Primary Knee OA: Rethinking Intra-articular Pain Management

Yadira I. Cabrera

The University of Texas at El Paso

College of Nursing

DNP Chair: Dr. Karim Singh

May 16, 2023

Abstract

Primary knee osteoarthritis is a common diagnosis found in people over 65 years of age. As a progressive disease, the burden on daily life is significant. Typically, patients complain of knee pain, stiffness, and swelling which worsens after prolonged sitting resulting in reduced participation in activities of daily living.

Locally, many patients with symptomatic knee OA are seen at a geriatric primary care clinic in West El Paso, Texas. Current practice in the clinic was to use methylprednisolone acetate 40 mg and referral to physical therapy for patients 65 years or older when the treatment plan included an intra-articular injection. This project was undertaken to identify the optimal corticosteroid and exercise regimen for patients 65 years or older with symptomatic primary knee osteoarthritis, and then implement and evaluate the regimen.

The methods for this quality improvement project use the RE-AIM Framework (Reach, Effectiveness, Adoption, Implementation, and Maintenance) which is an effective and common tool to adequately translate evidence into practice. The PDSA (Plan, Do, Study, Act) Cycle was also used to test the change that was implemented into practice. The validated pain score tool, WOMAC (Western Ontario and McMaster's Universities Arthritis) Index was utilized to monitor patients' pain pre- and post-intervention.

The use of triamcinolone acetonide for the intra-articular injection accompanied by provider-taught land-based exercises with repeat back demonstration were two high-evidence modalities in treating knee osteoarthritis that were put into practice for this quality improvement project.

A total of 13 patients met the criteria for this quality improvement intervention during a seven-week project timeline. The main findings demonstrated approximately 87.5% pain

improvement with the use of a lower soluble corticosteroid. Lastly, 61% of the patients were still performing the land-based exercises at the end of the seven weeks. The dual practice change to a lower soluble corticosteroid and provider-taught exercises proved to be highly effective.

Primary Knee OA: Rethinking Intra-articular Pain Management

Problem Description

Body joints are formed by the articulation of two bony structures covered by protective cartilage which allows for normal extension and flexion movement. As the body ages, the cartilage undergoes changes resulting in bone-to-bone direct contact. As the articulated bones suffer ongoing stress functionality decreases causing the growth of osteophytes which worsen pain and increase swelling and stiffness. There are many forms of arthritis with the most common being osteoarthritis (OA) of the hand, hip, and knee. According to the National Institute of Arthritis and Musculoskeletal and Skin Diseases, knee OA is a leading cause of disability and chronic pain affecting 30% of older adults (NIH NIAMS, 2022). The Centers for Disease Control and Prevention (CDC) estimates the burden of the disease affects over 32 million adults in the United States (CDC, 2020).

Weight-bearing joints are of major concern. Arthritic changes in weight-bearing joints are associated with decreased quality of life (social isolation, fatigue, and depression) and chronic pain. The Osteoarthritis Action Alliance which partners with the CDC estimates the annual medical costs reach $65 billion and of significance is a $71 billion annual earning loss (CDC, 2020). In addition, Chen et al. (2021) discussed the costs of end-stage knee OA with an initial total knee replacement beginning at $18,000. The trend of patients with symptomatic knee OA requesting narcotic pain relief in desperation amplifies the current opioid crisis.

Locally, many patients with symptomatic knee OA are seen at a geriatric primary care clinic in West El Paso, Texas. Current practice was to use methylprednisolone acetate 40 mg and referral to physical therapy when the treatment plan included an intra-articular corticosteroid injection. This project was undertaken to identify the optimal corticosteroid and exercise

regimen for patients 65 years or older with symptomatic primary knee OA, and then implement and evaluate the regimen.

Available Knowledge

Testa et al. (2021) emphasized the disabling effect and disease burden of primary knee osteoarthritis in the growing population of ages 65 years and above. With an aging population, the prevalence of knee OA is projected to increase with the lifetime risk of developing symptomatic knee OA to 45% (Meiyappan et. al., 2020). Research continues to investigate treatments to improve the quality of life and decrease pain associated with OA.

Evidence does highlight certain patient characteristics and predispositions for those diagnosed with knee OA which include being female and being obese (Testa et al., 2021). Primary care providers continue to make strides in managing and addressing the modifiable factor of obesity. The non-modifiable factor of gender becomes more complex. Females traditionally are known for their intrinsic nurturing characteristic and that role becomes negatively impacted by knee dysfunction and chronic pain.

Many times, patients do take the initiative in searching for pain control by self-prescribing over-the-counter oral and topical analgesics. They will also search for and use assistive devices such as canes and braces, but these may be constrained due to financial limitations. A review of current evidence reveals multiple treatment modalities available for pain management of knee OA.

Brophy & Fillingham (2022) provide a summary of the American Academy of Orthopedic Surgeons (AAOS) clinical practice guideline for the management of knee OA. This guideline provides a variety of management approaches from conservative treatment to pharmacotherapy and invasive interventions. The guideline provides evidence of improvement

in pain and function (and resulting improved quality of life) with the use of intra-articular corticosteroids. Because more than one choice of corticosteroid is available, the evidence was reviewed to determine the most effective corticosteroid treatment and supporting interventions.

Saltychev et al. (2020) in a systematic review and meta-analysis concluded that when pooling the results of eight randomized control trials, intra-articular corticosteroid injections demonstrated mild to moderate effect on pain severity with results lasting up to 3 months. In most of the international randomized controlled trials, triamcinolone was the favored corticosteroid for prolonged knee OA pain relief. In a review by Testa et al. (2021), a notable finding included information related to the importance of the chemical solubility of an injectable steroid. With clinical duration inversely related to solubility, the insoluble triamcinolone acetonide was the most used steroid (American Academy of Physical Medicine Rehabilitation, 2023). The corticosteroid is generally administered with an anesthetic, usually lidocaine and ropivacaine.

In addition to intra-articular injections, strengthening exercises improve pain and function of the knee. Because of barriers to supervised exercise programs such as travel or co-pay concerns (Brophy & Fillingham, 2022), knee conditioning programs that can be carried out in the patient's home setting may be more effective. The AAOS provides 12 exercises to help reduce stress on the knee that can be integrated into a treatment plan, therefore addressing common barriers to exercise participation (AAOS, 2023).

After translating current evidence, the following PICOT guide was developed for this quality improvement project.

P: Patients 65 years or older with primary knee osteoarthritis

I: triamcinolone acetonide 40 mg intra-articular plus land-based exercise education

C: methylprednisolone acetate 40 mg intra-articular and referral to physical therapy

O: reduced pain and participation in knee exercises

T: 7-week duration

Methods

The focus of this quality improvement project was set after completing an initial literature review and reviewing the evidence with the DNP Chair. As the project manager, I sent the proposal for approval to the clinic's medical director. Upon approval from the director, I submitted the project to The University of Texas at El Paso IRB and was granted a non-research designation.

Project planning began with identifying stakeholders who have a significant role in the care of patients in the clinic. The foundational framework for this project was RE-AIM (Reach, Effectiveness, Adoption, Implementation, and Maintenance) to support the translation of evidence into practice. This framework maintains the long-term delivery and implementation of a clinical practice change (Holtrop et. al., 2021). As the project manager, I provided a detailed background of the project goal to the medical director, scheduling staff, equipment/drug manager, and the medical assistant. The project timeline was reviewed to ensure it did not negatively affect the culture of the clinic or the expectations of patient care.

Current practice in the management of pain associated with a diagnosis of primary knee osteoarthritis revealed unmet patient outcomes. Patients returned to the clinic for continued knee pain and review of adherence to the initial treatment plan revealed lack of follow through with knee physical therapy for various reasons including lack of time and cost. In a longitudinal

qualitative study by Moore and colleagues the barriers associated with lack of participation in prescribed knee physiotherapy were equivalent (Moore et al., 2020). As the only provider in the clinic with the skill set of intra-articular corticosteroid injection intervention, symptomatic patients diagnosed with OA of the knee were scheduled into my panel. As an advanced practice registered nurse, I expanded my skill set through a common avenue. The clinic director offered a training seminar led by an expert in intra-articular knee injections for pain management. The program included anatomy and physiology, patient preparation, equipment, injection technique, and the use of methylprednisolone acetate. The origin of this quality improvement project came to light after questioning whether the use of methylprednisolone acetate 40mg for the intra-articular injection, and referral to physical therapy, were the best practice options.

The current practice for intra-articular injection in the clinic followed a set protocol. The first step was identifying symptomatic patients diagnosed with primary knee OA with current imaging. During the scheduled visit after the physical exam, the diagnosis was discussed, including pathophysiology, disease progression, pain management options, associated risks, and physical therapy. After the patient's questions were answered, the consent for treatment was signed. The patient preparation followed traditional positioning, skin prep, and strict adherence to aseptic technique with a medial approach injection. The corticosteroid was mixed with an injectable local anesthetic which is in alignment with expert opinion and evidence. The end of the visit included watching for negative reactions and providing a prescription for physical therapy.

The QI model PDSA (Plan, Do, Study, and Act) was integrated into this project to manage the new practice change and intervention. The PDSA is an excellent easy to understand

model for continuous improvement and project implementation of evidence-based changes into practice (PDSA, 2023)

The practice change based on evidence included altering two steps to the current practice. Participants in the project were all managed identically to current practice with the following exceptions. First, the corticosteroid was changed to 40mg of triamcinolone acetonide, and the patient was taught knee-strengthening exercises by the provider during the visit. Since the drug class had not changed, the risk profiles were the same. Patients with the following medical conditions were excluded from the project: immunocompromised, uncontrolled diabetes mellitus, rheumatoid arthritis, presence of knee joint effusion, and absolute contraindications.

The provider taught the patient the land-based knee-strengthening exercises following the recommendation from AAOS. This knee exercise program consists of 12 exercises aimed to improve flexibility and strength while targeting specific muscles: quadriceps (front of the thigh), hamstrings (back of the thigh), abductors (outer thigh), adductors (inner thigh), and the gluteus medius and gluteus maximus (buttocks) thereby reducing stress on the knee joint. Furthermore, flexibility through stretching is a key factor in restoring range of motion and preventing fall injuries.

To measure and assess the outcome of the practice change a pain score tool was used. The Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) (n.d)
has been used in practice since 1988. The original version is lengthy and for this project, an abbreviated version was used to elicit answers specifically addressing pain. The score is based on a Likert scale from zero to four (four is extreme pain) and of a benefit the tool is available in Spanish.

WESTERN ONTARIO AND MCMASTER OSTEOARTHRITIS INDEX (WOMAC)

Please circle the appropriate rating for each item.

RATE YOUR PAIN WHEN...	NONE	SLIGHT	MODERATE	SEVERE	EXTREME
Walking	0	1	2	3	4
Climbing stairs	0	1	2	3	4
Sleeping at night	0	1	2	3	4
Resting	0	1	2	3	4
Standing	0	1	2	3	4

The project plan included not only the initial visit but scheduled follow-up visits over seven weeks.

1. Week #1: initial visit to include a physical exam, obtaining WOMAC score, education, consent, intra-articular injection, provider demonstration of exercises, and repeat demonstration by the patient.
2. Week #2 through Week #6: obtain WOMAC score and assess continued participation in knee exercises.
3. Week #7 (last week): obtain WOMAC score and assess the use of knee exercises.

Results

The number of participants in this project totaled 13 with an average age of 74 years. The gender breakdown accurately aligns with the evidence which shows females are more at risk for knee OA. The female percentage for this project was 77%. Pre-injection self-reported pain scores using the WOMAC tool averaged out to 16 (maximum score is 20). Post-practice change, the self-reported pain score dropped to two which is an 87.5% improvement. Also, at the end of the project, 61% of the patients were continuing to perform land-based exercises at home.

There was an unexpected finding of savings in healthcare dollars. Triamcinolone acetonide comes in at a lower cost per vial than methylprednisolone acetate. The difference is

$1.50 which is a positive outcome for a healthcare organization that focuses on improving patient outcomes and minimizing healthcare costs.

Discussion

There are a variety of expert opinions and practices in the management of pain from primary knee osteoarthritis. Application of current evidence endorsed the use of a corticosteroid with lower solubility and slower absorption. The drug action of remaining longer in the joint space was found to decrease pain and improve knee range of motion. Improving the length of time the drug is in the joint allowed the patient to engage in land-based knee strengthening exercises which enhanced participation in activities of daily living because of less pain.

Investigating and implementing a practice change in the management of pain associated with knee OA provided patient-centered care. This quality improvement project introduced a lower solubility corticosteroid for intra-articular knee injection and included provider-taught knee conditioning exercises to improve patient outcomes. At the end of seven weeks, participants did have reduced knee pain. They also increased participation in activities of daily living. Even though a little over half of the participants continued with knee conditioning, it should not be underestimated that there is knee exercise knowledge retention that they may use in the future.

This population of patients is at increased risk for disability, falls, and limitations with activities of daily living from untreated knee pain. The feedback received during follow-up visits was positive. Participants indicated they could walk further without assistive devices, they could ascend stairs, and they increased their home activities such as housework and cooking. These improvements in overall function improved quality of life at a minimal cost without the need for costly knee surgery and recuperation time.

Limitations

This project highlighted several limitations. The first limitation was recognizing not all patients were at the same mobility level. There were two patients unable to climb onto the exam table due to limited mobility and obesity which resulted in changing the education approach of six of the twelve knee conditioning exercises. The second limitation was attempting to keep the time required by the provider to teach the knee-strengthening exercises in a traditional 15-minute office visit. The education, provider demonstration, and patient return demonstration of exercises added five to seven minutes on top of the scheduled time.

Another limitation that is commonly seen in primary care is a patient not returning for the scheduled follow-up visit. The goals for the structured follow-up visits were to reassess pain scores and validate ongoing participation with knee conditioning. To meet patients' needs, the project included telephonic communication for some patients.

Conclusion

A practice change in the management of knee pain in people diagnosed with primary knee osteoarthritis is endorsed by current evidence. The first aim of this quality improvement project was to change the familiar corticosteroid (methylprednisolone acetate) for intra-articular injection to a lower solubility corticosteroid (triamcinolone acetonide). The second aim addressed patient noncompliance with prescribed knee physical therapy and introduced knee-strengthening land-based exercises taught by the provider during the initial visit. This dual practice change proved to be highly effective. At the project's end, 87.5% of the patients had reduced knee pain thereby increasing participation in activities of daily living. Also noted was 61% of the patients continued knee-strengthening exercises taught by the provider.

Funding

This quality improvement project was supported by a scholarship awarded from the Paso Del Norte Health Foundation located in El Paso, Texas.

References

American Academy of Orthopedic Surgeons (AAOS) (2023). *Knee rehabilitation exercises - orthoinfo - AAOS*. OrthoInfo Knee Rehabilitation Exercises. Retrieved March 26, 2023, from https://orthoinfo.aaos.org/en/recovery/knee-conditioning-program/knee-pdf/

American Academy of Physical Medicine Rehabilitation. (2023). *Chart 1: Potency, solubility and preparations* - AAPM&R*. American Academy of Physical Medicine Rehabilitation Potency, Solubility and Preparations. Retrieved March 26, 2023, from https://media-now.aapmr.org/wp-content/uploads/2021/03/11182315/Steroids-and-Corticosteroids-Chart-1.pdf

Brophy, R. H., & Fillingham, Y. A. (2022). AAOS Clinical Practice Guideline Summary: Management of osteoarthritis of the knee (Nonarthroplasty), Third edition. *Journal of the American Academy of Orthopaedic Surgeons,* 30(9), e721–e729. https://doi.org/10.5435/jaaos-d-21-01233

Centers for Disease Control and Prevention (CDC). (2020, July 27). *Osteoarthritis (OA)*. Centers for Disease Control and Prevention. https://www.cdc.gov/arthritis/basics/osteoarthritis.htm

Chen, A. T., Bronsther, C. I., Stanley, E. E., Paltiel, A. D., Sullivan, J. K., Collins, J. E., Neogi, T., Katz, J. N., & Losina, E. (2021). The value of total knee replacement in patients with knee osteoarthritis and a body mass index of 40 kg/m2 or greater. *Annals of Internal Medicine*, *174*(6), 747–757. https://doi.org/10.7326/m20-4722

Holtrop, J. S., Estabrooks, P. A., Gaglio, B., Harden, S. M., Kessler, R. S., King, D. K., Kwan, B. M., Ory, M. G., Rabin, B. A., Shelton, R. C., & Glasgow, R. E. (2021). Understanding

and applying the RE-AIM framework: Clarifications and resources. *Journal of Clinical and Translational Science*, *5*(1), e126. https://doi.org/10.1017/cts.2021.789

Meiyappan, K. P., Cote, M. P., Bozic, K. J., & Halawi, M. J. (2020). Adherence to the American Academy of Orthopaedic Surgeons Clinical Practice Guidelines for nonoperative management of knee osteoarthritis. *The Journal of Arthroplasty*, *35*(2), 347–352. https://doi.org/10.1016/j.arth.2019.08.051

Moore, A. J., Holden, M. A., Foster, N. E., & Jinks, C. (2020). Therapeutic alliance facilitates adherence to physiotherapy-led exercise and physical activity for older adults with knee pain: A longitudinal qualitative study. *Journal of Physiotherapy*, *66*(1), 45–53. https://doi.org/10.1016/j.jphys.2019.11.004

National Institute of Health, U.S. Department of Health and Human Services. (2022, June 8). *NIAMS health information on osteoarthritis*. National Institute of Arthritis and Musculoskeletal and Skin Diseases. https://www.niams.nih.gov/health-topics/osteoarthritis

Plan, do, study, act (PDSA) cycles and the model for improvement. (2023). Retrieved March 27, 2023, from https://www.england.nhs.uk/wp-content/uploads/2022/01/qsir-pdsa-cycles-model-for-improvement.pdf

Saltychev, M., Mattie, R., McCormick, Z., & Laimi, K. (2020). The magnitude and duration of the effect of intra-articular corticosteroid injections on pain severity in knee osteoarthritis. *American Journal of Physical Medicine &Rehabilitation*, 99(7), 617–625. https://doi.org/10.1097/phm.0000000000001384

Testa G., Giardina, S.M.C., Culmone, A., Vescio, A., Turchetta, M., Cannavò, S., & Pavone, V. (2021). Intra-articular injections in knee osteoarthritis: A review of literature. *Journal of Functional Morphology and Kinesiology*, 6(1):15. https://doi.org/10.3390/jfmk6010015

Western Ontario and McMaster Universities Osteoarthritis Index. (n.d.). *WOMAC INDEX*. https://womac.com/womac/index.php. Retrieved March 2023, from https://womac.com/womac/index.php