Lower thrombosis risk with epidural blockade in knee arthroplasty

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Thirty-six patients scheduled for knee arthroplasty were randomized to general or epidural anesthesia that was prolonged into the postoperative period. All the patients wore graded compression stockings until full ambulation. No other thromboprophylactic treatment was given. In diagnosing deep venous thrombosis, bilateral ascending venography was performed 9–11 days after surgery. The incidence of thrombosis was 2/13 in the epidural group versus 10/16 in the general anesthesia group ($P < 0.05$).

The incidence of deep venous thrombosis associated with knee arthroplasty is about 50 percent without prophylactic treatment (McKenna et al. 1976, Lotke et al. 1984, Stulberg et al. 1984, Lynch et al. 1988, Stringer et al. 1989). Unlike morphine, regional local anesthetics produce a hyperkinetic lower limb circulation, and both spinal and epidural regional anesthesia reduce the incidence of thrombosis and pulmonary embolism following hip surgery (Davis et al. 1980, Thorburn et al. 1980, Modig et al. 1983, Davis et al. 1989). However, it has not been evaluated if regional anesthesia has a thromboprophylactic effect in major knee surgery performed in a bloodless field.

We compared epidural and general anesthesia as regards the incidence of deep venous thrombosis after knee arthroplasty.

Patients and methods

Included were patients who were scheduled for primary or revision knee arthroplasty with AGC-2000 components or unicompartmental knee arthroplasty with AGC-1500 components. After anesthesiologic assessment the patients were randomly allocated to receive either general anesthesia (Group G) or epidural anesthesia followed by postoperative epidural blockade with local anesthetics (Group E). Excluded from the study were patients with previous thromboembolic disease and patients on drugs with antithrombotic action. The study was approved by the local ethics committee, and informed consent from the patients was obtained.

Thirty-six patients entered the study. The groups were comparable as regards sex, age, duration of operation, and risk factors except body-mass index, which was higher in Group G (Table 1). After allocation, 2 patients were excluded from Group G (1 phlebographic examination was not possible, 1 patient had dextran during the operation), and 5 patients were excluded from Group E (4 patients refused phlebographic examination, 1 had a failed epidural anesthesia and received general anesthesia).

Table 1. Patients randomized to epidural or general anesthesia in knee arthroplasty. Median (range)

	Epidural (*n* 18)	General (*n* 18)
Sex (F + M)	13 + 5	12 + 6
Age	70 (46–87)	65 (38–85)
Body-mass index*	25	28
Cardiac disease	3	2
Varicose veins	1	1
Duration of operation (min)	80 (55–105)	80 (55–100)

* $p = 0.04$

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Group G. Anesthesia was obtained with thiopental/diazepam/fentanyl. Muscle relaxation was achieved with pancuronium. Following endotracheal intubation, nitrous oxide/oxygen was administered. For postoperative pain relief, ketobemidon (Ketogan®) was administered intramuscularly and ketobemidon and paracetamol orally.

Group E. Epidural blockade was achieved with 2 percent mepivacain (Carbocain®) injected via a lumbar epidural catheter. If necessary the patients were sedated with diazepam. During the first 3 days after the operation, 0.25 percent bupivacain (Marcain®) was administered via the epidural catheter using an infusion pump and starting at a rate of 5 mL/h. A sensory blockade of 4 to 6 dermatomes was intended, but in order not to impede early, active knee mobilization, motor function of the opposite leg was assessed and the infusion rate adjusted, securing a positive straight leg test and active knee motion. Paracetamol and ketobemidon were administered if further pain relief was required.

Knee mobilization was started the first postoperative day and included quadriceps exercises and active knee mobilization with full weight-bearing from the second postoperative day. Suction drains were removed when the secretion ceased, and the quantity of blood that accumulated in the suction bottles was recorded.

All the patients wore thigh-length, graded compression stockings (Comprinet®, Beiersdorf) on the contralateral leg from before the operation until full ambulation and calf-length graded compression stockings on the operated on leg from immediately after the operation until full ambulation.

For detection of thrombosis, bilateral ascending venography (Omnipaque®, Nyco Med) visualizing the entire deep-vein system of the leg and pelvis was performed on the 10th (9–11) postoperative day. The venograms were interpreted by radiologists who were uninformed about the anesthetic regimen. The venograms were positive if a constant intraluminal filling defect was seen in at least one projection (Rabinov and Paulin 1972).

The Mann-Whitney *U*-test and Fisher's test were used for the statistical analysis.

Results

Deep venous thrombosis was detected in 10/16 patients in Group G compared with 2/13 patients in Group E ($P < 0.05$). In all except 2 patients the thrombi were located in the operated on leg, with seven in calf veins and three in femoral veins in Group G versus one each in calf and popliteal veins in Group E. The median total volumes of drain collections in Groups G and E were 990 (195–3,275) mL and 1,060 (340–1,940) mL, respectively ($P > 0.4$).

There was no correlation between the occurrence of thrombosis and body-mass index in Group G ($P = 0.4$).

Discussion

Our observations confirm the protective effect of continuous epidural, lumbar blockade against deep venous thrombosis, even in operations performed with a tourniquet.

Epidural blockade has a beneficial influence on major factors of the triad of Virchow. Modig et al. (1980) assessed the blood flow in the lower extremities during hip arthroplasty performed under general or epidural anesthesia. Higher arterial inflow, venous emptying, and venous capacity were found in patients receiving epidural anesthesia. The fibrinolytic potential was enhanced (Modig et al. 1983). Finally, local anesthetics inhibited platelet aggregation (Borg and Modig 1985). In consequence, the anesthetic technique should be specified and standardized in clinical trials concerning prophylaxis against deep venous thrombosis after hip and knee replacement.

Impaired motor function, which may impede early active mobilization, is a drawback of postoperative epidural local anesthetics. We currently adjusted the infusion rate and used bupivacain, which in dilute solution provides good sensory blockade with little motor block (Bromage 1978).

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