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A COMPARATIVE STUDY BETWEEN EFFICACIES OF USG GUIDED GENICULAR NERVE BLOCK (GNB) AND THE CONSERVATIVE TREATMENT IN ADVANCED OSTEOARTHRITIS (OA) OF KNEE

Physical Medicine and Rehabilitation

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ABSTRACT

Introduction: Osteoarthritis of knee joint being a degenerative joint disease involves articular cartilage, subchondral bone, synovial tissue and joint capsule resulting in stiffness, swelling and pain. Conservative treatment plays the major key role. If conservative treatment fails, Total Knee Replacement (TKR) is traditionally considered but may have multiple perioperative morbidities. In addition, many patients are not appropriate surgical candidates and others simply do not want to undergo surgery. Thus, interventions on articular nerve branches like genicular nerves in the form of Genicular Nerve Block and cooled Radiofrequency Ablation have emerged as the successful alternatives to surgery for effective management of chronic pain associated with osteoarthritis of the knee joint. Targeted major nerves are superolateral (SL), superomedial (SM) and inferomedial (IM) genicular nerves. Ideal candidates for genicular nerve block are those with grade 3 & 4 primary OA knee of 40-80 years age group who are poorly responding to initial conservative treatment and unwilling or contraindicated for surgical management with VAS score >5 for pain. **Material and methods:** In this Parallel Group Open Label Randomized Controlled Trial, conducted in the Department of Physical Medicine and Rehabilitation, IPGME&R, SSKM Hospital, Kolkata between July, 2017 to December, 2018 (Eighteen months) 64 (32 in each group) cases of Primary osteoarthritis of knee OA knee, Radiologic K/L (Kellgren-Lawrence Grading Scale) score grade 3 & 4, Age: 40 - 80 years, poorly responding to initial treatments, VAS>5 for pain. In group 1, USG guided Genicular Nerve Block (GNB) and the conservative treatment in advanced osteoarthritis of knee and therapeutic exercise. In group 2, managed conservatively with Therapeutic Exercise, Modality (ICE pack), Pain medications (NSAIDS, oral opioids) and Neuromuscular electrical stimulation. Comparison done to compare the efficacies of USG guided Genicular Nerve Block (GNB) and the conservative treatment in advanced osteoarthritis of knee. Parameters used: Visual Analogue Scale (VAS), Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC). The patients were residents of Kolkata and surrounding districts, attending the Physical Medicine and Rehabilitation OPD at IPGME&R and SSKM Hospital, Kolkata, were included and studied if they fulfilled the inclusion and exclusion criteria after getting Institutional Ethics Committee clearance and informed written consent. After initial visit, followed up on 4th week and 12th week. **Results:** All the data collected during this study period were analyzed by using statistical software Statistica vertsion 6 [Tulsa, Oklahoma: StatSoft Inc., 2001] and GraphPad Prism version 4 [San Diego, California: GraphPad Software Inc., 2005] . The patients had shown significant pain relief and improvement in knee functions throughout a follow-up period of 3 months in respect to Visual Analogue Scale (VAS), Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) Score. **Conclusion:** Genicular Nerve Block may be a good option in the management of advanced Osteoarthritis Knee particularly Patients who want to avoid surgery, Patients unfit for knee replacement, Patients with failed knee replacement.

KEYWORDS

Genicular Nerve Block (GNB), advanced osteoarthritis of knee

INTRODUCTION:

Knee Osteoarthritis (OA) being a degenerative joint disease, initially involves the articular cartilage. There is Loss of cartilage- which is Heterogeneous and Progressive. Later on, there is affection of periarticular structures like subchondral bone, synovial tissue, joint capsule, ligaments and muscles acting on the joint, Bone tissue production, - Subcortical sclerosis and formation of Osteophytes.

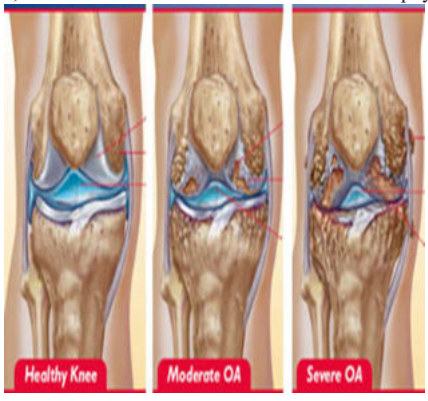


Figure: 1 showing different stages of osteoarthritis (OA) knee[1]

Osteoarthritis ranks as the 11th leading cause of years lived with disability & 3rd greatest contributor to loss of health-related quality of life. The prevalence increases with age. It is most frequent cause of pain and loss of function among older adults. The risk factors: ageing, obesity and mechanical stress.[2]

CLASSIFICATION:

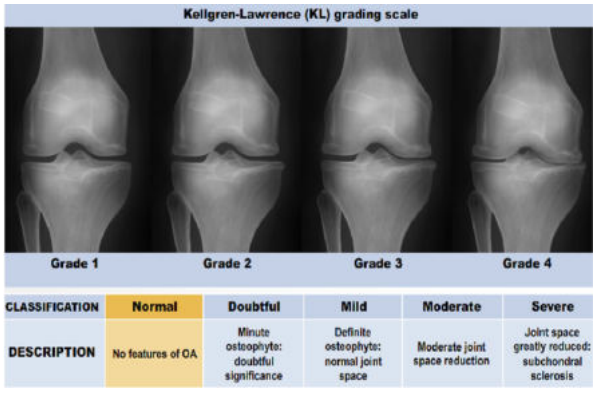


Figure: 2 showing radiological grading (KL Grading) of osteoarthritis (OA) knee[3]

Clinical features include Pain, Stiffness, Swelling, Crepitation, Joint instability, Reduced mobility, Muscle weakness, Bony deformity.

Treatment options are available:

1) Conservative: Physical and occupational therapy, weight loss, stretching exercises, acetaminophen, analgesics, oral and topical NSAIDs etc.
2) Local : a)Intra-articular steroid injections, b)Viscosupplementation, c) Prolotherapy, d) Stem cell therapy, e) Ozone therapy;

3) Surgery : a) Total Knee joint Replacement Surgery (Total Knee Arthroplasty), b) Partial Knee Replacement Surgery (Uni-compartmental Knee Arthroplasty).

Genicular Nerve Block is a successful alternative treatment options for refractory intractable knee pain due to advanced OA knee. Aims to provide pain relief by blocking afferent pain signaling of the major nerve fibers that innervate the knee joints.

COMPLICATIONS:

Complications are rare, but following may happens.

- Allergic reactions to local anaesthetics
- Post-procedural pain flare-up
- Neurological complications
- Infections

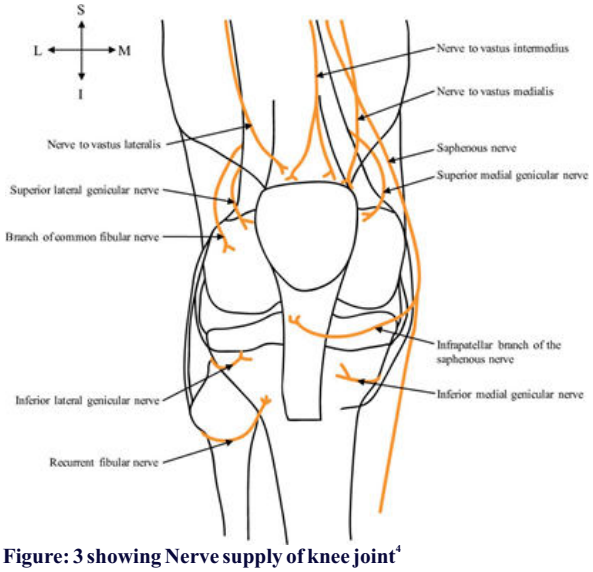
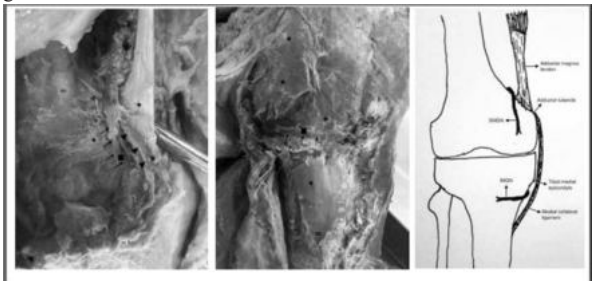


Figure: 3 showing Nerve supply of knee joint[4]

Nerve supply of knee joint: Genicular Nerves – a) Main innervating articular branches for the knee joint. b) Adjacent to periosteum, c) Can be targeted using bony landmarks under USG or fluoroscopy guidance.[4]



(a) SMGN (arrows) and the corresponding artery (arrowheads) shows a course curving around the femur shaft (infinity) and passing between the adductor magnus tendon (star) and the femoral medial epicondyle (cross), then descending anterior to the adductor tubercle. Target point (square) for SMGN is one cm anterior to the peak of the adductor tubercle (asterix). (b) IMGN (arrows) is situated horizontally around the lower parts of the tibial medial epicondyle (cross). IMGN passes beneath the medial collateral ligament (stars). Target point (square) for IMGN is at the midpoint between the peak of the tibial medial epicondyle (asterix) and the initial fibers inserting on the tibia (infinity) of the medial collateral ligament. (c) The diagram shows the course of the genicular nerves and related anatomic structures.
SMGN: superior medial genicular nerve, IMGN: inferior medial genicular nerve.

Figure: 4 showing Nerve supply of knee joint, nerve course and target point[5] **(Yasar E, et al. Accuracy of Ultrasound-Guided Genicular Nerve Block: A Cadaveric Study. Pain Physician. 2015;18(5):E899-904.)**

Indications of GNB: 1. Chronic knee pain secondary to OA, 2. Patients who want to avoid surgery, 3. Patients unfit for knee replacement, 4. Patients with failed knee replacement

Ultrasound imaging has several advantages 1) Inexpensive and easily repeatable, 2) Not expose the patient or the physician to ionizing radiation, 3) Can locate the genicular nerves by identifying nearby important anatomical landmarks.

Genicular nerve block has recently emerged as a novel alternative treatment in chronic knee pain. The needle placement for genicular nerve injection is made under fluoroscopic guidance with reference to bony landmarks. the accuracy of ultrasound-guided genicular nerve block also determined in a cadaveric model.[5]

Methodology:

•Study design : Parallel Group Open Label Randomised Controlled Trial

•Sample size : n=64; GROUP 1 (GNB) =32, GROUP 2 (CONS) =32

•Study duration: July, 2017 to December, 2018 (Eighteen months)

•Study place: Department of Physical Medicine & Rehabilitation, IPGMER & SSKMH, Kolkata.

Patients included:

- Adult patients capable of providing consent
- Primary OA knee
- Radiologic K/L (Kellgren-Lawrence Grading Scale) score: grade 3 & 4
- Age: 40 - 80 years
- Poorly responding to initial treatments
- Patients unwilling or contraindicated for surgical management
- VAS>5 for pain

Patients excluded:

- Patients unwilling to give consent
- Prior knee surgery
- Secondary osteoarthritis
- Sciatic/other neuropathic pain
- Coagulopathy
- IACS or viscosupplementation within last 3 months
- Uncontrolled systemic comorbidities

Objectives:

- To assess the effect of ultrasound guided GNB and Conservative management in chronic knee pain.
- To compare their effectiveness in terms of pain, stiffness and functional capacity.

Materials:

- Institutional Ethics committee clearance was taken.
- Written informed consents were taken.
- Computer generated randomization was done.

Parameters studied:

- Visual Analogue Scale (VAS)[2]
- Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC)[6]

For guidance: Samsung Medison PT60A Diagnostic Ultrasound system and Medison LN5-12 transducer.

For block: 1) Inj. Depot Methyl prednisolone (40mg/ml), 2) Inj. Lignocaine (2%), 3) Inj. Bupivacaine (0.25%).[7]

Baseline investigations were done.

Conservative management includes:

- Acetaminophen & analgesics
- Lifestyle modification
- Postural care
- Exercise therapy - ROM & strengthening exercises
- Electrotherapy
- Orthotic intervention

USG guidance is needed for identification of the targeted genicular nerves.

Procedure:

- GNB was performed in the operation theater with appropriate monitoring and proper aseptic precautions.
- The patient lies supine with knee extended on OT table.
- The ultrasound scanning was performed using a 5-12 MHz linear transducer in sagittal axis.

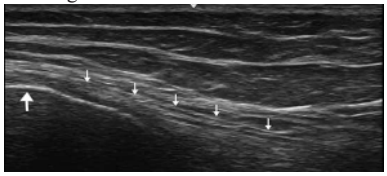


Figure: 5 showing knee joint with the transducer was placed in a sagittal orientation over the femoral medial epicondyle.[5]

The transducer was placed in a sagittal orientation over the femoral medial epicondyle. The transducer was then translated proximally to the level of the adductor tubercle and the insertion of the adductor magnus tendon (thin arrows) was imaged. The bony cortex one cm anterior to the peak of the adductor tubercle (thick arrow) was targeted for the injection to the SMGN.[5]

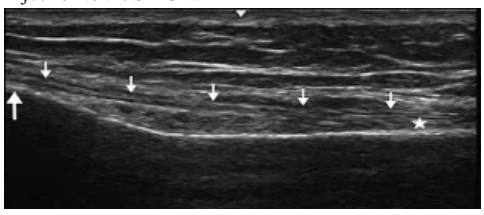


Figure: 6 showing knee joint with the transducer was placed in a sagittal orientation over the tibial medial epicondyle.[5]

The transducer was placed in a sagittal orientation over the tibial medial epicondyle. The medial collateral ligament (thin arrows) was visualized. The transducer was then translated distally to the level of the tibial insertion site of the medial collateral ligament below the tibial medial epicondyle. The point of the bony cortex at the midpoint between the peak of the tibial medial epicondyle (thick arrow) and the initial fibers inserting on the tibia of the medial collateral ligament (star) was targeted for the injection to the IMGN. Locating SM & IM genicular nerves.[5]

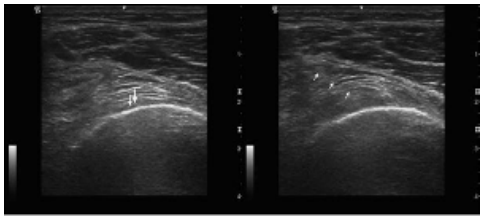


Figure: 7 showing knee joint with Transverse ultrasound image of the knee at the level of the femoral medial epicondyle.[8]

1. Transverse ultrasound image of the knee at the level of the femoral medial epicondyle. Superior medial genicular nerve (thick arrow) and the corresponding artery (thin arrow) were visualised.
2. The needle (arrows) was placed to the bony cortex 1 cm anterior to the peak of the adductor tubercle for the superior medial genicular nerve.[8]

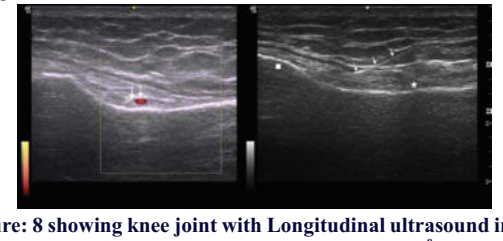


Figure: 8 showing knee joint with Longitudinal ultrasound image of the knee at the level of the tibial medial epicondyle.[8]

1. Longitudinal ultrasound image of the knee at the level of the tibial medial epicondyle. Inferior medial genicular nerve (thick arrow) and the corresponding artery (thin arrow) were visualized using power doppler.
2. The needle (arrows) was placed to the bony cortex at the midpoint between the peak of the tibial medial epicondyle (square) and the initial fibers inserting in the tibia of the medial collateral ligament (star) for inferior medial genicular nerve.

Figure: 9 showing the USG Guided procedure being done.

- After correct placement of the needle to the targeted genicular nerves (SL, SM & IM) each block was done with 2 ml solution from a mixture of Inj. Lignocaine 2% 3ml + Inj. 0.25% Bupivacaine 2ml + Depot methylprednisolone 40mg/ml 1 ml under real-time ultrasound guidance.
- Ideally a 22-gauge 38 mm spinal needle was advanced in parallel to the long axis of the transducer (in-plane approach) until the needle tip touched the bone.
- Needle tip was withdrawn few millimeters from the bone surface.
- One or two needle repositioning attempts were allowed during the procedure.

RESULTS AND ANALYSIS:

GR 1 (Genicular Nerve Block - GNB and **GR 2** (Conservative management group - CON.GR)

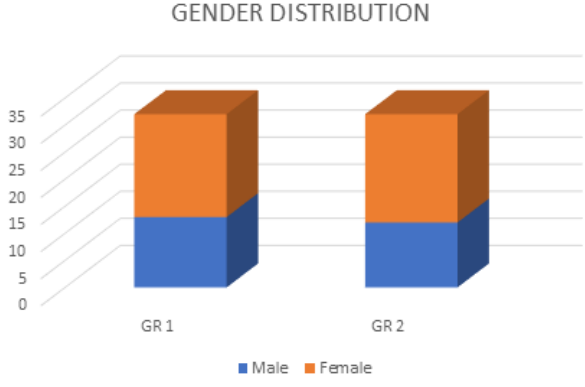


Figure: 10 showing Gender Distribution of study population in GROUP 1 and GROUP 2

64 (32 in each group with female predominance, In group 1 male: 13 and female: 19; In group 2 male: 12 and female: 20).

Table 1 showing Comparison of the numerical variables: between GR 1(genicular Nerve Block-GNB) and GR 2 (Conservative manage ment group-CON. GR)

	Mean GR 1(GNB)	Mean GR 2(CON.GR)	t-value	df	P value	Valid N GR 1	Valid N GR 2	Std. Dev. GR 1	Std. Dev. GR 2
AGE	55.5	54.2	0.76	62	0.45	32	32	6.88	7.58
VAS Baseline	7.3	7.2	0.27	62	0.79	32	32	0.97	0.92
VAS 4 WKS	2.1	3.7	-2.53	62	0.01	32	32	0.82	1.05
VAS 12 WKS	2.0	2.4	-1.59	62	0.10	32	32	0.72	0.84
WOMAC Baseline	46.6	47.1	-0.37	62	0.72	32	32	5.80	6.10
WOMAC 4 WKS	24.4	27.4	-2.28	62	0.03	32	32	4.80	5.80
WOMAC 12 WKS	14.1	14.6	-0.35	62	0.74	32	32	2.90	2.90

Change of VAS & WOMAC score with time:
Comparison of **VAS score** overtime in GR1 and GR 2:

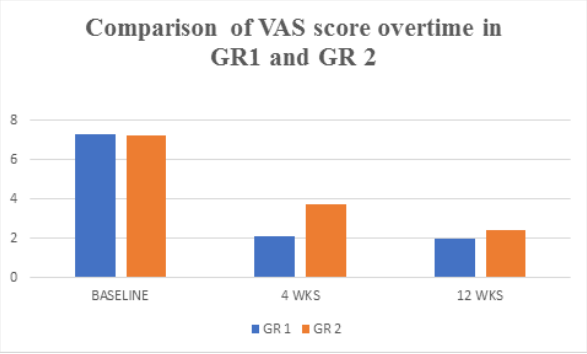


Figure: 11 showing Comparison of VAS score overtime in GROUP 1 and GROUP 2

Comparison of **WOMAC score** overtime in GR1 and GR 2

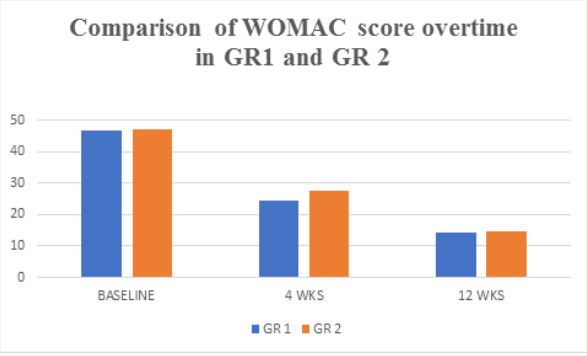


Figure: 12 showing Comparison of WOMAC score overtime in GROUP 1 and GROUP 2

DISCUSSIONS:

In this Parallel Group Open Label Randomized Controlled Trial, conducted in the Department of Physical Medicine and Rehabilitation, IPGME&R, SSKM Hospital, Kolkata between July, 2017 to December, 2018 (Eighteen months) 64 (32 in each group with female predominance, In group 1 male: 13 and female: 19; In group 2 male: 12 and female: 20) cases of Primary osteoarthritis of knee OA knee, Radiologic K/L (Kellgren-Lawrence Grading Scale) score grade 3 & 4, Age: 40 - 80 years, poorly responding to initial treatments, VAS>5 for pain. In group 1, USG guided Genicular Nerve Block (GNB) and the conservative treatment in advanced osteoarthritis of knee and therapeutic exercise. In group 2, managed conservatively with Therapeutic Exercise, Modality (ICE pack), Pain medications (NSAIDS, oral opioids) and Neuromuscular electrical stimulation. Mean age is 55.5 GR 1(genicular Nerve Block-GNB and 54.2 in GR 2 (Conservative management group-CON. GR). The patients had shown significant pain relief and improvement in knee functions throughout a follow-up period of 3 months in respect to Visual Analogue Scale (VAS), Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) score.

Serder K. et al also found significant improvement after genicular nerve block under USG guidance over 1 & 3 months. Their study have shown that genicular nerve block treatment is safe and beneficial in osteoarthritis related knee pain.[8]

In a double blind RCT done by Doo-Hwan Kim, et al. "Ultrasound-Guided Genicular Nerve Block for Knee Osteoarthritis: A Double-Blind, Randomized Controlled Trial of Local Anaesthetic Alone or in Combination with Corticosteroid" published in Pain Physician 2018; concluded that Ultrasound-guided GNB, when combined with a local anaesthetic and corticosteroid, can provide short-term pain relief. However, the clinical benefit of corticosteroid administration was not clear in comparison with local anaesthesia alone. Given the potential adverse effects, corticosteroids might not be appropriate as adjuvants during a GNB for chronic knee OA.[9]

In a Prospective Randomized study 'Prospective Randomized Comparison of the Efficacy of Ultrasound- vs Fluoroscopy-Guided Genicular Nerve Block for Chronic Knee Osteoarthritis', published *Pain Physician* in the year 2019 done by Doo-Hwan Kim et al. opined that Pain relief, functional improvement, and safety were similar between groups receiving ultrasound- and fluoroscopy-guided genicular nerve blocks. Therefore, either of the 2 imaging devices may be utilized during a genicular nerve block for chronic knee pain relief. However, considering radiation exposure, ultrasound guidance may be superior to fluoroscopic guidance.[10]

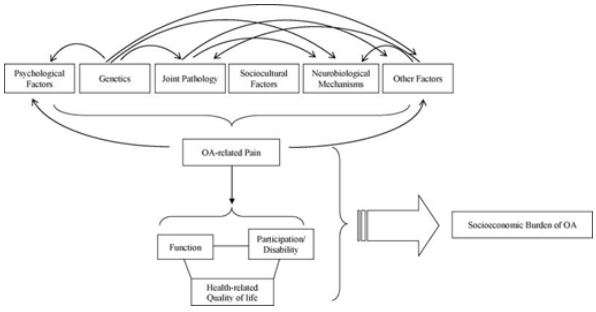


Figure 13 showing Schematic illustration of the multifactorial nature of pain in OA, with complex inter-relationships between various risk factors, and the potential wide-ranging effects of OA pain.[2]

As per literature, the effective treatment for OA and its related pain is not available to date, and the disease can be present for decades, the public health impact of OA is substantial on an individual and societal level (Figure 13).

With the high prevalence of knee OA globally,[11] not only is OA a leading cause of disability among older adults in the US,[12,13] but it is among the top 10 causes of disability worldwide.[11,14] In recent estimates of global years lived in disability, musculoskeletal-related conditions ranked second, with low back pain, neck pain, and knee OA being the three most common such conditions, and knee OA itself ranked within the top 10 noncommunicable diseases for global disability-adjusted life years (*i.e.,* years of life lost and years lived with disability).[14]

Considering the high prevalence of knee OA and as a cause of disability this procedure may be of great help as the patients had shown significant pain relief and improvement in knee functions with this on long time follow-up.

LIMITATIONS:

- Both the study parameters were subjective.
- No long term follow up was done.
- There was1 (one) patient shows Post-procedural pain flare-up subsided within few days.

CONCLUSIONS:

Genicular Nerve Block may be a good option in the management of advanced Osteoarthritis Knee particularly Patients who want to avoid surgery, Patients unfit for knee replacement, Patients with failed knee replacement.

REFERENCES:

1. https://images.app.goo.gl/KitwedBLXvCAUpak6
2. Tuhina Neogi, The Epidemiology and Impact of Pain in Osteoarthritis. –Osteoarthritis Cartilage. 2013 Sep; 21(9): 1145 1153. doi: 10.1016/j.joca.2013.03.018.PMCID: PMC3753584,NIHMSID: NIHMS479319,PMID: 23973124.
3. Antony, J., McGuinness, K., Connor, N.E., Moran, K.: Quantifying radiographic knee osteoarthritis severity using deep convolutional neural networks. In: Proceedings of the 23rd International Conference on Pattern Recognition. IEEE, (2016).
4. Bert Vanneste, Joanna Tomlinson, Matthias Desmet, Andrzej Krol. Feasibility of an ultrasound-guided approach to radiofrequency ablation of the superolateral, superomedial and inferomedial genicular nerves: a cadaveric study. *American Society of Regional Anesthesia & Pain Medicine* 2018. Published by BMJ. http://dx.doi.org/10.1136/rapm-2019-100381.
5. Evren Yasar, Serdar Kesikburun , Cenk Kılıç , Ümüt Güzelküçük , Fatih Yazar , Arif Kenan Tan . Accuracy of Ultrasound-Guided Genicular Nerve Block: A Cadaveric Study. *Pain Physician*. Sep-Oct 2015;18(5): E899-904.
6. Bellamy N, Buchanan WW, Goldsmith CH, Campbell J, Stitt LW. Validation study of WOMAC: a health status instrument for measuring clinically important patient relevant outcomes to antirheumatic drug therapy in patients with osteoarthritis of the hip or knee. *J Rheumatol*. 1988;15:1833–40. [PubMed] [Google Scholar]
7. An K, Elkassabany NM, Liu J. Dexamethasone as adjuvant to bupivacaine prolongs the duration of thermal antinociception and prevents bupivacaine-induced rebound hyperalgesia via regional mechanism in a mouse sciatic nerve block model. *PLoS One* 2015;10(4):e0123459.
8. Serdar Kesikburun, Evren Yaşar, Ayça Uran,, Emre Adigüzel, Bilge Yilmaz

Ultrasound-Guided Genicular Nerve Pulsed Radiofrequency Treatment For Painful Knee Osteoarthritis: A Preliminary Report. *Pain Physician* 2016; 19:E751-E759 ISSN 2150-1149.

9. Doo-Hwan Kim, , Seong-Soo Choi, Syn-Hae Yoon, So-Hee Lee, Dong-Kyun Seo, In-Gyu Lee, Woo-Jong Choi, Jin-Woo Shin, Ultrasound-Guided Genicular Nerve Block for Knee Osteoarthritis: A Double-Blind,Randomized Controlled Trial of Local Anesthetic Alone or in Combination with Corticosteroid**.** *Pain Physician* 2018; 21:41-51 ISSN 1533-3159.
10. Doo-Hwan Kim , Myung-Su Lee , Sookyung Lee , Syn-Hae Yoon , Jin-Woo Shin , Seong-Soo Choi. A Prospective Randomized Comparison of the Efficacy of Ultrasound- vs Fluoroscopy-Guided Genicular Nerve Block for Chronic Knee Osteoarthritis. *Pain Physician*.2019 Mar;22(2):139-146.
11. Vos T, Flaxman AD, Naghavi M, et al. Years lived with disability (YLDs) for 1160 sequelae of 289 diseases and injuries 1990–2010: a systematic analysis for the Global Burden of Disease Study 2010. *Lancet.* 2012;380:2163–96. [PMC free article] [PubMed] [Google Scholar]
12. Centers for Diseaes Control and Prevention. Prevalence of disabilities and associated health conditions among adults: United States, 1999. *MMWR Morb Mortal Wkly Rep.* 2001:120–5. [PubMed]
13. Guccione AA, Felson DT, Anderson JJ, et al. The effects of specific medical conditions on the functional limitations of elders in the Framingham Study. *Am J Public Health.* 1994;84:351–8. [PMC free article] [PubMed] [Google Scholar]
14. Murray CJ, Vos T, Lozano R, et al. Disability-adjusted life years (DALYs) for 291 diseases and injuries in 21 regions, 1990–2010: a systematic analysis for the Global Burden of Disease Study 2010. *Lancet.* 2012;380:2197–223. [PubMed] [Google Scholar]