MSD

Medical Science and Discovery
ISSN: 2148-6832

Preoperative predictions of severe postoperative pain in the patients who underwent cholecystectomy: A systematic review and meta-analysis

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ABSTRACT

Objective: The present study aims to investigate the impact of preoperative pain predictions on postoperative pain evaluation in patients who underwent cholecystectomy surgery. Pain is a frequently reported complaint following cholecystectomy, and understanding the factors that contribute to pain perception can help improve patient outcomes. Therefore, the study seeks to identify any potential preoperative predictors of pain that may affect postoperative pain evaluation.

Materials and Method: A literature review was conducted between 2012 and 2022 using various combinations of keywords such as "postoperative pain," "postoperative pain management," "cholecystectomy," and "preoperative pain prediction." The inclusion criteria for the study were articles published in peer-reviewed national or international journals in Turkish or English that examined preoperative pain predictors for patients who experienced severe postoperative pain.

Results: In the meta-analysis study, nine databases were searched, resulting in 7151 articles. However, only three full-text articles met the inclusion criteria and were included in the analysis. The combined results of these studies showed that the preoperative prediction rate of postoperative pain was 32%, the rate of postoperative pain without any symptoms in the preoperative period was 33%, and the preoperative prediction rate of post-laparoscopic pain was 38%. It was found that the rate of pain prediction after classical surgery was 15%, while the rate of pain prediction for surgeries lasting less than 30 minutes was 37%, and for surgeries lasting more than 30 minutes, it was 38%.

Conclusion: The preoperative prediction of the factors causing pain is an important component of effective pain management and enhancement of patient care quality.

Keywords: Cholecystectomy, Postoperative pain, Preoperative Pain Prediction, Postoperative Pain Management

INTRODUCTION

Pain is a subjective experience that affects many individuals and is often associated with various health problems, influencing quality of life. Pain commonly occurs after surgery, among other conditions, and can be a significant burden for patients. Globally, over 230 million surgical procedures are performed annually, with approximately 80% of patients reporting pain postoperatively, and nearly 70% of these individuals experiencing moderate to severe pain (1-3). Studies have indicated that 30-55% of surgical patients report moderate to severe pain on the first postoperative day (4,5). Surgical incision initiates pain, and the mediators released from the wound site exacerbate and prolong the pain. Direct activation of nociceptors, inflammation, and potential damage to nervous structures cause pain at the surgical site and surrounding areas immediately following the procedure (6-8). The perception of pain is not only a sensory stimulus but also a motivational condition that can affect mood, shaped by cultural learning, past experiences, anxiety, and depression (9,10). Therefore, postoperative pain can lead to physiological and psychological complications, decrease quality of life, and negatively impact the healing process, ultimately increasing mortality rates (6,11).

Cholecystectomy is an effective treatment for gallbladder diseases. The incidence of pain after the procedure varies from 3% to 56%. Demographic factors such as gender and age, physical inactivity, and certain psychological factors can influence the incidence of postoperative pain (12). Some studies have shown that gender is not a predictive variable for postoperative pain or analgesic needs (13), while evidence suggests that sleep disorders can increase postoperative pain (14).

Review Article

Received 20-02-2023

Accepted 27-02-2023

Available Online: 05-03-2023

Published 30-03-2023

http://dx.doi.org/10.36472/msd.v10i3.890

Although pain is a predictable experience after surgery, evidence has indicated that analgesic practices to relieve postoperative pain have been inadequate for many patients who have undergone surgery (16).

There is no comprehensive literature review that has analyzed the predictions of the postoperative pain observed in the patients who underwent cholecystectomy. This systematic review and meta-analysis aimed to analyze the preoperative predictions of the severe postoperative pain observed in the patients who underwent cholecystectomy.

Research Questions

1. What are the preoperative predictions of postoperative pain in patients who undergo cholecystectomy?
2. What factors influence postoperative pain prediction?

MATERIALS AND METHODS

Method: This study was carried out with a design of systematic review and meta-analysis. The study was conducted and reported based on the criteria of PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses statement).

Eligibility Criteria: The selection criteria for eligible studies for this systematic review and meta-analysis were determined according to PICOS (Figure 1). The studies included were published between 2012-2022 in national and international journals related to preoperative predictions of postoperative pain in patients who underwent cholecystectomy. Since the number of studies related to the subject was small, literature reviews comprising all studies addressing postoperative pain predictions without discrimination between types of pain were included. The studies included were descriptive, observational, and prospective studies published in English or Turkish languages. Studies with interventional designs, reviews, and case studies were excluded.

Review Strategy: Databases of Web of Science, Ovid, Medline, Sage Journal, Wiley Online Library, Clinical Key, Science Direct, Scopus and TR Index between 10.09.2022 to 15.09.2022 were screened to determine the eligible studies. These databases were screened using the various combinations of the keywords "postoperative pain, "postoperative pain management", "cholecystectomy", "preoperative pain prediction". The reference lists of the included research were also controlled.

Selection of the Studies: Two researchers independently carried out the selection of the full-text articles by reviewing the titles and abstracts based on inclusion criteria. The reference lists of the eligible articles were reviewed.

The Methodological Quality Assessment of the Studies: The qualitative assessment of the articles was conducted using the critical appraisal checklists developed for analytical cross-sectional studies by Joanna Briggs Institute (JBI). The critical appraisal checklist developed by JBI for analytical cross-sectional studies is composed of eight items. The questions of these checklists are answered by the options "yes, no, unclear, not applicable". The results of the assessment performed for each research included in this systematic review study were given a "quality score". The quality assessment was independently performed by two researchers, and any differences in their answers were discussed to reach a consensus. The final answers were then compiled into a single text.

Data Collection (Extraction/Exclusion): The research data was obtained by data collection tool developed by the researchers. Using this tool; data related with authors and publishment years, study design, parameters of preoperative pain predictions and sampling size were obtained. Two researchers carried out this procedure independently to be conflated into a single text by comparing their interpretations. In cases of different data; the related article was controlled again, and the collection of accurate data was assured.

Statistical Analysis: In this systematic review, data obtained from qualitative research (3 research) were conflated by a meta-analysis (pooled estimates). Since, postoperative pains were discussed in two separate sampling groups in the study of Zhang, the analysis of this study was included as two independent studies with titles of Zhang and Zhang2 in the meta-analysis (17). The meta-analysis of the study was performed using Comprehensive Meta-Analysis Version 3-Free Trial (https://www.meta-analysis.com/pages/demo.php). Cochran's Q and Higgins I^2 tests evaluated the heterogeneity between the researches, and I^2>50% was accepted to indicate a statistically significant heterogeneity. The results of Random Effect and Fixed Effect analyses were considered when I^2 was higher than 50% and lower than 50%, respectively. For each result variable; 95% confidence interval (CI) and Estimated Rates were calculated.

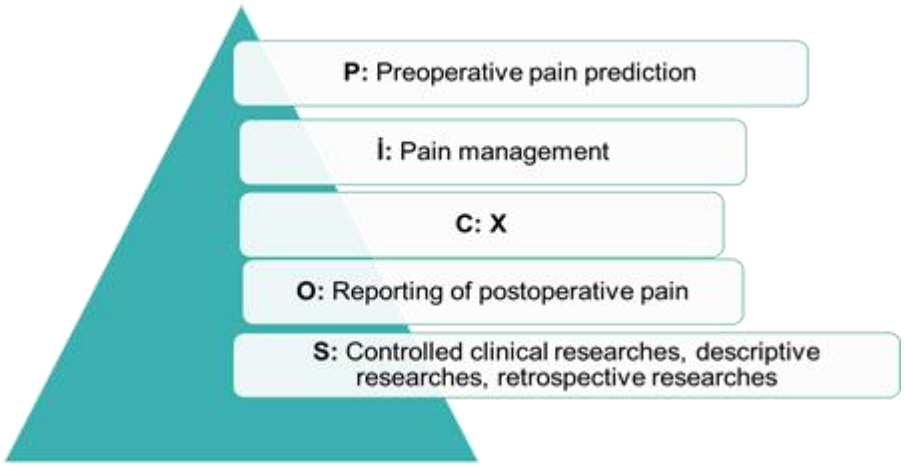

Figure 1. PICOS

http://dx.doi.org/10.36472/msd.v10i3.890

RESULTS

Review Results

Totally 7151 studies were reached as a result of the systematic review. Sixty-eight articles were selected due to the evaluations based on title, abstract and full-text. Data extraction process was conducted with three articles after exclusion of the duplicated records and evaluation according to inclusion criteria. The results of the study by Zhang which was one of the three articles were included in the meta-analysis as two separate data. Zhang considered the pain observed after cholecystectomy in the risk category. On the other side, Zhang2 evaluated pain monitored after cholecystectomy according to its clinical features. The explanations related with the selection and extraction processes were presented in **Figure 1**.

Quality Assessment Results

In the assessment of the three cross-sectional studies out of the studies included in this systematic review and meta-analysis; 5-7 items of eight-item quality assessment tool were answered "yes" (**Table 1**).

Meta-Analysis Results

The studies included in this systematic review and meta-analysis categorized the reports on preoperative predictions of severe postoperative pain in patients who underwent cholecystectomy into several groups, including postoperative pain, asymptomatic patients, patients who underwent laparoscopic surgery, patients who underwent classical surgery, surgeries lasting longer than 30 minutes, and surgeries lasting shorter than 30 minutes.

It was reported in three of the studies that postoperative pain may be predicted in the preoperative period (12,17). According to the conflated results of these studies, the estimated preoperative prediction rate of postoperative pain was reported as 32% (Z=-0.642; p=0.521; I2>50%). The separate evaluation of each study included in the analysis revealed a significant relationship in the results (p: 0.000), however, no statistical relationship was found in the conflated analysis results of the three studies (p: 0.521).

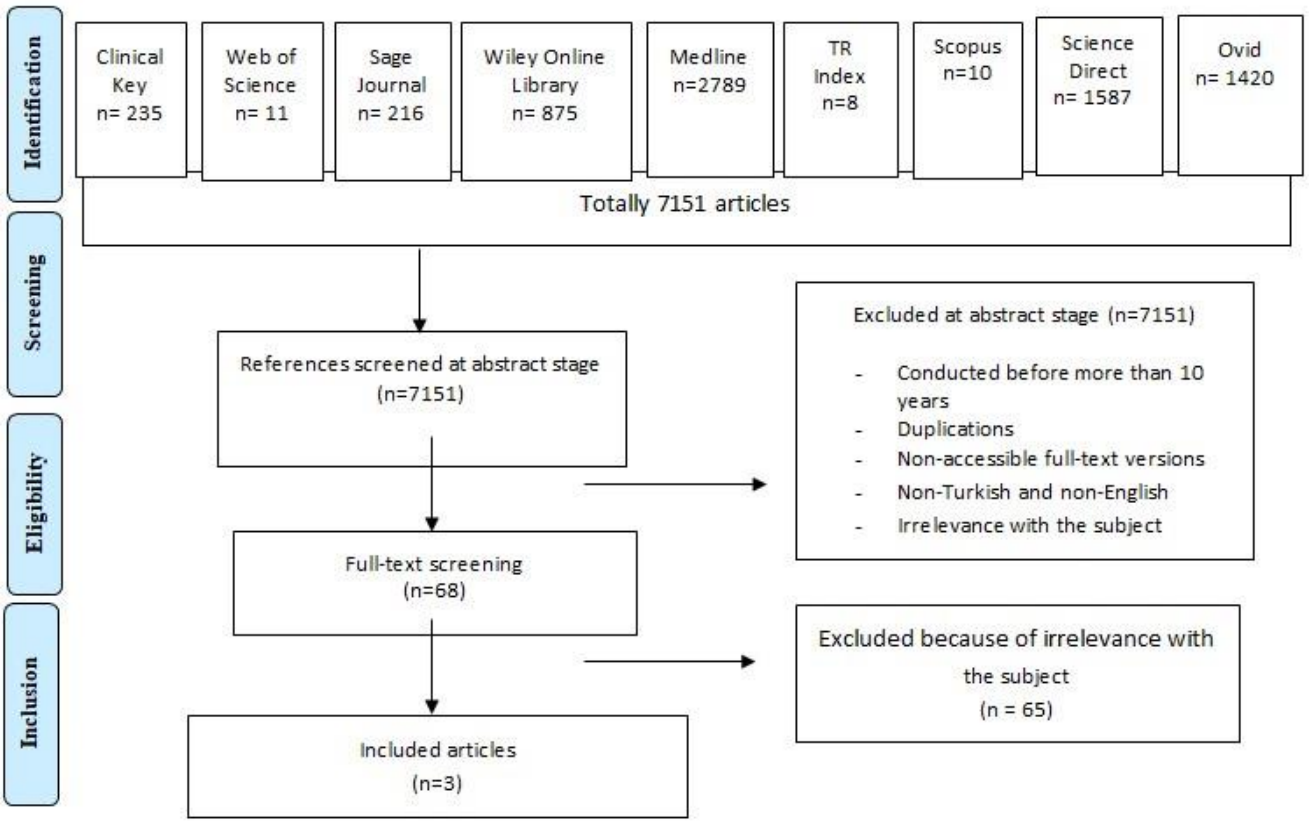

Figure 2: PRISMA Flow Diagram, *PRISMA: Preferred Reporting Items for Systematic Reviews and MetaAnalyses

Table 1: Quality Assessment Results

Author's Name, Publishment Year	Study Type	Quality score
Zhang, 2017	Descriptive Cross-sectional Study	Yes: 5/6 No:3/2
Blichfeldt-Eckhardt, 2014	Prospective Study	Yes: 5/7 No:3/1
Salazar-Parra, 2020	Retrospective Cohort Study	Yes: 6/7 No:2/1

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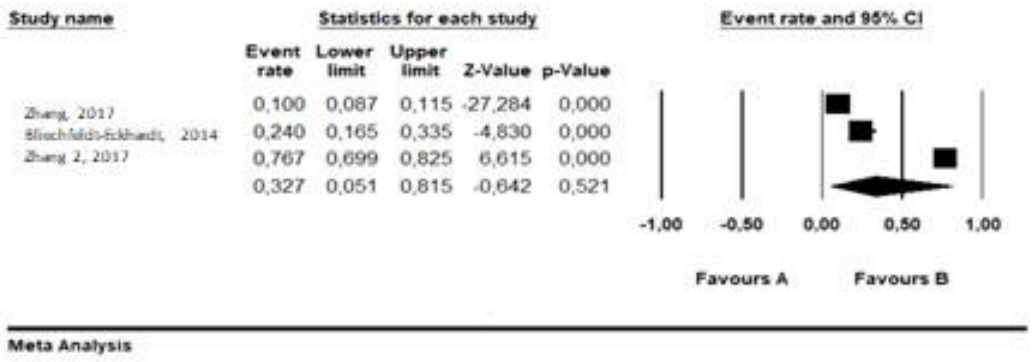

Figure 3: Postoperative pain

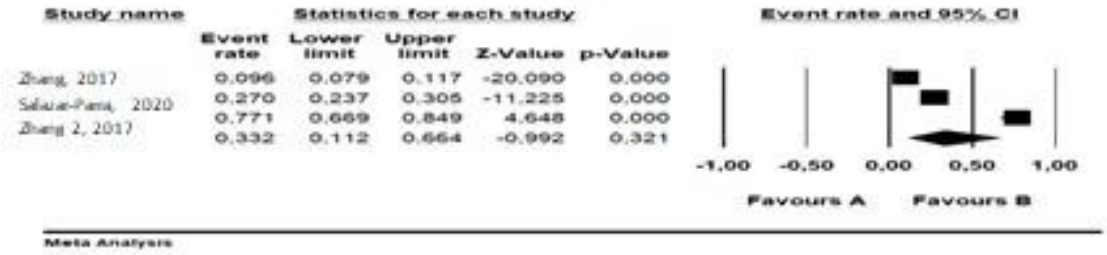

Figure 4: Asymptomatic pain

It was reported in three of the studies that no symptom of the postoperative pain was observed in the preoperative period (17,18). According to the conflated results of these studies, the estimated prediction rate of the postoperative pain being asymptomatic in the preoperative period was reported as 33% (Z=-0.992; p=0.321; I2>50%). The separate evaluation of each study included in the analysis revealed a significant relationship in the results (p: 0.000), however, no statistical relationship was found in the conflated analysis results of the three studies (p: 0.321).

It was reported in two of the studies that postoperative pain was predicted for the laparoscopic surgical operations (17). According to the conflated results of these studies, the estimated preoperative prediction rate of postoperative pain was reported as 38% (Z=-0.281; p=0.779; I2>50%). The separate evaluation of each study included in the analysis revealed a significant relationship in the results (p: 0.000), however, no statistical relationship was found in the conflated analysis results of two studies (p: 0.779).

It was reported in three of the studies that postoperative pain was predicted for the classical surgical operations (12,17). According to the conflated results of these studies, the estimated preoperative prediction rate of postoperative pain was reported as 15% (Z=-1.513; p=0.130; I2>50%). The separate evaluation of each study included in the analysis revealed a significant relationship in the results of two studies (p:0.000), however, no statistical relationship was found in the conflated analysis results of the three studies (p: 0.130).

It was reported in two of the studies that postoperative pain was predicted for the operations that lasted shorter than 30 minutes (17). According to the conflated results of these studies, the estimated preoperative prediction rate of postoperative pain was reported as 37% (Z=-0.313; p= 0.754; I2>50%). The separate evaluation of each study included in the analysis revealed a significant relationship in the results (p:0.000), however no statistical relationship was found in the conflated analysis results of two studies (p: 0.754).

It was reported in two of the studies that postoperative pain was predicted for the operations that lasted longer than 30 minutes (17). According to the conflated results of these studies, the estimated preoperative prediction rate of postoperative pain was reported as 38% (Z=-0.260; p=0.795; I2>50%). The separate evaluation of each study included in the analysis revealed a significant relationship in the results (p:0.000), however no statistical relationship was found in the conflated analysis results of the two studies (p: 0.795).

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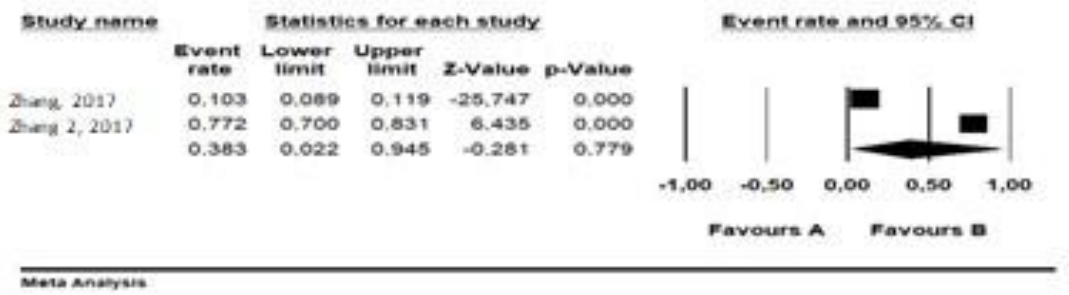

Figure 5: Operations Performed by Laparoscopic Surgery

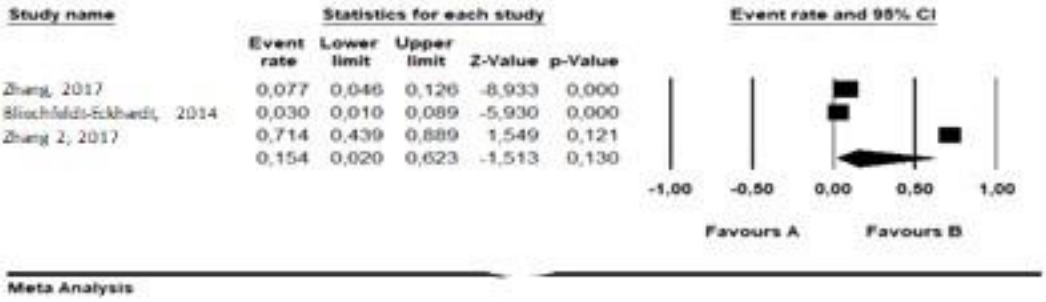

Figure 6: Operations Performed by Classical Surgery

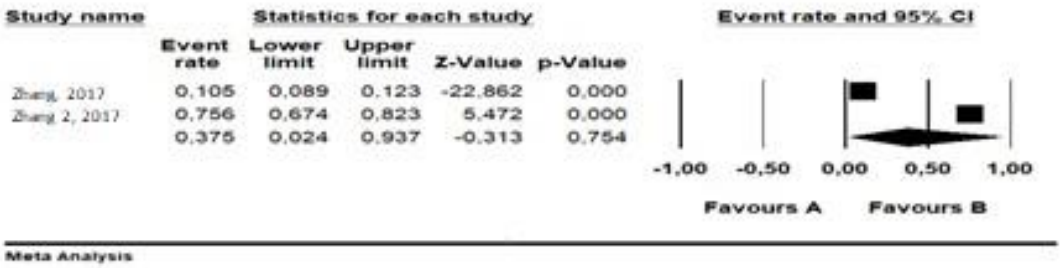

Figure 7: The Operations That Lasted Shorter Than 30 Minutes

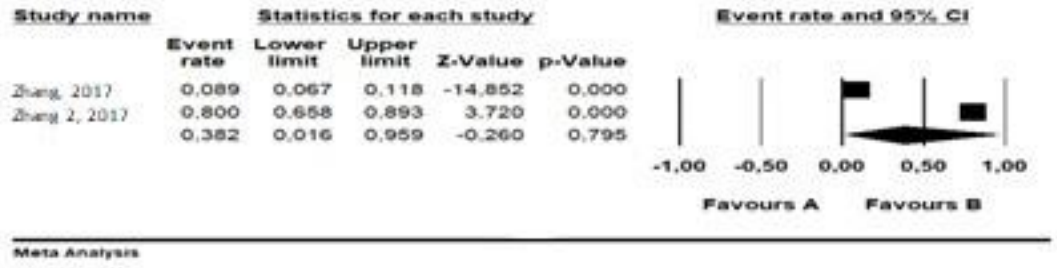

Figure 8: The Operations That Lasted Longer Than 30 Minutes

DISCUSSION

This study was carried out with a systematic review and meta-analysis design to investigate the preoperative predictions of severe postoperative pain in the patients who underwent cholecystectomy. The conflated results of the three research were presented in the study. We expect that our obtained results can contribute to determination of predictions of severe pain observed after cholecystectomy and thereby a better management of postoperative pain. In the present systematic review and meta-analysis; preoperative prediction rate of postoperative pain was reported as 32%.

Perkins and Franklin (2014) reported that preoperative prediction rate of pain was 23% (19). Preoperative depression has been found to have a statistically significant impact on post-operative pain according to a systematic review of eight studies including 314 patients (20).

On the other side, the separate evaluation of each study analyzed in this meta-analysis study revealed significant results whereas no significant relationship could be found in the meta-analysis results of the three articles. This meta-analysis study indicated some outcomes about the fact that postoperative pain is related to operation duration and type of operation. Wang et al. have reported in their study (2018) that advanced age, female gender, and preoperative pain are the predictive factors for postoperative pain (21). In the present meta-analysis study, the incidence of post-operative pain after operations that lasted longer than 30 minutes was found to be 38%, and a significant relationship was detected between operation duration and pain according to separate evaluations of the studies. However, no significant relationship was determined in the meta-analysis results of two studies (17). Zhang2 (17) reported in their study that abdominal pain lasting longer than 30 minutes at each episode and continuing for more than one month before cholecystectomy operation was associated with post-operative pain with a rate of 12.5%. Additionally, the present meta-analysis study assessed the prediction rate of post-operative pain being asymptomatic in the preoperative period to be 33%.

Eckhardt (2018) has stated in his study that pain observed before cholecystectomy is not associated with being symptomatic and that this result is not statistically significant (22). Bisgaard et al. (2001) reported in their study that there is no preoperative clinical relationship for predicting postoperative pain (23). Similar studies supported the present meta-analysis study, and a separate evaluation of the three articles included in the analysis manifested that preoperatively asymptomatic patients were significantly associated with postoperative pain, however, conflated results of the three studies revealed no significant relationship with postoperative pain. The preoperative prediction rate of postoperative pain was assessed to be 38% for laparoscopic operations. Stiff et al. (1994) reported in their study that 63.4% and 59.4% of the patients who underwent laparoscopic and open surgeries, respectively, were asymptomatic (24). In their study, Eckhardt et al. (2014) indicated that the monthly frequency of preoperative abdominal pain is an important risk factor for postoperative pain in patients who underwent laparoscopic cholecystectomy (12).

The preoperative prediction rate of postoperative pain was 15% for classical surgical operations. Zang2 et al. (2017) have predicted preoperative pain in 10.4% of the patients who underwent open surgery (17). In our study, the preoperative pain prediction rate of postoperative pain for the operations that lasted shorter than 30 minutes was found to be 37%. The preoperative pain prediction rate of postoperative pain for the operations that lasted longer than 30 minutes was determined to be 38%. Wang et al. (2018) have reported that there is a positive relationship between the severity of postoperative pain and the length of operation durations (21). The separate evaluation of each study included in this meta-analysis exhibited a significant relationship between operation duration and pain frequency, however, no significant relationship according to the conflated results of two studies.

CONCLUSION

The combined results of these studies show that the preoperative pain prediction rates for postoperative pain, asymptomatic preoperative pain, and postoperative pain prediction after laparoscopic surgery were 32%, 33%, and 38%, respectively. For classical surgery, the preoperative prediction rate for postoperative pain was determined to be 15%, while the prediction rates for operations lasting shorter and longer than 30 minutes were 37% and 38%, respectively. Various factors such as the grade, site, and duration of surgical intervention, type of anesthesia, subjective nature of pain, and patient attributes related to treatment and pain may contribute to the incidence of post-surgical pain. Several factors, including preoperative depression, advanced age, female gender, and preoperative pain, are effective predictors of severe post-operative pain, and controlling preoperative pain predictors may help reduce postoperative pain. Therefore, identifying the factors leading to preoperative pain is crucial for better post-operative pain management and improving patient care quality. However, since an adequate number of studies addressing the preoperative prediction of pain after cholecystectomy have not been found in the literature, further studies with high levels of evidence are needed to explore this topic.

Acknowledgments: None

Conflict of interest: The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article. This research did not receive and a specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Author Contributions: SG, HA, FEA: Study Design, literature review and writing**: SG, HA:** Revision

Ethical approval: All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and/or with the Helsinki Declaration of 1964 and later versions. Informed consent or substitute for it was obtained from all patients for being included in the study. Written consent was obtained from each patient to use their hospital data.

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