Effects of preoperative methoxamine on blood loss and haemodynamic variables during transurethral prostatic resection under spinal anaesthesia

F. A. Chambers, D. P. O'Toole, M. O. Corcoran and P. W. Keane

Summary
Thirty-six patients who presented for transurethral prostatic resection were allocated randomly to one of two groups. Patients in group A were given methoxamine 10 mg i.m., 15 min before spinal anaesthesia. Patients in group B acted as a control group. All patients received spinal anaesthesia. Preoperative administration of methoxamine 10 mg i.m. decreased blood loss significantly and improved haemodynamic stability compared with the control group. (Br. J. Anaesth. 1994; 73: 624-627)

Key words

Transurethral resection of the prostate (TURP) is performed commonly in elderly men who may have concurrent respiratory or cardiovascular disease. Effort should therefore be made to minimize blood loss and maintain haemodynamic stability. Abrams and colleagues [1] showed that there was a significant decrease in blood loss with regional compared with general anaesthesia. A recent study concluded that haemodynamic variables during TURP are more stable in patients receiving spinal compared with general anaesthesia [2]. Hypotension is a well documented complication of spinal anaesthesia [3], but is influenced also by patient and surgical factors.

α Adrenergic receptors are abundant in the prostatic adenoma and capsule, a finding that has many clinical implications [4-7]. Significant symptomatic improvement in patients with benign prostatic hypertrophy has been reported after treatment with α adrenoceptor blockers [8-10]. Administration of an α agonist could result theoretically in an in vivo contractile response of the prostatic tissue surrounding the prostatic veins, decreasing their calibre. This may result in decreased blood loss and improved haemodynamic stability. Methoxamine is a sympathomimetic agent with agonist actions mediated solely at α adrenoceptors.

The purpose of this study was to evaluate the effects of preoperative methoxamine on blood loss and haemodynamic state in patients undergoing transurethral prostatectomy under spinal anaesthesia.

Patients and methods
After local Ethics Committee approval and informed patient consent, we studied 36 patients undergoing TURP for benign prostatic hypertrophy under spinal anaesthesia. Patients were allocated randomly using random number tables to one of two groups (A and B). Patients with a history of hypertension, ischaemic heart disease or hyperthyroidism and those receiving β or α adrenoceptor blocking drugs were excluded from the study. Patients with preoperative histological confirmation or clinical suspicion of prostatic carcinoma were excluded also. Patients in group A were given methoxamine 10 mg i.m., 15 min before spinal anaesthesia. Patients in group B acted as controls.

No premedication was given. A 14-gauge cannula was inserted under local anaesthesia into a vein in the left forearm, and a central venous cannula was inserted percutaneously on the opposite side via an antecubital fossa vein for collection of blood samples and continuous monitoring of central venous pressure (CVP). Monitoring consisted of continuous ECG, non-invasive measurement of mean arterial pressure (MAP) recorded every 2 min, pulse oximetry and continuous measurement of CVP. Baseline measurements were recorded for each patient and an i.v. infusion of compound sodium lactate (Hartmann's solution) was started. Patients were not given fluid loads before anaesthesia.

Patients were turned on the left side with the trolley horizontal and under aseptic conditions the skin and subcutaneous tissues were infiltrated with 1% lignocaine. A 22-gauge spinal needle was inserted into the subarachnoid space at the L3-4 interspace. Hyperbaric 0.5% bupivacaine 2.5-3 ml in 6% glucose was then injected intrathecally. The patient was turned on his back again with the trolley still horizontal. Patients of short stature whom the anaesthetist (D.O.T. and F.C.) did not consider were suitable to receive bupivacaine 3 ml were given 2.5 ml instead. Analgesia was complete usually

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Effects of methoxamine in TURP

within 10–15 min and the block, as assessed by loss of cold sensitivity, extended from T8 to T10 in most patients. Patients were then positioned on the operating table and prepared for surgery. All patients breathed oxygen 4 litre min⁻¹ via a Hudson mask. The weight of prostatic tissue resected, time taken for resection, blood loss, volume of glycine used and the need for blood transfusion were recorded. The histology of the gland was recorded also.

The resection time was defined as the time the resectoscope was introduced into the bladder until the urethral catheter was inserted. The same consultant urologist (M.C.) operated on all patients using a standard 25-French gauge fibre-lit resectoscope with irrigation of the bladder using 1.5% glycine solution. The height of the glycine relative to the patient was standardized at 500 cm H₂O (irrigation pressure). Blood loss during surgery was measured using the photometric technique described by Jansen, Berseus and Johansson [11], the only modifications being the use of a lysant (17.7 ml of BRIJ (BDH Chemical, Poole, UK) in 250 ml of distilled water) and centrifugation before photometry. Blood loss was measured by collecting and measuring all irrigation fluid used during surgery and then mixing thoroughly before obtaining a sample for haemoglobin analysis using photometry. The exact blood loss was calculated by multiplying the haemoglobin content of the irrigation fluid by the volume of glycine used and dividing it by the preoperative haemoglobin content. Blood loss during surgery was calculated by a laboratory technician who was unaware of the group to which the patient belonged.

If significant hypotension developed, it was treated with i.v. fluids and ephedrine, the mode of therapy based on clinical assessment. Patients were assessed in the postoperative recovery room, on return to the ward and again the following day. Complications relating to anaesthesia and surgery were recorded, as were blood transfusion requirements. Blood samples were obtained for full blood count on completion of surgery and again the following morning.

Data are expressed as mean (SEM). Data were compared using Student’s unpaired t test. Comparison of the need for blood transfusion was by Fisher’s exact probability test. P < 0.05 was considered significant.

**Results**

There was no significant difference between groups in age, body weight, duration of resection, weight of prostate resected and volume of glycine used (table 1). Histological assessment of prostatic tissue in all patients did not reveal any evidence of malignancy. The major variables affecting blood loss during TURP are resection weight, resection time, histology of the gland and type of anaesthetic used [1]. The latter two variables were the same for all patients, and as mean resection time and mean resection weight were not statistically different it was reasonable to assume that the groups were comparable for the purpose of comparing blood loss.

Corrected blood loss was expressed as blood loss per gram of tissue resected per minute of resection time. There was a significant difference in blood loss and corrected blood loss between the two groups (P < 0.02 and P < 0.05, respectively) (table 2). Three patients in the control group required blood transfusions when the haemoglobin concentration decreased to less than 8 g dl⁻¹; blood transfusion was not required in the methoxamine treated patients (P = 0.26). Two patients required blood transfusions in the recovery ward (haemoglobin concentrations 6.8 and 7.2 g dl⁻¹). The third patient was transfused on the following morning (haemoglobin concentration 7.5 g dl⁻¹).

Changes in MAP, heart rate and CVP are shown in figures 1–3. There was no difference in MAP between the two groups before administration of methoxamine or just before spinal anaesthesia, but subsequently MAP was significantly lower in the control group. Ephedrine 6 mg was administered to three patients in the control group (systolic pressure decreased to less than 8 g dl⁻¹). The third patient was transfused with control group.

**Table 1** Patient characteristics (mean (SEM) or range). No significant differences between groups

<table>
<thead>
<tr>
<th>Group A (methoxamine)</th>
<th>Group B (control)</th>
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<tbody>
<tr>
<td>Age (yr)</td>
<td>72.5 (64–83)</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>76.4 (3.2)</td>
</tr>
<tr>
<td>Weight of prostate (g)</td>
<td>20.5 (3.2)</td>
</tr>
<tr>
<td>Duration of resection (min)</td>
<td>28.8 (2.5)</td>
</tr>
<tr>
<td>Volume of glycine used (litre)</td>
<td>11 3 (1.2)</td>
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</tbody>
</table>

**Table 2** Mean (SEM) intraoperative blood loss and corrected blood loss (expressed as millilitre of blood lost per gram of prostate resected per minute resection time) in the two groups

<table>
<thead>
<tr>
<th>Group A (methoxamine)</th>
<th>Group B (control)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blood loss (ml)</td>
<td>183 (39)</td>
</tr>
<tr>
<td>Corrected blood loss (ml g⁻¹ min⁻¹)</td>
<td>4.6 (0.7)</td>
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**Figure 1** Mean (SEM) changes in mean arterial pressure (MAP) in the methoxamine (——) and control (-----) groups. M = Administration of methoxamine, S = start of spinal anaesthesia. Time 0 = start of surgery. *P < 0.05, **P < 0.01 compared with control group.
Time (min)

Figure 2

Mean (SEM) changes in central venous pressure (CVP) in the methoxamine (■) and control (□) groups.

Time (min)

Figure 3

Mean (SEM) changes in heart rate (HR) in the methoxamine (■) and control (□) groups. *P > 0.05, **P < 0.05.

< 80 mm Hg). Heart rate increased significantly in the control group. There was no significant difference between the two groups in CVP measurements. There was an increase in CVP from baseline in both groups which was sustained throughout surgery (fig. 2). Patients who received methoxamine had significantly slower heart rates in the perioperative period (fig. 3).

The majority of patients in both groups had sensory blocks extending from T8 to T10 but three patients in the methoxamine group and two patients in the control group had sensory blocks extending from T6 to T8. There was no significant difference between the two groups in the height of sensory block. There were no anaesthetic or surgical complications in either group.

Discussion

A reduction in blood loss during TURP improves surgical visibility, decreases the incidence of blood transfusion and its associated risks, and results in improved haemodynamic stability. The use of spinal rather than general anaesthesia can decrease blood loss by 50% during TURP [1]. The primary factors which influence blood loss during TURP are the weight of the prostate resected, duration of resection, type of anaesthetic and histology of the gland [1, 12]. Raised CVP increases prostatic bleeding also [13–15]. Spinal anaesthesia results in vasodilatation of the vessels in the lower part of the body, increasing venous pooling, especially when the patient’s legs are in the lithotomy position. There was no significant difference between the two groups in CVP.

Administration of methoxamine 10 mg i.m., 15 min before anaesthesia, resulted in a significant decrease in blood loss and improved haemodynamic stability in patients undergoing TURP under spinal anaesthesia. The decrease in blood loss was probably caused by the contractile response of the prostatic tissue to methoxamine, an observation observed previously in vitro [4–7]. This could result in a decrease in the calibre of the prostatic veins with a subsequent reduction in blood loss.

Blood loss during TURP is related to the weight of the prostate resected, duration of resection and experience of the surgeon. There is no relationship between arterial pressure and blood loss during TURP [1]. As the same urologist (M.C.) operated on all patients and the two groups were comparable in resection time and weight of prostate resected, it is reasonable to conclude that the differences in blood loss can be attributed to methoxamine and its local action on the prostate. Three patients in the control group required blood transfusions whereas none of the patients in the methoxamine group required blood, although this was not statistically significant.

Recent interest has focused on the management of hypotension which occurs during central neural block, with proponents for either volume loading or vasopressors. Large volumes of fluid may not be desirable and are potentially dangerous in elderly patients, particularly those undergoing TURP, many of whom have poor cardiac function, with an increased risk of developing pulmonary oedema caused by absorption of irrigation fluid through the prostatic veins [12]. King and Dripps [16] reviewed data in more than 800 patients, in which methoxamine was used to attenuate the hypotensive effect of spinal anaesthesia. They concluded that despite preoperative administration of i.m. methoxamine, the mean decrease in arterial pressure was approximately 25% with a more marked decrease in the elderly. The failure of methoxamine to produce central nervous system stimulation or to cause abnormal ventricular rhythms while attenuating the hypotensive effect of spinal anaesthesia makes it a worthy agent for further study in this patient population.

References

Effects of methoxamine in TURP


