Chronic pain in knee osteoarthritis

Emerging interventions and opioid stewardship

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Knee osteoarthritis affects over one million people in Australia and is a leading cause of chronic pain, disability and reduced quality of life. Management requires an individualised, multidisciplinary approach that prioritises nonpharmacological strategies and careful opioid stewardship. Despite limited benefits, opioids remain commonly used, often complicating surgical eligibility and long-term outcomes. Emerging interventions such as genicular nerve blocks and radiofrequency ablation offer promising options for targeted pain relief and reduced opioid reliance.

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Key points

- **About 1.2 million people in Australia have knee osteoarthritis, contributing to disability, reduced quality of life and economic burden.**
- **Osteoarthritis pain is primarily nociceptive, but 20 to 30% of patients experience neuropathic features and central sensitisation.**
- **Exercise, weight loss and activity modification are key nonpharmacological treatments and should be prioritised.**
- **Opioids provide minimal benefit for chronic knee pain and carry significant risks; long-term use is discouraged.**
- **An opioid conversion calculator supports safer dosing and shared decision-making during opioid adjustments.**
- **Genicular nerve blocks (GNB) and radiofrequency ablation (GNRFA) are effective pain relief options for patients unresponsive to conservative care or ineligible for surgery.**
- **GNB offers short-term relief and may serve as a bridge to rehabilitation, whereas GNRFA offers longer-lasting relief.**
- **Evidence on GNRFA's role in opioid weaning is mixed; some studies suggest it helps reduce opioid use after total knee replacement if used preoperatively.**

In 2025, about 1,200,000 people in Australia are living with knee osteoarthritis.[1] This is frequently accompanied by chronic knee pain, a multifactorial condition that results in pain, stiffness, functional limitation with significant disability, reduced quality of life and substantial economic costs for both the individual and society.

What type of pain occurs in knee osteoarthritis?

Knee osteoarthritis pain is primarily nociceptive, originating from joint loading, movement and inflammation of structures such as the synovium, subchondral bone and ligaments. This pain is typically mechanical, with heightened sensitivity due to peripheral sensitisation of nociceptors.

Although pain is initially nociceptive, about 20 to 30% of patients – especially those with advanced osteoarthritis or awaiting arthroplasty – develop a neuropathic pain component, with neuropathic and central sensitisation mechanisms emerging as the condition progresses.[2-4]

Neuropathic pain in osteoarthritis arises from structural nerve injury within the joint, often due to chronic inflammation and tissue remodelling, leading to symptoms such as burning, tingling or shooting pain. Persistent nociceptive input and nerve injury can also induce central sensitisation, characterised by widespread pain hypersensitivity, pain disproportionate to joint pathology and psychological distress.[4] Recognising neuropathic and central sensitisation features is important, as affected patients often report more severe pain and disability and may benefit from tailored, multimodal pain management strategies.[5-7] Table 1 summarises

PAIN MANAGEMENT TODAY 2025; 12(1): 74-78

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Table 1. Pain mechanisms in knee osteoarthritis[6]

Pain mechanism	Description	Clinical features
Nociceptive pain	Caused by activation of nociceptors in joint tissues (synovium, subchondral bone, ligaments) due to mechanical stress, inflammation or tissue injury. Inflammatory cytokines (e.g. IL-6, TNF-α) and structural changes (e.g. bone marrow lesions, synovitis) sensitise peripheral nerves	Activity-related, aching pain that worsens with joint loading and movement, and improves with rest
Neuropathic pain	Results from injury to or pathological remodelling of sensory nerve fibres within the joint, particularly in advanced osteoarthritis. Neuroimmune interactions and nerve sprouting in subchondral bone and synovium contribute to abnormal pain signalling	Burning, tingling, shooting or electric shock-like pain; often associated with sensory changes; occurs in 20 to 30% of patients with advanced osteoarthritis
Central sensitisation	Persistent nociceptive input and/or nerve injury leads to increased excitability of central nervous system pathways, resulting in pain amplification, reduced descending inhibition and widespread pain sensitivity	Widespread or disproportionate pain, hyperalgesia, allodynia, pain at rest or at night and psychological distress

Abbreviations: IL-6 = interleukin-6; TNF-α = tumour necrosis factor alpha.

the different pain mechanisms involved in knee osteoarthritis and their relevant clinical features.[6]

Grading osteoarthritis

Knee osteoarthritis is radiographically graded using the Kellgren-Lawrence system, which ranges from grade 0 (no radiographic features) to grade 4 (severe joint space narrowing and deformity). Clinical symptoms often progress alongside radiographic changes but can show considerable individual variability.[8]

Managing chronic knee pain

The mainstay of chronic pain treatment can be divided into three pillars: nonpharmacological, pharmacological and interventional management, and this should be regularly revisited.

A summary of the different osteoarthritis grades and their recommended management strategies is shown in Table 2. Management requires a comprehensive, individualised approach tailored to the patient's comorbidities, functional goals, motivation and psychological readiness for change.[8,9] More specialised pain management is often sought in higher-grade knee osteoarthritis when pain and disability persist despite conservative treatment, or when pain is complex and difficult to manage by the GP alone.

Nonpharmacological management

GPs should prioritise nonpharmacological approaches as the foundation of knee osteoarthritis management, in line with national and international guidelines.[8,10,11] Experts such as the Neuro Orthopaedic Institute research group have challenged traditional views of osteoarthritis as a simple 'wear and tear' disease, instead highlighting the complex interplay between joint health, the nervous system and patient beliefs.[12]

Lifestyle modification is recommended, with a focus on exercise and physiotherapy to strengthen the quadriceps and surrounding muscles of hips and knees. Weight loss is also encouraged, targeting a body mass index (BMI) of less than 30 kg/m^2. Health coaching may assist with promoting activity modification, encouraging patients to switch to low-impact activities such as hydrotherapy and cycling, and incorporating daily stretching and myofascial release techniques (e.g. foam rolling) to improve joint mobility. Supportive footwear, such as shock-absorbing insoles and orthotics, may improve knee alignment and reduce strain.[13]

Psychological therapies such as cognitive behavioural therapy and mindfulness-based interventions also play a role. These therapies not only reduce pain and improve function but also address psychological factors that can exacerbate chronic pain.[14,15] Some complementary therapies such as heat application, transcutaneous electrical nerve stimulation, acupuncture, massage and yoga serve as adjuncts to standard care.[16-20]

Pharmacological management

Pharmacological treatment follows a graded approach, starting with simple analgesics such as paracetamol and NSAIDs, and may include topical agents such as NSAIDs, local anaesthetic patches (lignocaine 5%) and capsaicin or menthol applications.[8,10]

The role of opioids in chronic knee pain

Current clinical guidelines and high-quality evidence discourage the use of opioids for chronic knee pain because of limited benefit and significant risks. The Strategies for Prescribing Analgesics Comparative Effectiveness randomised trial found that opioids were not superior to nonopioid medications in improving pain-related function or reducing pain intensity in patients with chronic back or knee osteoarthritis over 12 months.[11]

Systematic reviews confirm that opioids offer, at best, only modest short-term pain relief and do not meaningfully improve pain or function for most patients with osteoarthritis.[1,11,21]

The risk of long-term opioid use – such as dependence, coma, overdose and other adverse side effects – often outweighs potential benefits. Thus, opioids should be reserved in select cases where all other treatments have failed and should be used with ongoing monitoring.[11,22]

Table 2. Kellgren-Lawrence grading scale for osteoarthritis and corresponding guideline-recommended management strategies

Kellgren-Lawrence grade	Typical clinical symptoms	Functional impact	Guideline-recommended management strategy
0	No symptoms	Full function	• Provide education and encourage self-management • Recommend weight management (if overweight) • Encourage physical activity and exercise promotion
1	Usually asymptomatic; may have very mild discomfort after heavy use	No significant limitation	• Provide education and encourage self-management • Recommend weight management (if overweight) • Encourage exercise (e.g. land-based, aquatic, strength, aerobic) • Consider physiotherapy • Monitor symptoms
2	Mild pain after activity, mild stiffness, possible swelling	Mild limitations in strenuous activities	• Continue above measures • Consider topical NSAIDs for pain • Consider walking aids if needed • Consider referral to allied health (e.g. physiotherapy, occupational therapy) • Consider cognitive behavioural therapy for persistent pain • Consider complementary therapies (e.g. Tai Chi, yoga), if appropriate
3	Frequent pain with movement, moderate stiffness (especially after rest), more pronounced swelling and crepitus	Noticeable difficulty with activities of daily living, reduced walking distance, decreased mobility	• Continue above measures • Consider oral NSAIDs (lowest effective dose, shortest duration) • Refer for intra-articular corticosteroid injections for flares or persistent symptoms • Consider tramadol for refractory pain (short-term use) • Consider referral to specialist if symptoms are severe or not controlled
4	Severe pain (often at rest and at night), marked stiffness, swelling, deformity	Significant loss of function, may require walking aids, severe restriction in daily activities	• Continue above measures • Consider opioid analgesia only if other options are exhausted and for short-term use • Consider referral for joint replacement surgery (if significant pain and functional limitation persist despite optimal nonsurgical management) • Ensure preoperative optimisation and shared decision-making

A recent Australian study found that about 16% of people with knee or hip osteoarthritis awaiting joint replacement surgery were using prescribed opioids regularly (daily) before surgery.[23,24] Most patients discontinue opioids in the perioperative period after a total knee replacement (TKR), but a notable minority, especially those with prior opioid use, continue using them long term.

Tools such as the Faculty of Pain Medicine opioid calculator can assist in calculating oral Morphine Equivalent Daily Dose (oMEDD).[25,26] This tool simplifies the conversion of different opioids and formulations into a standard reference, oMEDD. Its traffic light warning system helps clinicians assess the risk of dose-related harm and avoid excessive dosing and the associated complications. It also facilitates conversations with patients about opioid safety, reinforcing the importance of opioid stewardship and dose minimisation.

In Australia, 4 to 10% of patients with TKR continue opioid use beyond the early postoperative period, with higher rates among those with preoperative use.[27] The 'exceptional circumstances' rule, as set by the TGA and reflected in national guidelines, limits opioid prescribing for chronic noncancer pain to less than three months.[28,29] It is recommended to stay below 60 mg/day oMEDD, as the risk of harm and tolerance increases significantly with higher doses.[29]

Interventional management

Patients may receive interventional therapies, most commonly corticosteroids, platelet-rich plasma or hyaluronic acid injections into the knee joint, which can provide temporary relief.[30] Unfortunately, the analgesic benefits may be short-lived.

Genicular nerve blocks (GNBs) have emerged as a promising management option for knee osteoarthritis, especially for patients

Table 3. Features of genicular nerve block and genicular nerve radiofrequency ablation

Feature	Genicular nerve block	Genicular nerve radiofrequency ablation
Purpose	Short-term pain relief	Longer-term pain relief
Mechanism and procedure	Performed under imaging guidance (fluoroscopy or ultrasound); involves injection of local anaesthetic and corticosteroid at specific genicular nerve sites to temporarily block pain signals	Performed under imaging guidance; radiofrequency needles are placed at genicular nerve sites and heat is applied to ablate the nerves and disrupt their ability to transmit pain signals
Duration	Relief typically lasts several days to months if corticosteroid is used	Relief can last six months to one year, until the nerve regenerates
Role in care	Used as a test to predict response to genicular nerve radiofrequency ablation; if pain relief is ≥50% after the block, the patient is considered a candidate for ablation	Used for patients with chronic knee pain (often from osteoarthritis) who have failed conservative treatments and/or are not surgical candidates

who have not responded to conservative treatments or intra-articular injections, and for those who are ineligible for TKR.[19]

The role of genicular nerve procedures

What are geniculate nerves?

The genicular nerves are a group of sensory nerves that innervate the knee joint. There are three genicular nerves: the supralateral genicular nerve arises from the femoral nerve, the supramedial genicular nerve originates from the obturator nerve, and the inferomedial genicular nerve stems from the tibial division of the sciatic nerve.[31,32] However, anatomical variation is common. These nerves can be blocked under image guidance (e.g. image intensifier or ultrasound), avoiding the need for intra-articular injection, which is less effective when there is extensive structural damage and joint space narrowing, as in grade 4 osteoarthritis.[33]

Genicular nerve blocks and geniculate nerve radiofrequency ablation

In GNB, local anaesthetic and corticosteroids are injected at the junction of the epiphysis and diaphysis of the femur and tibia. A positive block response, typically defined as pain relief of 50% or more within 24 hours, suggests the targeted nerves are a significant source of nociceptive input.[34] A successful block depends on careful patient selection, as patients with central sensitisation are less likely to have a positive response to peripheral nerve blockade.[32]

GNB provides temporary pain relief, typically lasting several days to months, which can serve as a bridge to other treatments or facilitate rehabilitation. Genicular nerve radiofrequency ablation (GNRFA) provides longer-lasting pain relief, typically lasting six to 12 months, or longer.[35,36] In GNRFA, radiofrequency needles are placed at the same sites as the block. Heat is applied to sensory nerves, thereby disrupting the transmission of nociceptive signals from the periphery to the central nervous system.

These procedures are ideal for patients with chronic knee osteoarthritis pain who have not found relief from conservative measures or short-term interventions, are not candidates for surgery or prefer to postpone surgery.[35,37] GNB and GNRFA are both outlined in Table 3. Although there is currently no specific Medicare Benefits Schedule item number for GNB, item number 39323 x 3 can be used for GNRFA.

Genicular nerve radiofrequency ablation and opioid weaning

GNRFA is effective in reducing chronic knee pain and can provide significant and durable pain relief for patients with knee osteoarthritis.[38] However, the evidence regarding its direct impact on opioid weaning, particularly in the perioperative period for TKR, remains mixed.

Several randomised controlled trials and prospective studies with fewer than 1000 patients indicate that preoperative GNRFA does not consistently reduce immediate postoperative opioid use or time to cessation after TKR compared with controls.[39,40] These studies suggest that while GNRFA is effective for pain management, its influence on short-term opioid consumption following surgery is limited.

In contrast, a large national database study found that preoperative GNRFA was associated with a 50% reduction in the risk of prolonged postoperative opioid use compared with TKR alone (odds ratio 0.478; 95% confidence interval 0.409–0.559; $p < 0.001$).[41] This suggests that, on a population level, GNRFA may help reduce the likelihood of extended opioid use after knee replacement surgery.

Overall, while GNRFA is a valuable tool for chronic pain control, its role in facilitating opioid weaning after TKR is not yet firmly established and may depend on patient selection and timing of the intervention.

Ultimately, successful opioid weaning requires not just pain control but also the addressing of psychological and behavioural factors, such as catastrophising, fear of movement, depression and self-efficacy.[42] GPs and multidisciplinary teams play a central role in supporting safe opioid reduction and delivering holistic care for knee osteoarthritis patients.

An individualised management approach

The case studies presented in Box 1 and Box 2 illustrate the need for individualised care in knee osteoarthritis pain. Factors such as pain mechanism (nociceptive *vs* neuropathic pain *vs* central sensitisation), comorbidities, contraindications that affect treatment safety and effectiveness, and each patient's functional and psychological goals need to be considered.

1. Case study 1. A man with chronic knee pain and opioid use awaiting knee replacement

Presentation

A 57-year-old man with grade 3 knee osteoarthritis and chronic pain is awaiting total knee replacement. He lives with a supportive partner but struggles with daily activities and sleep because of the pain, which has led to reduced work hours and weight gain (body mass index [BMI] now 29 kg/m^2). Medications include:

- oxycodone 10 mg twice daily (equal to 30 mg/day oral Morphine Equivalent Daily Dose [oMEDD])
- paracetamol/codeine 500/30 mg, eight tablets per day (equal to 31 mg/day oMEDD)
- meloxicam 15 mg in the morning
- amitriptyline 25 mg at night

The patient's total daily opioid use is 61 mg/day oMEDD. He is concerned about further opioid escalation and the possibility of becoming ineligible for surgery if his BMI exceeds 30 kg/m^2 or his oMEDD significantly exceeds 60 mg/day. He feels trapped by pain and limited mobility.

Management

Perioperative pain management should focus on:

- physical comorbidities: BMI close to the surgical threshold, sleep disturbance and reduced mobility
- opioid stewardship: high current oMEDD with associated risk of harm and a need for dose reduction
- functional goals: preparing for surgery and improving daily activity and independence
- psychological distress: the feeling of being 'trapped' by pain

This requires a tailored plan centred on weight loss, physical activity and minimisation of opioid use. Interventional pain procedures, such as genicular nerve block, may be helpful if conservative measures are unsuccessful.

2. Case study 2. A woman with persistent pain and functional limitations following total knee replacement

Presentation

A 61-year-old female teacher, nine months post-total knee replacement, is working reduced hours because of ongoing pain. She takes:

- tapentadol modified release 150 mg twice daily and immediate release 50 mg twice daily (equal to 120 mg/day oral Morphine Equivalent Daily Dose)
- pregabalin 300 mg twice daily
- amitriptyline 25 mg at night

The patient is overweight with a body mass index of 31 kg/m^2, deconditioned (a decline in physical and sometimes cognitive function resulting from inactivity) and unable to take NSAIDs because of a history of gastric ulcers. Despite a technical successful total knee replacement and encouragement from her surgeon and physiotherapist, she finds prescribed exercises difficult and is unable to participate in physical activities or attend the gym. She walks with a stick. Although supported by her partner and colleagues, she is concerned about her ability to continue working, her financial security and her capacity to travel in the future. She feels frustrated by persistent pain and limited mobility and believes she cannot cope without her current analgesia.

Management

Addressing persistent postsurgical pain should consider:

- opioid tolerance: significantly above recommended dose, psychological dependence on analgesia and an elevated risk of harm
- polypharmacy: high-dose pregabalin and amitriptyline can inhibit weight loss
- physical limitations: strategies to improve physical capacity and confidence
- weight management: combining regular physical activity with a protein-rich, calorie-adequate diet to counteract medication-related weight gain and enhance muscle reconditioning
- psychosocial concerns: including the impact on work, financial insecurity and ongoing frustration

The patient's management plan must take into account her inability to use NSAIDs, focus on nonpharmacological therapies and consider interventional techniques such as genicular nerve block or genicular nerve radiofrequency ablation as a 'circuit breaker' to reduce opioid reliance. Psychological and social support should also be integrated.

Procedures such as GNB and GNRFA can serve as 'circuit breakers', interrupting the chronic pain cycle, offering targeted pain relief, reducing medication dependence, improving overall function and supporting broader multimodal rehabilitation strategies within an individualised care plan.

Conclusion

Knee osteoarthritis affects over a million people in Australia and causes chronic pain that is often multifactorial, involving nociceptive, neuropathic and central sensitisation components. Individualised, multidisciplinary management is essential, with GPs playing a central role in guiding a multifaceted management approach.

Uncontrolled pain can lead to inappropriate escalation of opioids, which is no longer supported by current guidelines. GNB and GNRFA can avoid prolonged or escalating use of opioids in patients who have not responded to conservative treatments or who are not candidates for surgery. While these procedures may facilitate opioid reduction in some patients, optimal weaning requires a comprehensive approach that also addresses psychological factors and pain drivers. Tools such as the Faculty of Pain Medicine Opioid Conversion Calculator enhance clinical safety and shared decision-making. **PMT**

References

A list of references is included in the online version of this article (www.painmanagementtoday.com.au).

COMPETING INTERESTS: Dr Hollington has received consulting fees from The Queen Elizabeth Hospital and The International Spine Centre as a chronic pain specialist. She has received payment for her expert testimonies for ReturntoworkSA. She is on the Faculty of Pain Medicine Board, South Australian Regional Committee Board and has previously been on the board of the Pelvic Pain Foundation of Australia.

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