

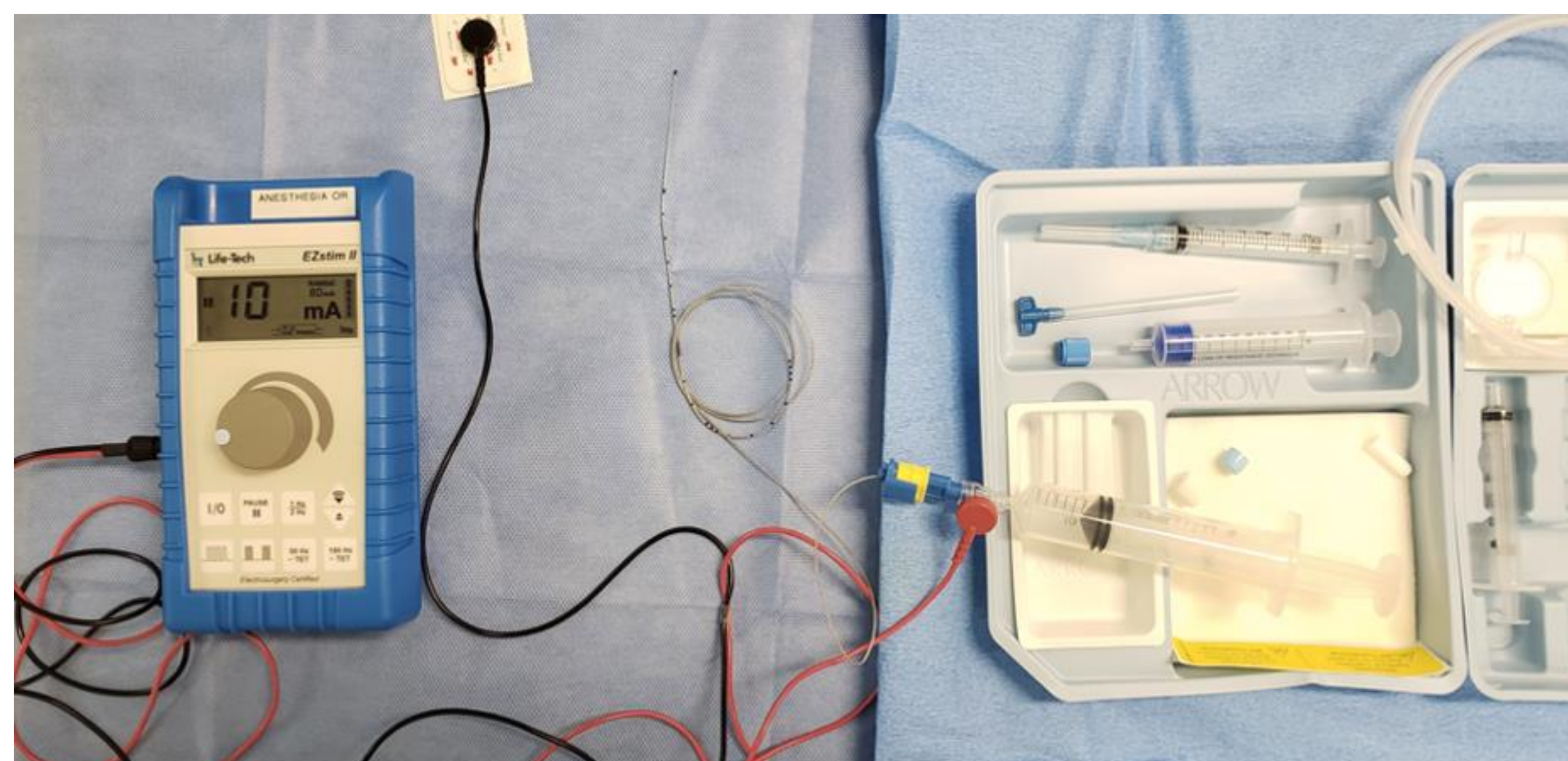
Characteristics of the Epidural Electrical Stimulation Test and Pressure Waveform to confirm epidural catheter placement in pregnant people with BMI ≥ 50 kg/m²

Shirley A. Santos, Cristian Arzola, Mrinalini Balki, Naveed Siddiqui, Hermann dos S. Fernandes, Kristi Downey, Jose C. A. Carvalho
Department of Anesthesiology and Pain Management
Mount Sinai Hospital, University of Toronto

Introduction

- Neuraxial anesthesia is the technique of choice for obstetric patients, particularly for those with body mass index (BMI) ≥ 50 kg/m², in whom complications related to airway management are likely to be more frequent. Hence, all steps to ensure effective regional anesthesia are especially important.
- Epidural electrical stimulation test (EEST) and epidural pressure waveform (PW) have been used to confirm placement of epidural catheter in the epidural space. EEST has been well studied in obstetric patients (1-3). However, the characteristics of EEST in patients with BMI ≥ 50 kg/m², particularly those receiving low thoracic epidural catheter placement, have not been studied. Similarly, there are only few studies on the use of PW in obstetric patients, showing conflicting results (4).

Objective: to describe the characteristics of EEST and PW in patients with BMI ≥ 50 kg/m² undergoing epidural analgesia/anesthesia for vaginal/cesarean delivery.



Methods

Research Ethics Board approval and patient's written informed consent.

Study design: Prospective observational study.

Population: Patients with BMI ≥ 50 kg/m² undergoing epidural analgesia for vaginal delivery or epidural anesthesia for cesarean delivery.

Procedures:

- Epidural catheter was inserted with the patient in the sitting position, at T12-L1, assisted by ultrasound. The epidural space was identified with loss-of-resistance technique to air or saline using a 17G Tuohy epidural needle via midline approach. A 19G wire-reinforced epidural catheter was advanced 7cm into the epidural space.
- Both EEST and PW were performed in all patients.
- PW was performed through the epidural needle and through the catheter.
- EEST was performed only through the catheter, before and after a test dose with lidocaine 2%.

Statistical analysis: results were presented descriptively. Frequency (percentage), mean (standard deviation) or median (inter quartile range) were reported as appropriate.

Characteristics of the Epidural Electrical Stimulation Test and Pressure Waveform to confirm epidural catheter placement in pregnant people with BMI ≥ 50 kg/m²

Shirley A. Santos, Cristian Arzola, Mrinalini Balki, Naveed Siddiqui, Hermann dos S. Fernandes, Kristi Downey, Jose C. A. Carvalho
Department of Anesthesiology and Pain Management
Mount Sinai Hospital, University of Toronto

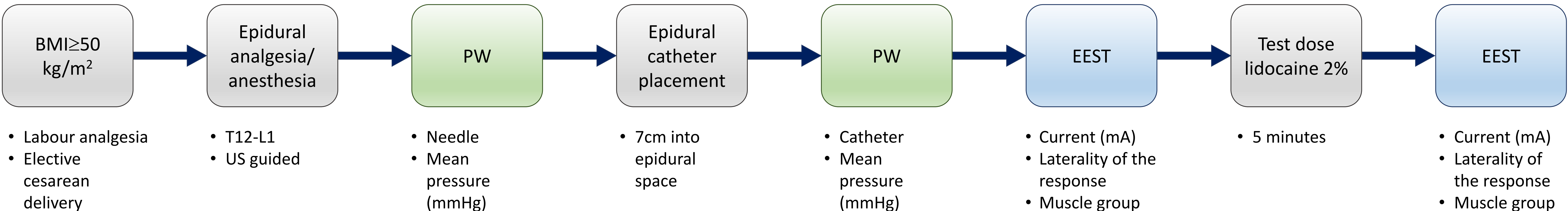
Methods (continued)

Pressure waveform (PW)

- PW transducer was levelled with the heart at the patient's manubrium-sternal angle.
- Test was considered positive when pulsatile waveform was observed in synchrony with heart rate.
- Monitor was set for a scale at 0-40 mmHg or to optimum scale.
- A small volume of normal saline (up to 5ml) was injected through the transducer in order to generate a column for pressure.

Epidural electrical stimulation test (EEST)

- EEST was assessed with a nerve stimulator connected to a metallic adapter placed between the catheter connector and the epidural filter.
- The negative lead of the nerve stimulator (anode) was attached to the metal hub of a Johans' adapter, and the positive lead (cathode) was connected to an electrode placed over the deltoid muscle.
- The frequency of the stimulator was set at 1 Hz with a pulse width of 0.2 msec. The current output was slowly increased from zero up to a maximum of 20 mA until motor activity was detected.





Characteristics of the Epidural Electrical Stimulation Test and Pressure Waveform to confirm epidural catheter placement in pregnant people with BMI ≥50 kg/m²

Shirley A. Santos, Cristian Arzola, Mrinalini Balki, Naveed Siddiqui, Hermann dos S. Fernandes, Kristi Downey, Jose C. A. Carvalho
Department of Anesthesiology and Pain Management
Mount Sinai Hospital, University of Toronto



Results

Table 1. Demographic characteristics and descriptive analysis for EEST and PW parameters.

Demographic characteristics	N=18
Age (years), mean (SD)	34.4 (5.7)
Primigravida, N (%)	4 (22.2)
Gestational age (weeks), mean (SD)	37.9 (1.1)
BMI (kg/m²), mean (SD)	57.7 (8.8)
Epidural electrical stimulation test (EEST)	
Current before test dose (mA), median (IQR)	5.5 (4,6.75)
Current after test dose (mA), median (IQR)	5 (4,7)
Motor response area, N (%)	
Abdomen	2 (11.1)
Thigh	9 (50.0)
Leg	6 (33.3)
Foot	1 (5.6)
Motor response laterality, N (%)	
Left	8 (44.4)
Right	6 (33.3)
Bilateral	4 (22.2)
Pressure waveform (PW)	
Positive through needle, N (%)	17 (94.4)
Pressure through needle (mmHg), median (IQR)	17 (12,35)
Positive through catheter, N (%)	15 (83.3)
Pressure through catheter (mmHg), median (IQR)	30 (21,32.5)
Epidural anesthesia outcome	
Effective analgesia/anesthesia, N (%)	16 (88.8)

SD, standard deviation; IQR, interquartile range.

Discussion

- Characteristics of EEST in pregnant patients with BMI≥50 kg/m² are similar compared to non-obese (1,2,3). Trend towards slightly higher incidence of bilateral response likely explained by level of the puncture.
- In a low thoracic epidural placement technique, the most common motor response was in the lower limbs and not in the thoracic or abdominal wall.
- Even though patients with obesity can have a higher impedance due to fat tissue, the current required to elicit a motor response for EEST was similar to non-obese patients (2).
- All patients had a positive EEST, in keeping with the sensitivity of 100% described in the literature for EEST (1).
- Our results for PW through the needle (94.4% response rate) are similar to those described in the literature (4).
- Although PW through the needle was positive in all patients except one, the PW through the catheter was only positive in 83.3% of patients. This may limit its clinical use if clinicians want to test the actual catheter.
- Our results showed 2 patients presenting both positive tests with ineffective surgical anesthesia requiring general anesthesia. This fact suggests that while both tests may confirm the presence of the catheter in the epidural space, they cannot predict the performance of the epidural catheter and appropriate epidural spread.

References

1) Tsui BC et al. RAPM 1999;24:17-23; 2) Margarido CB et al. Can J Anesth 2013;60:393-8; 3) Zakus P et al. Can J Anesth 2017;64:1211-7; 4) Al-Aamri I et al. Anaesthesia 2017;72:840-4.