

Microlumbar Nerve Root Decompression and Fusion under Epidural and Local Anaesthesia – the St. Luke's Experience

Sevillano Paul Leonard, M.D., Ver Mario, M.D., Yap Antonio, M.D.,
Partahusniotojo Pangkuwidjaja, M.D., Gaddi Victor Felix S., M.D.
Philippines

ABSTRACT

In spine surgery, general anaesthesia with hypotensive technique has always been considered the best form of anaesthesia. However, for microlumbar nerve root decompression (MLNRD), it is better that the patient stays awake so that intra-operative assessment of the correct level of the pathologic lesion causing nerve root compression can be achieved. Hence it is necessary that lighter analgesia – 0.2% Ropivacaine – be delivered so that radicular pain can be elicited.

The objectives of the study are the following: to confirm that by doing MLNRD under epidural anaesthesia, patients with serious cardiac or pulmonary problems can be safely operated on; to confirm that the surgeon can verify the correct level of nerve root being decompressed intra-op; to confirm that more extensive surgical procedures such as instrumented fusion can be done; to confirm patients' improvement in pain and functional status; to confirm that patients had short hospital stay and early return to work.

A descriptive study of all MLNRD cases done under epidural and local anaesthesia from October 2000-October 2001 at St. Luke's Medical Center, Philippines. Pre-op assessment was made using Visual Analog Pain Scale (VAPS) and Roland & Morris Disability Questionnaire (RMDQ). Intra-op verification by the surgeon of the correct nerve root level was done by stimulation of the nerve root. Failure of epidural anaesthesia prompted administration of progressive local anaesthesia (surgeon). Post-op VAPS and RMDQ were assessed including ability to stand up from the operating table, ambulate, and loss of radiculopathy by SLR test. Surgeon's and patients' satisfaction with the anaesthesia and procedure itself were graded in percentage.

A total of 56 patients satisfied the inclusion criteria. Two of which, who had cardiac and pulmonary problems, were safely operated on; while fusion surgery was successfully performed on four patients – two instrumented, two non-instrumented. The surgeon was able to verify the correct nerve root level in all patients who were awake intra-op. Immediately post-op, all patients were able to stand up from the operating table with improvement in SLR. Mean improvement in VAPS was nine and in RMDQ 19. Mean number of hospital days for those under epidural alone was six and for those supplemented with local anaesthesia three days. Mean number of weeks to return to work or school was 2.175. Surgeon's satisfaction rated a mean of 90% while patients' satisfaction rated a mean of 94.3%. This study confirms the advantages of doing microlumbar nerve root decompression under epidural anaesthesia,

namely: (a) ability to safely perform surgery on patients with serious cardiac or pulmonary problems; (b) ability to confirm the correct nerve root level being decompressed; (c) ability to perform not just nerve root decompression, but also more extensive procedures like posterolateral fusion; (d) ability of the anaesthesiologist to give post-op analgesia via epidural catheter; (e) the improvement of patients' pain and functional status; (f) short hospital stay and early return to work or school; (g) the procedure being safe.

INTRODUCTION

Spine surgeons face increasing economic and social pressures to improve long term results, to shorten hospital stays, to hasten patients' resumption of a productive life, and to decrease the cost and compensation of back surgery.^{9,13} This entails the introduction and development of new surgical techniques, and one of the more significant breakthroughs is microlumbar discectomy or more properly termed microlumbar nerve root decompression (MLNRD). Open discectomy for lumbar disc herniation was always regarded as the gold standard as far as surgical management for herniated nucleus pulposus (HNP), until 1934 when Mixter and Barr reported about microlumbar discectomy as a conservative approach to the virgin herniated disc.¹⁰ Since then microlumbar discectomy or microlumbar nerve root decompression has been reported and the technique refined notably by Yasargil and Caspar in 1977 and Robert Williams in 1978. One of the most salient virtues of microlumbar nerve root decompression is its approach and versatility in treating contained and non-contained herniated discs, which facilitates foraminotomy, if the latter is necessary.^{9,13} Since the procedure is performed with a microscope, it allows the surgeon to decrease the surgical exposure, bone removal, and blood loss. Coupled with the accuracy of defining and locating the pathology by MRI, three-dimensional computerized tomography (CT) scan, and occasionally CT discography, microlumbar nerve root decompression has proven to be less invasive and less debilitating, which allows for safe, immediate ambulation and same-day discharge.

At present, microlumbar nerve root decompression is widely regarded as the "gold standard" which has replaced open discectomy for the surgical management of HNP. In spine surgery, general anaesthesia with hypotensive technique was always considered the best form of anaesthesia.⁹ Likewise for microlumbar nerve root decompression, general anaesthesia was always used in the pioneering reports of Williams and Caspar. In 1991, Kuslich came out with a study regarding 'The tissue origin of low back pain and sciatica'.⁸ In his paper, he reported on pain

response to tissue stimulation during operations on the lumbar spine using local anaesthesia. He concluded that the pain-generating areas of the spine are located on the facet capsule, nerve root, and the outer annulus of the intervertebral disc. Thereby, he utilized local anaesthesia to block these pain-generating areas, adding more local anaesthesia in increments of 1-2 cc as necessary. He termed this procedure 'Progressive local anaesthesia'. With this premise, a spine surgeon can safely do lumbar surgery on a patient who is awake at the operating table. Kuslich has proven this in numerous patients. One of the co-authors, (VM), has reported excellent results in a series of 200 patients operated on for one or two-level lumbar disc herniations using microlumbar nerve root decompression utilizing progressive local anaesthesia.

However, microlumbar nerve root decompression under local anaesthesia has not yet been proven to be as effective in more than two-level surgeries and other more extensive spine procedures. It might induce local anaesthetic toxicity with the injection of a large dose of local anaesthetic if done for multiple-level surgery. For the patient, the infiltration of a local anaesthetic might be uncomfortable, and not all patients would readily consent to it. Likewise it might be giving added stress to the surgeon who has to give the local anaesthesia properly, convince the patient that the pain of the needleprick in the induction of local anaesthesia is temporary, and subsequently operate on the patient who, after the consecutive needlepricks might be a bit too apprehensive already. Not to mention the fact that not all surgeons have the training and skill in infiltrating local anaesthesia correctly at these pain-generating areas of the spine.

So, parallel with these advances in surgical techniques, the anaesthetist's armamentarium of procedures should also be evolving. The introduction of regional blocks has achieved a lot in the field of anaesthesia and pain management and the application of these techniques continues to expand. No regional anaesthesia technique has been studied and used extensively as lumbar epidural nerve block. It has been found to be beneficial for acute pain originating from trauma, surgery, and likewise for chronic and cancer pain. Specifically, epidural anaesthesia brings with it the advantage of differential sensory and motor blockade, depending on its concentration. During surgery, a higher concentration at 0.5 – 1.0% produces complete sensory and motor block. However, for microlumbar nerve root decompression, it is better that the patient stays awake so that intra-operative assessment of the correct level of the pathologic lesion which causes nerve root compression can be achieved. This is done by asking the awake patient intra-operatively whether he feels radicular pain when the specific nerve root or the tissues around it is touched, since only a compressed nerve root can give rise to radicular pain. Hence it is necessary that lighter analgesia – a concentration of 0.2% - be delivered so that radicular pain can be elicited. This practically eliminates the error of doing surgery on the wrong nerve root level. Furthermore, in patients with pulmonary and cardiac problems for whom general anaesthesia is contraindicated, this lighter form of anaesthesia can be given and the microlumbar decompression can push through to relieve the patient of

severe back pain and sciatica. Theoretically, it would also allow more extensive procedures to be performed compared to local anaesthesia alone. This is what this research paper aims to describe and confirm.

OBJECTIVES

1. This research study aims to describe our experience with microlumbar nerve root decompression (MLNRD) with or without fusion in a patient who is under either epidural anaesthesia alone or epidural anaesthesia supplemented with local anaesthesia.
2. This paper aims to describe and confirm the theoretical advantages of doing spine surgery on an awake patient, specifically:
 - a. The possibility of doing spine surgery in patients who have serious cardiac or pulmonary problems, who otherwise would not be cleared for general anaesthesia.
 - b. The possibility of the surgeon confirming the correct level/ nerve root he is decompressing by asking the patient, who is awake during the procedure, if he feels radicular pain when the nerve root is touched.
 - c. That the procedure is safe, and allows for rapid recovery.
3. Furthermore, we would like to assess this procedure peri-operatively with regard to the following parameters:
 - a. Patient's post-op pain and disability status compared to pre-op using the Visual Analog Pain Scale (VAPS) and the Roland & Morris Disability Questionnaire (RMDQ)
 - b. Patient's comfort intra-op with regard to positioning and absence of pain during the procedure itself.
 - c. Surgeon's satisfaction intra-op with regard to patient's anaesthesia and the amount of manipulation or extensiveness of the procedure he can do with this type of anaesthesia.
4. Patient's immediate post-op pain status assessed using VAPS, his ability to stand up from the OR table, absence of radiculopathy tested by straight leg raising (SLR) or even ambulation immediately post-op.
5. Patient's functional ability post-op with regard to activities of daily living (ADL), and likewise using the RMDQ.
4. We would like to describe the theoretical limitation of this procedure – that if the epidural anaesthesia is not sufficient, the surgeon must have the knowledge and skill to administer progressive local anaesthesia
5. We would like to describe the patient's overall satisfaction with the procedure – specifically if he considers himself generally feeling better post-op, he recovered back his functional status, he had a short hospital stay, and that he would recommend this procedure to his relatives or friends.

METHODS

This is a descriptive study of all cases of microlumbar nerve root decompression with or without fusion under epidural anaesthesia alone or epidural anaesthesia supplemented by local anaesthesia done at St. Luke's Medical Center from October 2000 to October 2001.

A single surgeon experienced in microscopic spine surgery and who is at the same time knowledgeable at doing progressive local anaesthesia did all surgical

procedures. A single anaesthesiologist experienced in administering epidural anaesthesia handled all cases.

Inclusion Criteria

The cases reviewed involved all patients with low back pain and radiculopathy diagnosed, by x-ray and/ or MRI, to have either herniated nucleus pulposus (HNP), spinal stenosis due to facet arthrosis and/or foraminal stenosis, and spondylolisthesis. All patients included underwent microlumbar nerve root decompression with or without fusion, under epidural anaesthesia alone or epidural anaesthesia supplemented by progressive local anaesthesia.

Pre-Operative Evaluation

Prior to surgery, all patients underwent a baseline evaluation, which included a complete clinical history and physical examination, a self-assessment of their radicular and low back pain using the 0 – 10 cm Visual Analog Pain Scale (VAPS),^{10,12} where '0' represents absence of pain, and '10' represents the most excruciating pain each one in three degrees of intensity ('most severe', 'average', and 'least severe'); and the administration of a Roland Morris Disability Questionnaire (RMDQ)^{10,11} modified for self-assessment of activity-related radicular pain, which consists of 24 questions; one point assigned to each question checked as 'yes', for a maximum score of 24. (Table 1)

An informed consent was obtained from all subjects pre-operatively. Once on NPO, usually 6 hours prior to the surgery, an intravenous catheter was inserted and D₅NR administered at a rate of 30 drops/min. This was

maintained until the time of surgery. Prophylactic antibiotic was given using Cefuroxime 1.5gm/IV. At the OR, vital signs were noted. Blood pressure was then monitored at 5 minutes interval, with a Dynamapp, a non-invasive arterial blood pressure apparatus. Peripheral oxygen saturation by pulse oximetry and cardiac monitoring by ECG were taken initially and then continuously throughout the procedure.

Induction of Epidural Anaesthesia

Plain lactated ringer's solution at 10 ml/kg was given as preload before epidural insertion. Patient was placed on lateral decubitus position (Figure 1). Epidural insertion site was identified at three interspaces above the level of the proposed procedure. After local infiltration of the skin, a gauge 18 Touhy needle was inserted using the "Loss of Resistance" technique which entails that there is a sudden loss of resistance to injection of about 2 cc. of air from a glass syringe, just as the tip of the needle enters the epidural space.^{1,3,5,7} The bevel of the needle was directed cephalad and the catheter advanced up to approximately 4 cm into the epidural space (Figure 2). The catheter was aspirated to evaluate the possibility of an intrathecal or intravenous placement and then secured properly. Patient was then returned to the supine position. Epidural test dose was by administering 3 ml. of Lidocaine 2% with Adrenaline 1:200,000 (0.005 mg/ml). A test dose is designed to detect both subarachnoid injection and intravascular injection. If negative, Ropivacaine 0.2% was administered slowly and using 'incremental dosing' until analgesia was reached at

Table 1 : Modified Roland Morris disability questionnaire

1. I stay home most of the time because of my sciatica.
2. I change position frequently to try and get comfortable with my sciatica.
3. I walk more slowly than usual because of my sciatica.
4. Because of my sciatica, I am not doing any of the jobs that I usually do around the house.
5. Because of my sciatica, I use a handrail to get upstairs.
6. Because of my sciatica, I lie down to rest more often.
7. Because of my sciatica, I have to hold on to something to get out of an easy chair.
8. Because of my sciatica, I try to get other people to do things for me.
9. I get dressed more slowly than usual because of my sciatica.
10. I only stand up for short periods of time because of my sciatica.
11. Because of my sciatica, I try not to bend or kneel down.
12. I find it difficult to get out of a chair because of my sciatica.
13. My sciatica is bothersome almost all of the time.
14. I find it difficult to turn over in bed because of my sciatica.
15. My appetite is not very good because of my sciatica.
16. I have trouble putting on my socks (or hose) because of my sciatica.
17. I only walk short distances because of my sciatica.
18. I sleep less well because of my sciatica.
19. Because of my sciatica, I get dressed with help from someone else.
20. I sit down most of the day because of my sciatica.
21. I avoid heavy jobs around the house because of my sciatica.
22. Because of my sciatica, I am more irritable and bad tempered with people than usual.
23. Because of my sciatica, I go upstairs more slowly than usual.
24. I stay in bed most of the time because of my sciatica.

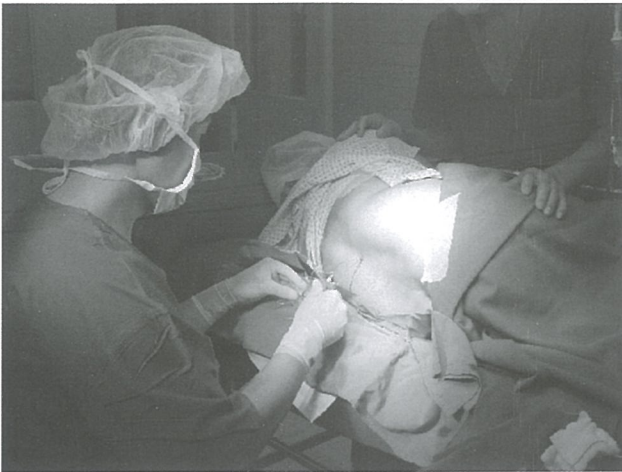


Figure 1. Induction of epidural anaesthesia

least two dermatomal levels above the approximated incision site by using the pinprick test. Straight leg raising and ability to stand were also observed before allowing the patient to kneel for the final position in surgery – the knee chest position using a modified Anderson seat (Figure 1). Mild sedation with titrated doses of Midazolam was given to apprehensive patients. Patients were kept awake intra-operatively and were even able to watch the microsurgery live by video connected to the operating microscope.

The surgeon again tested the adequacy of the analgesia by doing the pinprick test. If the analgesia was adequate, surgery proceeded; if inadequate, supplemental doses of Lidocaine 1% with epinephrine 1:100,000 by local infiltration was added. The specific pain-generating areas blocked were the facet capsule, nerve root, and the outer annulus of the intervertebral disc. The volume of the local anaesthetic was then recorded.

Microsurgical Nerve Root Decompression

A modification of the procedure described by Caspar and Williams was used.^{9,13} All patients were positioned in the knee-chest position using a modified Andrews seat (Figure 1). Proper level of the microlumbar decompression was identified with lateral x-ray using the two-needle technique. (Figure 2). An average of 2.5 cm. skin incision per level of microlumbar decompression was done. Incision was deepened to the subcutaneous tissue. At the level of the lumbodorsal fascia a curved incision was done about 1 cm. off the midline as recommended by McCulloh. A Williams self-retaining retractor was put in place. A

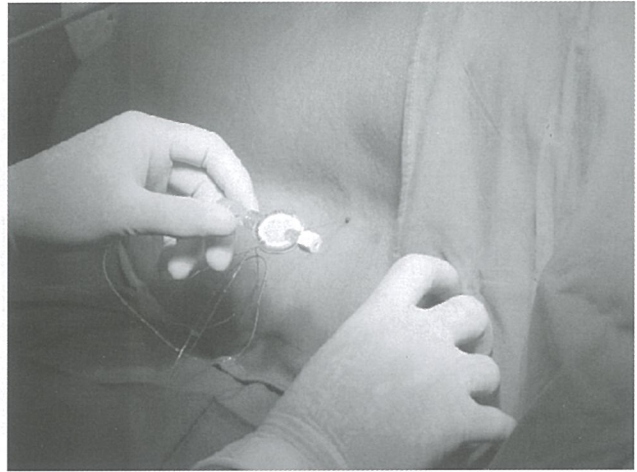


Figure 2. Epidural catheter insertion

Carl-Zeiss operating microscope was introduced into the operative field. Ligamentum flavum was sharply incised and removed. Epidural fat was protected and retracted.

Epidural veins were retracted when possible. If needed they were cauterized using bipolar electrocautery. When necessary, about 2 mm of the laminar edge was removed using Kerrison ronguers to expose the edge of the nerve root. Likewise, whenever necessary, a foraminotomy was done to ensure adequate decompression of the nerve root. In patients with facet arthrosis a limited hemifacetectomy was done using Kerrison ronguers. The nerve root was identified and carefully retracted. The correct level of the nerve root affected was confirmed by asking the awake patient if he experienced radicular pain upon touching the nerve root and the tissues around it.

When there was sequestered fragment with a hole in the posterior longitudinal ligament (PLL), it was delivered carefully with a hook, grasped, then removed with a pituitary rongeur. If there was no hole, a small hole was started with a no. 11 scalpel at the disc annulus. The hole was bluntly dilated enough to deliver the fragmented disc material. An up-cut rongeur was used to reach the midline, and a down-cut rongeur was used to reach into the foramen laterally. Two ball-tipped hooks 2 mm and 4 mm were used to reach across to the midline and out to the foramen to search for loose fragments and to ensure that the involved nerve root was adequately decompressed. Any bleeding was stopped with a bipolar coagulator and bone bleeding with bone wax. Washing of operative wound was done with NSS. The wound was closed in layers and the skin subcuticularly.



Figure 3. Knee-chest position using a modified Andrews seat

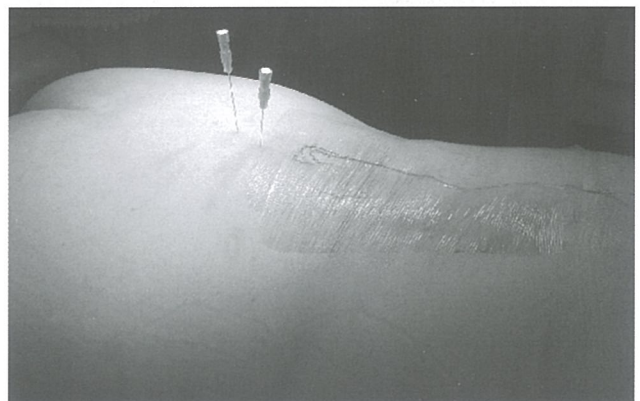


Figure 4. Two-needle technique of x-ray localization of level

Drainage was not necessary because blood loss was minimal. Tegaderm dressing was applied.

The surgeon was then asked whether he was satisfied with the anaesthesia given and the amount of manipulation and the extensiveness of the procedure that he was able to do. The surgeons level of satisfaction was recorded in percentage.

Post-operative Evaluation

Immediately after the surgery and still in the operating room, the patient was again assessed for his ability to stand and ambulate, SLR test was done, and the VAPS score was assessed. Patients were brought straight to their rooms without having to pass through the recovery room. Patients were sent home average of three to six days post-op on oral analgesics and antibiotics. At home, in an average of one to two weeks post-op, the Roland-Morris Disability Score was again assessed by telephone interview. Likewise, the patient was asked if he considered himself better in general

Table 2. Demographic characteristics of subjects

Gender	N	Mean Age
Males	30	44.63 (range 19-71)
Females	26	50.00 (range 18-84)
Total	56	47.32 (range 18-84)

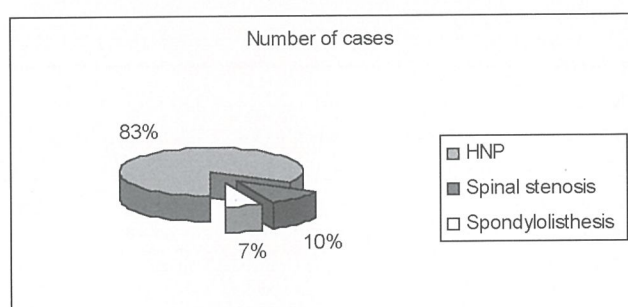


Figure 3. Diagnosis of subjects

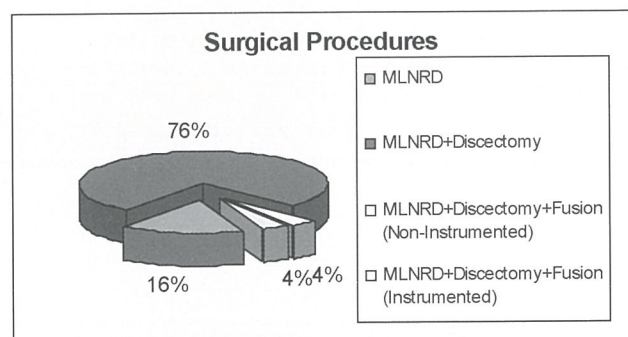


Figure 4. Surgical procedures

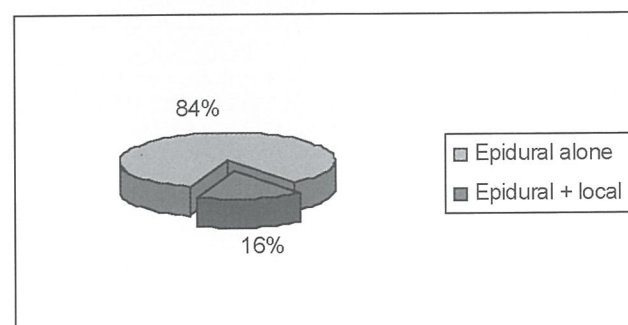


Figure 5. Type of anaesthesia given

post-op and to rate his satisfaction in percentage. The patient was also asked when he was able to go back to regular work, school or back to being able to perform activities of daily living (ADL). The question of whether he would recommend this procedure to his relatives or friends was also asked.

RESULTS

A total of 56 patients satisfied the inclusion criteria. There were 30 males and 26 females with a mean age of 47.32 (range 18-84) (Table 2). The diagnoses of the subjects involved were herniated nucleus pulposus (HNP) (83%), spinal stenosis (10%), and spondylolisthesis (7%). (Figure 3). The number of disc levels involved are seen in Table 3.

Table 3. Number of disc levels involved

Disc level	Number
L1L2	1
L2L3	4
L3L4	10
L4L5	41
L5S1	40
Total:	96

The operative procedures done included microlumbar nerve root decompression (MLNRD) (16%); MLNRD + discectomy (76%); MLNRD + discectomy + non-instrumented fusion, (4%) and MLNRD + discectomy + instrumented fusion (4%) (Figure 4).

There were four patients who underwent MLNRD + fusion for spondylolisthesis. Two out of these four had non-instrumented fusion using bone graft from the patient's iliac bone applied across the intertransverse processes to achieve posterolateral fusion. The remaining two underwent instrumented fusion utilizing pedicular screws spanned together by spinal rods much like the instrumented fusion done in scoliosis surgery. All of these four subjects were under epidural anaesthesia alone and did not require local anaesthesia supplementation. This goes to show that in an awake patient under epidural anaesthesia, a surgeon can harvest bone graft from the patient's iliac bone and do non-instrumented posterolateral fusion and even insert pedicular screws to achieve instrumented spinal fusion. This demonstrates the capability of this procedure for more extensive spine surgery which cannot be said about spine surgery under local anaesthesia alone.

There were two subjects who had cardiac and pulmonary problems and therefore were not cleared for general anaesthesia. These were an 82 year-old female with cardiac dysrhythmia - PVCs and a 71 year-old male with chronic asthma. Both of them had diagnoses of HNP causing severe radiculopathy. The option of epidural anaesthesia was given to them explaining that they would be awake during the surgery and that no aggravation of their cardiac and pulmonary conditions would be expected. Both of them underwent the procedure of MLNRD + discectomy relieving these patients of severe back pain and radiculopathy. No intra-operative complications were noted, and the patients were able to tolerate the procedure well.

Out of the 56 surgical procedures, 47 were under epidural anaesthesia alone. (Figure 5) The peak level of analgesia reached with Ropivacaine 0.2% was between T5 and T6 dermatomal levels. Mean volume of the initial dose was 14 ml $\pm$ 2.67 while mean onset time to the maximal level of sensory block produced at this concentration was 19.4 $\pm$ 4.35 minutes. (Table 4) Four patients had a hypotensive episode, which were successfully controlled with fluid infusion and administration of a single dose of 5-10 mg of Ephedrine sulfate. One of the patients also experienced bradycardia, which was reversed with the administration of 0.5 mg of Atropine sulfate. No urinary retention was noted in all patients.

Table 4. Pre-surgical evaluation after administration of Ropivacaine 0.2% via epidural catheter

Criteria	Mean $\pm$ SD
Onset time of analgesia	19.4 min $\pm$ 4.35
Initial volume of Ropivacaine 0.2%	14 ml $\pm$ 2.67
Maximal sensory level	T5.6 $\pm$ 0.84

The mean volume of Ropivacaine 0.2% used in 1-level MLNRD was 15.3 $\pm$ 3.79 and the mean duration for a 1-level MLNRD was 93.3 $\pm$ 17.56 minutes. The volume of Ropivacaine and duration of surgery increased in direct proportion to the number of levels decompressed. (Table 5)

Table 5. Mean volume of Ropivacaine 0.2% and mean duration of surgical procedure per number of levels of nerve root decompression

Number of levels decompressed	Volume of Ropivacaine 0.2% used (ml)	Duration of surgical procedure (min)
1 - level	15.3 $\pm$ 3.79	93.3 $\pm$ 17.56
2 - level	19.0 $\pm$ 1.83	141.2 $\pm$ 29.26
3 - level	20.0 $\pm$ 5.57	145.0 $\pm$ 39.05
4 - level	21.9 $\pm$ 4.62	151.7 $\pm$ 52.23

In the remaining nine subjects the surgeon needed to supplement the epidural anaesthesia with progressive local anaesthesia. All nine patients had a diagnosis of HNP. Five (5) out of these nine subjects experienced inadequate analgesia during skin incision. On examination, these patients were noted to have maldistribution of analgesia during the pinprick test. Analgesia was noted more on the unaffected side, meaning the side without radiculopathy. These patients were given progressive local anaesthesia utilizing Lidocaine 1% with epinephrine 1:100,000 anaesthetic mixture injected first into the skin, subcutaneous tissue, lumbodorsal fascia, then blocking the pain-generating areas – facet capsule, nerve root, and outer annulus of the disc. This demonstrates a limitation of this procedure in that if the epidural anaesthesia fails, the surgeon must be able to give progressive local anaesthesia and not all surgeons are skilled at doing the latter. After this, the surgeon was able to successfully do MLNRD + discectomy. After the surgery, when the epidural catheter was pulled out for inspection, the tip of the epidural catheter was noted to be kinked. This was the most common finding in the subjects where epidural anaesthesia alone was not sufficient. These patients were still able to stand, ambulate, and had negative SLR immediately post-op.

Three of these nine patients who had combined epidural and local anaesthesia could tolerate skin, subcutaneous tissue and lumbodorsal fascia incision but experienced extreme radicular pain even on gentle touching of the nerve root. This made it impossible for the surgeon to do any form of decompression around the nerve root since even the slightest manipulation using microsurgical instruments produced extreme radicular pain. A nerve root block was then done by the surgeon still using the lidocaine-epinephrine solution and likewise the anaesthesiologist gave light Propofol sedation. Intra-operatively, after MLNRD and discectomy, the surgeon found out that the herniated discs were huge and already extruded, tightly compressing the nerve root. After the sedation wore off, these three patients were likewise able to stand, and had negative SLR immediately post-op.

The last subject out of the nine who had combined epidural and local anaesthesia had adequate analgesia to pinprick on the skin but had pain during subcutaneous tissue and paravertebral muscle exposure needing about 10 ml of supplemental local anaesthesia. She also complained of extreme radicular pain on gentle manipulation of the nerve root. She was also managed with a nerve root block and Propofol sedation. This patient had undergone a successful MLNRD + discectomy of the same nerve root level 8 days prior. She was sent home two days after that first surgery greatly improved but however did not follow the surgeon's instructions and had sexual intercourse with her husband once she got home. She experienced

recurrence of low back pain and radiculopathy after that and was admitted just a week after her first surgery. Repeat MRI showed a re-herniation on the same level and was scheduled for surgery. Intra-operatively, the surgeon found out that the soft tissues were severely inflamed and edematous with the same nerve root compressed by re-herniation of disc fragments. Another MLNRD + discectomy was done. Patient was also able to stand up and had negative SLR immediately post-op.

All the patients were comfortable with their position on the modified Andrews seat and were kept awake and communicative. Most of them watched the surgical procedure on a television screen via a video camera attached to the operating microscope.

In all of the surgical procedures the surgeon was able to confirm the correct nerve root level by asking the awake patient if he feels radicular pain on touching the nerve root or tissues around it. Therefore no instance of incorrect level of nerve root decompression was noted. The mean satisfaction rate of the surgeon with regard to the anaesthesia given and the amount of manipulation he was able to achieve intra-op was 90%.

Immediately after the surgery, all patients noted significant improvement from their low back pain and sciatica, were able to stand up from the knee-chest position,

walk towards a nearby stretcher, and lie down on the stretcher by themselves. While on the stretcher the surgeon did SLR tests and noted it to be negative in all subjects. All subjects noted significant improvement on their VAPS immediately post-op. (Table 6)

In seven of the subjects, the anaesthesiologist was able to give supplementary doses of epidural anaesthesia in the ward for patients who were unable to tolerate the pain from the surgical wound with analgesics alone.

There was no recorded morbidity nor mortality from this procedure. The average hospital stay of the subjects who underwent MLNRD under epidural anaesthesia alone was 6 days and 3 days for those who were under epidural supplemented with progressive local anaesthesia. (Figure 6)

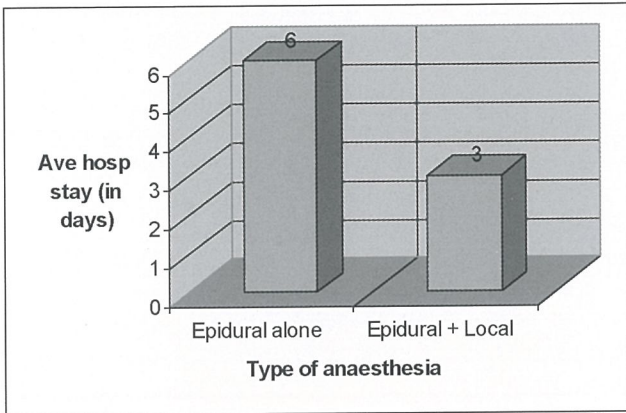


Figure 6. Average hospital stay

When the patient was already at home, the investigator did a telephone interview to assess the patients' Roland & Morris Disability Score (RMDQ) an average of 1-2 weeks post-op and inquired if the patient was already able to do ADLs and furthermore if the patient was already back to work or school. We noted a significant improvement in the RMDQ scores in all patients. The mean improvement in VAPS was 9 and the mean improvement in RMDQ was 19. (Table 6). The mean length of time for the patients to return to work or school or return to doing active household chores was 2.175 weeks.

When asked to rate their overall satisfaction with the procedure – specifically if they considered themselves generally feeling better post-op, if they recovered back their functional status, and if they had a short hospital stay, all subjects had a mean satisfaction rate of 94.3%. All subjects would recommend this procedure to their relatives and friends.

Table 6. VAPS and RMDQ Scores

*Visual Analog Pain Score **Roland-Morris Disability Questionnaire
NB: the post-op VAPS was obtained immediately in the

Pre-operative Score (Mean)		Post-operative Score (Mean)		Mean Improvement in Score	
VAPS*	RMDQ** (in the OR)	VAPS (at home)	RMDQ	VAPS	RMDQ
10	20	1	1	9	19

DISCUSSION

Centroneuraxis blocks or neuraxial anaesthesia include spinal, epidural, and caudal blocks which result in sympathetic block, sensory analgesia, and motor block (depending on dose concentration , and/or volume of local anaesthetic) after insertion of a needle in the plane of the centroneuraxis.^{1,3,7} The principal site of action for neuraxial blockade is the nerve root. Local anaesthetic is injected into the CSF (spinal anaesthesia) or the epidural space (epidural and caudal anaesthesia) and bathes the nerve root in the subarachnoid space or epidural space respectively. Despite these similarities, there are significant physiologic and pharmacologic differences. Spinal anaesthesia requires a small volume of drug devoid of systemic pharmacologic effects to produce profound, reproducible sensory analgesia. In contrast epidural anaesthesia necessitates a large volume of local anaesthetic that produces pharmacologically active systemic blood levels. Neuraxial anaesthesia greatly expands the anaesthesiologists armamentarium to allow alternatives to general anaesthesia when appropriate.

Some clinical studies suggest that post-operative morbidity – and possibly mortality - may be reduced with neuraxial blockade^{1,3,7}. These blocks may reduce the incidence of venous thrombosis and pulmonary embolism, cardiac complications in high risk patients, bleeding and transfusion requirements, vascular graft occlusion, pneumonia and respiratory depression in patients with chronic lung disease. This makes it safer to use in patients with cardiac and pulmonary problems rather than general anaesthesia, and this has been proven true in this study .

Epidural anaesthesia is a neuraxial technique offering a wider range of applications than the typical all-or-nothing spinal anaesthetic. The epidural agent is chosen based on the desired clinical effect, whether it is to be used as a primary anaesthetic, for supplementation of general anaesthesia or for analgesia. The anticipated duration of action of the procedure may call for a short- or long-acting single shot anaesthetic or the insertion of an epidural catheter for continuous infusion. Commonly-used short- to intermediate-acting agents for anaesthesia include 1.5-2% lidocaine, 3% chloroprocaine, and 2% mepivacaine. Long-acting agents include 0.5-0.75% bupivacaine. 0.5-1.0% ropivacaine, and etidocaine. Bupivacaine, an amide local anaesthetic with a slow onset and long duration of action, has a high potential for systemic toxicity. Ropivacaine, a mepivacaine analog is a less toxic alternative to bupivacaine, is roughly equivalent to bupivacaine in potency, onset, duration, and quality of

block. It is purported to have less motor block at lower concentrations while maintaining a good sensory block. These characteristics have made ropivacaine the anaesthetic of choice for MLNRD.

Epidural anaesthesia has a characteristic differential sensory and motor blockade, depending on its concentration. A higher concentration at 0.5 – 1.0% produces complete sensory and motor block. However, for microlumbar nerve root decompression, it is better that the patient stays awake so that intra-operative assessment of the correct level can be achieved. So a lighter concentration of the anaesthetic at 0.2% is used. This study has proven the advantage of having this differential sensory and motor blockade because by using light epidural anaesthesia, MLNRD and even fusion – both instrumented and non-instrumented - was performed on a patient who is awake, the surgeon was able to confirm the correct nerve root level, and the patient could immediately stand and even ambulate post-op.

In general, this procedure has been shown to improve the patients' pain and functional ability, has allowed only a short hospital stay, and allowed the patients' to get back to work or school in a short period of time. The satisfaction of both patient and surgeon with this procedure is high.

CONCLUSION

This study confirms the advantages of doing

microlumbar nerve root decompression under epidural anaesthesia, namely: (a) ability to safely perform surgery on patients with serious cardiac or pulmonary problems; (b) ability to confirm the correct nerve root level being decompressed; (c) ability to perform not just nerve root decompression, but also more extensive procedures like posterolateral fusion; (d) ability of the anaesthesiologist to give post-op analgesia via epidural catheter; (e) the improvement of patients' pain and functional status; (f) short hospital stay and early return to work or school; (g) the procedure being safe.

This study likewise confirms the limitation of this procedure: the need for a surgeon to be skilled in infiltrating progressive local anaesthesia in case the epidural anaesthesia fails.

RECOMMENDATION

We recommend the following follow-up studies which can use this study as take-off point:

- (a) a study comparing all spine cases done under epidural anaesthesia with those under general anaesthesia with regards outcome;
- (b) a study comparing the outcome of microlumbar nerve root decompression with standard laminectomy;
- (c) a long-term outcome study of patients who underwent microlumbar nerve root decompression under epidural with or without local anaesthesia.

REFERENCES

1. Bernards, Christopher: Epidural and Spinal Anaesthesia. Clinical Anesthesia (4th Ed) edited by Paul Barash et al. pp. 689-709 Lippincott Williams and Wilkins, Philadelphia, 2001
2. Beurskens, AJ, de Vet, H.C., Koke, A.J. Measuring the Functional Status of Patients with Low Back Pain: Assessment of the Quality of Four Disease – Specific Questionnaires. Spine 1995 Vol 20, No. 9, May 1, 1995, pp. 1017-1028
3. Brown, David: Spinal, Epidural, and Caudal Anesthesia (4th Ed) edited by Ronald D. Miller. pp. 1505-1530, Churchill Livingstone Inc., New York 1994
4. Deyo, R.A., and Dichl, A.K.: Measuring physical and psychosocial function in patients with low back pain. Spine 8: 635-642, 1983
5. Fukagawa D, et.al. Insertion of an Epidural Catheter from the Surgical Wound for Postoperative Analgesia – A Case Report. Masui. Sept 52(9): 987-989. 2003
6. Gary R. Strichartz, Neural Physiology and Local Anesthetic action, in Neural Blockade, 3rd Ed. Cousins M.J., Bridenbaugh (eds), Lippincott-Raven, 1998
7. Greenberg PE, Brown MD, Pallares VS, Tompkins JS, Mann NH. Epidural Anesthesia for lumbar spine surgery. J Spinal Disord. 1988; 1 (2): 139-43
8. Kleinman, Wayne: Spinal, Epidural and Caudal Blocks. Clinical Anesthesiology (3rd Ed) edited by Edward Morgan et al pp. 253-282, Mc Graw Hill, 2002
9. Kotilainen E. Microinvasive Lumbar Disc Surgery. A Study on Patients Treated with microdiscectomy or Percutaneous Nucleotomy for Disc Herniation. Ann Chir Gynaecol Suppl. 209: 1-50. 1994
10. Kotilainen E, Valtonen S, Carlson CA. Microsurgical Treatment of Lumbar Disc Herniation. Acta Neurochir (Wien). 120 (3-4): 143-149.1993
11. Kuslich, S.D., Vistrom CL, Michael C.J. The tissue origin of low back pain and sciatica; a report of pain response to tissue stimulation during operations on the lumbar spine using local anaesthesia. Orthop Clin North Am. 1991 Apr; 22 (2): 181-7.
12. McCulloch, A. A., Focus Issue on Lumbar Disc Herniation: Macro vs Microdiscectomy. Spine 1996, Vol 21, No 24s, Dec. 15, 1996, pp 455-465
13. Mixter WJ, Barr JS. Rupture of the intervertebral disc with involvement of spinal canal. N Engl J Med 1936; 211: 210
14. Porchet, P, Lombardi D., de Preux J. and Pople K.: Inhibition of epidural fibrosis with ADCON ®: Effect on clinical outcome one year following re-operation for recurrent lumbar radiculopathy. Neurological Research Vol 21 Supplement 1 pp. 551 – 560, 1999
15. Postacchini F, Cinotti G, Perugia D. Microdiscectomy in Treatment of Herniated Lumbar Disc. Ital J Orthop Traumatol. 18(1): 5-16. 1992
16. Roland, M., and Morris R.: A study of the natural history of back pain: Part I: Development of a reliable and sensitive measure of disability in low back pain. Spine 8: 141-144, 1983
17. Scott PJ, Huskisson EC. Graphic representation of pain. Pain 1976; 2: 175-184
18. Tetzlaff, JE, et.al. Spinal Anaesthesia for Elective Lumbar Spinal Surgery. J Clin Anesth. Dec 10(8): 666-669. 1998
19. Ver, MR: Microlumbar Discectomy Utilizing Progressive Local Anaesthesia. Presented at the 2002 Combined Orthopaedic Meeting, Raffles City Convention Centre, Singapore (unpublished)
20. Zahrani, F.: Microlumbar Discectomy: Is it safe as an outpatient procedure? Spine 19, No. 9, May 1, 1994; pp. 1070-1074, 1994