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Functional outcome of single periarticular injection of steroid at shoulder for Periarthritis of shoulder – A prospective study

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Abstract

Introduction: Adhesive capsulitis (frozen shoulder) affects 2% to 5% of the adult population. The accuracy rate of intraarticular injections at shoulder was 52.4% in a study by Hegedus *et al*. Periarticular placement may allow sufficient steroid to diffuse into an adjacent joint and so achieve a partial response. Issues that remain to be clarified include whether the accuracy of needle placement and anatomical site influences efficacy. Due to these uncertainties we decided to do this study.

Materials and Methods: A Prospective study analyzing the functional outcome of 34 cases of Single Periarticular injection of Steroid at Shoulder for Periarthritis of shoulder was conducted. The surgeon confirmed with C-arm image that the needle was *periarticular* and 'not intraarticular' and instilled the injection of 40 mg of Triamcinolone acetate. Findings were recorded and Outcomes were measured before the injection and during all the followups. Statistical Evaluation was made and Conclusions were arrived at.

Results: There were 34 patients (36 shoulders) treated with periarticular injection of steroid. The improvement in abduction was 38.11 degrees with p value 0.001, which is statistically significant. Improvement in flexion was 39.19 degrees. The improvement in Constant score was 21.22 with p value 0.001 which is statistically significant.

Conclusion: A single Periarticular injection of steroid for Periarthritis of shoulder provides good improvement in Abduction and Flexion. Its results are the same as with intraarticular injections. Blind injections without fluoroscopic guidance will give the same results as those with fluoroscopic guidance.

Keywords: Shoulder, Periarthritis, Periarticular injection, Steroid

Introduction

Shoulder disorders are a cause for significant morbidity, with a prevalence of 6.9% to 34% in the general population and up to 21% in those over 70 years old ^[1]. Common causes of shoulder pain are frozen shoulder, rotator cuff pathology like tendinitis, calcific tendinitis and rotator cuff tears and osteoarthritis ^[2]. Adhesive capsulitis (frozen shoulder) affects 2% to 5% of the adult population ^[1]. It may be idiopathic or present after shoulder immobilization, trauma, or surgery ^[3]. It may be intrinsic (tightening of the joint capsule) or extrinsic (scarring of the rotator interval or external rotators). It is usually self-limiting and has 3 phases: freezing, frozen, and thawing ^[3]. Diabetics with frozen shoulder may have a poorer prognosis. It is more common in middle age and in women ^[4] Current treatment modalities include physical therapy, corticosteroid injection, viscosupplementation with hyaluronic acid (HA), nonsteroidal anti-inflammatory drugs (NSAIDs), and glucosamine and chondroitin sulfate ^[1]. Steroids are especially helpful when significant pain is present as in the early stages of frozen shoulder.

The accuracy rate of intraarticular injections at shoulder was 52.4% in a study by Hegedus *et al* ^[5] in 2010. Hegedus *et al* found that relief of shoulder pain with injectables did not correlate with clinician experience, injection intra- or extracapsularly, and duration of symptoms. Interestingly, the location of injection was not a determinant of clinical effect; a steroid injection into the bicipital tendon sheath also provided pain relief ^[1] Periarticular placement may allow sufficient steroid to diffuse into an adjacent joint and so achieve a partial response ^[6]. The results of the study by Kraeutler ^[7] show that an anterior injection into the glenohumeral joint can be accurately placed without radiographic assistance using standard landmarks.

The body of evidence for intraarticular steroids for frozen shoulder is somewhat heterogeneous, but generally consistent with clinically meaningful short-term reduction in pain, with less clear evidence for functional improvement [4]. Although they have been in general clinical use since 1960s, the role of steroid injections in the management of localised shoulder complaints remains uncertain [6]. Issues that remain to be clarified include whether the accuracy of needle placement, anatomical site and type of corticosteroid influences efficacy [8]. Due to these uncertainties we decided to do a study analyzing the functional outcome of single periarticular injection of steroid at shoulder for Periarthritis of shoulder.

2. Materials and methods

A Prospective study analyzing the functional outcome of 34 cases of Single Periarticular injection of Steroid at Shoulder for Periarthritis of shoulder was conducted from August 2016 to February 2017 satisfying the inclusion and exclusion criteria at Sri Devaraj Urs Medical College and Academy of Higher Education, Kolar, India. The inclusion criteria were: 1. Patients with Periarthritis of shoulder (Shaffer’s criteria was considered) [9] 2. Duration of more than 4 weeks 3. Aged more than 30 years. The exclusion criteria were: 1. Rotator cuff tears 2. Shoulder instability 3. Shoulder weakness due to neurological disorders / hemiplegia 4. Previous history of local steroids to affected shoulder 5. Previous history of Manipulation under Anaesthesia / Arthroscopic capsular release / Arthrographic distension (hydrodilatation) 6. Uncontrolled Diabetes 7. Known hypersensitivity to Steroids / Lignocaine

Patients were screened to find their eligibility to study. Consent was taken and they were recruited into the study. Sample size was estimated based on Oxford Shoulder scores (OSS) from a study by Tim A Holt *et al* [12]. In an RCT, to detect a difference of 20% in OSS scores in experimental group and control group with 80% power and with 95% confidence level the sample size required was 30 cases. Sample size formula: $n = (Z_{\alpha/2} + Z_{\beta})^2 * 2 * \sigma^2 / d^2$, $Z_{\alpha/2}$ = Standard normal deviate at 95% confidence = 1.96, Z_{β} = Standard normal deviate for 80% power = 0.842, σ^2 = Average variance of OSS scores (Tim A Holt *et al.*) = 9.7 [12], d = expected mean difference in OSS scores = 6.72 (20%). All the data of the patients were recorded. Xrays were done if necessary. The surgeon injected the steroid into the periarticular area of the shoulder in an aseptic technique. One ml of triamcinolone acetonide i.e., 40 mg was mixed with 2 ml of 2% Lignocaine and was injected to the patients. Posterior Approach was used. The entry point was 1 cm below the angle of the acromion and 2 cm medial to it. [10] The needle was directed anteriorly and medially towards the coracoid process. Local anaesthesia to the skin was given to all with 1ml of 2% Lignocaine. 2 to 3 cm depth was reached

with a 20 gauge needle [11] C-arm guidance was used for all the patients. The surgeon confirmed with C-arm image that the needle was *periarticular* and ‘not intraarticular’ and instilled the injection. Fig 1 shows that the needle placement is “periarticular”.

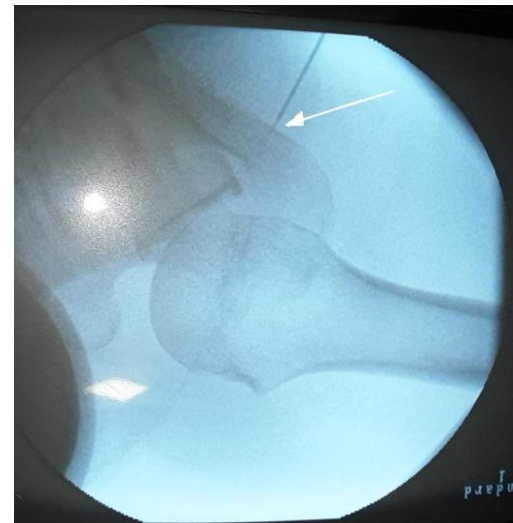


Fig 1: Shows that the tip of the needle is “periarticular” and away from the joint

Home exercises were advised for all the patients. The surgeon who recorded the clinical findings was different and hence the study was surgeon blinded. Findings were recorded and Outcomes were measured before the injection and during all the followups. Patients were followed up at 1 week, 3 weeks, 6 weeks and 12 weeks. Outcome measures like Constant Score [12] and Oxford Shoulder Score¹³ were measured. Photographs were taken.

2.1. Statistical Analysis: Analyses were performed using IBM SPSS version 22 software (SPSS Inc, Chicago, IL). Coded data were entered into an excel sheet. Outcome measures were presented by Mean, SD, Proportions and confidence intervals. Comparison of quantitative measures was done by t test and difference in proportions by Chi-square test. p value ≤ 0.05 was considered as statistically significant.

3. Results

There were 34 patients treated with periarticular injection of steroid. Two patients had bilateral affection. There were 18 males (53%). The mean age was 54.32 years (range 34 to 85 years). The mean duration of symptoms was 11 months (range 1 to 60 months). 3 (8.8%) patients had Diabetes mellitus. 6 (17.6%) patients had other co-morbidities like trauma, malignancy etc. The average preop abduction was 71.75 degrees (range 20 to 120 degrees). (shown in Table 1)

Table 1: showing mean, standard deviation, standard error mean

Paired Samples Statistics					
		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Abduction preop	71.75	36	27.346	4.558
	Abduction postop	109.86	36	30.456	5.076
Pair 2	Flexion preop	77.47	36	22.485	3.747
	Flexion postop	116.67	36	23.367	3.894
Pair 3	Strength preop	7.64	36	2.451	.409
	Strength postop	10.78	36	2.344	.391
Pair 4	Constant Score preop	36.75	36	7.879	1.313
	Constant Score postop	57.97	36	11.175	1.863
Pair 5	Oxford score preop	22.06	36	4.720	.787
	Oxford score postop	34.17	36	6.860	1.143

The values had a p value of 0.001 which is statistically significant (see Table 2).

Table 2: showing 95% confidence interval and p value

		t		Sig. (2-tailed)	
		95% Confidence Interval of the Difference			P value
		Lower	Upper		
Pair 1	Abduction preop - Abduction postop	-43.208	-33.014	-15.180	.001
Pair 2	Flexion preop - Flexion postop	-44.540	-33.848	-14.884	.001
Pair 3	Strength preop- Strength postop	-3.612	-2.666	-13.481	.001
Pair 4	Constant Score preop - Constant Score postop	-23.952	-18.492	-15.783	.001
Pair 5	Oxford score preop- Oxford score postop	-13.754	-10.468	-14.962	.001

The final abduction (after 3 months or final followup) was 109.86 degrees on average (range 64 to 165 degrees). So the improvement in abduction was 38.11 degrees with p value 0.001, which is statistically significant.

The average flexion was 77.47 degrees (range 30 to 116 degrees). The final flexion (after 3 months or final followup) was 116.66 degrees on average (range 66 to 156 degrees). So the improvement in flexion was 39.19 degrees with p value 0.001, which is statistically significant. By Shapiro-Wilk test it was verified that the data is normally distributed.

Fig 2a, 2c shows the initial range of movements and Fig 2b and 2d show the range of movements at the final follow up (12 weeks).



Fig 2c: Showing preop flexion 75 degrees in same patient



Fig 2a: Showing preop abduction 65 degrees



Fig 2d: Showing flexion 120 degrees at final followup, 12 weeks after periarticular injection



Fig 2b: Showing abduction 100 degrees at final followup, 12 weeks after periarticular injection

The average strength was 7.64 pounds (range 3 to 12 pounds). The final strength (after 3 months or final followup) was 10.78 pounds (range 6 to 16 pounds). So the improvement in strength was 3.14 pounds with p value 0.001 which is statistically significant. The average Preop Constant score was 36.75 (range 16 to 51). The average final Constant score was 57.97 (range 33 to 79) showing an improvement of 21.22 with p value 0.001 which is statistically significant. The preop constant scores in diabetic patients were 32.33 and in nondiabetics 37.15. The postop constant score in diabetics was 58.33 and in nondiabetics was 57.93. The average preop oxford shoulder scores was 22.05. The average post procedural oxford shoulder scores were 34.16. We have not repeated the injection to any of our patients in our study. There were no complications encountered in the study.

4. Discussion

Our study of periarticular injections showed improvement in Constant scores by 21, improvement in Oxford shoulder scores by 12 and improvement in range of movement, pain, strength / power and function which were tested while

calculating Constant scores. These results are similar to other studies such as Lim^[14] where Constant score improved by 20 and VAS improved by 3.5 as shown in the Table 3. Lim has used blind intraarticular steroid in this group.

Table 3: showing comparison between various studies.

	Abduction		Flexion		Strength		Constant score		Oxford SS score		Treatment
	preop	Final followup	preop	Final followup	preop	Final followup	Preop (range)	Final followup (range)	Preop	Final followup	
Our study	71.75	109.86	77.47	116.66	7.64	10.78	36.75 (16 – 51)	57.97 (33 – 79)	22.05	34.16	Periarticular steroid
Hegedus 2008 ^[5]							5.7 pain NPRS	4	48 dash	33	Intraarticular steroid
							5.9	3.5	46	30	extraarticular
Lim 2014 ^[14]	13 Ext rot	22 ER	97	115			39.9	58.7	7.2 VAS	3.6 VAS	blind Steroid
	8.6 ER	26.6 ER	98	114			35.8	52.3	7.2 VAS	3.9 VAS	Hyaluronic acid
Eustace <i>et al</i> ^[6]	129	146 (2 wks)	129	149	6.5	9.8					Steroid + dye, xray
	119	121	120	128							Periarticular steroid
Ajdabal 2008 ^[15] 12 wk followup	107	180	137	180	50 ER	90 ER	77.5 night pain	7.5			blind Steroid
	90	160	130	165	40	70	70	12.5			saline
Holt 2013 ^[2]									26.4	30.6	steroid
									25.4	32.7	lignocaine
Agirman 2016 ^[11]						1 month followup	7.11 VAS	2.23			Steroid, fluoroscopic
Ucuncu 2009 ^[16]							x	x +12.2	x blind VAS	x - 2.2±0.9 VAS	Blind
							y	y+32.2	yUSG VAS	y - 4±1.7 VAS	USG
Tvieta 2008 ^[17]	57 active	83	87 active	116	23 ER active	37	63 SPADI	26			Steroid, dye, fluroscopy

In Holts^[2] study, OSS improved by 5 with intraarticular steroids. In Ajdabal's^[15] study, pain reduced from 77 to 8 after blind intraarticular steroids. In Agirmans^[11] study VAS improved by 5, VAS score was 7.11 preop and 2.23 at 1 month followup. In Hegedus^[5] study intraarticular injections and extraarticular injections produced the same results. Here pain scores and Dash scores improved. In the 4-week follow up, regardless of group assignment or accuracy of the injection, patients improved significantly ($P < .01$) from pre- to post-injection. Improvement was typically over by 2.5 points in the Numeric Pain Rating Scale (NPRS) categories, over 8 points on the Short-Form McGill Pain Questionnaire (SFMPQ), and over by 13 points on the Disabilities of the Arm, Shoulder, and Hand questionnaire (DASH). The DASH score improvement was 13.3 in both the intraarticular and periarticular group. Improvement in the SFMPQ scale was 8.1 in the intraarticular and 8.9 in the periarticular group. Ucuncu^[16] study showed improved Constant score by 12.2 in blind group and 32.2 in USG group and also showed improved VAS by 4.0 ± 1.7 for Ultrasound guided vs. 2.2 ± 0.9 for blind technique. In Tvieta^[17] study the SPADI scores improved from 63 to 26. He had used dye and fluoroscopy for intraarticular steroid injection. All these show that Periarticular injections will produce the same results as with intraarticular injections.

Our study with fluoroscopic guidance showed similar Constant scores, OSS and pain scores when compared with other studies like Lim^[14], Holt^[2], Ajda bal^[15] etc as shown in Table 3 wherein they have used blind technique. Hegedus^[5] study with fluoroscopic guidance also showed equal results with intra and extra articular steroid. And also as deduced earlier that periarticular injections produce the same results as with intraarticular injections, we can believe that Blind injections will give the same results as those with fluoroscopic guidance. Fluoroscopic guidance has the disadvantage of its exposure to radiation.

Agirman *et al* showed that the mean joint depth was 43.5 mm at posterior and 27.1 mm at anterior side^[11]. We have injected at 2 or 3 cm deep and taken images with image intensifier to ensure that the steroid given is periarticular.

The strengths of our study are that 1. We are reporting the first prospective study of periarticular injection. 2. We have used the posterior approach, the advantage of posterior approach over anterior is that there is no risk of arterial or brachial plexus injury^[18]. Gross *et al*^[1] has reported that the location of injection was not a determinant of clinical effect; a steroid injection into the bicipital tendon sheath also provided pain relief. There are studies which have also used oral steroids for frozen shoulder and there has been improvement in symptoms and functions. 3. The steroid injection is given

periarticularly in our study, one more advantage of this is that there is no possibility of septic arthritis.

The limitations of the study being that the various studies analysed here are diverse and direct comparison is not possible.

5. Conclusion

A single Periarticular injection of steroid for Periarthritis of shoulder provides good improvement in Abduction and Flexion. Periarticular injections will produce the same results as with intraarticular injections (after comparing with various studies). Blind injections without fluoroscopic guidance will give the same results as those with fluoroscopic guidance.

6. Conflicts of Interest: Nil

7. Acknowledgements: Nil

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