tiveness of surgery on the treatment of acute spinal cord injury and its relation to pharmacological treatment. Neurrosurgery 35:240–249, 1994), but the impact was not examined for patients in the NASCIS III trials. The conclusion was reached that patients who underwent surgery were a selected and therefore skewed subgroup, but that surgery most likely did not influence the statistical reliability of the NASCIS II study. The report did conclude that surgical intervention may have an impact on the outcome of spinal cord injury. Therefore, this represents yet another potentially confounding variable in both trials.

The NASCIS studies were funded in part by the manufacturers of methylprednisolone. Dexamethasone also has a proven ability to scavenge free radicals, and there is experimental data to suggest that it also can be important in the treatment of spinal cord injury. To date there have been no comparison studies of which I am aware which would show that this commercial competitor to methylprednisolone is less effective, equally effective, or perhaps more effective than methylprednisolone in this application.

**RESPONSE:** I share Dr. Wilkinson’s concerns about methylprednisolone (MP) therapy. There is risk involved any time trial results are extrapolated into patient groups excluded from a study protocol. It is not unreasonable to expect that patients with diabetes and hypertension may demonstrate a higher incidence of complications from MP therapy in the setting of acute spinal cord injury (SCI). As Dr. Wilkinson points out, many of us feel compelled to indiscriminately prescribe MP for all individuals with SCI, assuming the risks are small. Charged with making decisions that are best for our patients, this may certainly be an unfair assumption.

Dr. Wilkinson also notes that time should be considered as a continuous variable (hours, minutes, seconds) rather than a categorical variable (≤8 hours, >8 hours) in the search for an interaction with MP therapy. Such a comparison could better elucidate a formal dose-response curve. Dr. Bracken has argued that the subanalysis of NASCIS II was based on a median time-to-treatment of 8.5 hours. A total of 487 patients were entered into the NASCIS II study; analysis of a true median time-to-treatment would assign 50% of patients (244 of 487) before an 8.5 hour cut-off and 50% after. We are not privileged to know the results of this particular comparison. Instead, a cut-off of 8 hours was somehow chosen, allowing for only 38% of patients (183 of 487) to be included in the post-hoc analysis. Any way one looks at it, the rationale behind an 8-hour window for MP therapy is obscure, uninformative, and suspicious for a random event.

Surgical intervention was not controlled within either of the NASCIS protocols, and certainly may be a confounding variable. Dexamethasone may indeed be at least as effective (or as ineffective) as methylprednisolone in acute SCI. However, if Dr. Wilkinson will permit me, perhaps an even more important concern needs to be addressed: given our serious reservations about safety and efficacy, why do so many of us continue to prescribe MP as a treatment for our SCI patients?

**Morphine Nerve Paste**

**TO THE EDITOR:** Morphine nerve paste (MNP), which provides immediate and long-term pain relief after lumbar surgery, is only indicated for use in lumbar discectomy and in lumbar decompression for stenosis. These were the only indications when the paste, its components, and its method of application were first described. The quantity of MNP used is equal to the volume of lamina and disc removed. Small laminotomies for disc rupture require less paste than multilevel laminectomies, and in each instance the paste fills the bone opening to the level of the dorsal surface of the adjacent lamina. The paste is also indicated for previously operated extradural scar cases, provided that the scar constricting the nerve root can be surgically removed. Adhesive lumbar radiculopathy is a variant of acquired stenosis. Morphine nerve paste was designed as a chemical adjunct to thorough nerve root decompression achieved by microneurosurgical technique. The paste is best used in cases of severe sciatica and neurogenic claudication. It was not designed as a remedy for back pain, which has causes more numerous than nerve roots compromised by disc rupture or stenosis. Back pain is often not a prominent feature in sciatic radicular pain that spreads down the leg from the buttock.

For best results MNP is applied after thorough nerve root decompression. Excessive bleeding must be avoided to observe clearly the nerve root and protect its blood supply. Removing the ruptured disc takes mechanical pressure off the nerve root, but the bipolar coagulation that accompanies excessive bleeding may result in nerve root ischemia or edema and set the stage for subsequent hypertrophic epidural scarring. Excessive bleeding can be a factor in dural tears, observed or unobserved. The use of MNP should be avoided whenever excessive bleeding is encountered, and MNP should not be applied when the dura exhibits a tear, even when the dural rent has been surgically repaired. Meticulous attention to surgical decompression, hemostasis, and dural integrity enhances results. The application of MNP in such cases provides immediate gratification after weeks or months of unrelenting sciatica. No narcotic agents are required in the postoperative period, as patients manage well with acetaminophen or without analgesics. The good effect of the MNP lasts 4 to 6 weeks, which is exactly the period when postoperative lumbar patients would otherwise experience variable discomfort and limitations.

Contraindications to MNP include a history of allergy to morphine or steroids, evidence of spinal infection, and need for spinal instrumentation. Instrumented cases, with plates, screws, or cages, constitute foreign bodies. Instrumented fusion cases typically involve substantial blood loss and increased risk of infection. Patients sometimes require drains that reduce the efficacy of the MNP. The paste should not be used in cervical spine cases, because of the proximity of respiratory centers. Respiratory depression due to the narcotic effect does not occur when MNP is used in lumbar laminectomies. Diabetes is a relative contraindication to the use of the paste because of increased risk of infection. Other contraindications to the use of MNP include those instances in which elective lumbar surgery typically results in inferior or outcomes, such as in patients with morbid obesity, drug addiction, and secondary gain.
The MNP technique involves the following steps. Two ml (1 μg) of Duramorph (morphine sulfate preservative free) is mixed into one small package of Avitene (microfibrillar collagen hemostat); 2 ml (80 μg) of Depomedrol (methylprednisolone acetate) is added; and 2 ml (500 μg) of Amicar (aminocaproic acid) is added to complete the MNP. The paste is thick enough to prevent the too-rapid escape of its mixed components from the local epidural space at the lumbar operative site. The paste passes downward through the opened annulus if a ruptured disc has been removed. At body temperature the paste will pass into the epidural space anterior to the dural tube, and around the nerve root after foraminotomy, as well as dorsally at the laminotomy or laminectomy site. The paste is kept away from the lumbodorsal fascia and skin. Two to 4 μg of additional liquid Duramorph are injected through a tiny needle, after water-tight closure of the lumbodorsal fascia with continuous running suture. This liquid reservoir of added Duramorph prolongs the analgesic action of the paste, eliminates muscle spasm, and tests the water-tightness of the closure. Amicar prevents lysis of the epidural blood clot, thereby retaining the analgesic chemicals at the local laminectomy site. Depomedrol has both an antiinflammatory and analgesic action. The peripheral ends of nerves are pain-sensitive nociceptors. These free nerve endings are present in a variety of tissues, both superficial and deep, including peristeum, ligament, and fascia.

The neurosurgeon must observe each step of the mixing process creating the MNP to ensure that no break in sterile technique occurs and to check the ingredients and dates, etc. The MNP should not be mixed until it is ready to be applied. The patient has already received prophylactic intravenously administered antibiotics and wound irrigation. Long-acting 0.5% marcaine is generously applied in the superficial tissues, and all patients undergo operation in a state of general anesthesia. No epidural catheters are required. No patient-controlled analgesia is needed. Systemic effects of opiates, such as a respiratory depression, ileus, and general pruritis are avoided.


Abstract

Object. Pain control can often be improved by local (as opposed to systemic) application of analgesic and/or anesthetic medication. The purpose of this study was to evaluate the efficacy of a single-dose epidural analgesic “paste” in the control of postoperative pain in patients who have undergone lumbar decompressive surgery.

Methods. Sixty patients undergoing routine elective lumbar decompressive surgery were randomized in a double-blind fashion to one of two groups: those receiving active paste or placebo paste. The paste was applied to the exposed dura at the time of surgery, just prior to wound closure. Patients received follow-up care in the hospital and at home for 3 months postsurgery. Several outcome measures were studied to ascertain differences in pain control and to ensure comparability between groups. Patients who received active paste demonstrated significantly lower pain scores compared with those who received placebo paste for up to 6 weeks postoperatively. General health perception indexed by the Short Form 36 was also significantly better in patients who received active paste for up to 6 weeks. In-hospital and outpatient oral narcotic consumption was significantly lower in the active paste-treated group. Inpatient straight leg raising scores were improved in those patients who received active compared with control paste.

Conclusions. Application of an analgesic paste directly to the epidural space during lumbar decompressive surgery significantly improves postoperative pain control, reduces prescribed analgesic drug consumption, and improves overall health perception for up to 6 weeks following surgery. The authors conclude that this postoperative pain control strategy is both effective and safe and may provide a new standard of pain management in patients undergoing lumbar discectomy or laminectomy.

They concluded that “Application of an analgesic paste directly to the epidural space during lumbar decompressive surgery significantly improves postoperative pain control, reduced prescribed analgesic drug consumption, and improves overall health perception for up to 6 weeks following surgery. The authors conclude that this postoperative pain control strategy is both effective and safe and may provide a new standard of pain management in patients undergoing lumbar discectomy or laminectomy.

The best outcomes are obtained with initial lumbar surgeries for disc rupture. The immediate end to the relentless agony of sciatica is truly nirvana to those who have suffered from the damaged roots of the largest nerve in the human body.

Charles W. Needham, M.D.
Norwalk, Connecticut

Reference


Response: We thank the Journal of Neurosurgery for allowing us to respond to Dr. Needham’s letter, which emphasizes the indications, contraindications, and techniques for the administration of MNP. The use of MNP was conceptualized and first described by Dr. Needham.

We agree that the selection criteria for patients to receive MNP is particularly important. Our general indication for MNP administration has been any patient undergoing lumbar decompressive surgery for degenerative (nonneoplastic, noninfectious) disease in whom the dura is exposed and fusion/instrumentation is not performed. Essentially, this represents the bulk of patients undergoing surgery for discectomy or laminectomy. It is important to reemphasize that we too have, so far, been reluctant to use MNP where a cerebrospinal fluid leak is either known or suspected. Our concern lies in the potential of respiratory compromise from even small doses of intrathecal morphine. Reluctance to use MNP in the setting of instrumented fusion arises from a lack of clinical experience, and at least a theoretical concern that the mixture might somehow (through mechanical or biochemical means) interfere with osteogenesis. Clearly, more research would be welcome in this area.

Although there has been concern raised that epidural methylprednisolone may predispose to epidural abscess formation,1–3 we did not find a deep-seated infection in any of the originally reported 60 patients nor have we seen a single instance of this in more than 110 patients prospectively studied as part of an ongoing study shared between our institutions. Formulation and administration of the paste is critical. We have continued to prepare and deliver MNP essentially as described by Needham. Our only modification has been to omit the injection of additional morphine through the fascia after closure. Instead we choose to mix this into the paste prior to subfascial application.