INTELLIGENT FIBER-NEEDLE OPTICAL COHERENCE TOMOGRAPHY IMAGE-GUIDED SYSTEM TO ASSIST EPIDURAL ANESTHESIA

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Epidural blockade is one type of neuraxial block. It is an effective way for analgesia associated with a spectrum of healthy people and seriously ill patients. However, epidural needle insertion is traditionally a blind technique whose success depends upon the experience of the operator. The technique of the loss of resistance (LOR) to air or hanging drops is the most common method used to identify the epidural space (ES). However, using the LOR technique, the epidural failure rate could be up to 3% owing to incorrect catheter placement. Even though there have been many approaches to assist the anesthesiologists in performing neuraxial anesthesia, none of the prior arts may be said as an unrestricted technique. The lack of a design that is with sufficient accuracy to the targets of interest and automatic indication of needle placement makes it difficult to all-round implementation of field usage of objectiveness. Clinicians are still looking for practical neuraxial techniques that allow "real time" observation of the epidural catheter introduction and drug deposition.

Currently, we have completed a prototype that employs the method of guided epidural block by combining a rotated side-looking fiber probe with a frequency swept OCT system, which provide a visual image and thus mediate the needle-probe technique by identifying different biological tissues surrounding the needle. Our method presents the first such demonstration of "live" two-dimensional (2D) images, which assists the navigation toward the ES, similar to the transesophageal ultrasound transducers currently used for cardiac imaging. Figure 1 shows a circular image within the ES. In this study, by using the subsurface features of OCT images, we then developed an automatic image recognition method for mediating the needle-probe technique objectively, which can be an intelligent epidural anaesthetic decision-support system with high sensitivity and high specificity. We anticipate that this technique will reduce the occurrence of failed epidural blocks and other complications such as post dural puncture headache (PDPH).

Reference: