Anticoagulation Following Placement of Epidural and Subarachnoid Catheters: An Evaluation of Neurologic Sequelae

Tadikonda L. K. Rao, M.D.,* and Adel A. El-Etr, M.D.†

The incidence of neurologic complications arising from anticoagulant therapy, following epidural and subarachnoid catheterization in 3,164 and 847 patients, respectively, was determined. Twenty patients experienced minor neurologic complications or low back pain which was self-limiting and resolved with time. There was no incidence of peridural hematoma leading to spinal cord compression. This investigation shows that the occurrence of symptomatic hematomas following anticoagulation in patients with epidural or subarachnoid catheters is a very rare complication, assuming proper patient selection, anatraumatic technique, and appropriate monitoring of anticoagulant activity. (Key words: Anesthesia: regional. Anesthetic techniques: epidural, continuous; subarachnoid, continuous. Blood: anticoagulants, heparin. Complications: hematoma, peridural; neurologic.)

The use of epidural or subarachnoid analgesia is contraindicated in patients who are already receiving anticoagulant therapy, as they may bleed into the peridural or subarachnoid space if the needle traumatizes one of the blood vessels. However, controversy still exists whether epidural or subarachnoid catheters can be inserted in patients prior to anticoagulation therapy. Occasional case reports have documented the occurrence of peridural hematomas leading to transient or permanent neurologic damage in patients who received anticoagulants following catheterization of the epidural space; however, the incidence of this major complication is unknown. In this investigation, the incidence of neurologic complications arising from anticoagulant therapy following epidural or subarachnoid catheterization in 4,011 patients was determined.

Materials and Methods

From January 1973 to December 1978, a total of 5,317 patients were scheduled for lower extremity peripheral vascular surgery in two hospitals. Patients with a history of leukemia, hemophilia, blood dyscrasias, thrombocytopenia or preoperative anticoagulation therapy were excluded from the study. Of the remaining 4,910 patients, 4,015 gave informed consent for regional anesthesia and to participate in the study. There were 2,654 males and 1,361 females included in the study. Of the 4,015 patients, 3,164 had continuous epidural anesthesia and 847 had continuous spinal anesthesia. In four patients, the regional technique was abandoned. The patients ranged in age from 42 to 73 years (mean = 61 years). All the patients underwent a clinical neurologic examination, including cranial nerves, by the anesthesiologist and a laboratory hemotologic screening prior to surgery. Hemotologic screening included hemoglobin level, hematocrit, platelet count, prothrombin time and partial thromboplastin time.

Preoperative medications were ordered according to the anesthesiologist's preference. Upon arrival in the operating room, an intravenous infusion was started and patients were monitored according to need; minimal monitoring included a lead II ECG, a chest stethoscope and a blood pressure cuff. The patients were placed in a lateral decubitus position and the back was aseptically prepared and draped. A 17-gauge Touhy needle was used to reach either the peridural or subarachnoid space. After proper identification of the space, a catheter was threaded 1–2 cm beyond the tip of the needle. If frank blood was aspirated anytime during the procedure, the technique was abandoned and the patients were rescheduled for surgery under general anesthesia on the following day. The local anesthetic used for peridural block varied according to the anesthesiologist's choice; for subarachnoid block all patients received 0.5 per cent hyperbaric tetracaine. Epinephrine 1:200,000 was variably used in the peridural blocks according to the anesthesiologist's choice. Epinephrine was not used in the subarachnoid blocks. Hypotension was avoided or treated...
promptly either by appropriate volume replacement or intravenous ephedrine as required. Prior to anticoagulation therapy, baseline activated clotting time was measured. Intraoperatively, about 50 to 60 min after performing the regional block, heparin was administered to the patients in 500 unit incremental doses every 3 min to maintain their activated clotting time at approximately twice the baseline value. The heparin dose was repeated every 6 h, following measurement of the activated clotting time, throughout the period of anticoagulation therapy. At the end of surgery, patients were transferred to the recovery room with the catheters in place to be used as needed for pain relief, sympathetic blockade or repeat anesthesia for those patients returned to the operating room for reexploration of the vessels. Twenty-four hours after insertion, the catheters were removed 1 h prior to the administration of the maintenance dose of heparin. The patients were evaluated after operation by the anesthesiologist for any neurologic complications.

Results

In four patients, following insertion of the needle in the epidural space, blood was freely aspirated. The needle was withdrawn and the patients were given general anesthesia on the following day. After operation, none of these patients developed complications. The mean control activated clotting time was 78 ± 28 s (± SEM) and following heparin administration was 174 ± 30 s. The mean dose of heparin required was 2,600 (±400) units every 6 h. In patients receiving epidural anesthesia, 804 received 1.5 per cent lidocaine, 1,129 received 1.5 per cent mepivacaine, and 1,231 received 0.75 per cent bupivacaine. Eipinephrine 1:200,000 was given to 210 patients in the lidocaine group, 806 patients in the mepivacaine group, and 624 patients in the bupivacaine group.

Four patients in the epidural group experienced paresthesias in the thigh and leg 3 to 4 days following removal of the catheter; these completely resolved within three weeks. One patient in the spinal group complained of numbness on the anterolateral aspect of the thigh on the third day after operation and examination revealed loss of sensation to touch and pin prick. This did not resolve until six months following surgery. Fifteen patients of which nine were in the epidural group and six in the subarachnoid group, complained of low backache on the third to fourth day after operation which completely resolved following analgesic therapy. No patient developed any symptoms or signs of epidural or subarachnoid spinal cord compression.

Discussion

Spinal epidural or subarachnoid hematoma can occur either spontaneously or following anticoagulation therapy without trauma. Twenty-five per cent of spontaneous spinal epidural hematomas are associated with anticoagulation therapy. In the published case reports of hematoma formation following insertion of continuous epidural catheters in patients who subsequently receive anticoagulants, the clotting time was usually not monitored. When the clotting time was monitored, heparin was administered without regard to the measured clotting time. Because of these case reports, controversy exists whether patients who might be administered anticoagulants during operation should receive continuous peridural or subarachnoid block. In the present series, insertion of the catheter did not cause any major neurologic complications.

The reasons for the absence of peridural hematoma in the present series may be first, that patients with a history of leukemia, thrombocytopenia, hemophilia or continued anticoagulant therapy were not given the continuous regional block. Second, administration of heparin was monitored throughout the perioperative period by activated clotting time and, thus, administration of excessive heparin was avoided. For peripheral vascular procedures, only lower levels of anticoagulants (activated clotting time of 130 to 150 s) are needed. Since the levels of Antithrombin III vary individually, the heparin requirements also vary individually and can be correctly predicted only by monitoring the activated clotting time.

Another important consideration may be the timing of the catheter removal. If the catheter is removed within 1 h prior to the administration of the next dose of heparin, the circulating heparin levels should be relatively low, thus minimizing the chance of bleeding into the epidural space.

Minor self-limiting neurologic complications like paresthesias and anesthesia in the lower extremity, as occurred in five of our patients, may be due to direct trauma to nerve roots either by the catheter or the needle or due to the operative procedure itself. Similar complications have been reported in a large series of epidural anesthetics, but complete recovery usually occurs within a few weeks to months. Patients who complain of backache should be closely observed, since backache may be the initial complaint with onset of a peridural hematoma.

Another important consideration in avoiding neurologic complications is the maintenance of arterial pressure at near normal levels. Hypotension may lead to thrombosis of the anterior spinal artery and severe neu-
rologic complications. Other possible causes of neurologic
deficit include arachnoiditis, trauma, and inadvertent injec-
tion of toxic material.

In conclusion, proper patient selection, atraumatic technique, monitoring of anticoagulant activity and re-
moval of the catheter when the circulating heparin level is low should minimize the occurrence of spinal epidural
or subarachnoid hematoma following anticoagulant ther-
apy in patients with peridural or subarachnoid catheters.

References
1. Bromage PR: Epidural analgesia. Philadelphia, W. B. Saunders,
1978, pp 240
2. Gingrich TF: Spinal epidural hematoma following continuous
4. Helperin SW, Cohen DD: Hematoma following epidural anes-
5. Janis KM: Epidural hematoma following post-operative epidural
6. Varkey GP, Brindle GF: Peridural anesthesia and anticoagulant
during anticoagulant therapy. Arch Intern Med 114:103–107,
1964
9. Williams WJ: Hematology, “Part IV—Hemostatis.” New York,
McGraw-Hill, 1972, pp 998–1266
10. Lund PC: Peridural anesthesia—a review of 10,000 administra-
11. Gutterman D: Acute spinal subdural hematoma following lumbar
from hematoma after lumbar puncture: A consequence of ant-
icoagulant therapy. JAMA 235:529–530, 1976