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Percutaneous steroid injection versus oral NSAIDs on treatment of symptomatic calcific rotator cuff tendinitis: a short-term retrospective clinical evaluation

Ercan Hassa

Department of Orthopaedics and Traumatology, Memorial Ankara Hospital, Ankara, Turkey

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ABSTRACT

Aim: Symptomatic calcific rotator cuff tendinopathies (CRCT) continue to be a significant health problem in the adult population because of intense pain and disability. Different clinical responses obtained with different treatment modalities show us the importance of determining the optimal method. The aim of this study is to compare short term pain and functional status improvements in adult patients diagnosed with CRCT and treated with oral non-steroid anti-inflammatory drugs (O-NSAID) or percutaneous steroid injections (PSI).

Material and Method: A retrospective examination was made of the clinical results of adult patients diagnosed with CRCT and treated with one of the two treatment methods. Whole study group was formed of 40 patients (20 male, 20 female) with a mean age of 42.35 ± 8.28 (range, 23-57) years. The clinical responses of the patients in a period of 3 months were compared between the two treatment groups O-NSAID, PSI using the Visual Analogue Scale (VAS) and the Quick Disability of the Arm, Shoulder, and Hand Scale (Q-DASH). The angular upper limit values of the active range of motion (ROM) of the shoulder joint (anteflexion and abduction angle) of patients also were compared in the study.

Results: In the PSI treatment group, in the 3rd week and 3rd month clinical evaluations, significant better responses were obtained in both the VAS and Q-DASH scores of the patients compared to O-NSAID treatment group (p=0.000, p=0.001, respectively). And significant greater shoulder anteflexion and abduction ROM upper limits were determined in the PSI treament group compared to O-NSAID treatment group at the end of the 3rd month (p=0.000, p=0.000, respectively).

Conclusion: The percutaneous steroid applications in treatment of CRCT can provide more pleasing short term results than O-NSAID treatments in terms of pain reduction and functional improvement.

Keywords: Calcific tendinopathy, rotator cuff, injection, steroid

INTRODUCTION

Shoulder pain is frequently encountered in the community and is a frequent reason for referral to orthopedic clinics and physical therapy units. The one-year prevalence has been reported in the range of 4.7%-46.7% in various series (1). There can be many ethiologies for pain in the shoulder region, such as arthrosis, rotator cuff tendinopathy, subacromial impingement, bursitis, or suprascapular nerve entrapment (2-5). This condition has a serious social and psychological effect other than health problems on patients, and can be a cause of disability (6). Rotator cuff tendinopathies can develop as a result of subacromial impingement or for intrinsic reasons (7). Sometimes these tendinopathies accompany calcium deposits in the muscle-tendinous structure or subacromial-subdeltoid bursa and can become an intensely painful condition which is termed as calcific rotator cuff tendinopathy (CRCT) (4). The prevalence of CRCT has been reported at rates varying from 7% to 42% in various published studies (8,9).

CRCTs can be diagnosed on X-ray, ultrasound, or magnetic resonance imaging (MRI) (10). The etiology of CRCT has not been clarified as yet but the probable mechanism is thought to be due to metaplasia of tenocytes to calcium-producing chondrocytes (4,9). The natural progression of untreated CRCT may lead to adhesive capsulitis, cuff tear or ossifying tendinitis (11). Different treatment methods described to date include extracorporeal shock wave therapy (ESWT), kinesio banding, platelet-rich plasma (PRP) administration, physical therapy and arthroscopic interventions (4,8,10,12,13). Non-surgical methods from

Corresponding Author: Ercan HASSA, dr.ercanhassa@gmail.com

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these treatments have been reported to have sufficient efficacy, and therefore it has been stated that these constitute the primary treatment methods (8). From these treatment methods, percutaneous treatment modalities are an effective and minimally invasive method (14-17). It has been reported that steroid treatment via percutaneous injections directed at painful calcium deposits reduces pain and provides sufficient resolution of mass effect of those deposits (15). The main aim of non-surgical methods is to provide improvement in the joint ROM, after the pain has subsided, with a physical therapy process. When no response is obtained to conservative treatments, and symptoms and findings persist, surgical options should be considered. Open or arthroscopic surgical methods aim to remove calcium deposits from the subacromial region and reduce mechanical irritation (18). The cost of interventional procedures in private hospitals, the fear of injections of patients and medical risks create hesitation in patients lead physicians towards non-invasive treatments among conservative solutions. Until now, no study has been published on the comparison of percutaneous steroid administrations and NSAID for patients with CRCT. The aim of this study was to retrospectively compare the functional gains and amount of pain reduction in patients diagnosed with CRCT and treated with O-NSAID or PSI (methyl-prednisolone + prilocaine combination) applications.

The study hypothesis is that the application of PSI in CRCT may provide better pain reduction and functional improvement compared to O-NSAID treatment methods, because of acute calcium deposit dissolvement.

MATERIAL AND METHOD

Ethics

The study was carried out with the permission of Memorial Ankara Hospital Ethics Committee (Date: 13.04.2023, Decision No:2023-2/1). All procedures were carried out in accordance with the ethical rules and the principles of the Declaration of Helsinki.

Participant

All procedures were carried out in accordance with the ethical rules and the principles of the Declaration of Helsinki. A retrospective evaluation was made of the clinical and radiological data of 40 adult patients who were diagnosed with symptomatic CRCT and treated with one of treatment modalities (O-NSAID, PSI) between 2020 January and 2023 March, in orthopaedics clinic. These patients were separated into two groups as 21 patients treated with O-NSAID and 19 patients treated with PSI. The clinical responses of the patients were examined and compared with each other according to the treatment and based on time.

The CRCT diagnose criteria have been accepted in the investigated patients confirmed with observing painful calcium deposits in subacromial or subdeltoid locations on anteroposterior X-rays of shoulder. The study exclusion criteria of patients were defined as determining any acute or chronic infection, a history of smoking, known collagen tissue disease, or a diagnosis of diabetes mellitus.

In normal clinical practice, the application of PSI to all patients that have symptomatic CRCT is recommended in the light of current literature, but some of the patients do not accept the risks of the interventions.

In this study, the patients that did not accept the PSI applications and treated with oral NSAID formed the O-NSAID group. And the patients who underwent percutaneous steroid applications constituted the PSI group. For evaluation of clinic responses of the patient's visual analogue scale (VAS) and Quick-Dysability of the Arm, Shoulder and Hand Scale (Q-DASH) scores, and the shoulder upper limit values (anteflexion and abduction angle) have been investigated from the patients file records. And results were compared within each group and between the two treatment groups according to time (pre-treatment, 3rd week, 3rd month). All of those datas obtained from hospital file records after study protocol established, since study designed in retrospective manner.

Imaging

Conventional radiography: In the diagnosis of CRCT, calcium deposits can be seen on X-ray within the soft tissue in the subacromial region and subdeltoid regions (proximal humerus around the shoulder). The localisation and morphology of calcium deposits can be understood on standard anteroposterior (AP), outlet, and axillary view images. The radiological classification of CRCT on X-ray was defined by Mole et al. (19). This classification is made according to calcium deposits as Type A: sharply defined, homogenous and dense calcification, Type B: sharply defined, dense in appearance, with multiple fragments, Type C: heterogeneous calcification in appearance, with a downy deposit, and Type D: dystrophic calcification in the tendon insertion. Gosen et al. (10) reported that Type C and Type D may show the resorptive phase. Gärtner and Heyer (20) separated CRCT into 3 types radiologically subtypes. In Type I calcium deposits are evident in the surroundings and there are lesions with intense calcifications (formation phase). In Type II, there are lesions with soft contours containing less intense calcification, and in Type III there are translucent lesions showing cloudy calcification (resorptive phase). In the study patients PSI treatments were applied by confirming calcified soft tissue areas on the X-rays that were sensitive on clinical examination.

During the application calcium deposits dissolvement was confirmed with fluoroscopic imaging (Figure 1). After the applications dissolvement has been also confirmed on X-ray (Figure 2). All the conventional imaging methods used for these patients were for usual clinical application, in treatment way. And all of those X-ray images were obtained from the radiology department after current study protocol designed. All the patients examined in current study were diagnosed with the AP X-ray and all patients diagnosed as CRCT were classified as Type B which defined by Mole et al. (19). In the study patients PSI treatments were applied by confirming calcified soft tissue areas on the X-rays that were sensitive on clinical examination. During the application calcium deposits dissolvement was confirmed with fluoroscopic imaging (**Figure 1**). After the applications dissolvement has been also confirmed on X-ray (**Figure 2**). All the conventional imaging methods used for these patients were for usual clinical application, in treatment way. And all of those X-ray images were obtained from the radiology department after current study protocol designed.

Magnetic resonance imaging: MRI is important in the musculoskeletal imaging of the shoulder region. However, protons with low resonance within the calcium deposits lead to low resolution of calcification deposits (21). If calcium deposits are oedematous, they can mimic tendon tear by causing signal changes. All the patients underwent MRI at the end of the 3rd month of treatment to determine potential tendon damage of those calcific deposits, for a routine control purpose in clinical practice. As the current study was designed retrospectively, MRI images were obtained from the radiology department after the study protocol was established. And no tendon rupture was detected in those images.

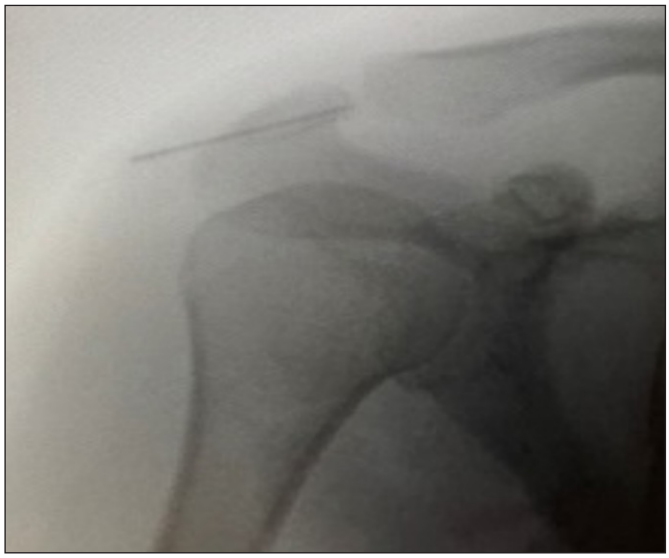

Figure 1. Flouroscopic view of dissolved calcium deposit region in a right shoulder of a patient diagnosed with CRCT, after PSI application.

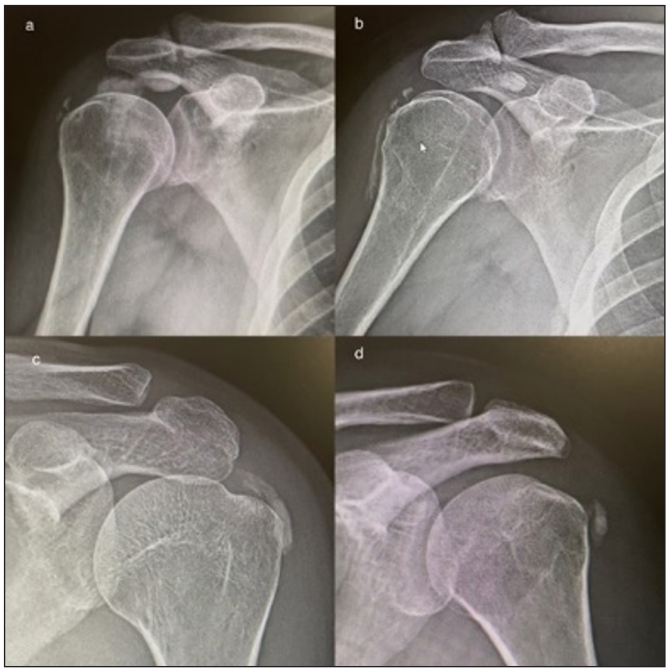

Figure 2. a.) Pre-treatment AP shoulder X-ray of a 47-year-old female patient with calcific deposits in the right shoulder subacromial region, b.) AP shoulder X-ray taken immediately after PSI of the same patient. c.) Pre-treatment AP X-ray of a 35-year-old female patient with calcific deposits in the left shoulder subdeltoid region, d.) AP X-ray of the same patient taken immediately after PSI.

Treatment Methods

Percutaneous steroid injection application: Calcific enthesopathies are basically painless and asymptomatic pathologies. When these ensethopathies are painful, the clinician can perform minimally invasive interventions targeting these lesions. The most frequently applied of these minimally invasive interventions is percutaneous injection method. Dry needling also is a different minimally invasive method that has been described for painful lesions. The ability to dissolve calcium deposits is important in respect of the regression of impingement findings and being able to prevent potential rotator cuff damage. Therefore, steroid injections targeting to volume occupying calcium deposits and/or drainage of those deposits with percutaneous fluids seem to be rational (4). Applications with a single or double needle can be made (17). To date, different fluid types (steroid types, lidocaine, hyaluronic acid, PRP) have been reported that applied through the injection route (17). In the current study, the PSI group was formed of patients diagnosed with CRCT who were applied with the combination of 1ml 40 mg methyl-prednisolone + 2 ml 2% prilocaine + 2 ml sterile sodium chloride solution to painful calcific lesions in the subacromial and/or subdeltoid regions (**Figure 1**). And all the injections have been applicate by a single senior orthopaedist, in a same manner for every patient.

Oral NSAID treatment: In the current study the patients that have been found in O-NSAID treatment group had been used Naproxen Sodium 750 mg per day for pain relief and improvement of functional status. All the patients in O-NSAID treatment group has been taken 2 box of pills because of intense pain, this means 3-week usage for treatment.

Physical treatment and rehabilitation: All the patients, that have belonged to two different treatment groups, has started physiotherapy programs in same clinic at 3rd week after start of treatment, for a six-week program. Those therapy programs have been including muscle stretches and ROM exercises.

Statistical Analysis

Data obtained in the study were analyzed statistically using SPSS (22.0 version software SPSS Inc., Chicago, IL, USA). Descriptive statistics were stated as mean ± standard deviation (SD) values for continuous variables with normal distribution, as median (range) values for variables not showing normal distribution, and as number (n) and percentage (%) for categorical variables. Suitability of the data to normal distribution was assessed with the Kolmogorov-Smirnov and Shapiro-Wilk tests. With the exception of age, all the other variables did not show normal distribution. In the comparisons of the median values of two independent groups, the Mann Whitney U-test was used, and for more than two groups, Kruskal Wallis variance analysis was applied. To determine from which group the difference originated after variance analysis, post-hoc paired comparison tests were used. A value of p <0.05 was accepted as statistically significant.

RESULTS

The data were analyzed of a total of 40 patients. The O-NSAID group of 21 (52.5%) patients comprised 11 females and 10 males with a mean age of 41.19 ± 7.12 (range, 22-51) years. The PSI group of 19 (47.5%) patients comprised 9 females and 10 males with a mean age of 43.42 ± 9.46 (range, 27-57) years. The dominant side was right-side in 25 (62.5%) patients and left-side in 15 (37.5%). No significant difference was determined between the groups in respect of age, gender, and dominant side (p>0.05). The time to diagnosis was median 2 (1-3) days in the O-NSAID group, and median 2 (1-2) days in the PSI group, with no statistically significant difference determined (p>0.05) (**Table 1**).

In both of O-NSAID and PSI groups according to the results of the Kruskal Wallis test, significant differences were determined between the VAS scores pre-treatment, on the 3rd post-treatment weeks, and at the end of the 3rd months (p<0.05). And according to the results of the Mann Whitney U test, the median VAS scores of both groups showed a statistically significant difference between the 3rd week and the 3rd month (p<0.05) (**Table 2**).

Table 1. Baseline characteristics in patients in the whole study group with CRCT

	O-NSAID group n=21	PSI group n=19	P value
Gender (F/M)	11/10	9/10	.752[a]
Dominant side	13/8	12/7	.935[a]
	m±sd (range)	**m±sd (range)**	
Age	41.19 ± 7.12 (23-51)	43.42 ± 9.46 (27-57)	.402[b]
	median (range)	**median (range)**	
Time to diagnosis (days)	2 (1-3)	2 (1-2)	.520[c]

a Pearson Chi-Square test with frequencies, b Student T test with mean ± SD values, c Mann Whitney U Test with median (range) values, M: mean, SD: standard deviation, O-NSAID: Oral Non-Steroid Anti-Inflammatory Drug, PSI: Percutaneous Steroid Injections

Table 2. The clinical results of the different treatment methods according to the VAS scores of the groups

		VAS Score				
	n	Pre-treatment (1)	3rd week (2)	3rd month (3)	P value	Post Hoc P value
O-NSAID group	21	8 (7-9)	7 (6-8)	6 (5-7)	.000[b*]	1-2: .011* 1-3: .000* 2-3: .000*
PSI group	19	8 (7-9)	4 (3-5)	2 (1-4)	.000[b]	1-2: .001* 1-3: .000* 2-3: .003*
P value		.940[a]	.000[a]	.001[a]		

a Mann Whitney U Test with median (range) values, b Kruskal Wallis Test with median (range) values, O-NSAID: Oral Non-Steroid Anti-Inflammatory Drug, PSI: Percutaneous Steroid Injections

In both of O-NSAID and PSI groups according to the results of the Mann Whitney U test, significant differences were determined between the Quick-DASH scores pre-treatment, on the 3rd post-treatment weeks, and at the end of the 3rd months (p<0.05). And according to the results of the Kruskal Wallis test, the median Quick-DASH scores of both groups showed a statistically significant difference between the 3rd week and the 3rd month (p<0.05) (**Table 3**).

Table 3. The clinical results of the different treatment methods according to the Quick-DASH scores of the groups

		Quick-DASH score				
	n	Pre-treatment (1)	3rd week (2)	3rd month (3)	P value	Post Hoc P value
O-NSAID group	21	92.5 (90-97.5)	85 (82.5-90)	50 (45-60)	.000[b*]	1-2: .001* 1-3: .000* 2-3: .001*
PSI group	19	92.5 (87.5-97.5)	62.5 (57.5-65)	17.5 (12.5-20)	.000[b*]	1-2: .001* 1-3: .000* 2-3: .001*
P value		.748 a	.000 a*	.000 a*		

a Mann Whitney U Test with median (range) values, b Kruskal Wallis Test with median (range) values, O-NSAID: Oral Non-Steroid Anti-Inflammatory Drug, PSI: Percutaneous Steroid Injections

No difference was determined between the O-NSAID group and the PSI group in respect of the pre-treatment median values of the shoulder anteflexion and abduction angle upper limits. A significant difference was determined in all groups by mean of anteflexion and abduction in respect of values at the end of 3rd months ($p<0.05$). A significant difference was determined between the groups in respect of the values at the end of 3rd months by mean of anteflexion and abduction angle upper limits ($p<0.05$) (**Table 4**). The gains in terms of both pain reduction and functional improvement has been presented as VAS and Quick-DASH Score boxplot diagrams in **Figure 3** and **4**.

Table 4. The change in upper limits of active shoulder ROM in patients according to time in different treatment type groups

ROM		O-NSAID group n=21	PSI group n=19	P value
Shoulder anteflexion upper limit (°)	Pre-treatment	20 (10-30)	20 (15-30)	.258
	3rd month	45 (30-55)	90 (75-90)	.000*
	P value	.000*	.000*	
Shoulder abduction upper limit (°)	Pre-treatment	20 (10-25)	20 (10-25)	.270
	3rd month	45 (40-55)	80 (70-90)	.000*
	P value	.000*	.000*	

Mann Whitney U Test with median (range) values, * $p<0.05$, ROM: Range of Motion, O-NSAID: Oral Non-Steroid Anti-Inflammatory Drug, PSI: Percutaneous Steroid Injections, °:Degree

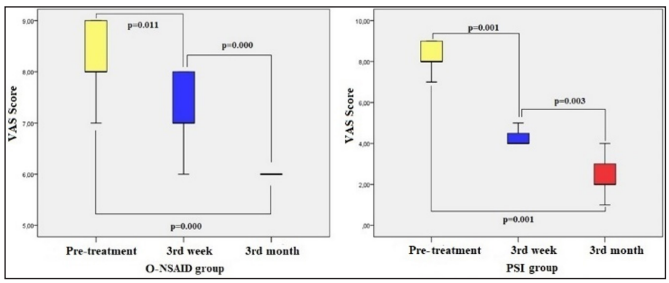

Figure 3. Boxplot showing the distribution of VAS score measurements pre-treatment treatment, on the 3rd week of treatment and at the end of the 3rd month of treatment

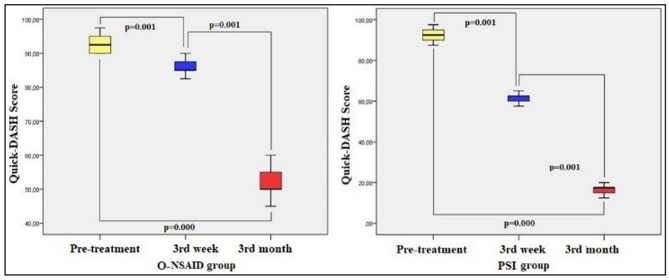

Figure 4. Boxplot showing the distribution of Quick-DASH scores pre-treatment, on the 3rd week of treatment and at the end of the 3rd month of treatment

DISCUSSION

It has been reported that CRCT diagnosis can be made with US or conventional radiologic techniques in patients with acute and intense painful shoulder condition (4). And mostly those calcium deposits may continue with ongoing clinical findings such as pain and disability in those patients without treatment (22). Percutaneous applications in the treatment of CRCT aim to dissolve painful calcium deposits. For this purpose, different fluids (including PRP, stem cells, sodium chloride, steroid, prolotherapy) have been presented in different papers for many times (16,23,24).

Imaging-guided minimally invasive injections have been reported to obtain effective results in CRCTs at rates of up to 80% (8). Greis et al. (8) also stated that sufficient responses could be obtained with non-surgical methods in the majority of cases. And Simpson et al. (25) showed that percutanous interventions were more effective in terms of pain reduction and functional improvement than ESWT applications. In current study the obtained data showed that lower VAS and Q-DASH scores were obtained in PSI applicated patients, compared to patients which treated with O-NSAID (**Table 2,3**). Moreover, a significant increase in shoulder joint ROM was determined in patients after PSI application compared to patients that treated with O-NSAID (**Table 4**).

In a study by Louwerens et al. (26), similar successful function and pain improvements were reported to have been obtained in a 1-year follow-up period after ultrasound-guided needling combined with a subacromial steroid injection and ESWT. But calcium deposits were seen to have benefitted more from the steroid injections by mean of dissolvement in same study (26). Dumoulin et al. (27) reported that treatments to be applied providing subacromial bursa communication with the calcium deposits in CRCT patients would be effective in the radiological and clinical results. In current study all the patient's calcium deposits have been dissolved with the PSI application successfully and this condition has been confirmed with fluoroscopic imaging. And the PSI applications in the current study in patients, were applied in way so that in patients with multiloculated calcium deposits, communication between lesions would be provided in the subacromial and subdeltoid bursa regions by injection application trajectory. In the light of the data obtained, it was thought that good pain improvement and functional gain, could be related to the PSI application targeting all the calcified foci.

Although the percutaneous application of these fluids has an important place in CRCT treatment in respect of pain and functional improvements, it may cause complications such as septic bursitis and vasovagal syncope (4). In the current study, we didn't determine any complications related to PSI application in any patient.

Azevedo et al. (28) reported that early interventions to painful calcific lesions in the shoulder region had most important prognostic factor on treatment response.

In the current study, the treatment process for all the patients was determined to have been started within three days after the onset of the clinical complaints. The positive clinical responses obtained in the two different treatment methods suggest that success also could be closely related with timing in treatment initiation other than treatment modality.

Limitations

First of all, the patient groups did not show normal distribution so the statistical analyses were performed with non-parametric tests. More significant interpretations may be able to be made in further studies of larger patient series so that normal distribution can be obtained and analyses can be made with parametric tests. Secondly, long-term results of the patients were not evaluated clinically or radiologically as the patients did not attend follow-up appointments, which was thought to be because the complaints had greatly decreased. Therefore, further studies to obtain data from longer term follow-up would be able to provide more detailed information about the long-term clinical results.

CONCLUSION

In the treatment of symptomatic calcific rotator cuff tendinitis, better pain and functional results can be obtained with the percutaneous steroid injections compared to oral NSAIDS, in short term. In those minimal invasive applications targeting all of the calcific lesions and doing that at the early time of diagnosis, it would be correct to think that the treatment success is increased.

ETHICAL DECLARATIONS

Ethics Committee Approval: The study was carried out with the permission of Memorial Ankara Hospital Ethics Committee (Date: 13.04.2023, Decision No:2023-2/1).

Informed Consent: Because the study was designed retrospectively, no written informed consent needed.

Referee Evaluation Process: Externally peer reviewed.

Conflict of Interest Statement: The authors have no conflicts of interest to declare.

Financial Disclosure: The authors declared that this study has received no financial support.

Author Contributions: All the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

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