Acoustic puncture assist device: A novel technique to identify the epidural space

ABSTRACT
Background: Acoustic puncture assist device (APAD) is designed to detect and signal the loss of resistance during the epidural procedure. We aimed to evaluate this device in terms of successful identification of the epidural space and the incidence of accidental dural puncture.

Patients and Methods: Following Institutional Review Board approval and written informed consent obtained from all patients, 200 adult patients (107 males) American Society of Anesthesiologists I-III who underwent lower limb orthopedic surgery under lumbar epidural anesthesia using APAD were enrolled in the study. APAD system was connected to the epidural needle using normal saline prefilled extension tube. Numbers of successful epidural attempts and accidental dural tap were documented.

Results: The mean values of the depth of epidural space and the time to perform epidural puncture were 5.8 ± 1.0 cm and 3.3 ± 1.4 min, respectively. In 63% of patients, epidural puncture was successful from the first attempt and in 1% it was successful from the fourth attempt. Epidural anesthesia by APAD was successful in 198 cases (99 %). Dural tap occurred in 2 cases (1%).

Conclusions: Using APAD, the success of identifying the epidural space was high and reliable.

Key words: Acoustic puncture assist device; anesthesia; epidural analgesia

Introduction
Failure of epidural analgesia and accidental dural tap are considered drawback of epidural technique.[1] Acoustic puncture assist device (APAD) is designed to detect and signal, by tone, the loss of resistance elicited during epidural technique. It records the pressure changes during epidural puncture of the ligamentum flavum. APAD also allows the anesthetist to hold the epidural needle with both hands and to identify the epidural space guided by acoustic signals. The use of APAD also adds sound to the sense of touch during epidural analgesia technique. Besides, APAD also provides an objective, visible pressure readings which again help in identifying the epidural space.[2,3]

This study was done to determine the efficacy of APAD in identifying the epidural space during epidural analgesia technique for lower limb orthopedic surgery patients.

Patients and Methods
Following Institutional Review Board approval and written informed consent obtained from all patients, 200 adult patients (107 males) American Society of Anesthesiologists I-III who underwent lower limb orthopedic surgery under lumbar epidural anesthesia using APAD were enrolled in the study. The mean age was 51 ± 19 years and the mean...
body mass index was 31 ± 6. All cases performed by one of three consultants who are expert in using APAD. Patients were connected to routine monitoring. The patient placed in sitting position and under complete aseptic technique the skin was punctured using the Touhy needle. APAD system (Equip Medikey, Gouda, The Netherlands) was assembled and connected to the epidural needle using normal saline prefilled extension tube [Figure 1]. The pressure needed to perform the epidural puncture was generated by syringe infusion pump. APAD transforms the generated pressure into corresponding acoustic and visible signals. Numbers of successful attempts and accidental dural tap were documented.

Results

The mean values of the depth of epidural space and the time to perform epidural puncture were 5.8 ± 1.0 cm and 3.3 ± 1.4 min, respectively. In 63% of patients, epidural puncture was successful from the first attempt and in 1% it was successful from the fourth attempt. Epidural anesthesia by APAD was successful in 198 cases (99%) [Figure 2]. Dural tap occurred in 2 cases (1%).

Discussion

In this study, the success rate of epidural analgesia facilitated with APAD was 99%, and the failure rate was only 1% which is considerably low if compared to the conventional epidural techniques. Moreover, the incidence of the dural tap was only 1% among our study which is again within the lowest range side incidence in the literature. In the literature, the reported incidence of the dural tap in conventional epidural analgesia technique is ranging between 0.61% and 10.9%. The use of APAD guided epidural analgesic technique might have the advantage of better hand control since we were using both hands for holding the needle besides the acoustic signal which alarms when the needle gets close to the dura.

Conclusion

Using APAD guided epidural analgesic technique; the success of identifying the epidural space was very high and reliable with a low incidence of inadvertent dural tap. We believe the APAD guided epidural technique may be a promising alternative to the conventional technique. Further studies on the use of APAD are needed to confirm our results.

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Nil.

Conflicts of interest

There are no conflicts of interest.

References

1. Bromage P, editor. Complications and contraindications. In: Epidural Analgesia. Philadelphia: WB Saunders; 1978. p. 654-708.
2. Lechner TJ, van Wijk MG, Maas AJ. Clinical results with a new acoustic device to identify the epidural space. Anesthesia 2002; 57:768-72.
3. Lechner TJ, van Wijk MG, Maas AJ, van Dorsten FR, Drost RA, Langenberg CJ, et al. Clinical results with the acoustic puncture assist device, a new acoustic device to identify the epidural space. Anesth Analg 2003;96:1183-7.
4. Lechner TJ, van Wijk MG, Jongenelis AA, Rybak M, van Niekerk J, Langenberg CJ. The use of a sound-enabled device to measure pressure during insertion of an epidural catheter in women in Labour. Anesthesia 2011;66:568-73.
5. Hermanides J, Hollmann MW, Stevens MF, Lirk P. Failed epidural: Causes and management. Br J Anaesth 2012;109:144-54.
6. Shaparin N, Gritsenko K, Shapiro D, Kosharskyy B, Kaye AD, Smith HS. Timing of neuraxial pain interventions following blood patch for post dural puncture headache. Pain Physician 2014;17:119-25.

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