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Effect of Epidural versus General Anaesthesia on Peroperative Blood Loss during Retropubic Prostatectomy

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Peroperative blood loss, arterial blood pressure and central venous pressure were studied in patients subjected to retropubic prostatectomy. The patients were randomly allocated to two groups, continuous lumbar epidural analgesia for up to 24 hours and a thiopentone–oxyg n–nitrous oxide–alcuronium–pethidine sequence with intermittent positive pressure ventilation. The mean peroperative blood loss during operations under epidural analgesia was significantly less than that under general anaesthesia (370 $\pm$ 34 ml vs. 590 $\mp$ 35 ml, mean $\mp$ SE). Only one patient out of 17 cases of epidural analgesia needed a peroperative blood transfusion, in contrast to 5 out of 21 general anaesthesias. Both the arterial systolic and diastolic pressures, and central venous pressure were significantly lower under epidural analgesia than general anaesthesia. It was concluded that decreased arterial and venous pressure were responsible for the reduced blood loss under epidural analgesia.

Introduction

The peroperative blood loss was found to have decreased when spinal or epidural analgesia were used for open prostatectomy [4, 14, 18]. Jensen and Stokke [6], in their retrospective study on the effect of epidural analgesia on the intraoperative blood loss during major abdominal surgery, found no correlation between the method of anaesthesia, general or general plus epidural, the behaviour of arterial blood pressure and the quantity of peroperative haemorrhage. These controversial reports and the importance of blood loss with an increase in both risk and cost prompted the present investigation.

Material and methods

The study included 38 patients subjected to retropubic prostatectomy due to hypertrophy of the prostatic gland. Informed consent was obtained from each subject. Patients were randomly assigned to receive continuous lumbar epidural analgesia or general anaesthesia. Table 1 represents some data of the patients.

The operation was performed by the same surgeon. The operative technique was Millin's retropubic prostatectomy [17], except in one case in the general group where a transvesical approach was chosen for technical reasons.

Table 1

Clinical data of patients subjected to retropubic prostatectomy (mean ± SD)

	Method of anaesthesia	
	general	epidural
Number of patients	21	17
Age (years)	66.6 ± 6.6	70.9 ± 8.9
Weight (kg)	69.9 ± 10.3	70.2 ± 10.2
Height (cm)	168.6 ± 5.6	169.0 ± 4.9
Physical condition on a fivepoint scale*	2.3 ± 0.6	2.6 ± 0.6

* According to Saklad [11]

A peripheral vein was cannulated for infusion of 5% glucose in 0.3% NaCl at a rate of 10 ml/kg b.w./hour. About 40 per cent of the patients in both groups received 500 to 1000 ml of polygeline (Haemaccel®) to correct hypotension or hypovolaemia or both. Blood transfusion was given if the blood loss exceeded about 10 per cent of the calculated blood volume of the patient. A central venous catheter was inserted percutaneously via the basilic vein and central venous pressure was measured with a water manometer. The left radial artery was cannulated for measurement of blood gases. The core temperature was recorded with the probe in the auditory canal and/or nasopharynx (Ellab, Copenhagen). Arterial blood pressure was measured by the method of Riva-Rocci. All the measurements were made before induction of anaesthesia, at the start and end of operation and peroperatively every 20 minutes, except for blood pressure which was measured every five minutes. Measurement of blood loss was carried out by weighing the swabs immediately after use, and by measuring the contents of the suction bottles. The blood-stained drapes were inspected and the amount of blood was estimated visually. The patients were premedicated orally with diazepam 45 minutes before operation. General anaesthesia was induced with thiopentone (Intraval®) in a dose sufficient to abolish the eyelash reflex (200–350 mg). Suxamethonium (Myolaxin®) 50 mg, was given to facilitate the orotracheal intubation with a cuffed tube. Anaesthesia was maintained with 30 per cent oxygen and 70 per cent nitrous oxide in a semiclosed absorber system. Ventilation was controlled with a Bennet anaesthesia ventilator, the respiratory frequency being 10/min and the tidal volume 10 ml/kg body weight. Arterial blood gases were analyzed every 20 minutes and the ventilation was adjusted aiming at normoventilation. Relaxation was provided by alcuronium (Alloferin®) (total dose 17.5–22.5 mg) and pethidine was given to supplement the anaesthesia (total dose 70–130 mg). At the end of anaesthesia muscle relaxation was antagonised with 1 mg atropine and 2 mg neostigmine intravenously.

For epidural analgesia, an epidural catheter was inserted at the 4th or 5th lumbar vertebral interspace. Epidural analgesia was achieved with 2% butanilicaine

(Hostacaine®) with 5 μg/ml incorporated adrenaline. The block produced reached at the maximum the 5th thoracic dermatome tested by the pin-prick technique. The sympathetic block was evaluated by measuring the skin temperature of the big toe and calf continuously. Sensory analgesia was excellent in 12 patients (completely painfree) and satisfactory in 5, necessitating the administration of 5–10 mg diazepam and 20–50 mg pethidine intravenously. Due to the motor block the patients were unable to flex their knees but could move their feet. Adequacy of the breathing was checked by arterial blood gas analysis.

Tables 2 and 3 represent some perioperative data. Antifibrinolytic therapy in the form of intravenous tranexamic acid (Cyclocapron®) was begun just before manual enucleation of the prostatic gland in a dose of 1 g. Student's *t*-test and χ^2-test for fourfold table were used in statistical analysis. A P-value >0.05 was considered as the limit of significance.

Table 2

Perioperative data of patients subjected to retropubic prostatectomy (mean ± SD)

	Method of anaesthesia	
	general	epidural
Number of patients	21	17
Duration of operation (min)	74.1 ± 3.2	71.2 ± 3.1
Crystalloid load (24 h, ml)	3506 ± 160	3659 ± 59
Urine output (24 h, ml)	930 ± 441	927 ± 320
Decrease of core temperature during operation	0.2 ± 0.1	0.2 ± 0.1

Table 3

Intraoperative arterial acid–base and blood gas values of patients subjected to retropubic prostatectomy (mean ± SE)

Method of anaesthesia	No. of patients	PaO_2	$PaCO_2$	pH	Bicarbonate	Base excess
General anaesthesia	21	18.6 ± 1.0	4.5 ± 0.3	7.41 ± 0.01	21.9 ± 0.6	−2.5 ± 0.6
Epidural analgesia	17	11.4 ± 0.4	4.3 ± 0.1	7.41 ± 0.005	22.3 ± 0.7	−2.7 ± 0.6

Results

The method of anaesthesia had a significant effect on the intra-operative blood loss (Fig. 1). In the epidural group the haemorrhage was markedly less and only one of the 17 patients needed a peroperative blood tranfusion in contrast to 5 out of 21 patients who received general anaesthesia.

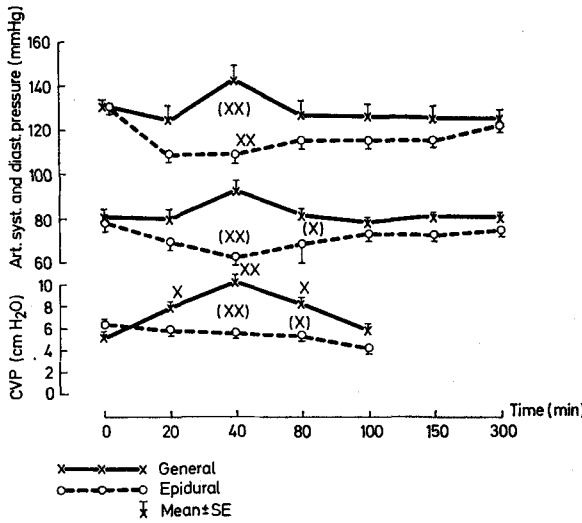

Fig. 1. Effect of the method of anaesthesia, general or epidural, on peroperative blood loss during retropubic prostatectomy. X = $p < 0.05$, XX = $p < 0.01$ compared with preoperative level. (X) = $p < 0.05$, (XX) = $p < 0.01$ between the groups

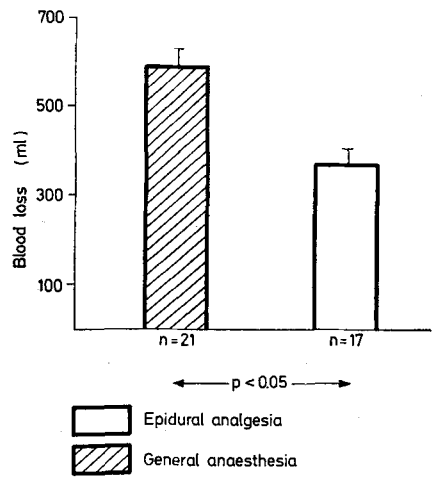

Fig. 2. The behaviour of systolic and diastolic blood pressure (mm Hg) and central venous pressure (cm H_2O) during retropubic prostatectomy under general or epidural anaesthesia

The peroperative blood loss showed no correlation with the age of the patients or the weight of prostatic glands. Epidural analgesia resulted in a significant decrease ($P < 0.01$) in arterial blood pressure. Central venous pressure decreased slightly. During general anaesthesia the arterial blood pressure increased insignifi-

cantly and the central venous pressure significantly (Fig. 2). In the general group there existed a correlation between blood pressure and intra-operative blood loss ($r = 0.46$; $n = 21$).

Discussion

Anaesthesia may be an important cause of bleeding during operation. In the present study haemorrhage necessitating blood transfusion occurred in 5 out of 21 patients who received general anaesthesia and only in one out of 17 patients who received epidural analgesia. In accordance with this, the mean blood loss was significantly higher during general anaesthesia than during epidural analgesia.

Our method of quantifying blood loss is somewhat unreliable. However, Bröckner et al. [3] have demonstrated that there is no significant difference between the "washing method" and the gravimetric method. The major part of blood loss was measured in bottles or swabs without the possibility of bias; only a minor part was visually estimated on the blood-stained drapes. The efficacy of epidural analgesia is doubtless, in part, due to arterial hypotension. Bodman [1] anaesthetized 100 prostatic patients. A technique of intermittent positive pressure breathing (IPPB) was used and the latter 50 patients had hypotension, induced with hexamethonium to about 100 mm/Hg systolic. Blood loss was significantly reduced from about 350 ml to 95 ml. Louden and Scott [8] found a reduced blood loss with epidural analgesia in vaginal surgery, compared with general anaesthesia with IPPB. However, they found no further decrease in blood loss in a hypotensive subgroup of the epidural patients. The authors concluded that arterial hypotension played only a minor part in the reduction of bleeding. Keith [7] came to a similar conclusion comparing epidural analgesia with general anaesthesia in total hip replacement surgery. Despite equally decreased arterial blood pressure below the preoperative level, blood loss was substantially less during epidural analgesia.

In the present investigation the arterial blood pressure was significantly higher in the general group. However, the role of hypotension cannot be estimated The behaviour of the central venous pressure indicated that increased venous pressure was one of the causes of haemorrhage. IPPB and surgical stimulation caused a significant increase in central venous pressures with double the preoperative level as an end result. In contrast to that, during epidural analgesia the veins are dilated due to sympathetic nerve blockade. The distensibility of the hypotonic veins lowers the venous pressure so that small gravitational forces may produce emptying of the veins [9]. Under epidural block slight elevation of the operative site, employed here by elevating the pelvis with the aid of a cushion, will empty the veins and minimize venous oozing. In the study of Renck [10] general anaesthesia with IPPB resulted in a significantly higher blood loss than general anaesthesia with spontaneous breathing or major conductive blockade, spinal or epidural. Similarly, with equal postoperative blood losses after prostatectomy under general or regional anaesthesia, the venous pressure returned to the preoperative level, which is an indication of

the effect of venous pressure on blood loss. This is shown in many studies where postoperative blood loss has been measured [10, 14].

Cardiac output seems to have no effect on peroperative blood loss. Sivarajan et al. [12] found similar blood losses despite significantly higher cardiac output during nitroprusside-induced hypotension compared with trimethaphan-induced hypotension. Epidural analgesia produces a hyperkinetic circulation in the legs [13] with a greatly increased cutaneous blood flow and a slightly increased muscle blood flow [16]. Cardiac output has been shown to remain stable with plain local anaesthetics or to increase with adrenaline containing local anaesthetics [13]. Thus, not the blood flow but the pressure, both arterial and venous, and the relative level of the operation site in relation to the right atrium seemed to be responsible for the amount of blood loss. The body temperature and the acid–base balance, factors which might have an influence on the intra-operative blood loss, were similar in both groups.

It is advisable to estimate the blood loss continuously, and possibly keep it in the normovolaemic state. Patients deprived in great part of the body of the sympathetic tone will have a reduced compensatory capacity against hypovolaemia. Bonica et al. [2] found a dangerous cardiac depression in a group of volunteers with hypovolaemia induced by removing 15 per cent of the blood volume when plain lidocaine was used for epidural analgesia. Hypotension has been found to be well tolerated by relatively old patients, without postoperative organ dysfunction [15]. However, patients with cerebrovascular accidents, hypertension and previous myocardial infarction will probably benefit from the pressure adapted in this study. Cerebral, hepatic and renal function as well as cardiovascular status showed postoperative derangement [5] and anyway the systolic blood pressure of 100 mm Hg was low enough to reduce significantly the peroperative blood loss.

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