

Measurement of epidural insertion pressures in labouring women of varying BMIs

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Introduction: To create high-fidelity epidural simulators it is important to incorporate in vivo epidural pressures.¹ This study presents the results of insertion pressures as a Tuohy needle is advanced through to the epidural space on a porcine cadaver followed with a clinical trial of labouring women of varying BMIs. The ultimate aim is to use these measured epidural pressures together with ultrasound and MRI images for the development of a novel epidural simulator to aid training.

Method: Ethics approval granted. A saddle cut of a pig was obtained within 24 hours of slaughter. Pressure measurement using a 16G Tuohy needle (Smiths Medical plc) required use of a three-way tap, a pressure transducer (Kimal plc) and a custom designed wireless transmitter and receiver, which allowed remote monitoring of epidural pressures. Following full informed consent, the clinical trial involved measurement of epidural pressures in 4 groups of labouring women (5 per group) with BMIs between <25 to >45. Ultrasound images of the lumbar region were undertaken before the pressure measurements and MRI images of the lumbar region were taken within 72hrs post-delivery.

Results: The maximum porcine epidural pressure peak ranged from 470-500mmHg (62.7-66.7kPa) equivalent to peak force of 11.1-11.8N prior to entering the epidural space. The maximum maternal epidural pressure ranged from 450-530mmHg (60.0-70.6kPa). This equates to force of 10.6-12.3N.

BMI Group	Highest mean pressure (mmHg)	Lowest mean pressure (mmHg)	Mean (mmHg)	Standard deviation
18.5 – 24.9	530	385	461	46.94
25 – 34.9	520	320	430	79.68
35 – 44.9	510	285	415	101.19
>45	450	280	376	71.33

Epidural pressure tracings by different operators demonstrate individual properties dependant on technique.

Discussion: The clinical trial in labouring women of various BMIs demonstrated that mean maternal epidural pressures reduce with increasing BMIs. The measured pressures with US and MRI images will be incorporated into a novel epidural simulator currently under development. Individual pressure tracings can be used to refine the epidural technique improving efficacy and safety.

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References

1. Vaughan N, Dubey VN, Wee MYK, Isaacs R, 2013, "A review of epidural simulators: where are we today?" Medical Engineering & Physics Journal, vol 35(9), 1235-50.