Functional outcome and pain relief in using intraarticular hyaluronic acid injection in osteoarthritis knee

Dr. K Thanigaimani and Dr. TC Yogesh

DOI: https://doi.org/10.22271/ortho.2018.v4.i2l.118

Abstract

Background: Osteoarthritis (OA) is the most common disease of joints in adults around the world. The aim of the study was to assess functional outcome and pain relief in using intraarticular injection hyaluronic acid in symptomatic osteoarthritis knee.

Methods: It was a prospective clinical study with 6 months of follow-up was conducted in the Dept. of Orthopaedics, Govt Stanley Medical College and Hospital, Chennai. Clinically proven n=45 osteoarthritis knees (OA) of 41 patients included in study on the basis of inclusion and exclusion as 4 patients having bilateral OA knee. Enrolled patients were treated by one dose of intraarticular injection of Hyaluronic acid (20 mcg/2ml) in affected knee joint. Functional outcome and clinical assessment was done by pain with visual analogue score (VAS) and knee range of movements, doyle’s index.

Results: 45 patients participated in study and reported statistically significant improvement in VAS score in mild and moderate osteoarthritis of knee from 4.86 and 7.51 points respectively pretreatment level to 3.0 and 5.41 points respectively at three months post Hyaluronic acid injection follow up, improvement in joint tenderness and improved significantly clinically as well as statistically in mild to moderate group while in severe group no clinical and statistically significant improvement was observed in any parameter.

Conclusion: We concluded that intraarticular injection hyaluronic acid should be considered as safe and effective modality of treatment in selected group of mild to moderate osteoarthritis only. The added advantage that Intraarticular Hyaluronic acid injections can last up to 6 months from the time of administration when compared to others which is proven in this study.

Keywords: Hyaluronic acid, OA knee, VAS score

Introduction

Osteoarthritis (OA) is one of the most types of musculoskeletal illnesses internationally [1]. It is predicted that 3.8% of the world’s population be afflicted by symptomatic knee OA [2,3]. This equates to approximately 277 million human beings residing with knee OA worldwide. The prevalence of OA is comparable across the globe and it is anticipated to growth dramatically as the population ages, specifically in low and-middle socio economic countries. The prevalence of osteoarthritis of knee joint in rural and urban India is predicted to be 3.9% and 5.5%, respectively [3-5]. It’s far estimated to be the fourth main reason for disability in elderly. Nearly 33%of all adults have radiological signs and symptoms of osteoarthritis [6,7].

Treatment of OA mainly involves symptom control, with a hope of enhancing knee mobility, which finally calls for knee replacement surgical treatment as the sickness progresses. Treatment commonly followed includes a combination of pharmaceutical interventions (i.e., analgesics and anti-inflammatory medications) and intra-articular injections of corticosteroids or hyaluronic acid (HA) similarly to energetic treatment (i.e., bodily remedy, exercises, orthotics, or manual therapy aimed at enhancing electricity and mobility) [8-10]. As knee OA advances and conservative remedies are now not effective for reducing signs and symptoms, surgical tactics emerge as important [10]. Intraarticular injections have an additional non operative approach for OA control while nonpharmacologic and medical treatment plans provide inadequate alleviation of signs and symptoms.
Intra articular injections of hyaluronic acids have been permitted by FDA for patients with osteoarthritis of the knee [10]. Some researches have already been established about the efficacy of hyaluronic acid injection in remedy of symptomatic OA knee [11-13]. The clinical benefit of IA HA on knee OA may rely on 2 mechanisms:
1. Mechanical viscosupplementation of the joint (allowing lubrication and shock absorption), and
2. The reestablishment of joint homeostasis by inducing endogenous collagen production, which continues long after the exogenous injection has left the joint [15].

**Aim**
This prospective observational study is being conducted to assess the final results and outcome of intra-articular hyaluronic acid in treatment of osteoarthritis of knee as a non operative remedy. This study had been conducted after getting appropriate ethical committee approval.

**Materials and Methods**
In this study we prospectively studied on 45 patients who were suffering from Osteoarthritis knee attending the department of Orthopedics, Govt. Stanley Medical College & Hospital, Chennai of both males and female patients of symptomatic osteoarthritis knee (OA Knee). Patient having massive cardiovascular disease, renal or hepatic ailment, pregnancy, malignancy, diabetes, previous surgical operation around knee joint and joint instability excluded from our observation. All of the patients had been explained about the study and detailed informed consent was received. The ones who gave consent to participate in the study had been enrolled in. Participants have been administered with one dose of intra articular injection of Hyaluronic acid (20mcg/2ml). Intra articular injections have been administrated with a team of three doctors with the help of ultrasound machine to identify the joint cavity with strict aseptic precautions after aspiration of any effusion if present. Sufferers were followed up frequently for 6 months. No analgesics prescribed for the duration of follow up except tab paracetamol (500 mg) SOS. At baseline, the demographic statistics and medical records of the patients become acquired. Evaluation of results achieved on the idea of VAS score, Joint tenderness assessed by way of the use of Doyle’s index as a 4 factor scale (zero- no tenderness, 1-patient complained of pain, 2-affected person complained of pain and winced, 3 affected person complained of ache, winced and withdrew the joint) [16], knee range of movements.

**Results**
45 patients participated during this study out of that 21 were males and 24 females of 35-85 years people. Most of the knees had moderate grade of degenerative joint disease (OA) (22 patients) in line with Kellegren Lawrence criteria followed by severe (7 patients) (who refused surgery) and mild (16 patients)

**Clinical examination prior to the treatment**

| Clinical Examination | Mild(16 Patients) | Moderate(22 Patients) | Severe(7 Patients) |
|----------------------|-------------------|-----------------------|--------------------|
| Pain at rest (VAS score) | 4.86 | 7.51 | 8.91 |

From the above table one can understand that pain at rest is very less in mild category and very much intolerable in severe category. For severe category patients even though surgery advised some refused surgery and some not considered for surgery due to associated co morbid medical conditions which preclude surgery. So, they have given one dose steroid to improve some movements and to alleviate pain.

**Clinical examination after 6 months of ia hyaluronic acid administration**

| Clinical Examination | Mild(16 Patients) | Moderate(22 Patients) | Severe(7 Patients) |
|----------------------|-------------------|-----------------------|--------------------|
| Pain at rest (VAS score) | 3.0 | 5.41 | 8.24 |

After 6 months the patients were again examined and VAS score recorded and compared to the previous assessment. Post intra articular injection pain at rest is clearly improved in mild and moderate osteoarthritis knee and to very less extent in severe OA knee. So it is proven that intra articular Hyaluronic acid injections are effective in improving the patients of Osteoarthritis significantly in mild and moderate Osteoarthritis.

**Discussion**
Hyaluronic acid (HA) is a type of mucopolysaccharide also called as glycosaminoglycan which is a major constituent of synovial fluid and cartilage matrix in normal joints. The viscous properties of the synovial fluid are mainly dependent on the concentration of Hyaluronic acid and its molecular weight (MW). In osteoarthritis, the concentration and molecular weight of Hyaluronic acid are comparatively decreased. The exogenous HA available for the purpose of intra articular viscosupplementation is formulated as different MW preparations enlisted below 1. low (range: 500,000–730,000 Da), 2. intermediate (800,000–2,000,000 Da), and 3. high MW (average: 6,000,000 Da) this includes cross-linked formulations of Hyaluronic acid (hylans) [11, 12, 17, 18].

The exact mechanism of how the exogenous Hyaluronic Acid works in osteoarthritis knee is unknown. However, the explained mechanism of Hyaluronic Acid activity occurs in 2 stages: 1) mechanical stage and 2) pharmacological stage. During the mechanical stage, synovial fluid is replaced by higher concentrations of Hyaluronic Acid thereby improving viscosity. This also restores the shock-absorbing and lubricating abilities of reduced synovial fluid and maintains a boundary layer around nociceptors (receptors for pain), reducing pain induction. The pharmacological stage induces the biosynthesis of endogenous Hyaluronic Acid and extracellular matrix components of cartilage, which reduces proteoglycan loss in cartilage and programmed cell death of chondrocytes. It also reduces inflammatory cell activities to reduce HA degradation and acts by reducing stimulation of pain mediators. The endogenous synthesis of Hyaluronic Acid by synovial fibroblasts is influenced by the concentration and molecular weight of Hyaluronic Acid in the extracellular environment. With the use of low molecular weight Hyaluronic Acid preparations only weak binding occurs and the biosynthesis of Hyaluronic Acid may not be sufficiently stimulated. With exogenous Hyaluronic Acid of intermediate MW, strong binding occurs and because of the high number...
of receptors stimulated endogenous Hyaluronic Acid biosynthesis is enhanced. While maximal receptor binding occurs with high MW Hyaluronic Acid (12, 17, 18).

Corticosteroids and Hyaluronic Acids are commonly used modes of management of knee Osteoarthritis not responding to more conservative therapy. Few direct comparisons of intra articular corticosteroids to Hyaluronic Acid injections have been performed. Therefore, current guidelines make no recommendations as to which class should be initially employed once the clinician is decided to use intra articular injection therapy for knee osteoarthritis (13, 14). Effect of intra articular Hyaluronic acid was assessed by recording pain at rest, joint line tenderness and range of movements clinically in all groups. There was a notable effect of intra articular hyaluronic acid in decreasing pain at rest (VAS) and joint tenderness from baseline to 6 months in this study. The relief of symptoms was higher among the patients of mild and moderate than severe category patients. There was no significant decrease in VAS and joint tenderness among the patients of severe osteoarthritis. No change was observed in range of movement. This correlates to the similar observations that were made by other observers.

**Conclusion**

Intra articular Hyaluronic acid injections can be a good and able alternative to non pharmacologic interventions in mild and moderate Osteoarthritis

The added advantage that Intra articular Hyaluronic acid injections can last up to 6 months from the time of administration when compared to others which is proven in this study.

**Limitations of this study**

Large volumes have to be studied to ascertain the importance of Hyaluronic acid as a visco supplementation in case of osteoarthritis.

**References**

1. Felson DT. Epidemiology of knee and hip osteoarthritis. Epidemiol Rev. 1988; 10:1-28.
2. Fransen M, Bridgett L, March L, Hoy D, Pensera E, Brooks P. The epidemiology of osteoarthritis in Asia. Int J Rheum Dis. 2011; 14(2):113-21.
3. Felson DT, Couropmituret NN, Chaisson CE, Hannan MT, Zhang Y, McAlindon TE et al.
4. Lawrence RC, Helmick CG, Arnett FC, Deyo RA, Felson DT, Giannini EH et al. Estimates of the prevalence of arthritis and selected musculoskeletal disorders in the United States. Arthritis Rheum. 1998; 41:778-99.
5. Sancheti P, Shetty VD, Dhillon MS, Sprague SA, Bhandari M. India-Based Knee Osteoarthritis Evaluation (iKare): A Multi-Centre Cross-Sectional Study on the Management of Knee Pain and Early Osteoarthritis in India. Clinics in Orthopedic Surgery. 2017; 9(3):286-294. doi:10.4055/cios.2017.9.3.286.
6. Padda AS, Mohan V, Singh J, Deepthi SS, Singh G, Dhillon HS. Health profile of the aged persons in urban and rural field practice areas of Medical College, Amritsar. Indian J of Com Med. 1998; 23:72-6.
7. Khan JA, Khan Z. A study of the leading causes of illness & physical disability in an urban aged population. Indian J Prev Soc. Med. 2000; 32:121-4.
8. Bhatia D, Bejarano T, Novo M. Current interventions in the management of knee osteoarthritis. Journal of Pharmacy & Bioallied Sciences. 2013; 5(1):30-38. doi:10.4103/0975-7406.106561.
9. Davis MA. Epidemiology of osteoarthritis. Clin Geriatr Med. 1988; 24:766-7.
10. Ringdahl E, Pandit S. Treatment of knee osteoarthritis. Am Fam Physician. 2011; 83:1287-92.
11. Goldberg VM, Goldberg L. Intra-articular hyaluronans: the treatment of knee pain in osteoarthritis. J Pain Res. 2010; 3:51-6.
12. Bellamy N1, Campbell J, Robinson V, Gee T, Bourne R, Wells G. Visco-supplementation for the treatment of osteoarthritis of the knee. Cochrane Database Syst Rev. 2006; 2:CD005321.
13. Bellamy N, Campbell J, Robinson V, Gee T, Bourne R, Wells G. Intraarticular corticosteroid for treatment of osteoarthritis of the knee. Cochrane Database Syst Rev. 2006; 2:CD005328.
14. Leopold SS, Redd BB, Warne WJ, Wehrle PA, Pettis PD, Shott S. Corticosteroid compared with hyaluronic acid injections for the treatment of osteoarthritis of the knee. J Bone Joint Surg. 2003.
15. Christelle Nguyen, Marie-Martine Lefèvre-Colau, Serge Poiraudreau, François Rannou. Evidence and recommendations for use of intra-articular injections for knee osteoarthritis. Annals of Physical and Rehabilitation Medicine. 2016; 59:3. https://doi.org/10.1016/j.j.physrehab.2016.02.008.
16. Bijsterbosch J, Wassenaar MJE, le Cessie S, Slagboom PE, Rosendaal FR, Huizinga TJ, et al. Doyle Index is a valuable additional pain measure in osteoarthritis, Osteoarthritis and Cartilage, 2010; 18:8. https://doi.org/10.1016/j.joca.2010.05.009.
17. Moreland LW. Intra-articular hyaluronan (hyaluronic acid) and hylans for the treatment of osteoarthritis: mechanisms of action. Arthritis Research & Therapy. 2003; 5(2):54-67.
18. Temple Michelle, Ren Shuwen, Quach Phu, Hansen Bradley, Chen C. Albert & Hasegawa, Akihiko & D. D’Lima, Darryl & Koziol, Jim & Masuda, Koichi & Lotz, Martin & Sah, Robert. Hyaluronan concentration and size distribution in human knee synovial fluid: Variations with age and cartilage degeneration. Arthritis Research & Therapy. 2016, 18. 10.1186/s13075-016-0922-4.