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Recurrence of piriformis syndrome: One year follow up post ultrasound guided injection therapy

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ABSTRACT

Background. Piriformis syndrome is a common cause of low back pain sometimes underdiagnosed due to a lack of distinguishing symptoms and patterns. Two methods of ultrasound-guided intramuscular injection (using a local anesthetic agent and combined with corticosteroids) have become the treatments of choice. However, some studies suggest these methods may result in recurrence even though data regarding the prevalence of recurrence and triggering factors are still lacking.

Objective. To identify the prevalence of and factors triggering the recurrence of piriformis syndrome treated with steroid and local anesthetic injections.

Methods. This is a prospective cohort following patients diagnosed with piriformis syndrome and treated with either a local anesthetic or a combination with the addition of corticosteroids. Demographic, risk factors, and the onset of pain recurrence data were taken and analyzed.

Results. From the 66 patients included in this study, 68.2% (n:45) reported recurrence of pain, with the majority occurring within the first three months post-injection. Subjects treated with combination therapy had a pain-free interval 13.45 weeks longer than subjects treated with a local anesthetic injection. There were no significant differences in risk factors between both groups.

Conclusion. Recurrence of piriformis syndrome was most commonly found within the first and third months of treatment. Both methods did not differ significantly, even though combination therapy tends to give longer pain-relief intervals.

Keywords: piriformis syndrome, ultrasound-guided injection, recurrent, triggering factors

BACKGROUND

Piriformis syndrome is a sciatic nerve peripheral neuritis disease caused by an anomaly of the piriformis muscle at the ischial tuberosity. Piriformis syndrome was discovered responsible for 0.3% to 6% of cases of low back pain, with or without sciatica. Piriformis syndrome is most common in middle age, with a male-to-female ratio of 6:1 [1]. When the body's systems are disrupted by chronic or acute injury, followed by excessive internal rotation of the pelvis, the piriformis muscle, mainly located in the buttock region, is subjected to increased pressure [2,3]. Some anatomical defects, including anatomical varieties, cause compression in the piriformis area. Anatomical variations of the piriformis muscle, anatomical variations of the sciatic nerve, direct invasion of tumors, and aneurysms of the inferior gluteal artery contribute to piriformis compression. Several other investigations have suggested that pelvic trauma (both macro and micro) can cause piriformis injury due to compression [2,4,5].

Piriformis syndrome has been challenging to diagnose since the clinical indications are similar to other causes of low back pain, such as herniated nucleus pulposus, sacroiliac joint pain, and facet joint pain. Radiological examinations rule out possible differential diagnoses but are not definite diagnostic tests. The gold standard for diagnosis is still piriformis muscle blockage using a local anesthetic drug. Nonsurgical therapy, such as physical and

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pharmacological therapy, is usually used to treat piriformis syndrome. However, surgical intervention may be considered if the patient has a disability or pain condition not well managed by the nonsurgical intervention [3,6].

Ultrasound-guided intramuscular injection of the piriformis using local anesthetic with or without steroids has become the treatment of choice for piriformis syndrome in many pain clinics since it may be used for diagnosis and therapy [7]. Although injectable therapy with local anesthetic and possibly steroids is thought to be effective, several studies have revealed it is only effective for a short period. According to the previous authors' acknowledgment, some studies still describe the prevalence of recurrent cases of piriformis syndrome associated with injectable therapy [2,5,8]. As a result, this study aims to determine whether or not piriformis syndrome recurs after injection therapy with local anesthetic medicines and steroids, as well as the triggering factors. Age, gender, BMI, medical history, and type of therapy used may all play a role in piriformis syndrome recurrence, but further research is needed to establish this [9–11].

MATERIALS AND METHODS

This is a prospective cohort study of 66 subjects with piriformis syndrome. Patients with piriformis syndrome who had ultrasound-guided local anesthetic injections with or without corticosteroids at Siloam Hospital Tangerang during August and October 2020 were identified using medical records. Data was taken through medical records in the form of demographic data (age, gender, weight, height, and occupation); clinical data (symptoms and signs, physical examination with or without investigations); and injection method, including post-injection evaluation.

In this study, participants were declared to have a recurrence of piriformis syndrome if they had a pain-free time of at least three days following piriformis injection therapy, then experienced the same pain symptoms as before piriformis injection therapy.

Patients with a history of surgery or pelvic region infection, as well as a history of cancer in their medical records, were automatically excluded. All individuals with complete medical records were contacted by phone. Subjects who agreed to participate were interviewed using the same questionnaire during the initial appointment for piriformis syndrome. The medical interview includes confirming the patient's identity; pain manifestations during the interview (symptoms, scale); and risk factors (disease history, history of trauma) being discussed at regular intervals post-injection. Improvement or worsening of pain experienced at the first hospital visit and the visual pain scale were substituted for the percentage of pain in telephone interviews.

Ethical Statement

This study was declared to have passed the ethical review by the Faculty of Medicine, Universitas Pelita Harapan, by obtaining ethics number 171/K-LKJ/ETIK/XI/2020.

Statistical Analyses

SPSS (Statistical Package for the Social Sciences) version 25 was used to enter and process all data. Descriptive statistics with a normal distribution was given numerically as a mean and standard deviation and categorical data as percentages. The t-test was performed to examine the mean differences between the recurrent and nonrecurring piriformis syndrome groups in the bivariate data presented. Furthermore, the logistic regression method examined several parameters influencing the recurrence output. If the p-value is less than 0.05, the results are significant.

RESULT

Sixty-six patients with piriformis syndrome following intramuscular injection were successfully followed up for a year. This study's subjects were women over 60, with an average BMI of 24.48±3.36 kg/m^2 (n:45) (68.2%); this included the 66 participants who suffered a recurrence of piriformis syndrome, with the most significant time covering the first to third post-injection months (Table 1). The two groups (piriformis syndrome sufferers with and without recurrence) were compared based on piriformis syndrome risk factors; there was no significant difference in the mean between the two groups (Table 2). All variables that could trigger the recurrence of piriformis syndrome were examined using a multivariate method, yielding a nonsignificant p-value (Table 3). When the first and third months of follow-up were examined, it was discovered that the group receiving local injection alone had a higher prevalence of recurrence than the group receiving combined injection therapy (Figure 1). The recurrence period differed between the two intervention groups, with the combined intervention group taking 13.45 weeks longer than the local anesthetic intervention group alone (Figure 2). According to the Chi-square test, the recurrence rate in both groups was 73.53% in the local anesthetic-only group and 62.5% in the 12-month combination therapy with local anesthetics and corticosteroids ($p>0.05$) (Table 4).

TABLE 1. Demographic and clinical characteristics of respondents

	Total (n=66)		Recurrent (n=45/68.2%)	
Variable	Frequency	%	Frequency	%
Age Group				
20-29	1	1.52	1	2.22
30-39	4	6.06	4	8.89
40-49	11	16.67	8	17.78
50-59	18	27.27	12	26.67
>60	32	48.48	20	44.44
Gender				
Male	18	27.27	12	26.67
Female	48	72.73	33	73.33
Injection therapy with USG-guidance				
Local Anesthetic	34	51.51	25	55.56
Local Anesthetic and Corticosteroid	32	48.49	20	44.44
History of Microtrauma				
No History	22	33.33	14	31.11
Long Distance Walk or Run	12	18.18	6	13.33
Sitting Cross-legged	8	12.12	6	13.33
Sitting still on Surface	24	36.36	19	42.22
History of Low Back Pain				
None	52	78.79	33	73.33
≥1	14	21.21	12	26.67
Recurrent				
None	21	31.82	-	-
Recurrent	45	68.18	-	-
Recurrent Period (1-12 months)				
No Recurrence	21	31.82	-	-
<1 month	11	16.67	-	-
1-3 month	20	30.3	-	-
>3 month	14	21.21	-	-

TABLE 2. Differences in means in the recurrent and non-recurrent groups

No.	Variables		n	Mean ± SD	Min/Max	P Value
1	Weight					
		With recurrence	45	60.94±9.72	48/83	0.7693
		Without recurrence	21	60.18±9.72	45/78	
2	Height					
		With recurrence	45	1.57±0.069	1.45/1,75	0.5258
		Without recurrence	21	1.56±0.054	1.46/1,7	
3	Body Mass Index					
		With recurrence	45	24.46±3.22	18.75/31.25	0.937
		Without recurrence	21	24.53±3.72	17.57/30.46	
4	Sitting duration (hours)					
		With recurrence	45	4.31±2.41	0/8"	0.1474
		Without recurrence	21	3.38±2.37	0/7"	
5	Pain scale					
		With recurrence	45	7.26±1.86	2/10"	0.1774
		Without recurrence	21	7.9±1.54	5/10"	

**Unpaired T-test*

TABLE 3. Multivariate analysis of recurrence risks

Variables	Odd Ratio	95% Confidence Interval	P value
Gender	1.1	0.34; 3.48	0.871
Age group	0.632	0.34; 1.15	0.134
Body mass index	0.993	0.85; 1.16	0.936
History of microtrauma	1.36	0.46; 4.02	0.576
Sitting duration (hours)	1.176	0.94; 1.46	0.148
History of low back pain	1.69	0.86; 3.34	0.126
Pain scale	0.803	0.58; 1.104	0.178
Intervention	0.6	0.21; 1.706	0.338

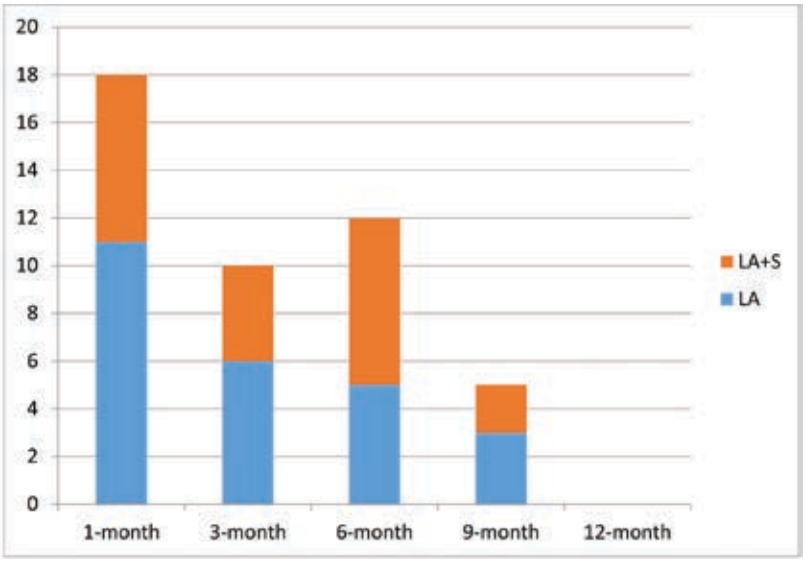

FIGURE 1. Recurrence periods in both injection therapies

DISCUSSION

This study looked at recurrence after 12 months in patients with piriformis syndrome who had a pain-free time of at least three days after injectable therapy. During this time, 45 (68.18%) of the 66 cases relapsed. A total of 34 subjects were treated with local anesthetic agents (2% lidocaine), while the other 32 were treated with a combination of the two (2% lidocaine and triamcinolone). The recurrence period differed between the two intervention groups, with the combined intervention group taking 13.45 weeks longer than the local anesthetic intervention group. According to the chi-square analysis, there was no signif-

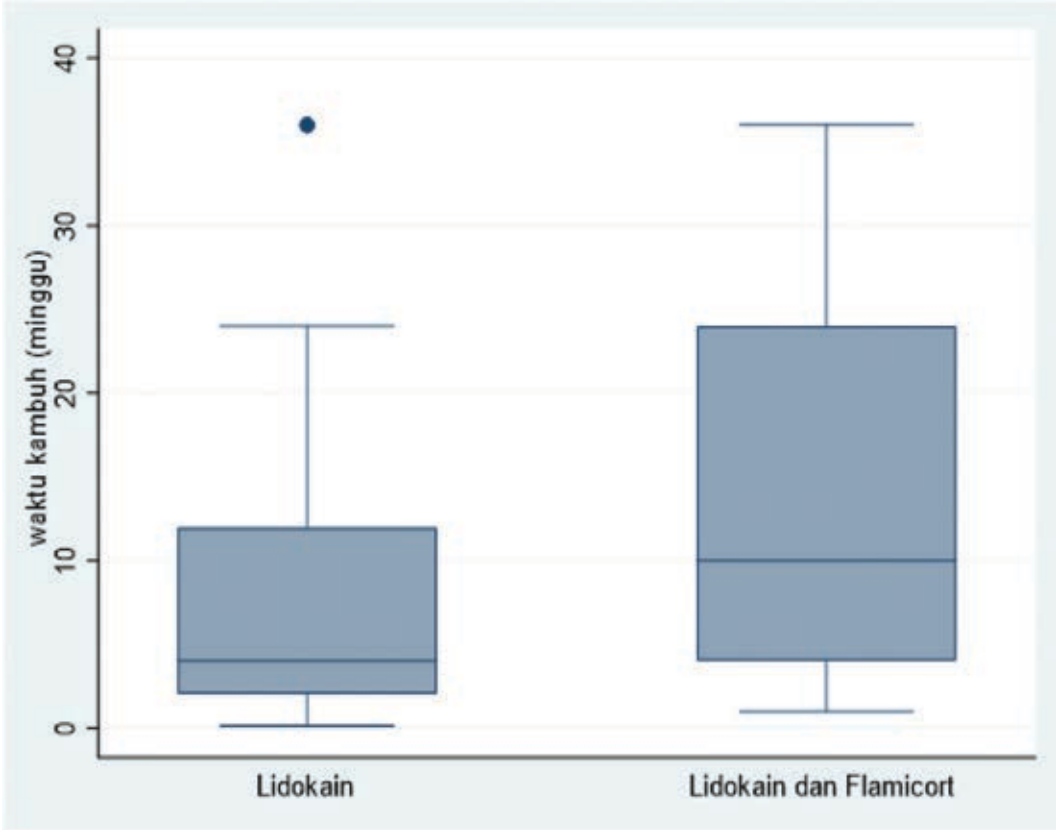

FIGURE 2. Box plot of recurrence periods

TABLE 4. Chi-square analysis of all subjects during 12 month-period

Period	Intervention*	Without recurrence		Recurrence		P Value
		n(%)	Total	n(%)	Total	
1-month	Local anaesthesia	23 (67.65)	48 (72.73)	11 (32.35)	18 (27.27)	0.34
	Local anaesthesia and steroid	25 (78.13)		7 (21.87)		
3-month	Local anaesthesia	17 (50)	38 (57.58)	17 (50)	28 (42.42)	0.19
	Local anaesthesia and steroid	21 (65.63)		11 (34.37)		
6-month	Local anaesthesia	12 (35.29)	26 (39.39)	22 (64.71)	40 (60.61)	0.48
	Local anaesthesia and steroid	14 (43.75)		18 (56.25)		
9-month	Local anaesthesia	9 (26.47)	21 (31.82)	25 (73.53)	45 (68.18)	0.92
	Local anaesthesia and steroid	12 (37.50)		20 (62.50)		
12-month	Local anaesthesia	9 (26.47)	21 (31.82)	25 (73.53)	45 (68.18)	0.92
	Local anaesthesia and steroid	12 (37.50)		20 (62.50)		

**Local anaesthesia only injected in 34 subjects whereas combination of local anaesthesia and steroid injected in 32 subjects*

icant link between the two groups and the recurrence of piriformis syndrome after 12 months ($p>0.05$). The results of this study are consistent with the findings of Misirlioglu et al. (2015)'s RCT (randomized controlled trial) study, which examined the effectiveness of local anesthetic injection blocks with and without corticosteroids in patients with piriformis syndrome [10].

The use of local anesthetics and anti-inflammatory drugs is intended to minimize edema and thereby facilitate nerve conduction owing to damage. Weinberg et al. (2015) and Jeong et al. (2016) published studies on the role of local anesthetics in relaxing the piriformis muscle and stopping the pain cycle. In contrast, steroid treatment has an anti-inflammatory role and prevents the transmission of nociceptive nerve fibers [11,12]. According to the Fishman study, roughly 71.1% of patients with piriformis syndrome improved significantly after receiving a combined injection of local anesthetic and corticosteroid, followed by physiotherapy [6,13]. Although the injection treatment is thought to be effective in hav-

ing a therapeutic impact on piriformis syndrome, its long-term therapeutic efficiency has not been thoroughly explored. Hee's 2015 retrospective analysis evaluating the effectiveness of therapy with or without ultrasound guidance was the most extended study examining therapeutic effectiveness [11]. Tugce's (2015) study, on the other hand, explored the same thing with fewer subjects and a shorter research time [10].

In some studies, local anesthetics are thought to act as an anti-nociceptive by inhibiting sodium channels and producing membrane stabilization. In comparison, corticosteroids are thought to have anti-inflammatory and anti-edema properties by inhibiting the activity of phospholipase-A2, diminishing the performance of arachidonic acid and prostaglandin synthesis, and functioning as an anti-nociceptive in piriformis syndrome [9,10,14]. However, compared to the corticosteroid combination, treatment with local anesthetic alone resulted in a similar resolution in this trial. Long-term treatment of piriformis syndrome necessitates a strategy that includes long-term muscle relaxant treatments, such as botulinum toxin-A and alteration of predisposing factors [6,7,15].

The administration of local anesthetic produces complete relaxation of the muscle bands by blocking nerves and reducing aberrant muscle activity; this process increases blood flow and oxygen, stopping the cycle of muscle spasms [10]. Furthermore, these agents aid in diluting the nerve-sensitizing chemical, causing the neural return mechanism to end [9,12]. However, no research has been done on the long-term calming impact of this local anesthetic drug in instances of piriformis syndrome. Ehad et al. (2019) concluded from a meta-analysis study that injecting local anesthetic drugs in instances with neck muscle myofascial syndrome resulted in considerable improvement for 2–8 weeks [16]. In contrast, the direct relaxing impact of corticosteroid drugs on piriformis syndrome has never been mentioned in the literature. This differs from the usage of botulinum toxin-A. This toxin is a potent catalyst that becomes neurotoxic by relaxing the piriformis muscle and paralyzing it. Through nociceptor sensitization, muscle contraction activity is immediately lost. Furthermore, this toxin inhibits pain signals to and from the central nervous system by blocking the release of neurotransmitters that play a role in sensitizing and activating nociceptors. As a result, much literature indicates that botulinum toxin-A therapy is more successful in the long run than local anesthetic with or without corticosteroids [6,13].

In addition to the short-term effect of injectable therapy, various risk factors for recurrence play a role in raising the likelihood of recurrence. According to the odds ratio (OR>1) in the multivariate analysis of this study, various predisposing factors, such as gender, history of microtrauma, duration of sitting, and previous history of low back pain ($p>0.05$), may increase the likelihood of recurrence. The authors emphasize predisposing factors that the patient in this discussion can control: history of microtrauma and duration of sitting. Microtrauma to the buttocks can be induced by various activities, including long-distance walking/running, sitting with crossed legs, and sitting on a hard surface. Of the 45 participants with recurrence, 31 (68.89%) had a history of microtrauma, and sitting on a hard surface was the most prevalent activity. Because of its function as a postural muscle, the piriformis muscle is prone to hyperactivity and hypertonicity, particularly while the individual is walking/standing or sitting for extended periods. If the major muscle responsible for a particular joint's movement becomes weak, other synergistic muscles will compensate [3]. Furthermore, participants who had a recurrence in this study had a history of sitting for more significant periods (with a mean of 4.31 ± 2.41 hours). Sitting for extended periods generates excessive contractions needed to maintain the position. This continual contraction increases stress in the surrounding area (sciatica), irritating and inducing inflammation in the piriformis muscle tissue, which results in complaints.

Age, body mass index, pain scale, and management were also evaluated as protective factors (OR1) for the occurrence of piriformis syndrome ($p>0.05$). The age group in this study differed from that of other studies, which stated that the age range of patients with piriformis syndrome was 40–60 years. This discrepancy might be influenced by each individual's unique activities and employment. However, the relationship between old age and piriformis syndrome recurrence has not been established. The likelihood of a decline in pelvic support muscle performance, hormonal changes, and comorbidities that worsen with age need to be investigated further. Furthermore, the mean body mass index (BMI) in all patients was 24.48 ± 3.36, with a predominance in the normal BMI group, consistent with Chen et al.'s study [16].

The data acquired for this study was based on medical records and telephone medical interviews. Hence, the information obtained was limited. Furthermore, this study solely compared the recurrence pain scale to the pre-injection pain scale to determine piriformis syndrome recurrence without considering other factors that cause recurrence.

CONCLUSION

Recurrence of piriformis syndrome was most common in the first and third months of treatment

with local anesthetic injection therapy and a combination of corticosteroids. The time of relapse did not differ significantly between the two groups, which is likely related to the importance of long-term relaxant effects in managing piriformis syndrome. Various risk variables, such as a history of microtrauma and prolonged sitting, must be controlled in addition to injectable therapy to reduce the recurrence of piriformis syndrome.

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REFERENCES

1. Siahaan YMT, Ketaren RJ, Hartoyo V, Tiffani P. The Predisposing Factors of Piriformis Syndrome: Study in a Referral Hospital. *Malang Neuro J.* 2019;5:76–9. doi: 10.21776/ub.mnj.2019.005.02.5
2. Kirschner JS, Foye PM, Cole JL. Piriformis syndrome, diagnosis and treatment. *Muscle Nerve*. 2009 Jul;40(1):10-8. doi: 10.1002/mus.21318
3. Jankovic D, Peng P, van Zundert A. Brief review: piriformis syndrome: etiology, diagnosis, and management. *Can J Anaesth.* 2013 Oct;60(10): 1003-12. doi: 10.1007/s12630-013-0009-5
4. Chang A, Ly N, Varacallo M. Piriformis Injection. 2022 Sep 4. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2023 Jan–. PMID: 28846327. From: https://www.ncbi.nlm.nih.gov/books/NBK448193/
5. Mitra SR, Roy S, Dutta AS, Ghosh A, Roy R, Jha AK. Piriformis Syndrome: A Review. *JEMDS*. 2014;3:3804-14. doi: 10.14260/jemds/2014/2362
6. Ripellino P, Cianfoni A, Izzo MGA, Gobbi C. Relapsing piriformis syndrome treated with botulinum toxin injections. *BMJ Case Rep.* 2019;12(8): e230981. doi: 10.1136/bcr-2019-230981
7. Siahaan YMT. Ultrasound-guided Botulinum toxin-A injection for recurrent piriformis syndrome: case series. *Neurona*. 2020:289–94. doi: 10.52386/neurona.v37i4.178
8. Norbury JW, Morris J, Warren KM, Adam L, Schreiber M, Clinton Faulk M, et al. Diagnosis and Management of Piriformis Syndrome. *Pract Neurol.* 2012;1:24–7.
9. Masala S, Crusco S, Meschini A, Taglieri A, Calabria E, Simonetti G. Piriformis syndrome: Long-term follow-up in patients treated with percutaneous injection of anesthetic and corticosteroid under CT guidance. *CardioVasc Interv Radiol.* 2012;35:375–82. doi: 10.1007/s00270-011-0185-z
10. Misirlioglu TO, Akgun K, Palamar D, Erden MG, Erbilir T. Piriformis syndrome: comparison of the effectiveness of local anesthetic and corticosteroid injections: a double-blinded, randomized controlled study. *Pain Physician.* 2015 Mar-Apr;18(2):163-71. PMID: 25794202
11. Jeong HS, Lee GY, Lee EG, Joe EG, Lee JW, Kang HS. Long-term assessment of clinical outcomes of ultrasound-guided steroid injections in patients with piriformis syndrome. *Ultrasonography*. 2015;34:206–10. doi: 10.14366/usg.14039
12. Weinberg L, Peake B, Tan C, Nikfarjam M. Pharmacokinetics and pharmacodynamics of lignocaine: A review. *World J Anesthesiol.* 2015;4(2):17-29. doi: 10.5313/wja.v4.i2.17
13. Childers MK, Wilson DJ, Gnatz SM, Conway RR, Sherman AK. Affiliations MA. Botulinum toxin type A use in piriformis muscle syndrome: A pilot study. *Am J Phys Med Rehabil.* 2002;81(10):751–9. doi: 10.1097/01.PHM.0000027426.98000.57
14. Ahmed MAA. Dexamethasone versus Magnesium Sulfate as an Adjuvant to Local Anesthetics in the Ultra-Sound Guided Injection of Piriformis Muscle for the Treatment of Piriformis Syndrome. *Open Anesthesia Journal.* 2020;14:35–41. doi:10.2174/2589645802014010035
15. Porta M. A comparative trial of botulinum toxin type A and methylprednisolone for the treatment of myofascial pain syndrome and pain from chronic muscle spasm. *Pain*. 2000 Mar;85(1-2):101–5. doi: 10.1016/s0304-3959(99)00264-x
16. Nouged E, Dajani J, Ku B, Al-Eryani K, Padilla M, Enciso R. Local Anesthetic Injections for the Short-Term Treatment of Head and Neck Myofascial Pain Syndrome: A Systematic Review with Meta-Analysis. *J Oral Facial Pain Headache*. 2019;33:183–98. doi: 10.11607/ofph.2277