

THEME ISSUE

Osteoarthritis, Part 1

How to approach the diagnosis
of knee osteoarthritis

In-office management of
knee osteoarthritis

Opioids have no role in patients
awaiting total knee arthroplasty

Who should get a knee
replacement?





The College of Physicians and Surgeons of BC recently closed the College Library. See the editorial (page 104) and the letter (page 106) for more on the topic, including a proposed solution.

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Vision: The *BCM J* is an independent and inclusive forum to communicate ideas, inspiring excellent health care in British Columbia.

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Special maneuver to detect fluid effusions in the knee: milking test. Images from the article "How to approach the diagnosis of knee osteoarthritis" by Darabian and colleagues, which begins on page 113.

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The CPSBC closed our medical library

On 15 March 2024, the College of Physicians and Surgeons of BC (CPSBC) closed its Library, which came as a shock to many of us. Physicians across British Columbia have expressed their dismay at this decision, both privately and in the pages of the *BCMJ*.^{1,2}

There is minimal information about the closure on the CPSBC's website, so I reached out to understand the rationale. The response read: "Registrants were not consulted. This difficult decision was made by the College Board after careful consideration of data showing significant decrease in library use over the years. There are no further details on the public record."

During the Library's final days, I called Dr Karen MacDonell (PhD), the former director of library services for CPSBC, to say thank you. I was an avid user of the Library, often requesting literature searches to help inform research projects and manuscript writing. The team was always thorough and prompt. As Dr MacDonell put it: "The Library was entirely focused on serving physicians so physicians might serve their patients."

As we reminisced on the Library's varied functions, it occurred to me that perhaps registrants underused the Library's services or weren't aware of its history. If we had known the Library needed our support, could we have advocated for it better? As the saying goes, you don't know what you've got until it's gone.

The first medical library in BC was established in 1906 by the Vancouver Medical Association.³ Eventually, the demand for and breadth of its services expanded to a point where a central provincial administration was warranted. In 1960, after a vote by BC physicians, the Library was taken on by the CPSBC. Chronicling the Library's transition for a 1963 article in the

Canadian Medical Association Journal, Dick and colleagues wrote: "This proposal was met favourably on the basis that the [College] Council, under the Medical Act, had a duty to maintain the standard of medical practice throughout the province. What better way was available than through an active medical library service?"³

In 1963, each doctor in the province was assessed an annual fee of \$25—noted to be the approximate cost of one annual medical journal subscription—demonstrating excellent value for money.³ The fee would be equivalent to about \$250 today, reflecting that we paid significantly less for the Library's services in the present day than physicians did in 1963. In 2022–2023, 60 years later, the portion of the CPSBC's expenses accounting for library services (including salaries and benefits) was \$1 863 000, or \$126.54 per active registrant, based on 14 723 professionally active registrants.⁴ For context, that is 5% of the CPSBC's \$36.7 million in expenditures, the largest of which are accreditation programs (16%), complaints and practice investigations (16%), and legal services (14%).

In 1963 there were two librarians and two clerical staff; most recently, there were four librarians and four library technicians. Among the team's responsibilities was locating articles, books, documents, and electronic resources from the CPSBC's collection, local libraries, and around the world. The team curated and maintained collections of books, journals, audio recordings, question banks, point-of-care tools, pharmacopeia, drug interaction checkers, therapeutic monitoring guidance, instructional videos, and reading lists. Many of you probably read the monthly *Cites & Bytes* newsletter, which presented physicians with a selection of clinically relevant citations from emerging literature.

According to the CPSBC's committee reports, for each of the last 3 reported years, an average of 1710 physicians posed over 10 000 queries, Library staff provided almost 13 000 copies of articles, and about 46 500 articles were downloaded from the Library's website.^{5–7} On average, almost 1200 in-depth literature searches were done each year. One librarian recalled that the "queries were endlessly varied, just as are physicians' patients." Physicians also had self-serve access to top-ranked point-of-care tools such as BMJ Best Practice and DynaMed and a variety of other online clinical information sources.

When I asked the Library team what they were most proud of in their work, one member replied: "I am proud to rest in the conviction that every single request was taken with utmost seriousness and engagement. We felt the responsibility to provide the best evidence we could find in response to clinical (and medicolegal, administrative, educational, etc.) questions. We saw the vulnerability of the physician saying 'I don't know the best way to help my patient,' so we applied our specialized skills plus that crucial characteristic of every successful library technician and librarian: curiosity."

Sir William Osler was the first donor to the Vancouver Medical Association's medical library, stating: "There is no better index of the intellectual status of the profession in any town than the condition of its medical library."³ Is it possible that in 118 years, Dr Osler's vision has gone from essential to obsolete? Are medical library services truly no longer necessary? Since the summer of 2023, three major Canadian health libraries either closed or were diminished: the CMA library (CMA Joule) closed, the CPSBC's library closed, and the Canadian Agency for Drugs and Technologies in Health recently

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Fewer apologies, more focus on trying our best

We are taught to take responsibility for our actions, make amends when we make a mistake, and offer apologies when needed. A funny stereotype is that Canadians love starting a conversation with an apology: “Sorry, but can I . . . ?” This practice seems ingrained in our culture.

Reflecting on when I started practicing family medicine, I often found myself apologizing to patients for systemic issues beyond my control, sharing in their frustration over the limitations of our health care system. This was often about prolonged wait times or lack of readily accessible care. Initially unaware, I repeatedly apologized for things I had no control over, which increased my own frustration and led to feelings of helplessness and eventual burnout. Of course, if a patient requires urgent attention, I try my best to advocate for them. If my genuine effort is unable to make a difference, I used to get frustrated. Now, I tell myself that I am trying my best. When we genuinely try our best, I find patients

are often very appreciative, irrespective of whether it changes the outcome.

As a society, we emphasize endpoints and outcomes, but it is vital to acknowledge dedication and going the extra mile for patients. When I ask more seasoned physicians what they find to be the most rewarding part of family practice, many tell me it is the longitudinal nature of the relationships formed with patients over many years and the ability to help them navigate their health journey. It is our commitment to patient well-being that leaves a lasting impact. I’ve learned to shift my mindset away from apologies and toward focus on actions and doing more for patients instead.

With the implementation of the Longitudinal Family Physician Payment Model, our time is more valued. I hope this model provides even more motivation for us to do more for our patients. We still face many *other* issues: many physicians

continue to grapple with mountains of paperwork, administrative burdens, and escalating overhead costs, and wait lists for essential investigations, specialist consultations, and surgeries persistently remain long.

As a family physician, I recognize that I am one piece of a complex puzzle. At times, navigating this complex system feels overwhelming. By embracing the mindset that we’re all striving

to do our best, we may alleviate some of the burdens imposed on us by the system. We all need to be mindful about physician burnout, and it has been encouraging to see many initiatives addressing physician wellness in the last few years. Happier physicians foster a more sustainable health care system. Let’s stop apologizing so much and remember we are all trying our best. ■

—Yvonne Sin, MD

Happier physicians foster a more sustainable health care system.

LIBRARY

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laid off half of its research information services staff.⁸

The future of medical information seeking is uncertain. Do we as a collective value a variety of information sources or a small number of corporate information tools? Medical libraries help ensure equitable access to skilled information professionals and a healthy, varied, expansive literature base, specific to each physician’s unique clinical circumstances. In losing the CPSBC Library, I believe we’ve lost a valuable member of our health care team.

In this issue, Dr Ian A. Gillespie, former president of Doctors of BC, proposes in a letter to the editor that Doctors of BC take over the Library.¹ I am curious to hear from more of our readers about what a medical library, or lack thereof, means to you. ■

—Caitlin Dunne, MD, FRCSC

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Letters to the editor

We welcome original letters of less than 500 words; we may edit them for clarity and length. Letters may be emailed to journal@doctorsofbc.ca or submitted online at bcmj.org/submit-letter and must include your city or town of residence, telephone number, and email address. Please disclose any competing interests.

Closure of the College Library: A proposal

The College of Physicians and Surgeons of BC announced the closure of the College Library (as of 15 March 2024) in an email sent on 1 March. I have reflected on the loss of this service since writing to the registrar of the College to express my concerns on 4 March.

I propose that urgent consideration be given to Doctors of BC taking over the operation of the College Library. I recall

another valuable service kept running by Doctors of BC (then known as the BC Medical Association or BCMA). At that time, the Physician Health Program was in danger; the College decided it no longer wanted to share the operating costs of the program with the BCMA and withdrew from involvement. Thankfully, additional funding was obtained through negotiations between Doctors of BC and the provincial government, and this important program was maintained.

Please consider whether there might be a win-win solution here for the physicians of BC, and the patients we serve, to maintain continuity of the College Library.

The Library staff consists of four librarians and four library technicians. Since COVID-19, much of their work has been done virtually, so there would be little need in the way of space at the office at 1665 West Broadway in Vancouver. Proximity to the *BC Medical Journal* and Communications Department staff would be a bonus.

I am sure many of our members would like to see a continuation of the service and a valuable new membership benefit. The limited number of free pages of reference articles could be continued for Doctors of BC members, and a service charge introduced for others who access the Library.

Doctors of BC members have been invited to give input to the upcoming negotiations for the next Physician Master Agreement, and we could submit this proposal for consideration in the negotiations—something that the government might be asked to support and take some credit for.

There is an opportunity for Doctors of BC and the College to announce a process

for the College Library to continue while still enabling the College's strategic planning that led to this decision.

Dr Bill Clifford, a pioneer in developing digital technology for physicians, has joined me in supporting this request. He incorporated a link to the College Library in the MOIS EMR.

The reason I ask for urgent action is to preserve the valuable experience of the current Library employees. Thank you very much for your consideration of this proposal.

—**Ian A. Gillespie, MD, FRCPC, DIPABPN, DIPABLM**
Victoria

Re: Diagnosing and treating adult attention-deficit/hyperactivity disorder

Dr Baerg Hall and Ms Cynthia Bucket provided an excellent and very detailed overview of the diagnosis and treatment of adult attention-deficit/hyperactivity disorder (ADHD) in the November *BCMJ* [2023;65:334-339]. The article provides step-by-step guidance for family physicians to address what seems like an increasing demand. I have worked collaboratively with family physicians at student health services at the University of Victoria and Simon Fraser University. We often discuss the challenges faced with diagnostic accuracy, especially considering other clinical factors. There is also concern about overdiagnosis when there is no opportunity to access collateral information from childhood. Another concern is the time involved in completing a detailed assessment.

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To address some of these issues, I put together a guide for anyone who might be considering getting assessed for ADHD and those who have a diagnosis and need information about both medication and nonmedication treatment. The guide includes step-by-step instructions and a checklist for patients to do much of the work gathering information to discuss with their physician. I hope this will save time in the assessment process and ensure physicians have more complete information to inform the diagnostic process.

The guide is available on the Pathways BC website under Mental Health—Adult > Information Handouts, Videos & Websites.

I have provided a detailed outline of an organizational approach based on widely available personal productivity tools. The tools are especially important for university students but may be relevant for anyone with a need to manage their busy lives. Artificial intelligence will be a game changer for people with ADHD, but having a basic understanding of personal productivity will very likely ensure successful application of this new technology.

I understand there may be other projects underway looking at ADHD assessment and treatment. I believe my guide would be a helpful adjunct to consider including.

Please also send any suggestions or corrections to me at adhdguide@shaw.ca.

I would like to thank Dr Tracy Monk and staff at Pathways BC for their assistance with my project. Pathways BC continues to expand and provides an exceptional resource for physicians and patients.

—Michael Cooper, MD, FRCPC
Victoria

Slow medicine: Part of the solution to the primary care crisis

The primary care crisis stems from multiple causes. Some of them are being substantively addressed by the Longitudinal Family Physician Payment Model. Solutions to others (such as administrative burden and alternatives to family doctors having to be small business owners) are actively being sought and implemented. I'm interested in addressing some of the causes that aren't as widely acknowledged or discussed.

It is estimated that 30% of the tests, treatments, and procedures we order are unnecessary and 10% of them are harmful.¹ Current approaches designed to address this issue struggle to move the dial. The remedy will require a deeper look at the values and assumptions that drive what we do. Dr H. Gilbert Welch's book *Less Medicine, More Health: 7 Assumptions That Drive Too Much Medical Care* addresses some of them—more information is always better, action is better than inaction, and early diagnosis is always better.² Additional drivers of too much medicine include our society's fear of death, black-and-white ideas about health and disease, and discomfort with uncertainty. Additionally, the influence of private interests on guidelines and standards of care has not been adequately addressed.

In a crisis, we need to go back to the basics: What is good health care? What is the goal of the work we do? I've considered this for some time and have come to this conclusion: good health care enables people to live their best lives. Good health care shows up when you need it and does as much as is necessary to restore health

and balance to allow you to continue to live your life. Critically, it seeks to not do harm.

There are many movements in medicine that aim to keep that goal central by raising the questions and offering approaches to help us discern the better path. Some of them are realistic medicine, value-based health care, minimally disruptive medicine, less is more medicine, sustainable health care, and slow medicine. I like the framework slow medicine provides, because it gets to the fundamental assumptions. Its name immediately calls out one assumption to be questioned: Is fast always better?

Most of us working in the Canadian health care system have a visceral sense of our current system's tempo. Fast, always; needs to be faster still. We could call it fast medicine. Often the quickest (and, importantly, the most lucrative) response to a patient or a result in front of you is to do something: write a prescription, order a test, make a referral, or ask the patient to book another appointment. Those may or may not be the correct actions. All of them create more demand on the system and require more physician hours. Fast medicine contributes to polypharmacy, fragmented care, overdiagnosis, overmedicalization, and the resultant inappropriate care. Not only that, every interaction with the health care system has an environmental cost: the transportation required for patients to attend multiple visits, the energy and resources required to produce medications and provide laboratory and medical imaging services, not to mention the waste.³ Fast medicine decreases our joy in our work, and I believe it is a significant factor in the lack of family physicians willing to start or remain in a longitudinal practice.

Slow medicine originated in Italy (after the slow food movement) and is based on medicine that is measured, respectful, and equitable. Slow medicine acknowledges the powerful intervention of time and of healthy skepticism and vows to remember our potential to cause harm. The principles of slow medicine include using evidence-based medicine to discern between effective and ineffective care (demanding the benefit be

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more than marginal), without commercial interests at the table shaping those determinations; the concept of health as inclusive of the psychological, spiritual, social, and environmental realms alongside the biological; and health and well-being as complex and more than the sum of our bodily functions or the age we reach. The default shouldn't be testing and treating but rather deliberate, careful, and measured actions. Slow medicine upholds a stance of curiosity and humility, resists the falsity of certainty, and requires an openness to doubt.

Although there is no formal slow medicine movement in Canada (yet), I've been experimenting with implementing the approach in my own practice. I've scheduled more time with patients, as well as time to think about my patients and review their charts. I make more time to call the consultants involved for advice, which often leads to fewer referrals and more useful investigations. I also share my expertise as a family physician, which includes the

patient's broader medical context and the whole person-centred lens (their values and life context to the best of my understanding). As a generalist, I endeavor to add value to the conversation by bringing a respectful skepticism of possible interventions. I aim to order fewer unnecessary tests and have sought to be more deliberate in deciding whether a follow-up appointment will contribute to a patient's well-being. I listen more deeply to my patients, making space for their wisdom on how best to approach their health and acknowledging that my priorities are often not theirs. I've also spent more time finding and sharing information about the actual magnitude of benefit a medication or intervention might provide, and I find it is routinely less than both the patient and I believed (over-attribution of benefit). During this process, I am starting to see Western medicine more clearly—the good and the bad. I see the laudable achievements. We have many tools we can use to decrease suffering and improve our

patients' lives; I want to use those well. I also see that there is much we do that is unlikely to improve our patients' well-being or that harms them, the health care system, and the environment.

Let's not waste the opportunity our health care crisis is offering to look closely and critically at what we do and why we do it.

—Jill Norris, MD, CCFP
Victoria

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A time to be bold

It's no secret that the inability of patients to access appropriate care in a timely way is a source of constant stress in our health care system. Whether it's for mental health services, medical imaging, consultations, or surgical care, Canadians wait longer than many other jurisdictions. For a myriad of reasons, wait times for specialist care and access to acute care continue to increase, exacerbated further by the COVID-19 pandemic. These delays are not without consequence. Longer wait times significantly impact cancer outcomes, community outpatient care, and mental health. Delays in at-home specialist care lead to an increase in patients using emergency department services for non-emergency issues, creating further challenges in an already overburdened system.

A health care system with reasonable wait times needs appropriate resources, capacity, and processes that prioritize patient access. But Canada—and specifically BC—lags behind many jurisdictions in areas such as hospital beds and health human resources. Canada has 2.6 hospital beds for every 1000 people, which is behind almost every Organisation for Economic Co-operation and Development (OECD) nation. BC has even less—a mere 1.95 hospital beds per 1000 people. Canada also has significantly fewer physicians compared with other jurisdictions and is graduating fewer medical school students than almost all other OECD countries. These are significant and major shortfalls in overall infrastructure. While changes won't happen overnight, we need to address these issues through significant investments.

Doctors of BC continues to raise this concern. In the 2011 BC Medical Association policy statement *Improving Access to Acute Care Services*, we called on the provincial government to model acute care beds on the principle of getting patients care in a timely fashion. Yet this continues

In BC, we have an advantage given our collaborative health care relationships and our reputation for leading change.

to be an ongoing challenge, with hospitals often functioning at or over 100% capacity and emergency rooms housing admitted patients in hallways and alcoves for days.

How, then, could we increase patient access to specialist care? I have some ideas that are perhaps idealistic—but if you don't aim high, you'll never know what can be achieved. In BC, we have an advantage given our collaborative health care relationships and our reputation for leading change. What if British Columbia committed to reaching the OECD average of 4.3 hospital beds per 1000 people by 2035, doubling our current operating room capacity, tripling seniors' community resources, and greatly increasing training, recruitment, and retention efforts to double the number of doctors in BC? What a wonderful world that would be.

Yes, these are bold proposals, but we have partially walked down this road already. Government announcements of a new hospital and cancer centre in Surrey; a new tower for Surrey Memorial Hospital; and new BC Cancer sites in Kamloops, Nanaimo, and Burnaby are all steps in this direction. The more than 2500 new long-term care beds announced over the last few years will also help.

Addressing the ongoing issues of lengthy waits to access specialty care, surgical procedures, diagnostic tests, and emergency care requires collective effort from all health care stakeholders. It requires bold initiatives. And it requires us to be better, together, to build on the steps already taken and continue on the path of resolving our health care challenges. ■

—Ahmer A. Karimuddin, MD, FRCS
Doctors of BC President

Management of tick bites and tick-borne diseases in British Columbia

Ticks are known vectors for transmission of tick-borne diseases in British Columbia. Tick bites and concern about tick-borne diseases are common presenting complaints to primary care and urgent care settings, especially during warmer months.¹ This article aims to inform clinicians about the ticks most commonly encountered in BC and the diseases they may transmit to humans.

Ticks and tick-borne diseases in BC

The prevalence of ticks and tick-borne diseases varies by geography.² In BC, *Ixodes pacificus* and *Ixodes angustus* ticks are predominant in the southern coastal regions, while *Dermacentor andersoni* are more common in the Interior and Northern regions.¹ *Ixodes* ticks are capable of transmitting *Borrelia burgdorferi*, *Anaplasma phagocytophilum*, and *Babesia* spp., while *Dermacentor* ticks are associated with Rocky Mountain spotted fever, tularemia, and tick paralysis [Table].³

Management of tick bites

Ticks found on patients should be removed promptly using forceps. Although the vast majority of tick bites in BC do not result in illness, patients should be advised to look for early symptoms of tick-borne diseases, such as fever, rash, fatigue, and aches. A localized rash within the first 48 hours after a tick bite is more likely to be a local reaction to the bite rather than an infection. While antibiotic post-exposure prophylaxis for Lyme disease may be indicated following a tick bite in geographic regions with high

TABLE. Summary of tick-borne diseases known to exist in BC ticks. Incidence is based on illnesses reported to or infections detected at the BCCDC.

Disease and pathogen	Ticks known to carry the pathogen in BC	Annual human incidence with BC-only exposure
Lyme disease <i>Borrelia burgdorferi</i>	<i>Ixodes</i> spp.	1–14 cases
Anaplasmosis <i>Anaplasma phagocytophilum</i>	<i>Ixodes</i> spp.	No reported cases*
Babesiosis <i>Babesia</i> spp.	<i>Ixodes</i> spp.	No reported cases*
Tularemia <i>Francisella tularensis</i>	<i>Dermacentor</i> spp.	0–2 cases
Rocky Mountain spotted fever <i>Rickettsia rickettsii</i>	<i>Dermacentor</i> spp.	0–3 cases
Tick paralysis (toxin mediated)	<i>Dermacentor</i> spp.	Not reportable, but known to occur rarely
Tick-borne relapsing fever <i>Borrelia hermsii</i>	<i>Ornithodoros hermsi</i>	0–7 cases per year

* While there are no reported human cases in BC, there have been locally acquired cases of babesiosis and anaplasmosis in Washington State.³

prevalence of *B. burgdorferi*, it is not usually required for tick exposures originating in BC due to the low prevalence (typically < 1%) of *B. burgdorferi* in BC ticks.^{1,4,5} In comparison, highly endemic areas in central and eastern Canada have tick positivity rates greater than 20%.⁶ The main reason for this difference is that *Ixodes scapularis*, found in eastern North America, is a more efficient carrier of *B. burgdorferi* compared with *Ixodes pacificus*, which is the predominant vector in BC.⁷

Photos of ticks may also be submitted for free by providers or patients to eTick (www.etick.ca), a public platform for image-based identification of ticks. They will identify the tick species and inform users about pathogens the tick may carry. Clinicians can also send ticks to the BCCDC Public Health Laboratory for free identification and pathogen analysis.⁸

Management of tick-borne diseases

If symptoms develop following a tick bite, clinical features and laboratory test results can guide diagnostic assessment and empiric treatment. Lab confirmation should be sought to determine the suspected cause of illness. Information about laboratory tests available at the Public Health Laboratory can be found at www.elabhandbook.info. ■

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Osteoarthritis, Part 1



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Osteoarthritis is a prevalent and debilitating condition that significantly impacts quality of life for millions of individuals worldwide. The specific focus in this theme issue is on large joint osteoarthritis, with knee osteoarthritis serving as a prime example. Knee

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osteoarthritis represents a growing public health concern, particularly as populations age and obesity rates increase. Within this context, family physicians are at the forefront of managing patients with osteoarthritis, addressing their diverse needs through a spectrum of strategies that extend from offering reassurance to considering surgical interventions, despite there being very little emphasis on musculoskeletal care in medical schools.

As guest editors of this two-part theme issue, we are delighted to present a collection of articles dedicated to advancing physicians' understanding and management of knee osteoarthritis. These articles shed light on various aspects of the disease, including etiology, diagnosis, treatment options, and emerging therapeutic strategies.

Article 1: Darabian and colleagues emphasize the importance of early and accurate diagnosis of knee osteoarthritis by family physicians to effectively manage the condition. Family physicians can rely on a combination of patient history, physical examination, and standing knee X-rays, which serve as the gold standard for confirmation. By diagnosing knee osteoarthritis promptly, family physicians can minimize unnecessary interventions, imaging, and referrals, which leads to improved patient outcomes and reduced health care costs.

Article 2: Sidhu and colleagues explore various treatment modalities for managing knee osteoarthritis in an office setting. Noninvasive options such as bracing, topical NSAIDs, and intra-articular injections of corticosteroids have shown effectiveness in improving pain and physical function. With respect to mesenchymal stem cell injections, further research is needed to warrant their routine usage in the clinical setting; therefore, their use should be discouraged for now.

Article 3: Marcuzzi and colleagues provide an excellent summary of the use of opioids in osteoarthritis. As with most cases of chronic noncancer pain, opioids are not indicated and have not been shown to be of value in controlling pain, contrary to common belief. In addition, the outcomes of treatment are much worse in patients on opioids. The reader is cautioned to not prescribe opioids for the treatment of osteoarthritis, as other modalities are much more effective.

Article 4: Boettcher and Moran discuss surgical management of knee osteoarthritis. They point out that managing patient expectations is crucial for successful outcomes, given that factors such as age, sex, and arthritis type can influence satisfaction following total knee replacement. Younger patients should not be denied access to total knee replacement solely based on age, as studies have shown positive outcomes and high satisfaction rates, even in younger patients. The past thinking that knee replacements fail universally in younger patients should now be behind us. The choice between partial and total knee replacement should be based on specific indications and discussion about revision rates; options such as unicompartmental and patellofemoral joint replacements should be considered for suitable but highly selected patients.

In Part 2 of this theme issue, authors will address the disparity in access to osteoarthritis care for Indigenous Peoples in rural BC, the challenges of assessing surgical risk in combination with obesity in orthopaedic patients, radiological diagnosis and image-guided percutaneous treatments for knee osteoarthritis, and physiotherapy in the treatment of osteoarthritis. ■

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How to approach the diagnosis of knee osteoarthritis

Knee osteoarthritis is the leading cause of knee pain in adults. Family physicians can rely on a combination of patient history, physical examination, and standing knee X-rays to successfully diagnose it in the office.

ABSTRACT: Knee osteoarthritis, a prevalent chronic disease, results from the loss of articular cartilage within the knee joint and is the leading cause of knee pain in adults. Early detection, lifestyle modifications, and patient education can improve patients' quality of life, curb office visits for knee pain, and avert unnecessary imaging, interventions, and specialist referrals. In most patients, diagnosis can be established in the family practice setting based on a comprehensive pain history and physical examination. Standing X-rays of the knee joints are the gold standard for confirming the diagnosis. If imaging is required, radiography should be the first modality employed. If there is suspicion of an underlying infectious or inflammatory cause, further testing or referral to a specialist, such as an orthopaedic surgeon or rheumatologist, may be warranted. During the early stages of osteoarthritis, patients can be encouraged to

undertake low-impact exercises and adopt a balanced diet to facilitate weight loss. This can ease the load on affected joints, strengthen the muscles that support the joints, improve mobility, and reduce pain. Educating patients about their condition can improve their ability to cope with the disease, enhance their adherence to treatment plans, and ultimately result in better clinical outcomes. Patients who are more knowledgeable about their condition experience less anxiety and a greater sense of control, which leads to better health outcomes.

Knee osteoarthritis, the predominant cause of chronic knee pain, often leads patients to consult their family practitioner. This complex joint disease is characterized by cartilage loss, reactive bone formation, subchondral cystic changes, joint deformity, and disruption of surrounding soft tissues, and manifests primarily as activity-related pain and functional limitation. Establishing a diagnosis and offering guidance on the anticipated clinical trajectory can enhance patients' comprehension of their condition, curb office visits for knee pain, and avert unnecessary interventions such as indiscriminate physiotherapy and massage therapy in cases of unclear diagnosis. This article presents a systematic approach to recognizing and diagnosing knee osteoarthritis, thereby minimizing unwarranted testing.

Risk factors

Knee osteoarthritis affects approximately 40% of adults over the age of 60, and age

over 50 years is the most significant risk factor.¹ Other risk factors include female sex, obesity, and history of knee malalignment or injury.^{2,3} While the evidence concerning the influence of recreational activities on knee osteoarthritis risk is varied, it is improbable that such activities, provided they do not result in substantial joint injury, contribute to the onset of this condition.^{3,4}

Causes

Knee osteoarthritis can be both primary and secondary.⁵ As individuals age, the quantity of synovial fluid diminishes and the cartilage thins, leading to the onset of primary osteoarthritis. Patients with predisposing conditions may experience early or premature osteoarthritis due to secondary factors. Potential causes of secondary knee osteoarthritis include:

- Trauma, such as cruciate ligament injuries, intra-articular fractures, and extra-articular deformities.
- Crystalline arthritis (gout or calcium pyrophosphate deposition disease-related arthritis).
- Avascular necrosis.
- Metabolic diseases (e.g., ochronosis).
- Intra-articular infection.
- Inflammatory arthritis (e.g., rheumatoid arthritis, psoriatic arthritis).
- Iron overload (hemochromatosis).
- Hemophilia (recurrent hemarthrosis).
- Neoplasms, such as intra-articular tenosynovial giant cell tumors.

The bony remodeling associated with osteoarthritis leads to increased friction and

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pressure points within the knee joint, which precipitates pain and ultimately reduces mobility and flexibility. The multifaceted nature of this pain results from the loss of normal subchondral bone protection provided by articular cartilage and the exposure of the densely nerve-supplied subchondral bone, and from synovitis and inflammatory responses. However, the exact mechanisms have not been fully elucidated. There is no consistent correlation among knee osteoarthritis patients in terms of the degree of fluid and cartilage loss, bony changes, and pain.⁵ Consequently, a patient’s level of pain does not always align with the severity of radiological changes, and radiological changes may not consistently correspond to actual pathological alterations.

Diagnosis

In most patients, the diagnosis of knee osteoarthritis is established using a combination of history and focused examination. Standing X-rays of the knee joints are the gold standard for confirming the diagnosis.³ A comprehensive pain history, including the onset, location (i.e., left, right, or bilateral knee pain that is anterior, medial, or lateral), and quality of the pain, should be elicited.⁵⁻⁷ Clinicians should pay close attention to the onset and severity of pain symptoms, the presence of any exacerbating or relieving factors, and the patient’s current level of functional activity. Additionally, it is essential to ask about any history of knee injuries or surgeries, preceding trauma, or instances of warmth or swelling in other peripheral joints.

Characteristic symptoms

Knee osteoarthritis pain is generally characterized as dull, either localized to a specific compartment or widespread, exacerbated by weight-bearing and joint movement, and eased with rest. Patients with patellofemoral osteoarthritis usually report a gradual onset of anterior knee pain, especially during activities that strain the knee in flexion, such as stair climbing, squatting, or rising from a seated position. Subjective stiffness often subsides in less than 30

minutes. Pain associated with knee osteoarthritis typically improves with rest, analgesics, and anti-inflammatory medication. Patients may also note a sensation of fullness or swelling at the back of the knee and a loss of extension, potentially indicating a related popliteal (Baker) cyst. It is critical to clarify that a Baker cyst does not cause pain, and its removal will not alleviate symptoms, a common misunderstanding among patients.⁸

Pain from osteoarthritis typically escalates in severity gradually over months to years, but patients can present at any stage of their disease. In the early or mild phases, pain is sporadic and predictable and has minimal impact on daily activities. Those with moderate osteoarthritis may endure unpredictable pain, possibly linked with knee locking or buckling, which could disrupt daily activities such as walking, bending, squatting, and stair climbing. In severe or advanced osteoarthritis, a constant dull pain is the norm, with occasional episodes of high-intensity pain limiting activities. Over time, patients may experience diminished functionality, including restricted joint movement, reduced ability to walk, and associated muscle weakness. In the long term, knee osteoarthritis can result in fatigue, sleep disturbances, and even depression.⁸ **Table 1** summarizes symptoms of early, moderate, and advanced knee osteoarthritis.

Physical examination

A physical examination should begin with an observation of lower limb alignment and gait.⁹ An antalgic, or pain-induced, gait is characterized by a shorter stance phase and possibly reduced stride length on the affected side. When the patient is standing, examine both knees for deformities such as genu varum (bowleg deformity) or genu valgum (knock-knee deformity), which are indicative of more advanced osteoarthritis. Additionally, look for swelling in the popliteal region, which may suggest the presence of a Baker cyst.

With the patient lying supine on the examination table, conduct a thorough examination of the knee. The skin should be fully exposed to assess for any changes, including scars, erythema, ecchymosis, previous surgical marks, or skin conditions such as psoriasis. Examine the medial and lateral parapatellar fossae for swelling; although these areas may be obscured by adipose tissue, effusions, or bony remodeling, comparing them visually to the opposite knee may be informative. Examination for quadriceps muscle atrophy, which may signal chronic or more advanced pathology, should also be considered.

Divide palpation of joint lines and soft tissue structures into assessments of medial, midline, and lateral structures. With the knee flexed at 90 degrees, palpate the

TABLE 1. Symptoms of early, moderate, and advanced knee osteoarthritis.⁸

Stage of knee osteoarthritis	Symptoms	Radiography results
Early	<ul style="list-style-type: none"> • Sporadic but predictable pain • Minimal impact on daily activities 	<ul style="list-style-type: none"> • Normal joint space • Osteophyte formation
Moderate	<ul style="list-style-type: none"> • Unpredictable pain • Locking or buckling of the knees • Affects daily activities, such as walking, bending, squatting, and climbing stairs 	<ul style="list-style-type: none"> • Moderate reduction in joint space • Multiple osteophytes
Advanced	<ul style="list-style-type: none"> • Constant but mostly dull pain • Occasional episodes of high-intensity pain • Limited joint motion • Reduced ability to ambulate • Muscle weakness • Fatigue • Sleep impairment • Depression 	<ul style="list-style-type: none"> • Considerable reduction in joint space • Subchondral sclerosis • Large osteophytes • Bone end deformity



FIGURE 1. Special maneuver to detect fluid effusions in the knee: milking test. Apply pressure and sweep your hand up the medial side of the knee. This pushes the fluid laterally. Immediately sweep your hand down the lateral knee. This pushes the fluid back. Look for a bulge sign in the medial fossa.

medial and lateral joint lines for tenderness or osteophytes (bony prominences). Patellar crepitus can be identified by holding the patella and passively flexing and extending the knee. The movement of the patella can be examined by pressing it medially and laterally; limited or painful movement could suggest patellofemoral osteoarthritis. Alternatively, patellofemoral disease may be detected by pressing the patella against the femoral condyles while the leg is extended and looking for signs of pain or discomfort.

Evaluate knee joint function by assessing range of motion and strength. Active knee flexion can be measured by asking the patient to bring their heel toward their buttock. The typical range of knee flexion for individuals with normally sized extremities is approximately 150 degrees, but flexion over 130 degrees would generally be considered normal for most individuals. If active range of motion is restricted, evaluate passive range of motion as well. Measure knee flexion strength through isometric strength testing with the patient lying supine. Stabilize the knee at a 90-degree angle with one hand, extend the leg with the other, and ask the patient to resist the movement. Have the patient straighten the leg, and evaluate extension by checking for a 180-degree angle. Any degree of flexion contracture is abnormal. Test the strength of knee extension by pushing against the patient's leg and asking them to resist. Last, examination of the ipsilateral hip and lumbar spine is essential to check for pain that could be referred to the knee from the lower back or hip.



FIGURE 2. Special maneuver to detect fluid effusions in the knee: ballottement test. Apply pressure with the thumb and index finger of one hand, and squeeze and press down the suprapatellar recess with the other hand.

Special maneuvers

If there is suspicion of fluid effusions in the knees, further evaluation can be carried out using methods such as the fluid wave (for small effusions), ballottement (for moderate effusions), and patellar tap (for large effusions).⁹ Perform the milking test for fluid wave or bulge sign in small effusions by applying firm pressure on the medial knee and sweeping your hand proximally along the medial side of the knee to push fluid into the lateral suprapatellar recess [Figure 1]. Then swiftly sweep your hand along the lateral knee and observe the medial fossa to detect whether a bulge forms.

For moderate to large effusions, perform the ballottement test by cupping the thumb and fingers of one hand on either side of the patella and placing your other hand on the suprapatellar recess [Figure 2]. Apply firm pressure down above the patella; in



FIGURE 3. Special maneuver to detect fluid effusions in the knee: patellar tap. Apply pressure with one hand on the suprapatellar recess to push the fluid under the patella. With the index finger of the other hand, push the patella toward the femur.

cases of moderate effusions, fluid will form under your fingers and push them outward.

For large effusions, perform the patellar tap by placing one hand over the suprapatellar recess and applying pressure to displace fluid under the patella [Figure 3]. Then use a finger from the other hand to press the patella downward toward the femur. The patella should tap the femur and bounce back up to hit the finger.

Red flags warranting additional testing or referral

If there is any suspicion of an underlying infectious or inflammatory cause, further testing or referral to a specialist may be warranted. A warm or swollen knee could suggest inflammatory or septic arthritis, which necessitates further evaluation via arthrocentesis. Synovial fluid should typically be analyzed for cell count, differential, culture

with Gram stain, and crystal examination. If infection is strongly suspected—such as in patients with fever, immunosuppression, or a history of intravenous drug use—additional tests, including complete blood count, C-reactive protein, and blood culture, are recommended. If there are concerns about inflammatory arthritis, a referral to a rheumatologist or orthopaedic surgeon may be advisable.

It is recommended to refer the patient to a rheumatologist if there are:⁶

- Risks of inflammatory arthritis.
- Small and large joint polyarthritis symptoms.
- Systemic symptoms such as weight loss or fatigue.
- Nonarticular symptoms, including rash, inflammatory bowel disease, or psoriasis.

Referral to an orthopaedic surgeon is recommended for patients with:

- Reduced effectiveness of pain management.
- Significantly reduced joint mobility that impacts daily activities.
- Failure of pain medication and treatment programs.

Imaging

Contemporary clinical practice guidelines suggest that knee osteoarthritis can be diagnosed without MRI in individuals over 45 years of age who present with activity-related joint pain, morning stiffness lasting less than 30 minutes, crepitus on active motion, and bony enlargement, provided there is no discernible warmth in the joint.¹⁰ Deformity, instability, periarticular or joint-line tenderness, and pain with patellofemoral compression are additional characteristics that could exist.³ Atypical characteristics such as a history of trauma, extended morning stiffness in the joint, rapid symptom progression, or the presence of a warm, swollen joint may indicate alternative or concurrent diagnoses. Consideration should be given to important differential diagnoses such as gout, other inflammatory arthritides (such as rheumatoid arthritis), septic arthritis, and malignancies

causing bone pain. If a palpable effusion is detected, aspiration and analysis of the synovial fluid can aid in excluding septic arthritis, identifying the presence of urate or calcium pyrophosphate crystals, and ruling out other inflammatory arthritides.

Once knee osteoarthritis is suspected, its diagnosis should be confirmed using standing plain X-ray.¹¹ If imaging is required, radiography should be the first modality employed.

Conventional radiographs can expose characteristics of osteoarthritis in the affected joints, including joint space narrowing due to cartilage loss. In more advanced stages of knee osteoarthritis, radiographic findings may reveal subchondral cysts, sclerosis, bone spurs, and misaligned joint surfaces, either as a cause or result of osteoarthritis. Subchondral sclerosis and osteophytosis are typically the earliest radiographic osteoarthritis features, which increase in both extent and size as osteoarthritis progresses. These precede the radiographic joint space narrowing that typically occurs at a later stage of the disease.¹²⁻¹⁴

The following are the standard X-ray examinations performed to evaluate knee osteoarthritis:

- Standing anteroposterior view of both knees. It is important that this is done with the patient standing, bearing weight on the joint. It is also important to include both knees for comparison in cases of mild osteoarthritis.
- Lateral view.

- Skyline view of both patellofemoral joints. This is a top-angled view, looking down at the knee caps.

Table 2 summarizes when a certain imaging modality may be useful.¹⁵

In osteoarthritis, there is no indication for any further imaging. In particular, an MRI scan for patients over the age of 40 is rarely indicated and does not add value for the diagnosis or treatment of osteoarthritis. If proceeding beyond radiography, soft tissues are best imaged using ultrasonography or MRI, and bones are best imaged using CT scan or MRI. The main detectable features of different imaging modalities used in osteoarthritis are summarized in Table 3.

Patient expectations

Educating patients about their diagnosis and the anticipated clinical progression of osteoarthritis has been linked to a better understanding of the origins of their chronic knee pain.¹⁶ Especially during the early stages of osteoarthritis, comprehensive education aims to encourage patients to make lifestyle modifications such as incorporating low-impact exercises into their routine and adopting a balanced diet to facilitate weight loss. These lifestyle changes can significantly improve patients’ quality of life by easing the load on the affected joints, improving mobility, and reducing pain. Exercise in particular strengthens the muscles that support the joints, thereby stabilizing them and improving overall function.

Furthermore, education extends beyond

TABLE 2. Suggested uses of imaging modalities in the diagnosis of knee osteoarthritis.

Imaging technique	Usage
X-ray	Patients with chronic knee pain.
CT scan	Patients with chronic knee pain if X-ray is negative or if it detects joint effusion, osteochondritis dissecans, loose bodies, signs of cartilage or meniscal repair, degenerative changes, chondrocalcinosis, or evidence of prior osseous injury.
MRI	Patients with chronic knee pain if X-ray is negative or if it detects joint effusion, osteochondritis dissecans, loose bodies, signs of cartilage or meniscal repair, or evidence of prior osseous injury. Patients with chronic knee pain if X-ray detects degenerative changes or chondrocalcinosis.
Ultrasonography	Patients with chronic knee pain if X-ray is negative or if it detects joint effusion.

TABLE 3. Pathologic features of knee osteoarthritis that are detectable by various imaging techniques.¹¹

Imaging technique	Detectable pathologic features
X-ray	<ul style="list-style-type: none"> • Osteophytes • Subchondral sclerosis, erosions, and cysts • Joint space narrowing • Bone remodeling and attrition • Subchondral trabecular bone analysis • Joint morphology
CT scan	<ul style="list-style-type: none"> • Cortical bone • Articular surface of a joint
MRI	<ul style="list-style-type: none"> • Cartilage abnormalities • Synovitis and joint effusion • Fibrocartilage and ligament abnormalities • Subchondral bone marrow lesions and cysts • Bone attrition • Osteophytes • Bone erosion • Three-dimensional bone shape • Muscle
Ultrasonography	<ul style="list-style-type: none"> • Synovitis • Cartilage • Osteophytes • Menisci • Quantification of ultrasonography imaging pathologic changes

the realm of lifestyle modifications to include information about osteoarthritis as a disease, including causes, effects, progression, and available treatment options. Providing patients with this knowledge empowers them to make informed decisions about their health and actively participate in their own care. This sense of agency can improve their ability to cope with the disease, enhance adherence to treatment plans, and ultimately result in better clinical outcomes. Studies have shown that patients who are more knowledgeable about their condition experience less anxiety and a greater sense of control, which leads to better health outcomes.^{17,18}

Summary

Knee osteoarthritis is the most prevalent form of arthritis that affects the knee. In most instances, a detailed patient history and comprehensive physical examination conducted in the family practice setting are sufficient to make a preliminary diagnosis. The diagnosis is most reliably confirmed through characteristic findings on standing knee X-rays, which continue to be the gold

standard. Therefore, more advanced imaging techniques should not be routinely requested in patients who present with chronic knee pain, unless the clinical presentation suggests alternative or additional diagnoses that warrant further investigation. Family physicians should focus on early detection, patient education, and lifestyle modifications to manage symptoms and improve patients' quality of life. ■

Competing interests

None declared.

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In-office management of knee osteoarthritis

Treating knee osteoarthritis in the clinic using unloader braces, topical applications of NSAIDs, and intra-articular corticosteroid injections can help improve function and pain management.

ABSTRACT: Nonsurgical management of knee osteoarthritis should be used in less severe disease cases or while patients await total knee arthroplasty. Bracing appears to improve function, pain management, and quality of life, but further high-quality research is needed. We recommend using unloader braces specifically in unicompartmental osteoarthritis; however, patient compliance is imperative to achieve the benefits. The safety, efficacy, and benefits of topical applications of NSAIDs are well outlined in the literature, and their use should be considered in knee osteoarthritis. Further study is needed to assess the efficacy of topical applications of capsaicin and herbal remedies, such as *Hedera helix*, and clinical trials on the use of cannabis to manage osteoarthritis pain have yet to be reported in the literature. There is

substantial evidence that corticosteroid injections are beneficial for short-term pain relief in knee osteoarthritis. Viscosupplementation may have a role in the office setting, but it is not currently recommended for routine usage due to a lack of data showing clinically relevant differences associated with its use. Currently, there is not enough evidence to support the routine use of mesenchymal stem cell injections for osteoarthritis management, and the cost is significantly higher than that of alternative therapies.

Knee osteoarthritis is a degenerative condition that results from progressive loss of articular cartilage, usually in the setting of chronic wear and tear or many years after trauma that has caused articular irregularity. Currently, 3.9 million Canadians over the age of 20 years have been diagnosed with osteoarthritis.¹ The economic burden of arthritis in Canada has been estimated to be more than \$6.4 billion.² Patients typically experience knee pain that is often gradual, increases with activity, and leads to swelling and pain that gets worse over time.³ The definitive surgical management for this condition when pain and disability are recalcitrant to other forms of treatment is a total knee replacement. However, before surgery is considered, many different treatment modalities, ranging in invasiveness from knee braces and topical treatments to intra-articular injections, can be used in the office setting to treat knee osteoarthritis.

Unloader braces

In the setting of unicompartmental knee osteoarthritis, there is often a coronal malalignment that leads to an increased mechanical load on the medial or lateral compartments. Knee bracing via unloader braces is a conservative option that offers mechanical unloading in the coronal plane to counteract the plane of the deformity driving the pathology.⁴ For example, symptoms due to isolated medial compartment osteoarthritis in the setting of a varus lower limb malalignment will often be improved with a valgus-producing force that can be applied using an unloader brace. Bracing is a safe and noninvasive option, but it requires patient adherence over a long period to be efficacious. The literature indicates that brace treatment can be used to improve function, quality of life, and pain; however, there is heterogeneity in studies and a lack of high-quality studies.

In a multicentre RCT that involved 117 patients, the effects of unloader braces in unicompartmental osteoarthritis were analyzed; pain severity and knee function scores were improved with bracing.⁵ Additionally, the bracing group had an increased walking distance at 3 and 12 months ($P = .03$ and $P = .04$, respectively).⁵ It was concluded that bracing was effective.

The effects of unloading braces were also examined in an RCT conducted with 67 patients who presented with medial knee osteoarthritis.⁶ The offloading brace was worn for 6 weeks; the brace group

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had a statistically significant reduction in 24-hour pain ($P < .0001$) and better functional outcomes based on the Lequesne index score ($P < .0001$).⁶ It was concluded that unloading knee braces were effective in improving motion and global pain in the setting of medial knee osteoarthritis.⁶ The benefits of unloader braces were also confirmed by an RCT that involved 119 patients. It showed that unloader bracing led to improvements in quality of life ($P = .001$) and function ($P < .001$) for patients with varus gonarthrosis.⁷ Another study examined whether unloading braces were a cost-effective method for bridging and postponing surgery in unicompartmental knee osteoarthritis.⁸ It indicated that unloading braces were cost-effective for the management of unicompartmental osteoarthritis and were beneficial for the capacity, budget, wait-list length, frequency, and required severity of surgical intervention.⁸ In contrast, a meta-analysis of 14 systematic reviews and 9 RCTs brought into question the efficacy of unloader braces.⁹ It suggested that the use of unloader knee braces likely increases physical function through walking distance, but its efficacy for quality of life and pain was questioned.⁹ The study acknowledged the lack of homogeneity in the studies reviewed in regard to the type of brace, protocol, and outcome measures.⁹ Bracing appears to improve function, pain, and quality of life; however, further high-quality research is needed. We recommend the use of unloader braces specifically in the setting of unicompartmental osteoarthritis, but patient compliance is imperative to achieve the mentioned benefits.

Topical treatments

Topical applications of NSAIDs have been a mainstay in the treatment of osteoarthritis.¹⁰ They function by inhibiting the production of prostaglandins, which leads to anti-inflammatory and analgesic effects.¹⁰ A number of high-quality studies have indicated that NSAIDs are effective in improving function and quality of life and have few or no adverse events in patients with knee osteoarthritis.¹¹⁻¹⁴ In an RCT that compared

diclofenac with controls in 216 patients with knee osteoarthritis, diclofenac usage resulted in improvements in pain, physical function, and stiffness ($P = .003$, $P = .0001$, and $P = .002$, respectively).¹¹ Despite finding that 39% of the topical diclofenac group (consisting of 1.5% w/w diclofenac sodium) suffered from local skin dryness and skin irritation, it was concluded that topical NSAIDs were safe and efficacious for knee osteoarthritis.¹¹ A large multicentre RCT with 1395 patients assessed the efficacy and safety of topical ketoprofen and oral celecoxib.¹² Topical ketoprofen was superior to oral placebo and was considered to be noninferior to celecoxib with regard to pain based on the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC).¹¹ Similar results were found in an RCT with 248 patients in which topical diclofenac was compared with a placebo solution.¹³ The study's primary endpoint was pain relief, measured by the WOMAC, and it indicated that diclofenac was superior in reducing pain and stiffness and increasing physical function.¹³ Although 36% of the diclofenac patients had minor local skin irritation, it was concluded that topical diclofenac provided safe treatment with minimal systemic side effects.¹³ The efficacy of topical NSAIDs was further confirmed in an RCT with 260 patients; the topical NSAIDs group had a greater reduction in WOMAC pain scores ($P = .04$) and a minimal increase in adverse events such as skin irritation (38.8% vs 31.5%) compared with the placebo group.¹⁴ The safety, efficacy, and benefits of NSAIDs are well outlined in the literature, and their use should be considered in the management of knee osteoarthritis.

Additional studies have assessed novel topical therapies, such as herbal remedies and capsaicin. *Hedera helix*, an evergreen ivy plant with anti-inflammatory properties, has recently been studied for its use in the management of knee osteoarthritis.¹⁵ The effects of *H. helix* gel versus diclofenac versus placebo were compared in an RCT with 150 patients.¹⁵ *H. helix* and diclofenac significantly reduced stiffness and assisted with physical function compared with the placebo ($P < .05$).¹⁵ *H. helix* showed a higher

reduction in pain and stiffness than diclofenac, but the results were not statistically significant.¹⁵ Herbal remedies such as *H. helix* require further study to validate their use over NSAIDs in knee osteoarthritis.

Capsaicin, a neurotoxin found in chili peppers, works via destruction of primary afferent fibres, which leads to its analgesic effect.¹⁶ A systematic review examined the effects of capsaicin on osteoarthritis in various joints.¹⁷ The review included five RCTs, of which three were for knee osteoarthritis. Capsaicin was of only moderate efficacy in reducing knee pain up to 20 weeks, as analyzed by the visual analogue scale.¹⁷ Although there was mild topical site burning and local skin irritation in 35% to 100% of patients, it was concluded that the treatment was safe and well tolerated and had no systematic effects.¹⁷ However, further study is needed to assess the efficacy of capsaicin compared with the gold standard, topical treatment with NSAIDs.

The use of cannabis to manage osteoarthritis pain is being studied, but no clinical trials have been reported in the literature. A retrospective review of 71 patients who self-reported cannabis use in the perioperative period of total knee arthroplasty showed no improvement in total length of hospital stay, no reduction in in-hospital total morphine equivalent consumption, and no difference in postoperative functional outcomes up to 1 year after surgery.¹⁸ Despite these results, given the ongoing opioid crisis in North America, investigation of alternative therapies for pain management in knee osteoarthritis is an essential area of focus for future research.

Steroid and hyaluronic acid injections

Corticosteroid injections have been used in osteoarthritis for their anti-inflammatory effects and ability to block the immune cascade, which results in reduced swelling and pain, and ultimately increased function.¹⁹ Several studies have outlined the efficacy of steroid injections in reducing pain.²⁰⁻²³ In an RCT in which 125 patients were randomly assigned to receive either prednisolone or a

placebo, the prednisolone group had a statistically significant improvement in 6-minute walking distance, patient global assessment, knee pain, and benefits to physical function at 6 weeks compared with the placebo group ($P < .05$, $P < .001$, $P < .001$, and $P < .05$, respectively).²⁰ Additionally, there was a reduction in inflammatory markers such as Interleukin-1, Interleukin-5, tumor necrosis factor alpha, and high-sensitivity C-reactive protein in the treatment group compared with the placebo group, which persisted at both 6 and 12 weeks.²⁰ The use of corticosteroids was further validated in a prospective multicentre cohort study that examined the effects of intra-articular corticosteroid injections in knee osteoarthritis at 3 weeks, 6 weeks, 3 months, and 6 months.²¹ All 100 participants had improved scores in the visual numeric scale and WOMAC at every time point except at 6 months for the visual numeric scale ($P < .0001$).²¹ It was concluded that intra-articular corticosteroid injections are beneficial for pain and function and should, therefore, be considered in the management of knee osteoarthritis.²¹ In an RCT involving 117 patients, the effects of an intra-articular corticosteroid injection were compared with those of a placebo using the visual analogue scale and WOMAC.²² There was a statistically significant decrease in pain in the treatment group compared with the placebo group at 2 weeks and 6 weeks but not at 12 weeks, which indicated that corticosteroids were effective only in the short term.²² A systematic review of 27 RCTs with a total of 1767 participants examined the efficacy and duration of intra-articular corticosteroid injections; however, it was unclear whether corticosteroid injections were significantly and clinically effective at reducing knee osteoarthritis pain after 1 to 6 weeks.²³ Additionally, the American Academy of Orthopaedic Surgeons has downgraded its recommendation regarding intra-articular steroid injections to moderate efficacy because studies have indicated that they may accelerate osteoarthritis through chondrotoxicity.^{24,25} Although recent literature has called into question the long-term efficacy

of corticosteroid injections, there remains substantial evidence that they are beneficial for short-term pain relief in knee osteoarthritis. There is no lifetime limit for the number of steroid injections in a particular joint.

Hyaluronic acid is a glycosaminoglycan that is considered to be a key element of cartilage and synovial fluid.¹⁹ Inflammation occurs in knee osteoarthritis, which leads to alteration of the viscoelastic nature of synovial fluid and a reduction in the concentration and weight of hyaluronic acid.¹⁹ Supplementation via intra-articular injection is thought to work by re-establishing the lubricating effect of the synovial fluid.¹⁹ However, the literature is divided regarding the efficacy and benefits of viscosupplementation for pain reduction. A systematic review and meta-analysis of 89 studies with 12 667 patients showed no clinical benefit in terms of pain reduction associated with the use of hyaluronic acid.²⁶ In contrast, a meta-analysis of 54 trials and 7545 patients indicated that intra-articular hyaluronic acid had a therapeutic effect at 4, 8, and 24 weeks.²⁷ Cross-linked preparations tend to be more effective than older preparations; hence the variability in the literature. Viscosupplementation may have a role in the office setting, but currently, the American Academy of Orthopaedic Surgeons does not recommend routine usage of hyaluronic acid injections because of the lack of evidence showing clinically relevant differences associated with their use.²⁸ Some patients may benefit greatly from these injections, but they need to be counseled that not everyone benefits from them, and the cost is substantial. If the patient agrees to be treated, it is reasonable to offer one injection. If the patient benefits for at least 4 to 6 months, another injection can be given.

Stem cell injections

Intra-articular stem cell injection is an emerging novel therapy that is currently being investigated for its use in knee osteoarthritis. Mesenchymal stem cells have a complex mechanism of action and are thought to provide beneficial effects via their anticatabolic,

anabolic, and anti-inflammatory mechanisms of action.²⁹ Mesenchymal stem cells are harvested from bone marrow and adipose tissue via minimally invasive approaches and can be injected into the intra-articular space.²⁹ Multiple studies on treating osteoarthritis with intra-articular injection of stem cells have demonstrated therapeutic effects in terms of pain management and functional benefits and have indicated that the treatment has no permanent adverse effects and is safe for use.³⁰⁻³³ However, although the treatment could provide significant benefits to patients and prevent osteoarthritis disease progression,³⁰⁻³³ the literature lacks robust data to support routine use of the treatment in clinical practice. Most studies have small sample sizes, there are concerns about the methodology used, and often the studies do not include a control group.²⁹ In addition, the cost of mesenchymal stem cell injections for osteoarthritis management is significantly higher than that of other therapies. As health systems develop economic awareness and continue to improve their cost-effectiveness, the use of mesenchymal stem cell injections is likely to fall by the wayside unless significant clinical benefit can be demonstrated in future well-designed studies.

Summary

Osteoarthritis is becoming increasingly prevalent in Canada due to an aging population, and it has a significant economic impact. Nonsurgical management options should be used for knee osteoarthritis, either as temporizing measures while patients wait for a total knee arthroplasty or as definitive measures in less severe disease. With long surgical wait times, there is a need for conservative therapies to bridge and delay surgical intervention. Clinical therapeutic modalities such as unloader braces, topical treatments, and intra-articular steroids have been shown to be beneficial for both pain management and function in knee osteoarthritis. These modalities are summarized in the **Table**. Further research into the use of hyaluronic acid and mesenchymal stem cell injections is needed to warrant their routine use in the clinic setting. ■

Competing interests

None declared.

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TABLE. Summary of recommendations for in-office management of knee osteoarthritis.

Treatment	Recommendation
Unloader braces	Usage recommended, specifically in unicompartmental osteoarthritis
Topical NSAIDs	Usage recommended
Topical <i>Hedera helix</i>	Further study required
Topical capsaicin	Further study required
Topical cannabis	Not routinely recommended
Steroid injection	Usage recommended
Viscosupplementation injection	Not routinely recommended
Stem cell injection	Not routinely recommended

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Opioids have no role in patients awaiting total knee arthroplasty

Given their limited efficacy relative to other first-line osteoarthritis treatments, adverse effects, worsened postoperative outcomes, and the uncertain but avoidable risk of substance use disorder, opioids should not be prescribed to patients awaiting total knee arthroplasty.

ABSTRACT: End-stage osteoarthritis of the knee can be a debilitating condition that greatly reduces patients' quality of life. Total knee arthroplasty is an elective operation that can relieve pain and improve functioning but can be inaccessible due to prolonged wait times in British Columbia. An increasing number of patients awaiting total knee arthroplasty have been prescribed opioids to manage their pain in the interim. We review the current literature on opioid use in chronic noncancer pain, with knee osteoarthritis, and prior to total knee arthroplasty; highlight concerns about the practice; and advise against opioid use in this patient population. Given the limited efficacy of opioids relative to other first-line osteoarthritis treatments, adverse effects, worsened postoperative outcomes, uncertain but avoidable risk of substance use disorder, and availability

of promising alternative treatments, we recommend against the use of opioids in patients awaiting total knee arthroplasty.

Total knee arthroplasty is a surgical procedure performed to relieve pain secondary to osteoarthritis of the knee. It is considered in patients who have chronic pain that is severe enough to hinder daily functioning and in cases where first-line pharmacologic and nonpharmacologic arthritis treatments are ineffective.

The procedure can lead to significant improvements in pain, functioning, and quality of life. However, wait times are a barrier for many patients. The BC Surgical Patient Registry estimates that as of 31 March 2022, 8315 patients were awaiting total knee arthroplasty; 90% of surgeries performed between 1 January 2022 and 21 March 2022 had a wait time of 51.4 weeks.¹ These reports may underrepresent the crisis because they do not account for eligible patients who were unable to book or reserve a position on surgical wait lists. This prolonged preoperative period has a serious impact on the quality of life of patients with severe knee osteoarthritis; many self-report on the EuroQoL five-dimension questionnaire as being in a health state "worse than death."²

The wait times for elective procedures have increased since the start of the COVID-19 pandemic, as hospitals shifted toward prioritizing acute care. More than

6 million elective orthopaedic procedures were canceled globally during the first peak of the pandemic.³

An increasing number of patients awaiting total knee arthroplasty are receiving opioids to manage their pain in the interim, and the pandemic has bolstered this trend. In the United Kingdom, the median wait times for hip and knee arthroplasty increased from 365 days to 455 days following the outbreak of COVID, and the proportion of patients on any opioid by the time they reached surgical follow-up during that period increased from 41.2% to 55.0%.⁴ In Alberta between 2013 and 2015, an estimated 31% of knee osteoarthritis patients were prescribed at least one opioid prior to total knee arthroplasty.⁵ While there are no direct data for British Columbia, the prescription of tramadol/tapentadol in surgical specialties increased by 12% between 2013 and 2018.⁶ Globally, there has been an overall rapid increase in the use of opioids to manage chronic noncancer pain.⁷

We aim to raise awareness about the growing trend in opioid prescribing in patients awaiting total knee arthroplasty by outlining the current evidence on the efficacy of opioids [Table], their impact on surgical outcomes, and the risk of opioid use disorder in this patient population. We also discuss potential alternative treatments to manage pain prior to total knee arthroplasty.

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TABLE. Evidence on the efficacy of opioids: Summary of results included in the narrative literature review, grouped by outcome measures.

Article	Condition	Study design	N	Quality of evidence	Intervention vs control	Outcome measure(s)	Results	Statistical significance	Comments
Clinical efficacy of opioids in arthroplasty candidates									
Welsch and colleagues, 2020 ¹⁰	Osteoarthritis	Systematic review and meta-analysis	17 RCTs	Moderate quality	Opioid vs placebo	Pain relief ≥ 50%	Risk difference 0.02 95% CI (0.00, 0.05) P = .05	No	No clinically relevant difference in pain relief
Avouac and colleagues, 2007 ¹⁴	Osteoarthritis	Meta-analysis	13 RCTs	High quality	Opioid vs placebo	Difference in pain score (10 cm visual analogue scale, WOMAC score, index pain intensity score, 5-point Likert scale)	Effect size -0.58 95% CI (-0.64, -0.52) P < .0001	Yes	
			18 RCTs	High quality	Opioid vs placebo	Any adverse event	NNH 4 (strong opioids) NNH 9 (weak opioids)	N/A	
da Costa and colleagues, 2014 ⁹	Osteoarthritis of the knee/hip	Systematic review	12 RCTs	High quality	Opioid vs placebo	Difference in pain score (various) ≤ 1 month	RR -0.40 95% CI (-0.50, -0.30) P = .001	Yes	Decreasing effect size after 1 month
			10 RCTs	High quality	Opioid vs placebo	Difference in pain score (various) >1 month	RR -0.15 95% CI (-0.22, -0.08) P = .001	Yes	
			9 RCTs	Moderate quality	Opioid vs placebo	Any adverse event	RR 1.49 95% CI (1.35, 1.63)	Yes (line of no difference not crossed)	
			19 RCTs	High quality	Opioid vs placebo	Withdrawal from study due to adverse event	RR 3.76 95% CI (2.93, 4.82)	Yes (line of no difference not crossed)	
Busse and colleagues, 2018 ⁸	Chronic non-cancer pain	Systematic review	42 RCTs	High quality	Opioid vs placebo	Difference in pain score (10 cm visual analogue scale) at 3- to 6-month follow-up	WMD -0.69 95% CI (-0.82, -0.56) P < .001	Yes	Decrease in effect size with longer follow-up
			51 RCTs	High quality	Opioid vs placebo	Difference in physical function score (36-item short-form physical component score) over 3 months	WMD 2.04 95% CI (1.41, 2.68)	Yes (line of no difference not crossed)	Difference not clinically significant given 36-item short form (difference of 2.04 points out of 100 total points)

RCT = randomized controlled trial; NNH = number needed to harm; RR = risk ratio; WMD = weighted mean difference; WOMAC = Western Ontario and McMaster Universities Arthritis Index; EPHP = Effective Public Healthcare Panacea Project.

TABLE (cont'd from page 123). Evidence on the efficacy of opioids: Summary of results included in the narrative literature review, grouped by outcome measures.

Article	Condition	Study design	N	Quality of evidence	Intervention vs control	Outcome measure(s)	Results	Statistical significance	Comments
Clinical efficacy of opioids in arthroplasty candidates (continued)									
Krebs and colleagues, 2018 ¹¹	Chronic back pain, knee/hip osteoarthritis	RCT	234 participants	High-quality GRADE score	Opioid vs acetaminophen or NSAIDs	Difference in pain-related function (Brief Pain Inventory interference scale) at 12-month follow-up	Difference 0.1 95% CI (-0.5, 0.7) P = .58	No	
Effect of opioids on postsurgical outcomes									
Hannon and colleagues, 2020 ¹⁷	Osteoarthritis post-joint arthroplasty	Systematic review	58 studies	Low quality	Preoperative opioid use vs opioid-naive patients	Prevalence of revision surgery	Three studies found no difference; one found higher rates of revision surgery in patients with preoperative opioid use	N/A	
Smith and colleagues, 2017 ¹⁵	Osteoarthritis of the knee, post-total knee arthroplasty	Prospective cohort study	156 participants	Strong EPHPP quality assessment score	Preoperative opioid use vs opioid-naive patients	Improvement from baseline pain score (WOMAC) 6 months post-total knee arthroplasty	Difference -6.6 95% CI (-11.5, -1.7)	Yes (line of no difference not crossed)	
Goplen and colleagues, 2021 ⁵	Osteoarthritis of the knee, post-total knee arthroplasty	Retrospective cohort study	1907 participants	Strong EPHPP quality assessment score	Preoperative opioid use vs opioid-naive patients	Difference in pain score (WOMAC) 12 months post-total knee arthroplasty	Difference 7.7 95% CI (4.0, 11.6) P < .001	Yes	
Substance use disorder and related outcomes									
Jantarada and colleagues, 2021 ¹⁸	Chronic non-cancer pain	Systematic review and meta-analysis	19 studies	13/19 graded low risk of bias	N/A	Prevalence of problematic opioid use in chronic noncancer pain patients	36.3% prevalence	N/A	
Tay and colleagues, 2022 ²⁰	Osteoarthritis post-total joint arthroplasty	Systematic review and meta-analysis	29 studies	High quality	N/A	Rate of opioid use 3 months postoperatively	26% 95% CI (19% to 33%)	N/A	Opioid-naive patients were less likely to have continued post-operative opioid use than those who were opioid-tolerant pre-operatively
						Rate of opioid use 6 months postoperatively	20% 95% CI (17% to 24%)	N/A	
			1 study	Moderate quality		Rate of opioid use 9 months postoperatively	23% 95% CI (17% to 28%)	N/A	
						Rate of opioid use 9 months postoperatively	21% 95% CI (12% to 29%)	N/A	

RCT = randomized controlled trial; NNH = number needed to harm; RR = risk ratio; WMD = weighted mean difference; WOMAC = Western Ontario and McMaster Universities Arthritis Index; EPHPP = Effective Public Healthcare Panacea Project.

TABLE (cont'd from page 124). Evidence on the efficacy of opioids: Summary of results included in the narrative literature review, grouped by outcome measures.

Article	Condition	Study design	N	Quality of evidence	Intervention vs control	Outcome measure(s)	Results	Statistical significance	Comments
Substance use disorder and related outcomes (continued)									
Vowles and colleagues, 2015 ¹⁹	Chronic non-cancer pain	Systematic review	13 studies	High quality	N/A	Rate of opioid misuse in chronic noncancer pain patients	2.0% to 56.3%	N/A	
			10 studies	High quality	N/A	Rate of opioid addiction in chronic noncancer pain patients	0.7% to 23.0%	N/A	
da Costa and colleagues, 2014 ⁹	Osteoarthritis	Systematic review	3 RCTs	Moderate quality	Opioid vs placebo	Rate of withdrawal symptoms	Withdrawal symptoms 1.5% more frequent in patients prescribed opioids	N/A	

RCT = randomized controlled trial; NNH = number needed to harm; RR = risk ratio; WMD = weighted mean difference; WOMAC = Western Ontario and McMaster Universities Arthritis Index; EPHPP = Effective Public Healthcare Panacea Project.

Clinical efficacy of opioids in arthroplasty candidates

Opioid therapy has been broadly shown to have modest effects in chronic noncancer pain. A recent systematic review examined 42 high-quality randomized controlled trials that followed chronic noncancer pain patients for 3 months or longer. It compared pain reduction between patients prescribed opioids and those on a placebo. While a clinically significant difference was seen in the opioids group, the effect size decreased in studies that followed up with patients for longer periods.⁸ The review also examined 51 high-quality randomized controlled trials that compared physical functioning in chronic noncancer pain patients on opioids versus those on placebo and found no clinically significant difference on the 36-item short-form physical component score.⁸

Similar results have been observed in patients with hip and knee osteoarthritis: systematic reviews have demonstrated a decreasing effect on pain relief⁹ or no clinically relevant difference in pain relief¹⁰ when opioids were used for more than 1 month. A narrative review of 35 studies on patients

with knee osteoarthritis found no clinical difference in patient-reported pain outcomes between opioid and nonopioid users when the drug was used as a long-term therapy.⁷

Some evidence suggests that opioid therapy is not superior to nonopioid first-line medications used by osteoarthritis patients, such as acetaminophen and NSAIDs. Only a limited number of head-to-head trials have compared these analgesics in chronic noncancer pain patients, which has prevented meta-analyses on the topic. However, a recent randomized controlled trial examined the efficacy of different analgesics in chronic hip, back, and knee pain. It compared patients on opioids with those on acetaminophen and NSAIDs and found no significant difference in pain-related function at 12-month follow-up.¹¹

The unwanted side effects of opioids must also be considered when evaluating their clinical use. Many patients with chronic noncancer pain tend to discontinue opioid use due to adverse events or insufficient pain management.¹² A recent systematic review on patient preferences in treating chronic noncancer pain found

that the adverse effects of opioids may reduce or eliminate any benefit unless pain relief is significant.¹³ A meta-analysis of 18 high-quality studies on patients with osteoarthritis found the number needed to harm was 4 for strong opioids and 9 for weak opioids.¹⁴ Another systematic review found that among patients with osteoarthritis in the hip or knee, those on opioids had a pooled risk ratio of 1.49 for any adverse event and a pooled risk ratio of 3.76 of dropping out due to any adverse event, compared with controls.⁹

Effect of opioids on postsurgical outcomes

Presurgical use of opioids has been associated with worse outcomes in both pain and functioning after total knee arthroplasty has been completed. A narrative review of 35 studies found that patients on opioids had a statistically significantly lower Knee Society Score following total knee arthroplasty, had longer in-hospital stays, and had a higher prevalence of subsequent referrals to pain management.⁷ A prospective cohort study of 156 patients reported that patients with preoperative opioid use

had a smaller improvement in their Western Ontario and McMaster Universities Arthritis Index (WOMAC) pain scores 6 months following total knee arthroplasty than those who were opioid-naïve.¹⁵ This disparity continued to be seen 12 months after total knee arthroplasty, with patients on opioids prior to surgery having lower adjusted WOMAC scores and physical functioning scores.⁵

Postoperative pain is one of the most significant factors that determines whether a revision operation is performed.¹⁶ A systematic review found conflicting evidence as to whether preoperative opioid use independently increased the prevalence of revision surgery after joint arthroplasty; one article found an increased rate and three found no difference relative to opioid-naïve patients, though all studies were graded as low quality.¹⁷

Substance use disorder and related outcomes

Evidence suggests there is an increased risk of substance use disorder in patients who are prescribed opioids for chronic pain, but effect sizes are variable. A systematic review of 19 articles, 13 of which presented a low risk of bias, found that problematic opioid use was prevalent in 36.3% of patients with chronic noncancer pain.¹⁸ A second systematic review examined 13 high-quality studies on misuse and 10 high-quality studies on addiction in patients with chronic noncancer pain who were prescribed opioids. The rates of misuse varied from 2.0% to 56.3%, and the rates of addiction ranged from 0.7% to 23.0%.¹⁹

In the context of osteoarthritis of the knee or hip, moderate-quality evidence from three articles in a larger systematic review indicated that withdrawal symptoms were 1.5% more frequent in patients prescribed opioids compared with those given placebo.⁹

Several articles have examined the risk of prolonged postoperative opioid use following total joint arthroplasty. A recent systematic review of 29 high-quality studies and 1 moderate-quality study found that

patients who underwent total knee arthroplasty had rates of postoperative opioid use as follows: at 3 months, 26% (95% CI, 19% to 33%); at 6 months, 20% (95% CI, 17% to 24%); at 9 months, 23% (95% CI, 17% to 28%); and at 12 months, 21% (95% CI, 12% to 29%). It also found that opioid-naïve patients were less likely to have continued postoperative opioid use than those who were opioid-tolerant preoperatively.²⁰

Discussion

Certain factors, separate from preoperative opioid use, have been found to increase the risk of prolonged opioid use after total knee arthroplasty. They include anxiety, substance misuse, and alcohol misuse.²¹ Physicians have commonly used screening tools to gauge a patient's risk for opioid use disorder before issuing an opioid prescription. However, a recent review article noted that the two most commonly used risk assessment tools in BC—the Opioid Risk Tool and the Prescription Opioid Misuse Index—are based on lower-quality studies and have poor predictive accuracy.²² Given the uncertainty of prognosis even after screening, avoiding prescribing opioids to patients who are awaiting total knee arthroplasty, especially considering opioids' lack of efficacy, may be the safest option.

There is clinical equipoise on whether long-acting versus short-acting opioids lead to better outcomes in patients with chronic noncancer pain. However, a qualitative systematic review of six randomized trials found no difference in pain relief, consumption of rescue analgesia, quality of sleep, or physical functioning. It noted that these findings challenge several guidelines that recommend long-acting opioids as a safer option.²³ In the experience of the senior authors, the use of long-acting opioids is much more difficult to taper off, which results in a higher rate of dependence; therefore, their use needs to be avoided in patients with chronic noncancer pain.

Many current guidelines caution against the use of opioids in patients with knee osteoarthritis and in those awaiting total knee arthroplasty. The American College of

Rheumatology and the Arthritis Foundation recommend using tramadol for knee osteoarthritis only if the patient has contraindications to NSAIDs, has no available surgical options, and finds other therapies ineffective. It also advises against prescribing nontramadol opioids in this patient group unless alternative treatments have been exhausted, and even then, the lowest possible dose for the shortest possible length is recommended.²⁴ Guidelines from the European Society for Clinical and Economic Aspects of Osteoporosis, Osteoarthritis and Musculoskeletal Diseases recommend the use of opioids only as a last step before osteoarthritis surgery; the slow titration of sustained-release tramadol, a weak opioid, affords sustained analgesia with improved tolerability.²⁵ A recent review article of United States data recommended that during the perioperative period for total joint arthroplasty, opioids be prescribed only when absolutely necessary, at their lowest dose, and for the shortest duration necessary to control symptoms; close monitoring of common adverse effects should also be conducted.²⁶

Novel minimally invasive procedures

Minimally invasive procedures have shown promise as alternative pain management options in patients awaiting total knee arthroplasty. Specifically, genicular artery embolization has demonstrated safety, good efficacy, and no serious complications in multiple preliminary clinical trials.²⁷ Further investigation into techniques such as genicular artery embolization may lead to breakthroughs in patient care and revision of current management algorithms. To this effect, the World Health Organization has added minimally invasive procedures as a step on its analgesic ladder.²⁸

Pain as a psychosocial issue

Pain is a complex psychosocial issue, and an individual's response to a given level of nociception can vary based on their circumstances, mental health, mindset, and coping mechanisms.¹⁶ Some factors associated with preoperative opioid use in

knee osteoarthritis include comorbid spine osteoarthritis, higher symptomatic joint count, depressive symptoms, obesity, being a current or former smoker, and current use of other prescription pain medication,²⁹ all of which may be linked to social determinants of health.

While avoiding opioids is ideal for opioid-naïve patients awaiting total knee arthroplasty, many individuals undergoing joint replacement in Canada and the United States are already on potent opioids.¹⁶ It is especially important in these patients to use a harm reduction approach and provide psychosocial support. There is preliminary evidence that brief psychological interventions may reduce prescription opioid-related harm in patients with chronic pain.³⁰

Summary

End-stage osteoarthritis of the knee can be a debilitating condition that greatly lowers patients' quality of life. Total knee arthroplasty is an elective operation that can relieve pain and improve functioning, but it can be inaccessible due to prolonged wait times in BC. An increasing number of patients awaiting total knee arthroplasty have been prescribed opioids to manage their pain in the interim. Given the limited efficacy of opioids relative to other first-line osteoarthritis treatments, adverse effects, worsened postoperative outcomes, uncertain but avoidable risk of substance use disorder, and the presence of promising alternative treatments, we recommend against their use in patients awaiting total knee arthroplasty. Novel minimally invasive procedures such as genicular artery embolization may help reduce the need for presurgical opioid use. From a systems perspective, sustained efforts at shortening wait times for consultation with orthopaedic surgeons and improving access to surgical services would obviate the need to prescribe opioids and diminish the iatrogenic contribution to the opioid crisis in BC. ■

Competing interests

None declared.

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Who should get a knee replacement?

The decision-making process for total knee replacement is multifaceted and involves considerations that extend beyond radiographic evidence, including patient age, comorbidities, BMI, activity levels, and total versus partial replacement.

ABSTRACT: Knee osteoarthritis is a prevalent and variably debilitating condition, often leading to referral for possible total knee replacement when symptoms align with radiographic evidence of osteoarthritis. However, the severity of radiographic findings does not consistently correlate with patient-reported pain levels. We explore the intricacies of patient selection for knee replacement surgery and address the complex interplay between symptoms, radiographic evidence of osteoarthritis, and realistic outcome expectations following surgery. We also emphasize the need for a nuanced understanding of the relationship between structural changes and subjective patient experience. The age factor in total knee replacement candidacy has historically led to arbitrary age-based restrictions regarding referral, with patients advised to wait until older ages. Recent studies have challenged this notion and suggested that patients younger than 55 years can experience positive outcomes. Additionally, considerations for posttraumatic arthritis versus other arthritic causes highlight the importance of individualized preoperative counseling. Implant survival and revision rates are affected by patient age at

time of surgery, activity level, and BMI, among other factors. Based on patient-reported outcomes, patients with elevated BMI, despite higher rates of complications, do benefit, barring complication. Patient satisfaction following total knee replacement is dependent on various factors, including age, activity level, severity of osteoarthritis, and gender, which highlights the need for individualized counseling, considering diverse patient profiles and potential predictors of dissatisfaction. Specifically addressing the concerns of active patients requires counseling regarding postoperative activity restrictions, considering the balance between pain relief, improved function, and potential for increased risk of revision surgery. The choice between partial and total knee replacement is explored, with a focus on indications and survivorship. In guiding primary care physicians on when to refer patients, patient-reported outcome measures such as the Oxford Knee Score can be helpful, but further practical thresholds for surgical consideration must be considered. Maximizing nonoperative management prior to or while awaiting consultation is always beneficial and recommended. Ultimately, knee osteoarthritis is a complex medical pathology that is most effectively addressed through individualized patient counseling, shared decision making, and collaboration between primary care physicians and orthopaedic surgeons to optimize outcomes and satisfaction while navigating knee replacement options and timing of surgical intervention.

Knee osteoarthritis is a common and often debilitating disease. Referral to an orthopaedic surgeon is appropriate when there are radiographic changes consistent with osteoarthritis that are accompanied by symptoms. However, the severity of osteoarthritis on radiographs does not necessarily correlate with the level of pain experienced by the patient. It is important for patients to understand that surgery is a pain-reducing operation, not necessarily a pain-eliminating one. Managing patient expectations is necessary for successful surgical outcomes, because despite our best efforts, not everyone is satisfied following total knee replacement. In a large systematic review of more than 1200 studies on patient satisfaction after total knee replacement, 83% of the studies reported more than 80% patient satisfaction.¹ However, many factors must be considered and addressed preoperatively. The review showed that predictors of satisfaction included older age, higher-grade osteoarthritis, and male sex; predictors of dissatisfaction included less severe disease, younger age, osteoarthritis as a primary diagnosis as opposed to inflammatory arthritis, and female sex.¹ Keeping these factors in mind, in addition to chronic unexplained pain or related disorders such as chronic myofascial pain, fibromyalgia, and other disorders related to central sensitization, we address some common concerns regarding total knee replacement by adequately counseling the patient

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ahead of the procedure. The primary care provider plays a large role in this regard and in counseling the patient that not everyone who has a knee replacement is pain-free, especially those with the above-noted conditions, and that having some pain after a total knee replacement, albeit less than the preoperative pain, is not necessarily an indication of failure and does not require multiple investigations and referrals once a thorough workup by the surgeon has ruled out failure. We outline important considerations related to knee arthroplasty, framed through several common questions from the patient's perspective.

Am I too young (or too old)?

Should we be denying younger patients access to total knee replacement if they have a higher chance of dissatisfaction? Due to a variety of factors, including implant survival, revision rates, and activity levels, patients have been commonly told not to pursue total knee replacement until they are older and significantly debilitated, often using an arbitrary cutoff of 65 years of age. This can lead a patient to suffer unnecessarily with significant symptoms for many years to avoid a possible revision operation in the future. In a systematic review of functional outcomes in patients younger than 55 years of age, there was a greater than 50% improvement in functional knee scores, as measured by the Knee Society Score, as well as a satisfaction rate of 85.5%.² In addition, the all-cause revision rate was 5.4% for the entire cohort of 1283 total knee replacements at a mean of 10.8 years follow-up.² Also, 10-year survival for aseptic loosening alone was 98.2%.² These are encouraging findings and support total knee replacement as an excellent treatment option for younger patients with osteoarthritic knees. Therefore, the age cutoff of 65 years should be considered obsolete, and patients should not be told they need to wait until they are older.

The cause of the young arthritic knee is important to consider, because a post-traumatic arthritic knee presents unique challenges compared with a more typical arthritic knee. Brockman and colleagues³

demonstrated that the incidences of wound infections (both superficial and deep) and deep vein thrombosis were higher in patients with posttraumatic arthritis. Patients with posttraumatic arthritis also had a higher prevalence of drug and alcohol abuse, psychosis, and liver disease, whereas osteoarthritic patients more commonly had obesity, diabetes, heart disease, and lung disease as comorbidities.³ This further illustrates differences between these two patient populations and suggests that they

Should we be denying younger patients access to total knee replacement if they have a higher chance of dissatisfaction?

would require different types of preoperative counseling to achieve a satisfactory postoperative result. However, these are generalizations based on cohort analyses; each patient should be evaluated as an individual. One of the most common reasons for osteoarthritis at a younger age is a previous knee ligament injury, which carries far fewer risks and technical difficulties than a patient with a significant fracture that is affecting the knee joint.

In a systematic review and meta-analysis conducted to establish how long a knee replacement lasts, approximately 82% of total knee replacements lasted 25 years or more.⁴ It is important to discuss revision rates in patients with total knee replacement who are younger than 60 years of age, because they have a significantly increased lifetime risk of revision surgery: up to one in three for patients aged 50 to 55 years.⁵ Revision rates following total knee replacement are a much more salient point for the younger patient as compared to the older patient. In discussion with the potential surgical patient, the risk of future revision surgery versus quality of life indicators should be considered. In our opinion, having a one-in-three lifetime risk of revision

surgery is not significant enough to warrant a patient suffering unnecessarily for a decade or more, but this is a shared decision that should be made with the patient.

Elderly patients tend to do better than younger patients when considering patient-reported outcome measures. However, in this patient cohort, comorbidities and the ability to recover and lead a fulfilling functional life after surgery play a significant role in the shared decision-making discussion with the patient and their family. Consideration should be given to whether the patient is healthy enough to undergo the procedure and tolerate the recovery process. If they are healthy, willing, and disabled enough, then knee replacement can give them pain-free years at the end of their life. For instance, an elderly patient with severe chronic obstructive pulmonary disease or congestive heart failure and very limited functional mobility will not benefit from the increased mobility afforded by a total knee replacement compared with a healthy elderly patient who would otherwise be active without debilitating knee pain.

Is my BMI too high?

Any physician who cares for patients with knee osteoarthritis, whether a primary care physician or an orthopaedic surgeon, understands the difficulty of managing a patient with an elevated BMI and concomitant painful knee symptoms. Patients often find it difficult to stay active, which can negatively impact their overall health and weight. Even in highly motivated patients who have an elevated BMI, low-impact exercise activities, such as cycling and swimming, pose unique challenges that can be equipment- or access-related or may be due to issues such as body image, which can have serious psychosocial implications. Psychosocial issues may be deep-rooted and may have developed over many years; therefore, a cursory evaluation by a surgeon will miss these unspoken concerns. Patients with an elevated BMI often present with pain symptoms that are disproportionate to the degree of radiographic change present, not because they are more likely to talk

about experiencing pain, but because of mechanical overload and the complex role that obesity and metabolic syndrome play in the initiation and progression of knee osteoarthritis.⁶ The physician should maximize nonoperative measures that, if applied along with weight loss, often result in significant symptom improvement. From a biomechanical standpoint, excess weight contributes to an increased mechanical burden with altered dynamic movement and loading patterns.⁷ It is important to explain to patients that the knee is a joint that does not like extra weight and that weight loss may allow them to avoid surgical intervention, because these patients already have a higher perioperative risk profile than those without an elevated BMI. Telling a patient with an elevated BMI to lose a certain number of pounds before surgery is unhelpful. These patients may have struggled with obesity for many years, often decades, and are often not equipped to lose weight on their own. They need assistance by being referred to a medical weight-loss clinic, where they can receive medical and counseling support and possible referral to bariatric surgery, if necessary, as discussed by Zentner and colleagues in part 2 of this theme issue. Finally, BMI is a poor indicator of surgical risk, and using the BMI cutoff of 30 will greatly restrict many patients from receiving a complication-free surgical procedure.⁸ Morbid obesity with a BMI greater than 40 carries a serious risk of complications.⁹ Also, the surgical risks depend on the distribution of fat relative to the joint. A patient with central obesity will have a higher risk of medical complications as opposed to surgical complications, whereas a patient with a large periarticular soft tissue envelope will have higher risk of early reoperation and infection.¹⁰

Once a shared decision to perform total joint replacement has been made by the surgeon and patient, a frank discussion regarding perioperative risks is required so patients can make an informed decision to proceed with surgery. A study on the relationship between BMI and the risk of periprosthetic joint infection showed a nonlinear dose response with a relative

risk increase of at least four with BMI of 40 or higher.¹¹ It is also very important for patients to understand that treatment for most periprosthetic joint infections includes reoperation, long-term intravenous antibiotic therapy, worse functional outcomes, and a small chance of a nonreconstructable joint or amputation. These patients also have a

Young, active patients who receive total knee replacement are more likely to require revision surgery because they are higher-demand patients for a longer period.

significantly higher risk of both medical and surgical complications, as well as longer stays in hospital.¹² Although patients with an elevated BMI are at higher risk of complications, their clinical outcomes, if a complication does not occur, are favorable. A study of more than 500 patients who underwent total knee replacement between 1987 and 2004 indicated that morbid obesity did not affect 1-year outcomes based on Western Ontario and McMaster Universities Osteoarthritis Index scores.¹³ Finally, different BMI cutoffs have been suggested in the literature to mitigate perioperative risk, but they continue to be affected by many variables and will ultimately be surgeon- and patient-dependent, in a shared decision-making model.

Am I too active?

Should younger patients who are more likely to be active have long-term restrictions on certain activities? Patient questions about what they can and cannot do following total knee replacement are common, and surgeons are much more lenient with postoperative restrictions now than they were in the past. Contact sports and high-impact loading activities, such as running, tennis, basketball, soccer, hockey, and football, carry a higher risk of directly damaging

the prosthetic joint, but activity restriction following total knee replacement should be individualized based on the patient's overall physical fitness, their experience with the activity they wish to return to, their ability to appropriately rehabilitate prior to returning to activity, and their understanding of the risks associated with increased activity.¹⁴ Highly motivated and educated patients who have successfully rehabilitated following total knee replacement can safely and reliably return to many activities with few restrictions, but this ability is quite variable between patients; many factors contribute to their overall postoperative return to activity. "Did you do this activity before?" is a good question to ask the patient to determine their planned postoperative regimen and potentially help guide them back to their desired activity level. In British Columbia, where skiing and noncontact hockey are common activities, many patients return to these activities without undue risk.

Young, active patients who receive total knee replacement are more likely to require revision surgery because they are higher-demand patients for a longer period. A retrospective matched cohort study of more than 1000 "active" and "inactive" patients who underwent total knee replacement found that at 2 years following total knee replacement, 27.3% of the active patients and 69.5% of the inactive patients improved their baseline activity levels, but revision rates were higher for active patients: 3.2% compared with 1.6% for inactive patients at 5 to 10 years postoperatively.¹⁵ Activity level is associated with higher revision rates; therefore, patients should be counseled about this prior to surgery, but the absolute increase in higher revision rate is not large, even though it is double in relative terms.

Should I get a partial or total knee replacement?

The choice to have any type of partial knee replacement, whether unicompartmental or patellofemoral, or a total knee replacement requires specific indications and discussion about revision rates. The most commonly

replaced single compartment is the medial compartment. The indications for unicompartmental knee replacement are unicompartmental osteoarthritis or osteonecrosis, a coronal deformity less than 15 degrees, flexion contracture less than 15 degrees, functionally intact anterior cruciate ligament and structurally intact collateral ligaments, and the absence of inflammatory arthritis.¹⁶ Activity level, age, BMI, anterior knee pain, and a previous high tibial osteotomy are no longer considered contraindications to unicompartmental knee replacement, but they can factor into long-term survivorship.¹⁶ The reasons for revision have varied over the years, but more recent literature suggests that polyethylene wear, progressive osteoarthritis of other compartments, aseptic loosening, and subsidence tend to be the most common modes of failure.¹⁷ A systematic review and meta-analysis reported pooled estimates of survival for unicompartmental knee replacement of 85.5% at 15 years, 81.9% at 20 years, and 72.0% at 25 years.⁴ These estimates further support unicompartmental knee replacement as a durable option for a specific patient population, although revision rates continue to be higher than those after a total knee replacement. The advantage of a partial knee replacement is better function and a quicker recovery, which needs to be balanced against the higher rate of long-term failure. Only the patient, with informed consent, can balance these competing risks and benefits prior to deciding to proceed with a partial or total knee replacement.

Less commonly performed (and indicated) are patellofemoral joint replacements. They are indicated in patients with isolated patellofemoral osteoarthritis, which is most often seen in female patients, often with an elevated BMI. Outcomes following patellofemoral joint replacement are variable; however, improvements in surgical technique, patient selection, and implant design have improved overall outcomes.¹⁸ A systematic review found that patellofemoral joint replacement survivorship was 83.3% at 10 years and 66.6% at 20 years.¹⁶ Survivorship is not as favorable as with total

knee replacement, but several studies have confirmed that in carefully selected patients, patellofemoral joint replacement could delay total knee replacement by 10 to 15 years in up to 80% of patients.¹⁸ Overall, isolated patellofemoral osteoarthritis is a difficult problem that must be treated initially with maximal conservative measures, but in the literature, patellofemoral joint replacement is supported as a viable surgical option in highly selected patients.

The advantage of a partial knee replacement is better function and a quicker recovery, which needs to be balanced against the higher rate of long-term failure.

The decision about undergoing total knee replacement versus unicompartmental knee replacement versus patellofemoral joint replacement should be made between the patient and the surgeon and does not really need to be a consideration for the referring doctor. However, it is important to recognize that disease that is affecting only one compartment is not a contraindication to referral.

When to refer?

Referral to an orthopaedic surgeon can take many months, and primary care physicians often struggle to decide whether their patient has symptoms that warrant referral. Orthopaedic surgeons would also like their offices to be filled with patients who are ready for surgery. Many different patient-reported outcome measures exist; a commonly employed measure is the Oxford Knee Score. It is a relatively short questionnaire and is easy to administer to assess function and pain related to the knee. A retrospective study reviewed pre-consultation Oxford Knee Scores over a 3-year period for a single surgeon and identified a conservative and effective threshold for knees of a score greater than 32, where patients

are unlikely to be deemed surgical.¹⁹ The Oxford Knee Score can help family physicians identify patients who are likely not candidates for surgery and may instead benefit from aggressive nonsurgical measures.

A score to guide practitioners is helpful to provide objective guidelines for referral, but when patients have radiographic evidence of knee osteoarthritis with pain symptoms that are affecting their daily lives, most surgeons view that patient as a reasonable referral. Pain and the disability associated with it are the main reasons for referral. Mechanical issues such as deformity are seldom a consideration for surgery. A patient with deformity and no pain is unlikely to be offered a joint replacement.

When considering a referral, pre-referral radiographs should be performed. They should include weight-bearing anteroposterior, lateral, and, if possible, 20-degree flexed weight-bearing anteroposterior (Rosenberg) views. Rarely is an MRI or CT scan indicated. If necessary, they will be ordered by the orthopaedic surgeon. An MRI scan in an osteoarthritic knee almost always shows a degenerative meniscal tear, which is of no diagnostic power and will not affect treatment. If a patient is referred with a meniscal tear for arthroscopy when they really have significant arthritis, the expectations and the discussion that follows can be difficult and fruitless for both the patient and the surgeon.

Summary

The decision-making process for total knee replacement is multifaceted and involves considerations that extend beyond radiographic evidence, including patient age, comorbidities, BMI, activity levels, and total versus partial replacement. Addressing these concerns requires thorough preoperative counseling and careful consideration of individual patient factors. Patient satisfaction after total knee replacement is generally high; however, it is crucial to manage patient expectations. Encouraging findings suggest that younger patients can benefit significantly from knee arthroplasty, with satisfactory functional outcomes and

long-term implant survival. The notion of a fixed age cutoff is becoming obsolete, which emphasizes the importance of individualized assessments. Furthermore, the cause of knee arthritis, especially in younger patients, introduces unique considerations.

BMI considerations in total knee replacement extend beyond a simple threshold, with a focus on overall health, perioperative risk management, and distribution of fat relative to the joint. While an elevated BMI is associated with increased risks, effective weight management strategies, including referral to a medical weight-loss clinic, can significantly improve outcomes. The discussion about BMI should move beyond arbitrary cutoffs.

Referral decisions hinge on multiple factors, but the importance of prereferral radiographs cannot be overstated: they help in facilitating accurate assessments and avoiding potential mismatches between patient expectations and surgical interventions. In navigating these complex decisions, collaborative efforts between primary care physicians and orthopaedic surgeons play a pivotal role. Effective communication, patient education, and appropriate referral will help ensure that knee arthroplasty remains a valuable and tailored intervention for patients. ■

Competing interests

None declared.

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An MRI scan in an osteoarthritic knee almost always shows a degenerative meniscal tear, which is of no diagnostic power and will not affect treatment.

Blood and body fluid exposures in the workplace: Scenarios you may encounter in your clinic

Blood and body fluid exposures can occur in a variety of health care workplace settings. As a physician, you have different roles and responsibilities in different situations, particularly if you manage your own clinic. Below are three scenarios you might encounter in your clinic as an employer, worker, and primary care provider.

Scenario 1: A clinic assistant you employ is assisting you in a minor procedure, and they sustain a needlestick injury

In this scenario, you as the physician are the employer, which means your role begins before the exposure occurs.

For employers, preparation, planning, education, and training are key. All employers, including physicians managing clinics, must ensure resources such as personal protective equipment, safe work procedures, and worker training are available and implemented in accordance with the requirements of an exposure control plan.¹ The purpose of an exposure control plan is to prevent workers from experiencing harmful exposure to infectious diseases in the workplace.

The plan includes a statement of purpose; responsibilities of the employer, supervisors, and workers; risk identification and assessment; control measures; written safe-work procedures; education and training; and written records. In your clinic's exposure control plan, you detail your clinic's approach to events such as blood and body

fluid exposures (and, therefore, needlestick injuries).

Before scenario 1 occurs, you as the employer are expected to have done the following to prevent risk to workers at your workplace:

1. Reviewed the substance-specific requirements for biological agents in the OHS Regulation (Sections 6.33–6.40).²
2. Implemented infection prevention and control practices³ for your practice (to create your exposure control plan).
3. Provided training for all workers at your clinic.
4. Advised your workers to report incidents to you immediately to ensure timely follow-up for medical evaluation at the nearest hospital emergency room.

In the occupational needlestick scenario, let's assume your clinic assistant follows first-aid procedures in your clinic and then seeks medical care in the nearest emergency room. The treating physician then performs a risk assessment and manages your employee according to British Columbia Centre for Disease Control guidelines [Box], which includes completing a Management of Percutaneous or Per mucosal Exposure to Blood and Body Fluid/Laboratory Requisition form.⁴

In this case, the emergency room physician would submit a Physician's First Report (Form 8)⁵ to WorkSafeBC, and a claim would be started. As the employer, you would submit an Employer's Report of Injury or Occupational Disease (Form 7)⁶ and complete an Employer Incident Investigation Report (Form 52E40).⁷

Scenario 2: You are performing a minor procedure on a patient at your clinic, and you sustain a needlestick injury

In this scenario, you are an incorporated physician and are paid through your corporation. Your corporation is registered with WorkSafeBC as required by law, which gives you the status of a worker at your corporation. As a worker, you would launch a claim with WorkSafeBC by calling Teleclaim at 1 888 967-5377.

See www.worksafebc.com/physician-guide-to-registration to learn when registering with WorkSafeBC is mandatory or optional for community physicians.

Scenario 3: Your patient sustains a percutaneous/parenteral exposure through a needlestick injury in their workplace, and you see them in your clinic after their emergency room visit

In this scenario, a risk assessment was done in the emergency room, and management involved postexposure prophylaxis and baseline blood testing, as well as follow-up with their primary care provider, you.

A Management of Percutaneous or Per mucosal Exposure to Blood and Body Fluid Letter for Follow-Up Physician⁸ would be sent to you, providing guidance on next steps and testing for your patient and relevant contact information. If a WorkSafeBC claim or Physician's First Report (Form 8)⁵ was not initiated, you would fill out a Form 8 to start a claim. If a Form 8 was completed by the emergency room physician, you as the primary care provider would also submit a Form 8 for your patient.

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This article is the opinion of WorkSafeBC and has not been peer reviewed by the BCMJ Editorial Board.

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To learn more

You can reach a medical advisor at WorkSafeBC through a RACE request by phone or app. Visit www.raceconnect.ca for more information.

If you have questions about registering with WorkSafeBC or about your coverage, contact WorkSafeBC’s Assessment Department at 1 888 922-2768, Monday to Friday, 8:30 a.m. to 4:30 p.m. You may also complete a Physician Registration Application (Form 1800PHPC),⁹ and a WorkSafeBC representative will respond. ■

—**Olivia Sampson, MD, CCFP, MPH, RCPSC, ABPM**
Manager, Medical Services, WorkSafeBC

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BOX. Guidance for health care workers on the assessment of risk and medical management of exposures.

The purpose of this article is *not* to detail the medical management of occupational blood and body fluid exposures.

For information on the appropriate risk assessment and clinical management recommendations for persons exposed to blood or body fluid in a health care or community setting, refer to the “Blood and Body Fluid Exposure Management” section in the British Columbia Centre for Disease Control *Communicable Disease Control* manual. (www.bccdc.ca/health-professionals/clinical-resources/communicable-disease-control-manual/communicable-disease-control)

For guidance on handling exposures in other settings, refer to the British Columbia Centre for Excellence in HIV/AIDS *HIV Post-Exposure Prophylaxis (PEP) Guidelines*. (www.bccfe.ca/publications/centre-documents/hiv-post-exposure-prophylaxis-pep-guidelines)

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Dr Lorne Gordon Irvine 1950–2024

Dr Lorne Gordon Irvine passed away peacefully at home on 23 February 2024. He was born in Estevan, Saskatchewan, to R. Keith and Phyllis Irvine on 13 September 1950.

Lorne graduated from Estevan Collegiate Institute in 1968, then went to the University of Saskatchewan to follow in his grandfather's and father's footsteps by becoming a pharmacist and returning to Estevan to work in the family pharmacy. Lorne returned to university a year later to pursue a career in medicine and graduated from the University of Saskatchewan College of Medicine in 1979. During medical school, he spent some time in Honolulu learning marine medicine, as well as training in scuba diving. He then started his family practice in Nanaimo, which also included marine medical certification.

Lorne enjoyed numerous activities, many of which he continued throughout his life. He was always physically active; even as a youth, he would run through the valley near his home. Lorne also enjoyed spending his childhood summers at White Bear (Carlyle) Lake, boating and swimming. His love of boats and water continued into his university days when he and his brother James would go on wilderness canoe trips in northern Saskatchewan.

Lorne continued running, taking long walks, playing squash, and skiing. He upgraded from a canoe to a small yacht, and he and his partner, Sandra, enjoyed many summers boating around the Gulf Islands, staying at various marinas. In winter months, they often chose the warmth of Mexico.

Lorne was very proud of his girls, Leah and Diane, and was so pleased to have them living within easy visiting distance. The birth of his first grandchild, William, also pleased him immensely. Watching William grow and seeing him celebrate his first birthday brought Lorne great joy.

Lorne is survived by his partner, Sandra Backman; daughters, Leah (Dave) and Diane (Jay); grandson, William; siblings, James (Trudy) Irvine, Betty (Glen) Trowell, Doreene (Ken) Menz, and Keith (Cheryl) Irvine; and stepdaughter, Lisa (Dan).

A celebration of life will be held on 11 May 2024 at the Nanaimo Yacht Club.

—Sandra Backman
Nanaimo

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Dr Charles Carpenter

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Dr William Anthony Cawkell

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Dr Ralph Marenus Christensen

4 June 1928–2 November 2023
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Dr David Douglas Cochrane

19 December 1950–17 February 2024
Obituary: www.springfieldfuneralhome.com/obituaries/cochrane-david-douglas-Dr/

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RECENTLY DECEASED PHYSICIANS

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Dr Warwick Llewellyn Evans

21 October 1950–2 July 2023

Dr Bruce Alan Fleming

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Obituary: <https://vancouver.sunandprovince.remembering.ca/obituary/bruce-fleming-1085830333>

Dr U. Pal Gareau

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Dr Arthur Adolf Shier

12 September 1934–15 April 2023

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Obituary: <https://apt.med.ubc.ca/news/we-have-sadly-lost-one-of-our-dear-colleagues-very-unexpectedly>

Dr Zahir Shamshudin Vellani

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Dr Margot Anne Walker

1 August 1947–13 May 2023

Dr Paul Julius Warbeck

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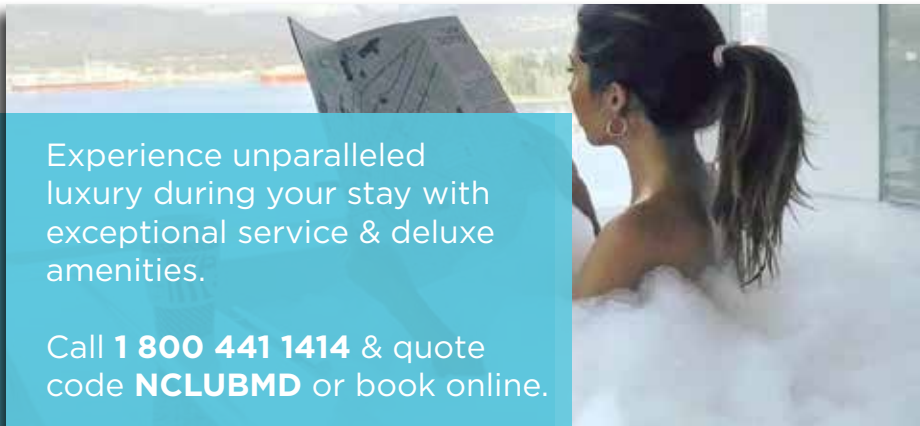
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