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Review Article

REVIEW ARTICLE

Perioperative and persistent opioid use after surgery: a scoping review

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Abstract

Persistent opioid use after surgery is a growing concern, with existing reviews lacking strong predictors beyond prior opioid use. This scoping review aimed to identify knowledge gaps for future research, particularly regarding the impact of the perioperative period (including preoperative, intraoperative, and postoperative) opioid use on persistent opioid use after surgery. A comprehensive database search of prospective studies explored the association between perioperative opioid use and persistent use in adults after surgery. From the 21 identified studies, we found a complex relationship between perioperative opioid use and persistent use. Preoperative opioid use correlated with persistent use, but the impact of intraoperative and short-term postoperative use remained unclear. Interestingly, postoperative prescriptions at 3 months predicted a higher risk of persistent use at 6 and 12 months. These findings highlight the need for further research to explore the mediating factors that increase the risk of persistent use among preoperative opioid users, along with the specific roles of intraoperative and postsurgical inpatient opioid consumption, and short-term postoperative opioid prescriptions (≤30 days).

Keywords: intraoperative opioid; opioid crisis; perioperative opioid; persistent opioid; postoperative opioid; preoperative opioid

The term 'opioid epidemic' refers to the increased rates of deaths and hospitalisations as a result of illicit and prescribed opioids.[1] The significant increase in opioid prescriptions in the USA and some European countries has been accompanied by an increase in misuse, and opioid-related morbidity and mortality.[2,3] Prescription opioids are linked to ~40% of opioid overdose deaths in the USA. In 2017, this epidemic was estimated to have incurred a cost of $1.02 trillion related to prescription opioid-related overdose, abuse, and dependence.[4,5]

Persistent postoperative opioid use (PPOU) has emerged as a growing concern and is believed to be a significant contributor to the opioid epidemic, primarily because of its association with chronic pain development, tolerance and dependence, fear of withdrawal, and an increased risk of opioid diversion and illicit use.[6–10] Continued opioid consumption after the period of normal postoperative healing has been referred to as persistent use.[11] The definitions of PPOU among studies vary, ranging from 31 days to 1 yr after surgery.[12] Nevertheless, 6–10% of patients who are opioid-naive will develop persistent opioid use.[6] Additionally, the incidence of persistent opioid use among patients who already use

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opioids before surgery is significantly higher, ranging from 35% to 75%.[6]

Unravelling the reasons behind PPOU remains a challenge. Postoperative surgical site pain might intuitively be considered the primary driver; however, several investigations have yielded negative results regarding the potential association between postoperative surgical site pain and PPOU. Goesling and colleagues[13] showed that neither preoperative surgical site pain nor its change over 6 months impacted opioid use at 6 months (odds ratio [OR] 0.98, P=0.819; OR 1.01, P=0.900, respectively). Melis and colleagues[14] further examined pain scores at discharge in adult orthopaedic surgery patients and found no association with long-term opioid use (OR 1.22, 95% confidence interval [CI] 0.99–1.50). Additionally, a multicentre study by Kuck and colleagues[15] found no correlation between opioid use and surgical site pain at 3 months after surgery. These findings suggest that factors beyond pain perception play a significant role in PPOU. Intriguingly, Brummett and colleagues[16] even found minor operations leading to similar PPOU rates as major ones, highlighting the need to explore a broader range of influences on PPOU, moving beyond just surgical site pain.

Overall, pain is not the sole factor contributing to PPOU. Examining the contribution of perioperative opioids could reveal a different story. The existing literature on the association between perioperative opioid use and the development of PPOU is not well-defined. Therefore, we conducted a scoping review to explore the breadth, scope, and characteristics of current prospective research in this area and to identify any gaps in the existing literature which may guide to frame research questions for future prospective studies.

Here, the following research question was formulated: what is known from the literature about the association between perioperative opioid use and the development of persistent opioid use (defined as any opioid prescription filled beyond 30 days after surgery) in adult surgical patients (>18 yr)?

Methods

This review follows the framework outlined by Arksey and O'Malley,[17] which involves defining the research question, identifying, and selecting relevant studies, charting the data, and reporting the findings. The reporting follows the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for scoping reviews (PRISMA-ScR).[18]

Eligibility criteria

This scoping review aims to include prospective studies or retrospective database analyses of prospectively collected data that investigate the relationship or contribution of perioperative opioids (preoperative, intraoperative, or postoperative) to persistent opioid use (defined as any opioid prescription beyond 30 days after surgery) in adult humans. We adopted this more conservative definition to maximise the review's potential to explore the patterns and effects of perioperative opioids on PPOU. Although examining a single study design may lead to limited conclusions, Carley and colleagues[19] argue that focusing on comparable studies helps identify strengths and weaknesses within the chosen design, leading to more meaningful insights, particularly in pain therapy reviews, which often struggle to draw conclusions because of poor research quality and mixed designs.

The search was limited to English-language studies involving adults (≥18 yr). Studies comparing multimodal analgesia or regional anaesthesia (e.g. spinal, epidural, or nerve blocks) with opioid-based anaesthesia were excluded, regardless of the outcome measured. This exclusion is necessary to avoid bias and ensure valid conclusions. Additionally, literature reviews, guidelines, retrospective chart reviews without prospective data, trial registry records, meeting abstracts, conference abstracts, and forum abstracts were excluded.

Information sources and search

Comprehensive search strategies were developed with the help of an Aberdeen University librarian to identify relevant studies across major electronic databases (PubMed via NCBI, Scopus via Elsevier, MEDLINE via Ovid, Embase via Ovid, and Cochrane Library via Wiley) up to 9 February 2024. These strategies used a variety of keywords including 'Perioperative Period*', 'Persistent opioid*', and terms related to specific opioid medications (Supplementary material 1).

In addition to the electronic search, a hand search of the references of all retrieved articles was conducted to identify relevant trials not captured by the initial strategy. EndNote (Clarivate Analytics (US) LLC) software was used to manage the retrieved references, including deduplication.

Selection of sources of evidence

The references were exported to Rayyan software after deduplication for independent screening of title and abstract by two authors (BA and JK) based on inclusion criteria. Disagreements regarding study selection were resolved through discussion with the third author (PF).

Data charting process and items

After the screening phase, selected studies were exported to Covidence for data extraction using a predefined template (Supplementary material 2). This template, collaboratively developed by two authors (BA and PF), ensured consistent data collection of predetermined variables. The extracted data have been reviewed and discussed to update the data charting form.

Synthesis of results

We grouped the studies by the phase of opioid administration during the perioperative period: preoperative use, intraoperative administration, postsurgical (inpatient) administration, and postoperative prescription. We then summarised the surgical procedures, sample size, the incidence and definition of PPOU, and the reported effect estimates (OR, hazard ratio [HR], or relative risk [RR]) for perioperative opioid use as predictors of PPOU. Additionally, we explored risk factors for PPOU among preoperative opioid users.

Results

Selection of sources of evidence

A total of 2383 studies were identified through database searches and a hand search. Only 21 studies met our inclusion criteria and were included in the final review. The selection process, including the number of studies identified, included, and excluded, along with the reasons for exclusion, is detailed

in a flow diagram (Supplementary Fig. S1). Characteristics of studies included in the scoping review are detailed in Supplementary Table S1.

Preoperative opioid use

Preoperative opioid users exhibit a high prevalence of PPOU, with substantial variability across studies, ranging from 10.2% to 65%. Almost half of the studies (44.4%) investigated the contribution of preoperative opioid use to PPOU as the primary outcome. Among various factors examined, preoperative opioid use appears to be the strongest predictor of PPOU. However, studies report widely varying adjusted odds ratios (aORs), ranging from 0.9 to 35.33 (Supplementary Table S2).

Figure 1 shows the main risk factors that contribute to PPOU among preoperative opioid users. Few studies examined a limited number of factors.[13,20–24] These studies identified several risk factors associated with PPOU, demonstrating positive ORs and statistical significance. Other factors showed positive ORs but not statistical significance.[25] The factors accounting for contradictory findings among studies are unknown (Table 1).

Intraoperative opioid administration

Only one study investigated the contribution of intraoperative opioid administration to PPOU.[15] Out of the 680 patients in the final dataset who underwent different procedures, 96 (14%) continued to use opioids 3 months after surgery, with 23 (4%) identified as new persistent opioid users. The study shows no significant difference in the likelihood of patients continuing opioid use at 3 months, regardless of whether they received

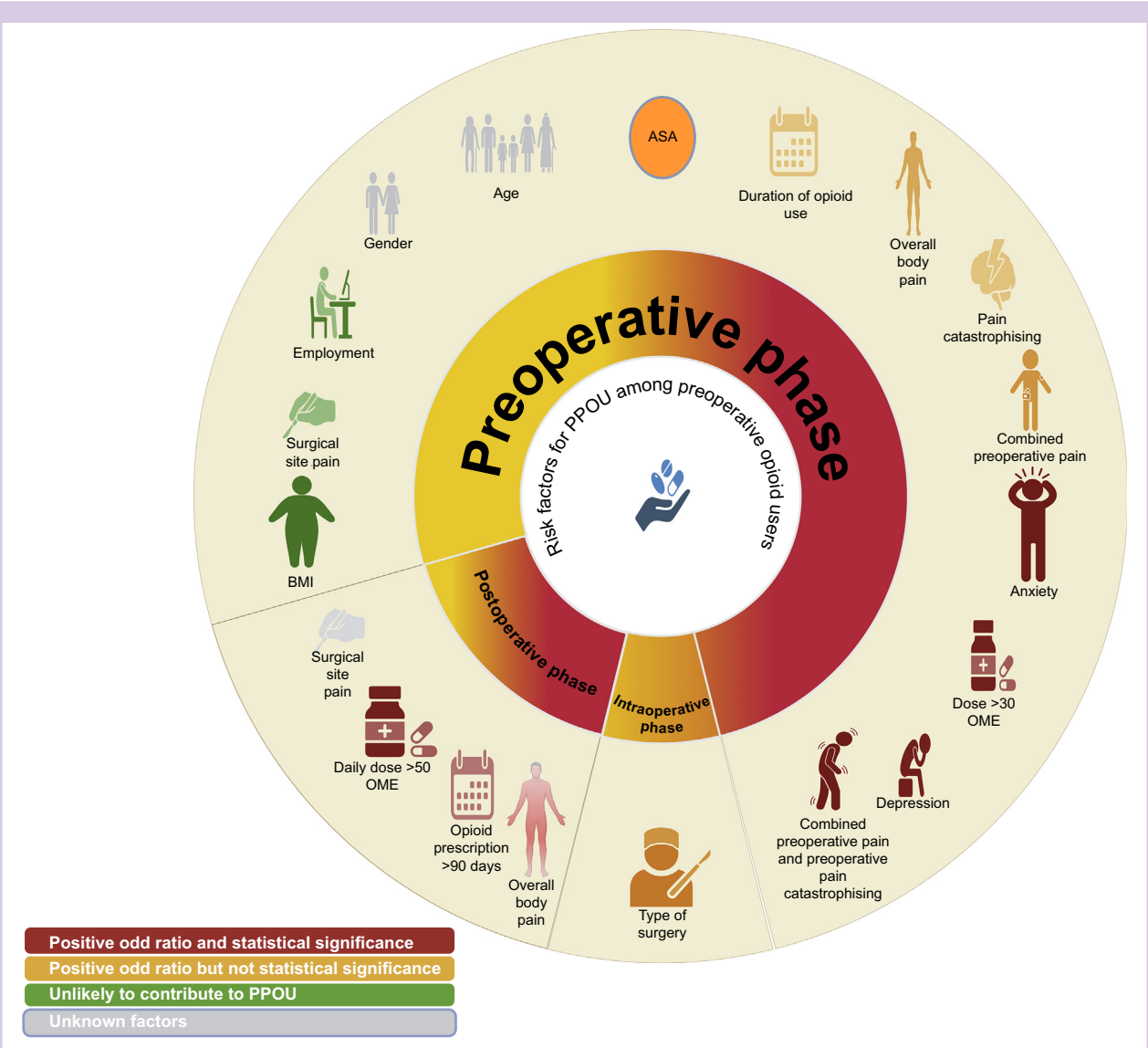

Fig 1. Risk factors for persistent opioid use after surgery among preoperative opioid users. OME, oral morphine equivalents; PPOU, persistent postoperative opioid use. Unknown factors: factors with inconsistent associations with persistent opioid use across studies—some studies demonstrating a significant effect, whereas others finding no predictive value. Created in BioRender. Almodibeg, B. (2025) https://BioRender.com/l35f888.

Table 1 *Risk factors for persistent opioid use after surgery among preoperative opioid users. aOR, adjusted odd ratio; CI, confidence interval; HR: hazard ratio; Likely, positive ORs and statistical significance; OME, oral morphine equivalents; Possible, positive ORs but not statistical significance;* PPOU, persistent postoperative opioid use; *Unlikely, dose not contribute to PPOU; unknown factors explain the contradictory findings among studies; ZDS, Zagazig Depression Scale.*

Factors	Likelihood of contributing	Summary of results
Preoperative surgical site pain	Unlikely	Baseline surgical site pain was not associated with PPOU; aOR 0.95 (95% CI 0.64–1.41)[20]
Preoperative overall body pain	Possible	Three studies suggest that preoperative overall body pain could be associated with PPOU; however, this association was not statistically significant; aOR 1.43 (95% CI 0.96–2.20), aOR 1.45 (95% CI 0.59–3.60) and aOR 1.24 (95% CI 0.85–1.82); P=0.269.[13,20,21]
Preoperative pain catastrophising	Possible	Pain catastrophising was not significantly associated with PPOU; aOR 1.69 (95% CI 0.69–4.14)[21]
Combined preoperative pain and preoperative pain catastrophising	Likely	The combination significantly associated with PPOU, after adjusting for preoperative opioid use was high pain catastrophising and high preoperative pain; aOR 2.56 (95% CI 1.04–6.29)[21]
Combined preoperative pain (surgical site pain and pain in a different body area)	Possible	The aOR suggests that the group who used opioids before surgery for combined pain had greater opioid use at 6 months after surgery than those who used opioids only for preoperative surgical site pain; however, this difference was not statistically significant; aOR 2.28 (95% CI 0.47–6.54)[20]
Preoperative opioid daily dose >30 OME per day	Likely	After adjusting for preoperative chronic opioid therapy (prescribed most days >50% for 3 consecutive months) and other factors, a high preoperative opioid dosage was significantly associated with chronic opioid use at 1 yr post-surgery; aOR 4.1 (95% CI 2.9–5.7); P<0.001.[22] This association remains significant even for non-chronic user; aOR 4.93 (95% CI 3.08–7.89).[22] A 1-unit increase in OME may raise the odds of opioid use at 6 months by 7%.[13]
Preoperative duration of opioid use	Possible	The duration of opioid use before surgery was positively associated with PPOU in two studies, though this association was not statistically significant in one study; aOR 1.11 (95% CI 0.94–1.31),[20] whereas it was significant in Hills study; aOR 15 (95% CI 11.42–19.71)[22]
Postoperative surgical site pain	Unknown	One study found that surgical site pain at follow-up was positively associated with PPOU; aOR 1.60 (95% CI 1.10–2.38).[20] However, another reported that changes in knee/hip pain were not predictive; aOR 1.00 (95% CI 0.88–1.14); P=0.963.[13]
Postoperative overall body pain	Likely	Overall pain at follow-up was positively associated with PPOU; aOR 1.80 (95% CI 1.23–2.66).[20] This was confirmed in one study showing that a decrease in overall body pain was associated with lower odds of being on opioids at 6 months; aOR 0.62 (95% CI 0.46–0.82); P=0.001.[13]
Duration of postoperative opioid prescription >90 days	Likely	Postoperative opioid use (>90 days) increased chronic opioid use at 1 yr; aOR 6.4 (95% CI 4.1–9.9) compared with brief use (<30 days).[24]
Postoperative opioid prescription daily dose >50 OME	Likely	Report that the likelihood of opioid cessation rates at 1 yr increased significantly with initial daily opioid dosages (<50 OMEs) compared with dosages of 50–89 OMEs, as evidenced by HR 1.61 (95% CI 1.22–2.12); P=0.001.[24]
Preoperative employment	Unlikely	Preoperative employment status was not associated with PPOU at 12 months; aOR 0.83 (95% CI 0.44–1.56); P=0.56.[23]
Preoperative anxiety	Likely	Preoperative anxiety was positively associated with PPOU at 12 months; aOR 2.07 (95% CI 1.05–4.08); P=0.04.[23]
Preoperative depression	Likely	In patients taking preoperative opioids, those with depression as measured by ZDS score were significantly less likely to be opioid-free at 12 months compared with those without depression; aOR 2.47 (95% CI 1.26–4.84); P=0.008.[23]
American Society of Anesthesiologists (ASA) physical status score	Possible	ASA physical status score 2 was positively associated with PPOU, though this association was not statistically significant; aOR 1.85 (95% CI 0.15–22.40); P=0.63.[23]
BMI	Unlikely	BMI was not associated with PPOU at 12 months; aOR 0.99 (95% CI 0.95–1.03); P=0.462.[23]
Age	Unknown	One study reported that older patients were less likely to experience PPOU than younger patients. This finding was statistically significant; aOR 0.61 (95% CI 0.40–0.91).[20] However, another reported that age was not predictive; aOR 1.01 (95% CI 0.98–1.03); P=0.66.[23]
Gender	Unknown	One study reported that males had higher rates of PPOU than females. However, this difference was not statistically significant; aOR 1.56 (95% CI 0.69–3.65).[20] Another reported that females had uncertain differences compared with males; aOR 1.67 (95% CI 0.68–4.13); P=0.265.[13] A third reported that gender was not predictive; aOR 1.04 (95% CI 0.59–1.84); P=0.89.[23]

Continued

Table 1 Continued

Factors	Likelihood of contributing	Summary of results
Type of surgery	Possible	One study reported that patients who underwent total knee arthroplasty were significantly more likely to experience PPOU than those who underwent total hip arthroplasty; aOR 2.39 (95% CI 1.05–5.62).[20] Another study reported uncertain differences between knee and hip surgery; aOR 1.23 (95% CI 0.48–3.12); P=0.669.[13] A last one reported that more invasive surgery was significantly associated with PPOU at 12 months; aOR 5.73 (95% CI 1.50–21.90); P=0.01.[23]

high or low morphine equivalents doses intraoperatively. This is supported by the aOR of 1.04 (95% CI 0.96–1.20).

Postsurgical (inpatient) opioid administration

Three studies investigated the association between postsurgical (inpatient) opioid administration and PPOU. Although all studies found no significant association between inpatient opioid administration and increased risk of PPOU at 6 weeks and 12 months after surgery, Hofer and colleagues[26] identified a weak association between inpatient opioid administration use and PPOU at 6 months, and among opioid-naive patients at 12 months (Supplementary Table S3).

Postoperative opioid prescription

Five studies examined the association between postoperative opioid prescriptions and PPOU. Three of these studies found a significant positive association between opioid use at 3 months and a heightened risk of PPOU at 6 and 12 months after surgery. However, the impact of short-term (<30 days) postoperative opioid prescriptions on PPOU remains inconclusive across studies (Supplementary Table S4).

Discussion

This scoping review identified 2383 studies through database searches and hand searching. However, only 21 prospective studies examining the association between perioperative opioid use and PPOU were included in the final review. Most excluded studies (approximately 90%) were retrospective studies or conference abstracts. The association between perioperative opioid use and the development of PPOU shows different patterns depending on the phase of opioid use.

Preoperative opioid use

Preoperative opioid users exhibit a high prevalence of PPOU. However, there is considerable variation in the definitions of PPOU and the methodologies used for assessing preoperative opioid use among the studies reviewed, which could explain the substantial heterogeneity observed in both the prevalence of PPOU among preoperative opioid users and the wide range of aORs. Other factors may also contribute to this variability. Differences in study populations, surgical procedures, and patient-related risk factors could all play a role in these disparities and influence the likelihood of PPOU.

Despite these variations, the contribution of preoperative opioid users to PPOU is well-established in the literature.[7,27,28] All studies, with the exception of two non-significant findings, demonstrate a positive association between preoperative opioid use and PPOU. However, it is important to consider that these two non-significant studies may have been underpowered to detect predictive variables because of the low rates of chronic opioid use in their samples.

The risk factors for preoperative opioid users becoming chronic users after surgery remain poorly understood. Only a few prospective studies with relatively small sample sizes have explored a limited number of factors associated with this increased risk. These factors include combined preoperative pain and pain catastrophising, high opioid doses, prolonged postoperative opioid prescriptions, postoperative overall body pain, and pre-existing mental health issues. In contrast, factors such as preoperative overall body pain, preoperative pain catastrophising alone, preoperative duration of opioid use, ASA physical status score, and type of surgery showed positive ORs but lacked statistical significance, possibly contributing to PPOU. Other factors (e.g. age, gender, surgical site pain) showed contradictory findings. This limited research highlights a significant knowledge gap in understanding the factors that contribute to PPOU in this population.

Conducting more comprehensive studies is crucial. These studies should explore the mediating effects of patient characteristics, surgical procedures, pain management practices, and healthcare system factors on PPOU risk among preoperative users. Identifying high-risk preoperative opioid users would then allow for the development of personalised treatment pathways to minimise their risk of chronic use.

Intraoperative and postoperative opioid use

The contribution of intraoperative opioid administration to PPOU is not well-understood. Limited evidence, from only one study suggesting no association, highlights a significant gap that needs to be addressed.

Three studies examining the contribution of postoperative (inpatient) opioid use to PPOU yielded inconclusive findings. The average 75th percentile of inpatient narcotic consumption varied across studies and showed no significant association with PPOU at 6 weeks in two studies. However, the third study, interestingly, found a positive association at 6 months, which persisted at 12 months for opioid-naive patients only. These conflicting results highlight a significant gap in our understanding that needs to be addressed.

Conversely, postoperative opioid prescriptions demonstrate a positive association with PPOU. Opioid use at 3 months positively correlates with increased risk of PPOU at 6 and 12 months after surgery. However, the impact of short-term (<30 days) postoperative opioid prescriptions on PPOU remains unclear across studies, likely because of the lack of consensus on a specific dose threshold that increases PPOU risk across studies reviewed and variability in surgical procedures, which

might influence the impact of short-term prescriptions. The specific dose threshold for opioid prescriptions within the first 30 days that contributes to PPOU appears complex. It is likely to be influenced by both the type of surgery and potentially other postoperative risk factors. This highlights a significant knowledge gap that necessitates further investigation.

Preoperative pain and persistent postoperative opioid use

Ten studies in this scoping review examined the potential association between preoperative pain status and PPOU among both opioid-naive and preoperative opioid users, except for one study that distinguishes between these two groups. Preoperative pain has been assessed across studies as either related to surgery (preoperative surgical site pain), unspecified (preoperative pain intensity), or overall body pain (preoperative overall body pain). Among these, five studies assessed preoperative surgical site pain intensity using different scales across different procedures and none found an influence on PPOU or the decision to continue opioids.[13,15,24,29,30]

Four studies examining unspecified preoperative pain intensity with the numeric pain scale also found no link to PPOU,[21,31–33] though one study using the Defense and Veterans Pain Rating Scale found a significant association.[34] However, this study was limited by the use of multivariable mixed effects modelling with only 13 participants reporting PPOU, increasing the risks of overfitting, parameter estimation instability, and reduced statistical power.

Three studies explored preoperative overall body pain using the Brief Pain Inventory (BPI) with no association to PPOU.[13,15,29] However, Goesling and colleagues[13] conducted separate multivariable logistic regression models for patients not on opioids on the day of surgery and found that higher preoperative overall body pain was statistically predictive of PPOU.

Postsurgical pain and persistent postoperative opioid use

Postsurgical pain might intuitively be considered the primary driver of opioid use, but the association between the two is complex. Only three studies included in this scoping review provide insights into this complexity.[13,29,35] Carroll and colleagues[29] explored postoperative surgical site pain and found that, in multivariable analysis, the intensity of postoperative surgical site pain at the time of opioid cessation did not significantly predict the decision to continue or discontinue opioids. However, they emphasised that no patients reported taking opioids after their pain had fully resolved. Interestingly, most postsurgical patients ceased opioid use before their pain had completely subsided. This suggests that variations in opioid use duration occurred exclusively in the presence of persistent pain. For example, if two patients experienced pain for 90 days after knee surgery, one might have stopped taking opioids by day 10, whereas the other might have continued until day 80. Goesling and colleagues[13] further investigated this intricate relationship and found that changes in surgical site pain did not predict PPOU. However, a reduction in overall body pain from baseline to 6 months was associated with lower odds of PPOU. Another study assessed postoperative pain intensity using the numeric pain rating scale (0–10) without specifying whether the pain was surgery-related. This study conducted multivariable logistic regression analyses to identify predictors and covariates of postoperative opioid use 90 days or more after elective orthopaedic surgery.[36] It found that a postoperative pain intensity score of 0–2 (mild) *vs* 3 or greater (moderate to severe) significantly predicted PPOU.

Trajectory of postsurgical pain

Only one study included in this scoping review (the PAIN OUT study) explored the trajectory of postsurgical pain and opioid use in a mixed surgical cohort of 2326 patients across 11 European hospitals.[26] The study categorised chronic pain into three main categories: unrelated to surgery, related to surgery, and chronic postsurgical pain as defined by the International Classification of Diseases (ICD-11). Persistence of opioid use was found in 3.5% (n=82) of the cohort. Among persistent users, postsurgical pain was a factor, but a substantial portion (64.6%) experienced chronic pain unrelated to surgery. Furthermore, only 4.9% met the strict ICD-11 definition of postsurgical chronic pain. These findings highlight the need for further research into why patients continue using opioids beyond poorly managed surgical pain.

Could perioperative opioid be boosting the risk of chronic postsurgical pain?

This scoping review provides some evidence of the contribution of perioperative opioid use particularly during the preoperative and postoperative phases to PPOU. This raises an important question: does opioid use contribute to chronic postsurgical pain and subsequent PPOU, or is it the other way round?

Only two studies in our scoping review yielded interesting findings. Verrier and colleagues[33] examined the relationship between opioid use and pain intensity using the BPI. Although they did not observe a correlation between opioid use and pain intensity at baseline, they found that opioid use was strongly associated with pain intensity scores at each postoperative visit (6 weeks, 3 months, and 6 months).

Hills and colleagues,[24] on the contrary, reported that patients with a brief duration of postoperative opioid use (<30 days) were significantly more likely than those with an intermediate duration of use (31–60 days) to achieve meaningful improvement in extremity or axial pain. Furthermore, these patients were less likely to develop chronic opioid use at 1 yr.

These two studies shed light on the complex relationship between perioperative opioid use and chronic postsurgical pain. We propose investigating the association between perioperative opioid use and PPOU to better understand and simplify this intricate relationship. Such an approach could not only clarify the opioid–chronic pain connection but also help identify other potential reasons for continued opioid use, such as tolerance, hyperalgesia, and addiction.

A recently published review comprehensively summarises chronic postsurgical pain and PPOU based on existing systematic reviews and meta-analyses.[37] It reviewed six meta-analyses and one additional systematic review that discussed the contributing factors that increase the risk of PPOU. None of the included meta-analyses definitively addressed the role of perioperative opioid use in chronic postsurgical pain nor in PPOU apart from preoperative opioid use which been identified as the strongest predictor of PPOU. However,

substantial heterogeneity in the reported results and inconsistencies in PPOU and chronic postsurgical pain prevalence hampered the accuracy of identifying predictors.

One systematic review, focused specifically on cardiac surgery patients, briefly noted postoperative opioid prescriptions as a contributor to PPOU. However, this conclusion was derived from a single retrospective study, further constrained by unadjusted odds ratios and the influence of confounding variables.

In contrast, our scoping review addresses these limitations by concentrating on prospective study designs. By systematically reviewing prospective data, this review offers a more consistent evaluation of the role of perioperative opioid use in PPOU, highlights a critical knowledge gap, and emphasises the need for further well-designed prospective studies.

The current scoping review has some limitations in its selection criteria. The chosen approach, likely for reasons of feasibility and drawing stronger conclusions, limited the review to studies based on prospective data collection. However, a broader review that included other data sources could potentially yield different insights. Additionally, this review does not extract data on concomitant medications, particularly psychotropic medications, nor does it consistently account for evidence of drug abuse in PPOU cases. These factors could illuminate other dimensions influencing the likelihood of developing PPOU.

Conclusions

The relationship between perioperative opioid use and development of PPOU appears complex. Preoperative opioid use shows a positive association with PPOU. However, our findings regarding intraoperative opioid administration are limited by the paucity of available evidence. Although only one study has examined the relationship between intraoperative opioid use and PPOU, the available data suggest that there may not be a significant association. Postsurgical (inpatient) opioid administration also shows no significant association at 6 weeks and 12 months after surgery, with a weak association only at 12 months among opioid-naive patients and at 6 months for both preoperative users and opioid-naive patients. Regarding postoperative opioid prescriptions, it is demonstrated that opioid use at 3 months significantly increases the risk of PPOU at 6 and 12 months after surgery. However, the impact of short-term (<30 days) postoperative opioid prescriptions as a potential mediator of PPOU remains inconclusive across studies.

Authors' contributions

Conceptualisation: BA, PF
Methodology: BA, PF
Software: BA, JK, PF
Validation: PF
Formal analysis: BA, JK
Investigation: BA, PF
Re-sources: BA, PF
Data curation: BA, JK, PF
Writing—original draft preparation: BA
Writing—review and editing: PF
Visualisation: PF
Supervision: PF
Project administration: BA
Funding acquisition: BA

All authors have read and agreed to the published version of the manuscript.

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Declarations of interest

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.bjao.2025.100412.

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