

Post Spinal Surgery Pain: Management Begins Before Your Approach

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Abstract

Background Data: Patients scheduled for spinal surgeries are expected to experience severe postoperative pain. Thus, effective postoperative analgesia is necessary to obtain an enhanced functional outcome, early ambulation, short hospital stay and prevention of chronic pain. Although opioid is the key element of most postoperative analgesic regimens, multimodal therapy is currently an effective way to decrease opioid usage and the related adverse events. Pre-incision infiltration with local anesthetic is used to improve postoperative analgesia and reduce opioid consumption when given as a part of multimodal analgesia.

Purpose: The purpose of this study was to prospectively evaluate the effectiveness of preemptive local infiltration with local anesthesia combined with systemic analgesia in pain control after spine surgery.

Study Design: A prospective descriptive clinical case study.

Patients and Methods: A prospective study of 147 cases of spine surgery operated at the neurosurgery department in Sohag university hospital from December 2011 to March 2015 was conducted. A basic monitoring was applied to all patients and anesthesia was induced according to the standard protocol following preemptive local infiltration with local anesthesia. Postoperative pain was controlled with paracetamol, ketorolac and/or nalbuphine. Postoperative pain was assessed using visual analogue score (VAS).

Results: The study included 66 females and 81 male patients, aged 19-77 years. Discectomy was rated in spine surgeries followed by lumbar fixation, laminectomy, spinal cord tumors, lateral mass fixation and discectomy with cage. VAS didn't exceed score 3 except for 9 cases rating (6%). They requested

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rescue analgesia. Most of the patients were allowed to move 3 hours after surgery except for those who revealed intraoperative dural injury (11 cases). Almost all patients were discharged to home after a short hospital stay less than 3 days. Only 9 cases stayed >3 days.

Conclusion: Preemptive local infiltration with local anesthesia combined with systemic analgesia allowed good pain control after spine surgery, early ambulation, shortened the time of hospital stay and decreased the incidence of complications. (2015ESJ098)

Keywords: Post spinal surgery, pain, local infiltration, VAS

Introduction

Patients scheduled for spinal surgeries are expected to experience severe postoperative pain. Thus, effective postoperative analgesia is necessary to obtain an enhanced functional outcome, early ambulation, short hospital stay and prevention of chronic pain.¹³

Pain in the back originates from various tissues, such as: vertebrae, intervertebral discs, ligaments, dura, sleeves of nerve roots, capsule of facet joints, fascia, and muscles. The innervation of these structures occurs via the posterior rami of spinal nerves connected to sympathetic and parasympathetic nerves. Additionally, postoperative inflammation, mechanical irritation or compression may cause pain.^{2,4}

Furthermore, postoperative pain results from the activation of various pain mechanisms, including nociceptive, neuropathic, and inflammatory.¹⁴ Various mechanoreceptors and nociceptors that have the capability of eliciting pain which transmits these sensations.^{5,15}

Peripheral and central sensitization contributes to the development of an increased pain. In addition, surgery's region does not appear to have a bearing on the pain severity. It also resembles the surgeries of cervical, thoracic or lumbar spine.^{3,7}

However, over the postoperative period, pain is more localized in subjects whose pain persisted; the scores of visual analog scale (VAS) tend elevate.⁵ The intensity of postoperative pain is proportionally linked to the number of vertebrae involved in the surgery.¹⁵

Although Opioid is the corner stone of

most postoperative analgesic regimens, multimodal therapy is currently an effective way to decrease opioid usage and the related adverse events, such as: somnolence, pruritus, respiratory depression, nausea, vomiting, urinary retention and delayed recovery.^{2,13} Pre- incision infiltration with local anesthetic is used to improve postoperative analgesia and reduce opioid consumption when given as a part of multimodal analgesia.^{4,14} No single strategy has proved to be generally effective and there is no "gold standard" ^{3,4}.

The purpose of this observational study was to prospectively evaluate the effectiveness of Preemptive local infiltration with local anesthesia combined with systemic analgesia in pain control after spine surgery, early ambulation, shortened the time of hospital stay and decreased the opioids consumption, and incidence of expected side effects. Also, we focused on the outcome of postoperative pain in patients with long segment interventions, and instrumented fusion surgeries as they constitute the most invasive of the surgical techniques.

Patients and Methods

We prospectively studied all the patients scheduled for spine surgery the in Neurosurgery Department, Sohag University between December 2011 to March 2015. The total number of patients was 285 patients. Indications, site of surgery, level of affected segments, techniques of the approach, Postoperative course (improvement of symptoms), complications such as (infection, CSF leak, etc..) and postoperative pain, and hospital stay all were assessed.

Patients included in the current study are those who were eligible for spinal surgery. Severely uncontrolled DM, recurrent spinal surgery, psychologically diseased patient, drug addicted, inability to cooperate (inability to speak or understand), markedly obese patient with body mass index >40%, and known allergic to any drugs, or systemic tumor were collectively excluded from this study.

Preoperative Plan:

No pain regimens were recommended before our approach. Visual Analogue Scale and patient's satisfaction were explained to all patients during visits paid before the operation (Figure 1). VAS Numerical values were attributed to verbal scores ranged from 0 (no pain), 1-3 (mild pain), 4-6 (moderate pain), 7-9 (severe pain), and up to 10 (most severe imaginable pain). Patient satisfaction aims to evaluate the patient expectation as regards our protocol in relieving the pain symptoms postoperatively. Patient satisfaction was expressed to highly satisfactory results (complete improvement), fair (they confirmed a definite improvement but still suboptimal result), and poor response (they confirmed mild, or no improvement).

Perioperative Plan:

On their arrival at the operations room, a basic monitoring (pulse oximetry, electrocardiogram, noninvasive blood pressure and endtidal carbon dioxide) was applied to all patients and anesthesia was induced according to the standard protocol with propofol 2 mg/kg, nalbuphin 0.1 mg/kg and rocuronium 0.75 mg/kg to facilitate endo-tracheal intubation and mechanical ventilation. After inducing general anesthesia arterial catheter, 20 gauges were inserted in the radial artery to allow invasive blood pressure monitoring. Patients were placed in knee-chest or prone position based on surgery type. Local infiltration subcutaneously at the site of incision and in paraspinal muscles with lidocaine 2% 10 ml and bupivacaine 0.5% 10 ml was done immediately before skin incision. A controlled hypotension was conducted in all

patients using nitroglycerine infusion 1-5mcg/kg/min the mean arterial pressure target scored 60 to 80 mmHg, depending on the baseline measurement and patient condition.

Postoperative Plan:

At the surgical ward, patients were scheduled to receive one of two standardized post-operative pain treatment regimens: (A) Patients undergoing lumbar discectomy, lumbar decompression, cervical decompression, dorsal decompression and cervical interbody fusion were scheduled for paracetamol 1000 mg infusion intravenously every 8 hours, ketorolac 30 mg intramuscularly every 24 hours. (B) Patients undergoing instrumented fusion Surgeries, (cervical, dorsal, and lumber), or long segment surgeries were scheduled for paracetamol 1000 mg infusion intravenously every 6 hours, ketorolac 30 mg intramuscularly every 12 hours, and Patients were allowed to receive incremental doses of nalbuphine 2mg intravenously if VAS was ≥ 4 .

Patients were advised to start early ambulation (within 3 hours postoperative). post-operative visual analogue (VAS) pain score at rest and during mobilization (defined by a standardized movement from recumbent position to sitting on the bedside or standing up), opioid consumption (0-24) h after operation, and side effects (levels of sedation, nausea and use of antiemetic). VAS evaluation was addressed 3, 6, 12, and 24 hours postoperatively. Patient satisfaction was assessed 24, and 48 hours postoperatively.

Statistical Analysis:

Data were analyzed using Microsoft Excel 2013 software and IBM-SPSS version 22, quantitative data were expressed as Mean \pm SD; while qualitative data were expressed as number and percentage. Pearson Chi Square statistic was used to compare percentages of qualitative data and Student's t test was used to compare means of quantitative data. P value less than <0.05 was considered significant

Results

By application of inclusion and exclusion criteria, 146 patients were recruited for this report. Sixty six were females (45%) and 81 were male patients. They aged 19-77 years, with a mean 48 years old (Figure 2). Lumber discectomy was reported in 45 patients, followed by lumber laminectomy (N=36), lumbar fixation (N=25), anterior cervical interbody fusion (ACIF) (N=14), cervical laminectomy (N=11), dorsal laminectomy (N=8), dorsal fixation (N=4), and cervical lateral mass fixation (N=3) (Table 1).

Pain scores during rest, and at 3 (movement), 6, 12 and 24 h after surgery for instrumented (n=46), and non-instrumented fusion patients are summarized in table 2. Pain scores during rest, and at movement 3,6,12 and 24 h after surgery for short segment (≤ 3 levels) (N=109), and long segment patients are summarized in table 3.

Generally, VAS (at rest) after 24 hours in all patients didn't exceed score 3(94%) except for 9 patients rating (6%). Five patients revealed severe VAS score (3 patients had long segment lumber fixation 5 levels, one had 4 level cervical laminectomy, and one had lateral mass fixation 4 levels) that required rescue analgesia twice, and four patients revealed moderate VAS score (2 patients had 3 levels lumber fixation, and 2 patients had 3 levels lumber laminectomy) that required rescue analgesia once. No serious side

effects as regards nalbuphine consumption other than mild nausea in 3 patients without need for additional antiemetic.

Out of 146 patients, eleven patients (7.5%) were not allowed for early ambulation due to intraoperative dural injury, which was postponed according to surgeon's decision (ranged from 3-14 days). 121 patients (82.8%) revealed early ambulation (within 3 hours) according to scheduled postoperative plan, one patient moved within 3-6 hours (0.7%), 9 patients moved within 6-12 hours (6%), and four patients (3 patients with long segment lumber fixation, and one patient with 4 level lumber laminectomy) showed late ambulation (after 24 hours), (Table 4).

Almost all patients were discharged to home after a short hospital stay less than 3 days. Furthermore, seven patients (4.7%) stayed 3-15 days (4 patients with 5 level lumber fixation, and 3 patients due to dural tears) and two patients (1.4%) stayed more than 15 days due to dural injury (Table 5).

Outcome was described as highly satisfactory in 114 patients (78.1%), Twenty three patients (15.8%) were fairly satisfied, and Poor satisfaction was reported in Nine patients (4 patients had dural tear, 3 had long segment lumber fixation 5 levels, one had lateral mass fixation 4 levels, and one had dorsal laminectomy 6 levels due to epidural lesion) (Figure 3).

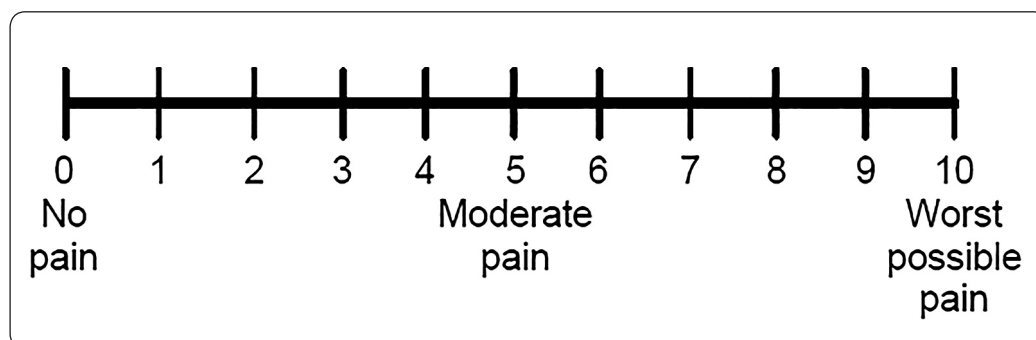


Figure 1. Visual Analogue Scale (VAS)

Table 1. Type of surgery

| Type of Surgery | Patients No. | % |
|---|--------------|-------|
| Lumber Discectomy | 45 | 30.8% |
| Lumber Laminectomy | 36 | 24.7% |
| Lumber fixation | 25 | 17.1% |
| Anterior cervical interbody fusion (ACIF) | 14 | 9.6% |
| Cervical laminectomy | 11 | 7.5% |
| Dorsal laminectomy | 8 | 5.5% |
| Dorsal fixation | 4 | 2.7% |
| Cervical lateral mass fixation | 3 | 2.1% |

Table 2. Postoperative pain Instrumentation Versus Non-instrumented

| Time after surgery | Mean VAS at Rest | | | Mean VAS at Movement | | |
|--------------------|---------------------------|--------------------------------|---------|---------------------------|--------------------------------|---------|
| | Instrumented cases (N=46) | Non-instrumented cases (N=100) | P value | Instrumented cases (N=46) | Non-instrumented cases (N=100) | P value |
| 3 hours | 4.2±1.2 | 3.6±1.3 | 0.007 | 5.2±1.4 | 4.1±1.3 | <0.001 |
| 6 hours | 2.5±0.9 | 1.9±1.1 | 0.001 | 3.2±1.5 | 2.9±1.1 | 0.227 |
| 12 hours | 2.9±2.3 | 2.1±1.3 | 0.029 | 4.5±2.3 | 3.7±1.6 | 0.035 |
| 24 hours | 2.4±1.1 | 1.8±0.8 | 0.001 | 4.6±2.4 | 2.8±1.9 | <0.001 |

Table 3. Postoperative Pain Long Versus Short Segment

| Time after surgery | Mean VAS at Rest | | | Mean VAS at Movement | | |
|--------------------|-----------------------|---------------------|---------|-----------------------|---------------------|------------------|
| | Short Segment (N=109) | Long Segment (N=37) | P value | Short Segment (N=109) | Long Segment (N=37) | P value |
| 3 hours | 3.5±1.1 | 4.5±1.8 | 0.002 | 3.9±1.0 | 5.5±2.7 | 0.001 |
| 6 hours | 2.0±0.5 | 2.4±0.7 | 0.002 | 2.7±0.7 | 3.7±1.6 | <0.001 |
| 12 hours | 2.0±1.1 | 3.1±2.1 | 0.003 | 3.5±1.1 | 5.1±2.9 | 0.001 |
| 24 hours | 1.9±1.3 | 2.3±0.8 | 0.029 | 3.1±1.8 | 4.2±2.7 | 0.022 |

Table 4. Mobility after Surgery

| Time after Surgery (hours) | Patients No.(%) |
|----------------------------|-----------------|
| <3 | 121(82.8%) |
| 3-6 | 1(0.7%) |
| 6-12 | 9(6.2%) |
| >24 | 4(2.7%) |
| Late movement (3-14 days) | 11(7.5%) |

Table 5. Hospital Stay after Surgery

| Hospital Stay (days) | Patients No. (%) |
|----------------------|------------------|
| <3 | 137(93.8%) |
| 3-15 | 7(4.8%) |
| >15 | 2(1.4%) |

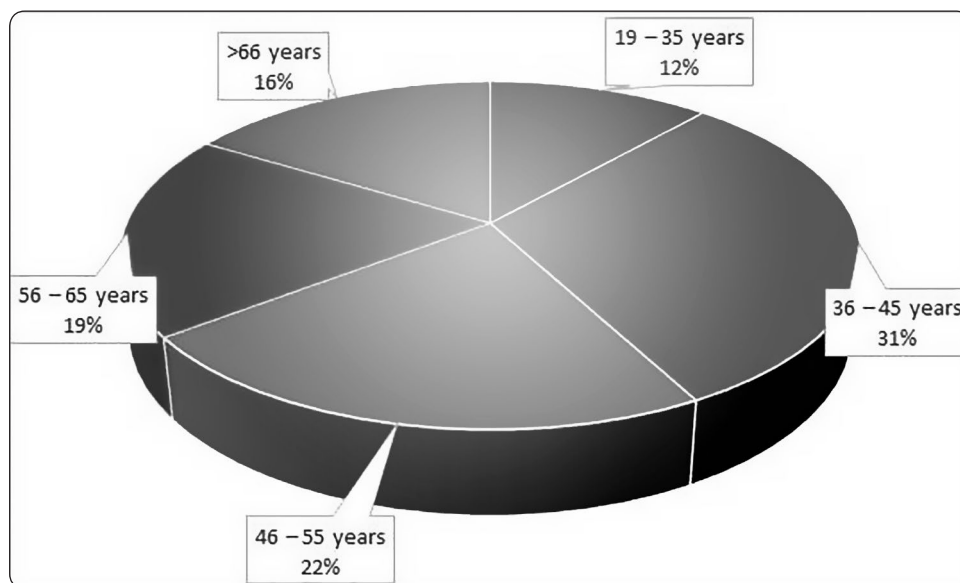


Figure 2. Age of the study group

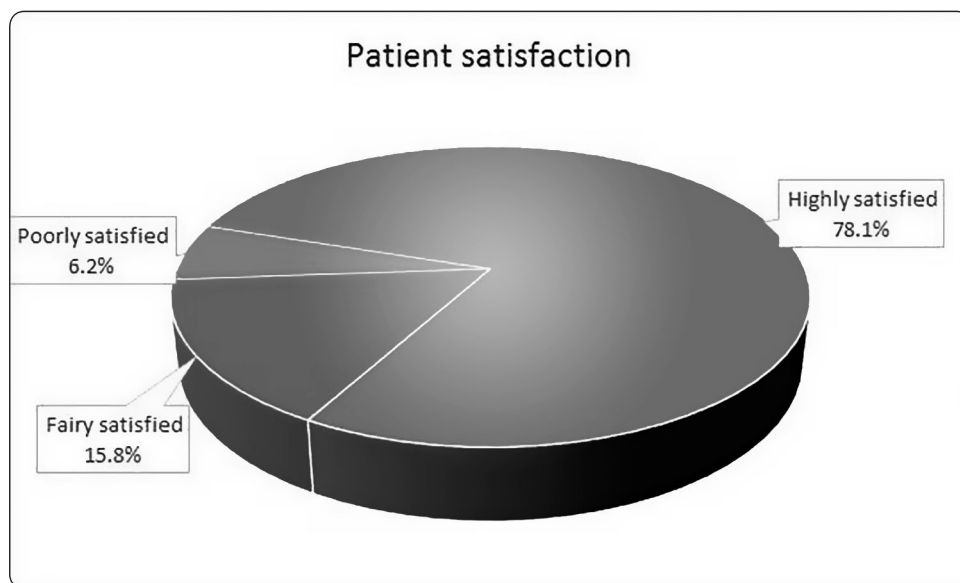


Figure 3. Postoperative Patient Satisfaction

Discussion

This prospective, observational study aimed to show that pre-incision infiltration with a mixture of lidocaine and bupivacaine, as a part of multimodal analgesia, remarkably reduces postoperative pain and consumption of opioids. It also allows early mobilization and decreases the length of hospital stay in patients who underwent spine surgery. It was suggested that blocking impulse transmission along afferent axons with local anesthetics before the noxious stimulus (incision) prevents hyperalgesia of the central nervous system. Consequently, it reduces postoperative pain and the need for analgesics.^{4,5} The phenomenon of “wind-up”, hyperalgesia that follows noxious stimuli, can be prevented by blocking afferent receptors with local anesthetic or using opioids to suppress excitability of the central nervous system.⁸

Several clinical trials have demonstrated contradicting results regarding the effectiveness of preemptive analgesia. They were attributed to different types of the surgical incision, the timing of infiltration and the duration of local anesthetic action used.^{3,7} Our data are consistent with the previous studies which demonstrated that infiltration of subcutaneous tissue and Paraspinal musculature resulted in marked reduction of postoperative analgesic demand.

Timothy et al,¹² conducted a randomized double-blind trial including 52 patients for evaluation of the effect of intraoperative wound infiltration with bupivacaine 0.25% (1ml/kg) compared to placebo (Na Cl 0.9% 1ml/kg) in patients undergoing lumbar spine surgery. It was concluded that bupivacaine infiltration prior to wound closure is a simple and safe method to provide analgesia in patients scheduled for lumbar spine surgery.

Mullen and Cook⁸ conducted an uncontrolled study, infiltrating paravertebral musculature with 50 ml of 0.25% bupivacaine after lumbar fascia closure. It was reported that postoperative pain was reduced. However, only 2 out of 21

patients required a single dose of narcotic for transient radicular pain.

Teddy et al,¹¹ conducted a blinded trial on 46 patients in which 40 ml of 0.25% bupivacaine or normal saline was injected subcutaneously and in the Paraspinal musculature at the end of the surgery. In spite of the initial reduction in analgesic demand, there was no significant difference observed between both groups in pain scores. It was concluded that bupivacaine infiltration was ineffective in reducing postoperative pain and it was not recommended as a routine practice. These results might be explained by the time of local anesthesia infiltration, inconsistent with the concept of preemptive analgesia, and single use of local anesthetic material. Infiltration after the onset of pain gives a chance to the plasticity of the central nervous system and ineffective pain management.

In a prospective randomized double-blind study conducted by Raymond et al,⁹ patients undergoing abdominal hysterectomy were assessed to compare the efficacy of preincision infiltration of bupivacaine to wound infiltration after the end of hysterectomy and the impact of timing of local anesthesia infiltration on postoperative opioid requirements. They concluded that, no statistically significant effect of either pre-incision or after incision local infiltration on opioid consumption or postoperative pain scores was observed. They illustrated that this may be attributed to the difficulty to achieve complete neuronal block in such type of surgery with local anesthetic infiltration. Therefore, a central neuroaxial block may be required to prevent pain.⁹

In the current study, a mixture of lidocaine and bupivacaine was used to get the advantage of rapid onset of lidocaine and the long period of bupivacaine unlike previous studies which almost used different doses and concentrations of bupivacaine. Two large randomized, placebo-controlled, double-blind trials by Bianconi¹ in 2004, and, more recently, by Kristensen et al,⁶ in

2014; confirmed the same pronounced efficacy in pain reduction using this simple approach, in addition to decreased opioids consumption, and incidence of expected side effects.

In our study, It was clearly noticed that VAS tends to higher in long segment, and instrumented fusion surgeries group, than short segment, and non-instrumented group which greatly support in Rikke et al,¹⁰ study.

Many previous reporters discussed the golden role of opioid in decreasing the postoperative pain that ranged from a total of (4.7-6.2) mg IV morphine equivalents within 0-24 hours post-operatively.^{1,2,6,10}

Although Rikke et al,¹⁰ revealed marked decrease in opioid consumption than our study results that ranged from (2-4) mg , but also a raised objection was believed from our side because a multimodal drugs were used such as ibuprofen, pregabalin, and small fixed doses of opioids in the former study, in addition to preoperative pain regimens were addressed.

As regards the patient satisfaction, a good results was obtained in 93% of our patients, that proportionally directed to VAS results, but poor results could be explained by informed dural tear that occurred in 2.7% of patients, procedure itself (either long segment, or instrumented fusion) in 3.4% of patients, and finally it could be due to unrealistic expectations as clinical and radiological evaluation did not reveal any objective reason for feeling of dissatisfaction.

Although we strongly believed in our approach, depending on large number of patients, strict follow up, and different selected surgical procedures, but also wide range of selected pain control modalities, and different expected results, make ideal algorithm is a matter of controversy.

Conclusion

Preemptive local infiltration with local anesthesia combined with systemic analgesia allowed good pain control after spine surgery,

early ambulation, shortened the time of hospital stay and decreased the incidence of complications.

A directly proportional relationship was addressed between type of the procedure especially instrumented fusion surgeries, and number of the operated segments from one side, and with the expected VAS from the other side.

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الملخص العربي

ألم ما بعد جراحات العمود الفقري: العلاج يبدأ قبل تدخل الجراحي

البيانات الخلفية: المرضى الذين يتعرضون لجراحات العمود الفقري من المتوقع أن تحدث لهم آلام شديدة بعد إجراء الجراحة، ولهذا فإن القيام بتسكين فعال لما بعد العملية الجراحية هو أمر ضروري للحصول على نتائج وظيفية جيدة ولمساعدة المريض على القيام والتحرك في وقت مبكر وتقصير فترة الإقامة في المستشفى والوقاية من الآلام المزمنة. وعلى الرغم من أن الأفيونات هي عنصر أساسي في معظم نظم مسكنات ما بعد العملية الجراحية، فإن العلاج متعدد الطرائق هو طاليا وسيلة فعالة لتقليل استخدام المواد الأفيونية بما تحويه من آثار جانبية. يستخدم المخدر الموضعي قبل الشق الجراحي لتحسين تسكين ما بعد العملية الجراحية والحد من استهلاك المواد الأفيونية عندما تعطى كجزء من التسكين المتعدد الطرائق.

الغرض: تهدف الدراسة الحالية إلى تقييم تأثير الحقن بمخدر موضعي (ليدوكائين وخليط بوبيفيكين) قبل الجراحة على آلام ما بعد الجراحة واستخدام المسكنات الخاصة بهم.

تصميم الدراسة: دراسة مستقبلية سريرية.

المرضى والطرق: أجريت دراسة على ١٤٧ حالة جراحة عمود فقري تم إجراؤها في قسم جراحة المخ والأعصاب في مستشفى جامعة سوهاج في الفترة من يونيو ٢٠٠٩ إلى سبتمبر ٢٠١٥. تم تطبيق المراقبة الأساسية لجميع المرضى وأعطى التخدير وفقا للبروتوكول القياسي. وتمت السيطرة على الألم بعد العملية الجراحية باستخدام الباراسيتامول أو الكيتورولاك أو النالبوفين. تم تقييم الألم بعد العملية الجراحية باستخدام درجة التماثلية البصرية (VAS).

النتائج: شملت الدراسة ٦٦ من الإناث و ٨١ من الذكور المرضى، الذين تتراوح أعمارهم بين ١٩-٧٧ عاما. كان استئصال الغضروف الفقري هو الأكثر شيوعاً في جراحات العمود الفقري تليها تثبيت الفقرات القطنية ثم ثقب الفقرات ثم علاج أورام النخاع الشوكي والتثبيت الشامل الجانبي واستئصال الغضروف مع تركيب قفص. لم تتجاوز قيمة مؤشر VAS رقم ٣ باستثناء ٩ حالات وبنسبة (٦ ٪) وهؤلاء طلبوا تسكيناً عاجلاً لإنقاذهم من الألم الشديد. سمح لمعظم المرضى بالتحرك بعد الجراحة بثلاث ساعات إلا لأولئك الذين اكتشفت إصابة الأم الجافية أثناء العملية لديهم، وكان عددهم (١١ حالة). جميع المرضى خرجوا من المستشفى بعد مدة قصيرة أقل من ٣ أيام، بينما بقيت ٩ حالات فقط لمدة أكبر من ٣ أيام.

الخلاصة: الحقن الموضعي بمخدر موضعي جنباً إلى جنب مع استخدام المسكنات النظامية يسمح بالسيطرة على الألم بصورة جيدة بعد جراحة العمود الفقري ويسمح بحركة المريض في وقت مبكر وتقصير وقت الإقامة في المستشفى وانخفاض معدل حدوث المضاعفات.