



Pain management in postoperative bone fracture patients: A systematic scoping review

Siti Nurjanah^{1*}

Aep Maulid Mulyana¹

Hesti Dina Arhustia¹

Risna Ayuningsih¹

Yuni Fuji Fazriyyah¹

Urip Rahayu¹

Sandra Pebrianti¹

Hidayat Arifin²

¹ Faculty of Nursing, Universitas Padjadjaran, Bandung, Indonesia

² Department of Advanced Nursing, Faculty of Nursing, Universitas Airlangga, Surabaya, Indonesia

*Correspondence:

Siti Nurjanah
Faculty of Nursing, Universitas Padjadjaran Bandung 43351, Indonesia, Telp. +6285773735174
Email: siti17052@mail.unpad.ac.id

Volume 2(2), 126-133

© The Author(s) 2023

<http://dx.doi.org/10.55048/jpns23>

e-ISSN 2827-8100

p-ISSN 2827-8496

Received : March 29, 2022

Revised : April 7, 2022

Accepted : April 2, 2023

Published: May 30, 2023



This is an **Open Access** article distributed under the terms of the [Creative Commons Attribution-NonCommercial 4.0 International License](https://creativecommons.org/licenses/by-nc/4.0/).

ABSTRACT

Background: A fracture is a condition in which the continuity of bone tissue is broken, causing stress and pain during the healing process. Therefore, the management of pain in postoperative bone fracture patients should be addressed..

Objective: The aim is to identify interventions for managing pain in patients with postoperative bone fractures.

Design: A systematic scoping review.

Data Sources: The search process was conducted from March 8 to March 15, 2022, using the following databases: PubMed, CINAHL, and Science Direct.

Review Methods: PRISMA flowcharts were used for the systematic review. Articles published in the last five years (2018-2022) were included, focusing on full-text articles, randomized controlled trials (RCTs), and cohort studies that discussed the topic of postoperative pain management in fracture patients. The search yielded a total of 4,324 articles from the four databases. After screening by year, 819 articles were obtained. Based on the full text and abstracts of 432 articles, and applying exclusion and inclusion criteria, five articles were selected.

Results: The five articles demonstrated that pain management in postoperative bone fracture patients can be achieved through various pharmacological approaches, including peripheral nerve block anesthesia, antioxidants (vitamin C), intravenous tranexamic acid, intravenous dexamethasone, and the use of calculators and comprehensive pain plans as management tools.

Conclusions: This study recommends that healthcare professionals apply and further develop the findings as a pain management strategy for postoperative bone fracture patients.

Keywords: bone fracture; pain intervention; pain management; post-operative

INTRODUCTION

Fracture is a condition where the continuity of bone tissue is broken, causing stress on the bone (Purwanto, 2016). According to Santos et al. (2018), fractures are severe injuries that can extensively affect soft tissue and bone, resulting in trauma such as vulnus, bleeding, bruising, stretching, partial tears, blood vessel disorders, and nerve disorders. Fractures require a long

Nursing and Healthcare Practices

- Nurses administer pharmacological approaches like peripheral nerve block anesthesia, vitamin C antioxidants, and intravenous medications (tranexamic acid, dexamethasone) for pain management in postoperative bone fracture patients.
- Nurses employ calculators and comprehensive pain plans as effective tools for managing pain in postoperative bone fracture patients.
- The study highlights the need for healthcare professionals, including nurses, to adopt and advance these strategies for effective pain management in postoperative bone fracture patients.

healing process.

Globally, the prevalence of injury-related deaths is 4.4 million, with 3.16 million attributed to accidents, 1.25 million to violence, 1 in 3 due to traffic accidents, 1 in 6 due to suicide, 1 in 10 due to homicide, and 1 in 61 due to war and conflict. Falls account for over 684,000 deaths each year, along with temporary or permanent disabilities. Approximately 90% of injury-related deaths occur in low- and middle-income countries (WHO, 2021). According to the Basic Health Research 2018 in Indonesia, there has been an increase in fracture cases up to the year 2018. The highest prevalence of injuries is on the lower extremities at 67.9%, while the upper extremities account for 32.7% (Ministry of Health RI, 2018).

Fracture patients face various problems, with postoperative pain being one of the most common. Therefore, fracture patients require measures for pain management (Mahartha et al., 2017). Several methods, both pharmacological and non-pharmacological, have been proposed, but not all of them effectively treat pain in postoperative fracture patients. This indicates a need for further development in pain management methods to alleviate the severity of pain in postoperative fracture patients (Imani et al., 2019).

Regarding pain management in fracture patients who have undergone frequent

surgeries, only drugs are used (McDonald et al., 2020). Aligning with the research of Luo et al. (2018), management of chronic pain solely relies on pharmacological approaches, including the administration of celecoxib, transdermal buprenorphine, and codeine with added ibuprofen. A study by Elsevier & Cannada (2020) demonstrated that hematoma blocks can effectively reduce pain in patients with bone fractures, surpassing systemic analgesics in pain management for clients with hip fractures. The purpose of this research is to identify interventions that can be implemented for pain management in postoperative fracture patients.

METHODS

Design

A systematic scoping review was utilized for this study.

Search Methods

The search for articles was conducted using PRISMA flowcharts for systematic review research (Figure 1). The databases used were PubMed, CINAHL, and ScienceDirect, focusing on articles published in the last five years (2018-2022). The terms used in this study included "intervention," "strategies," "treatment," "program," "management," "pain management," "pain control," "managing pain," "postoperative," "post-operative," "postoperative," "post-surgery," "open fracture," "fractures," and "open fracture injuries."

Eligibility Criteria

The inclusion criteria for this scoping review included full-text articles, randomized controlled trial (RCT) designs, cohort studies, and articles discussing pain management in patients with postoperative fractures. Articles not written in English were excluded. Seven researchers (UR, SP, AMM, HAD, SN, YFF, and RA) independently conducted the article search process, screened articles, and compiled the results for the scoping review.

Data Charting

Data charting involved comprehensive analysis of the selected articles. The extracted data was then presented in a scoping review results table, which included information such as title, author, year of publication, location, study design, population, intervention, pain

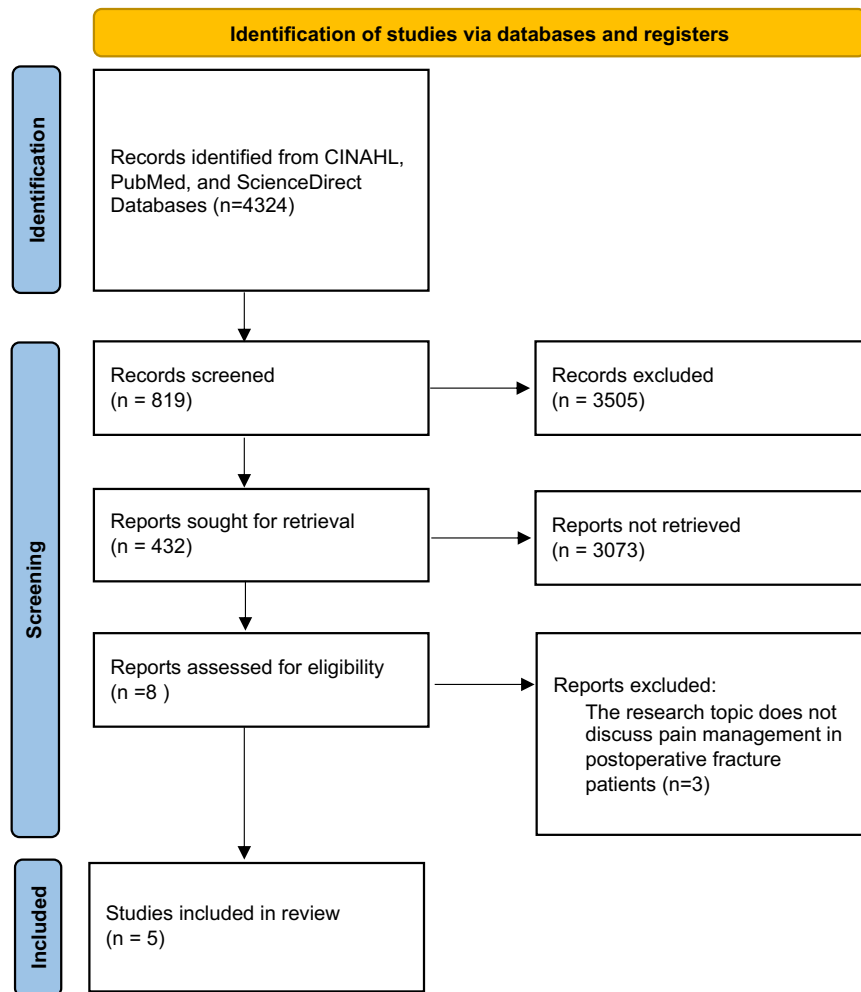


Figure 1. PRISMA Diagram

scale, and research results. The results of the data extraction were further elaborated in the discussion section.

Quality Appraisal

The quality of the studies was assessed using the critical appraisal checklist tools provided by the Joanna Briggs Institute (JBI) for research with RCT and cohort study designs. The tool for RCTs consisted of 13 consistent assessment questions, while the tool for cohort studies had 11 consistent assessment questions, covering four categories: yes, no, unclear, and not applicable. "Yes" was assigned a value of 1, "no" a value of 0, and the total score ranged from 0 to 9 (Table 1).

RESULTS

The article search yielded a total of 4,324 articles based on the keywords used, obtained from PubMed, CINAHL, and ScienceDirect.

After screening by year, 819 articles were identified. From the full text and abstracts of 432 articles, and applying the exclusion and inclusion criteria, six articles were selected. These articles focused on interventions and pain management in patients with postoperative fractures. All articles were published between 2018 and 2022, utilized the randomized controlled trial method, and were written in English (Table 2).

In this article, the methods of fracture pain management were categorized into two groups: pharmacology and assistive devices. Pharmacological pain management involved peripheral nerve block anesthesia, antioxidant (vitamin C), intravenous tranexamic acid, and intravenous dexamethasone. Assistive devices, such as the Calculator and Comprehensive Pain Plan, were used as management tools. The analysis of the five articles revealed the following characteristics.

Table 1. Quality Assessment

Author (Year)	JBI Critical Appraisal Checklist	
	%	Score
Sort (2021)	69.23	9/13
Jamieson (2019)	81.81	9/11
Sumit Kumar et al. (2018)	72.72	8/11
Haomin Cui et al. (2021)	76.92	10/13
Alemnew et al. (2021)	69.23	9/13

Table 2. Included Studies Characteristics.

Author (Year)	Design	Age	Gender	Intervention	Tool Measuring	Pre Pain	Post Pain	Results
Sort et al. (2021)	RCT	44-66	M: 31 F: 46	Peripheral nerve block anaesthesia	Pain NRS (0-10)	4	2	Reduce pain
Jamieson et al. (2019)	Cohort Study	48-53	M: 111 F: 110	Predictive Pain Calculator and Comprehensive Pain Plan	Visual Analog Scale (0-10)	N/A	N/A	Reduce pain
Jain et al. (2019)	Cohort Study	20-60	M: 45 F: 15	Anti-oxidants (vitamin-C)	Visual Analog Scale (0-10)	4	2	Reduce pain
Cui et al. (2021)	RCT	18-40	M: 63 F: 33	Intravenous tranexamic acid	Visual Analog Scale (0-10)	5	4	Reduce pain
Alemnew et al. (2020)	RCT	18-65	M: 51) F: 9	Intravenous dexamethasone	Pain NRS (0-10)	3	2	Reduce pain

The research was conducted in various countries, including England, Denmark, India, China, Ethiopia, and the United States (with one article from each country). Overall, the study involved 812 participants, ranging in age from 16 to 67 years. The findings indicate that the Predictive Pain Calculator and Comprehensive Pain Plan, peripheral nerve block anesthesia, antioxidant (vitamin C), intravenous tranexamic acid, and intravenous dexamethasone can help reduce pain in postoperative fracture patients (Table 3).

DISCUSSION

Fractures and Postoperative Pain

A fracture is a condition where there is a complete or partial loss of bone continuity, usually caused by trauma. In patients undergoing surgery for fractures, one of the

problems that can arise is pain resulting from the wounds and surgery itself.

Postoperative pain is an unintended consequence of surgery and poses a major challenge for healthcare providers (Jain et al., 2019). Effective pain relief is necessary to reduce the level of pain experienced by fracture patients. In postoperative patients, pain can be severe and persistent, with an average duration of 72.45 minutes, significantly affecting patient comfort. Therefore, a comprehensive understanding of fractures is crucial for orthopedic treatment planning, which can help reduce hospitalizations, outpatient visits, and optimize the allocation of surgical resources (Bergh et al., 2021).

Pain can be experienced throughout the entire area of the fracture. To address the issue of pain in fracture patients, effective pain management approaches are required. Broadly speaking, there are two main approaches to

Table 3. Data Charting

Author (Year) Country	Design	Intervention	Sample	Results
Sort et al. (2021) Denmark	RCT	Peripheral nerve blocks (PNBs)	375	PNB's success rate is >94%. PNB is better than SA. Benefit of PNB can decrease pain scores and morphine consumption, although pain rebounds substantially when PNB subsides. The quality of the group score is 99% PNB vs 90% SA.
Jain et al. (2019) India	Cohort	antioxidant (vitamin-C)	60	The group receiving vitamin C showed increased VAS scores at the end of the second and sixth weeks of follow-up, decreased analgesia requirements and improved functional outcomes compared with the placebo group. Vitamin C supplementation helps reduce the need for analgesics in patients undergoing surgery for foot and ankle trauma, improves VAS scores and achieves better functional outcomes.
Jamieson et al. (2019) Amerika	Cohort	Predictive Pain Calculator and Comprehensive Pain Plan	221	After the intervention, prescribed opioids decreased by 63% or 120.2 to 11.7 8.9 milligram morphine (MME) pills/surgery. Opioid consumption decreased 58% 25.0 to 16.7 pills/surgery. Opioid use decreased from 13.5 pills/surgery to 10.3 pills/surgery. Implementation of pain plans and calculators affects the likelihood of pain control that the patient assesses but is unsatisfactory or unplanned opioid refills.
Cui et al. (2021) China	RCT	Intravenous tranexamic acid	96	The mean VAS pain score on elbow movement showed a significant difference between the two groups on POD 1 (TXA: 5 vs. placebo: 6,P.003) and POD 2 (TXA: 4 vs. placebo: 5,P.023) . Intravenous administration of TXA significantly decreased postoperative drainage volume and estimated total blood loss and reduced elbow pain with movement during the early postoperative days in patients undergoing OEA.
Alemnew et al. (2020) Ethiopia	RCT	Intravenous dexamethasone	60	There was a significant difference between the groups in the time to first analgesia, tramadol, diclofenac and morphine with p-values of 0.017, 0.036 and 0.046, respectively. For pain severity scores, differences were found at 6 hours (p 0.039) and 12 hours (p 0.024), but there was no significant reduction in the incidence of postoperative nausea and vomiting (p 0.448).

pain management: pharmacological and non-pharmacological methods (Butu, 2018). In this study, we identified several ways to manage pain in postoperative fracture patients.

Intervention 1: Pain management with a pharmacological approach

Analgesics are one of the primary therapeutic options used in pain management for fracture patients (Siti, 2017). Pharmacological therapy is commonly employed to reduce pain in fracture patients.

Peripheral Nerve Block (PNB). Peripheral nerve blocks are considered a beneficial anesthesia method in surgery, helping to improve comfort and reduce pain in fracture patients (Henningsen et al., 2018). Sort et al. (2021) demonstrated that successful PNB significantly reduced fracture pain scores and morphine consumption, although pain returned when the PNB effect subsided. Haslam et al. (2013) supported the use of regional nerve block anesthesia as an optimal approach for providing analgesia, promoting mobilization, and reducing acute hospitalization time in pain patients.

Vitamin C. Vitamin C acts as an antioxidant, stabilizing reactive oxygen species (ROS) that cause damage to membrane lipids and microcirculation. Its use aims to reduce vascular permeability, limit protein loss, aid in the healing process, and alleviate pain in postoperative fracture patients (Aim et al., 2017). Administration of vitamin C in postoperative fracture patients has shown increased pain scores, reduced analgesic requirements, and improved functional outcomes (Jain et al., 2019).

Intravenous Tranexamic Acid. Tranexamic acid (TXA) is an amino acid that inhibits plasminogen activation and exerts an antifibrinolytic effect (Xiao et al., 2019). Intravenous administration of tranexamic acid significantly reduces postoperative drainage volume, the risk of blood loss, and pain in postoperative fracture patients (Cui et al., 2021).

Intravenous Dexamethasone. Uncontrolled pain in postoperative patients poses risks of severe morbidity related to venous thrombosis, pulmonary embolism, pneumonia, and myocardial infarction. Intravenous dexamethasone helps improve postoperative analgesia, thereby reducing pain (Heesen et al., 2019). Alemnew et al. (2020) demonstrated

that intravenous dexamethasone administration can reduce pain levels in postoperative fracture patients. Similarly, Abdallah et al. (2015) found that intravenous dexamethasone reduces pain scores, opioid consumption, and improves postoperative comfort in fracture patients.

Intervention 2: Pain management with a pain plan approach

Comprehensive pain care should involve effective collaborative treatment and care, aiming to minimize side effects and alleviate pain severity (Tick et al., 2018). Jamieson et al. (2019) found that implementing comprehensive pain planning for outpatient surgery reduces opioid prescription, consumption, and wastage, while improving pain relief.

CONCLUSION

Pain issues faced by fracture patients not only impact their health but also affect various aspects of their lives. The management of postoperative fracture patients needs to be further developed, particularly in reducing the level of pain experienced by these patients. The results of this scoping review demonstrate that pain management in postoperative fracture patients can be achieved through pharmacological approaches, including peripheral nerve block anesthesia, antioxidant (vitamin C) administration, intravenous tranexamic acid, intravenous dexamethasone, and the utilization of management tools such as the Calculator and Comprehensive Pain Plan. Therefore, based on the findings of this scoping review, nurses can recommend these strategies to other healthcare professionals, including doctors, as a pain management strategy for postoperative fracture patients.

Declaration of Interest

The authors declare that no conflicts of interest exist.

Acknowledgment

None

Funding

None

Data Availability

The datasets generated during and/or analyzed during the current study are available from the

corresponding author on reasonable request.

REFERENCES

- Abdallah, FW, Johnson, J., Chan, V., Murgatroyd, H., Ghafari, M., Ami, N., Jin, R., & Brull, R. (2015). Intravenous dexamethasone and perineural dexamethasone similarly prolong the duration of analgesia after supraclavicular brachial plexus block: A randomized, triple-arm, double-blind, placebo-controlled trial. *Regional Anesthesia and Pain Medicine* , 40 (2), 125–132. <https://doi.org/10.1097/AAP.0000000000000210>
- Aïm, F., Klouche, S., Frison, A., Bauer, T., & Hardy, P. (2017). Efficacy of vitamin C in preventing complex regional pain syndrome after wrist fracture: A systematic review and meta-analysis. *Orthopedics and Traumatology: Surgery and Research* , 103 (3), 465–470. <https://doi.org/10.1016/j.otsr.2016.12.021>
- Alemnew, EF, Lemma, DT, Abate, SM, & Regassa, BA (2020). Effectiveness of intravenous dexamethasone on fascia iliaca compartment block with bupivacaine as part of postoperative multimodal analgesia for an open reduction and internal fixation surgery of femoral fracture in Hawassa Comprehensive Referral Hospital, Ethiopia, 2019: A randomized controlled trial. *International Journal of Surgery Open* , 25 , 24-28. <https://doi.org/10.1016/j.ijso.2020.06.007>
- Bergh, C., Wennergren, D., Möller, M., & Brisby, H. (2021). Fracture incidence in adults in relation to age and gender: A study of 27,169 fractures in the Swedish Fracture Register in a well-defined catchment area. *PLoS ONE* , 15 (12 December), 1–18. <https://doi.org/10.1371/journal.pone.0244291>
- Butu, A. (2018). *The relationship between pain intensity and pain management strategies in patients with ORIF postoperative fractures at RSUP H. Adam Malik Medan*. Thesis .
- Cui, H., Yu, S., Ruan, J., Sun, Z., Li, J., Chen, S., & Fan, C. (2021). Intravenous tranexamic acid reduces postoperative drainage and pain after open elbow arthrolysis: a randomized controlled trial. *Journal of Shoulder and Elbow Surgery* , 30 (8), 1725–1732. <https://doi.org/10.1016/j.jse.2021.04.031>
- Elsevier, H., & Cannada, LK (2020). Management of pain associated with fractures. *Springer* , 18 (3), 130–137. <https://doi.org/10.1007/s11914-020-00578-3>
- Haslam, L., Lansdown, A., Lee, J., & Van Der Vyver, M. (2013). Survey of current practices: Peripheral nerve block utilization by ED physicians for treatment of pain in the hip fracture patient population. *Canadian Geriatrics Journal* , 16 (1), 16–21. <https://doi.org/10.5770/cgj.16.52>
- Heesen, M., Rijs, K., Hilber, N., Eid, K., Al-Oweidi, A., Rossaint, R., & Klimek, M. (2019). Effect of intravenous dexamethasone on postoperative pain after spinal anaesthesia – a systematic review with meta-analysis and trial sequential analysis. *Association of Anesthesia* , 74 (8), 1047–1056. <https://doi.org/10.1111/anae.14666>
- Henningsen, MJ, Sort, R., Møller, AM, & Herling, SF (2018). Peripheral nerve block in ankle fracture surgery: a qualitative study of patients' experiences. *Anaesthesia* , 73 (1), 49–58. <https://doi.org/10.1111/anae.14088>
- Imani, F., Zaman, B., & De Negri, P. (2019). A high dose of fentanyl may accelerate the onset of acute postoperative pain. *Anesthesiology and Pain Medicine* , 9 (5), 4–5. <https://doi.org/10.5812/aapm.94498>
- Jain, SK, Dar, MY, Kumar, S., Yadav, A., & Kearns, SR (2019). Role of anti-oxidant (vitamin-C) in post-operative pain relief in foot and ankle trauma surgery: A prospective randomized trial. *Foot and Ankle Surgery* , 25 (4), 542–545. <https://doi.org/10.1016/j.fas.2018.05.001>
- Jamieson, MD, Everhart, JS, Lin, JS, Jain, SA, Cloud, HM, & Goyal, KS (2019). Reduction of opioid use after upper-extremity surgery through a predictive pain calculator and comprehensive pain plan. *Journal of Hand Surgery* , 44 (12), 1050-1059.e4. <https://doi.org/10.1016/j.jhsa.2019.10.002>
- Indonesian Ministry of Health. (2018). Results of basic health research 2018. *Indonesian Ministry of Health* , 53 (9), 1689–1699.
- Luo, P., Lou, J., & Yang, S. (2018). Pain management during rehabilitation after distal radius fracture stabilized with volar locking plate: A prospective cohort study. *BioMed Research International* , 1–6. <https://doi.org/10.1155/2018/5786089>
- Mahartha, GRA, Maliawan, S., & Kawiya, KS (2017). Fracture management in

- musculoskeletal trauma. *E-Jurnal Medika Udayana* , 2 (3), 548–560.
- McDonald, EL, Daniel, JN, Rogero, RG, Shakked, RJ, Nicholson, K., Pedowitz, DI, Raikin, SM, Bilolikar, V., & Winters, BS (2020). How does perioperative ketorolac affect opioid consumption and pain management after ankle fracture surgery? *Clinical Orthopedics and Related Research* , 478 (1), 144–151. <https://doi.org/10.1097/CORR.0000000000000978>
- Purwanto, H. (2016). *Medical surgical nursing II*. Health HR Center for Health, Ministry of Health RI .
- Santos, A. de L., Nitta, CT, Boni, G., Sanchez, GT, Sugawara Tamaoki, MJ, & Reis, FB dos. (2018). Evaluation and comparison of open and closed tibia shaft fractures in a quaternary reference center. *Acta Ortopedica Brasileira* , 26 (3), 194–197. <https://doi.org/10.1590/1413-785220182603184073>
- Siti, A. (2017). Pain management in the elderly with a non-pharmacological approach. *Muhammadiyah Journal of Nursing* , 2 (1), 179–182.
- Sort, R., Brorson, S., Gögenur, I., Hald, LL, Nielsen, JK, Salling, N., Hougaard, S., Foss, NB, Tengberg, PT, Klausen, TW, & Møller, AM (2021). Peripheral nerve block anesthesia and postoperative pain in acute ankle fracture surgery: the AnAnkle randomized trial. *British Journal of Anaesthesia* , 126 (4), 881–888. <https://doi.org/10.1016/j.bja.2020.12.037>
- Tick, H., Nielsen, A., Pelletier, KR, Bonakdar, R., Simmons, S., Glick, R., Ratner, E., Lemmon, RL, Wayne, P., & Zador, V. (2018). Evidence-based nonpharmacologic strategies for comprehensive pain care: The consortium pain task force white paper. *Explore* , 14 (3), 177–211. <https://doi.org/10.1016/j.explore.2018.02.001>
- WHO. (2021). Injury and violence . <https://www.who.int/news-room/fact-sheets/detail/injuries-andviolence>
- Xiao, C., Zhang, S., Long, N., Yu, W., & Jiang, Y. (2019). Is intravenous tranexamic acid effective and safe during hip fracture surgery? An updated meta-analysis of randomized controlled trials. *Archives of Orthopedic and Trauma Surgery* , 139 (7), 893–902. <https://doi.org/10.1007/s00402-019-03118-6>