longer insertion length may provide superior analgesia.
References


Figure 1

Representative ultrasound images of posterior approached-continuous interscalene brachial plexus block at the catheter insertion day and the day after the catheter insertion.  

**a:** the catheter was placed between the C5 and C6 nerve roots and beyond the interscalene space.  

**b:** the catheter was retracted 2.3 cm compared to the initially placed position.  

ASM: anterior scalene muscle.  

MSM: middle scalene muscle.  

LA: local anesthetics.  

White arrow: most proximal port of the catheter available, to be identified by the hyperechoic flush induced by air.  
White triangle: catheter visible by ultrasound.
c: There was a negative correlation between catheter insertion length and distance of dislocation ($r = -0.66$, 95% Confidence intervals [CI] -0.84 to -0.37, $p < 0.001$).