Local Steroid Application for Early Postsurgical Lumbar Discectomy Pain Relief

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ABSTRACT

Background: Edema and inflammation of the nerve root because of its handling are responsible for creating postoperative uncomfortable situations for many patients. Several adjuncts to lumbar discectomy procedure to reduce nerve root inflammation have been studied in literature.

Objective: The purpose of this study was to evaluate the efficacy of local application of gelfoam soaked with low-dose Depo-Medrol (methylprednisolone) on the affected nerve root, in controlling early postoperative pain following lumbar discectomy surgeries.

Patients and Methods: Thirty patients with single level lumbar disc prolapse candidate for discectomy were randomly allocated in 2 equal groups (n=15), group A (steroid group) and group B (control group). After performing a standard hemipartial laminectomy and discectomy and before the closure of fascia at the end of surgery, a gelfoam soaked with 40 mg methylprednisolone acetate was left on the decompressed nerve root in the steroid group and a saline soaked gelfoam was applied to the nerve root in the control group. Postoperative back and radicular pain intensity was assessed by a visual analogue scale (VAS) before and at 24, 48 hours and 1 week after surgery.

Results: There were no statistical difference in back and radicular intensity between the two groups preoperatively and at 24 hours postoperatively. However, the difference became significant between the 2 groups at 48 hours postoperatively and at final follow-up after 1 week which suggests that after first 24 hours the pain relief in the steroid group was significant compared to the control group.

Conclusion: Local application of low-dose steroid alone can sufficiently reduce the postoperative back and leg pain effectively after 48 hours and at 1 week follow up.

INTRODUCTION

Lumbar disc prolapse is one of the most common causes of lower back and radicular pain. Discectomy, after failure of conservative treatment, significantly relieves back pain as well as radicular symptoms. However, residual back pain and radicular leg pain are not uncommon following discectomy. This pain may vary in intensity and it can cause significant postoperative disability.1

Edema and inflammation of the nerve root because of its handling are responsible for creating uncomfortable situations for many patients and may increase the postoperative requirement of anti-inflammatory analgesics or morphine derivatives and exposes the patient to side effects related to these medicines. Reduction of inflammation and edema of the affected nerve root should reduce the postoperative pain intensity.1

Because each tissue in the back is innervated, in theory any of these can be responsible for pain.2 The dura mater is innervated primarily by the sinuvertebral nerve, but is also innervated by the nerve plexus of the posterior longitudinal ligament and the nerve plexus of radicular branches of segmental arteries. The sinuvertebral nerve is primarily a sympathetic nerve and courses in a cephalic and caudal direction up to 4 segments. This results in considerable overlap of innervations between adjacent segments and count for the multiple pain sites of the dural adhesion.3 The anterior region of the dura mater is densely innervated, while the posterior region of the dura is sparsely innervated4.

Dural pain is described as funicular pain; diffuse, poorly localized, burning sensation or abrupt stabbing pain. It is not radicular in distribution but rather involves unilateral or bilateral limbs, trunk, or entire body. Pain or paresthesia is associated with prolonged sitting or flexed positions3.

Immunohistochemical studies of the dura mater have illustrated a significant number of nociceptive fibers5. Clinical experiments have demonstrated that the ventral dura is sensitive both to mechanical and chemical stimulation6,7. Numerous studies point to the particularly noxious effect on the dura by inflammatory material produced by injured disc8,9,10.

In conclusion, it could be said that “the mechanism of discodural interactions is a conflict between an inert and mostly painless structure (nucleus and inner part of the annulus) and a pain-sensitive duraligamentous complex (outermost rim of annulus, posterior...

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longitudinal ligament, dura mater and dural ligaments), all innervated by the sinuvertebral nerves\textsuperscript{11}.

**PATIENTS AND METHODS**

**Patient population**

Our study included patients who had single lumbar disc herniation presenting with unilateral leg symptoms and back pain, after a period of failed conservative period not less than 4 weeks. The patients were operated upon during the period between March 2013 and March 2014. The Visual analogue scale (VAS) pain measurement was recorded for all patients preoperatively.

We excluded the patients who had bilateral radicular symptoms, disc involvement at more than one level, level above L4–5, chronic disc disease, neurological deficit at the time of operation.

None of the patients had any systemic illness, diabetes mellitus, or previous back surgery.

This prospective randomized control study included 30 patients which were randomly allocated in 2 equal groups (n=15), group A (steroid group) and group B (control group). Randomisation was performed immediately before surgery by opening a sealed envelope with a note inside indicating to which group the patient was assigned.

Ten males and five females were included in the steroid group and seven males and eight females in the control group (Figure 1).

The average duration of symptoms before surgery was 6.5 weeks (3–11 weeks range) for the steroid group and 6.6 weeks (4–10 weeks range) for the control group. One patient in the steroid group was operated before 4 weeks of conservative management because of severe incapacitating pain.

**Operative technique**

All patients were operated upon by microdiscectomy in the same way. The patients were placed in the prone position after general anaesthesia. A 3–5-cm midline incision was made over the proper segment determined by fluoroscopy. No skin or paraspinal muscle infiltration was made before the incision. Paraspinal muscles were unilaterally stripped from the spinous process and lamina of the vertebra on the side of herniation with the help of cautery. Interspinous and supraspinous ligaments remained intact in all procedures. After unilateral flavectomy, the herniated disc was approached by retracting the nerve root medially and was removed. Following haemostasis, a 3 cm×2.5cm Gelfoam soaked with 40 mg methylprednisolone acetate was left on the decompressed nerve root in the steroid group. In the control group, saline soaked Gelfoam was applied to the nerve root. The wound was closed over a 12 french sized subfascial suction drain which was removed after 24 hours.

**Postoperative evaluation**

No patient from either group received any steroid formula to relieve the postoperative symptoms either in the form of oral or systemic application. None of the patients in the entire study group received any muscle relaxant or morphine derivatives for postoperative back or leg pain.

Postoperatively, pain was controlled with a fixed dose of non-steroidal anti-inflammatory NSAIDS drug (Diclofenac sodium 75mg twice daily) for the first 2 days only to maintain the uniformity of the study. Upon discharge Piroxicam 20 mg once per day orally was prescribed for one week.

Postoperatively, the patients in both groups were asked to grade their back and leg pain intensity and VAS score were recorded after 24 and 48 hours postoperatively and after 1 week. The pain intensity was graded from 0 (no pain) to 10 (most severe pain). All patients were encouraged to walk immediately postoperatively. We compared VAS scores between control and steroid groups using unpaired t test. P values less than 0.001 were considered statistically significant.
RESULTS

Our results showed no statistical difference between the two groups according to age (p=0.108) nor according to duration of symptoms (p=0.898) at the time of operation.

Preoperatively the mean VAS in the steroid group was 7.8 and 7.4 in the control group with no statistical difference between the two groups (p=0.552). Postoperatively at 24 hours, the mean VAS score was 2.6 in the steroid group and 3.5 in the control group showing significant relief of pain in both groups compared to the preoperative status. However, there was no statistically significant difference between both groups in VAS score recorded 24 hours postoperatively (p=0.00178). However, the difference became significant between the 2 groups at 48 hours postoperatively (p=0.00035), and at final follow-up after 1 week (p=0.00026) which suggests that after first 24 hours the pain relief in the steroid group was significant compared to the control group (Figure 3).

None of the patients showed VAS score more than 5 during the entire postoperative follow-up period. However, no obvious complications were noted postoperatively in either group in the form of infection or neurological deficits. There were no dural tears or CSF leaks intra-operatively.

DISCUSSION

As both compression and inflammatory edema of a nerve root is the cause of symptoms in lumbar disc herniations, literature shows that improvement in clinical symptoms is best correlated with a decrease in the inflammation and swelling of the affected nerve root. This indicates that a patient cannot be completely relieved of back or leg pain even after successful removal of the herniated disc because discectomy cannot reduce edema and inflammation immediately after operation.

Perioperative use of corticosteroids and bupivacaine has been reported as effective analgesia and decreases opioid or analgesic use without complications. Local or systematic use of various steroids is described in the literature in lumbar disc patients. Wound infiltration with an anaesthetic agent before the skin incision is also a way of reducing postoperative back pain. All the modalities aim at mobilising the patient early and reducing the disability. However, use of these methods in high doses predispose to the risk of postoperative infections. In our study, we didn't apply any of the previous modalities, and used local application of low dose steroids as the only modality in pain control measures.

Debi et al. reported the effectiveness of epidural steroids to reduce pain following lumbar disc surgery in a prospective randomized clinical study. Their study included Sixty-one patients undergoing lumbar discectomy. They used a 80 mg of methylprednisolone-soaked collagen absorbable sponge in the study group and 2 ml saline-soaked collagen absorbable sponge in a control group over the affected nerve root after discectomy. They reported statistically significant back pain relief on postoperative days 1, 2, 6, and 14 in the study group (the group that received steroids) with no difference found 1 year after surgery or when leg pain was compared. Also they reported no observed side effects related to the steroids used. In our study we used a VAS for both leg and back pain which was significantly lower in the steroid group after 48 hours and 1 week postoperatively. The second difference is that we obtained similar improvement in back pain as well as radicular leg pain with 40 mg of methylprednisolone (half the dose) soaked absorbable gelfoam.

Lotfinia et al. evaluated the use intra-operative use of epidural methylprednisolone or bupivacaine for postsurgical lumbar discectomy pain relief. At the end of the surgery, before the closure of fascia, 40 mg methylprednisolone with 3 mL normal saline for group 1, 2 mL bupivacaine 5% with 2 mL normal saline for group 2 and 4 mL normal saline for group 3 were instilled onto the epidural and exposed nerve root. They reported no significant difference in back and radicular pain intensity between the three groups at 24, 48, 72, and 96 hours after surgery. The main difference in this study is that they didn't maintain the medications over the affected nerve root by using the soaked gelfoam and medications were instilled epidurally with the potential to rapidly redistribute and escape from the spinal canal or the affected nerve root.

Gibsons et al. evaluated postoperative lumbar discectomy pain control using an epidural gelfoam soaked with methylprednisolone acetate (40-80 mg) and 2 to 4 mg of preservative-free morphine. Their study included 45 patients. They reported that on the first post-operative day (POD) of surgery, 18 patients (40%) did not require any postoperative analgesics; on POD 2, 22 patients (49%) did not require analgesics. Six patients (13%) received parenteral narcotics; four (9%) received one dose only, and two (4%) had two or more doses. Thirty-one patients (68.9%) were discharged...
from the hospital on POD 2, and 10 (22.2\%) were discharged POD 2.They also reported good pain control at 1 and at 3-5 weeks follow up. However, three patients in their study needed bladder catheterization due to urinary retention. The long term analgesic effect of epidural morphine is associated with high incidence of side effects as reported in several studies in literature.\textsuperscript{21}\textsuperscript{22}\textsuperscript{23}\textsuperscript{24} Side effects include nausea and vomiting (incidence up to 46\% in one study),\textsuperscript{22} urinary retention (incidence up to 25\%)\textsuperscript{22} pruritis, anxiety and respiratory depression.\textsuperscript{22} In our study we didn't add morphine to the applied gelfoam because of the high incidence of its side effects, and secondly to evaluate methylprednisolone efficacy without the use of other local drugs.

**CONCLUSION**

Local application of low-dose steroid alone can sufficiently reduce the postoperative back and leg pain effectively after 48 hours and at 1 week follow up, after single level lumbar microdiscectomy.

The relief of symptoms in the early postoperative period helps patients with early mobilization and early return to their jobs.

However, we lacked the long term evaluation of this modality in this study.

**Declaration**

The author(s) declare no conflict of interest or any financial support and confirm the approval of the submitted article by the concerned ethical committee.

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