International Olympic Committee consensus statement on pain management in elite athletes

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ABSTRACT

Pain is a common problem among elite athletes and is frequently associated with sport injury. Both pain and injury interfere with the performance of elite athletes. There are currently no evidence-based or consensus-based guidelines for the management of pain in elite athletes. Typically, pain management consists of the provision of analgesics, rest and physical therapy. More appropriately, a treatment strategy should address all contributors to pain including underlying pathophysiology, biomechanical abnormalities and psychosocial issues, and should employ therapies providing optimal benefit and minimal harm. To advance the development of a more standardised, evidence-informed approach to pain management in elite athletes, an IOC Consensus Group critically evaluated the current state of the science and practice of pain management in sport and prepared recommendations for a more unified approach to this important topic.

BACKGROUND

The IOC convened a consensus meeting from 2 to 5 November 2016, at which experts reviewed the scientific literature addressing pain management in elite athletes. We searched for and analysed current best evidence, with the aim of reaching a consensus regarding the quality of the evidence in order to provide guidance for clinical practice and athlete management.

The group was charged with the following

- to review the literature describing pharmacological and non-pharmacological treatments for the management of pain in elite athletes
- to review the literature on the physiology of pain related to sport injury
- to establish core ethical and clinical principles for the management of pain in elite athletes
- to provide a sound rationale for the best-practice management of pain in elite athletes
- to provide a rationale for the prohibition of certain analgesics and the basis for appropriately granting Therapeutic Use Exemptions for their use
- to provide a review of the risks and benefits of the use of analgesic medications in sport including short-term strategies to permit competition with optimal pain management.

This consensus paper fulfils the IOC charge by addressing the multifaceted aspects of pain physiology and pain management in elite athletes through the lenses of epidemiology, sports medicine, pain medicine, pain psychology, pharmacology and ethics.

PREVALENCE OF USE OF PHARMACOLOGICAL AND NON-PHARMACOLOGICAL TREATMENTS TO MANAGE PAIN IN ELITE ATHLETES

Elite athletes commonly use prescription and over-the-counter analgesics to prevent or relieve pain.[1–18] These have typically included: oral non-steroidal anti-inflammatory drugs (NSAIDs),[2 4 6 16 17] injectable NSAIDs,[5] other non-opioid analgesics,[1 4 8 9] opioid analgesics,[1 3 4 7 8 10 18] injectable and transdermal anaesthetics[11] and other medications and over-the-counter supplements.[1 3 12–15]

Despite the perception that the use of medications and non-pharmacological strategies to relieve and prevent pain is widespread in sport,[8 9 12] we could identify no comprehensive assessment of the frequency and effects of such use among elite athletes. Accordingly, a systematic literature review focusing on elite athletes' use of medications for pain was completed. The results are presented in detail in a separate article (Harle CA, Danielson EC, Smith L, et al. Analgesic management of pain in elite athletes: A systematic review. 2017, personal communication). A survey completed by team physicians during the 2016 Summer Olympics in Rio de Janeiro provides insight into physician prescribing patterns and is attached in supplementary online appendix A.

TYPES OF PAIN

'Pain management' includes a general understanding of pain physiology, including types of pain. By understanding types of pain, the clinician can better recommend an appropriate treatment plan. For a detailed discussion of core principles of pain physiology and pain management, the reader is referred to an accompanying article on this subject.

Pain is an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage.[19] (See supplementary online appendix B for definitions of key terminology.) Pain can be classified as nociceptive, neuropathic or nociplastic/algopathic/nocipathic.[19–22] *Nociceptive pain* refers to

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pain clearly associated with tissue damage or inflammation.[19 20] This is the type of pain most commonly associated with sport injury.[19 22] *Inflammatory pain* is a type of nociceptive pain that results from the activation and sensitisation of nociceptors by inflammatory mediators[20] and is common in acute traumatic sport injury with associated swelling and inflammation.[20] *Neuropathic pain* results from a lesion or disease in the somatosensory nervous system[19] and is common in Paralympic athletes with spinal cord injury.[23] A third type of pain is common among individuals with chronic pain. These individuals have chronic pain that is neither nociceptive nor neuropathic but associated with clinical and psychophysical findings (hypersensitivity) that suggest altered nociceptive functioning (eg, as in fibromyalgia, non-specific low back pain). Terms proposed for this third type of pain include *nociplastic*, *algopathic* and *nocipathic*.[22] Studies in athlete populations are lacking, but it is plausible that pain in the immediate aftermath of most sport injuries is nociceptive associated with tissue damage, and nociplastic/algopathic/nocipathic pain may develop after injury and may be seen in athletes with chronic pain.

MECHANISMS AND TYPES OF INJURY

The IOC has defined *sports injury* as new or recurring musculoskeletal complaints incurred during competition or training that require medical attention, regardless of the potential absence from competition or training.[24] Others have suggested that a definition of sports injury should require restricted activity for at least 1 day.[25] (See appendix B for definitions of key terminology.)

Acute traumatic injury refers to a single event that leads to a singular macrotrauma on previously healthy tissue.[26] Acute traumatic injury in the athlete may be accompanied by fear, anxiety and heightened cognitive focus on the injury.[27]

Overuse injuries occur from repetitive submaximal loading of the musculoskeletal system when inadequate recovery has not allowed structural adaptation to occur.[28 29] Injury, then, is the outcome of the difference between the volume and intensity of the stress or force applied to the body and the body's ability to dissipate this stress or force. Injury may result from repetitive microtrauma imposed on otherwise healthy tissue or repeated application of lesser forces to already damaged tissue. In essence, athletes are not training at an optimal workload to build physical capacity and resilience to the demands of the sport.[30 31]

Subacute recurrent injuries and chronic degenerative conditions may form a continuum with overuse injuries. A recurrent injury is an incident of the same type and at the same site linked to an index incident, which occurs after an athlete's return to full function and participation from the recorded index incident.[32] Although degenerative conditions may develop independent of sport injury, some result from prior acute or repetitive overuse injuries and manifest as a chronic overuse injury.[33]

CORE PRINCIPLES OF MAKING A DIAGNOSIS IN ELITE ATHLETES IN PAIN

Sports medicine commonly focuses on the diagnosis and management of sport-related injury. Pain medicine focuses on the diagnosis and management of pain disorders. Importantly, injury may occur without pain, and pain may present without evidence of injury. When performing a history and examination of an elite athlete in pain, the sports medicine clinician should discern if there is an injury that reasonably accounts for pain. Pain management and injury management are not necessarily identical, as discussed in detail in this paper. Supplementary online appendix C provides an overview of core principles of diagnosis in elite athletes in pain.

NON-PHARMACOLOGICAL PAIN MANAGEMENT STRATEGIES IN ELITE ATHLETES

Non-pharmacological pain management should be considered in the earliest stages of pain and is essential in pain management beyond the acute phase. Pain is a subjective experience dependent on complex interactions of neurobiological, cognitive, affective, contextual and environmental factors. Thus, pain management depends on identifying contributory factors from biological, psychosocial and contextual domains and addressing them through various evidence-based techniques.[34–36] Educating the athlete regarding the role of the central nervous system in pain, especially in chronic pain, can increase receptivity of the athlete to a biopsychosocial approach to pain management.[34]

Physical therapy is important for most pain problems, especially in subacute and chronic phases.[37–39] In addition to therapy targeted at increasing strength, stamina, and endurance, and at correcting biomechanical contributors to pain and injury, trained and informed physical therapists can act as front-line clinicians who identify and address inaccurate conceptualisations of pain and injury plus psychosocial and contextual influences on pain.[40–43] Psychological strategies, which can begin immediately after injury, also target pain management directly through training in skills such as muscle relaxation and imagery, as well as indirectly by identifying and addressing an athlete's worries and concerns, any comorbid mental health disorders and environmental factors relevant to recovery and return to play (RTP).[44 45]

Modalities and massage

Various modalities and massage have traditionally been the mainstays of physical therapy for pain.[37–39 46–49] The Rio Survey indicated that over 75% of physicians surveyed used physical therapy for pain management (appendix A). Recent studies, however, show that many physical therapy techniques have no clear benefit beyond non-specific effects and natural history, with some exceptions. Low-level laser therapy may be beneficial in treating tendinopathy and improving acute muscle recovery.[50–54] Although cryotherapy is commonly used, there is little evidence from prospective studies assessing the benefit of this intervention.[54–56] Ultrasound therapy may have a limited role in managing plantar fasciitis[56] but has not demonstrated effectiveness in other studies.[57] Electrical stimulation,[49 58–60] massage therapy,[48 61–63] myofascial trigger point treatments[64–67] and acupuncture[68–70] have not shown reliable and consistent efficacy for relief of pain resulting from musculoskeletal injury.

The effects of modalities may be manifest in an individually specific way, especially as it pertains to the skill of the treating clinician.[61 71–75] That is, the patient's and the clinician's expectations and skill, respectively, about a particular treatment's mechanism and effects are potentially powerful determinants of outcome.[76–78] The practitioner needs to balance the relative weight of expectation of benefit (and therefore likely benefit) with potential risk.

Movement, strength and conditioning

Movement and exercise may have pain-relieving effects.[79 80] Strength training and conditioning are effective as rehabilitation tools after injury. They can also be helpful in managing pain and reversing deconditioning in individuals with chronic painful conditions such as osteoarthritis,[81–84] fibromyalgia[85–92] and chronic musculoskeletal pain.[93 94] Exercise can activate

endogenous opioid[95] and cannabinoid systems,[96] induce an anti-inflammatory state[97] and activate antinociceptive pathways.[95 98–101] Isometric exercise can promote intracortical inhibition (which downregulates brain networks that subserve pain) and may offer significant pain-relieving benefits beyond those offered by isotonic and eccentric exercises for managing tendinopathy.[102–104] Although data from athletes are lacking, there is evidence in other pain populations (particularly chronic pain) that movement and exercise-based approaches can improve patient self-efficacy for managing pain and fear of (re)injury.[34 44]

Psychosocial interventions

Psychosocial interventions with possible efficacy in sports rehabilitation include skills training in goal setting, imagery, relaxation and positive self-statements.[105] Stress inoculation training was shown to reduce anxiety, pain and days to recovery after arthroscopic surgery for meniscus injury.[106] Other interventions relevant to athletes include cognitive restructuring (identifying and challenging negatively biased appraisals) and developing plans for maintaining treatment gains and coping with setbacks and pain flare-ups.[105] These strategies are broadly categorised as cognitive–behavioural therapies (CBTs). CBT is the prevailing psychosocial treatment for chronic pain problems, and there is high-level evidence of its efficacy in reducing pain and pain-related disability in studies of non-athletes.[105 107 108] Psychologically informed physical therapy, which incorporates cognitive and behavioural principles and strategies (eg, techniques to reduce fear-avoidance, use of graded activity and exposure techniques), and education about pain during physical rehabilitation, is a promising approach with some evidence supporting its use.[34 109] Psychological assessment and intervention by a specialist should be normalised by the treatment and coaching team, so that it can be implemented when necessary and without stigma.

Sleep and nutrition

Disordered sleep is common among athletes, both when recovering from injury and during the competition and training seasons.[110 111] Sleep and pain have a reciprocal relationship—pain disturbs sleep, and poor sleep quality or duration increases pain levels in clinical populations and decreases pain thresholds in otherwise healthy people.[112–118] Addressing sleep disorders could improve performance and the general health of the athlete.[111] Psychological strategies including CBT,[119] self-hypnosis[120] and mindfulness-based stress reduction[121] show significant potential to improve sleep in non-athletes. CBT for insomnia has demonstrated efficacy.[122–124] Studies in athlete populations are lacking, but it is plausible that these results would be generalisable to athletes.

Persistent pain is influenced by any proinflammatory load,[125] which makes nutrition possibly relevant to managing pain in athletes. However, studies demonstrating benefit from nutritional supplements are not methodologically sound and have unclear relevance to elite athletes.[126–138] Furthermore, supplements are poorly regulated and may contain banned substances. Consequently, supplements cannot currently be recommended as part of pain management for elite athletes.

Surgery

Elective surgery has no place in the treatment of pain itself but may address structural damage non-responsive to non-operative treatment, or to avoid further impairment of an athlete's health.[139] An operation for a chronic injury and pain condition must aim to correct a structural problem that influences pain and functional limitations[140–142] and should occur as part of a multifaceted, biopsychosocial management approach.[143] Surgical intervention includes setting individual treatment and outcome goals for the athlete. The athlete must have a complete understanding of the risks and benefits and accurate expectations about postsurgical recovery and pain. When appropriate, surgery can be part of a multidisciplinary approach for pain reduction. Surgery should not be performed to treat chronic pain simply because all other interventions have failed but should rather be used when a structural problem associated with the pain has been identified.[139]

PHARMACOLOGICAL PAIN MANAGEMENT STRATEGIES IN ELITE ATHLETES

Guiding principles

Appropriate and effective pain management requires a thoughtful and individualised approach to evaluation and care, including an assessment of the implications of treatment for both short-term and long-term health.[144] The prescription, or provision, of medication is common to the management of pain in elite athletes. Analgesic medications should be used in accordance with relevant regulations and the general guidelines for their safe and efficacious use.[145] The core pharmacological principles of pain management in elite athletes include:

- Medication prescription should be only ***one*** component of managing pain. Combining medication use with appropriate non-pharmacological measures limits disability and optimises probability of improvement.
- Medications should be prescribed at the lowest effective dose for the shortest period of time. They should be discontinued if they are ineffective or not tolerated, and as the pain from the injury resolves.
- Medications should be prescribed in a manner consistent with established, recognised pharmacological and pharmacodynamic principles, including route of administration, time of onset of action, effectiveness for pain relief and potential side effects and complications. Consideration of an athlete's medical and medication history is essential.
- Physicians prescribing analgesic medications to athletes should possess a complete understanding of the prevailing rules and regulations regarding prohibited substances and Therapeutic Use Exemptions specific to the governing body that controls the athlete's sport.
- Recording athlete-reported severity of pain (eg, with a numerical rating scale) can be useful in monitoring the effectiveness of a medication.
- Prescription medications should only be provided to athletes by licenced healthcare providers who understand potential side effects or misuse of medications, and whose licensure includes this scope of practice. Written documentation of each assessment and prescription is a basic standard of care.
- Informed consent is fundamental in medical care, including those situations in which medication is prescribed. This is also true for care of the elite athlete; however, obtaining such consent can be challenging in competitive situations when an athlete seeks same-day RTP. At a minimum, any substantial risk of short-term or long-term worsening of an injury should be discussed and documented.
- Medications should not be prescribed to athletes for pain or injury prevention.

Table 1 Medications for managing acute, severe pain from a severe injury that does not allow same-day return to play

Intravenous	► Morphine (10 mg) ► Fentanyl (100 mcg, titrated to effect)
Inhalation	► Entonox/Nitronox (inhaled 50:50 oxygen and nitrous oxide mixture) ► Methoxyflurane/penthrox
Intranasal	► Diamorphine (1600 mcg in commercially available administrator) ► Fentanyl (100 mcg administered via nasal syringe adapter)

MEDICATION MANAGEMENT BASED ON PAIN SEVERITY AND ANTICIPATED RTP

I. Medications for managing acute pain in the elite athlete on the same day as the injury: on the field of play, sideline or locker room

Physicians providing care at a practice or game/match scenario should have a comprehensive emergency medical action plan, including provisions for acute pain management.[146] Pain management may depend on whether same-day RTP is contemplated.

No same-day RTP

A major acute injury with associated *severe pain* may require pain management on the field of play or on the sidelines (table 1). Extending the hospital emergency department onto the field of play may be necessary. The severely injured athlete must receive effective pain treatment as soon as possible, and certainly before any prehospital treatment (eg, manipulation or splinting) is attempted.[146]

Same-day RTP

Medications may play a central role in the management of an athlete with acute pain who is considered for same-day RTP. Paracetamol, NSAIDs and local anaesthetics are commonly employed in such situations[147–157] (table 2). Knowledge of relevant pharmacokinetics, including time to onset of action and plasma concentrations, is valuable. The primary determinant when providing analgesics in same-day RTP situations is the athlete's safety.[145 156] Analgesia that allows competition should not place the athlete at risk of worsening injury.

Table 2 Medication management for acute pain and same-day return to play

Mild to moderate pain	
Paracetamol (oral)	Loading dose up to 2 g, then 325–1000 mg PO every 4–6 hours, up to 4 g per 24 hours
NSAIDs (oral)	► Ibuprofen: 400–800 mg every 4–6 hours with food, up to 3200 mg per 24 hours ► Naproxen: 250–500 mg 2× daily with food ► Ketorolac: 10 mg every 4–6 hours with food, up to 40 mg per 24 hours ► Celecoxib: 200–400 mg 2× daily ► Etoricoxib: 90–120 mg once daily
Topical analgesics	► Rubefacients: methyl salicylate; turpentine oil; ammonia water ► Cooling sensation: camphor; menthol ► Vasodilation: histamine dihydrochloride; methyl nicotinate ► Irritation without rebefaction: capsaicin; capsicum oleoresin
Moderate to severe pain	
NSAIDs (injection)	Ketorolac: 15–30 mg IM or IV up to 4×/day, at least 6 hours apart, or a single 60 mg injection
Local anaesthetic injections	

IV, intravenous; NSAIDs, non-steroidal anti-inflammatory drugs; IM, intramuscular; PO, oral.

For *mild to moderate pain*, paracetamol, alone or with NSAIDs, will usually suffice.[152 157] Paracetamol does not have an effect on the gastric mucosa, renal function or platelet activity–considerations that should figure prominently in prescribing analgesic medication to those participating in sport.[158] NSAIDs may be slightly more analgesic than paracetamol[159] and together provide more pain relief than either alone.[157 160] It is important that paracetamol be given in sufficient dosing, including a 2 g loading dose and 1 g every 4–6 hours thereafter, as needed.[161] Intramuscular ketorolac has been widely used in certain elite sports because of possible greater analgesic efficacy without significant reported side effects,[5] although concerns remain[162] and prescribing recommendations are narrow.[5 163] If the injury develops with an ongoing haematoma, ketorolac and traditional NSAIDs may worsen the bleeding, whereas this is no concern with paracetamol or a COX-2 selective NSAID.[164] Topical anaesthetics may provide relief of well-localised, more superficial conditions such as intercostal pain.[156]

For moderate to severe pain, paracetamol and NSAIDs remain an option, including paracetamol with ketorolac. Opioid use in an opioid-naïve individual is usually associated with cognitive, behavioural and reaction-time effects detrimental to individual performance[165 166] and may theoretically place other athletes at risk in sports that require quick reaction time in a crowded space (cycling and basketball). There is no compelling evidence demonstrating that opioids such as tramadol and codeine provide pain relief that is superior to NSAIDs.[154] Tramadol can also impair reaction time in tramadol-naïve individuals.[154] Thus, opioids have little or no role in same-day RTP; if anything, they are ergolytic, not ergogenic.

Injected local anaesthetics have also been used for moderate to severe pain and same-day RTP in elite athletes, either pregame or during competition.[151 153] There are some limited data from a case series of National Rugby League players.[153] Most governing bodies, including the World Anti-Doping Agency (WADA), have not banned these injections.[167] Intra-articular injections of local anaesthetic should be avoided into weight-bearing joints or as intratendon or intraligament injections.[151 153]

Corticosteroid injections have no role for same-day RTP. They do not provide pain relief superior to that of local anaesthetics[168 169] and can cause acute muscle/tendon weakening, thereby increasing the chance of injury.[168–171] Other injections, such as platelet-rich plasma (PRP) and intra-articular viscosupplementation, are not useful for same-day RTP.[172–175]

II. Medications for managing mild to moderate acute pain in the elite athlete beyond the day of injury

Medications should not be prescribed as a stand-alone treatment when managing acute pain beyond same-day RTP in athletes.[144] It is essential to diagnose the injury *and* the cause of pain and to begin rehabilitation that addresses both. Thus, non-pharmacological strategies should begin immediately.

Medications for acute pain should normally not be used for more than 5 days.[150 176 177] The Rio Survey (supplementary online appendix A) indicated that 31% of physicians usually prescribe NSAIDs for 1–2 days' duration, 42% prescribe a 3–5 day course and 21% prescribe NSAIDs for longer than 7 days. Even for more severe injuries with associated moderate to severe pain, medications should be re-evaluated if pain persists beyond 10 days. The process should address the underlying injury or pathology

Box 1 Medication management for acute pain (pain duration less than 4–6 weeks) beyond the day of injury

Mild to moderate pain

Oral paracetamol, non-steroidal anti-inflammatory drugs, topical analgesics, as per table 2.

Corticosteroid injections (equivocal evidence):

- Intra-articular
- Bursal
- Peritendinous
- Epidural
- Facet
- Sacroiliac

Severe pain commensurate with injury

Consider adding opioids:

- Initial prescription not to exceed 5 days
- No opioid prescription beyond 10 days

and the possibility that pain characteristics are changing (see below).[150 177]

The most appropriate medications for treating mild to moderate acute pain in the elite athlete beyond the day of injury include oral paracetamol and oral NSAIDs.[150 156 157] (box 1) Both provide good pain relief, but the risk–benefit profile is considerably different. Paracetamol is a non-specific analgesic without anti-inflammatory agents and usually lacks other systemic side-effects when used in prescription doses. Hepatotoxicity occurs in daily doses greater than 4 g.[158]

The choice of paracetamol versus NSAIDs[147] may have more to do with physician preference in using one medication or another. NSAIDs may be slightly more analgesic than paracetamol,[159] but together provide more pain relief than either alone.[157 160] If there is no known inflammatory contributor to pain, paracetamol is preferable to an NSAID because of its lower risk profile in the majority of people.[150]

Corticosteroid injections must be coordinated carefully with other aspects of rehabilitation, since their suppression of the inflammatory cascade may hinder tissue healing.[172 173] Their pain-relieving effects may result in worsening of the injury if the exercise programme exceeds the capacity of the injured tissue.[172 173] Overall, the evidence suggests that corticosteroid injections may provide pain relief and hasten rehabilitation but do not improve tissue healing.[178–189] The incidence of complications of corticosteroid injection in treating athletic injuries is unknown.[168 170 171]

Two other types of injection therapies used are PRP therapy and viscosupplementation. PRP has been used to address a variety of conditions ranging from acute muscle injury to tendinopathy to osteoarthritis. The literature on the efficacy of PRP has been hampered by methodological limitations. Although some encouraging results have been reported, more large, methodologically rigorous randomised, double-blinded studies are needed before endorsing this treatment.[174 175 190–197] Viscosupplementation has been most studied in the treatment of knee osteoarthritis. The highest quality randomised controlled studies show only mild pain relief and functional improvement compared with placebo injections.[198 199]

III. Use of medications for managing severe acute pain in the elite athlete beyond the day of injury

When an athlete has severe acute pain, relief of pain is not only humane but may be necessary to facilitate early mobilisation.[200 201] The Rio Survey indicated that 71% of the Olympic team physicians surveyed considered the ability to enable rehabilitation exercises to be an important factor when forming a treatment plan for an athlete (supplementary online appendix A). It is reasonable to begin treatment with paracetamol and/or NSAIDs, as indicated.[147–150 202 203] Injection medications may also be considered.[172 173]

In a dose-dependent manner, opioids are the most effective medications for severe acute pain.[204–207] However, many risks are associated with opioid use. Thus, before prescribing opioids, the physician should[208–213]:

- make a diagnosis that includes assessment of pain and its relationship to the injury, including whether the athlete's pain seems appropriate for the injury
- establish and measure goals for pain relief and improved function
- assess current status and personal history with respect to mental health and alcohol and other substance use, validate such history with other health professionals involved in the patient's care if necessary and incorporate strategies to mitigate risks of opioid use
- Begin first-line non-opioid therapy and evaluate adherence to and effectiveness of the treatment before considering initiation of opioid therapy unless pain is severe and clearly associated with an injury consistent with that level of pain
- prescribe the lowest effective dose and limit prescription of opioids to 5 days. Ongoing use can be reconsidered but should rarely exceed 10 days and should be accompanied by informed consent regarding the risks of opioid dependence or addiction as well as overdose, especially if used in combination with alcohol or benzodiazepines.
- opioid use beyond 10 days should be considered with caution. Opioid therapy is rarely appropriate for longer than 10 days after an acute painful injury. Risks increase substantially with the number of days opioids are used. Opioid use for more than 7 days after painful musculoskeletal work injury has been associated with increased odds of disability 1 year later.[214] The likelihood of chronic opioid use increases with each additional day of medication supplied starting with the third day, with the sharpest increase in chronic opioid use observed after the 5th day on therapy, a second prescription or refill and an initial 10-day or 30-day supply.[215] If opioids are prescribed for more than 10 days, it is essential to have a plan in place for limiting risk of diversion and a plan and timeline for discontinuing opioid use.

IV. Medications for managing subacute and chronic pain in the elite athlete

Pain associated with sport injury may be acute (up to 6 weeks), subacute (6–12 weeks) or chronic (3 months or longer).[216] When pain has persisted beyond 6 weeks of an injury or inciting event, the influences on pain and disability should be re-explored. In most cases, there is no sound rationale for long-term use of NSAIDs for pain management in elite athletes.[150 176 177] Although paracetamol may be used intermittently, there is no strong rationale for using this class of medication beyond the acute period.[150] Considerable caution should be used in considering the use of opioid medication to treat subacute or chronic pain, given the serious risks and lack of evidence regarding benefits associated with long-term use.[208 209] Importantly, individuals whose pain has not responded to treatment and who develop subacute and chronic pain have a

Table 3 Acute, subacute and chronic pain: definitions and treatment implications

Pain duration	Type of pain	Treatment considerations
<6 weeks	Acute	Treatment focused on treating injury and managing pain, including identifying possible psychosocial and environmental factors influencing pain.
6–12 weeks	Subacute	Approach shifts from management of acute pain to improving function and preventing chronic pain and associated disability.
>12 weeks	Chronic	Identify and continue to address psychosocial/environmental factors influencing pain, disability and dysfunction. Focus should be on improving function.

higher risk profile for addiction and comorbid psychiatric conditions.[204 207–212]

Perhaps the most important consideration in managing subacute and chronic pain in elite athletes is to shift the treatment approach from relieving pain to improving function and preventing chronic pain and associated disability (table 3). Treatment should involve a multidisciplinary approach.[217–220] Analgesic medications used to treat acute pain in elite athletes should rarely be used for subacute and chronic pain. Athletes should be informed that analgesic medications carry risks, especially when used long term.[221–224]

Chronic pain may be associated with psychosocial factors, including mood and sleep disturbance, fear of pain and reinjury, avoidance of activities believed to increase pain or cause physical harm, concern about not achieving pre-injury level of proficiency and perception of being disconnected from coaches and teammates.[40–45 225] It is especially important to address the common comorbid conditions of depression, anxiety and sleep disorder.[221 222]

Before beginning adjuvant medications for chronic pain, if possible the athlete should be evaluated by a clinician with experience in managing chronic pain.[218] Consideration should be given to pain being driven by peripheral nociceptive activation versus neuropathic or nociplastic/algopathic/nocipathic pain. The most commonly used adjuvants for treating chronic, neuropathic or nociplastic/algopathic/nocipathic pain are anticonvulsants and antidepressants[221 226–231] (table 4). Caution must be applied for treating adolescent elite athletes with adjuvant medications. For more localised pain, second-line medications include capsaicin patches (8%) and lidocaine patches. Tramadol may have a role in some cases of chronic pain because of its dual mechanism of action as a weak opioid and an upregulator of the serotonin system, but more research is needed to increase knowledge of benefits and risks.[228]

V. The special case of cannabinoids

A cannabinoid is one of a class of diverse chemical compounds that activates the endogenous endocannabinoid system.[232] Exogenous cannabinoids include phytocannabinoids such as tetrahydrocannabinol and cannabidiol, and synthetic cannabinoids such as K2 and 'spice'. Cannabis has been cited as possibly a useful substance for pain management.[233–235] Indeed, it has been said in the popular press that cannabis is safer than opioids and should be used instead of opioids for managing chronic musculoskeletal pain in American football players.[236] However, current evidence suggests that opioids should rarely be prescribed for chronic musculoskeletal pain,[208–212] and evidence is lacking concerning the benefits and risks of cannabis for chronic musculoskeletal pain management. Cannabis has no role in the management of severe acute pain, as no studies have demonstrated its efficacy in this situation.[237]

Cannabinoids have been studied for treatment of pain conditions including neuropathic pain, fibromyalgia, spinal cord injury, spasticity from multiple sclerosis, HIV neuropathy and cancer pain. In general, the studies are short term and small and show minor or modest improvement in pain relief.[238 239] There is good evidence that cannabinoids have a modest analgesic effect for some pain conditions such as, for example, refractory neuropathic pain.[240 241] Cannabinoids are considered possible third-line agents for some chronic pain conditions.[242] Cannabinoids are considered ergolytic,[242] and like opioids, carry risks, including addiction. In summary, current evidence does not justify the use of cannabinoids for pain management in elite athletes.

PAIN MANAGEMENT STRATEGIES WHEN EXPECTED RECOVERY IS DELAYED

It should be kept in mind that pain is a conscious experience that can be influenced by a variety of factors, including nociceptive activity and cognitive and affective factors. Pain is not necessarily related in a linear manner to nociceptive input.[23] Optimal clinical management continually evaluates these various influences on pain independent of injury. Unique considerations for the elite athlete in pain relate to competitive requirements and demands

Table 4 Selected adjuvant medications for neuropathic and nociplastic/algopathic/nocipathic pain in adults*

First-line medications	Total daily dose and dose regimen
Anticonvulsants	
Gabapentin	Begin at 100–300 mg 1–3×/day; may be increased to 1200–3600 mg/day in three divided doses
Pregabalin	Begin at 25 to 75 mg 1–2×/day; may be increased up to a dose of 150–600 mg/day in divided doses
Antidepressants	
Serotonin–noradrenaline reuptake inhibitors: duloxetine	Begin at 20 to 30 mg 1×/day; may be increased up to 120 mg 1×/day
Serotonin–noradrenaline reuptake inhibitors: venlafaxine ER	Begin at 37.5–75 mg 1×/day; may be increased to 225 mg 1×/day or in divided doses
Tricyclic: amitriptyline or nortriptyline	Begin at 10–20 mg at night; may be increased to 150 mg at night
Second-line medications	**Total daily dose and dose regimen**
Capsaicin 8% patches	1–4 patches to painful area for 30–60 min q 3 months
Lidocaine patches	1–3 patches to painful region 1×/day for up to 12 hours and then off for 12 hours
Tramadol	50–400 mg 2–3×/day

*There are many elite athletes who are teenagers and young adults, and an expert in managing this population should be consulted before beginning anticonvulsants or antidepressants for pain management.

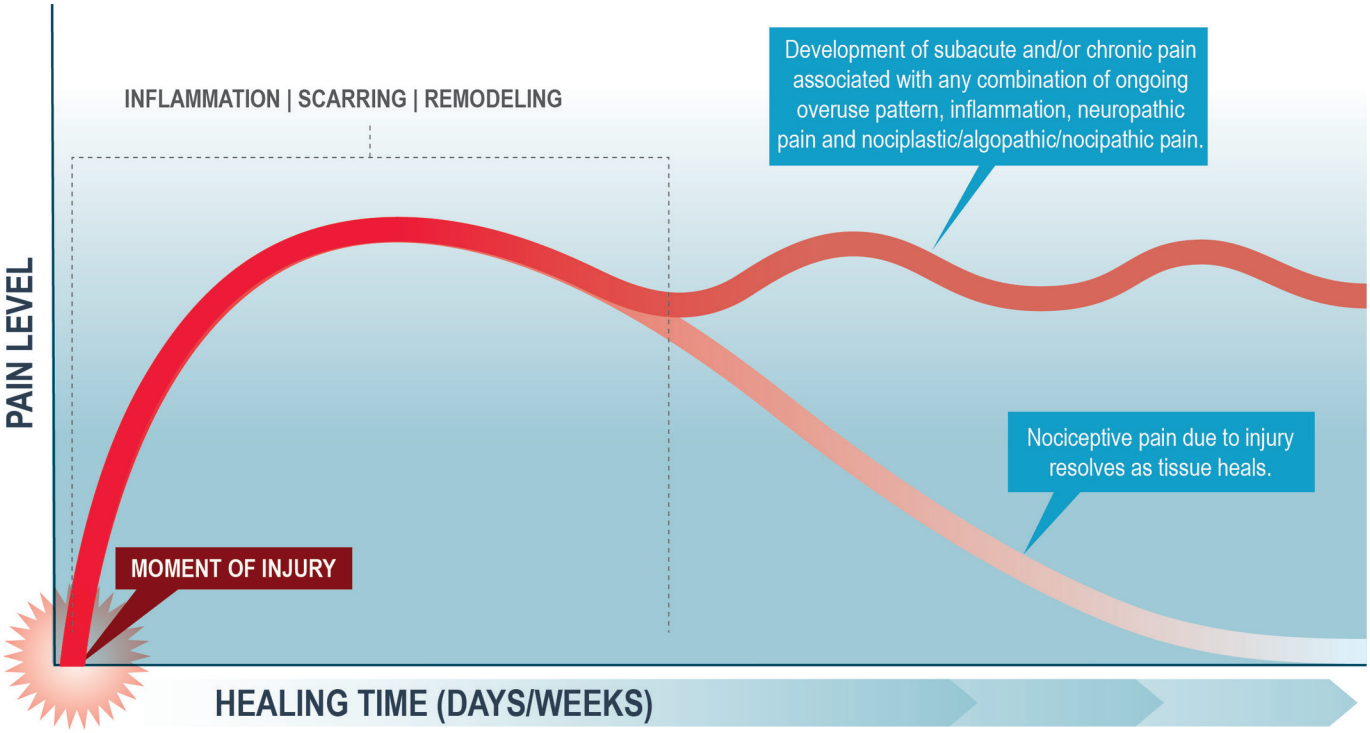

Figure 1 Pain variation following injury based on influences of pain. Adapted with permission, Butler DS and Moseley GL: *Explain Pain*, 2nd Edition, Noigroup Publications, 2013.

and relationships between the athlete and his/her professional and medical teams. The motivation of elite athletes to maximise bodily performance is another factor in pain assessment and has important implications for management in a clinically optimal and ethically appropriate manner.[40–45 225]

Pain management plans should be communicated openly with the athlete and all those involved in management of the athlete's injury, recovery and RTP. A plan for reassessment at critical time points should be established and clearly communicated to all parties, especially when athletes change their treating team during their recovery. This protocol should include the plan for injury and pain management and information about the predicted time course of pain, rehabilitation and key milestones.[200]

In the acute phase, emphasis should be on reassuring the athlete and providing education about realistic expectations, the normal course of the injury and associated pain (figure 1).[27 243] The athlete should understand his/her role in optimising recovery. Accurate injury diagnosis underpins expectations about the path to recovery and pain resolution. Most athletes will recover from injury in the predicted manner.[244] However, monitoring recovery closely, quickly identifying any deviation from the predicted path (figure 1) and re-assessing if recovery is not occurring as predicted are all of critical importance.

There is ample literature and clinical experience regarding anticipated recovery from many sport injuries.[244–251] Box 2 provides a checklist that can be used clinically to evaluate need for further assessment. When pain fails to improve as expected, or changes in its distribution or quality, a prompt reevaluation is indicated, with three distinct but related objectives: (1) determination of whether the initial diagnosis is correct; (2) determination of whether the *injury* is healing as expected; and (3) identification of important non-injury factors that may be influencing the pain. Each objective may require assessment by a different clinician, further imaging or other testing. In most cases, the physical therapist (or other treating clinician such as athletic trainer) should be involved in monitoring recovery milestones, minimising impact of the injury and optimising return to performance. When the athlete's pain interferes with recovery in an atypical manner, the physical therapist and other treating clinicians must assess and respond to possible contributors, including biomechanics and the kinetic chain continuum, and psychosocial and contextual domains.[23 252 253]

There are two clear triggers for involving psychological assessment and treatment: (1) the clinician may identify psychosocial issues likely contributing to poor recovery and requiring a specialist; or (2) pain and function have not improved as expected within a few weeks after injury.[27 246 247 250 251] A psychologist can assess modifiable psychosocial influences on pain, treatment adherence and pain-related performance issues, and work with the athlete to address these barriers to recovery. Key psychosocial factors associated with poor treatment adherence and outcomes after sport injury include mood

Box 2 Checklist to assess need for further evaluation

(Positive response indicates risk of deviation from the predicted path to recovery)

- Is the pain worsening, spreading or both?
- Is pain occurring at rest or during the night?
- Has any new pain emerged in other anatomical locations?
- Does the pain fluctuate in a manner not explained by mechanical load?
- Does the pain seem out of proportion to the severity of the injury?
- Is the quality of the pain changing or is the pain becoming more distressing?
- Has the athlete's expectations of recovery changed for the worse?

Table 5 2017 WADA Prohibited List

Prohibited at all times	
Prohibited substances	► S0: Non-approved substances ► S1: Anabolic agents ► S2: Peptide hormones, growth factors, related substance and mimetics ► S3: Beta-2 agonists ► S4: Hormone and metabolic modulators ► S5: Diuretics and masking agents
Prohibited methods	► M1: Manipulation of blood and blood components ► M2: Chemical and physical manipulation ► M3: Gene doping
Prohibited in competition only	
Prohibited substances in all sports	► Stimulants ► Narcotics ► Buprenorphine; dextromoramide; diamorphine (heroin); fentanyl and its derivatives; hydromorphone; methadone; morphine; nicomorphine; oxycodone; oxymorphone; pentazocine; pethidine ► Cannabinoids ► Glucocorticoids
Prohibited substances in select sports	► Alcohol ► Beta-blockers

WADA, World Anti-Doping Agency.

disturbance, fear of reinjury, concern about not achieving preinjury level of proficiency and feeling disconnected from coaches and teammates.[19 23 252–255] Other more general psychosocial influences include anxiety, stress, catastrophising (excessively negative appraisals of pain and its implications), depression and maladaptive fear of pain and re-injury and consequent avoidance of activities believed to increase pain, cause physical harm or both.[23 41 43 225 253] Finally, other mental health problems (eg, eating or substance use disorders) can also impede recovery and require a psychologist's intervention. The assessment must also evaluate the context and meaning of the prolonged pain and slow return to performance.[251 256–258]

ANTIDOPING ISSUES IN PAIN MANAGEMENT

'Narcotic Analgesics' was a category of the initial IOC 'Prohibited' list.[167] The 'Narcotics' section was retained in the 'Prohibited List' developed by the WADA, its IOC successor (see table 5). Cannabis was also added to the WADA Prohibited List. Despite public perception that analgesic use might allow athletes to enhance performance, there is scant evidence to support this hypothesis, as noted below.

Substances or categories may be added or subtracted to the Prohibited List annually, via a process that includes extensive stakeholder feedback and deliberation by experts, based on the latest scientific evidence available. A substance will be considered for inclusion in the Prohibited List if it meets two out of the three following criteria:

- Use of the substance would enhance or has the potential to enhance sport performance.
- Use of the substance poses an actual or potential health risk.
- Use of the substance would be seen as contrary to the 'spirit of sport'.

Therapeutic Use Exemptions (TUEs) allow the use of a prohibited substance to treat legitimate medical conditions or injury.[259] The criteria for granting a TUE include the following:

- The absence of treatment would pose a significant detriment to the athlete's health.
- Treatment will produce no performance-enhancing effect, other than the return to the athlete's normal state of health.
- No reasonable permitted therapeutic alternative exists.

TUEs can also be provided retroactively, if the treatment was provided in an acute situation. Retroactive TUEs are also allowed under exceptional circumstances, such as insufficient opportunity to submit an application.

There is limited literature to suggest that any analgesics enhance performance. Small, unblinded studies typically involving non-elite subjects have suggested that paracetamol can improve time to exhaustion[260] or decrease perceived exertion in a graded run.[261 262] NSAIDs have no effect on sprinting,[263] vertical jumping or endurance running performance but can decrease soreness.[2 263–265] Opioids can decrease pain[265] and increase anaerobic performance[265] but not overall physical performance after muscle damage.[265] Opioids can increase tolerance to pain associated with tourniquet-induced ischaemia,[266] but the translation to elite athlete performance is unclear. Attenuated afferent feedback following opioid use may cause a greater rate of accumulation of muscle metabolites and excessive development of peripheral muscle fatigue.[267] Cannabis can reduce anxiety,[242 268] but no ergogenic effects have been demonstrated.[242 269]

Pain management decisions should be made carefully, respecting confidentiality issues and ensuring appropriate consent where appropriate. The use of analgesics should be guided by pain severity and anticipated RTP, as noted above, and by the core principles described in this consensus document. Items on the Prohibited List should be used sparingly to globally regulate this important area of professional practice and allow individualised yet responsible treatment.

SPECIAL CONSIDERATIONS: PARALYMPIC ATHLETES

Para-athletes can experience more pain than their able-bodied counterparts, perhaps because of an increased incidence of injuries in their sports, or the nature of a specific impairment.[270 271] Although pain or discomfort in para-athletes can be a common clinical feature among those within each of the 10 recognised impairment categories, more severe pain can occur in those experiencing stump pain, phantom limb pain, spasticity-related pain or in those who have suffered spinal cord injuries.[272]

Central neuropathic pain is common in athletes following a spinal cord injury or stroke or in those with multiple sclerosis.[273] One study estimated the incidence of neuropathic pain following a spinal cord injury to be 53% for neuropathic pain at the level of the lesion, and 27% for neuropathic pain below the level of the lesion.[274] Phantom limb pain can affect up to 80% of lower limb amputees, and pain in the stump residuum can occur in 55%–76% of these individuals.[275] Chronic musculoskeletal pain is estimated to occur in 60%–80% of individuals with cerebral palsy and reflects increased muscle tone, dystonia and spasticity.[276 277] The use of pain medications, particularly those used to treat chronic neuropathic pain, is therefore higher in para-athletes than in their able-bodied counterparts.[278 279]

ETHICAL ISSUES

Understanding how pain is experienced by an athlete is important.[280] Part of the socialisation of athletes in male sport includes a degree of (hyper)masculinisation, leading to efforts to disregard or downplay pain and injury.[281] Similar norms may exist in women's and girls' sports.[282] More recently, the literature has addressed the phenomenology (felt experience) of pain[283]; pain may be an everyday experience for elite athletes, and an

abrupt change in pain experience may indicate a clinically relevant change in biomechanical, psychological or social factors.[284]

Managing pain in elite athletes must account for the tension between ignoring or masking pain versus understanding the protective role of pain in the presence of injury. The IOC medical code is clear in this regard and asserts that 'The health and the welfare of athletes are pre-eminent and prevail over competitive, economic, legal or political considerations'.[285] This principle emphasises the primacy and protects the integrity of the clinical encounter, which is pre-eminent in ensuring appropriate pain management. Pain and injury mechanisms can be complex; the clinician must have appropriate time and space to diagnose and delineate treatment options.

The principle of respect for patient autonomy is codified in procedures for informed consent.[286] These processes seek to assure the patient's comprehension and his/her voluntary decision making. It is not always clear when an athlete makes an informed choice to 'play through pain' and when he/she may be under duress from stakeholders within their sports environment.[287–289] The principle of non-maleficence (do no harm) must guide the clinician's actions and recommendations to the patient in acute pain. In chronic pain contexts, however, there are broader opportunities for discussions with the patient, including an evaluation of short-term and long-term goals, the potential for emotional conflicts that may arise with prolonged suffering and the possibility of more pronounced external influences on ethical decision making.[280 290] Therefore, an informed and well-documented discussion should occur between the clinician, the broader healthcare team and the athlete when considering approaches to the management of chronic pain.[291]

FUTURE DIRECTIONS

Pain management in the elite athlete should always follow principles of good medicine, be multidisciplinary and occur with the understanding that pain and injury are not the same. Further research and increased consistency in measures and methods across studies are needed to better understand the incidence and prevalence of analgesic medication use in sport, and the benefits and risks of various pharmacological and non-pharmacological treatments, and their combinations, for specific pain presentations. There is an urgent need to increase awareness of sports medicine physicians of recent advances in the understanding of pain and its management through evidence-based guidance, as well as for increased research on pain and its management in elite athletes, in order to improve treatment of this important problem. Given that pain is commonly self-managed by athletes using over-the-counter pain medications or supplements, information specifically aimed at athletes on the safe and efficacious use of pain medications is also warranted.

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Disclaimer This consensus paper provides an overview of pain management issues in elite athletes that are important to physicians and other clinicians who treat elite athletes. It is not intended as a clinical practice guideline or legal standard of care and should not be interpreted as such. This consensus paper serves as a guide and, as such, is of a general nature, consistent with the reasonable practice of the healthcare professional. Individual treatment will depend on the facts and circumstances specific to each individual case.

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