Hypobaric spinal anaesthesia with bupivacaine (0.1%) gives selective sensory block for ano-rectal surgery

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Twenty adult male patients undergoing anorectal surgery in the jackknife position under spinal anaesthesia were studied for the anaesthetic properties of 5 ml hypobaric 0.1% bupivacaine. The patients were positioned in the prone, jack-knife position with a pillow under the hips and with an operating table break angulation of 30° with head down tilt of 20°. In this position a 25-gauge Quincke spinal needle was inserted intrathecally through L₃₋₄ and 5 ml solution, prepared by mixing 1 ml bupivacaine 0.5% with 4 ml of distilled water with a specific gravity of 1.001 at 20° C, was given over 15–20 sec. Onset time, progression and upper level of sensory blockade evaluated by pin prick, and the extent of motor block (1 = full motor movement at ankle and knee joint, 2 = restricted motor movements, 3 = full motor block, no movements) were measured at one minute intervals for the first five minutes, then every five minutes for 30 min. The number of dermatomes blocked was also noted. The median level of cephalad sensory blockage was of L₁, with a range from T₁₀–L₃. On average, nine dermatomes were blocked (range 7–12). Motor blockade was not observed in any patient. Changes in heart rate and blood pressure were minimal. The average duration of post-operative analgesia was 339.5 ± 182.9 min. Post-spinal headache was not observed in any patients. In conclusion, 5 ml

intrathecal hypobaric bupivacaine, 0.1%, provided excellent perioperative analgesia without motor blockade and haemodynamic stability in patients undergoing anorectal surgery in jackknife position.

Les propriétés anesthésiques de la bupivacaine hypobare 0,1% 5 ml en rachianesthésie sont étudiées chez vingt sujets de sexe masculin cubissant une chirurgie anorectale en position de décubitus ventral cassée. Les patients sont installés en décubitus ventral avec un oreiller sous les hanches et la table d'opération est cassée pour faire un angle de 30° et la tête inclinée vers le bas pour un angle de 20°. Dans cette position, une aiguille rachidienne Quincke 25 G est insérée dans l'espace sous-arachnoïdien L₃₋₄; une solution de 5 ml contenant un ml de bupivacaine 0,5% avec quatre ml d'eau distillée pour une gravité spécifique de 1,001 à 20° C est injectée en 15–20 sec. Le début d'installation, la progression et le niveau supérieur du bloc sensitif sont évalués à la piqure d'aiguille. L'étendue du bloc moteur (1 = motricité intacte à la cheville et au genou, 2 = motricité limitée, 3 = bloc moteur complet) est mesurée à intervalles d'une minute pour les cinq premières minutes et à toutes le cinq minutes pour 30 min. Le nombre de dermatomes bloqués est aussi noté. Le niveau moyen du bloc céphalique sensitif se situe à L₁ avec un écart de T₁₀ à L₃. En moyenne, neuf dermatomes sont bloqués (écart 7 à 12). Aucun des patients ne présente de bloc moteur. Les altérations de la fréquence cardiaque et de la pression artérielle sont minimales. L'analgésie postopératoire persiste pendant 339 ± 182,9 min. Aucun patient ne se plaint de céphalée postdurale. Pour conclure, 5 ml de bupivacaine 0,1% hypobare procurent en rachianesthésie une excellente analgésie périopératoire, sans bloc moteur, et la stabilité hémodynamique à des patients qui subissent une chirurgie anorectale en position de décubitus ventral cassé.

Key words

ANAESTHESIA, LOCAL: bupivacaine;
ANAESTHETIC TECHNIQUES: spinal;
SURGERY: anorectal.

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Accepted for publication 27th March, 1995.

Hypobaric bupivacaine is used to provide spinal anaesthesia for a variety of surgical procedures but with con-

flicting results.¹⁻⁴ Taivainen, Tuominen and Rosenberg³ noted high cephalad spread of block (mean T₁ segment) accompanied by marked hypotension with 8 ml hypobaric bupivacaine 0.19% administered intrathecally in the sitting position. On the other hand, Van Gessel *et al.* reported a high incidence of failure while using 3 ml hypobaric bupivacaine 0.25% in patients undergoing hip surgery.

The present study was designed to evaluate the anaesthetic properties of hypobaric bupivacaine, 0.1%, administered intrathecally in the prone, jack-knife position for patients undergoing anorectal surgery in the same position.

Methods

Following Institutional Research Board approval 20 ASA I and II adult male patients undergoing elective anorectal surgery of about one hour duration or less were selected for this study. Informed consent was obtained from all patients.

Premedication comprised midazolam 0.04 mg · kg⁻¹ (maximum dose 3 mg) *im* 45–60 min before the scheduled operation. All patients had a forearm vein cannulated in the pre-anaesthetic room and an infusion of lactated Ringer's 1.5 ml · kg⁻¹ · hr⁻¹ started without loading dose of crystalloid and this was not altered during the perioperative period.

The patients were positioned as for surgery in the prone, jack-knife position with a pillow under the hips and with an operating table break angulation of 30° with head down tilt of 20°. Dural puncture was performed in this position under aseptic conditions using a 25-gauge Quincke type spinal needle with an introducer at the L₃₋₄ space. Dural puncture was confirmed by aspiration of CSF. Spinal anaesthesia was produced with 5 ml hypobaric bupivacaine, 0.1%, given over 15–20 sec. The needle and the bevel direction were the same in all patients. The hypobaric solution was prepared by taking 1 ml plain bupivacaine, 0.5% and mixing it with 4 ml distilled water. The solution had a specific gravity of 1.001 at 20°C by refractometer (Atago Co., Japan).

Heart rate (HR), non-invasive arterial pressure, ECG and oxygen saturation were monitored during the perioperative period using Drager Narkomed 4 anaesthesia machine monitors. Levels of sensory and motor block were monitored as per study protocol.

The following variables were recorded:

- Time taken to perform the spinal block (from cleaning and draping to completion of injection);
- Onset time, progression and upper level of sensory blockade evaluated by pin prick, and the extent of motor block (1 = full motor movement at ankle and knee joint, 2 = restricted motor movements,

3 = full motor block, no movements) were measured at one-minute intervals for the first five minutes, then every five minutes for 30 min. The number of dermatomes blocked was noted;

- Heart rate and mean arterial pressure (MAP) were recorded preoperatively and at 1, 5, 10, 15, 20 and 30 min after the post-spinal block;
- Patients were discharged from the Post Anaesthetic Recovery Room (PARR) on return of sensation and the ability to bend the knees and flex the hips;
- Time of first post-surgical analgesic requirement requested by the patient;
- Complications.

All results are expressed as mean ± SD (range), or as median (range) for ordinal data. Repeated measure ANOVA was performed for statistical analysis of haemodynamic values. This was followed by Fisher PLSD, Scheffe F-test and Dunnett "t" test. Linear regression analysis was used to examine the correlation between dermatomes blocked at 30 min and age, height, weight and the postoperative analgesia requirements ($P < 0.05$ was considered significant).

Results

The Demographic data are shown in Table I. In this study, spinal anaesthesia was given for a variety of anorectal surgical procedures, the commonest being pilonidal sinus excision (35%), Table II.

The time taken to perform the block was 6.8 min (range 5–12 min). The onset of sensory blockade took a mean of 5.3 ± 0.7 min. The highest sensory block was T₁₀. On average nine dermatomes were blocked and motor power was preserved in all patients (Table III). No changes in HR or MAP were observed.

The duration of surgery was 37.8 ± 19.8 min with a maximum duration of 70 min. The PARR stay of the patient was seldom more than 60 min. Patients had adequate postoperative pain relief for $339.5 \text{ min} \pm 182.9$ min (Table III).

No post-spinal headache was observed in any patient. There was no correlation between the level of sensory block and height, weight or age but there was a negative correlation between the number of sensory dermatomes blocked and the duration of postoperative analgesia obtained by spinal block ($y = -79.086x + 1047$, $r^2 = 0.167$).

Discussion

The distribution of a hypobaric solution depends on posture and on the anatomical configuration of the spinal column. Thus, a high sensory blockade is found when hypobaric bupivacaine is administered in the sitting position³ which provides a poor block in patients undergoing hip surgery in the supine position.¹ In this study

TABLE I Demographic data

	Age (yr)	Weight (kg)	Height (cm)
Mean	32.2	78.8	172.9
±	12.9	11.7	3.9
(Range)	(18–66)	(57–101)	(167.5–180.0)

TABLE II Surgical procedures

	n	%
1 Pilonidal sinus excision	7	35
2 Anal fistulectomy	5	25
3 Haemorrhoidectomy	4	20
4 Incision and drainage perianal abscess	2	10
5 Anal polypectomy	1	5
6 Examination under anaesthesia and sphincterotomy	1	5

TABLE III: Anaesthetic and analgesic characteristics

Onset of sensory block (min)	Mean	5.3
	±SD	0.7
	(Range)	(4–7)
Level of sensory block (cephalad)	Median	L ₁
	(Range)	T ₁₀ –L ₃
No. of dermatomes blocked (sensory)	Mean	9.0
	±SD	0.9
	(Range)	(7–12)
Postoperative analgesia	Mean	339.5 min
	±SD	182.9
	(Range)	120–600 min

we took advantage of the prone, jack-knife position for anorectal surgery and the baricity of bupivacaine 0.1% which resulted in good sensory block with preservation of motor function.

The speed of local anaesthetic agent administration intrathecally does not alter the level of sensory or motor blockade when using small internal diameter spinal needles.^{4–6} We kept the rate of bupivacaine injection and the needle size constant. Dural puncture was performed at the L_{3–4} interspace with a 25-gauge needle in the prone, jack-knife position. The time taken to perform the block in this position was little different from the time needed to perform spinal anaesthesia in the sitting or lateral decubitus position.

The onset time of sensory blockade was fairly uniform in all and the highest sensory blockade recorded of T₁₀ was lower than that reported by others.⁷ In these, the use of the sitting posture may have led to high cephalad spread of the sensory blockade while a higher dose, 7.5 mg, could have been responsible for sensory blockade to T₇.

We did not find any correlation between the height

of our patients and the highest level of sensory blockade. This was not surprising since the height distribution of our patients was fairly uniform (range 167.5–180 cm). Differences in height must be substantial if they are to effect the level of sensory blockade.⁸

Motor blockade was absent in our patients which is in agreement with Rosenblatt,² where 2.5 mg hypobaric bupivacaine was injected intrathecally in the prone position with good sensory blockade but minimal motor blockade during percutaneous nephrostomy. This could be attributed to the dorsal distribution of the hypobaric solution in the subarachnoid space sparing the ventral nerve roots and also to the low concentration of bupivacaine in both the studies.

Haemodynamic stability was probably due to the hypobaric solution which remained localised to the area of injection due to the prone, jack-knife position with restricted sympathetic blockade.⁸

The PARR stay of the patients was seldom more than one hour in this series (range 40–65 min). Well preserved motor function, good analgesia, and haemodynamic stability were responsible for good PARR scores and uneventful discharge to the wards.

All patients had good postoperative analgesia. Mean time to first postoperative analgesia was 339.5 ± 182.9 (range 120–600) min. The time to receiving postoperative analgesia was inversely related to the initial spread of spinal blockade. We believe that the restricted initial blockade is the result of less spread of local anaesthetic which leads to more intense block that requires a longer time to dissipate and produces longer pain relief.

In conclusion, hypobaric spinal anaesthetic with 5 ml, bupivacaine 0.1%, was found to be effective and safe for anorectal surgery with well preserved motor power. An added advantage of performing spinal anaesthesia in the same position as that required for surgery is that it assures spread of the hypobaric bupivacaine is restricted to the sacral, lumbar and lower thoracic roots and preserves haemodynamic stability.

Acknowledgment

The authors would like to express their appreciation to Ms. Claire S. Thomas for her assistance in the final preparation of this manuscript.

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