

CASE REPORT

Titrated spinal anaesthesia in high-risk patients undergoing lower limb surgery

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Summary

We present a series of six critically ill patients (ASA 4E) undergoing major lower limb vascular and orthopaedic surgery using a carefully titrated spinal anaesthetic technique via a spinal catheter. All six patients received three boluses of 0.5ml of 0.5% hyperbaric bupivacaine 15 minutes apart for induction and anaesthesia and surgery proceeded uneventfully.

INTRODUCTION

This brief communication revisits an under-utilised anaesthetic technique that dates back over two decades and updates the technique using modern equipment. Continuous spinal anaesthesia has been validated as a safe, reliable and reproducible technique for surgery involving the lower limb.¹ The technique became popular for its provision of long-lasting spinal blockade, thereby facilitating anaesthesia for surgery that would otherwise exceed the duration conferred by a single dose spinal anaesthetic.

The technique lost popularity following a number of case reports of cauda equina syndrome associated with continuous spinal anaesthesia and the use of microcatheters.² An FDA investigation in 1992 led to withdrawal of approval of microcatheters smaller than 24G for intrathecal. Proposed mechanisms of nerve

injury included maldistribution of local anaesthetic as microcatheters have a limited flow rate. As the technique of continuous spinal anaesthesia lends itself to repeat dosing, pooling of local anaesthetic in the caudal region is a potential risk.³ We describe a technique using a 20G catheter.

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The clinical features of the six patients in this series are outlined in Table 1.

All six patients received a spinal catheter as described in Table 2. No sedation was administered. The titration process, three 0.5 boluses of 0.5% hyperbaric bupivacaine 15 minutes apart, meant that the induction of anaesthesia took around an hour. Upon successful demonstration of anaesthesia of the operative region surgery was commenced without the

Table 1. Six patients undergoing major lower limb surgery with significant co-morbidities

Patient	Age (years)	Surgery	Comorbidities
1	60 female	Femoral-popliteal bypass	Asystolic arrest on GA induction Recent GI bleeds Recent quadruple coronary bypass surgery Recent acute renal failure requiring dialysis
2	72 male	Femoral embolectomy from artery graft	Severe emphysema and pulmonary hypertension (pulmonary arterial pressure 39mmHg)
3	78 female	Dynamic hip screw for fractured neck of femur	Aortic stenosis (peak gradients 44mmHg) Recent haemorrhagic cerebral infarct Ischaemic heart disease (IHD), diabetes, atrial fibrillation, congestive cardiac failure
4	91 female	Dynamic hip screw for fractured neck of femur	Aortic stenosis (peak gradient 70mmHg) IHD
5	76 female	Insertion of femoral intramedullary nail Cerebrovascular disease	VT arrest on induction of GA Unstable angina
6	86 male	Above knee amputation	COPD with current infective exacerbation Cardiac failure (Left ventricular ejection fraction 20-25%) Recent acute coronary syndrome

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Table 2. Description of titrated spinal anaesthetic technique (Adapted from Professor Colin Goodchild, Monash University Department of Anaesthesia)

Position of patient	In lateral position, with the operative leg down.
Equipment	A standard 18G Tuohy epidural set with a 20G Portex epidural catheter.
Technique	<p>Following strict sterile preparation, the Tuohy needle is inserted at the lumbar 4/5 vertebral space in the midline to identify the epidural space using loss of resistance with saline.</p> <p>The syringe is then disconnected and the remaining saline discarded. The syringe is reattached and the plunger gently withdrawn. This has the effect of creating slight negative pressure to facilitate apposition of the dura to the tip of the needle. (Technique from reference 1, adapted by Prof Colin Goodchild).</p> <p>The needle is then advanced a further 0.5cm to puncture the dura. The syringe is then disconnected and the Portex catheter is fed through the needle. The correct placement of the catheter can be confirmed by flow of cerebrospinal fluid within the catheter.</p> <p>The catheter is secured with 3 to 5cm of the catheter left within the subarachnoid space, in the same manner as an epidural.</p> <p>Clear labeling of the catheter is essential to avoid confusion with an epidural catheter.</p>
Medication	<p>We used hyperbaric 0.5% bupivacaine aiming for a unilateral block. 0.5ml aliquots were titrated at 10 to 15 minute intervals to achieve the desired block.</p> <p>We do not use the catheters on our surgical wards, removing the catheter before transfer to the ward. However we do run infusions for patients admitted to the ICU postoperatively (preservative-free morphine at 10mcg.h⁻¹).</p>

aid of any sedatives. Patients 1 and 5 received an additional bolus due to the long duration of surgery. All operations were successfully completed with minimal vasopressor support (three doses of 0.5mg metaraminol or less) and all patients were cardiovascularly stable intraoperatively and in the immediate postoperative period. There were no intraoperative adverse events. All six patients were managed in a post-anaesthesia care unit (PACU) and no adverse events (hypotension, sedation, respiratory depression, nausea or vomiting) were observed.

Four of the six patients were discharged from hospital. Two patients died in the postoperative period; patient 6 died from fulminant acute pulmonary edema 3 days postoperatively, and patient 2 died following a respiratory arrest 2 days postoperatively. Post mortem concluded that both died of their underlying conditions.

DISCUSSION

Titrated spinal anesthesia remains a clinically underutilised technique. It continues to have a role as an alternative to general anaesthesia where single-dose spinal techniques are undesirable or inappropriate. There are case reports of successful use of titrated spinal anaesthesia in the parturient with congenital heart disease,⁴ the role of titrated spinal anaesthesia in the peripartum management of a parturient with severe aortic stenosis⁵ and also where severe aortic stenosis would normally preclude the technique of single-dose spinal for lower limb surgery.⁶

The key benefit conferred by this technique is greater haemodynamic stability achieved in patients with limited cardiac reserve and major co-morbid disease, who face significant cardiovascular challenges when undergoing lower limb vascular and orthopaedic surgery.

This has been demonstrated in a number of elective randomised controlled trials involving similar patient groups, whom were optimised but not critically ill.^{7,8}

Spinal anaesthesia is associated with a risk of profound and prolonged hypotension related to rapid sympathetic block. However careful titration of the spinal dose allows more gradual extension of the block which can be manipulated and titrated to achieve the desired clinical effect, whilst minimizing the haemodynamic consequences.

This series of patients demonstrates the use of titrated spinal anaesthesia in patients where conventional single-dose spinal anaesthesia would usually be contraindicated and in whom general anaesthesia would be considered very high-risk or had already proven to be inappropriate.

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