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Impact of Hyaluronic Acid Injections in Patients with Glenohumeral Osteoarthritis

[*]Dr. Md. Nadim Kamal[1], Dr. Ziaur Rahman Chowdhury[2], Dr. Md. Abdul Kalam Azad[3], Dr. Nadia Rahman[4], Dr. Badrunnesa Ahmed[5], Dr. Mohammad Golam Nobi[6], Dr. Md. Imamur Rashid[7]

[1]Associate Professor, Department of Physical Medicine and Rehabilitation, Bangladesh Medical University, Dhaka, Bangladesh

[2]Associate Professor, Department of Physical Medicine and Rehabilitation, Bangladesh Medical University, Dhaka, Bangladesh

[3]Associate Professor, Department of Physical Medicine and Rehabilitation, Bangladesh Medical University, Dhaka, Bangladesh

[4]Associate Professor, Department of Physical Medicine and Rehabilitation, Bangladesh Medical University, Dhaka, Bangladesh

[5]Associate Professor, Department of Physical Medicine and Rehabilitation, Bangladesh Medical University, Dhaka, Bangladesh

[6]Associate Professor, Department of Physical Medicine and Rehabilitation, Bangladesh Medical University, Dhaka, Bangladesh

[7]Associate Professor, Department of Physical Medicine and Rehabilitation, Bangladesh Medical University, Dhaka, Bangladesh

Corresponding Author: Dr. Md. Nadim Kamal, Associate Professor, Department of Physical Medicine and Rehabilitation, Bangladesh Medical University, Dhaka, Bangladesh

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KEYWORDS

Hyaluronic Acid, Glenohumeral Osteoarthritis, Pain Relief.

ABSTRACT:

Background: Osteoarthritis (OA) is the most common cause of disability among older adults, significantly impacting both patients and healthcare systems. Glenohumeral osteoarthritis (GH-OA), a degenerative condition of the shoulder joint, commonly affects individuals over 60 years and leads to pain, reduced range of motion, and functional impairment.

Aim of the study: The aim of the study was to evaluate the clinical impact of hyaluronic acid injections on pain relief and functional outcomes in patients with glenohumeral osteoarthritis.

Methods: This prospective observational study at the Department of Physical Medicine and Rehabilitation, Bangladesh Medical University (BMU) (March–August 2025) included 52 patients with glenohumeral osteoarthritis receiving a single intra-articular hyaluronic acid injection. Outcomes—pain (VAS), function (ASES), ROM, satisfaction, and adverse events—were assessed at baseline, 6, and 12 weeks, and analyzed using SPSS v26 (mean ± SD; $p < 0.05$).

Results: Among 52 patients (mean age 60.2 years), most were female and had KL Grade II–III disease with right shoulder involvement. Pain (VAS) reduced from 7.2 to 3.5, function (ASES) improved from 48.6 to 74.1, and ROM increased across all planes by 12 weeks (all $p < 0.001$). Overall, 73% were satisfied with treatment, and only minor transient adverse events (5.8%) were reported, with no major complications.

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Conclusion: Hyaluronic acid injections provided significant pain relief, improved function and range of motion, high patient satisfaction, and a low rate of minor adverse events, making them a safe and effective treatment for glenohumeral osteoarthritis.

Introduction

Osteoarthritis (OA) represents the most common cause of disability among older adults and poses a substantial socioeconomic challenge for both patients and healthcare systems [1,2]. Glenohumeral osteoarthritis (GH-OA), also referred to as shoulder OA, is a degenerative condition affecting the shoulder joint [3]. Although the precise prevalence of shoulder OA is not well-documented, estimates range widely from 4% to 26% [4], with population studies indicating that 16.1%–20.1% of individuals over 65 years show radiographic signs of GH-OA [5]. This condition predominantly affects older adults, typically between 60 and 70 years of age, with patients reporting pain that may arise spontaneously or following trauma [6,7]. While primary GH-OA can present across a wide age range, it is estimated that 5%–21% of adults in the United States experience shoulder pain, and nearly one-third of individuals over 60 worldwide are affected by GH-OA [8].

Radiological assessments, including X-ray and MRI, commonly reveal hallmark features of GH-OA such as narrowing of the joint space, subchondral bone sclerosis, and osteophyte formation. At the tissue level, OA is defined by degenerative loss of hyaline cartilage, leading to pain, functional impairment, and overall disability [4]. Patients with symptomatic primary GH-OA often experience pain, restricted range of motion (ROM), and progressive deterioration of shoulder function [9], which may be particularly noticeable at night while lying on the affected shoulder. These structural changes in cartilage, synovium, synovial fluid, and subchondral bone can interfere with daily activities and occupational tasks and, in some cases, contribute to psychological consequences such as depressive symptoms [10-13].

Surgical intervention in the form of shoulder arthroplasty is considered a definitive treatment for GH-OA, providing significant pain relief and improved ROM; however, it carries high costs and potential morbidity [14,15]. Consequently, nonoperative strategies are frequently pursued, including physical therapy, analgesic medications, nonsteroidal and steroidal anti-inflammatory drugs, and intra-articular corticosteroid injections. Despite their widespread use, analgesics and NSAIDs are not always sufficient and can produce significant adverse effects, particularly among older patients [16-18]. Physical therapy aims to preserve ROM and maintain muscle strength, yet evidence for the effectiveness of conservative measures remains inconsistent, and many individuals continue to experience ongoing pain and functional limitation [8].

Among non-surgical options, intra-articular injections of hyaluronic acid (HA) have gained prominence due to their ability to supplement the naturally occurring HA in synovial fluid. HA, a non-sulfated glycosaminoglycan, plays an important role in maintaining chondrocyte function and the viscoelastic properties of synovial fluid [19-21]. The therapeutic purpose of HA injections is to reduce pain, enhance joint lubrication, and improve functional capacity while mitigating disability. Clinical studies have consistently shown that HA injections are well-tolerated and can lead to meaningful reductions in pain [22-24]. In the context of GH-OA, HA is believed to restore the rheological properties of synovial fluid, promote pain relief, and partially recover shoulder ROM [25,26]. Additionally, HA exhibits a favorable safety profile and is considered a viable nonoperative treatment, particularly when delaying surgical intervention is desirable.

Despite growing interest in hyaluronic acid (HA) as a nonoperative treatment for glenohumeral osteoarthritis, the majority of research has focused on lower limb joints, such as the knee and hip, with relatively few studies investigating its efficacy specifically in the shoulder. Evidence regarding the optimal patient selection, functional outcomes, and long-term benefits of HA injections for GH-OA remains limited and sometimes contradictory. Moreover, variations in HA formulations, injection protocols, and follow-up durations across studies have hindered the establishment of standardized clinical guidelines. This paucity of targeted, high-quality data on the clinical impact of HA in glenohumeral OA underscores the need for further research. Therefore, the

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purpose of the study is to evaluate the clinical impact of hyaluronic acid injections on pain relief and functional outcomes in patients with glenohumeral osteoarthritis.

Objective

- To evaluate the clinical impact of hyaluronic acid injections on pain relief and functional outcomes in patients with glenohumeral osteoarthritis.

Methodology & Materials

This prospective observational study was conducted in the Department of Physical Medicine and Rehabilitation at Bangladesh Medical University (BMU) from March 2025 to August 2025. A total of 52 patients diagnosed with glenohumeral osteoarthritis were included, selected according to predefined inclusion and exclusion criteria. Data were collected to evaluate the clinical and functional impact of intra-articular hyaluronic acid injection on pain, shoulder mobility, and functional outcomes over the follow-up period.

Inclusion Criteria:

- Patients aged 40 years and older.
- Clinical diagnosis of glenohumeral osteoarthritis (GHOA) with symptoms (pain, stiffness) persisting for at least 3 months.
- Radiographic confirmation of GHOA (Kellgren-Lawrence Grade I–IV) on standard anteroposterior and axillary view X-rays.
- Failure to respond to at least 4 weeks of conservative management (e.g., oral analgesics, physical therapy).

Exclusion Criteria:

- Full-thickness rotator cuff tear confirmed by ultrasonography or MRI.
- History of previous shoulder surgery on the affected side.
- Intra-articular corticosteroid injection in the affected shoulder within the last 3 months.
- Inflammatory arthritis (e.g., rheumatoid arthritis, gout).
- Septic arthritis, active infection, or skin lesion at the injection site.
- Known hypersensitivity to hyaluronic acid preparations.
- Coagulopathy or use of anticoagulant medication (other than aspirin).

Patients were recruited from outpatient services based on clinical evaluation and radiographic confirmation of GHOA using the Kellgren–Lawrence grading system. All participants received a single intra-articular injection of hyaluronic acid administered under aseptic conditions by a trained physician, and were advised to avoid strenuous shoulder activity for 48 hours post-injection. Clinical outcomes were assessed at baseline, 6 weeks, and 12 weeks, including pain intensity using the Visual Analog Scale (VAS), functional status via the American Shoulder and Elbow Surgeons (ASES) score, shoulder range of motion (forward flexion, abduction, and external rotation), patient satisfaction on a four-point scale (highly satisfied, satisfied, neutral, dissatisfied), and adverse events such as local or systemic complications. Data were compiled and analyzed using SPSS version 26.0 (IBM Corp., Armonk, NY, USA), with continuous variables presented as mean ± standard deviation (SD) and categorical variables as frequencies and percentages. Changes from baseline to follow-up were evaluated using paired statistical tests, with p-values <0.05 considered statistically significant.

Results

Table 1: Baseline Characteristics of the Study Patients (n = 52)

Variable		**n**	**%**
Age Group (in years)	40–50	8	15.4
	51–60	19	36.5
	61–70	17	32.7
	>70	8	15.4

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	Mean ± Sd	60.2 ± 9.3	
Sex	Male	22	42.3
	Female	30	57.7
Side involved	Right shoulder	33	63.5
	Left shoulder	19	36.5
Kellgren–Lawrence Grade	Grade I	8	15.4
	Grade II	18	34.6
	Grade III	14	26.9
	Grade IV	12	23.1

Table 1 presents the demographic and clinical characteristics of the study population. The mean age of patients was 60.2 ± 9.3 years, with the highest frequency observed in the 51–60 year age group (n = 19, 36.5%), followed by 61–70 years (n = 17, 32.7%). Female participants comprised 30 patients (57.7%), while males accounted for 22 patients (42.3%). Right shoulder involvement was more frequent (n = 33, 63.5%) compared to the left shoulder (n = 19, 36.5%). Radiographic evaluation using the Kellgren–Lawrence grading system indicated that most patients had moderate disease, with Grade II (n = 18, 34.6%) and Grade III (n = 14, 26.9%) being the most common.

Table 2: Pain (VAS) Scores at Baseline and Follow-Up (n = 52)

Time Point	n	Mean VAS ± SD	p-value*
Baseline	52	7.2 ± 1.1	–
6 weeks	52	4.1 ± 1.3	<0.001
12 weeks	52	3.5 ± 1.2	<0.001

Table 2 presents the changes in Visual Analog Scale (VAS) pain scores from baseline to follow-up assessments. The mean VAS score at baseline was 7.2 ± 1.1, which significantly reduced to 4.1 ± 1.3 at 6 weeks ($p < 0.001$) and further to 3.5 ± 1.2 at 12 weeks ($p < 0.001$).

Table 3: Functional Outcomes (ASES Score) at Baseline and Follow-Up (n = 52)

Time Point	n	Mean ASES ± SD	p-value*
Baseline	52	48.6 ± 9.5	–
6 weeks	52	67.3 ± 10.8	<0.001
12 weeks	52	74.1 ± 11.2	<0.001

Table 3 summarizes changes in functional status assessed using the American Shoulder and Elbow Surgeons (ASES) score across different evaluation points. The mean ASES score improved from 48.6 ± 9.5 at baseline to 67.3 ± 10.8 at 6 weeks ($p < 0.001$), and further to 74.1 ± 11.2 at 12 weeks ($p < 0.001$).

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Table 4: Range of Motion Improvements at Baseline and 12 Weeks (n = 52)

Movement	n	Baseline (Mean ± SD)	12 Weeks (Mean ± SD)	p-value*
Forward Flexion (°)	52	102 ± 18	128 ± 16	<0.001
Abduction (°)	52	94 ± 21	121 ± 19	<0.001
External Rotation (°)	52	21 ± 6	31 ± 7	<0.001

Table 4 summarizes changes in shoulder range of motion (ROM) following hyaluronic acid injections in patients with glenohumeral osteoarthritis. Significant improvements were observed in all measured movements over the 12-week period. Forward flexion increased from 102 ± 18° at baseline to 128 ± 16° at 12 weeks ($p < 0.001$), abduction improved from 94 ± 21° to 121 ± 19° ($p < 0.001$), and external rotation increased from 21 ± 6° to 31 ± 7° ($p < 0.001$).

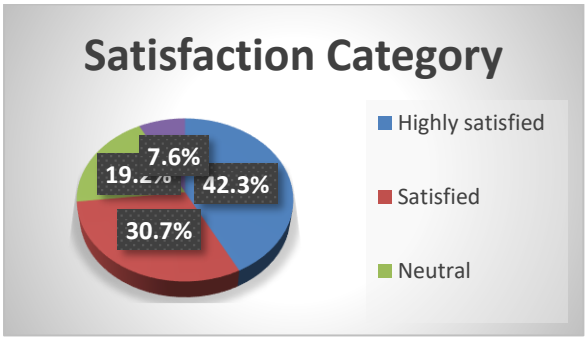

Figure 1: Patient-Reported Satisfaction Following Hyaluronic Acid Injection (n = 52)

Figure 1 presents the distribution of patient satisfaction at 12 weeks after treatment. The majority of participants reported positive outcomes, with 22 patients (42.3%) highly satisfied and 16 patients (30.7%) satisfied. Meanwhile, 10 patients (19.2%) were neutral, and 4 patients (7.6%) reported dissatisfaction or no improvement following the intervention.

Table 5: Adverse Events Following Hyaluronic Acid Injection (n = 52)

Adverse Event	n	%
Transient swelling	3	5.8
Injection site discomfort	3	5.8
Major complications	0	0.0

Table 5 summarizes the adverse events observed in patients after intra-articular hyaluronic acid injections. Minor complications were infrequent, with 3 patients (5.8%) experiencing transient swelling and 3 patients (5.8%) reporting injection site discomfort. No major complications were observed in any patient (0.0%).

Discussion

Glenohumeral osteoarthritis (GH-OA) is a prevalent degenerative joint condition that can lead to significant pain, restricted shoulder mobility, and impaired functional capacity if not adequately managed. Intra-articular hyaluronic acid (HA) injections have emerged as a nonoperative therapeutic option aimed at restoring synovial fluid properties, reducing pain, and improving joint function. The findings of this study demonstrate that HA injections in patients with GH-OA result in substantial reductions in pain intensity, as evidenced by decreased VAS scores, along with marked improvements in functional outcomes, including ASES scores and shoulder range of motion. These results highlight the clinical relevance of HA as an effective intervention for alleviating symptoms and enhancing daily functional capacity in patients with degenerative shoulder arthritis.

The demographic profile of patients in the present study reflects patterns consistent with previously published literature on glenohumeral osteoarthritis. The mean age of 60.2 ± 9.3 years aligns closely with Juel et al.[27], who reported a comparable mean age of approximately 61.9 years, highlighting that GH osteoarthritis predominantly affects individuals in the sixth decade of life. A progressive rise in frequency of osteoarthritis with advancing age observed in our sample also corresponds with the systematic review and meta-analysis by Prakash et al.[28], which reported a significant association between increasing age and GH OA, with a pooled odds ratio of 3.18 for older age groups. Our study showed a

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slightly higher representation of females (57.7%), consistent with the female predominance suggested by Prakash et al. The distribution of radiographic severity based on Kellgren–Lawrence grading, with the majority presenting with Grade II and III disease, mirrors trends described in studies such as Juel et al.[27], where intermediate disease severity was most common. The predominance of right-sided involvement (63.5%) may reflect limb dominance and functional demand, a trend also described in imaging-based assessments of GH OA. Overall, these demographic characteristics support the representativeness and external validity of our sample.

The present study demonstrated a marked and statistically significant reduction in pain following intra-articular hyaluronic acid injections, with mean VAS scores improving from 7.2 ± 1.1 at baseline to 4.1 ± 1.3 at 6 weeks and 3.5 ± 1.2 at 12 weeks. These findings are consistent with Monti et al.[29], who observed a substantial decline in pain intensity following Hyalubrix injections, and with Di et al.[30], who reported greater pain improvement in patients receiving three HA injections combined with physiotherapy compared to physiotherapy alone. Together, these results indicate that HA injections produce clinically meaningful and progressive pain reduction, supporting their role as a valuable non-operative treatment option for GH osteoarthritis.

In terms of functional outcomes, mean ASES scores increased from 48.6 ± 9.5 at baseline to 67.3 ± 10.8 at 6 weeks and 74.1 ± 11.2 at 12 weeks ($p < 0.001$). These improvements are consistent with Kirschner et al.[31], who observed significant ASES enhancement over 12 months following a single HA injection, and with the meta-analysis by Zhang et al.[32], which reported functional improvement across multiple HA studies. This demonstrates that HA injections not only reduce pain but also confer substantial and clinically relevant gains in shoulder function over the short-term follow-up period.

The study also showed significant improvements in shoulder range of motion, with forward flexion, abduction, and external rotation all increasing substantially by 12 weeks. These findings align with Porcellini et al.[33], who reported meaningful gains in multiple planes of motion following Hymovis® injections, and with Di et al.[30], who observed within-group improvement in forward elevation and upward trends in external rotation over time. Collectively, these studies reinforce that HA injections reliably enhance glenohumeral joint mobility.

Patient-reported satisfaction was high, with 42.3% highly satisfied and 30.7% satisfied, while only 7.6% reported dissatisfaction or no improvement. These results are consistent with Merolla et al.[26], who found significantly higher satisfaction following Hylan G-F 20 injections at 1, 3, and 6 months, indicating that HA is well-tolerated and provides substantial subjective improvement in symptoms and overall treatment experience.

Finally, HA injections demonstrated a favorable safety profile. Minor complications were infrequent, with 3 patients (5.8%) experiencing transient swelling and 3 patients (5.8%) reporting injection site discomfort, while no major complications occurred. This aligns with Noël et al.[34], who reported only mild or moderate adverse events and no serious treatment-related complications following Hylan G-F 20 injections. Overall, these findings confirm that HA injections are generally safe and well-tolerated as a non-operative intervention for glenohumeral osteoarthritis.

Limitations of the study

This study had some limitations:

- The study population was relatively small, limiting generalizability.
- The sample was not randomly selected.
- The study's limited geographic scope may introduce sample bias, potentially affecting the broader applicability of the findings.

Conclusion

Glenohumeral osteoarthritis is a progressive degenerative condition that often leads to pain and functional limitation requiring effective non-operative management. This study demonstrated that intra-articular hyaluronic acid injections provide meaningful clinical benefit, achieving significant reductions in pain (VAS 7.2 to 3.5) and improvements in shoulder function (ASES 48.6 to 74.1) over 12 weeks. Range of motion increased across all measured planes, and most patients reported high satisfaction with treatment outcomes. The intervention was also well-tolerated, with only minor,

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transient adverse events and no major complications. Overall, these findings support hyaluronic acid injection as a safe, effective, and patient-acceptable therapeutic option for managing symptoms of glenohumeral osteoarthritis.

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