

COMPARISON OF INTRA-ARTICULAR METHYLPREDNISOLONE AND KETOROLAC INJECTIONS IN IMPROVING RANGE OF MOTION FOR DIFFERENT SHOULDER JOINT DISORDERS

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ABSTRACT

Objective: To compare the efficacy of intra-articular injection of methyl prednisolone with ketorolac for improvement in range of motion in various shoulder joint disorders.

Study Design: Quasi-experimental study.

Place and Duration of Study: Departments of Internal and Rehabilitation Medicine, Combined Military Hospital Mangla, from Nov 2018 to May 2019.

Methodology: Through non-probability consecutive sampling, patients with shoulder disorders were enrolled in the study and divided into two groups. Group A received intra articular corticosteroid injection and group B received intra-articular Ketorolac injection. Outcome was measured in terms of improvement in shoulder range of motion.

Results: A total of 60 patients were selected, 40 (66.7%) male and 20 (33.3%) female. Thirty (50%) patients had adhesive capsulitis, 24 (40%) had rotator cuff syndrome and 6 (10%) had impingement syndrome. Twenty four patients received methyl prednisolone acetate injection while 36 received ketorolac injection. There was no significant difference in the mean gain in flexion, extension, abduction, internal or external rotation between both groups ($p=0.224$, $p=0.261$, $p=0.884$, $p=0.238$, and $p=0.584$ respectively).

Conclusion: There was no significant difference in efficacy of corticosteroid and ketorolac when injected intra-articularly in shoulder joint disorders.

Keywords: Intraarticular injections, Methylprednisolone, Ketorolac, Shoulder joint.

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INTRODUCTION

Shoulder joint has unique dynamics. This function is attributed to its ball and socket nature. Tasks such as prehensile function of hand, reach, and exploration of surroundings are basic for survival. The extensive ranges of motion of shoulder joint enable these activities in a smooth and coordinated manner. The shoulder joint complex is a combination of three joints viz; glenohumeral, acromioclavicular and sternoclavicular joints. In addition, scapulothoracic articulation forms a functional joint between the concave anterior surface of scapula and convex posterior thoracic wall. Together the complex creates smooth and well-coordinated movements of upper limbs ranging from the primitive activities of reaching and exploring the surroundings to the most intricate and dexterous movement patterns. Consequently shoulder joint is subjected to multiple injuries. These may result from trauma, immobilization, overuse injuries (occupational or sports related) or gradual degeneration. Shoulder joint disorders can be secondary to other systemic disorders including

various metabolic/endocrine disorders e.g. diabetes mellitus, neurologic disorders e.g. stroke, cardiac diseases, heart surgery, and malignancy^{1,2}.

Shoulder joint disorders are the third commonest kind of musculoskeletal disorders. The incidence of shoulder pain reporting in primary care per year is 14.7 per 1000 patients and the lifetime prevalence is 70%³. Patients reporting with shoulder pain mainly fall into categories of adhesive capsulitis, rotator cuff syndrome, impingement syndrome, osteoarthritis, post-traumatic stiffness, and dislocations. However, there is no definite data on the prevalence of these different pathologies in general population.

There are diverse non-operative options available for treating shoulder joint disorders. These include intra-articular corticosteroids, intra-articular NSAIDs, viscosupplementation, platelet-rich plasma and capsular hydro-dilatation with normal saline⁴. Intra-articular platelet rich plasma has been found to have more sustained effects than corticosteroids however it is a costlier option and the pain relief is quite slow⁵. Corticosteroids have remained a mainstay of treatment in shoulder joint pathologies. Intra-articular corticosteroid injections reduce pain, inflammation and improve

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range of motion and hence contribute to early return of function^{6,7}. Nevertheless, the risks and benefits of intra-articular corticosteroid injections are debatable. Intra-articular steroids have been linked to accelerated osteoarthritis in addition to short term adverse effects⁸. It is advisable to space subsequent injections by several weeks. Therefore not >4 injections are suggested in a year. Also if previous injections do not offer any relief, further injections are less likely to offer benefit. Corticosteroids are contraindicated in case of infections, malignancy or fractures. They are not to be given into ligaments/tendons due to risk of rupture. Post injection steroid flare has been observed within 24-36 hours secondary to crystal induced synovitis caused by precipitation of preservatives in steroid suspension. Other possible local side effects include, soft tissue/subcutaneous fat atrophy, and skin hypopigmentation. Also in diabetic patients post injection surge in blood glucose levels occurs which may last for a week. Less common side effects include infection, vascular injury, and post injection neuritis⁶. Ketorolac (an NSAID) has been found to have a comparable efficacy with no observed damaging effect on the joint⁹. Thus it can be another tool in the arsenal when other options have proved ineffective for intra-articular injections for knee arthritis. To the best of our knowledge, there has been little research in Pakistan concerning the use of NSAIDs as intra-articular injection mixture. We hypothesized that intra-articular ketorolac injection would produce similar pain relief. Thus, the primary aim of this study was to compare the efficacy of ketorolac (an NSAID) with Depo-Medrol (methyl prednisolone i.e. a corticosteroid) in improving range of motion for various shoulder joint pathologies.

METHODOLOGY

This quasi-experimental study (single-blind study) was carried out at the departments of internal and rehabilitation medicine, Combined Military Hospital Mangla, from November 2018 to May 2019. The Ethical review committee of the hospital reviewed the study proposal and found it to be ethically sound (EC ref no. 18/Trg/CMH Mgl dated 7 Nov 2018). After verbal informed consent, the individuals of age 18-75 years belonging to both genders who were diagnosed with a particular shoulder pathology and had shoulder pain for at least 3 months were selected through consecutive sampling covering ethical considerations as guided by the declarations of Helsinki. A sample size of 32 with 16 in each intervention group was calculated through an online sample size calculator while taking

anticipated mean and standard deviation of group-1 as 1.8 and 0.3 respectively, anticipated mean of group-2 as 1.5, with level of significance (5%) and power of the test (80%)¹⁰.

The selected shoulder pathologies were rotator cuff syndrome, adhesive capsulitis of the shoulder, and the shoulder impingement syndrome. Impingement syndrome was defined as shoulder pain with positive impingement sign (Neer’s test or Hawkins-Kennedy test), painful arcing during active arm elevation, and positive empty can test¹¹. A diagnosis of rotator cuff tendinosis was made if, on stressing the rotator cuff by applying a resistive force, the patient complained of pain in one or more portions of the rotator cuff with or without positive tests for impingement syndrome mentioned above¹². Adhesive capsulitis was diagnosed if there was restriction of shoulder movements both passive and active in flexion, abduction, internal and external rotation with at least 50% in one movement compared with the normal side in the absence of bony restriction^{12,13}. Patients with uncontrolled diabetes, fractures of bones comprising the shoulder joint, osteomyelitis, malignancy and deranged renal functions were excluded from the study.

Seventy-eight patients were identified as possible candidates as per the inclusion criteria and a total of 60 patients were finally selected for the study (figure).

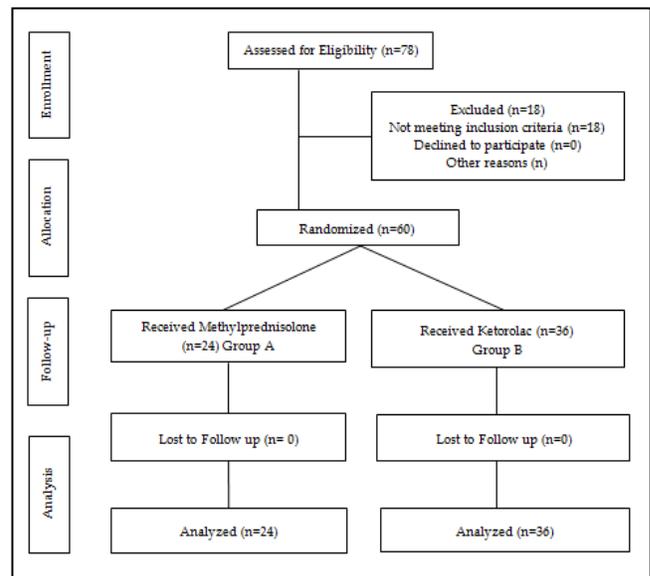


Figure: Flow chart.

Twenty-four (40%) patients irrespective of shoulder pathology were randomly allocated through coin toss method to the Depo-Medrol group while 36 (60%) were included in the ketorolac group. The ROM of the

affected joint was measured through goniometry before injection and then at four weeks after the injection. A written proforma was filled for each patient that contained patient identification number, intervention group, age, primary shoulder pathology, and the measurements of ROM in flexion, extension, abduction, internal, and external rotation.

A 1ml (40 mg) of methyl prednisolone acetate with 2ml solution of 2% W/V lignocaine (Lignocaine, Elite Pharma Limited, Lahore, Pakistan) via 5ml sterilized disposable syringe was injected into the affected shoulder of each patient with methyl prednisolone acetate injection while 1ml (30mg) of Ketorolac (Toradol, Roche Pakistan limited, Karachi, Pakistan) with 2ml solution of 2% W/V lignocaine (Lignocaine, Elite Pharma Limited, Lahore, Pakistan) via 5ml sterilized disposable syringe was injected for each patient with ketorolac injection. The blind technique for shoulder injection i.e. without ultrasound or fluoroscopic guidance was used in both groups. For all patients, posterior approach glenohumeral injection was administered. A single operator performed the injection procedures in both groups. The operator was a consultant physiatrist with seven years of experience in performing pain procedures.

All inductees were shifted on a combination of paracetamol (650 mg and orphenadrine citrate (50 mg) (Nuberol Forte, Searle Pakistan Limited, Karachi, Pakistan) twice daily orally and local application of piroxicam gel 0.5% w/w (Pcam, Merck Private Limited, Karachi, Pakistan) four times a day. After the injection, a comprehensive rehabilitation plan comprising of therapeutic exercises particular to the disease was given to all patients in both groups. All exercises in the

we provided the patients a feasible belated period of one week, however, the measurement results were reflected in the same category of 4 week post-treatment. To encourage timely follow-up, we offered the recruits appointment-free checkup for the next 6 months if they reported at the appropriate time. Luckily, it worked and all recruits reported for the follow up in time and there was no dropout.

The Statistical Package for Social Sciences version 20 (IBM Corp., Armonk, NY, USA) was used for all analyses. All values were measured for the groups before start of intervention, and after 4 weeks of intervention. For variables of age and ROM, means and standard deviations were calculated. The improvements in ROM between the two groups were analyzed using independent sample or paired sample t-tests where appropriate. A *p*-value ≤ 0.05 was considered statistically significant.

RESULTS

Of 60 patients finally selected, 40 (66.7%) were male and 20 (33.3%) were female. The mean age of the sample was 49 ± 11 years (range: 27-70 years). Thirty (50%) patients had adhesive capsulitis, 24 (40%) had rotator cuff syndrome and 4 (10%) had impingement syndrome. The demographics for the two groups are compared in table-I. Twenty-four patients received methyl prednisolone acetate injection while 36 received ketorolac injection. The ROM in flexion, extension, abduction, internal rotation, and external rotation before and after treatment are given in table-II. Each group had a significant gain in ROM in flexion, extension, abduction, internal, and external rotation after treatment (table-II).

Table-I: Comparison of demographics among the two treatment groups frequency.

Variables	Group A (Methyl Prednisolone Acetate Injection) (n=24)	Group B (Ketorolac Injection) (n=36)
Mean age	55 ± 9 years (range: 38-70 years)	45 ± 10 years (range: 27-62 years)
Gender		
Male	14 (58.3%)	26 (72.2%)
Female	10 (41.7%)	10 (27.8%)
Shoulder Pathology		
Adhesive Capsulitis	12 (50%)	18 (50%)
Rotator Cuff Syndrome	10 (41.7%)	14 (38.9%)
Shoulder Impingement Syndrome	2 (8.3%)	4 (11.1%)

plan were home based as most of our recruits were far dwellers and found it difficult to come to the rehabilitation center on daily basis. The same investigator took the ROM measurements before and after four weeks of intervention through goniometer. For the follow up,

There was no significant difference in the mean gain in flexion, extension, abduction, internal or external rotation between both groups (*p*=0.224, *p*=0.261, *p*=0.884, *p*=0.238, and *p*=0.584 respectively) (table-III).

Table-II: Pre and post intervention mean values and their comparison for range of motion in flexion, extension, abduction, internal rotation, and external rotation for each group.

Variables	Group A (Methyl Prednisolone Acetate Injection) (n=24)		p-value	Group B (Ketorolac Injection) (n=36)		p-value
	Pre- Treatment	Four Weeks Post Treatment		Pre-Treatment	Four Weeks Post Treatment	
	Mean ± SD*	Mean ± SD		Mean ± SD	Mean ± SD	
Flexion	95.4 ± 31.4	117.1 ± 29.2	<0.001	106.7 ± 28.1	135.6 ± 29.4	0.001
Extension	36.2 ± 15.9	45.4 ± 11.7	<0.001	43.3 ± 12.3	55.1 ± 6.7	<0.001
Abduction	87.5 ± 35.8	115.4 ± 32.9	<0.001	102.6 ± 30.9	131.1 ± 27.6	<0.001
Internal Rotation	24.6 ± 15	41.2 ± 16.4	0.007	34.2 ± 15.5	55.8 ± 19.6	<0.001
External Rotation	38.3 ± 28.9	54.6 ± 27.9	<0.001	50 ± 23.8	68.1 ± 22	<0.001

N: Frequency *SD: Standard deviation.

Table-III: The mean improvement in range of motion in flexion, extension, abduction, internal and external rotation.

Variables	Group A (Methyl Prednisolone Acetate) (n=24) Mean (SD)*	Group B (Ketorolac) (n=36) Mean (SD)	p-value
Mean increase in flexion	21.7 (17.6)	28.9 (27.8)	0.224
Mean increase in extension	9.2 (7.8)	11.8 (10)	0.261
Mean increase in abduction	27.9 (13.3)	28.5 (17.4)	0.884
Mean increase in internal rotation	16.7 (15.2)	21.7 (16.8)	0.238
Mean increase in external rotation	16.2 (12.7)	18.1 (12)	0.584

N: Frequency *SD: Standard deviation.

DISCUSSION

The results of our study are comparable to earlier studies which reveal a similar efficacy of intra-articular steroids and NSAIDs. Min *et al*¹⁴, compared ketorolac to methylprednisolone in 32 patients with subacromial impingement syndrome when used as a single dose subacromial injection. Their study reported comparable efficacy of both these agents in terms of improvement in the University of California at Los Angeles (UCLA) Shoulder Scores during 4 week follow-up. Tahiri *et al*¹⁵, reported that a single injection of 60 mg ketorolac resulted in equivalent improvements in outcome compared to a single injection of 40 mg methylprednisolone for the treatment of subacromial impingement when assessed at 12 weeks. In a retrospective comparative study by Park *et al*¹⁶, it was reported that the treatment of osteoarthritis of the hip with intra-articular ketorolac injection was as effective as that with intra-articular corticosteroid injection. Xu *et al*⁹, carried out a pilot-controlled clinical study to assess the effect of ketorolac in intra-articular injection analgesia for postoperative pain in patients undergoing shoulder arthroscopy. They concluded that the combination of ketorolac and a multimodal drug regime (ropivacaine, morphine, and triamcinolone acetonide) resulted in improved post-surgical pain scores. They also proposed further prospective controlled trials to allow for definite treatment recommendations. In another study conducted by Bellamy *et al*¹⁷, the economic impact of ketorolac was compared with corticosteroid intra-articular knee injection for osteoarthritis. Accord-

ing to them, pain relief was similar between the two injectates. Ketorolac knee injection was found safe and effective with a cost savings percentage difference of 143% when compared with corticosteroid.

The side effects of intra-articular steroids have been confirmed in various studies. In a study by Kew *et al*¹⁸, in a cohort of patients who underwent arthroscopic surgery for rotator cuff repair or subacromial decompression, the risk of infection after 1 month was higher in patients who had received intra articular corticosteroid injection compared to the control group who did not receive any such injection. Similarly Baverel *et al*¹⁹, found that the re-tear rate of rotator cuff in patients who received corticosteroid injection after arthroscopic repair of the rotator cuff was greater than the patients who did not receive post-operative corticosteroid injection.

Assuming that both NSAIDs and corticosteroids function by locally decreasing inflammation, this study provides evidence of equivalent if not superior results of injectable ketorolac. Improvement in function and satisfaction are directly associated with the patient's ability to strengthen the rotator cuff. Practitioners may utilize this as a possible short-term alternative for non-operative treatment of subacromial impingement syndrome. Therefore with a similar efficacy and less side effects of intra-articular NSAIDs as compared to corticosteroids proved by this body of evidence, clinicians and patients can make a sound decision regarding the choice of treatment modality.

We used the coin method for randomization. Currently, in randomized study designs, the coin method is generally discouraged because it results in unequal distribution of subjects in both groups. Secondly, the results are based upon the immediate improvements in shoulder ROM at 4 weeks post injection. Long term assessment could not be done due to failure to follow up. Thirdly, we used blind technique for injection. Injections under ultrasound guidance might have produced even better results.

CONCLUSION

Both methylprednisolone and ketorolac have equivalent outcomes when used as intra-articular injections in shoulder disorders on the basis of improvement in the range of motion of shoulder. Therefore, ketorolac can be considered as alternative drug where corticosteroids are contraindicated, provided that the patient has no past history of allergy to NSAIDs and has optimal renal functions.

CONFLICT OF INTEREST

This study has no conflict of interest to be declared by any author.

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