BLOOD LOSS IN TOTAL HIP REPLACEMENT: EXTRADURAL V. PHENOPERIDINE ANALGESIA

S. P. Chin, M. N. Abou-Madi, B. Eurin, J. Witvoet and J. Montagne

SUMMARY

The effects of phenoperidine and extradural analgesia on blood loss during and after total hip replacement were compared in 41 patients randomly divided into two statistically comparable groups. Mean blood loss in patients who received phenoperidine was 1065 ± 316 ml and in patients who received extradural analgesia with 0.5% bupivacaine with adrenaline 1:200,000 it was 650 ± 277 ml (P < 0.001). There was no significant difference in postoperative blood loss between the two groups. The reduction in blood loss resulting from the extradural block may prove beneficial in decreasing the hazard and cost of blood transfusions and in facilitating autologous transfusion.

Total hip replacement (Charnley, 1979) is considered the procedure of choice for radical treatment of osteoarthritis and rheumatoid arthritis of the hip. There are two major complications of this procedure: haemorrhage and thromboembolism. The operation has a mortality rate of 1–2% and most deaths are secondary to postoperative pulmonary thromboembolism.

Previous studies of elective surgical procedures have confirmed the advantage of extradural anaesthesia over other techniques. It reduces operative blood loss (Keith, 1977), endocrine metabolic response to surgical stress (Kehlet, 1978; Harari et al., 1980) and the risk of thromboembolism (Modig et al., 1979). Extradural anaesthesia also improves postoperative $P_{aO_2}$, the physical and mental state of the patient (Hole, Teajesen and Beeivik, 1980), and nitrogen balance (Brandt et al., 1978).

However, concerns have been expressed about the adequacy of surgical muscle relaxation following extradural anaesthesia, and the patient's discomfort after more than 1 h of lateral decubitus position. (Those operated on under extradural anaesthesia complain of pain in the dependant shoulder and at sites of i.v. infusions.)

To reassess extradural anaesthesia and study its effect on operative blood loss in patients undergoing total hip replacement, we performed a prospective, randomized study, comparing operative blood loss in two groups of patients operated on under light general anaesthesia supplemented with either an extradural block or phenoperidine analgesia.

METHODS

We studied 41 patients, ASA class I and II (23 females and 18 males; age 45–86 yr) with advanced osteoarthritis of the hip who were to undergo total hip replacement. (One patient had both hips replaced over a 1-month interval.) Patients with rheumatoid arthritis, ankylosing spondylitis, Paget's disease, and with previous hip operations were excluded from the study. Almost 60% of patients in both groups were receiving indomethacin, sulindac or diclofenac before operation.

Laboratory investigations before operation included full blood count and coagulation screen, plasma electrolyte concentration, chest x-ray, and e.c.g. Laboratory data for all patients were normal with no evidence of recent disease.

Patients were allocated randomly to two groups of 20. The patient with bilateral hip replacement was operated on once with extradural anaesthesia and once with phenoperidine.

All surgical procedures were performed by the same orthopaedic surgeon who was not informed of the anaesthetic technique. Surgery was performed in the lateral position using a posterolateral approach. A ceramic-type prosthesis was used and both the acetabular and the femoral prostheses were fixed with acrylic cement.
Anaesthesia technique

Premedication consisted of atropine 0.5 mg, trimedazine 0.25 mg kg\(^{-1}\) and meperidine 1 mg kg\(^{-1}\) given i.m. 1 h before induction of anaesthesia.

In group I patients, anaesthesia was induced with thiopentone 4–5 mg kg\(^{-1}\) i.v. Suxamethonium 1 mg kg\(^{-1}\) was given i.v. to facilitate tracheal intubation. The lungs were ventilated mechanically using a Manley ventilator and a gas mixture of nitrous oxide 4 litre min\(^{-1}\) and oxygen 3 litre min\(^{-1}\). Subsequent analgesia and muscle relaxation were achieved with phenoperidine and pancuronium given i.v. as required. The last doses of phenoperidine and pancuronium were administered approximately 45–60 min before the end of surgery. Residual muscle paralysis was antagonized with atropine and neostigmine.

In group II patients, anaesthesia was also induced with thiopentone 4–5 mg kg\(^{-1}\) i.v. Suxamethionium 1 mg kg\(^{-1}\) was also administered i.v. to facilitate tracheal intubation and the lungs were mechanically ventilated using a Manley ventilator and a gas mixture of nitrous oxide 4 litre min\(^{-1}\) and oxygen 3 litre min\(^{-1}\). Pancuronium was given to facilitate mechanical ventilation. Patients were then placed in a flexed lateral position with the side to be operated on lowermost. Extradural anaesthesia was administered through a 17-gauge Tuohy needle at L3–4 interspace; one dose of 0.5% bupivacaine with adrenaline 1:200 000 was injected, the dose having been calculated in relation to age and size of patients (64.5 ± 5.5 mg). Fifteen minutes later, patients were placed in position for surgery. An infusion of Ringer's lactate was used to supplement maintenance fluid intake; blood loss greater than 10% of calculated blood volume was replaced with packed red blood cells. Heparin 1250 u. every 3 h was given starting immediately after surgery for a period of up to 10–15 days on average.

Operative blood loss was estimated from the increase in weight of swabs and towels and the contents of suction bottles. For 36 h after operation, blood draining from the wound was collected in closed vacuum bottles. Haemoglobin concentrations and haematocrits were estimated on the 1st and 6th days after operation. The results for each group were compared using Mann–Whitney tests.

Platelet count and partial thromboplastin time were also estimated on the 1st and 6th days after operation.

RESULTS

Both groups were statistically comparable with regard to age, sex and physical status before operation (table I), but height and weight of patients were statistically greater in group II (extradural) patients. The average duration of surgery was not statistically different between the two groups; 102 ± 11 in group I and 101 ± 14 in group II (min). There was no significant difference in sizes of prostheses between the two groups.

Blood loss during and after operation in the two groups are shown in table II and figure 1. The mean blood loss during operation in group I patients (phenoperidine) was 1065 ± 316 ml. Mean blood loss during operation in group II patients (extradural) was 650 ± 277 ml (P<0.001). During the period after operation, there were no differences in blood loss between both groups (table II). Haemoglobin and haematocrit values taken on the 1st and 6th days after operation did not show any difference between the two groups (table II). Mean changes in arterial pressure were the same in both groups, decreasing 20–30% below values before operation. Coagulation screen was normal in all patients.

DISCUSSION

Both groups of patients were statistically comparable although weight and height were

<table>
<thead>
<tr>
<th>TABLE I. Details of patients before operation</th>
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<tbody>
<tr>
<td>No. of patients</td>
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<td>-----------------</td>
</tr>
<tr>
<td>Group I (phenoperidine)</td>
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<tr>
<td>Group II (extradural)</td>
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TABLE II. Mean blood loss

<table>
<thead>
<tr>
<th>Group I (phenoperidine)</th>
<th>Group II (extradural)</th>
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<tr>
<td>During operation</td>
<td>First 24 h after operation</td>
</tr>
<tr>
<td>1065 ± 316</td>
<td>650 ± 277</td>
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<tr>
<td>509 ± 270</td>
<td>545 ± 122</td>
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<tr>
<td>(P &lt; 0.001)</td>
<td>(n.s.)</td>
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Greater in the extradural group. Large variations in operative blood loss can occur even among patients of the same study group. These variations are mainly secondary to the patients' anatomico-physiological states and chronobiological changes (Radzialowski and Bousquet, 1968; Scheving, von Mayersbach and Pauly, 1974), or can be a result of different operative techniques if more than one surgeon is involved (Hole, Teajesen and Beeivik, 1980). Large variations in operative blood loss have also been reported when the same surgeon has performed identical procedures (Hercus et al., 1961). In our series, operative blood loss varied from 800 to 1900 ml in the phenoperidine group and from 300 to 1400 ml in the extradural group. One surgeon performed the same surgical procedure in both groups.

Gravimetric methods for determination of operative blood loss are simple, reliable and used commonly (Gouin, Dessemond and Benoit, 1978). Their reliability, however, compared with colorimetric techniques, electronic conductivity techniques and blood volume measurements, remains to be determined. Arterial pressure decreased by 20–30% from values before operation in both groups. The mechanisms involved in the smaller operative blood losses in the extradural group are not completely understood. These may include:

- **Redistribution of circulating blood volume secondary to reduction in hydrostatic pressure;**
- **vasodilatation of arteries, arterioles and veins** in the area affected by the extradural block with gravitational emptying of the blood vessels in the lateral position from the uppermost operative site;
- **shunting of blood away from muscles and bones to subcutaneous tissue and skin** (Cousin and Wright, 1971);
- **compensatory vasoconstriction** of the operative site (Bond, 1969). A combination of these effects may occur.

Controlled ventilation during general anaesthesia may cause an increase in intrathoracic pressure (Moir, 1968). This leads to diminished venous return from the periphery and an increase of venous pressure which may cause increased bleeding during hip replacement. In our study, we combined controlled ventilation with extradural anaesthesia. This resulted in a significant reduction in operative blood loss (P < 0.001) compared with the other group of patients whose controlled ventilation was supplemented with i.v. injections of phenoperidine.
Extradural anaesthesia probably offset the effect of controlled ventilation on the peripheral venous pressure by causing peripheral vasodilatation. Also, light general anaesthesia induced before performing the extradural block allows smooth and painless positioning of the patient.

We believe that significant reduction in operative blood loss can be achieved through appropriate selection of extradural anaesthesia for patients undergoing hip replacement. The reduced need for blood transfusion can be successfully met by autotransfusion techniques in which 900–1200 ml of blood can be stocked by the Piggback autologue transfusion technique (Ellison and Wurzel, 1975) hence reducing the risks and cost of large blood transfusion.

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REFERENCES


Effets comparés de l'analgésie par voie peridurale et de l'analgésie à la phénoperidine sur les pertes sanguines dans les prothèses totales de hanche

RESUME

Nous avons comparé les effets de la phénoperidine et de l'analgésie péridurale sur les pertes sanguines pendant et après prothèse totale de hanche chez 41 patients répartis au hasard en deux groupes statistiquement comparables. La perte sanguine moyenne s'est élevée à 1065 ± 316 ml chez les patients qui recevaient de la phénoperidine et à 650 ± 277 ml chez ceux qui recevaient une analgésie péridurale avec de la bupivacaine à 0,5% adrénaline en 1/200.000 émulsion (P < 0,001). Il n'y a pas eu de différence significative entre les deux groupes pour ce qui est de la perte sanguine post-opératoire. La réduction du saignement obtenue par le bloc péridural peut être un avantage car elle diminue les risques et le coût de la transfusion, et facilite les transfusions autologues.
BLOOD LOSS IN TOTAL HIP REPLACEMENT

BLUTVERLUST BEI HÜFTGELENKSTOTALEN-PROTHESEN: VERGLEICH DER ANALGETISCHEN WIRKUNG VON PERIDURALANÄSTHESIE UND PHENOPERIDIN

ZUSAMMENFASSUNG
Die Wirkung von Phenoperidin und Periduralanästhesie auf den Blutverlust während und nach Hüftgelenkstotalendoprothese wurde bei 41 Patienten verglichen, die wir nach Randomisierung in zwei statistisch vergleichbare Gruppen aufgeteilt haben. Der mittlere Blutverlust bei den Patienten mit Phenoperidin betrug 1065 ± 316 ml, während die Patienten mit Periduralanästhesie (0,5% Bupivacain mit Adrenalin 1:200 000) 650 ± 277 (P < 0.001) ml Blut verloren. Es gab keinen signifikanten Unterschied im postoperativen Blutverlust zwischen den beiden Gruppen. Die Reduzierung des Blutverlusts, die sich aus der Periduralanästhesie ergibt, kann sich als günstig für die Senkung des Risikos und der Kosten von Bluttransfusionen, als auch für die Erleichterung der autologen Transfusion erweisen.

PERDIDA DE SANGRE EN LA SUSTITUCION TOTAL DE LA CADERA: USO FENOPERIDINA EN COMPARACION CON LA ANESTESIA EXTRADURAL

SUMARIO
Se compararon los efectos de la anestesia con fenoperidina en comparación con la anestesia extradural, en lo tocante a la pérdida de sangre durante la intervención quirúrgica, tendente a la sustitución total de la cadera y después de dicha intervención, en 41 pacientes divididos de forma aleatoria en dos grupos estadisticamente comparativos. La pérdida media de sangre en los pacientes que recibieron fenoperidina fue de 1,065 ± 316 ml y para los pacientes que recibieron analgesia extradural con bupivacaina al 95% y con adrenalin en una proporción de 1,200,000 dicha pérdida fue de 650 ± 277 ml (P < 0.001). No hubo diferencia estadísticamente significativa en la pérdida de sangre después de la operación entre los dos grupos. La reducción de la pérdida de sangre como resultado del bloqueo extradural puede que llegue a ser beneficiosa en lo relativo a la disminución del peligro potencial y del coste de las transfusiones sanguíneas y para facilitar las transfusiones autólogas.