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Clinical Study

General *versus* epidural anesthesia for lumbar microdiscectomy

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ABSTRACT

This study was a retrospective analysis of 850 lumbar microdiscectomy (LMD) under epidural anesthesia (EA; n = 573) or general anesthesia (GA; n = 277) performed by the same surgeon and paid by invoice to the Social Security Institution of the Turkish Republic between April 2003 and May 2013. Although GA is the most frequently used method of anesthesia during LMD, the choice of regional anesthetia (epidural, spinal or a combination of these) differs between surgeons and anesthetists. Studies have reported that EA in surgery for lumbar disc herniation may be more reliable than GA, as it enables the surgeon to communicate with the patient during surgery, but few studies have compared the costs of these two anesthetic methods in LMD. We found that EA patient costs were significantly lower than GA patient costs ($p < 0.01$) and there was a statistically significant difference between the two groups in terms of the time spent in the operating room ($p < 0.01$). There was no difference in the duration of surgery ($p > 0.05$). The anesthetic method used during LMD affected the complication rate, cost and efficiency of operating room use. We suggest that EA is an anesthetic method that can contribute to health care cost savings and enable LMD to be completed with less nerve root manipulation and more comfort, efficacy, reliability and cost efficiency without affecting the success rate of the surgical procedure.

1. Introduction

Symptoms related to lumbar disc herniation reduce the quality of everyday life and cause a loss of labor force productivity, and lumbar disc hernia surgery is one of the most frequently performed surgical procedures in neurosurgical practice. Surgical techniques for the treatment of lumbar disc herniation, such as microdiscectomy and endoscopic approaches, have been developed to reduce the duration of hospitalization and to allow a rapid return to daily life and work. In addition, the type of anesthesia used is important for reducing complications during and after surgery and can affect patient comfort. Although general anesthesia (GA) is the most frequently used method during lumbar microdiscectomy (LMD), the choice of a regional anesthetic (epidural, spinal or a combination of these) differs between surgeons and for different anesthetics.

Studies have reported that epidural anesthesia (EA) in LMD may be more reliable than GA as it allows the surgeon to communicate with the patient during surgery, but few studies have compared the costs of these two anesthetic methods in LMD surgery [1,2]. In general, the annual cost of minimally invasive approaches for LMD surgery has increased in parallel with the use of modern technology. When the cost of anesthesia is considered, the use of the most economical anesthetic method can significantly reduce the total cost of LMD surgery. For other surgical procedures, the costs of regional anesthetic and GA methods have been compared and it has been found that the cost of anesthesia is mainly related to its effect on surgical duration and whether the surgery can occur in an ambulatory setting [3–5]. This retrospective investigation compared the length of time the operating room was occupied and the cost of anesthesia when EA and GA methods were used, and assessed EA reliability and applicability. Complications linked to patient position during GA (peripheral nerve compression, ophthalmological damage), complications linked to EA (unsuccessful EA, epilepsy) and general surgical complications (dural injury, infection, additional neurological deficits) were also examined and discussed with regard to the anesthetic method used.

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2. Methods

Permission was granted by the Gaziantep Sanko University Sani Konukoglu Private Hospital Ethics Committee prior to retrospectively screening a total of 850 LMD under EA (n = 573) or GA (n = 277) performed by the same surgeon and financed by invoice to the Social Security Institution of the Turkish Republic between April 2003 and May 2013. All patients provided written consent for the surgical procedure and anesthetic method. Patients with radicular pain and/or neurological deficits linked to disc compression, as identified by imaging (MRI and CT scan), and who had no response to at least 3 weeks of conservative treatment, underwent a standard LMD with a surgical microscope (Leica M525 OH4; Leica Biosystems, Nussloch, Germany).

Patients were recorded for age, sex, operated disc levels, duration in the operating room, duration of surgery, the patient's first request for postoperative analgesia, the cost of anesthesia and complications. The duration in the operating room and the duration of surgery were obtained from the anesthesia monitoring form, and the EA and GA patients were compared based on these parameters. In the postoperative period, the time of the first analgesic request by the patient was obtained from the observation chart.

2.1. Anesthesia procedure

All patients were given 1 mg of intravenous midazolam 30 minutes before the operation as a premedication. Additionally, antibiotic prophylaxis was given using 1 g of cefazolin before skin incision and 1 g every 8 hours postoperatively.

Before induction in the GA group, 4 L/minute oxygen (O_2) was given through a mask for preoxygenation. Induction was then conducted using 1 μg/kg remifentanil, 2–3 mg/kg propofol and 0.5 mg/kg rocuronium intravenously. After induction and oxygenation, intubation was performed with an endotracheal tube with a cuff. To maintain anesthesia, 0.25 μg/kg remifentanil, 2–2.5% sevoflurane and 4 L/minute fresh gas flow (50% O_2/50% air mix) were administered. Before extubation, 1 ampule of a nonsteroidal anti-inflammatory drug (NSAID) and 0.5 mg/kg tramadol were administered. After approximately 30 minutes in the recovery room, the patient was sent to the ward.

In the operating room, EA was administered in the sitting position under aseptic conditions at one or two levels above the operation field. After local anesthesia with subcutaneous prilocaine hydrochloride, an 18 gauge Tuohy needle was inserted into the epidural space using the loss of resistance method and a 14–16 cm^3 mix of 50 μg fentanyl (1 cm^3), 100 mg lidocaine hydrochloride (5 cm^3) and 50 mg bupivacaine (10 cm^3) was administered. An epidural catheter was not inserted in any patients. After the injection, the patients were laid in a horizontal position. Following this, the surgical region and legs were checked for pain sensation using the pinprick test after which the patients were placed in the prone position. After the patients were settled in the most comfortable and appropriate prone position, they were sedated using 0.03 mg/kg midazolam. After 10 minutes in the recovery room in the postoperative period, they were moved to the ward.

2.2. Cost

To calculate the direct costs for each patient, the intravenous and ıntramuscular medications used for anesthesia and the volatile anesthetics, single-use supplies, preoperative and postoperative analgesics and other medications used were considered. The time expenditure costs of personnel, surgeon and anesthetist fees, general costs of running the hospital such as electricity, water, air conditioning and depreciation, and the aspects of LMD that were the same for both anesthetic methods such as surgical procedure medication, supplies and preoperative preparation (laboratory and radiology), were not included in the calculation.

Because all ampules and vials were destroyed regardless of their remaining contents in accordance with the Turkish Ministry of Health's Implementation Communiqué, the cost calculation for the ampules and vials was based on the numbers used. The data used for the cost calculation for each patient were obtained from the invoice information in the hospital computer system, which included the prices of anesthetic medications, supplies and postoperative analgesic medications. The prices of the medications used for anesthesia in the operations under EA or GA and the prices for postoperative analgesia were collected separately. The average cost was obtained in Turkish Liras (TL) and converted into US dollars (1 USD: 2.1 TL).

The cost calculation for GA was performed based on the total price of anesthetic medications, intravenous fluids, postoperative analgesic medications (NSAID, tramadol) and supplies (intubation tubes, aspiration probes, intravenous catheters, injectors, disposable anesthetic breathing circuit devices, airway tubes). The costs of the medications used to treat side effects in the postoperative period such as nausea, vomiting, hypotension and bronchospasm were also added to the cost calculation.

The cost calculation for EA included the costs of anesthetic medications (crystalloid, bupivacaine, prilocaine hydrochloride, fentanyl, lidocaine hydrochloride, midazolam), supplies (intravenous catheters, Tuohy needles, injectors) and postoperative analgesic medications (NSAID, tramadol).

2.3. Statistical analyses

SPSS statistics (version 21; IBM Corporation, Armonk, NY, USA) was used for the statistical analyses. Descriptive statistics for continuous variables are given as the mean ± standard deviation and median (range) values. Comparisons between the groups were completed with Mann–Whitney tests and independent sample *t*-tests for continuous variables, and chi-squared tests for categorical variables. A correlation analysis was also completed. Statistical significance was accepted at $p < 0.05$.

3. Results

A total of 850 LMD were completed in 797 patients (53 patients underwent repeat LMD due to recurrence at the same level); 573 surgeries were performed under EA and 277 were performed under GA. There was no significant difference between the EA and GA patients in terms of age or sex ($p > 0.05$; Table 1).

Thirty-four of the operations performed under EA and 39 under GA were second operations performed for recurrence at the same level as that treated by the original surgery; 28 and 25 of those patients had undergone the original surgery at our clinic and 6 and 14 at other centers, for the EA and GA groups, respectively (Table 2).

Table 1
Demographic distribution of lumbar microdiscectomy patients by type of anaesthesia

	LMD, n	Age, mean years ± SD	Age range, years*	Sex (M/F)*
Epidural anesthesia	573	44.2 ± 11.86	20–76	328/245
General anesthesia	277	43.33 ± 11.18	20–70	158/119

* EA *versus* GA patients for age and sex ($p > 0.05$).
F = female, LMD = lumbar microdiscectomy, M = male, SD = standard deviation.