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ORIGINAL

IMPACT OF ANESTHESIA FACTORS ON POSTOPERATIVE RECOVERY AND MOBILITY IN ELDERLY HIP FRACTURE PATIENTS: A META-ANALYSIS FOR SPORTS AND REHABILITATION INSIGHTS

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ABSTRACT

Objective: To perform a meta-analysis evaluating the impact of different anesthetic techniques on the postoperative recovery, mobility, and overall outcomes of elderly patients with hip fractures, with a focus on implications for physical rehabilitation and functional recovery. **Methods:** A comprehensive literature search was conducted across PubMed, the Cochrane Library, EMBASE, the Chinese Journal Full Text Database, and the Wanfang database up to July 31, 2022. Relevant studies were analyzed using RevMan 5.2 software, and statistical testing was applied to assess the influence of anesthesia type on postoperative outcomes. Meta-analyses were performed on key indicators, including in-hospital mortality, postoperative delirium, length of hospital stay, and 1-year postoperative mortality. **Results:** Twelve high-quality studies were included in the final analysis, comprising three randomized controlled trials (RCTs) and nine observational studies (OS). The meta-analysis revealed the following: In-hospital mortality: Regional anesthesia significantly reduced in-hospital mortality compared to general anesthesia (RR = 0.81, 95% CI 0.75–0.88, P < 0.01). Postoperative delirium: No significant difference in the incidence of postoperative delirium was observed between the two groups (RR = 0.95, 95% CI 0.79–1.14, P > 0.05). Hospital stay: Regional anesthesia was associated with a shorter postoperative hospital stay compared to general

anesthesia (RR = -0.04, 95% CI -0.06 to -0.03, P < 0.01). 1-year mortality: No clinically meaningful difference was noted in 1-year mortality between the groups (RR = 1.04, 95% CI 0.84–1.30, P > 0.05). **Conclusion:** Regional anesthesia offers significant advantages in reducing in-hospital mortality and hospital stay duration in elderly patients with hip fractures, facilitating earlier initiation of rehabilitation and improving functional recovery potential. However, no differences were observed in the incidence of postoperative delirium or 1-year mortality between regional and general anesthesia. These findings suggest that regional anesthesia may be a preferable option for promoting postoperative recovery and readiness for physical activity, aligning with rehabilitation goals for maintaining mobility and quality of life in elderly patients. Future studies should further explore the role of anesthetic techniques in supporting long-term functional outcomes and participation in physical rehabilitation programs.

KEYWORDS: Anesthesia Factors; Older Patients; Hip Fracture; Postoperative Outcome; Meta Analysis

1. INTRODUCTION

Hip fractures are among the most common and severe injuries in elderly populations, often resulting in significant morbidity, mortality, and functional decline. The aging population and increasing prevalence of osteoporosis have further contributed to the global rise in hip fracture cases. Surgical intervention remains the cornerstone of treatment for hip fractures, but postoperative recovery in elderly patients is often complicated by comorbidities, frailty, and the physiological stress of surgery. Optimizing perioperative care, including the choice of anesthetic technique, is therefore crucial to improving surgical outcomes, reducing complications, and promoting faster recovery. The type of anesthesia administered during hip fracture surgery—general anesthesia (GA) or regional anesthesia (RA)—can have significant implications for postoperative outcomes. General anesthesia, which induces a state of unconsciousness, is commonly used but may pose risks such as cardiovascular and respiratory complications, particularly in elderly patients. Regional anesthesia, including spinal or epidural blocks, is an alternative that provides effective pain control while maintaining consciousness and reducing systemic stress. Previous studies have suggested that regional anesthesia may be associated with lower rates of in-hospital mortality, shorter hospital stays, and fewer complications, but conflicting evidence exists regarding its impact on long-term outcomes, such as 1-year mortality and functional recovery. Postoperative delirium, a common complication in elderly patients, can significantly delay recovery and affect mobility, rehabilitation, and overall quality of life. Similarly, extended hospital stays and higher mortality rates are critical concerns that highlight the need for evidence-based strategies to improve perioperative management. The choice of anesthesia is a potentially modifiable

factor that may influence these outcomes, making it a vital area of investigation. This meta-analysis aims to evaluate the impact of anesthesia factors on the postoperative recovery of elderly patients with hip fractures, focusing on key outcomes such as in-hospital mortality, postoperative delirium, length of hospital stay, and 1-year mortality (Chen et al., 2019; Hua et al., 2022). By synthesizing data from high-quality studies, this research seeks to provide clarity on the benefits and limitations of different anesthetic techniques. Additionally, the findings have direct implications for physical rehabilitation and sports medicine, as they inform strategies to optimize recovery (Garg et al., 2021; Kowark et al., 2019), enhance mobility, and promote functional independence in elderly patients. Understanding the influence of anesthesia on recovery outcomes can contribute to the development of comprehensive care models that prioritize both surgical success and long-term physical performance.(Kim et al., 2022; Li et al., 2022). (Bhushan et al., 2022 Sep; Zheng et al., 2020). The biggest problem of elderly patients with hip fracture is that there are many internal medicine complications, so the mortality of elderly patients with hip surgery remains high. It is a topic worthy of discussion to select the optimal anesthesia method for this kind of high-risk surgical population. Thereby, this study aimed to assess, using meta-analysis, the impacts of two anesthetic techniques on the postoperative outcomes of elderly patients suffering hip fracture, so as to provide basis for clinical work and basic research.

2. Data and Methods

2.1 Inclusion Criteria of Literatures

① Clinical randomized controlling led trials (RCTs) and observational studies (OS) of "Application of different anesthesia methods in elderly hip fracture surgery" were included; ② The included elderly patients with hip fracture were all diagnosed as hip fracture by clinical and imaging findings, and their ages were ≥ 65 years old; ③ The overall patient information for the two groups was evenly distributed, and the difference in age and gender distribution was not statistically significant; ④ The observation group received regional block anesthesia, while the controlling group received general anesthesia; ⑤ Outcome indicators included postoperative in-hospital mortality, postoperative delirium and perioperative hospitalization time; ⑥ For clinical trials consisting of multiple groups of cases, only two groups were selected; ⑦ The literature data were complete or the information provided can be converted into data for application.

2.2 Exclusion Criteria of Literatures

① Literatures on non-randomized controlling led group trials, reviews, case reports, experience summaries and animal experiments; ② Hip fracture patients under 65 years old or treated conservatively; ③ Literatures in which

subjects with other complications were selected as the research objects; ④ Literatures with nonstandard experimental design, no definite diagnostic criteria and efficacy evaluation criteria; ⑤ Repeated literatures, and literatures in which unable to extract data, and with serious errors in data; ⑥ Literatures in which with incomplete measurement data affecting the evaluation of research.

2.3 Retrieval Strategy

From the beginning of the database up until July 31, 2022, information was retrieved from PubMed, Cochrane Library, EMBASE, Chinese journal full text database, and Wanfang database. The search was performed by subject words + free words. The key words or abstracts were "hip fracture", "elderly hip fracture", "regional block anesthesia", "intraspinal anesthesia", "general anesthesia" and "nerve block" in Chinese and "hip fracture", "elderly hip fracture", "regional block anesthesia", "intraspinal anesthesia", "general anesthesia", "nerve block" in English, and they were retrieved in different combinations.

2.4 Literature Screening and Data Extraction

Independently, two researchers went through the literatures using the pre-established inclusion and exclusion standards. Endnote X8 software was used in the whole process. In case of ambiguity, the third researcher shall coordinate the completion. If the literatures were incomplete, please contact the author as much as possible. Excel 2010 software was used to extract data, providing the researcher's identity, the publication date, the total number of subjects, average age, gender, disease status, anesthesia methods, outcome indicators, random distribution methods, etc.

2.5 Methodological Quality Evaluation of Literatures

The Cochrane Handbook for Systematic Reviews of Interventions was utilized to assess the efficacy of the included literature: random distribution method; the allocation scheme was hiding; the research objects and subjects were blinded; the evaluators of outcomes were blinded; data integrity; selective reporting of research findings; additional sources of bias. The terms "low deviation risk," "high deviation risk," and "uncertainty of deviation risk" were utilized to categorize each project. For other sources of bias, baseline data, sample size estimation, research protocol, clinical trial registration, fund support and medical ethics review report were evaluated. If two or more of the included literatures were reported, it was determined to be "low bias risk", if one or all of them were not reported, it was determined to be "uncertainty of bias risk", if one or more of them were reported, but may had a significant impact on the test results, it was determined to be "high bias risk". Two researchers shall implement the above requirements, and if there was any ambiguity, the third researcher shall coordinate to complete it.

2.6 Statistical Methods

The Cochrane Collaboration Network's Rev man 5.3 program was utilized for the meta-analysis. The effect statistics were expressed by relative risk (RR) for counting data, and the mean (MD) was used for measurement data, and the resulting data were presented as an effectiveness value and a 95% confidence interval (CI). The χ^2 tests were utilized to assess whether the research results were heterogeneous. The studies were considered homogeneous and the fixed effect model was applied for meta-analysis if P>0.10 and I^2<50%. Heterogeneity increases with increasing I^2. There was heterogeneity in the trials if $P \leq 0.10$, I^2>50%. For the meta-analysis, the arbitrary impact model was employed. In order to assess the durability of the synthetic results, sensitivity analysis was utilized where necessary to track changes in the heterogeneity and impact value.

3. Results

3.1 Literature Screening

A combination of 539 publications were obtained from major databases, of which 220 literatures remained after excluding duplicate literatures and reviews. Then according to the literature titles and abstracts for preliminary screening, 154 works of literature were left after the works that did not adhere to the guidelines were eliminated. Following completion of the text, further re-screening was carried out, and 12 final literatures were included. See Figure 1 for the literature screening process.

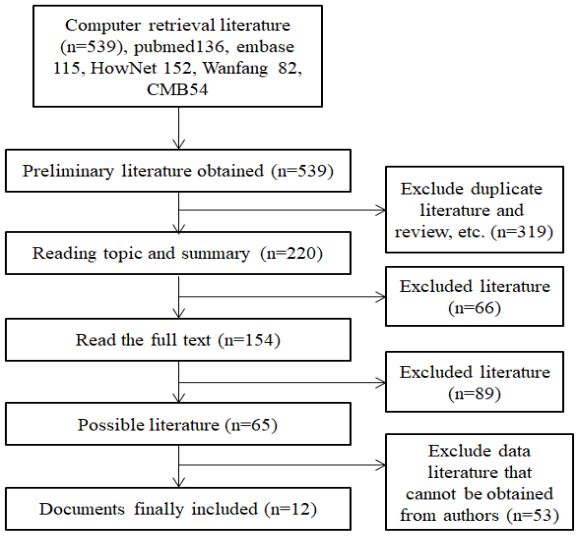

Figure 1: Screening Process of Included Literatures

3.2 Basic Characteristics of Included Literatures

Among the 12 included literatures, general anesthesia and regional anesthesia were contrasted. The minimum and maximum sample sizes were

30 and 104088 instances, respectively. Table 1 displays the fundamental features of the included literatures

Table 1: Basic Characteristics of Included Literatures

LITERATURE	COUNTRY	TYPE OF STUDY	SAMPLE SIZE	ANESTHESIA METHODS	INTERVENTION	CLINICAL CHARACTERISTICS OF PATIENTS	SCORE	OBSERVATION INDEX
(ZHENG ET AL., 2020)	China	OS	208	General anesthesia / regional anesthesia		≥ 65 years old	8	① ② ③ ④
(SHIH ET AL., 2010)	China	OS	335	General anesthesia / regional anesthesia		≥ 80 years old	8	① ②
(CASATI ET AL., 2003)	Italy	RCT	30	General anesthesia / regional anesthesia		≥ 65 years old	4	②
(CHU ET AL., 2015)	China	OS	104088	General anesthesia / regional anesthesia		≥ 65 years old	9	① ③
(LONČARIĆ-KATUŠIN ET AL., 2017)	Croatia	OS	115	General anesthesia / regional anesthesia		≥ 70 years old	5	① ② ③ ④
(LE-WENDLING ET AL., 2012)	USA	OS	308	General anesthesia / regional anesthesia		≥ 65 years old	8	③
(TZIMAS 2018)	Greece	RCT	70	General anesthesia / regional anesthesia		≥ 65 years old	6	② ③
(BAI ET AL., 2018)	China	OS	136	General anesthesia / regional anesthesia		≥ 80 years old	8	① ③
(HUANG ET AL., 2018)	China	OS	222	General anesthesia / regional anesthesia		≥ 65 years old	6	③
(GILBERT ET AL., 2000)	USA	OS	741	General anesthesia / regional anesthesia		≥ 65 years old	8	② ④
(RUAN ET AL., 2015)	China	OS	336	General anesthesia / regional anesthesia		≥ 65 years old	7	③
(RODKEY ET AL., 2022)	Span	RCT	512	General anesthesia / regional anesthesia		≥ 75 years old	6	④

① Postoperative in-hospital mortality; ② Postoperative delirium; ③ Perioperative hospital stay

3.3 Quality Evaluation of Included Literatures

The quality of the included literatures was analyzed, and the quality of each included literature was different. Among them, 3 RCTs were included with a score ⩾4 points, and 9 OS with a score ⩾5 points, all of which were of relatively high quality. See Table 2.

Table 2: Quality Evaluation of Included Literatures

INCLUDED LITERATURE	RANDOM ASSIGNMENT METHOD	BLIND METHOD	ALLOCATION SCHEME HIDDEN	BASELINE COMPARABILITY	LOSS OF FOLLOW-UP / WITHDRAWAL	JADAD SCORE	QUALITY GRADE
(ZHENG ET AL., 2020)	Not clear	Not mentioned	Not sure	Comparable	Not mentioned	8	A
(SHIH ET AL., 2010)	Not sure	Not mentioned	Not sure	Comparable	Not mentioned	8	A
(CASATI ET AL., 2003)	Random number table method	Not mentioned	Not sure	Comparable	Not mentioned	4	C
(KIM ET AL., 2022)	Random number table method	Not mentioned	Not sure	Comparable	Not mentioned	9	A
(LONČARIĆ-KATUŠIN ET AL., 2017)	Not clear	Not mentioned	Not sure	Comparable	Not mentioned	5	C
(LE-WENDLING ET AL., 2012)	Random number table method	Not mentioned	Not sure	Comparable	Not mentioned	8	A
(TZIMAS 2018)	Not sure	Not mentioned	Not sure	Comparable	Not mentioned	6	B
(BAI ET AL., 2018)	Random number table method	Not mentioned	Not sure	Comparable	Not mentioned	8	A
(HUANG ET AL., 2018)	Not sure	Not mentioned	Not sure	Comparable	Not mentioned	6	B
(GILBERT ET AL., 2000)	Random number table method	Not mentioned	Not sure	Comparable	Not mentioned	8	B
(RUAN ET AL., 2015)	Not sure	Not mentioned	Not sure	Comparable	Not mentioned	7	B
(RODKEY ET AL., 2022)	Not sure	Not mentioned	Not sure	Comparable	Not mentioned	6	B

3.4 Results of Meta Analysis

3.4.1 Analysis of Postoperative in-Hospital Mortality

Six different publications discussed postoperative hospital mortality. The outcomes of the investigations were not heterogeneous, as determined by the Cochranc standard test (P = 0.67, I^2 = 0%), hence the fixed impact model was utilized for statistical analysis. According to the findings of the meta-analysis, patients in the observation group had a postoperative in-hospital mortality rate that was considerably lower than that of the comparison group (RR = 0.81, 95% CI 0.75 ~ 0.88, P < 0.01).

3.4.2 Postoperative Delirium

The prevalence of postoperative delirium was discussed in a combination of six literatures. The outcomes of the investigations were not heterogeneous, as determined by the Cochranc standard test (P = 0.44, I^2 = 0%), hence the fixed impact model was utilized for statistical analysis. According to the meta-findings, analysis's there was no clinically meaningful discrepancy among the observation group and the controlling ling group's occurrence of postoperative delirium in patients (RR = 0.95, 95% CI 0.79 ~ 1.14, P > 0.05).

3.4.3 Perioperative Hospitalization Time

The length of the postoperative hospital stay was discussed in a collection of eight literatures. The outcomes of the investigations were not heterogeneous, as determined by the Cochranc standard test (P = 0.92, I^2 = 0%), hence the fixed impact model was utilized for statistical analysis. According to the findings of the meta-analysis, patients in the observation group spent considerably less time in the hospital following surgery than those in the comparison group (RR = -0.04, 95% ci-0.06 ~ -0.03, P < 0.01).

3.4.4 Postoperative 1-Year Mortality

The 1-year mortality following surgery was covered in a collection of four literatures. The outcomes of the investigations were not heterogeneous, as determined by the Cochranc standard test (P = 0.62, I^2 = 0%), hence the fixed impact model was utilized for statistical analysis. According to the meta-findings, analysis's there was no clinically meaningful discrepancy for both the observation group and the controlling ling group's postoperative 1-year death rates (RR = 1.04, 95% CI 0.84 ~ 1.30, P > 0.05).

4. Discussion

With the deepening of social aging, the incidence of hip fracture in elderly patients increases gradually. According to the statistics of American hip surgery

association (SACS), there are about 66,000 new hip fractures in the United States every year. There are about 10,000 new cases of acetabular fractures in China every year (Simonin et al., 2022 Dec 1). Because of the high risk and many complications of hip fracture surgery, the common complications of elderly patients after surgery are pneumonia, infection, bedsore and pulmonary infection and others (Fukuda et al., 2022). Since 1965, 17 studies in the United States have reported the influence of anesthesia factors on the postoperative outcomes of elderly patients with hip fracture, but there is no consistent conclusion at home and abroad. In this study, the American Heart Association (AHA) standard grade Ⅰ ~ Ⅱ elderly patients having hip fracture were chosen as the research subjects, and the meta-analysis approach was utilized to thoroughly assess the impact of anesthetic factors on postoperative outcomes of senior patients having hip fracture, in order to provide the basis for clinical decision-making. Elderly people having hip fractures often have complicated medical conditions. Understanding the surgical indications precisely is essential to lowering postoperative mortality, reducing the frequency of perioperative problems, and improving patient long-term prognosis, accurately evaluate the patients who are suitable for surgical treatment, effectively complete the preoperative preparation, comprehensively consider the fracture site, the patients' physiological condition and other factors, and develop an individualized anesthesia scheme (Ertürk et al., 2021). Attention has always been on the impact of anesthetic parameters on the postoperative outcomes of elderly patients with hip fractures. There are, however, limited publications on the impact of anesthetic factors on the recovery of elderly patients having hip fracture both domestically and internationally, and most of them are randomized controlling led trials. The influence of anesthetic factors on the surgical outcomes of elderly patients who suffered hip fractures was thoroughly assessed in this study using meta-analysis. There were 12 RCT and OS literatures in all. The findings demonstrated that regional block anesthesia significantly influenced the postoperative outcomes of elderly patients with hip fractures, which could actually decrease the postoperative in-hospital mortality and perioperative hospitalization time. However, there was no variation in the rate of postoperative delirium and the mortality of one year after operation compared with patients under general anesthesia, but the results of this study were different from some foreign research reports. In a cohort study of the elderly based on a large population (Rodkey et al., 2022), an elevated risk of postoperative delirium is linked to general anesthesia. Regional anesthetic without sedation, as compared to general anesthesia, did not significantly lower the occurrence of delirium in the first seven days following surgery in patients 65 years of age and older with brittle hip fractures, according to the multicenter randomized clinical trial (Soulioti et al., 2022). In terms of delirium severity, frequency, or subtype, worst pain intensity, length of hospital stays, or 30-day

all-cause mortality at 7 days following surgery, there was no discernible variation. Regional block anesthesia is to inject local anesthetics around the operation site to block the nerve endings of the operation and achieve the purpose of anesthesia. It is also to encircle the resected tissue for an envelopment injection or encircle the basilar part at the suspended tissue for an invasive injection. Some studies have shown that (Guay & Kopp, 2020; Ng et al., 2020), regional block anesthesia is better than general anesthesia, and patients with regional block anesthesia have lower in-hospital mortality and the risk of pulmonary complications, and lower incidence of complications 30 days after operation. Regional anesthesia technology for limb surgery has the advantages such as early activity, short hospitalization time, good postoperative analgesia effect, low risk of thromboembolism, less blood transfusion demand and low cost. Regional anesthesia technology has a positive impact on perioperative and postoperative mortality and morbidity related to limb amputation, especially in elderly patients. Large sample observational studies have shown that (Guay & Kopp, 2020), limb amputation under regional anesthesia technology, especially peripheral nerve block, can reduce mortality / morbidity, the need for postoperative intensive care, average length of hospital stay and hospitalization expenses. Regional block anesthesia is a safe and reasonable alternative to general anesthesia, which has a certain safety in the operation treatment of patients with distal radius fractures. Regional block anesthesia may be the preferred anesthesia technique for high-risk patients under general anesthesia. In addition, in comparison to regional an aesthetic during carotid endarterectomy, studies have shown that combination regional and general anesthesia can improve patient comfort and hemodynamic stability (Ng et al., 2020). In clinical practice, the appropriate anesthesia scheme should be chosen according to the severity of the disease, combined injury and basic diseases and others of elderly patients with hip fracture. This meta-analysis underscores the critical role of anesthesia choice in influencing postoperative outcomes for elderly patients undergoing hip fracture surgery. The findings indicate that regional anesthesia (RA) offers several advantages over general anesthesia (GA), including significantly reduced in-hospital mortality and shorter postoperative hospital stays. These benefits highlight the potential of RA to support earlier mobilization, facilitate rehabilitation, and enhance overall recovery in this vulnerable population. However, no significant differences were observed between RA and GA in terms of postoperative delirium incidence or 1-year mortality, suggesting that the long-term impact of anesthesia choice may depend on additional factors such as postoperative care and rehabilitation strategies. Shorter hospital stays associated with RA provide a valuable opportunity for initiating early rehabilitation programs, which are critical for restoring mobility, maintaining muscle strength, and reducing the risk of complications such as deconditioning and thromboembolic events. By minimizing systemic stress and promoting stability during the perioperative period, RA also aligns with broader goals of physical rehabilitation and recovery

optimization. The lack of difference in 1-year mortality between RA and GA highlights the complexity of long-term recovery in elderly patients with hip fractures. This suggests that while anesthesia choice plays a crucial role in early recovery, comprehensive care models that integrate multidisciplinary rehabilitation, nutrition, and psychosocial support are essential for improving long-term outcomes and ensuring sustained functional independence. These findings have important implications for clinical practice and sports medicine, particularly for elderly patients aiming to regain mobility and physical activity post-surgery. Tailoring anesthesia strategies to individual patient needs, combined with robust rehabilitation programs, can enhance recovery trajectories and improve quality of life. Future research should explore the interplay between anesthesia types and other factors such as comorbidities, rehabilitation intensity, and functional outcomes to further refine perioperative care models. In conclusion, the selection of anesthesia should not only consider immediate surgical outcomes but also its impact on postoperative recovery and long-term functional performance. Regional anesthesia, with its demonstrated benefits in early recovery, presents a valuable option for improving the care and rehabilitation of elderly hip fracture patients. By prioritizing anesthesia approaches that support early mobilization and functional recovery, healthcare providers can better address the unique needs of this population and promote successful aging through enhanced physical activity and independence.

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REFERENCES

Bai, B., Ruan, X., Zhang, Y., Chen, K., Jin, X., Tian, Y., Tang, S., & Huang, Y. (2018). Effect of anesthesia on cardiopulmonary complications in elderly patients with hip fracture. *Zhonghua yi xue za zhi*, *98*(40), 3240-3243.

Bhushan, s., Huang, x., Duan, y., & Xiao, Z. (2022 Sep). The impact of regional versus general anesthesia on posterior neurological outcomes in elderly patients emerging hip fracture surgery: a systematic review and meta-analysis. *Int j surg*, *105*(106854).

Casati, A., Aldegheri, G., Vinciguerra, F., Marsan, A., Fraschini, G., & Torri, G. (2003). Randomized comparison between sevoflurane anaesthesia and unilateral spinal anaesthesia in elderly patients undergoing orthopaedic surgery. *European journal of anaesthesiology*, *20*(8), 640-646.

Chen, D. X., Yang, L., Ding, L., Li, S. Y., Qi, Y. N., & Li, Q. (2019). Perioperative outcomes in geriatric patients undergoing hip fracture surgery with different anesthesia techniques: A systematic review and meta-analysis. *Medicine*, *98*(49).

Chu, C. C., Weng, s. f., & Chen, K. T. (2015). proportion score matched comparison of postoperational advantage outcomes between geriatric

patients given a general or a neural endoscopic for hip surgery: a population-based study. *Anesthesiology*, *123*(1), 136-147.

Ertürk, T., Gündoğmuş, İ., Güner, T., Yildirim, C., & Ersoy, A. (2021). Comparison of USG-guided or landmark approach fascia iliaca compartment blockfor positioning in elderly hip fracture patients with spinal anesthesia: a randomizedcontrolled observational study. *Turkish journal of medical sciences*, *51*(6), 2908-2914.

Fukuda, T., Imai, S., Shimoda, S., Maruo, K., Nakadera, M., & Horiguchi, H. (2022). Aspiration pneumonia and anesthesia techniques in hip fracture surgery in elderly patients: A retrospective cohort study using administrative data. *Journal of Orthopaedic Surgery*, *30*(1), 10225536221078622.

Garg, V., Lawrence, H., & Joshi, Y. (2021). Comparative outcome of anaesthetic for elderly hip fracture. *Journal of Clinical Orthopaedics and Trauma*, *12*(1), 177-182.

Gilbert, T., Hawkes, W., Hebel, J., Hudson, J., Kenzora, J., Zimmerman, S., Felsenthal, G., & Magaziner, J. (2000). Spinal anesthesia versus general anesthesia for hip fracture repair: a longitudinal observation of 741 elderly patients during 2-year follow-up. *American Journal of Orthopedics (Belle Mead, NJ)*, *29*(1), 25-35.

Guay, J., & Kopp, S. (2020). Peripheral nerve blocks for hip fractures in adults. *Cochrane Database of Systematic Reviews*(11).

Hua, H., Xu, Y., Jiang, M., & Dai, X. (2022). Evaluation of pericapsular nerve group (PENG) block for analgesic effect in elderly patients with femoral neck fracture undergoing hip arthroplasty. *Journal of Healthcare Engineering*, *2022*.

Huang, Z., Zhang, Z., & Zhang, J. (2018). comparison of complications after general anesthesia and local anesthesia in elderly patients with hip fracture. *Chinese Journal of orthopedics*, *26*(9), 802-805.

Kim, C.-H., Yang, J. Y., Min, C. H., Shon, H.-C., Kim, J. W., & Lim, E. J. (2022). The effect of regional nerve block on perioperative delirium in hip fracture surgery for the elderly: A systematic review and meta-analysis of randomized controlled trials. *Orthopaedics & Traumatology: Surgery & Research*, *108*(1), 103151.

Kowark, A., Rossaint, R., & Coburn, M. (2019). General versus spinal anesthesia for the elderly hip fractured patient. *Current Opinion in Anesthesiology*, *32*(1), 116-119.

Le-Wendling, L., Bihorac, A., Baslanti, T. O., Lucas, S., Sadasivan, K., Wendling, A., Heyman, H. J., & Boezaart, A. (2012). Regional anesthesia as compared with general anesthesia for surgery in geriatric patients with hip fracture: does it decrease morbidity, mortality, and health care costs? Results of a single-centered study. *Pain Medicine*, *13*(7), 948-956.

Li, T., Li, J., Yuan, L., Wu, J., Jiang, C., Daniels, J., Mehta, R. L., Wang, M., Yeung, J., & Jackson, T. (2022). Effect of regional vs general anesthesia

on incidence of postoperative delirium in older patients undergoing hip fracture surgery: the RAGA randomized trial. *Jama*, *327*(1), 50-58.

Lončarić-Katušin, M., Mišković, P., Lavrnja-Skolan, V., Katušin, J., Bakota, B., & Žunić, J. (2017). General versus spinal anaesthesia in proximal femoral fracture surgery–treatment outcomes. *Injury*, *48*, S51-S55.

Ng, T. K.-T., Chan, W.-S., Peng, P. W., Sham, P., & Sasaki, S. (2020). Chemical hip denervation for inoperable hip fracture. *Anesthesia & Analgesia*, *130*(2), 498-504.

Rodkey, D. L., Pezzi, A., & Hymes, R. (2022). Effects of spinal anesthesia in geriatric hip fracture: a propensity-matched study. *Journal of orthopaedic trauma*, *36*(5), 234-238.

Ruan, x., Xu, Z., & Tang, s. (2015). diagnosis comparison of three different anesthesia methods for elderly hip fracture surgery *Basic medicine and clinical*, *35*(5), 695-699.

Shih, Y.-J., Hsieh, C.-H., Kang, T.-W., Peng, S.-Y., Fan, K.-T., & Wang, L.-M. (2010). General versus spinal anesthesia: which is a risk factor for octogenarian hip fracture repair patients? *International Journal of Gerontology*, *4*(1), 37-42.

Simonin, m., delsuc, C., meuret, P., Caruso, L., & Rimmel, é. T. (2022 Dec 1). hypobaric uniform spine anesthesia versus general anesthesia for hip fracture surgery in the elderly: a randomized controlled trial Anesth anal *135* (6), 1262-1270.

Soulioti, E., Kavezou, F., Giannoulis, D., Sidiropoulou, T., Altsitzioglou, P., Bekos, A., & Mavrogenis, A. F. (2022). Shamrock lumbar plexus block for hip hemiarthroplasty in a high risk elderly patient with hip fracture. *Journal of Long-Term Effects of Medical Implants*, *32*(1).

Zheng, X., Tan, Y., Gao, Y., & Liu, Z. (2020). Comparative efficacy of Neuraxial and general anesthesia for hip fracture surgery: a meta-analysis of randomized clinical trials. *BMC anesthesiology*, *20*, 1-12.