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Review article

New modalities of pain treatment after outpatient orthopaedic surgery

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ABSTRACT

Postoperative pain relief is one of the cornerstones of success of orthopaedic surgery. Development of new minimally-invasive surgical procedures, as well as improvements in pharmacological and local and regional techniques should result in optimal postoperative pain control for all patients. The analgesic strategy has to be efficient, with minimal side effects, and be easy to manage at home. Multimodal analgesia allows for a reduction of opiate use and thereby its side effects. Local and regional analgesia is a major component of this multimodal strategy, associated with optimal pain relief, even upon mobilization, and it has beneficial effects on postoperative recovery. Ultrasound guidance improves the success rate of distal nerve blocks and makes distal selective blockade possible, helping to preserve the limb's motility. Besides peripheral nerve blocks, local infiltration (incisional and/or intra-articular) is also important to consider. Duration of the nerve blockade is limited after a single injection. This must be taken into consideration to avoid the recurrence of pain when the patient returns home. Continuous perineural blocks using catheters are an option that can be easily managed at home with monitoring by home-care nurses. Extended-release liposomal bupivacaine and adjuvants such as dexamethasone could significantly enhance the duration of the sensory block, thereby reducing the indications for pain pumps. Non-pharmacological approaches, such as cryotherapy, hypnosis and acupuncture should not be ignored.

1. Introduction

Orthopaedic surgery is increasingly being performed in an ambulatory setting, and currently makes up 38% of all outpatient procedures in France [1]. Some procedures, such as carpal tunnel release (more than 90% of cases) and arthroscopic meniscectomy of the knee, are already largely being performed on an ambulatory basis. For others, such as arthroscopic shoulder surgery or knee ligament surgery, there is significant room for improvement. The transition to ambulatory care for certain procedures, particularly major surgical ones, is influenced by many factors, both organizational and medical [2]. Surgical experience and the rapid development of surgical techniques into less invasive procedures are major contributors. Optimal control over postoperative pain (POP) is a determining factor for the success of ambulatory care [3].

Orthopaedic surgery is considered one of the most painful procedures during the postoperative period [4]. Poorly controlled POP is the source of discomfort, non-planned hospitalisation, readmission, metabolic complications, delayed functional recovery and patient dissatisfaction. The pain felt upon returning home is the most common complaint of patients and the main cause of failures in ambulatory care [5,6].

There are currently many pharmacological and technical methods that can achieve optimal analgesia, independent of the surgical procedure carried out. The chosen strategy must take into account the type of procedure, the patient and social environment, and the organizational context of the care [7].

2. Multimodal analgesia

POP prevention and treatment strategies for ambulatory procedures have been the subject of many published articles [8]. The general principle, common to all disciplines, is multimodal analgesia, which is the combination of different agents and/or techniques,

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acting on the entire length of the pain conduction routes, from the skin incision to central integration structures. The goal is to potentiate these techniques to increase their effectiveness and reduce the administered dose, thereby the resulting side effects. In particular, this strategy aims to reduce or even eliminate the use of opiates, which have dose-dependent adverse effects that delay functional recovery. These effects consist of nausea and vomiting, but also sedation and balance problems, which are particularly common in the elderly and can lead to failure of the ambulatory care.

Multimodal analgesia starts in the preoperative phase. Preventative administration of certain agents on the day of surgery may be beneficial:

- Cox2-selective NSAIDs (400 mg celecoxib) have been shown to have an extended analgesic benefit, without increasing the risk of bleeding after ambulatory knee arthroscopy [9];
- gabapentin (Neurontin®) (or pregabalin) reduces postoperative pain, opiate intake and the risk of developing chronic postoperative pain [10]. However, its weak anxiolytic effects and side effects, namely dose-dependent sedation, give it an unfavourable risk–benefit profile for outpatient procedures [11];
- dexamethasone has a well-document beneficial effect on postoperative analgesia: it reduces the need for morphine-based agents, the incidence of nausea and vomiting, the length of the postoperative stay, and accelerates functional recovery, all without negatively affecting wound healing [12].

In addition, the benefits of non-pharmacological techniques, such as hypnosis, acupuncture and cryotherapy, must not be underestimated [13].

The use of non-opioid analgesics (paracetamol, NSAIDs, nefopam, etc.) is preferred during multimodal analgesia [14]:

- nefopam reduces the need for morphine-like agents by 35% during the first 24 hours after an orthopaedic procedure, without side effects, particularly when administered slowly [15]. It has limited oral bioavailability, but demonstrated efficacy and safety [16];
- NSAIDs are the gold-standard analgesics in this field. Their potential negative effect on wound healing and bone repair is controversial, but in their current state, there is no reason not to prescribe them, at least for a short duration and when complying with the contraindications and precautions for use [17].

In cases of moderate to intense pain, opiates may need to be administered. Tramadol is a morphine derivative, which for equivalent analgesia, induces more side effects than morphine itself. It is a prodrug; its transformation in the liver, as with codeine, is dependent on a genetic polymorphism, making it unpredictable [18]. It can be inhibited by ondansetron, which limits the analgesic effects of tramadol [19], and as a consequence, its benefits in an ambulatory setting.

When the pain justifies that prescription of an opiate, typically in combination with other analgesics, the oral forms of morphine sulphate allow for good dose adjustments, with typically good tolerance when the doses are adjusted to the pain intensity; however the drawbacks are inherent problems surrounding dispensing.

Independent of the pharmacology strategies used, they cannot by themselves provide satisfactory control over the POP after orthopaedic surgery, particularly when immediate postoperative mobilization is required, for example after arthrolysis. Only local and regional anaesthesia/analgesia (LRA) can achieve this objective, making it particularly well-suited to the context of ambulatory orthopaedic surgery [20,21].

3. Local and regional analgesia in the ambulatory setting

LRA can be used alone, as an anaesthetic technique, or for analgesia, in combination with sedation or even general anaesthesia. This analgesic method is preferred whenever possible, according to the expert opinion of the French Society of Anaesthesia and Intensive Care (SFAR) on the anaesthesia/analgesia of outpatients [7].

LRA provides optimal analgesia, especially during mobilization, significant reduction in the need for morphine-containing agents and its associated side effects, and faster functional recovery [22]. It significantly reduces the inflammatory reaction at the incision [23]. Several studies have shown a clear correlation between increased LRA use and the success of major knee and shoulder procedures in an ambulatory setting [24].

These LRA techniques must continue to evolve along with the development of minimally-invasive surgery in order to preserve a favourable risk–benefit ratio for patients. As a consequence, LRA is changing rapidly. Use of ultrasonography to locate nerves now leads to a nearly 100% success rate, with fast implementation of the nerve blocks and reduction of the associated risks (intravascular injection, nerve injury, etc.).

This new “ultrasound-guided” technique has also made it possible to perform peripheral nerve blocks that were previously difficult to carry out. The distal nerve trunks can be identified more easily to obtain more selective analgesia while preserving the motor function in the limbs. These distal blocks seem particularly relevant for surgery in the distal part of the arm. When performing an axillary block, selective distal blocking with a long-acting local anaesthetics in the nerve territories affected by the surgery itself offers extended analgesia and greater comfort for patients undergoing ambulatory hand or wrist surgery [25].

This concept also applies to analgesia after leg surgery. Blocking of the infrapatellar branch of the saphenous nerve provides effective analgesia after knee arthroscopy, with no quadriceps muscle weakness, and a positive effect on function, even several weeks after surgery [26]. For ambulatory percutaneous hallux valgus surgery, distal nerve blocks in the foot are highly effective and allow for earlier ambulation than proximal sciatic nerve block [27].

Local anaesthetic infiltration into a surgical wound or joint blocks the pain at its origin – the surgical site itself – without altering motor function. This method is virtually devoid of side effects, thus is particularly well-suited for ambulatory surgery [28]. After knee ligament reconstruction, local infiltration analgesia, combining wound and intra-articular injection, is as effective as a femoral nerve block [29]. Decompression of the medial nerve of the carpal tunnel can be performed with local anaesthesia infiltration [30]. Intra-articular infiltration with a single injection (to avoid risk of cartilage damage) with a combination of local anaesthetics (morphine and NSAIDs) provides high-quality analgesia without after-effects on the muscles after knee arthroscopy [31]. The preferred indication for local infiltration is foot and ankle surgery, as it allows for earlier ambulation and reduces the risk of falls when compared to more extensive blocks of the lower limb [32]. Injecting a combination of ropivacain, morphine and NSAIDs at the operated site provides significant analgesia after hallux valgus surgery [33]. These combinations of analgesic agents used for local infiltration are typically facility-specific and are not well standardized. There is scant recent evidence for the advantages of adjuvants in addition to local anaesthetic agents for infiltration. For the infiltration of a skin wound, the benefit of adding an NSAID to bupivacaine is controversial and does not seem be to superior to systemic administration [34,35]. The addition of local epinephrine infiltration has been advocated by some to increase the duration of the action of the local anaesthetic and to reduce local bleeding. With long-acting local anaesthetics such as ropivacaine, there is little to no benefit of adding epinephrine, especially at high concentrations [36]. On the