Original Article

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The Effect of Local Steroid Injection on Prevertebral Soft Tissue Swelling after Anterior Cervical Discectomy and Fusion

M. Hasani Barzi (MD)[1], M. Nikoobakht (MD)*[2], N. Hasani Barzi (MD)[3], F. Khanali (MD)[4], Z. Yazdi (MD)[5]

1.Department of of Neurosurgery, Faculty of Medicine, Qazvin University of Medical Sciences, Qazvin, I.R.Iran
2.Department of of Neurosurgery, Faculty of Medicine, Iran University of Medical Sciences, Tehran, I.R.Iran
3.Qazvin University of Medical Sciences, Qazvin, I.R.Iran
4.Department of Radiology, University of Medical Sciences, Qazvin, I.R.Iran
5.Department of Social Medicine, University of Medical Sciences, Qazvin, I.R.Iran

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ABSTRACT

BACKGROUND AND OBJECTIVE: Airway obstruction is a lethal complication of anterior cervical discectomy and prevertebral soft tissue swelling after surgery is one the important causes of this complication. The aim of this study is to investigate the effect of local steroid injection on prevertebral soft tissue swelling after anterior cervical discectomy and fusion (ACDF).

METHODS: This randomized clinical trial was conducted on 40 patients hospitalized in Qazvin educational & clinical Rajaee hospital who were candidates for ACDF in one to three segments because of myelopathy or radiculopathy. Patients were randomly divided into case and control groups. In case group (20 patients), 80 mg methylprednisolone was injected locally on the site of the operation. No injection was performed in control group (20 patients). Lateral neck radiography was performed one day before surgery and on the second and tenth day after surgery. The ratio of prevertebral soft tissue thickness to mid anteroposterior vertebral body (S/V) was calculated for C3-C7. In addition, pain and dysphagia after surgery were recorded on the second and tenth day after surgery (IRCT:201507212327N1).

FINDINGS: S/V ratio in C3-C7 revealed no significant difference in both groups. On the second day after surgery, increase in S/V ratio in all cervical vertebrae revealed a significant difference between the two groups compared with the day before surgery ($p<0.001$). However, this level of increase on the tenth day was only significant in C5 (control group=0.10±0.07, case group=0.02±0.08) and C7 (control group=0.11±0.05, case group=0.02±0.1) ($p=0.004$ and $p=0.002$, respectively). There was also a significant difference between the two groups on the second and tenth day regarding intensity of pain and dysphagia after surgery ($p=0.001$).

CONCLUSION: Based on the results of this study, local methylprednisolone injection reduces prevertebral soft tissue swelling, pain and dysphagia after surgery.

KEY WORDS: *Steroid, Discectomy, Fusion, Soft tissue, Prevertebral, Dysphagia*.

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***Corresponding author: M. Nikoobakht (MD)**
Address: Department of of Neurosurgery, Faculty of Medicine, Iran University of Medical Sciences, Tehran, I.R.Iran
Tel: +98 21 86701
E-mail: mnikobakht@gmail.com

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Introduction

Cervical discopathy is a degenerative cervical spine disease that causes clinical syndromes such as radiculopathy and myelopathy and requires surgery in some cases (1). Although anterior cervical discectomy is a prevalent and relatively low-risk cervical spine surgery, it may sometimes be accompanied by lethal complications such as airway obstruction caused by prevertebral soft tissue swelling (PSTS) (2, 3). Although mortality caused by this complication is extremely rare, some cases have been reported so far (4, 5). In addition, airway obstruction caused by this surgery is an unpredictable complication. Therefore, preventing prevertebral soft tissue swelling is highly important for reducing these unwanted complications. It has been made clear that steroids reduce inflammation by reducing an inflammatory cytokine called platelet-activating factor (PAF), which ultimately leads to tissue swelling reduction (6). Methylprednisolone is a glucocorticoid drug that prevents and inhibits inflammation by controlling protein synthesis, inhibiting the migration of polymorphonuclear leukocytes and fibroblasts, reducing capillary permeability and stabilizing lysosomes at cellular level (7). Since anti-inflammatory drugs may impair the fusion process, the use of steroids is not generally accepted (8). Several studies have been dedicated to anti-inflammatory effects of corticosteroid in anterior cervical discectomy. Pedram et al. reported reduced pharyngeal and laryngeal edema, reduced inflammatory changes and reduced dysphagia and dysphonia by intravenous injection of methylprednisolone after anterior cervical discectomy (9). Lee et al. reported reduced prevertebral soft tissue swelling and odynophagia after surgery using triamcinolone-impregnated Surgicel on surgery site (10). However, the effect of topical steroid injection in surgery site on PSTS, dysphagia and pain were not studied before. This study aims to investigate the effect of topical steroid injection on prevertebral soft tissue swelling after anterior cervical discectomy and fusion.

Methods

This randomized clinical trial was conducted among patients hospitalized in Shahid Rajaee Hospital in Qazvin after being approved by Ethics Committee of Qazvin University of Medical Sciences (11138/20/D) and registered in Clinical Trial Center of Iran (IRCT:201507212327N1) in 2014-2015. 40 patients with myelopathy or radiculopathy, who were candidates for ACDF in one to three segments, entered the study based on clinical examinations and MRI results. Patients were excluded from the study in certain cases including involvement of more than three segments, need for corpectomy, history of cervical trauma, any form of infection or tumor in cervical spine, metabolic diseases such as rheumatoid arthritis, diabetes and chronic heart or kidney diseases. First, the aim of the study was explained to the participants and a written informed consent was obtained from patients. The participants were divided into two groups of 20 (case and control) using different colored cards. The demographic characteristics such as age, gender and level of cervical vertebrae involvement were specified and recorded for both groups. A lateral neck radiograph was prepared one day before surgery.

A single radiologist using a standard ruler measured the prevertebral soft tissue thickness and anteroposterior diameter of vertebral body and calculated S/V ratio separately for C3-C7. A single surgeon operated all participants. After microscopic discectomy and decompression using Smith-Robinson bone graft method and cage system, anterior fusion was performed at vertebral level and finally surgery site was washed with 200 ml saline. At the end of the operation and before wound closure in the case group, 80 mg methylprednisolone was injected into longus coli muscles on both sides and into sternocleidomastoid muscle on the operated side. The patients in control group did not receive the injection. Lateral neck radiography was performed again for both groups to examine the level of prevertebral soft tissue swelling and its changes on the second and tenth day after surgery and S/V ratio was specified for C3-C7.

Then, the difference in S/V ratio before the surgery, two days after surgery and ten days after that was calculated and recorded. In addition, the level of dysphagia on the second and tenth day after surgery was specified for both groups according to the standard table (Functional grades of dysphagia) (11). Post-surgery pain was also specified on the second and tenth day after surgery based on visual analogue scale (VAS). Data were analyzed using SPSS V.19 and statistical tests including T-test, Chi-square, Mann-whitney and repeated measures ANOVA, while $p<0.05$ was considered significant.

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Results

We did not observe a significant difference between the two groups in terms of age and gender. Highest level of intervertebral disc involvement in both groups was observed in C_{5-6} level and lowest involvement was observed in C_{4-5} level (table 1). The difference in S/V ratio in C3-C7 before the surgery was not significant between the two groups (table 2).

Table 1. The demographic characteristics of the two groups

Variable / Group	Case N(%)	Control N(%)	P-value
Age (year) Mean±SD	50.3±12.1	48.3±10.6	0.59
Gender			
Man	8(40)	8(40)	1
Woman	12(60)	12(60)	
Patients according to the involved vertebrae			
C4/5	1(5)	1(5)	0.355
C5/6	12(60)	11(55)	
C6/7	3(15)	2(10)	
C4/5/6	1(5)	2(10)	
C5/6/7	3(15)	4(20)	

Table 2. A comparison of mean S/V ratio in C3-C7 before surgery between the two groups

Variable / Group	Control Mean±SD	Case Mean±SD	P-value
C3	0.21±0.14	0.29±0.22	0.134
C4	0.29±0.20	0.40±0.24	0.152
C5	0.62±0.17	0.71±0.13	0.090
C6	0.77±0.12	0.82±0.10	0.161
C7	0.76±0.13	0.78±0.17	0.678

There was a statistically significant difference between all cervical vertebrae on the second day after surgery in regard with mean S/V changes ($p<0.05$). On the tenth day after surgery, the difference was found to be 0.10±0.07 in control group and 0.02±0.08 in case group ($p=0.002$) in C5 and it was found to be 0.11±0.05 in control group and 0.02±0.10 in case group in C7 ($p=0.004$), indicating a significant difference between the two groups. Difference in other cervical vertebrae was not statistically significant. Mean S/V changes were significant in C5-C7 on the second and the tenth day after surgery (table 3). Mean severity of dysphagia was 2.55±0.51 and 4.25±0.44 in control and case groups on the second day after surgery, respectively ($p<0.001$). Moreover, the difference in severity of dysphagia between the two groups was significant on the tenth day after surgery ($p<0.001$). The difference in post-surgery pain between the two groups was also statistically significant on the second and tenth day after surgery ($p<0.001$) (table 4).

Table 3. A comparison of mean S/V changes in C3-C7 between the two groups on the second and tenth day after surgery

Group	Control Mean±SD	Case Mean±SD	P-value*	P-value**
2nd day				
C3	0.20±0.06	0.06±0.04	0.001	0.520
C4	0.20±0.07	0.08±0.04	0.001	0.052
C5	0.21±0.05	0.05±0.05	0.001	0.006
C6	0.18±0.03	0.06±0.05	0.001	0.007
C7	0.19±0.04	0.06±0.05	0.001	0.048
10th day				
C3	0.30±0.83	0.03±0.03	0.160	0.520
C4	0.10±0.06	0.05±0.14	0.190	0.052
C5	0.10±0.07	0.02±0.08	0.002	0.006
C6	0.07±0.11	0.03±0.07	0.159	0.007
C7	0.11±0.05	0.02±0.10	0.004	0.048

*** P-value based on t-test,** P-value based on repeated measures ANOVA**.

Table 4. A comparison of mean severity of dysphagia and pain between the two groups on the second and tenth day after surgery

Variable	Group	Case Mean±SD	Control Mean±SD	P-value
dysphagia	2nd day	2.55±0.51	4.25±0.44	<0.001
	10th day	1.35±0.48	2.1±0.30	<0.001
pain	2nd day	4.7±0.73	7.5±0.53	<0.001
	10th day	2.2±0.61	3.35±0.67	<0.001

Discussion

Results of the study demonstrated that injection of topical methylprednisolone significantly reduced prevertebral soft tissue swelling in C3-C7 on the second day after surgery, whereas on the tenth day, reduced swelling was only observed in C5 and C7. In addition, significant reduction of dysphagia and pain was observed on the second and tenth day after surgery. Lee et al. reported reduced prevertebral soft tissue swelling after discectomy using triamcinolone-impregnated Surgicel on surgery site in patients with maximum involvement of two cervical segments. After using topical steroids, soft tissue swelling was reduced significantly in C3 and C4, C3-C6, C3-C5 and C3-C6 immediately after surgery, two days after surgery, four

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days after surgery and two weeks after surgery, respectively (10). Results of their study regarding the second day after surgery are in line with the present study. However, their results regarding the tenth day after surgery were different from our study. A significant difference was observed in C3 and C4 in the study of Lee et al., while in the present study, the difference was observed in C5 and C7. This difference might be related to the method of topical steroid administration.

Since Lee et al. used steroid-impregnated Surgicel in their study, some steroid may possibly exit through the drainage system at the end of the operation. In our study, steroid was injected intramuscularly, ruling out the possibility of exit through the drainage system. On the other hand, most cervical disc surgeries in our study were performed in the space between C5 and C6 and topical injection was done in that segment, revealing greater impact in that segment. Koreckij et al. investigated the effect of using methylprednisolone-impregnated gel foam in surgery site on prevertebral soft tissue swelling. Results indicated swelling reduction one day after surgery (12). Results of a study by Song et al. showed that short-term use of systemic methylprednisolone reduces prevertebral soft tissue swelling in C2-C7 (13).

Although the method of steroid administration in this study was different from ours, the results were in line with the results of our study. In another study by Nam et al., 62 patients with cervical disc underwent surgery at the same level and were divided into three groups. The first group received 10, 5 and 5 mg intravenous dexamethasone immediately after surgery, one day after surgery and two days after surgery, respectively. The second group received 20, 10 and 10 mg intravenous dexamethasone, respectively and the third group received intravenous normal saline. Lateral neck radiography was performed immediately after surgery and five days after surgery. The results did not reveal a significant difference between the three groups in terms of soft tissue swelling and dysphagia (14). Difference in our results and the results of their study might be due to difference in the method of steroid administration as well as the time of injection. In the study of Nam et al., the first dose of intravenous dexamethasone was administered immediately after surgery; whereas in our study, methylprednisolone was administered topically before the end of the operation. Regarding time, early administration of steroid may have more effect on reduction of soft tissue swelling and subsequently, reduction of dysphagia. Airway obstruction is also one of the complications of anterior cervical discectomy. This obstruction is caused by damage to muscles, serous and subsequently soft tissue swelling in this area. Therefore, it is sometimes necessary that endotracheal tube be withdrawn dilatorily after the operation (15).

In a double-blind clinical trial, Emery et al. investigated the role of intravenous corticosteroid in preventing delayed withdrawal of endotracheal tube after cervical disc surgery compared with the placebo. In this study, 8 mg intravenous dexamethasone was administered before the surgery, 8 hours after surgery and 16 hours after that in one group. In another group, saline was used as placebo. The results of this study were unable to support the positive role of dexamethasone in preventing delayed withdrawal of endotracheal tube (16).

In seems that the difference between the results of Emery and the present study is because of the type of corticosteroid used and the method of administration. Nevertheless, the effect of steroid on reduction of soft tissue swelling was proved to be significant in some studies. Among them is the study of Franques et al., who proved airway swelling reduction by administering 20 mg methylprednisolone 12 hours before endotracheal tube withdrawal (17). In the same year, Lee et al. reported the positive effects of administering dexamethasone in tracheal edema reduction in patients who were intubated for the last 48 hours (18).

Dysphagia is another significant complication of anterior cervical discectomy (19). The incidence of dysphagia was reported to be 1.7% to 71% in different studies and this wide range may be attributed to difference in design of the studies, difference in definition and difference in method of measuring dysphagia (20, 21). In the present study, administration of topical steroid significantly reduced the incidence of dysphagia after anterior cervical discectomy. In the study of Lee et al., the incidence of dysphagia was measured by visual analogue scale (VAS) and it was demonstrated that the level of dysphagia in the steroid receiving group was significantly lower than the control group, which was in line with our results (10). In the study of Song et al., short-term use of systemic methylprednisolone also reduced dysphagia after anterior cervical surgery (13).

According to the study of Koreckij et al., administration of methylprednisolone on surgery site

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revealed swelling reduction after cervical surgery (12). Study of Jeyamohan et al. showed that intravenous dexamethasone injection before the surgery until 24 hours after surgery reduces dysphagia significantly (8). The results of the abovementioned studies regarding dysphagia after discectomy are in line with our study. This indicates the fact that any method of steroid use may reduce prevertebral soft tissue swelling and subsequently reduce dysphagia.

The results of our study also demonstrated that post-surgery pain in steroid receiving group was significantly lower than control group, while this variable was not assessed in other studies. Eventually, it seems that we can reduce prevertebral soft tissue swelling and subsequently reduce pain and dysphagia through topical injection of methylprednisolone in anterior cervical discectomy. This is a simple and effective method without adverse side effects.

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References

1.Shaffery CI, Sonntag VKH, Vollmer DG, winn HR, Youmans neurological Surgery,6th .Philadelphia: saunders; 2011.p. 2859-60.

2. Fountas KN, Kapsalaki EZ, Nikolakakos LG, Leonidas G, Hugh F, Kim W, et al. Anterior cervical discectomy and fusion associated complications. Spine J. 2007;32(21):2310-17.

3.Riley LH 3rd, Skolasky RL, Albert TJ, Heller JG. Dysphagia after anterior cervical decompression and fusion: prevalence and risk factors from a longitudinal cohort study. Spine J. 2005;30(22):2564-9.

4. Emery SE, Smith MD, Bohlman HH. Upper-airway obstruction after multilevel cervical corpectomy for myelopathy. J Bone Joint Surg Am. 1991; 73(4): 544-51.

5. Sagi HC, Beutler W, Carroll E. Airway complications associated with surgery on the anterior cervical spine. J Neurosurg Spine. 2002;27(9): 949-53.

6. Boswell MV, Trescot AM, Datta S, Schultz DM, Hansen HC, Abdi S, et al. Interventional techniques: evidence-based practice guidelines in the management of chronic spinal pain. Pain Physician. 2007;10(1):7-111.

7. Trevor AJ, Katzung BG, Kruidering-Hall M, Masters SB. Katzung & Trevors Pharmacology, Examination & baard review, 10th ed. Mc Graw Hill LANGE. Corticosteroids and Antagonists.2013; ch:39: 343-349

8. Jeyamohan SB, Kenning TJ, Petronis KA, et al. Effect of steroid use in anterior cervical discectomy and fusion: a randomized controlled trial. J of Neurosurgery: spine 2015; 23(2): 137-143.

9. Pedram M, Castagnera L, Carat X, Vital JM. Pharyngolaryngeal lesions in patients undergoing cervical spine surgery through the anterior approach: contribution of methylprednisolone. Eur Spine J. 2003;12(1):84-90.

10. Lee SH, Kim KT, Suk SK, Park KJ, Oh KI. Effect of retropharyngeal steroid on prevertebral soft tissue swelling following anterior cervical discectomy and fusion: a prospective, randomized study. Spine J. 2011;36(26): 2286-92.

11. Brunicardi FC, Andersen DK, Billiar TR, Dunn DL, Hunter JG, Matthews JB, et al. Schwarte`s principles of surgery. 10th ed. Vol 1. NewYork: Mc Grow Hill. 2015;p. 1008.

12. Koreckij TD, Davidson AA, Baker KC, Park DK. Retropharyngeal steroids and dysphagia following multi-level anterior cervical surgery. Spine J. 2016;41(9):530-34.

13. Song KJ, Lee SK, Ko JH, Yoo MJ, Kim DY, Lee KB. The clinical efficacy of short-term steroid treatment in multilevel anterior cervical arthrodesis. Spine J. 2014;14(12):2954-8.

14. Nam TW, Lee DH, Shin JK, Goh TS, Lee JS. Effect of intravenous dexamethasone on prevertebral soft tissue swelling after anterior cervical discectomy and fusion. Acta Orthop.Belg. 2013;79(2):211-5.

15. Suk KS, Kim KT, Lee SH, Park SW. Prevertebral soft tissue swelling after anterior cervical discectomy and fusion with plate fixation. Int orthop. 2006;30(4):290-4.

16. Emery SE, Akhavan S, Miller P, Furey CG, Yoo JU, Rowbottom JR. Steroids and risk factors for airway compromise in multilevel corpectomy patients. Spine. 2009;34(3): 229-32.

17. François B, Bellissant E, Gissot V, Desachy A, Normand S, Boulain T, et al. 12-h pretreatment with methylprednisolone versus placebo for prevention of postextubation laryngeal oedema: a randomised double-blind trial. Lancet. 2007;369(9567):1083-9.

18. Lee CH, Peng MJ, Wu CL. Dexamethasone to prevent postextubation airway obstruction in adults: a prospective, randomized, double-blind, placebo-controlled study. Crit Care. 2007;11(4):72.

19. Carucci LR, Turner MA, Yeatman CF. Dysphagia secondary to anterior cervical fusion: radiologic evaluation and findings in 74 patients. Am J Roentgenol. 2015:204(4):768-75.

20. Joaquim AF, Murar J, Savage JW, Patel AA. Dysphagia after anterior cervical spine surgery: a systematic review of potential preventative measures. Spine J. 2014;14(9):2246-60.

21. Cho SK, Lu Y, Lee DH. Dysphagia following anterior cervical spinal surgery. Bone Joint J.2013;95(7):868-73.

[DOR: 20.1001.1.15614107.1395.18.10.1.3]
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