

Review Article: Risk factors of post-operative pain after ankle fractures surgery based on gender: systematic Review

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ABSTRACT

Introduction: Most patients experience moderate to severe pain after ankle surgery. Early and appropriate treatment of postoperative pain is essential for effective treatment that leads to preservation of lung function, normal breathing, rehabilitation and prevention of chronic pain. In this retrospective study, we aimed to identify potential predictors of moderate-to-severe postoperative pain in the post-anesthesia care unit (PACU) in patients undergoing gastric bypass surgery.

Material and Methods: In this systematic review VAS/vNRS score of 4-6 is considered moderate, and 7-10 is considered severe. Additional factors investigated included time from ankle fracture to surgery, anesthesia procedure, preoperative anesthesia, medication use and postoperative medication use, classification radiation, bone complexity, surgical technique, and tourniquet operative time.

Results: Data from 336 patients who underwent ankle arthroplasty between January 2009 and December 2022 were analyzed. None of the following variables had a significant effect on pain; age, weight, smoking, time from fracture to surgery, type of anesthesia, opioids to control dysfunction, complexity of the fracture, surgical procedure or tourniquet technique increase. Gender predicted moderate to severe pain after PACU by 2 differences.31 (1.39–3.86, P = 0.001). To our knowledge, this is the first study to report gender differences in pain reporting in the hours following joint surgery.

Conclusion: Female patients who had surgery for ankle sprains reported higher pain scores in the PACU than men.

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Introduction

Regional A systematic review involving 23,037 patients reported that previous pain, stress, young age, and type of surgery (orthopedic, thoracic, and abdominal) were important predictors of bite use after severe pain. None of the studies specifically examined joints. Sexuality and pain is the purpose of a review of data on clinical and postoperative pain in experimental studies of ankle fractures. There is strong evidence to support that women experience more pain than men in acute situations, including post-operative and surgical situations. The difference between the female reproductive system is more pronounced during adolescence.

The review examined several studies, some of which included orthopedic patients. They concluded that men and women perceive pain differently. However, none of the studies included patients with arthritis. A database search of major databases in MEDLINE (Ovid), Cochrane Library, Web of Science, and Excerpta Medica Database (EMBASE) revealed only four studies on short-term pain after ankle surgery. Two prospective and one retrospective studies evaluated the effect of pneumatic tourniquets on postoperative pain.

In the United States, the prevalence of diabetes has increased at an alarming rate, with approximately 25.8 million people (8.3% of the population) living with the disease. The incidence of diabetes increased to 26.9% in patients aged 65 and over.

Diabetes mellitus and/or hyperglycemia are associated with increased surgical site complication rates after total joint replacement, bone surgery, orthopedic surgery, or foot and ankle surgery. Appropriate adjustment for patient mix is essential for meaningful comparisons of SSI rates if SSI is to be accepted as an effective measure of quality of care.

Diabetic patients undergoing foot and ankle surgery with special attention to infectious and non-infectious diseases such as peripheral neuropathy, Charcot neuroarthropathy, peripheral artery disease and foot ulcer. An increased incidence of infection has been observed in diabetic patients after ankle sprains or primary joint arthrodesis.

A retrospective control study found that patients with diabetes experienced more complications at the surgery site after foot and ankle surgery than patients with and without diabetes. This prospective study aimed to confirm the results of previous studies. Our hypothesis is that patients with diabetes have a higher risk of developing surgical site infection compared to patients with or without diabetes without complications. An additional objective of this study was to compare the cost of surgical intervention in nondiabetic patients with and without peripheral neuropathy and to evaluate the effect of glycemic control on the cost of surgical site.

A small number of patients (n=32) were included in the first study, and 138 patients were included in the second study. The third, which included 603 patients, examined tourniquet procedures and subsequent opioid use, as well as acute pain scores and post-anesthetic care unit (PACU) time. Fourth, the relationship between gender and body mass index (BMI) and pain scores was analyzed retrospectively. To complement these analyzes, this study aimed to examine potential markers of moderate to severe pain after ankle surgery.

Material and Methods

Study Design: The current study conducted a systematic review using a multivariate analysis to identify factors associated with perceived pain intensity in the PACU in patients undergoing ankle surgery. Data were collected at Tabriz University in western Iran between January 2009 and December 2022. This project

has been listed as a quality improvement project by the Research Committee . Therefore, according to Norwegian standards, ethical procedures have been approved by the Data Protection Commissioner (2011/69) and do not require patient information.

Patients criteria: Included patients were ≥ 18 years old; they have separate ankles; and the American Society of Anesthesiologists (ASA) physical score of 1, 2, or 3. 412 eligible patients were identified using hospital planning software (Orbit 4, Evry). agree to be included. Procedures not included are re-operations, tibial pilon fractures, bone fractures, and even non-ankle injuries that require treatment. We excluded 76 patients after correct radiation distribution.

Measurements(Pain, Radiology classification, Tourniquet procedure, Clinical characteristics, Pain management):

Self-reported pain was recorded while the patient was in the PACU. We assessed pain using the visual acuity scale (VAS) or numerical rating scale (vNRS). The VAS scale is a horizontal straight line 100mm long, the end of the line represents positive and negative visual effects. Patients in this PACU were instructed to indicate their pain on a 100 mm line on a scale with a moving line to indicate their pain. Using the vNRS, patients were asked to rate their pain on an 11-point scale from 0 ("no pain") to 10 ("worst pain"). Both VAS and vNRS are valid and reliable tools for assessing postoperative pain. vNRS is the preferred VAS in this PACU. Nurses reported their pain scores in the postoperative record. Pain was considered acceptable if the VAS/vNRS score was 3 or less. According to local regulations, if the score is moderate (4-6) or strong (7 or higher), the patient is treated with drugs, usually intravenous (IV) opioids, according to the international publication.

Ankle bones are classified according to the anatomical classification of Danis (1949) and Weber (1972) mentioned by Donken et al. This technique uses imaging to classify bones as follows: Weber A below syndesmosis; Weber B above syndesmosis; and Weber C on syndesmosis. Isolated medial (tibial) fractures were identified and included in one group but not further defined radiographically. Tourniquet inflation is a standard procedure in orthopedic surgery. It is used to stop blood flow, thus increasing the visibility of the surgical field.

However, the use of a tourniquet reduces the time available to perform the procedure and may increase the risk of complications. There are two main types of tourniquets used: Esmarch bandages and pneumatic tourniquets. When collecting data for this study, we used the pneumatic technique for the Zimmer ATS 500 or 1200 tourniquet system: the pneumatic pressure was maintained between 250 and 300 mmHg and a thin bag was placed in the shape of a pole. Local regulations generally recommend that the procedure not exceed 90 minutes, with a maximum of 120 minutes. By searching the data of published articles, we were unable to find the right questions to identify factors that might influence patients' perception of ankle fracture. Therefore, we developed a data abstraction table with input from local experts (nurses, anesthesiologists, and orthopedic surgeons) in the PACU, operating room, and orthopedic ward. According to local guidelines at the time of study, spinal cord is the best choice of anesthesia for ankle surgery. Alternatives are general anaesthesia/general anaesthesia, popliteal block, or a combination thereof. In PACU, nurses administer medications as directed by the anesthesiologist. Standard therapy is acetaminophen (1000 mg every 6 hours), morphine or ketobermidone (2-5 mg intravenous , if VAS/vNRS ≥ 4). NSAIDs are self-administered by a plastic surgeon.

Data management and statistical analysis:

All statistical analyzes were performed using R version 3.2.2 (R Foundation for Statistical Computing, www.r-project.org) and SPSS version 22 (SPSS Inc., Chicago, IL, USA) for Windows. All tests were bilateral and P values less than 0.05 were considered significant. First, we analyzed side effects using the VAS/vNRS score as the standard index. For future reference, we also included data based on the mean of the F test using analysis of variance (ANOVA). Second, we analyzed the ability to predict pain using the dual VAS/vNRS score. 0-3 for mild pain and 4-10 for moderate to severe pain. This serves two purposes. The first reason is that it allows us to compare the clinical points considered as adequate pain (3 and below) and insufficient pain (4 and above). The second benefit of the duality is that it allows us to include patients who initially lacked VAS/vNRS data in the new analysis. Of the 336 patients included in this study, 112 did not record their VAS/vNRS scores. We calculated the missing VAS/vNRS scores for these patients according to the following criteria: We assumed that the VAS/vNRS score would be in the 0-3 range if the patient did not take opioids at the next

hospitalization. Also, if the patient is taking opioids, we think that VAS/vNRS is in category 4-10. Our hypothesis is based on the PACU pain management policy where a VAS/vNRS score of 3 is considered "moderate" pain and does not require opioids. For more severe pain, patients are prescribed opioids. All patient variables were considered possible markers of VAS/vNRS and these associations were analyzed using logistic regression models. We calculated rough and adjusted odds ratios (ORs) and 95% confidence intervals (CIs) for each patient variable. Adjusted ORs were estimated with multivariate logistic regression models, including other patient variables that could influence the effect of the outcome variable (eg, change changes). In this study, the variables were the same for each study patient variable and were selected from each variable with a P value less than 0.25 in the comparison univariate logistic regression analysis.

Results

The mean age was 52 years (range, 18-93). Women constitute 53.6% of the total population. Average tourniquet time is 65 minutes. PACU length of stay is approximately 1 to 7 hours on average (Figure 1).

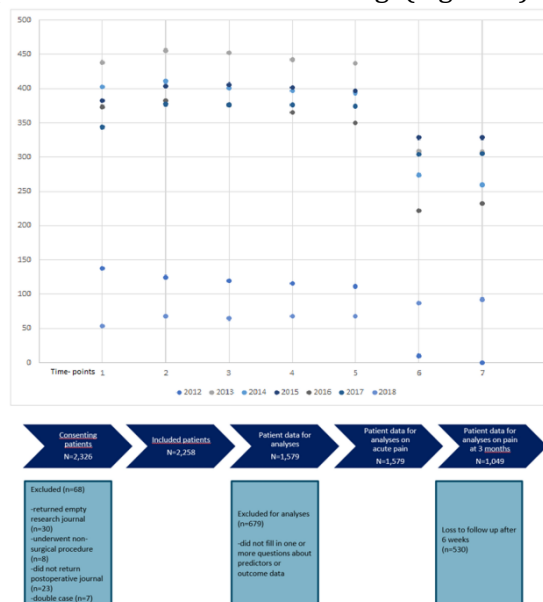


Figure 1: participants characters

During their PACU stay, 67% of patients achieved VAS/vNRS results. Data loading may have increased the power of our analysis for some predictors, but had no further effect when compared to a model not loaded using all VAS/vNRS data ($n = 224$; data not shown). Mean and median pain scores were based on sustained VAS/vNRS 0-10. Defines the distribution of pain. Because the overall distribution of VAS/vNRS was highly skewed (Figure 2), data

were presented as medians and compared between groups using the non-parametric Kruskal-Wallis test. The mean time spent in the PACU was 255 minutes (range: 125-555 minutes) for the pain-free group and 420 minutes (range: 95-3350 minutes) for the pain-free group. The mean pain score for the pain group was $4.7 (\pm SE 0.19)$. Seventy-three percent of patients take opioids during surgery (Figure 2).

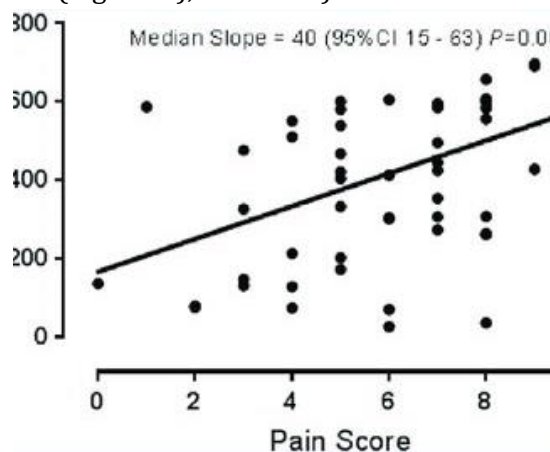


Figure 2: Pain after surgery

The complexity of treatment in this group of patients is evident in PACU pain management. Postoperative pain management ranged from none ($n = 48$) to 28 different pain management methods or regimens. To illustrate: a compound may be a drug such as paracetamol; paracetamol and morphine elsewhere; third, morphine and paracetamol; and fourth, a combination of seven drugs for treatment or pain-related pain throughout the PACU. (such as morphine, ketobimidine, ketorolac, clonidine, ketamine, diazepam, and midazolam).

Most of the fractures (67%) were classified as Weber type B fractures. Of these, 2 are classified as Weber A and 18 as tracheal (tibial) bones.

Interestingly, we examined the association between VAS/vNRS ≥ 4 and joint fractures and differentiated single and multiple (bi- and tri-articular) fractures with additional injuries. Statistical testing showed significant differences in groups except for the effect of subluxation of one or more bones. However, when testing the interaction between single and multiple fractures with or without syndesmosis injury, there was no significant difference (interaction time, $P = 0.74$). The type of ankle fracture with or without dislocation and subluxation was also not significant (interaction term, $P = 0.31$). After correction, the numbers don't matter (Figure 3).

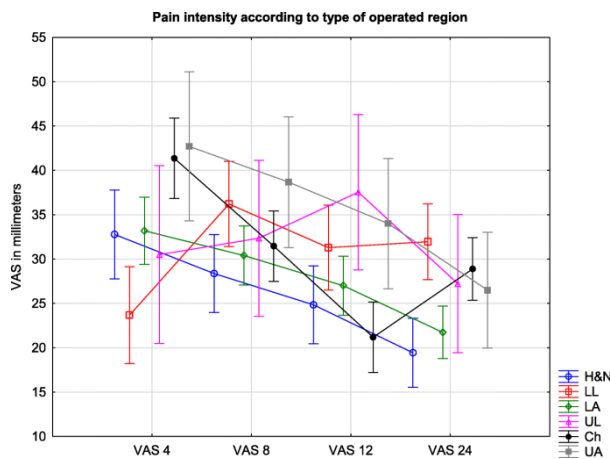


Figure 3: Pain intensity in 24h after surgery

Tourniquet inflation technique was applied to almost all patients (92%). Twenty-three patients were operated without surgery. Of these, 14 patients were treated outside, while the remaining 9 patients used other surgeries. It was reported that three patients were lifted with a tourniquet, but the duration was not given and three patients died. The tourniquet technique is not critical.

Gender and multiple bone fractures were predictors of VAS/vNRS score ≥ 4 . The p-values from parametric and non-parametric tests are basically the same. The results showed that women were three times more likely than men to obtain a VAS/vNRS score ≥ 4 (odds ratio (OR) 2.85 [95% confidence interval (CI) :3.55: 1.79-4.60] Patients with multiple ankle fractures were at twice the risk of reporting a VAS/vNRS score ≥ 4 compared with patients with a single fracture (OR 2.32, [95% CI, 1.44 -3.78]). When adjusted for confounders, we found only one significant factor in predicting moderate or severe pain: coexistence of women (OR 2.31, [95% CI, 1.39–3.86]).

Discussion

In this study, we analyzed the determinants of moderate-to-severe pain after PACU in patients undergoing hip replacement surgery. Age, gender, smoking status, body weight, time from ankle sprain to surgery, anesthesia procedures,

pre- and postoperative medications, complications, surgery and Tourniquet Inflation. This is one of the few studies looking at this particular group of patients and self-reported pain. Most patients (67%) experienced severe or severe pain while in the PACU. We found that cohabitation was a predictor of moderate to severe pain after hip replacement surgery.

The International Association for the Study of Pain (IASP) presents Women's Pain each year to raise awareness of this important issue. In our study, women were more than twice as likely as men to report a VAS/vNRS score ≥ 4 . Gender has also been reported to be a predictor of chronic and severe pain, but these studies are related to patients who have had multiple surgeries. A recent review of the effect of gender on pain perception in PAIN shows the similarities and differences between different pain tests performed in the laboratory in healthy workers. Racine and colleagues clearly show that women tolerate stress and violence better than men.

However, more uncertain are indications that pain sensitivity to cold and ischemic pain is comparable to that of men and women. Overall, this review cannot draw conclusions about gender differences and perceptions of pain at the examination site. A randomized controlled trial (RCT versus placebo) found increased pain in men and women after arthroscopic knee surgery. One third of patients do not report pain.

For the group that reported the least mild pain, women had a higher risk of experiencing pain than men after the first 2 hours after arrival at the PACU. Overall, however, the evidence on gender and disease is mixed.

Quality reviews include studies conducted in clinical settings. Many factors have been identified as predictors of back pain, but gender is not one of them. However, another review of two studies in the Journal of Research and Science found that women reported higher pain scores than men for different types of pain and were more responsive to pain tests (except for ischemic pain) than men. Interestingly, however, in their tests, they found that women had more post-operative pain than men. We identified four studies evaluating pain in the PACU in patients undergoing ankle surgery, with varying conclusions.

One study found that men over the age of thirty experienced more pain after pneumatic tourniquet surgery. Second, it showed that patients who applied a tourniquet during ankle surgery experienced more pain. The third conclusion is that tourniquet use is associated with increased opioid use, increased postoperative pain, longer length of stay, and longer PACU stay compared to no tourniquet use. A fourth and final study found no difference in pain between obesity and gender in arthritis patients. However, they found that pain decreased with age.

Interestingly, the participants were treated individually with intravenous morphine. However, they could not include postoperative morphine as a patient-controlled analgesic because this information was not available for the study group. Therefore, the fact that gender and body mass indices were not associated with post-traumatic pain scores may be due to differences in opioid consumption. Our results compare gender analysis as the sole predictor of moderate-to-severe pain in the PACU with published data on this particular group. A recent

study of patients with lumbar disc herniation found an association between being female and having the mu-opioid receptor A118G genotype and pain severity one year after surgery/treatment. Explanations for gender differences point to gender differences in mental and social conditions as well as biological factors such as hormonal, skin thickness, and neurobiological factors, leading to differences in clinical trials between men and women.

Even good prospective studies have biases. The selection of the control group introduces a bias that we try to reduce by including all patients without diabetes, rather than trying to match them with the study group. We acknowledge that this may indicate a systematic error, as the control group of non-diabetic patients without hypertension was not necessarily compared with other groups. We tried to minimize the measurement confusion between the four different groups by following a traditional treatment approach. From 99, eight percent of patients are ready for evaluation. A valid criticism of this study concerns our 30-day study period used in two previous studies to assess surgical site pain after foot and ankle surgery. Two recent orthopedic trauma studies also used a 30-day endpoint to assess hyperglycemia and its relationship to surgery. It is recommended to monitor the surgical site for up to one year when using orthopedic implants. Most surgical site infections occur within the first 30 days, and a recent study of surgical site infections after spinal surgery shows that the median time from surgery to diagnosis is 11 days⁴. Another study found that the average time from surgery to diagnosis was 16 days after hip replacement and 25 days after knee replacement. There may be interviewer bias in our study because the principal investigator (D.K.W.) determined the outcome first.

Fracture complexity was determined more in patients with syndesmosis injury, subluxation or complete dislocation. When we examined the

relationship between fracture, we found no significant difference between fracture and mild or severe pain. Studies with larger samples of patients with similar bone density are needed to draw stronger conclusions about the lack of association. The study included 336 patients, making it one of the largest studies of its kind. However, pain was not scored for all patients. Pain scores were lost for 112 patients. This is a limitation, as the validity of pain scores for the entire group of 336 people may be reduced. However, when the predictors of the 224 group were evaluated by pain scores, the results remained the same. Future research should place special emphasis on education and the care and use of pain assessment tools. This study was retrospective and aimed to identify predictors of pain severity and severity. This design limited our analysis to patients receiving standard care. Missing patient data is a known challenge in retrospective studies.

Conclusion

Most patients undergoing ankle surgery have moderate to severe pain after PACU. We found significant gender differences in postoperative pain. Female patients who had surgery for ankle sprain reported higher pain scores in the PACU than men.

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