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Clinical efficacy of targeted injection of drugs in combination with ozone in treatment of lumbar disc protrusion

Yu Yang[1#], Xue-gang Liang[2#], Pin-quan Li[1], Guan-bao Li[1] and Kai Guan[*]

[1]Minimally Invasive Spine Surgery, Yulin Orthopaedic Hospital of Chinese and Western Medicine, Yulin, Guangxi, PR China

[2]Department of Spine surgery, Ningxia people's Hospital，Yinchuan City, Ningxia,PR,China

Abstract: To investigate the clinical efficacy of targeted injection of drugs surrounding the protruded lumbar disc in combination with the ozone in treatment of lumbar disc protrusion. Between January 2017 and January 2019, a total of 120 patients with lumbar disc protrusion were recruited in this study and divided into the control group and observation group, with 60 patients in each group. Patients in the control group received the ozone treatment, while those in the observation group additionally took the targeted injection of betamethasone surrounding the protruded lumbar disc. Following one month of treatment, we compared the short-term efficacy, joint range of motion in bending forward or backward of the lumbar disc, limb function, life quality and functional disturbance before and after treatment. In the observation group, the short-term effectiveness rate was higher than that in the control group (P<0.05), while after treatment, the joint range of motion in bending forward or backward of lumbar disc in the observation group was improved when comparing to the control group (P<0.05). After treatment, BI and Fugl-Meyer scale were all higher in the observation than those in the control group (P<0.05), with a lower Oswestry score (P<0.05). Targeted injection of betamethasone surrounding the protruded lumbar disc in combination with the ozone performs well in short-term efficacy, conducive to the improvement of the lumbar disc function and limb function and alleviation in function disturbance. Thus, this strategy is worthy of being promoted in clinical practice.

Keywords: Targeted injection of betamethasone surrounding the protruded lumbar disc, ozone, lumbar disc protrusion, clinical efficacy.

INTRODUCTION

Lumbar disc protrusion refers to the degenerative changes in the nucleus pulposus, fibrous rings and cartilage plate of lumbar disc under the external stimuli to damage the fibrous rings, thereby resulting in the protrusion of the nucleus pulposus from the rupture into the canalis spinalis, and thus giving rise to the suppression and stimuli to the adjacent spinal nerves, mostly affecting the L4-5 and L5-S1 segment, taking up nearly 95%, with clinical manifestations like waist pains or limb numbness, severely affecting the health and life of patients (Du *et al*., 2017). Surgical treatment is the most common treatment method for treatment of lumbar disc protrusion that is able to improve the symptoms and mitigate the pains, but limited due to the severe trauma, high risk and poor compliance and tolerance of patients (Yoon *et al*., 2016). As shown in the previous studies (Liu *et al*., 2016), targeted injection of betamethasone surrounding the protruded lumbar disc in combination with the ozone has been reported to improve the lumbar disc function and the limb function, but the efficacy remains to be validated. Thus, in this study, we enrolled a total of 120 patients with lumbar disc protrusion in this hospital between January 2017 and January 2019 as the subjects to explore the clinical efficacy of targeted injection of betamethasone surrounding the protruded lumbar disc in combination with the ozone.

MATERIALS AND METHODS

General data

Between January, 1st 2017 and January 1st 2019, a total of 120 patients with lumbar disc protrusion were recruited in this study and divided into the control group and observation group, with 60 patients in each group. In the control group, there were 34 males and 26 females, aged between 31 and 65 years, with an average of (51.29±5.77) years; disease course of patients ranged from 1 to 18 years, with an average of (10.21±2.69) years. Protrusion type: There were 30 patients with protrusion, 20 with prolapse and 10 with dissociation. Protrusion site: There were 25 patients with protrusion in L3-4, 29 in L4-5 and 6 in L5-S1. In the observation group, there were 31 males and 29 females, aged between 30 and 67 years, with an average of (52.31±5.82) years; disease course of patients ranged from 1 to 19 years, with an average of (10.25±2.72) years. Protrusion type: There were 24 patients with protrusion, 21 with prolapse and 11 with dissociation. Protrusion site: There were 24 patients with

*Corresponding author: e-mail: g8001k@126.com #Contributed equally to this work

Corresponding address: Department of Orthopacdits of The Seventh Medical Center, General Hospital of PLA, No.5, NanMenCang, DongCheng District, Beijing, PR China

protrusion in L3-4, 28 in L4-5 and 8 in L5-S1. No significant differences were shown in comparison of the general data, including the sex ratio and age, of the patients between two groups ($P > 0.05$), suggesting that the data were comparable. This study was approved by the Ethical Committee of Yulin Orthopaedic Hospital of Chinese and Western Medicine.

Criteria of inclusion and exclusion

Inclusion criteria: 1) Patients conforming to the diagnostic criteria of lumbar disc protrusion, with manifestations of waist pain or leg pain in nerve region; 2) patients with the indications of targeted injection of drugs surrounding the protruded lumbar disc and ozone treatment; 3) patients in good compliance.

Exclusion criteria: 1) Patients complicated with the osseous spinal canal stenosis, ligamentum flavum hypertrophy or bone tuberculosis; 2) patients complicated with the discitis, bone marrow tumors or tolerating the surgery poorly; 3) patients with malignancies or diseases in immune system.

Methods

Patients in the control group received the ozone treatment. In brief, patients in supine position were anesthetized locally by use of 2% lidocaine, and under the guidance of C-arm X ray, a needle was used to penetrate into the target zone. After the needle was ascertained to be located inside the lumbar disc, sensory and motor nerves were sequentially stimulated to determine the anomaly. radiofrequency ablation was then performed for those without any anomaly, and afterwards, 4 to 10 mL ozone in concentration of 50 μg/mL was injected into the lumbar disc. Patients were delivered back to the wards and required to stay in bed for 1 to 2 days.

Those in the observation group additionally took the targeted injection of betamethasone surrounding the protruded lumbar disc. In brief, after the ozone treatment similar to that in the control group, they were required to take the prone position in computed tomography machine to perform the location of lumbar disc (Qiu *et al*., 2016). In light of the local anatomic structure and the protrusion target in lumbar disc, the distance and angle of the needle site to the target site were measured. Following the infiltrative anesthesia at the penetrating site, penetration was performed by use of 21G (15 cm) percutaneous transhepatic cholangiography (PTC) (Hekko-medical, Japan) as per the angle. Contrast agent was given when the patients complained about the pains in waist or sore and swollen in affected limbs to make sure that the agent was delivered successfully to the target site under the guidance of computed tomography (CT). Then, mixture of 2 mL compound betamethasone (diprospan, Beijing Four Rings Biopharmaceutical Co., Ltd.; State Food and Drug Administration (SFDA) Approval No.H20051410), mecobalamin tablet (Mecobalamin, China Associate Pharmaceutical Co., Ltd; SFDA Approval No.H20050320) and 8 mL salviae miltiorrhizae in normal saline. Following treatment, patients were required to keep in prone position for at least 2 h to guarantee the sufficient diffusion of drugs, and not to participate in the labor. At one month after treatment, the efficacy was evaluated.

Evaluation of efficacy

Short-term efficacy

Macnab function evaluation criteria were adopted to assess the short-term efficacy (Alexandre *et al*., 2002). The total effectiveness rate = (Number of excellence and improvement)/total ×100%.

Joint range of motion in vertebra

X-ray examination was performed to determine the joint range of motion in lumbar disc bending forward or backward.

Limb function, life quality and functional disturbance

Fugl-Meyer scale (higher score representing the better limb function, Barthel scale (higher score representing the better life quality) and Oswestry index (lower score representing the better recovery from the functional disturbance) were used to evaluate the improvement in limb function, life quality and functional disturbance.

STATISTICAL ANALYSIS

SPSS 18.0 software was used to process the data. Count data were presented in form of percentage (%), measurement data were presented in form of mean± standard deviation and compared by chi-square test. $P<0.05$ suggested the statistical significance of difference.

RESULTS

Comparison of the short-term efficacy between two groups

The short-term effectiveness rate in the observation group was 93.33%, higher than 86.67% in the control group ($P<0.05$, table 1).

Comparison of the joint range of motion in the lumbar disc of patients between two groups

Before treatment, comparison of the joint ranges of motion in lumbar disc bending forward and backward revealed no significant difference ($P>0.05$), while after treatment, these indexes were improved in the observation group ($P<0.05$, table 2).

Comparison of the limb function, life quality and functional disturbance of patients between two groups

Before treatment, the differences in evaluating the limb

Table 1: Comparison of the short-term efficacy between two groups [n (%)]

Group	N	Excellence	Improvement	Failure	Total effectiveness rate
Observation group	60	49(81.67)	7(11.66)	4(6.67)	56(93.33)
Control group	60	42(70.00)	10(16.67)	8(13.33)	42(86.67)
χ^2					6.982
P					0.037

Table 2: Comparison of the joint range of motion in the lumbar disc of patients between two groups (mean ± standard deviation)

Group	N	Angle of lumbar disc in bending forward		Angle of lumbar disc in bending backward	
		Before treatment	After treatment	Before treatment	After treatment
Observation group	60	39.42±2.67	58.97±4.52	15.22±0.58	21.47±2.42
Control group	60	39.41±2.66	45.37±4.65	15.21±0.55	18.34±1.85
χ^2		1.294	15.772	0.984	13.294
P		0.133	0	0.09	0

Table 3: Comparison of the limb function, life quality and functional disturbance of patients between two groups (mean ± standard deviation)

	N	Fugl-Meyer scale				BI index				Oswestry score			
		Before treatment	After treatment	χ2	P	Before treatment	After treatment	χ2	P	Before treatment	After treatment	χ2	P
Observation group	60	38.47 ±4.38	48.92 ±5.42	9.853	0	62.32 ±5.76	83.47 ±5.90	16.848	0	22.32 ±4.36	7.85 ±2.85	18.264	0
Control group	60	38.10 ±4.42	42.39 ±5.18	4.139	0	62.10 ±5.72	75.68 ±5.79	10.960	0	22.31 ±4.32	12.33 ±3.49	11.813	0
χ2		3.582	5.722			2.643	6.197			0.957	6.540		
P		0.473	0			0.294	0			0.09	0		

function, life quality and functional disturbance between two groups showed no statistical significance ($P>0.05$), but after treatment, the patients in the observation group had better improvement than their counterparts in the control group ($P<0.05$, table 3).

DISCUSSION

Lumbar disc protrusion mainly manifests the back pain or sciatica, complicated with the numbness in unilateral or bilateral lower limbs, and has been regarded as the major cause of the pains in waist or legs (Li *et al*., 2016; Guan *et al*., 2016). Degenerative changes in lumbar disc, the major cause of lumbar disc protrusion, is mostly caused by the long-term incorrect waist posture, sudden weight bearing, extremely cold environment and increase in abdominal pressure due to the pregnancy or coughing (Lee *et al*., 2016). Generally, lumbar disc protrusion has no evident symptoms in the early stage, and as the disease progresses, patients gradually complain about the pains or numbness in waist or lower limbs, while in some severe cases, patients may be tortured by the Cauda equina or pressured marrow, resulting in the dysfunction in excretion, or even the paralysis in lower limbs, which has deteriorated the life quality of patients (Qian *et al*., 2016). At present, three hypotheses have been developed for elucidating the pathogenesis of lumbar disc protrusion: Hypothesis of local pressure by protrusion, autoimmune hypothesis and inflammatory mediator hypothesis (Liu *et al*., 2012). Thus, we infer that efficacy of treatment for lumbar disc protrusion depends on the pathogenesis. In recent years, targeted injection of drugs surrounding the protruded lumbar disc in combination with the ozone treatment has been widely applied in the lumbar disc protrusion patients, with promising efficacy.

As for the mechanism of ozone in treatment of lumbar disc protrusion, it is generally believed that ozone has the oxidative effect, anti-inflammatory effect, analgesic effect and immunosuppression effect (Wu *et al*., 2017). Ozone, as a potent oxidant, can oxidize the nucleus pulposus in lumbar disc by dehydrating the proteoglycan, thereby decreasing the pressure inside the lumbar disc by shrinking the nucleus pulposus, finally reducing the protruded lumbar disc into the original place (Liao, 2016; Murphy K *et al*., 2015). The shrinkage or retraction of the lumbar disc may mitigate the suppression on the nerve root while increase the reflux of venous blood, thereby augmenting the local blood supply, which can improve the hypoxia-sensitive pains of nerve root. Besides, oxygen can promote the expression of anti-oxidative enzyme and inhibit the generation of inflammatory factors, thus

dilating the vessels and eliminating the absorbance of inflammatory mediator, so as to mitigate the pains (Andreula *et al*., 2003). CT guidance for the injection of drugs at the targeted site in protruded lumbar disc can help the physicians to deliver the drugs to the target site precisely, which can benefit the absorbance of lumbar disc and relieve the inflammation in nerve root.

The results of this study showed that the total effectiveness rate in the short-term treatment in the observation was superior to that of the control group (P<0.05), suggesting that this strategy benefits the recovery of patients by improving the clinical efficacy. Furthermore, after treatment, patients in the observation group had better performance in the joint range of motion when bending forward or backward the lumbar disc, BI index and Fugl-Meyer scores than their counterparts in the control group (P<0.05), with a lower Oswestry score (P<0.05), indicating that this strategy, by introducing the advantages of different protocols, improves the waist functions and limb function, and mitigate the functional disturbance of patients (Brina and Villani 2004). However, patients should perfect the relevant examinations before treatment, and guarantee to comply the treatment protocol. However, patients with the calcified protruded lumbar disc or with spinal canal stenosis are not eligible for this strategy.

CONCLUSION

In conclusion, targeted injection of betamethasone surrounding the protruded lumbar disc in combination with the ozone performs well in short-term efficacy, conducive to the improvement of the lumbar disc function and limb function and alleviation in function disturbance. Thus, this strategy is worthy of being promoted in clinical practice. However, the conclusion of this study remains to be validated due to the small sample size, thus we will expand the sample size in the future study, aiming to provide more reliable evidence for clinical practice.

REFERENCES

Alexandre A, Buric J and Linfsa F (2002). Intradiscal injection of 02-03 to treat lumbar disc hemiations. Results at five years. *Rivista Italian Diossigeno-Ozonotherapia*, **1**(2): 165-169.

Andreula CF, Simonetti L and De Santis F (2003). Minimally invasive oxygen-ozone therapy for lumbar disk herniation. *AJNR Am. J. Neuroradiol.,* **24**(5): 996-1000.

Brina L and Villani PC (2004). Treatment of rotator cuff lesions with echo guided infiltration of an Oxygen-Ozone mixture. *Rivista Italiana di Ossigeno-Ozonoterapia*, **3**(2): 139-147.

Du P, Xiao YY and Lu W (2017). CT guided percutaneous nucleus pulposus ablation combined with ozone injection for the treatment of lumbar disc herniation. *Chinese Interventional Imaging and Therapeutics,* **14**(5): 266-269.

Guan JW, Zhang HT and Sun HT (2016). Imaging analysis and endoscopic treatment of intraspinal ossification of lumbar disc herniation. *Chinese Journal of Orthopaedics*, **24**(21): 1932-1937.

Liao HM (2016). Observation and nursing of the therapeutic effect of semiconductor laser combined with electroacupuncture and ultrashort wave on lumbar disc herniation. *Laser Magazine*, **37**(2): 149-151.

Li B, Xu XX and Du Y (2016). CT guided chemo ablation combined with lumbar intermuscular groove block for the treatment of lumbar disc herniation. *Clinical Radiology Journal*, **35**(9): 1432-1436.

Liu CS, Xu FH and Yi YS (2016). Prediction of the effect of ozone targeted therapy on lumbar disc herniation by regional mapping in. *Chinese Medicine*, **56**(29): 78-80.

Liu QG, Song ZB and Gao JW (2012). Microendoscopic discectomy versus microscopic discectomy for treatment of lumbar disc herniations: A systematic review of randomized controlled trials. *Chin. J. Cintemp. Neurol. Neurosurg,* **12**(4): 399-406.

Lee JH, Lee SH and Huang SF (2016). Clinical and radiological characteristics of lumbosacral lateral disc herniation in comparison with those of medical disc herniation. *Medicine* (Baltimore), **95**(7): e2733.

Murphy K, Muto M and Steppan J (2015). Treatment of contained herniated lumbar discs with ozone and corticosteroid: A pilot clinical study. *Can. Assoc. Radiol. J.*, **66**(4): 377-384.

Qian YF, Jin MJ and Fang H (2016). Observation of the curative effect of lumbar core muscle strength training combined with suspension training on lumbar disc herniation. *Chinese Journal of Physical Medicine and Rehabilitation,* **38**(9): 704-706.

Qiu PC, Liu JF and Pan LT (2016). Application of different minimally invasive therapies combined with collagenase in the treatment of lumbar disc herniation. *Medicine,* **37**(z2): 105-107.

Wu Y, Sun YJ and Zhang JF (2017). Clinical study on "Du Du Qi guiding needling" combined with electroacupuncture in treating mild to moderate lumbar disc herniation with blood stasis type. *Chinese Acupuncture*, **37**(5): 467-472.

Yoon MA, Hong SJ and Kang CH (2016). T1rho and T2 mapping of lumbar intervertebral disc: Correlation with degeneration and morphologic changes in different disc region. *Magn. Reson. Imaging,* **34**(7): 932-939.