International Journal of Surgery Open 8 (2017) 11–14

Contents lists available at ScienceDirect

International Journal of Surgery Open

journal homepage: www.elsevier.com/locate/ijso

Clinical evaluation of 34 cases treated with sequestrectomy: Minimum two year follow up

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ARTICLE INFO

Article history:
Received 13 February 2017
Received in revised form
1 May 2017
Accepted 21 May 2017
Available online 24 May 2017

1. Introduction

Lumbar discectomy represents a good treatment choice for lumbar disc herniation in the presence of sciatica or neurological deficits [1,2]. In 1934, disc herniation to spinal canal was first described by Mixter and Barr who employed laminectomy to treat herniation [3]. In 1977, Yasargil and Caspar introduced surgical microscope into removal of lumbar herniated disc with excellent lightning, very good visualization and smaller skin and fascia incisions [4,5]. Subsequently, a new surgical technique, namely sequestrectomy, was reported for virgin lumbar disc herniation by Williams et al. [6]. This technique included no currettement of disc tissue, no laminectomy or facet trauma, no dilatation of annulus in order to preserve disc tissue [6]. Then, Sprengler et al. described a less invasive method called limited discectomy. This technique includes removal of sequestered fragment without penetrating disc space [7]. It was shown that good results reaching up to 90% could be achieved without increased rates of re-herniation in conservative approaches in disc surgery [8–10]. By recent technical improvements, most surgeons employ various minimal invasive operation techniques in order to preserve soft tissues and relevant structures and to accelerate recovery period [11]. In the present study, it was aimed to assess long-term clinical outcomes in 34 patients underwent sequestrectomy.

2. Materials and methods

2.1. Study population

This retrospective study included 34 patients with lumber disc herniation who underwent sequestrectomy at American Hospital between 2010 and 2011 in a single center. There 14 women and 20 men with a mean age of 52.9 years (range: 37–77 years). The mean follow-up was 37.8 months (range: 26–48 months). All patients had unilateral disc herniation at a single level between L2 and S1. The study included group 1 (fragment-fissure) and group 3 (fragment-contained) patients according to Carragee classification. Sequestrectomy criteria were stable fibrous ring without significant bulging of disc and only small perforation in fibrous ring. Exclusion criteria were prior spinal surgery at the same level, spinal stenosis, extraforaminal or bilateral disc herniation, segmental instability or active infection. Based on Carragee classification, disc herniation was assigned in one of the four groups presented in Table 1. This classification was used for patient selection. Only group 1 and 3 patients were recruited.

2.2. Radiological evaluation

Before surgery, all patients underwent imaging studies including anteroposterior and lateral spinal radiographs and lumbar MR imaging.

2.3. Clinical evaluation

Quality of life and pain scores were evaluated by using visual

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http://dx.doi.org/10.1016/j.ijso.2017.05.004

Table 1
Disc herniation classification system by Carragee et al. [12].

Classification	I.Fragment-Fisssure	II. Fragment-Defect	III.Fragment-Contained	IV. No Fragment contained
Disc fragment	Extruded or sequestrated	Extruded or sequestrated	Subanular detached fragments	No subanular detached fragments
Annulus defect	Minimal	Large or massive	Intact	Intact

analogue scale (VAS) and Oswestry Disability Index (ODI) at baseline and on the months 3, 12 and 24 after surgery.

2.4. Operative technique

All surgeries were performed by the same 4 surgeons (1 Professor, 3 Associate Professor of Neurosurgery). All patients were operated under general anesthesia and in prone position. All patients received preoperative antibiotic prophylaxis. All operations were performed by using an operating microscope and standard midline dorsal approach. Skin incision used was approximately 3 cm. Fascia was incised at midline. Surgical level was determined by intraoperative fluoroscopy. Surgeons performed minimal interlaminar fenestration including removal of minimal bone and lateral aspect of the ligamentum flavum. In all occasions, surgeons identified and retracted root and dura mater to the midline. Then, annular defect was visualized and measured by using a dissector. Annular defect was smaller than 5 mm in all patients. After removal of the sequestrated fragment with or without incision of posterior longitudinal ligament, discectomy and curettement of the disc space were not performed.

2.5. Statistical analysis

All data were analyzed by using SPSS for Windows version 15.0. Preoperative and postoperative clinical data were compared by using paired sample *t*-test. p value < 0.05 was considered as statistically significant.

3. Results

The most frequently operated disc level was L5-S1 in 18 patients; followed by L4-L5 in 17 patients, L2-L3 in 5 patients and L3-L4 levels in 3 patients. Four patients underwent re-operation due re-herniation, representing a recurrence rate of 9.3%. In these patients, re-operation was performed on the day 10, on the months 3 and 5 and at the year 3 after surgery. Following discectomy, dynamic instrumentation was performed in 2 patients with preoperative disc degeneration. Table 2 presents comparison of VAS and ODI scores at all time points. At baseline, the mean VAS and ODI scores were 8.53 (6–10) and 75.7 (48–90), respectively. The mean VAS and ODI scores were 1.23 (0–4) and 3.95 (0–14) on the month 3 whereas 0.79 (0–3) and 2.74 (0–12) on the month 12 and 0.48 (0–2) and 2.09 (0–10) on the month 24 after surgery, respectively. When compared to baseline values, significant decreases were observed in VAS scores on the month 3, 12 and 24 after surgery ($p = 0.000$; $p = 0.00$; and $p = 0.000$, respectively). In addition, there were significant in ODI scores on the month 3, 12 and 24 after surgery compared to baseline values ($p = 0.000$; $p = 0.000$; $p = 0.000$, respectively).

Table 2
Clinical outcome.

	Preoperative	Postoperative (3rd month)	Postoperative (12th month)	Postoperative (24th month)
VAS score				
Mean	8.53	1,23	0,79	0,48
Range	(6–10)	(0–4)	(0–3)	(0–2)
ODI score				
Mean	75,7	3,95	2,74	2,09
Range	(48–90)	(0–14)	(0–12)	(0–10)

4. Discussion

In 2003, herniated discs were classified into 4 groups based on type of herniation by Carragee: 1) fragment-fissure herniation (characterized by minimal annular defect and an extruded or sequestrated fragment); 2) Fragment defect herniation (characterized by large or massive annular defect and an extruded or sequestrated fragment); 3) Fragment contained herniation (characterized by intact annulus and one or more subanuler detached fragments that were removed by making an oblique incision in the annulus); and 4) No fragment contained herniation (characterized by intact annulus and no sub-annular detached fragment) (12).

Re-herniation rate was found to be 27% in group 2 patients. The best clinical results were achieved in groups 1 and 3 while poorest results were observed in group 4 patients [12].

In a case series involving 259 patients, recurrence rate was found to be 3.4% by subtotal discectomy while it was found to be 21.2% by fragment excision alone in Carragee type 2 patients, indicating statistical significance [13].

Integrity of fibrous ring is the key factor for re-herniation after sequestrectomy [8,12,14]. In a study with 3-years follow-up, Fakouri et al. performed sequestrectomy to the patients with annulus defect<5 mm and no marked bulging by taking this key point into consideration. The authors reported only one re-herniation [15].

It is needed to use well-defined criteria and to be careful while selecting patients for sequestrectomy [16]. The most important criteria are lack of bulging in disc and large defect in fibrous ring. In addition, clinical outcomes are better in sequestrated and extruded disc herniation when compared to fragment contained herniation [16].

In a prospective, controlled study on 168 patients, very low recurrence rate in sequestrectomy comparable to standard microdiscectomy group was attributed to optimal patient selection [14].

Only Carragee group 1 and 3 patients with small or no annular defect were included to our study.

In the literature, re-herniation rate in patients underwent sequestrectomy was reported as 5% in a prospective, controlled study by Kast and Thome [14,17]; 2% in a case series by Faulhauer and Manicke [8]; 4.2% (92% within first 9 months) in a case series of 903 patients by Williams et al. [18]; 8% in a case series of 477 patient by Goald et al. [19]; and 5.8% in a case series by Wenger et al. [20]. In our study, recurrence rate was 9.3% (4 patients) in agreement with literature. In the literature, recurrence rate varies from 2% to 18% in standard micro-discectomy [21].

Wenger et al. reported late outcomes in a series of 104 consecutive patients who underwent Williams' sequestrectomy for virgin lumbar disc herniation. In that study, mean follow-up was 5.3 years and revision procedure was performed in 6 patients (5.8%) for recurrent lumbar disc herniation at the same level after 0.4–3.1 years (mean, 1.8 years). Authors yielded excellent success rate of 92.5% [20].