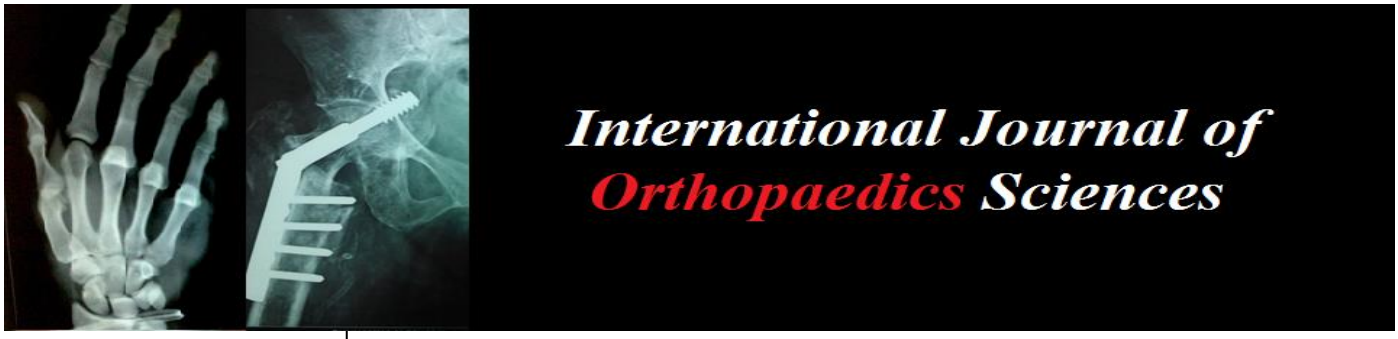

E-ISSN: 2395-1958
P-ISSN: 2706-6630
IJOS 2019; 5(4): 918-922

www.orthopaper.com
Received: 19-08-2019
Accepted: 23-09-2019

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Persistent opioid use after hip and knee arthroplasty

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DOI: https://doi.org/10.22271/ortho.2019.v5.i4p.1798

Abstract
While opioids have well-established benefits in managing postoperative pain, the adverse effects of persistent opioid use are a subject of increasing concern. The prevalence of persistent opioid use in opioid naïve patients undergoing Orthopaedic surgery has been reported as 13.7%.
In this study, we aimed to quantify the prevalence of opioid use in our arthroplasty patients.
Methods: This single centre observational cohort study evaluated the duration of postoperative opioid use in consecutive patients undergoing unilateral primary knee or hip arthroplasty. A survey designed by a panel of experienced clinicians, consisted of 10 multiple-choice questions and 1 free text response, was sent via email or post 3 months post-surgery. The data was collated on Excel and analysed.
Results: Eighty-eight (88) patients responded to our survey. The overall prevalence of persistent opioid use at 3 months following total joint arthroplasty was 7%. Almost 80% of patients had ceased opioids by 6-weeks after surgery. Preoperative opioid users, patients having total knee arthroplasty, females and patient with low back pain were more likely to be members of the persistent opioid group. 87% of patients rated their understanding regarding opioids usage as adequate or excellent.
Conclusion: The incidence of persistent opioid use in our population was low, especially in the opioid naïve group. We believe the key to the low rate of persistent opioid use lies in patient education, tapering opioids before surgery and use of evidence-based care pain management pathways.

Keywords: Opioid use, opioid abuse, arthroplasty, education

Introduction
Knee and hip arthroplasty are common surgical interventions performed worldwide for joint pain [1]. Over the past decade, opioids have become the mainstay of post-operative pain management [2, 3]. Opioids have well-established benefits in managing postoperative pain. The adverse effects of persistent opioid use however, are the subject of increasing concern [4-7].
Opioid use and abuse are extensively reported, especially in North America. In 2016, overdose of prescription opioids caused more than 20,000 deaths in the America [8]. Opioid addiction can cause major health, social, and economic problems [8]. From an orthopaedic perspective, opioid related immune suppression and risk of prosthetic joint infections are also worrying [7, 9, 10]. Opioid-prescribing practices are under increased scrutiny, there is need to better educate both patients and prescribers, and to identify evidence-based strategies to avert the opioid epidemic [6].
For arthritic pain, non-tramadol opioids offer small benefit, but increased risk of adverse events [11]. Following joint replacement, outcomes are better [12, 13] and the postoperative opioid consumption risk is lower in opioid naive patients [14]. In an opioid tolerant cohort, reducing the opioid dose improved outcomes [7].
As the number of arthroplasties increases, there is risk a large number of orthopaedic patients may become persistent opioid users [15]. In view of this growing concern, we investigated the prevalence and factors relating to persistent opioid use in our arthroplasty patients.

Methods
This is a single centre observational cohort study involving consecutive patients of the two senior authors. Following approved by the institutions research ethics board, patients were recruited if they met study criteria.

Patient selection

Inclusion criteria

- Age greater than 18 years at the time of surgery
- Unilateral Total hip arthroplasty (THA) or Total knee arthroplasty (TKA) surgery
- Understands written English

Exclusion criteria

- Revision or bilateral joint replacement
- Significant pain-related illness within 3 months following surgery
- Surgical procedure in the 3 months after joint replacement that required opioids

We identified patients with operation dates between March and October 2017 and invited them to take part. Demographics such as operation type, age and body mass index at the time of surgery where recorded for those who gave their informed consent.

Patients with operation dates between March and October 2017 were identified from our patient database and invited to participate. Demographics such as operation type, age and body mass index at the time of surgery were obtained.

All surgeries were performed at a private metropolitan hospital by 1 of 2 senior authors. Standardised care pathways included regional anaesthesia, multimodal analgesia, and education.

Regional anaesthetics

- Central neuraxial block anaesthetic techniques (Spinal anaesthesia with bupivacaine 0.5%, no additives) with propofol-based sedation.
- High volume local anaesthetic infiltration (100 mls of ropivacaine 0.2%).
- Continuous adductor canal catheter infusion for 3 days (Ropivacaine 0.2% at 6mls per hour). TKA patients only.

Multimodal analgesia

- Regular paracetamol (Acetaminophen), meloxicam or celecoxib, pregabalin and tapentadol-sustained release.
- Tapentadol-immediate release and/or oxycodone for breakthrough pain.
- Acute Pain Service (Anaesthetist and nurse daily round) tapered analgesics.

Patient education

- Commenced pre-operatively in our clinic, to encourage tapering of opioids preoperatively
- Multiple modes of delivery- preoperative education class, written patient guide, bedside advice on analgesic tapering, and discharge summary documentation.

A purpose-designed survey devised by a panel of experienced clinicians (An anaesthetist, 2 surgeons, a nurse and a physiotherapist) was used. It consisted of 10 multiple-choice questions, and 1 free text response. Questions sought to identify risk factors (Such as depression, anxiety and preoperative opioid use) and the prevalence of persistent opioid medication use after surgery. The survey was emailed or posted 3 months (± 2 weeks) from their operation anniversary date. A reference list identifying of common opioid medications accompanied the survey. Participants could make contact should they want to verify medications that constituted opioids. For the purposes of this study, codeine constituent medications (eg. Panadeine forte) were not included.

We adopted a definition of persistent opioid use to be longer than 3 months of use from the operation date. To be representative of a typical arthroplasty population we targeted a sample of 100 respondents. The data was collated on Microsoft Excel and analysed and the results reported in line with STROCSS Criteria [16].

Results

One hundred and sixty (160) patients were invited to participate of whom 88 (55%) responded to the survey. The demographics of the cohort are listed in Table 1.

Table 1: Cohort demographics

Demographic	Central tendency/ Percentage N= 88
Age (years)	64 (10.7)
Body Mass Index (kgm^{-2})	29 (6.0)
General Health Short Form 12 Physical Component Score Mental Component Score	 44.5 (10.8) 52.8 (10.6)
Gender Female Male	 60% 40%
Preoperative opioid dependency	11%
Smoker	11%
Anxiety	26 %
Low back pain	42%
Operation type Total Hip Arthroplasty Total Knee Arthroplasty	 58% 42%
Painful conditions Only the recently operated joint Polyarthritis Back pain Fibromyalgia Another joint replacement	 52% 44% 42% 5% 3%

Incidence of opioid use

Only 6 patients (7%) were persistent opioid users in our cohort. Table 2 provides further description of the individual traits of this subgroup. A 93% majority stopped taking opioids by 3-months. Forty percent (40%) had ceased opioid dependence by postoperative week 2. (Fig 1)

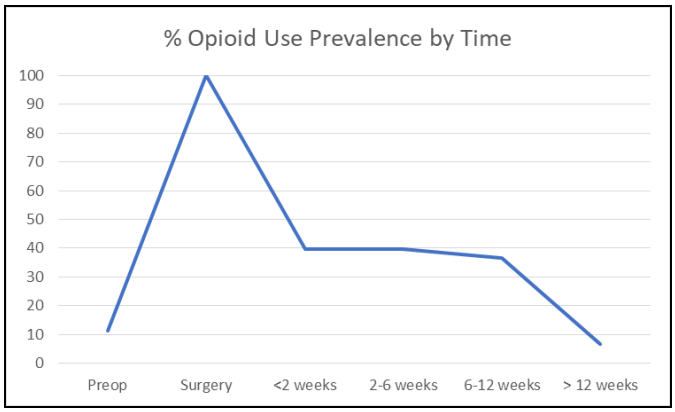

Fig 1: Percentage of opioid users pre and post hip or knee arthroplasty

The group with the highest prevalence of persistent opioid dependence were patients who had undergone TKA (5 of 6). Only 1 patient underwent THA, however took opioids to address low back pain.

Of the 10 patients who took opioids before surgery, 3

continued to take opioids beyond 3 months of their surgical intervention. All 3 cited other painful joints as a reason for their persistent use. (Table 2).

Table 2: Chronic opioid users – Risk factors and reasons for persistent opioid use

Patient	Preoperative opioid use	Depression/ anxiety	Back pain	TKA	Female	Low knowledge	Reason(s) for persistent use
A				√	√		Recent TKA only
B			√	√	√		Recent TKA Other painful joints
C			√	√	√		Recent TKA Other painful joints
D	√	√	√	√	√		Recent TKA Other painful joints
E	√			√			Other painful joint (TKA other side)
F	√	√	√		√	√	Other painful joints

Patient knowledge and opioid management

Eight-seven percent (87%) of patients rated their understanding about opioids as adequate or excellent. Some (13%) expressed they would like to know more regarding their pain management. Only 1 persistent opioid user indicated a need for a better understanding. In relation to associated health burdens, nearly 60% of patients managed their pain and medications independent of pain-management medical appointments. However, 16% sought further advice and 30% made appointments for renewal of scripts during their arthroplasty sub-acute recovery period.

Discussion

In a large Australian study, the prevalence of persistent opioid use post hip or knee orthopaedic surgery was 13.7% [12]. In a similar studies at University Hospital in Michigan (USA) the rate was 29% [13] and 34% [5]. In TKA cohorts, 23% to 50% prevalence have been reported [17-19]. In this study, the prevalence of persistent opioid use was only 7%. Although our study was not powered to identify specific risk factors for persistent opioid use, we propose that the low prevalence of use in our patients is consistent with a relatively low proportion of opioid dependent individuals within our sample preoperatively, and the strategies we employ to combat this issue. These include the combination of regional anaesthetic techniques, multimodal analgesia and patient education and support.

Risk factors associated with persistent opioid use include preoperative opioid use [20]. In our cohort, only 11% were opioid dependent before surgery. This contrasts to 29% in an arthroplasty cohort examined in the United States [13]. Both studies found preoperative opioid users to have a higher likelihood to be persistent opioid users after arthroplasty. Gosling *et al* [13] reported taking >60 mg oral morphine equivalents preoperatively, related to an 80% likelihood of persistent use postoperatively. Adding weight to this, 11% of our preoperative opioid subgroup held a 50% representation of membership in the persistent opioid user group postoperatively.

Preoperative opioid use is advocated for severe joint pain yet, opioids are not effective in managing chronic arthritic pain [11, 21]. Alongside this, exists evidence that these patients are more likely to report poorer functional outcomes following arthroplasty [17, 22, 23]. Assessing patient's opioid status before surgery and taking steps to taper opioids preoperatively are important steps in reducing subsequence opioid use and improving satisfaction [12, 13]. Strategies to do so are perhaps under-utilised. Opioid withdrawal symptoms are usually prevented with 25% of the previous day's opioid dose [24]. In our practice, we advocate to prospective arthroplasty patients to partner with their general practitioner or pain specialist. The aim being to stabilising them on their optimal (lower) opioid regimen at least 4 weeks prior to surgery.

Risk factors associated with persistent opioid use after surgical procedures also include a history of back pain, anxiety and/or depression [8, 20], surgical type [12]. In orthopaedic arthroplasty literature, overall body pain, greater affected joint pain, and greater catastrophising [25], anxiety [25], being female [25, 26], depression [26], having TKA surgery, [5] and younger age at time of TKA [25] are also reported. Goesling *et al* [16] summate this well stating "the relationship between persistent opioid use following arthroplasty is far more complex than improvement in pain in the affected joint".

A patient-related risk factor of note in our study, was the 42% of our cohort reporting low back pain. This preoperative factor featured highly amongst the persistent opioid users. Back pain was cited as their reason to continue with their opioid medications. It seems reasonable to presume some preoperative opioid users will be unable to wean their opioid dependence when chronic back pain persists following hip or knee arthroplasty.

Surgical type can also influence the prevalence of persistent opioid use. In an opioid naïve cohort, Stark *et al* [12] reported spinal and orthopaedic surgery amongst 4 factors independently associated with persistent post-surgical opioid use. In 2 studies examining preoperative opioid suers contrasting TKA in to THA surgery type was a predictor of 6-month opioid use [13] and to a significance level of p=0.001 for persistent use at 12 months [5]. All (excepting one) of our persistent users had undergone TKR which lends support to this relationship. Furthermore, 5 of 6 were female. The one THA persistent user was female, a preoperative opioid user and suffered low back pain, which illustrates the likelihood of a multifactorial interplay of risk factors.

A higher proportion of patients with diagnosed anxiety or depressed also featured our persistent opioid use group. This risk factor is modifiable as patient education and engagement in the perioperative period is associated with lower anxiety levels, improved pain control and lower opioid usage post-surgery [27, 28]. In our cohort, patient appraisal of their own understanding of opioid dosages indicated 87% were

confident in their knowledge. Furthermore, this was reflected in the low percentage of patients (16%) requiring extra medical appointments to address a pain management issue. This reflects the positive impact an importance of perioperative patient education.

Adoption of evidence-based practice pathways can help address opioid dependence. A recently published Cochrane review found regional anaesthesia to reduce the risk of developing persistent postoperative pain [30]. Other studies showed regional anaesthesia lowered opioid use and led to better functional outcomes. Similarly, the additive effect of multimodal analgesia in managing postoperative pain is well recognised [27]. The use of paracetamol, non-steroidal anti-inflammatory medications and pregabalin or gabapentin (assuming no contraindication) in the perioperative period decreases subsequent opioid use [27].

This observational cohort study is not without limitations: a smaller than expected membership of chronic opioid users in our cohort, a response rate at 55% poses potential bias, and it's methodology to use patient reported survey is subject to recall bias. Similarly, our results stem from privately insured patients and may not extrapolate to wider patient populations.

Conclusion

This study provides insight into the 7% prevalence of persistent opioid use in arthroplasty patients at our institution. We believe several layers of address are key to the lowering the rate of persistent opioid use. Strategies targeting modifiable risk factors include patient education, tapering opioids before surgery and use of evidence-based care pain management pathways.

Acknowledgement

No external funding or conflicts of interest in relation to this study.

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