

# Hypertonic Dextrose Prolotherapy Injection in Grade IV Knee Osteoarthritis with Obesity: A Case Report

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## ABSTRACT

*The main complaint in knee osteoarthritis (KOA) is knee pain and limited range of motion (ROM) which affects the patient's quality of life. Dextrose prolotherapy successfully reduced pain and enhanced functional status and quality of life in chronic knee pain, which is classified as KOA grade II or III by the Kellgren-Lawrence classification. We present a case of grade IV KOA with co-morbid obesity who refused surgical management but got dextrose prolotherapy instead. She received prolotherapy for the right knee 5 times with a gap of 4 weeks between treatments. Western Ontario and McMaster Universities Osteoarthritis (WOMAC score), Numerical Rating Scale (NRS), knee ROM, Barthel index, count test, and Timed Up and Go Test (TUG) were evaluated 1 day after each treatment and compared to each post-injection score. This patient is also comorbid of grade II obesity which is associated with mechanical loads on the knee joint causing inflammation and progression of KOA. After 5 months of prolotherapy treatment, strengthened quadriceps muscle exercising and static cycle endurance exercising, this patient has improvements in pain (NRS score 8 to 3), WOMAC (WOMAC score 82.3 to 31.3), and cardiorespiratory function (count test 18 to 28 and TUG from 40 to 28). Hypertonic dextrose prolotherapy (HDP) is interventional therapy as an alternative for those who refuse surgery, due to its advantages including, inexpensive, easily conducted, safe with minimal or even no recorded complications, and long-term efficacy even for grade IV of KOA like this patient.*

**Keywords:** Osteoarthritis; obesity; hypertonic dextrose prolotherapy.

## INTRODUCTION

KOA is a degenerative, chronic, and progressive knee joint disease. The main complaint in KOA patients is knee pain and limited knee ROM which affects the patient's quality of life. The high prevalence of KOA is one of the main causes of disability in the older adults worldwide due to chronic pain which

is a social and economic burden for patients, and caregivers, and costs to the national health system.<sup>1-4</sup>

KOA affected about 654.1 million above 40 years individual in 2020 worldwide. KOA increased by around 30% over 65 years old. The prevalence of KOA in Indonesia in 2018 reached 8.5% and 6.1% in women and men

respectively. It could influence the quality of life, meanwhile, most treatments only focus on treating the symptoms without fixing the pathology process. Therapeutic approached predominantly addressed symptoms, but no therapies had been able to halt or delay Osteoarthritis (OA) progression or provide effective and long-lasting symptomatic relief. Pharmacological treatments were widely used to show the benefits to be limited, whereas the risks seemed higher than expected. Therefore, several other intra-articular injection therapies are being developed for the treatment of musculoskeletal diseases<sup>1,3,5-8</sup>.

Prolotherapy is an injection technique that uses certain substances in the articular spaces, ligaments, and tendons which aims to treat chronic pain in the musculoskeletal case, including KOA. Hypertonic dextrose prolotherapy (HDP) has been understood to lead to healing due to pain control through tissue proliferation potentially mediated by inflammatory mechanisms.<sup>1,9</sup> The local inflammatory cascade's inception, which causes tissue growth and remodeling, is regarded to be a part of the healing process. Small volumes of an irritating solution are intra-articular injected or in contact with sore tendon and ligament insertions, at several spots during this treatment. The substance is supposed to start the body's healing reaction.<sup>4</sup> According to a study with individuals who had persistent chronic knee pain had classified as KOA grade II or III by the Kellgren-Lawrence classification, dextrose prolotherapy was successful in reducing pain and enhancing functional status and quality of life.<sup>10</sup>

According to a previous study, intra-articular injection therapies for KOA are comparable to other treatments. The evidence that intraarticular corticosteroids can reduce pain temporarily for up to 4 weeks, but it is uncertain whether these effects continue to have an impact after 1 to 6 weeks. Hyaluronic acid intra-articular injections tend to provide long-lasting pain relief, reach its peak at 8 weeks, and disappear at 24 months. Despite being a new treatment, intraarticular Platelet-Rich Plasma (PRP) lacks high-quality scientific proof of its effectiveness.<sup>9</sup> In short-term follow-up, HDP shows efficacy comparable to intra-articular injection with hyaluronic

acid for lowering pain and enhancing function in osteoarthritis of the knee. Prolotherapy is something that can be easily conducted in the primary care context, is affordable, and high safety profile. Therefore, it merits consideration.<sup>11,12</sup>

## CASE ILLUSTRATION

### Patient Information

A 54-year-old female patient, complained of pain in both knees (the right side is worse) since 2 years ago, getting worse in the last 2 months. The pain was localized and getting worse when she got up from sitting and went up or down stairs with NRS 8 (on a scale of 0-10). It also appeared at the end of the day after a long walking and had to use a quadripod cane to walk daily. Pain improved with rest and sitting with an NRS value of 4 in both knees. She also complained of crepitus when moving the knee and stiffness in both knees usually 5-10 minutes in the morning. The patient has an obese for about 10 years and has no history of trauma or previous surgery.

She could do activities such as eating, bathing, dressing, grooming, defecating, and urinating independently even with an assistive device. The patient experienced limitations in doing household chores and needed the help of her husband to wash clothes, cook, dry clothes, and other household chores that required mobilization outside the home. She routinely controlled to Orthopedic polyclinic at the Surabaya Hajj Hospital and was diagnosed as grade III KOA based on the clinical and X-ray results of the knee and was advised to undergo surgery. The patient refused surgery and chose less invasive treatment instead.

### Physical Examination

On inspection, we found varus deformity on both knees when standing. There was crepitus during the moving knee joint, positive patella grinding test on both sides and Vastus Medialis Oblique muscle atrophy. The Q angle while lying down (non-weight bearing) was 12° varus and 10° varus for the right and left sides, respectively, worsening when standing (weight bearing) with 14° varus and 11° varus for the right and left

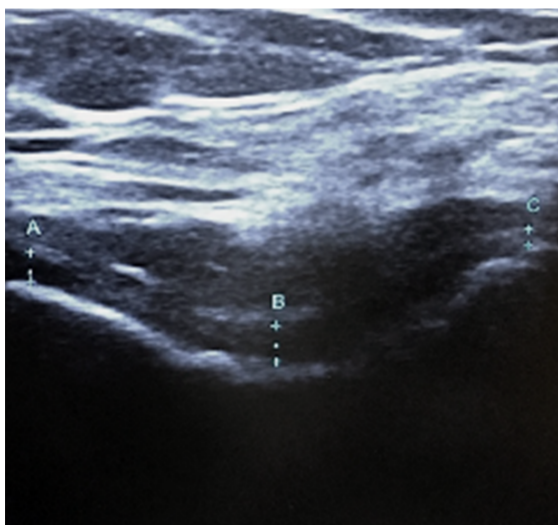
sides, respectively. There was limited ROM in knee flexion, 0-90° on the right side and 0-105° on the left side. The WOMAC score at the first visit was 82.3% and the cardiorespiratory function decreased as the count test 18, chest expansion of T2, T4, and T6 were 3, 2.5, 2.5 cm respectively and the 3 meters TUG test time was prolonged (40 seconds). The Barthel Index score was 85 which shows limitations on stairs and toilet use points. The nutritional status of the patient showed grade II obesity with a BMI of 38.1 kg/m<sup>2</sup>.

### Diagnostic Investigation

X-rays of both knees showed osteophytes, narrowing joint space, and kissing bone which according to the Kellgren Larence classification clinically and radiologically constituted grade IV KOA. Ultrasound of the knee was performed to detect cartilage abnormalities (**Figure 1**) and demonstrated thinning of cartilage in the medial femoral condyle (MFC), sclerotic subchondral bone layers, and osteophytes at the femoral and tibial condyles. A previous study that evaluated the cartilage among OA patients showed that femoral cartilage was thinner compared to the healthy group.<sup>13</sup>

### Management

Before the injection procedure, the patient was examined on both knees with a musculoskeletal ultrasound device to determine the pathological



**Figure 1.** Right knee femoral cartilage ultrasound, A: Lateral Femoral Condyle (LFC); B: Inter Femoral Condyle (IFC); C: Medial Femoral Condyle (MFC). The MFC was thinner than the LFC.

location and injection target. We used 20% Dextrose solution for prolotherapy procedures on the supra patellar recess, medial and lateral collateral ligament, and coronary ligament with sterile procedure. Before doing the injection of prolotherapy, we did an injection in three genicular nerves to reduce the pain that might appear after prolotherapy treatment by using 1% Lidocaine solution in the superior lateral, medial superior, and medial inferior genicular nerve. The patient received injection therapy for the right knee 5 times with a gap of 4 weeks between injections.

### Follow-up and Outcomes

The patient was educated to limit strenuous weight bearing activities for 3 days post injection and could start light exercise on day 4 gradually up to day 10. When she felt pain after injection, she was permitted to take an acetaminophen class of painkillers (paracetamol) but not NSAIDs to avoid inhibition of the prolotherapy effect.

WOMAC score and NRS were assessed 1 day after each injection and compared to each post-injection score. We also monitored for ROM of knee flexion-extension, Barthel index as the quality-of-life parameter, count test, and Time Up and Go Test (TUG) as cardiorespiratory function and mobility function from TUG.

After 5 months of prolotherapy treatment, strengthened quadricep muscle exercising, and static cycle endurance exercising, she had improvement in pain, WOMAC score, and cardiorespiratory function as seen in **Table 1**. ROM of right knee flexion was also improved from 0-90° to 0-100° and the Barthel index score was 100 (able to use the toilet and go upstairs independently).

### DISCUSSION

We presented a case of grade IV KOA with comorbid obesity. The patient refused to undergo surgery treatment and chose Interventional Pain Management with HDP as a less invasive treatment. One of the main indications for the management of HDP is chronic KOA with the presence of stage II-IV Kellgren-Lawrence on radiographic findings.<sup>14</sup> Hypertonic dextrose prolotherapy is an evidence-based interventional

**Table 1.** Evaluation of the Numeric Rating Score, WOMAC score, Time Up and Go, and Count Test from baseline, first injection (month 1) until month 5.

Evaluation	Baseline (Pre-injection)	Month 1	Month 2	Month 3	Month 4	Month 5
Numeric Rating Score*	8	6	5	5	4	3
WOMAC Score (%)*	82.3	57.3	57.3	59.4	35.4	31.3
Time Up and Go (second)*	40	37	35	35	30	28
Count Test (count)**	18	18	20	20	22	28

\*lower score better, \*\*higher score better

therapy in the form of intraarticular injection used for chronic musculoskeletal pain conditions, including KOA.<sup>15</sup> It's also effective in reducing pain and improving knee ROM in KOA, with an efficacy of almost the same as hyaluronic acid (HA) injection but with more benefits and minimal side effects.<sup>12</sup> Intra-articular injection of HDP in KOA grade IV produces analgesia, one study observed that the analgesia effect was immediate and even started to be active 20 minutes after injection and persisted for up to 9 months thereafter.<sup>3</sup>

Gradually, the patient experienced an improvement in her pain score as a result of the healing process until her NRS pain score reduced from 8 to 3 when doing activities. Knee flexion ROM also increased to 100° so that it was more flexible in knee movement. A study showed that patients who received HDP interventions experienced an increase in walking speed for

KOA patients compared as previous.<sup>16</sup> The effect of an improved NRS pain score also provides an increase in other parameters such as the Barthel index, WOMAC scores, and TUG test. Recent studies that compared the effects of hyaluronic acid and HDP observed changes based on WOMAC and NRS total scores. They concluded that there was a greater change in NRS scores in the group that received HDP.<sup>1</sup> This is in line with another study which observed decreased WOMAC pain and stiffness scores and improved knee ROM at 18 weeks after intervention in the HDP group compared to the control group.<sup>10</sup> After 5 times prolotherapys, the X-ray showed an improvement in the medial knee compartment space (**Figure 2**). This result gives hope if monthly dextrose prolotherapy continued for up to 1 year able to improve pain as well as a better XRay image of the knee compartment space.

This patient also had a complicating factor



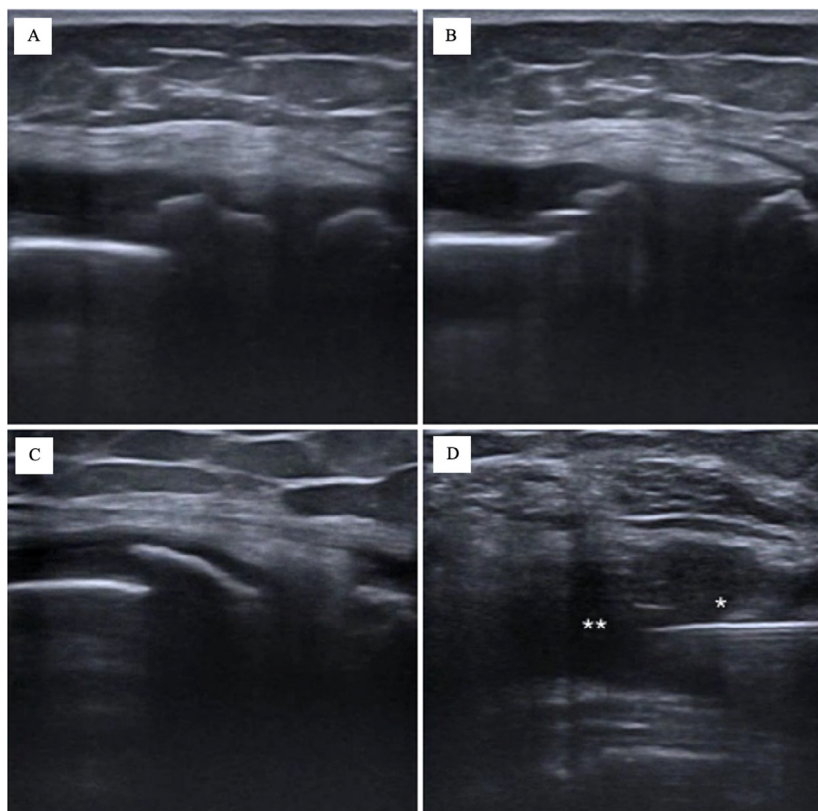
**Figure 2.** Xray of righth knee before (left) and after five months HDP (right). There was decreasing of sclerotic appearance after treatment.



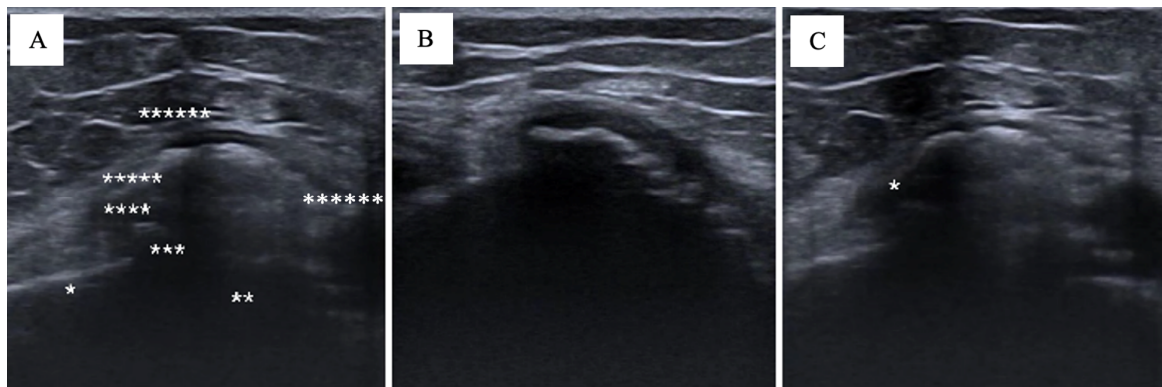
of grade II obesity. Body Mass Index (BMI) assessment is useful in suggesting to the relationship between obesity and KOA.<sup>17</sup> Obesity is one of the risk factors for causing KOA through an increase in excessive body weight, especially on the knees which are the body's main burden support. The condition of obesity associated with mechanical loads on the knee joint causes inflammation which makes the progression of KOA development and decreases the functional capacity of each patient.<sup>18</sup> A study that measured the thickness of the femoral cartilage in a sample of healthy people showed that there was no relationship between BMI and thinning of the thickness of the femoral cartilage. This phenomenon may occur because in patients with high BMI there is thickening of the femoral cartilage. The exact cause is unknown, but it is suspected due to edema that occurs to an inflammatory process in patients with high BMI.<sup>19</sup> A meta-analysis showed an increase in knee function due to a significant reduction in knee pain and joint stiffness to those who received a weight loss program, to

reduce the 50% subscale of the WOMAC score required a 25% weight loss.<sup>20</sup> Recent studies have concluded that KOA management required many aspects, including a combination of anti-inflammatories with a low-calorie diet which has a greater effect on weight loss and reduced pain intensity compared to the group who just received a low-calorie diet.<sup>21</sup>

Quality of life is also improved with pain reduction, stronger quadriceps muscles and better balance and walking endurance. The results of the Barthel index showed that after getting prolotherapy, she was able to use the toilet and upstairs without assistance. From the WOMAC score, she achieved better physical function in going up and down stairs, getting up from sitting, standing, walking, getting in or out of the car, toileting, showering, and doing light household tasks. In line with another study conclude that quality of life improvement among KOA patient correlate with decreasing of pain and improvement of global function to do the daily activity.<sup>21,22</sup>



**Figure 3.** (A and B) There were osteophytes in Femoral and Tibial Medial Condyle; (C) Medial Collateral Ligament with osteophytes in MFC; and (D) Dextrose Prolotherapy in suprapatellar recess: \*needle, \*\*injection substance.



**Figure 4.** (A) Bulging of Medial Meniscal and Protruded, \*Femur, \*\*Tibia, \*\*\*Protruded Meniscal, \*\*\*\*Capsule, \*\*\*\*\* MCL, \*\*\*\*\*Fat pad; (B) Coronary Ligament: Osteophyte (++); and (C) Injection in medial compartment of knee, ruptured tendon with out of plane approach \*injectate.

## CONCLUSION

Prolotherapy in KOA provides benefits for pain improvement and physical function with a regenerative process. Dextrose is one of the preferred substance to be considered for prolotherapy because it is easily conducted, the price is cheap and there are no complications in most studies. From this case, we can conclude that dextrose solution for prolotherapy is a good alternative interventional therapy because of its efficacy in the regeneration process of the knee compartment in KOA patients. Ultrasound device improves the accuracy of prolotherapy in order to target the exact site of injection according to conditions that can be found on ultrasound imaging. In addition, other therapies such as medication and physical exercise are needed to support prolotherapy with various post-prolotherapy considerations. Comprehensive management and regular prolotherapy for at least 6-12 months can reduce pain, and improve physical function and quality of life. Future studies regarding to prolotherapy as regenerative treatment in patients with KOA should be carried out that can refine and optimize injection protocols such as the location and the main frequency of prolotherapy which is preceded by previous genicular nerve block injections. Intervention and follow-up to one year would be ideal to assess the benefits of prolotherapy.

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