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Original Investigation

Intraoperative Results and Postoperative Clinical Outcomes of Lumbar Microdiscectomy in Patients who Previously Received a Transforaminal Anterior Epidural Steroid Injection for Lumbar Radiculopathy

Sait OZTURK[1], Bekir AKGUN[1], Fatih Serhat EROL[1], Selami Ates ONAL[2], Metin KAPLAN[1]

[1]Firat University, School of Medicine, Department of Neurosurgery, Elazig, Turkey
[2]Firat University, School of Medicine, Department of Anesthesiology and Reanimation, Division of Pain Clinic, Elazig, Turkey

ABSTRACT

AIM: To describe the intra- and postoperative results of patients who received a transforaminal anterior epidural steroid injection (TAESI) prior to lumbar microdiscectomy.

MATERIAL and METHODS: Sixty-four patients who did not improve after minimally invasive techniques (MIT) for lumbar radiculopathy were evaluated. Thirty-two of them treated with techniques other than TAESI and those receiving thrombolytic or anticoagulant drugs before microdiscectomy were excluded. We recorded the type of MIT, numbers of levels and injections, time interval between the last MIT and microdiscectomy, duration of surgery, amount of intraoperative blood loss, rate of incidental durotomy, postoperative infection, and visual analogue scale (VAS) scores for leg pain before and after microdiscectomy at 24 hours, and the 1st and 3rd months (Group 1). A total of 35 patients with no history of MIT or lumbar surgery who had undergone unilateral, single-level lumbar microdiscectomy at our clinic were randomly selected to be included in the control group (Group 2) and same parameters were recorded for the comparison of both groups.

RESULTS: The mean duration of lumbar discectomy was 140 minutes, and the amount of average intraoperative blood loss was 227 cc in the study group (Group 1), and 65 minutes and 73 cc, respectively in the control group (Group 2)($p>0.05$). The comparison of VAS scores revealed that lumbar discectomy was still effective after TAESI ($p=0.00$).

CONCLUSION: Although epidural steroid injection is an effective modality for the management of chronic pain, these patients should be informed preoperatively about the relatively long duration of surgery and the possible requirement for blood transfusion.

KEYWORDS: Steroid injection, Radiculopathy, Microdiscectomy, Transforaminal, Epidural

INTRODUCTION

In industrialized countries, approximately 80% of the population experiences an episode of low back pain (LBP) at least once in their lifetime (5). There are many pathologies and specific anatomic locations that may lead to LBP, but intervertebral disc herniation is recognized as one of the most common causes (7).

Although many patients with LBP benefit from conservative treatment methods such as short-term bed rest, medical therapy, lifestyle changes, and physical therapy and exercise, approximately 7% experience chronic pain (16). Moreover, 15% of those with chronic LBP require surgery (4). Although microdiscectomy, the most effective method for surgical treatment of lumbar herniated discs, provides satisfactory results, it can result in several complications such as recurrence,

Corresponding author: Sait OZTURK
E-mail: drsaitozturk@yahoo.com

dural injury, cerebrospinal fluid (CSF) fistula, neural injury, or neurological deficits (2). Because of these risks, minimally invasive techniques (MITs) have recently gained popularity as alternatives to surgery for lumbar herniated disc (18).

The main advantages of relieving spine-related pain with MITs are no requirement of general anesthesia, early mobilization and faster return to activities of daily life, reduced healthcare cost, lower infection rates, and less blood loss (14). Epidural steroid injections are the most frequently performed MIT for spine-related pain (14).

To our knowledge, there is no published report comparing patients with and without a history of epidural steroid injection and lumbar microdiscectomy. Here we present the intra- and postoperative results of patients who received transforaminal anterior epidural steroid injection (TAESI) prior to lumbar microdiscectomy, as well as the early clinical outcomes.

MATERIAL and METHODS

Patients

With the approval of the ethics committee of our institution, we evaluated 64 of 2461 patients who had received MIT for lumbar radiculopathy in the Pain Clinic between February 2011 and December 2015 and who felt no relief after the procedures. Thirty-two patients were treated with different techniques other than TAESI and those receiving thrombolytic or anticoagulant drugs before microdiscectomy were excluded. In addition, patients who underwent lumbar laminectomy, stabilization, or bilateral and/or multilevel microdiscectomy were excluded from the study. Patients with a body mass index (BMI) over 30 kg/m^2 and with co-morbid diseases associated with predisposing factors for bleeding (diabetes mellitus, renal failure, ischemic heart diseases, ischemic cerebrovascular disease) were excluded. The remaining 32 non-smoker patients with extruded or sequestrated lumbar discs (Group 1) who had undergone unilateral and single-level microdiscectomy were included. The classification of herniated discs that was defined by Modic was used (13).

We recorded the type of MIT, numbers of levels and injections, time interval between the last MIT and microdiscectomy, duration of surgery, amount of intraoperative blood loss, rate of incidental durotomy, postoperative infection, and visual analog scale (VAS) scores before and after microdiscectomy at 24 hours, and the 30th and 90th day.

A total of 35 non-smoker patients with no history of MIT or lumbar surgery who had undergone unilateral, single-level lumbar microdiscectomy due to extruded or sequestrated lumbar discs in our clinic were randomly selected to be included as the control group (Group 2). Patients with a body mass index (BMI) over 30 kg/m^2 and with co-morbid diseases that are predisposing for bleeding (diabetes mellitus, renal failure, ischemic heart diseases, ischemic cerebrovascular disease) were excluded. This group was treated by same surgeons in the same time period as the study group. The control group (Group 2) data were compared with those of the patients who had undergone lumbar microdiscectomy following a history of TAESI (Group 1).

Epidural Injection Procedure

TAESI was applied to all patients who did not respond to one-month conservative treatment and who had radiculopathy due to lumbar disc herniation (bulging and protrusion). All procedures were performed using C-arm fluoroscopy under local anesthesia by the inpatient method. In all cases, a mix of 80 mg triamcinolone and 3 ml of 0.5% bupivacaine was transforaminally injected to the anterior epidural area.

Surgical Treatment

Under general anesthesia, the paravertebral muscle fascia was opened in the prone position by using a 3 cm skin incision. Sharp and obtuse dissection was performed to reach the lamina using cautery. Partial hemilaminectomy was performed microsurgically. Following ligamentum flavectomy and foraminotomy, microdiscectomy was performed. All the patients in both groups were operated by same expert spine surgeons. There was no complication during the surgeries like dural tear, root injury, etc.

Statistical Analysis

To examine differences between the groups, we used Chi-square testing for categorical variables and the Student t test for continuous variables. Mann–Whitney U testing was used to examine non-parametric data. To analyze our data, we used STATA version 12. A p value less than 0.05 was considered as statistically significant.

RESULTS

In Group 1 (n=32; 16 females, 16 males), the mean age was 45.9 ±11.1 years (range: 29-65 years) (Table I). The numbers of patients who received single-level, two-level, and three-level TAESI were 18, 13, and 1, respectively (mean: 1.4). The patients underwent an average of 2.6 sessions (range: 1-4). The mean time interval between the last TAESI and lumbar microdiscectomy was 5.2 months (range: 1-26). The mean duration of lumbar discectomy was 140 minutes, and the amount of average intraoperative blood loss was 227 cc (Table I). The mean VAS scores preoperatively and at 24 hours, 30th day and 90th day postoperatively were 9.5, 2, 1 and 1 respectively. There were no infections in the early or late postoperative periods (Table I). The mean age of control group who had no history of lumbar MIT and who underwent unilateral and single-level lumbar microdiscectomy (Group 2; n=35, 18 males, 17 females) was 45.8±9.6 years (range: 31-63 years). The mean duration of surgery and amount of blood loss were 65 minutes and 73 cc, respectively in Group 2 (Table II). The mean VAS scores for leg pain in Group 2 preoperatively and at 24 hours, 30th day and 90th day postoperatively were 9.5, 2, 1 and 1, respectively. No patients in the control group experienced infection (Table II).

The duration of surgery and amount of intraoperative blood loss were different between the two groups (p>0.05) (Table III). Group 1 patients had a longer duration of surgery and more intraoperative blood loss (p>0.05). Also, 5/32 patients in study group received blood transfusion. The time interval between the last TAESI and lumbar microdiscectomy was found be associated with both of these variables (p=0.002).

Table I: Group 1 Patients' Demographics, Preoperative Characteristics Related to TAESI, Intraoperative Results and VAS Scores for Leg Pain Before and After Lumbar Microdiscectomy

Patients	Age (year)	Gender	Type of Minimally Invasive Technique	Steroid Injected Foramina	Number of Injection Level(s)	Number(s) of Injection Procedure	Level of Microdiscectomy	Time of Surgery after Last Injection (month)	Loss of Blood During Microdiscectomy (cc)	Duration of Surgery (min)	VAS		
											Just Before surgery	One day after surgery	One and 3 months after surgery
1	47	Male	TAESI	Left L4-L5 and L5-S1	2	1	Left L4-5	1	235	125	10	3	1
2	55	Female	TAESI	Left L4-L5 and L5-S1	2	3	Left L3-4	5	180	150	9	4	2
3	41	Female	TAESI	Left L4-L5	1	3	Left L4-5	6	205	115	9	2	1
4	61	Female	TAESI	Left L5-S1	1	3	Left L5-S1	7	120	210	10	1	1
5	57	Male	TAESI	Right L4-L5 and L5-S1	2	3	Right L4-5	3	230	160	9	2	1
6	40	Female	TAESI	Left L4-L5	1	3	Left L4-5	3	210	130	9	3	1
7	40	Male	TAESI	Right L4-L5	1	3	Right L4-5	24	140	230	8	2	1
8	31	Female	TAESI	Right L4-L5	1	2	Right L5-S1	2	140	110	9	2	1
9	34	Male	TAESI	Left L4-L5	1	3	Left L5-S1	3	260	140	9	2	1
10	41	Male	TAESI	Right L4-L5 and L5-S1	2	3	Right L4-5	26	160	180	10	2	1
11	58	Male	TAESI	Left L4-L5 and L5-S1	2	1	Left L4-5	1	210	110	10	3	2
12	44	Male	TAESI	Left L4-L5	1	3	Left L5-S1	1	300	120	10	2	1
13	48	Female	TAESI	Right L4-L5	1	5	Right L4-5	2	280	160	10	2	1
14	40	Male	TAESI	Right L4-L5	1	1	Right L4-5	1	320	140	9	3	1
15	49	Male	TAESI	Left L5-S1	1	4	Left L5-S1	14	240	110	10	2	1
16	51	Female	TAESI	Right L4-L5 and L5-S1	2	1	Right L4-5	2	170	120	10	2	1
17	28	Female	TAESI	Left L2-3, L3-4, and L4-5	3	3	Left L4-5	2	180	110	10	1	1
18	53	Male	TAESI	Right L4-L5 and L5-S1	2	3	Right L4-5	2	250	140	9	2	1

Table I: Cont.

Patients	Age (year)	Gender	Type of Minimally Invasive Technique	Steroid Injected Foramina	Number of Injection Level(s)	Number(s) of Injection Procedure	Level of Microdiscectomy	Time of Surgery after Last Injection (month)	Loss of Blood During Microdiscectomy (cc)	Duration of Surgery (min)	VAS		
											Just Before surgery	One day after surgery	One and 3 months after surgery
20	38	Male	TAESI	Right L4-L5 and L5-S1	2	3	Right L5-S1	1	240	120	10	1	1
21	41	Male	TAESI	Right L4-L5 and L5-S1	2	2	Right L5-S1	4	320	130	9	2	1
22	58	Female	TAESI	Right L5-S1	1	3	Right L5-S1	1	240	130	9	2	1
23	29	Female	TAESI	Right L5-S1	1	2	Right L5-S1	3	280	110	10	2	1
24	53	Male	TAESI	Left L3-4 and L4-5	2	1	Left L3-4	1	200	130	10	3	2
25	62	Female	TAESI	Left L1-2 and L2-3	2	4	Left L2-3	1	200	160	9	1	1
26	31	Male	TAESI	Right L5-S1	1	3	Right L5-S1	6	190	145	9	2	1
27	64	Female	TAESI	Left L4-L5 and L5-S1	2	3	Left L4-5	15	200	180	10	2	1
28	37	Male	TAESI	Right L4-L5	1	2	Right L4-5	1	170	140	9	1	1
29	61	Female	TAESI	Right L4-L5	1	3	Right L4-5	24	280	140	10	2	1
30	31	Female	TAESI	Right L4-L5	1	3	Right L4-5	2	260	120	10	3	1
31	65	Male	TAESI	Left T12-L1 and L1-L2	2	3	Left L1-2	2	310	150	10	2	1
32	36	Female	TAESI	Right L4-L5	1	2	Right L4-5	2	220	150	10	1	1
Mean	**45.9**				**1.4**	**2.6**		**5.2**	**227 cc**	**139**	**9.5**	**2**	**1**

Table II: Group 2 Patients' Demographics, Intraoperative Results and Vas Scores for Leg Pain Before and After Lumbar Microdiscectomy

Patients	Age (year)	Gender	Level of Microdiscectomy	Loss of Blood During Microdiscectomy (cc)	Duration of Surgery (minutes)	VAS		
						Just Before surgery	One day after surgery	One and 3 months after surgery
1	42	Male	Left L4-5	80	60	10	3	1
2	51	Female	Left L3-4	100	65	9	4	1
3	46	Female	Left L4-5	60	70	9	2	1
4	62	Female	Left L5-S1	85	80	10	1	1
5	53	Male	Right L4-5	90	75	9	2	1
6	44	Female	Left L4-5	100	65	9	3	1
7	38	Male	Right L4-5	105	70	8	2	1
8	34	Female	Right L5-S1	75	80	9	2	1
9	32	Male	Left L5-S1	85	55	9	2	1
10	39	Male	Right L4-5	90	60	10	2	1
11	60	Male	Left L4-5	90	64	10	3	1
12	31	Male	Left L5-S1	90	59	10	2	1
13	54	Female	Right L4-5	65	72	10	2	1
14	41	Male	Right L4-5	80	61	9	3	1
15	47	Male	Left L5-S1	85	68	10	2	1
16	50	Female	Right L4-5	80	69	10	2	1
17	33	Female	Left L4-5	90	58	10	1	1
18	53	Male	Right L4-5	95	80	9	2	1
19	44	Female	Left L4-5	60	50	10	2	1
20	36	Male	Right L5-S1	55	60	10	1	1
21	38	Male	Right L5-S1	40	65	9	2	1
22	54	Female	Right L5-S1	60	58	9	2	1
23	35	Female	Right L5-S1	45	62	10	2	1
24	51	Male	Left L3-4	50	64	10	3	2
25	32	Female	Left L2-3	55	60	9	1	1
26	60	Male	Right L5-S1	55	70	9	2	1
27	59	Female	Left L4-5	60	75	10	2	1
28	51	Male	Right L4-5	60	80	9	1	1
29	58	Female	Right L4-5	70	68	10	2	1
30	37	Female	Right L4-5	80	72	10	3	1
31	38	Male	Left L1-2	65	70	10	2	1
32	63	Female	Right L4-5	45	55	10	1	1
33	47	Male	Right L4-5	85	60	10	3	2
34	39	Male	Left L5-S1	80	65	10	2	1
35	51	Female	Right L4-5	75	60	9	2	1
Mean	**45.8**			**73 cc**	**65.8**	**9.5**	**2**	**1**

Table III: Comparison of the Intraoperative and Postoperative Results Between the Groups

	Group 1 (±SD)	Group 2 (±SD)	p
Duration of Surgery (minutes)	140 ± 28	65 ± 7	1.96
Loss of Blood During Microdiscectomy (cc)	227 ± 171	73 ± 17	2.24
VAS			
Before surgery	9,5	9,5	**0.00**
One day after surgery	2	2	**0.00**
One month after surgery	1	1	**0.00**
Three months after surgery	1	1	**0.00**

±SD: *Standard deviation.*

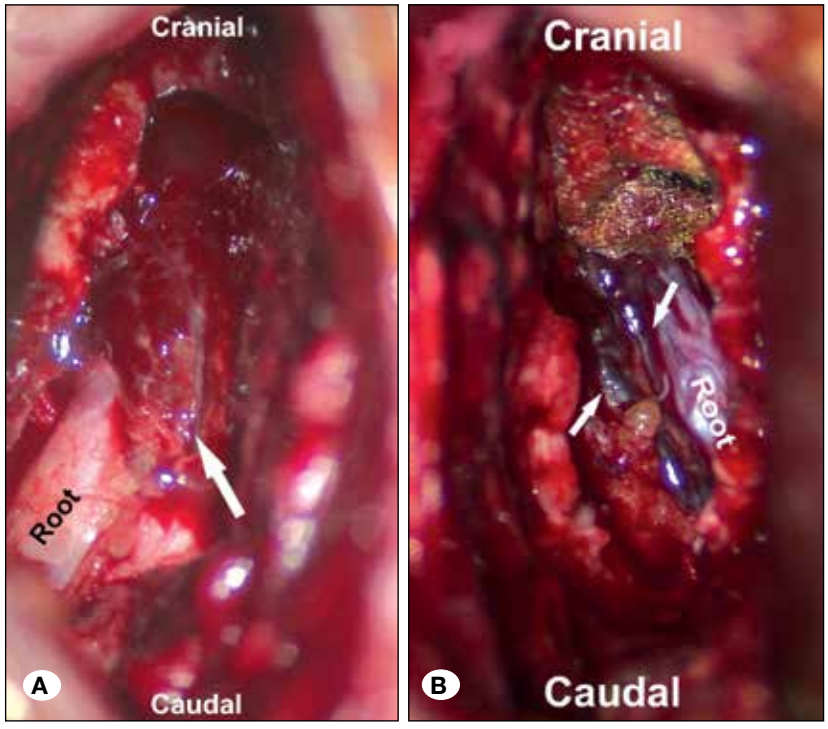

Figure 1: Intraoperative photographs of two patients from Group 1. **A)** A remarkable vascular structure observed in the epidural area (white arrow), and **B)** dilated epidural vessels (white arrows).

The comparison of the preoperative, early and late postoperative VAS scores for leg pain revealed that lumbar discectomy was still effective in Group 1 (p=0.00). Patients from both groups were mobilized 12 hours after surgery and discharged at 24 hours. Postoperative analgesic need was equivalent in both groups.

The rate of incidental durotomy was 0% in both groups.

DISCUSSION

While a sequestrated intervertebral disc may not cause symptoms, a protruded disc can have severe clinical outcomes. In such cases, the most important factor influencing patient complaints is inflammation (12). Treatment aiming to reduce inflammation should alleviate pain and facilitate functional recovery. The action mechanisms of corticosteroids remain unclear. They are thought to exert their effects by suppressing inflammation, stabilizing the neural membrane, and inhibiting nociceptive ectopic discharges in the affected nerve (12). On the other hand, local anesthetics are proposed to act through the mechanisms of nerve block and wind-down (10,12). Although many different epidural techniques are used, the most effective and reliable method is the transforaminal anterior injection, which was also preferred at our clinic (1).

In this report, 2.6% (64 of 2461 patients) of the cases required lumbar surgery subsequent to MIT, and the surgery was performed after an average of 21 weeks following the last injection. As shown by other studies, epidural steroid application is an effective method in the early and mid-term but the effect fades over time (1,8).

Steroids simulate the synthesis of lipocortin, which inhibits phospholipase A2. This enzyme acts on cell membrane phospholipids to release arachidonic acid, which causes the inflammation. Phospholipase A2 inhibition reduces inflammation, mitotic activity, and protein synthesis, all of which help ameliorate symptoms (17). However, in this study, increased vascularity in the surgical area, where the epidural steroid was injected, and the high amount of blood loss during microdiscectomy appeared to be remarkable outcomes (Figure 1A, B). One of the important advantages of microdiscectomy is reduced blood loss with less tissue damage.

How can we explain the increased amount of intraoperative blood loss in patients who received epidural steroid injections? In the literature, there are only a few reports regarding over-bleeding after steroid injections (3,6,9,11,15). In 2002, Manchikanti reported that exogenous steroids suppress the hypothalamic–pituitary–adrenal (HPA) axis (11). In addition, Lamberts et al. found that recovery of the HPA axis may take as long as one year after exogenous steroid discontinuation (9). James et al. reported abnormal uterine bleeding after corticosteroid administration via an intra-articular knee injection and concluded that the exogenous steroids disrupted circulating hormone levels, leading to abnormal bleeding (6). In 1999, Ullian described the effects of steroids on vascular tone and emphasized that steroids increase vascular tone by trophic effects including hypertrophy and/or hyperplasia of vascular smooth muscle cells (15). Another study reported that steroids potentiate the effects of both epidermal growth factor and vascular endothelial growth factor (3). In addition, an increased number of binding sites for these growth factors were observed following steroid injections. As a result, there are two main mechanisms that causing over-bleeding during the surgery. The first one is disruption of the hypothalamic–pituitary–adrenal axis and then the patients who received steroids are more susceptible to increased amount of bleeding intraoperatively. The second and more acceptable reason is increased vascularity of the epidural region following steroid injections by activation of the vascular endothelial growth factors.

Lumbar microdiscectomy is associated with minimal tissue damage, minimal blood loss, early mobilization, and less need of postoperative analgesics. However, patients should be asked if they have any history of steroid injection. Although epidural steroid injection is an effective modality for managing chronic pain, these patients should be informed preoperatively about the relatively long surgery duration and the possible requirement for transfusion. Similarly, the surgical team should keep these possibilities in mind and be ready to deal with complications.

CONCLUSION

Receiving epidural steroid injection earlier for lumbar radiculopathy increases the duration of the lumbar microdiscectomy procedure and may cause increased amount of intraoperative bleeding.

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