



Systematic Review / Meta-analysis



Prevention and management of postoperative nausea and vomiting after cesarean section: A systematic literature review

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ABSTRACT

Introduction: Post-operative nausea and vomiting (PONV) are a common post-operative problem in anesthesia. The incidence of PONV in patients undergoing cesarean sections is very high. Post-operative nausea and vomiting have many negative impacts on the patient, baby, family, and health care system. Therefore, appropriate evidence-based knowledge regarding the prevention and management of PONV for those high-risk patients is a timely and very important issue to address to decrease the associated complications.

Methods: A comprehensive literature search was conducted in Pubmed/Medline, Cochrane reviews, and google scholar including those studies published in the English language from 2010 up to 2021. The methodological quality of the included studies was appraised by the Cochrane risk of a biased assessment tool for intervention and non-interventional studies.

Result: The search strategy identified a total of 10,540 articles from different electronic databases. 33 articles were selected for screening after duplicates were removed; finally, 17 articles were included for critical appraisal and 16 articles were excluded with reasons. The included articles consist of 15 RCT, 1 non-control prospective cohort, and 1 cross-sectional study.

Conclusion: Pieces of evidence revealed that all obstetrics patients undergoing cesarean section should be given multimodal PONV prophylaxis. It is shown that a multimodal approach by a combination of different antiemetic agents should be preferred and most effective in preventing intraoperative and postoperative nausea and vomiting for patients undergoing cesarean section because of the complex pathophysiology of nausea and vomiting.

1. Introduction

Postoperative nausea and vomiting (PONV) is defined as any nausea or any urge or desire to vomit, or vomiting or both nausea and vomiting that occurs during the first 24–48 h post-operative time in patients undergoing surgery [1]. PONV is a common long-standing post-operative problem in anesthesia and remains a challenge, especially in obstetrics populations, and occurs more often after cesarean operations under regional anesthesia [2]. Knowing the pathophysiology of PONV and assessing its risk factors can provide a more rational approach to prevention and management. Some anesthetic and analgesic agents are emetogenic and thus predispose patients to a high risk of PONV [3]. Combining multiple antiemetic drugs with different sites of action as part of a risk-based PONV prophylaxis regimen will reduce the incidence

of PONV [4].

The pathophysiology of nausea is complex mechanisms that include psychological states, the autonomic nervous system, the central nervous system, gastric dysrhythmias, and the endocrine system [5]. The mechanism of PONV occurrence is complex and multifactorial which includes the chemoreceptor triggering zone (CTZ), reflex afferent pathways from the cerebral cortex, the vagal mucosal pathway in the gastrointestinal system, neuronal pathways from the vestibular system, and midbrain afferents. Stimulation of these afferent pathways activates the vomiting center via dopaminergic, histaminergic, cholinergic (muscarinic), or serotonergic receptors. These receptors serve as the basis on which pharmacological therapy for nausea and vomiting is acted for the prevention and management of PONV [6].

The risk factors for PONV are patient-specific, surgery-related, and

Abbreviations: PONV, post-operative nausea and vomiting; IONV, Intra-operative nausea and vomiting; NV, Nausea and vomiting; CS, Cesarean section; RCT, Randomized control trial; ROB, Risk of bias; CSE, Combined spinal-epidural; SR, Systematic review; MA, Meta-analysis; PRISMA, Preferred reporting items for systematic review and meta-analysis; SA, Spinal anesthesia; IV, Intravenous.

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anesthesia-related [1,7] while the independent risk factors for PONV include female gender, previous history of PONV or motion sickness, non-smoking status, and intraoperative opioids according to simplified Apfel score risk assessment [1]. There are other additional risk factors for the development of nausea and vomiting in these obstetrics patients including intraoperative shivering, use of a volatile agent, intraoperative hypotension, intraoperative hypoxia, oxytocin used for the uterotonic purpose, longer duration of uterine exteriorization, emergency surgery, and primiparous [2].

The overall incidence of postoperative nausea and vomiting (PONV) has been reported to be 30% in all post-operative patients and up to 80% in high-risk patients[7]. A study in Iran by Jabalamei et al. among 132 patients undergoing CS showed that the incidence of nausea was 73.6% during the 2 h after surgery during spinal anesthesia for cesarean delivery[8]. The prevalence of NV after cesarean section under spinal anesthesia in Ethiopia was found to be 54.3% in Gandhi memorial hospital and the incidence of intraoperative nausea and vomiting after spinal anesthesia in south Gondar zone hospitals was 40.2% [2,9]. The symptoms of nausea and vomiting occur more frequently in pregnant patients compared with non-pregnant due to the high level of progesterone that causes an increase in gastrin secretion, smooth muscle relaxation, decrease in gastrointestinal motility and lower esophageal sphincter tones[8].

Postoperative nausea and vomiting after the cesarean section has several undesirable consequences including but not limited to delayed mother to baby bonding, pulmonary aspiration of the gastric contents in anesthetized patients, metabolic alkalosis, the risk of esophageal rupture, decreased patient satisfaction, bleeding and the increased abdominal pressure during vomiting may cause pressure on suture lines resulting opened sutures of the operation site and incisional hernias [4, 7,10]. A study by Yilmaz et al. described dehydration, electrolyte imbalance, infections, aspiration, and prolonged hospital stay as common complications of PONV [11].

PONV can be prevented by prophylactic administration of antiemetics and adjunct antiemetics medications. Evidence shows that avoiding extremely emetogenic anesthetic drugs and opioids and ensuring adequate hydration are crucial to minimizing the risk of developing PONV [4]. Studies show that dexamethasone prophylaxis has antiemetic effectiveness with a single dose of 5–10 mg IV for parturient undergoing cesarean delivery under spinal anesthesia receiving neuraxial morphine [12]. It is shown that administration of metoclopramide in a dose of 10 mg prophylaxis against IONV and early PONV is effective and safe for a significant reduction in the incidence of IONV and PONV in women undergoing CS under regional anesthesia [13].

The consensus guideline by Gan et al. recommended serotonin antagonists such as ondansetron as a first-line treatment for PONV in general surgical patients who do not receive antiemetic prophylaxis [10]. In addition to these antiemetic treatments, an assessment to detect and minimize factors that exacerbate PONV should be performed. For the surgical patient, it is recommended to practice strategies that help to reduce baseline risk for developing PONV such as preferred use of regional anesthesia to avoid general anesthesia, favored use of propofol infusions, avoiding the use of nitrous oxide and other inhalational anesthetics agents, decreasing of perioperative opioids consumption and sufficient perioperative hydration [3,14].

The specific review for PONV prevention and management for an obstetric patient undergoing cesarean section is a serious and important issue. Since the guidelines and systematic reviews on the prevention and management of PONV for a general surgical population may not be applied for obstetrics, this review is performed to provide insight concerning the prevention and management of such complications. This systematic literature review has a paramount significance to grant parturient undergoing cesarean section with safe, effective, and inexpensive prevention and treatment practices for postoperative nausea and vomiting.

2. Methods

2.1. Study setting and search strategies

A comprehensive search was conducted in electronic databases including Cochrane Library, PubMed/Medline, and google scholar including those studies published in the English language from 2010 up to 2021. The search strategy was intended to explore all available published and unpublished observational, randomized controlled trials and non-randomized studies on prevention and treatment of PONV among obstetrics patients undergoing cesarean section under spinal or general anesthesia. A comprehensive initial search was employed in PubMed/Medline. A second search was undertaken by combining free text words and indexed terms with Boolean operators and was performed using PICO words [Cesarean section OR cesarean delivery OR C-section OR operative delivery OR CS OR C/S OR cis AND dexamethasone OR metoclopramide OR scopolamine OR atropine OR dimenhydrinate OR ondansetron OR granisetron OR tropisetron OR dolasetron OR palonosetron OR ketamine OR Propofol OR Dexmedetomidine OR acupressure OR acupuncture OR ginger AND placebo OR normal saline AND nausea OR vomiting OR PONV AND prophylaxis OR prevention AND treatment OR management].

The third search was conducted with the reference lists of all identified reports and articles for additional studies. Finally, an additional and grey literature search was conducted on Google scholars. After the duplicates were removed using the EndNote reference manager; all retrieved studies were evaluated for inclusion in the systematic literature review based on the eligibility criteria. First, the title and abstract of each article were examined and citations that failed to meet the inclusion criteria and abstract only articles were discarded. Full-text copies of the remaining citations were obtained and reviewed. This work is fully compliant with the PRISMA 2020 statement [15] and it has been registered with a Research Registry UIN of reviewregistry1277 (<https://www.researchregistry.com/browse-the-registry#registryofsystematicreviewsmeta-analyses/>). The results of the search strategy were summarized with a PRISMA flow chart (Fig. 1).

2.2. Inclusion criteria

All observational, randomized controlled trials and non-randomized studies reporting the treatment and prevention of PONV after cesarean section and those published in the English language from 2010 up to 2021 were included.

2.3. Exclusion criteria

Studies that include other than obstetric and no full-text availability after an email request to the corresponding author.

2.4. Data extraction

The data was extracted with a customized excel sheet by two independent reviewers and discrepancy or disagreement was resolved by consensus. The extracted data includes the patient population, age, country/study area, sample size, study design, year of publication, primary outcome, secondary outcomes, complications associated with interventions, type of anesthesia, and duration of surgery were recorded.

2.5. Critical appraisal

The risk of bias assessment was performed using the Cochrane Collaboration risk of a bias assessment tool for RCT studies and ROBINS tool for assessing the risk of bias in non-randomized studies of interventions [16]. The methodological quality of all the 15 RCT studies was assessed by ROB tool that has components including selection bias (Random sequence generation and allocation concealment),

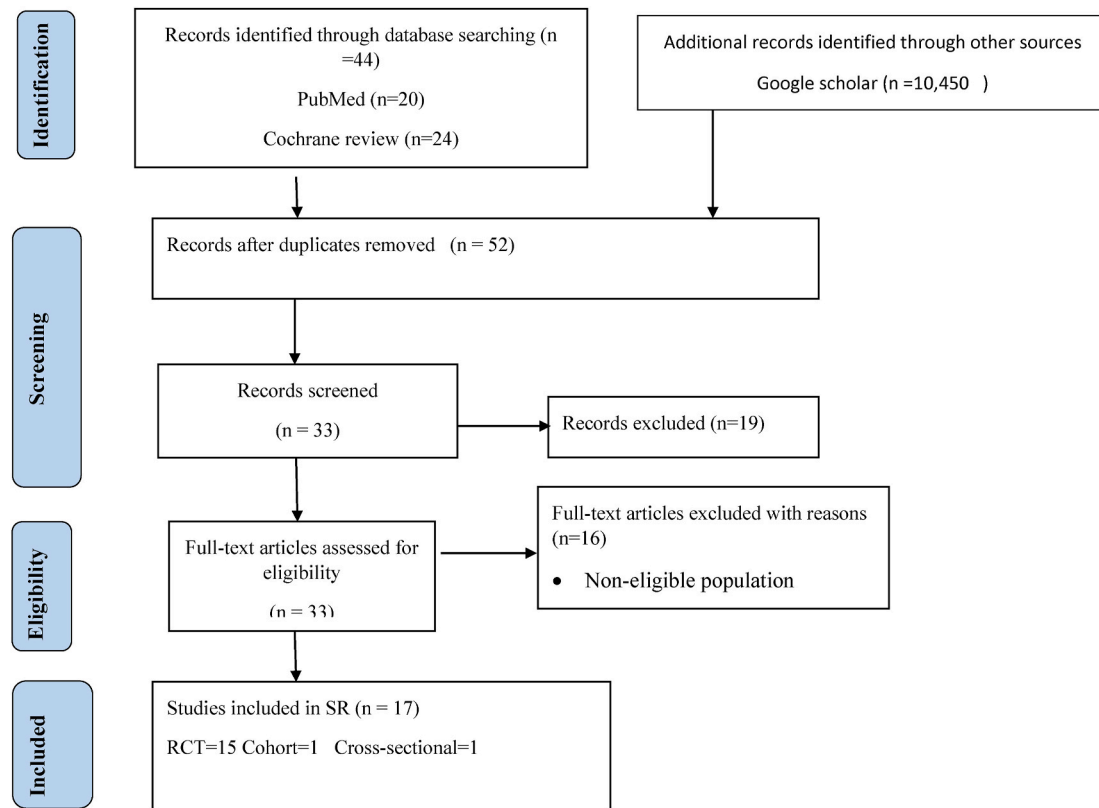


Fig. 1. Flow chart selection of studies by PRISMA Diagram.

Table 1
Risk of bias assessment (ROB).

| Studies | Selection bias | | performance bias (blinding of participant and personnel) | detection bias (blinding of outcomes) | attrition bias (incomplete outcome) | reporting bias (selective reporting) | other bias | ROB |
|------------------------------|----------------------------|------------------------|--|---------------------------------------|-------------------------------------|--------------------------------------|------------|-----|
| | Random sequence generation | Allocation concealment | | | | | | |
| D.Moghadam A. et al., 2013 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 6 |
| H.Noroozinia et al., 2013 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 6 |
| M.El-Deeb et al., 2011 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 6 |
| Pakniat H et al., 2020 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 6 |
| Zeraati H et al., 2016 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 5 |
| Kalava A et al., 2013 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 3 |
| Rasooli S et al., 2019 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 5 |
| Voigt M et al., 2013 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 4 |
| Rasheed MA et al., 2019 | 0 | 1 | 1 | 0 | 1 | 1 | 1 | 5 |
| Modir H et al., 2019 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 5 |
| Dasgupta M et al., 2012 | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 5 |
| Chattopadhyay S et al., 2015 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 6 |
| Kampo S et al., 2019 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 6 |
| Abdella et al., 2019 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 5 |
| Jabalameji et al., 2012 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 5 |

ROB: 1-3 = high risk (H), 4-7 = low risk (L), 0 = for NO, 1 = for YES; 2 = for UNCERTAIN.

performance bias (blinding of participants and Personnel), detection bias (blinding of outcome Assessment), attrition bias (Incomplete outcome data), reporting bias (Selective reporting), and other bias (Anything else, ideally pre-specified) (Table 1). The quality of our systematic review was evaluated as high and it is reported in line with AMSTAR 2 criteria [17].

3. Result

The comprehensive search strategy identified a total of 10,540 articles from different electronic databases. 33 articles were selected for screening after duplicates were removed with EndNote reference manager; finally, 17 articles were included for critical appraisal and 16 articles were excluded with reasons. The included articles consist of 15 RCT, 1 non-control prospective cohort, and 1 cross-sectional study. Among the 17 studies included in the review, 7 from Iran, 4 from India, 2 from Egypt, and one each from USA, Ethiopia, Germany, and Ghana, respectively. The 15 included RCTs were all comparative studies involving pharmacological intervention with non-pharmacological and placebo for the prevention of PONV. Four studies are on the non-pharmacological approach and the rest are all concentrated on pharmacologic studies. The study selection process is listed in the PRISMA flow chart (Fig. 1). The summary of the studies included in the review is listed in the table below (Table 2).

4. Discussion

Post-operative nausea and vomiting is a disturbing common post-operative complication that has a great impact on patient outcomes. The purpose of performing this literature review is mainly to provide a summary regarding the strategies for the prevention and management of PONV after cesarean section from the available recent literature.

The NICE guideline recommends that Women having a cesarean section should be offered antiemetic (either pharmacological or non-pharmacological) to reduce nausea and vomiting during Cesarean section [34]. The most commonly practiced antiemetic prophylaxis agents include serotonin antagonists (like ondansetron, granisetron, palonosetron, tropisetron), dopamine antagonists (metoclopramide), and corticosteroids (dexamethasone) [13,24,26,27,31,33,35]. Whereas Acupressure, Acupuncture, and ginger are the non-pharmacological approaches discussed in this literature review for the prevention of PONV [18–23]. These non-pharmacological interventions were simple to use with minimum side effects and easily available, especially for resource-limited settings where there is a scarcity of antiemetic prophylaxis agents.

A systematic review and guideline by Teshome et al., in 2020 for the preoperative prevention and postoperative management of nausea and vomiting in a resource-limited setting recommend assessing every patient who comes for surgery for the PONV risk factors and to categorize based on the APFEL risk score and its prevention and management as low or high risk of PONV. This systematic review also recommends using ondansetron as first-line rescue antiemetic treatment but if not available 10 mg IV bolus of metoclopramide may be used as second-line drugs, especially in resource-limited settings [36]. In our review, there was not enough literature on the treatment strategies of PONV.

Evidence shows the effectiveness of low-dose Propofol and naloxone and alcohol inhalation for PONV treatments. A review by Tan et al., in 2020 reported low dose naloxone or 20 mg Propofol was effective for the treatment of intractable PONV following cesarean delivery and also this review reported isopropyl alcohol inhalation reduces nausea severity faster than ondansetron or promethazine [3].

A consensus guideline for PONV in surgical patients by Gan et al. recommends that in patients who develop PONV, prior prophylaxis administration should be assessed, and rescue treatment should consist of drugs from a different class than those used for prophylaxis. Patients who receive prophylaxis and develop PONV within 6 h after

prophylaxis, should receive treatment with an agent of a different pharmacological class from the one given for prophylaxis. But After 6 h of the administration of a short-acting antiemetic (such as ondansetron or droperidol), a repeat dose could be possible. This guideline also recommended serotonin antagonists as a first-line for the treatment of PONV in general surgical patients who do not receive antiemetic prophylaxis for post-operative vomiting [10]. In our review, there was one study by Jabalameli et al. that compares midazolam-ondansetron combination with individual medication for PONV treatment [8].

Monotherapy through pharmacological agents such as dexamethasone, Dexmedetomidine, midazolam, anticholinergic, antihistamine, 5HT₃ receptor antagonist, Dopamine antagonist, and Propofol are some of the studied agents for the prevention of PONV. Most RCT studies and meta-analysis displays the effectiveness of dexamethasone (corticosteroid) and Metoclopramide (dopamine antagonist) prophylaxis for the prevention of PONV after cesarean section as a single drug and as a combination with other antiemetic and confirmed their effectiveness [12,13].

The multimodal approach is using a combination of different antiemetic medications that act on different receptors for the reason that the pathophysiology of nausea and vomiting (NV) involves different mechanisms [24]. Therefore, the prophylaxis and management of nausea and vomiting could incorporate blockage of these involved receptors. The medications that used for PONV prevention and treatment (antiemetics) include dopamine-receptor antagonists (like metoclopramide, domperidone, haloperidol) Muscarinic cholinceptor antagonists (atropine, scopolamine), Histamine H₁-receptor antagonists (promethazine, dimenhydrinate, cyclizine), and 5-HT₃-receptor antagonists (ondansetron, palonosetron, granisetron, tropisetron). The combination of an antiemetic agent should be preferred for use in preventing intra-operative NV and PONV for patients undergoing cesarean section under spinal anesthesia [25].

Evidence comparing combination therapy with monotherapy interventions shows the superiority of multimodal therapy prophylaxis. Rasheed et al. compare the effectiveness of single dexamethasone and metoclopramide with that of combination metoclopramide + dexamethasone. It's shown in this study that the combination of the two medications was significantly better for the prevention of PONV as compared to the use of dexamethasone and metoclopramide alone [26]. Rasooli et al. found the incidence and severity of nausea and vomiting was significantly lower in the metoclopramide-ondansetron group when compared to the metoclopramide alone [24]. Voigt et al. reported that a combination of tropisetron + metoclopramide was more effective in preventing NV compared to dimenhydrinate + dexamethasone and tropisetron alone [25]. Jabalameli et al. compares midazolam, ondansetron, and a combination of both and reported that combination of intravenous administration of ondansetron with midazolam was superior to using a single drug in the treatment of nausea and vomiting after cesarean section under spinal anesthesia [8].

5. Conclusion

Prophylaxis for PONV prevention should be considered for all obstetrics patients undergoing cesarean section. Studies show multimodal approach by a combination of an antiemetic agent such as ondansetron, dexamethasone, Dexmedetomidine, and metoclopramide should be preferred and most effective in preventing intraoperative and PONV for patients undergoing cesarean section because of the complex pathophysiology of nausea and vomiting. The prevention strategy through prophylactic administration of antiemetics is more effective and better than starting therapy after the occurrence of nausea and vomiting.

5.1. The strength and limitation of the review

5.1.1. Strength

This review included recent literature focused on the prevention of

Table: 2

Description of included studies in the review.

| S. N | Authors with citation | Publication year | country | Mean age | Sample size | Design | Intervention modality (prevention or treatment) | Main findings | ROB |
|------|-----------------------------|------------------|----------|----------|-------------|-----------------------------|--|--|------|
| 1 | Moghadam A et al. [18] | 2013 | Iran | 26.5 | 102 | RCT | Effect of acupressure on postoperative nausea and vomiting in cesarean section | Acupressure was shown to be effective for reducing nausea and vomiting. | Low |
| 2 | H.Noroozina et al. [19] | 2013 | Iran | | 152 | RCT | The Effect of Acupressure on Nausea and Vomiting after Cesarean Section Under Spinal Anesthesia | Acupressure when done 30 min before surgery effectively reduces postoperative nausea and vomiting. | Low |
| 3 | M.El-Deeb et al. [20] | 2011 | Egypt | 30 | 450 | RCT | Effect of acupuncture on nausea and/or vomiting during and after cesarean section in comparison with ondansetron | Acupuncture has comparable effectiveness with a single dose of 4 mg ondansetron in PONV prevention and is cost-effective. | Low |
| 4 | Pakniat H et al. [21] | 2020 | Iran | 29 | 180 | RCT | The effect of ginger and metoclopramide in the prevention of nausea and vomiting during and after surgery in the cesarean section under spinal anesthesia. | Ginger has the same effectiveness as metoclopramide in reducing nausea and vomiting in patients undergoing cesarean section. | Low |
| 5 | Zeraati H et al. [22] | 2016 | Iran | 30 | 92 | RCT | The effect of ginger extract on the incidence and severity of nausea and vomiting after cesarean section under spinal anesthesia. | Ginger extract can be used to reduce nausea and vomiting during cesarean section under spinal anesthesia. | Low |
| 6 | Kalava A et al. [23] | 2013 | USA | | 239 | RCT, | Efficacy of ginger on intraoperative and postoperative nausea and vomiting in elective cesarean section patients. | Ginger has no effect on the overall occurrence of intraoperative nausea and vomiting during cesarean section done under CSE anesthesia | High |
| 7 | Rasooli S et al. [24] | 2019 | Iran | 29 | 110 | RCT | Preventing nausea and vomiting using ondansetron and metoclopramide-phenylephrine in cesarean section using spinal anesthesia. | The combination of prophylactic therapy with metoclopramide and ondansetron can significantly reduce intra and PON in patients undergoing CS under spinal anesthesia. | Low |
| 8 | Voigt M et al. [25] | 2013 | Germany | >18 | 308 | RCT, | Prophylaxis of intra-and postoperative nausea and vomiting in patients during cesarean section in spinal anesthesia. | tropisetron 2 mg and metoclopramide 20 mg Prophylaxis for patients undergoing cesarean section decreases the incidence of nausea and vomiting | Low |
| 9 | Rasheed MA et al. [26] | 2019 | India | 26 | 120 | RCT, | Evaluation of Efficacy of Metoclopramide, Dexamethasone and Their Combination for the Prevention of Postoperative Nausea and Vomiting (PONV) in Patients Undergoing Cesarean Section. | Prophylactic administration of a combination of dexamethasone and metoclopramide was significantly superior for the prevention of PONV than the use of dexamethasone and metoclopramide alone. | Low |
| 10 | Modir H et al. [27] | 2019 | Iran | 26 | 140 | RCT, | Prophylactic efficacy of dexamethasone, ketamine, and Dexmedetomidine against intra- and postoperative nausea and vomiting under spinal anesthesia. | Dexmedetomidine has a greater effect in reducing nausea and vomiting. Although All three medications could reduce nausea and vomiting in patients. | Low |
| 11 | Endalew ES et al. [28] | 2018 | Ethiopia | > | 132 | Prospective non-controlled, | Effectiveness of intravenous metoclopramide prophylaxis on the reduction of intraoperative and early postoperative nausea and vomiting after emergency cesarean section under spinal anesthesia. | low metoclopramide Prophylaxis reduces the incidence and severity of intraoperative and early PONV compared to the non-treatment group | Low |
| 12 | Patel PC. et al. [29] | 2021 | India | 30 | 90 | Cross-sectional | Comparison of injection granisetron versus injection ondansetron for control of IONV and PONV among the women undergoing lower segment cesarean section under spinal anesthesia. | 2 mg IV Granisetron is better in preventing intraoperative as well as PONV as compared to 4 mg IV ondansetron. | Low |
| 13 | Dasgupta M et al. [30] | 2012 | India | 28.5 | 80 | RCT, | Randomized, placebo-controlled trial of granisetron for control of nausea and vomiting during cesarean delivery under spinal anesthesia. | use of granisetron Prophylaxis is effective for preventing vomiting episodes during spinal anesthesia for cesarean section | Low |
| 14 | Chattopadhyay S et al. [31] | 2015 | Indian | 26.5 | 109 | RCT, | Palonosetron versus ramosetron prophylaxis for control of postoperative nausea and vomiting after cesarean delivery under spinal anesthesia. | Polanosetron Prophylaxis is more effective than ramosetron prophylaxis for the long-term prevention of PONV after cesarean section. | Low |
| 15 | | 2019 | Ghana | 30 | 345 | RCT | | | Low |

(continued on next page)

Table 2 (continued)

| S. N | Authors with citation | Publication year | country | Mean age | Sample size | Design | Intervention modality (prevention or treatment) | Main findings | ROB |
|------|-------------------------|------------------|---------|----------|-------------|--------|---|---|-----|
| | Kampo S et al. [32], | | | | | | Sub-hypnotic dose of Propofol as antiemetic prophylaxis attenuates intrathecal morphine-induced postoperative nausea and vomiting, and pruritus in parturient undergoing cesarean section | sub-hypnotic dose of Propofol has the same effectiveness as metoclopramide in the prevention of PONV in women undergoing cesarean section under spinal anesthesia with adjunct intrathecal morphine | |
| 16 | Abdalla E et al. [33] | 2019 | Egypt | | 120 | RCT | Intravenous dexamethasone combined with intrathecal atropine to prevent morphine-related nausea and vomiting after cesarean delivery. | Combination of IV dexamethasone and intrathecal atropine has additive antiemetic effect after SA for CS using bupivacaine and morphine | low |
| 17 | Jabalumeli M et al. [8] | 2012 | Iran | 31.5 | 132 | RCT | Treatment of postoperative nausea and vomiting after spinal anesthesia for cesarean delivery: comparison of midazolam, ondansetron, and a combination. | IV 30 µg/kg midazolam in combination with IV 8 mg ondansetron was superior to administering a single drug for the treatment of emetic symptoms after CS under SA. | Low |

PONV in parturient undergoing CS and most of the studies are randomized control trials with good quality of evidence. Additionally, this review includes some approaches such as non-pharmacological adjunct.

5.1.2. Limitations

Our review has also many limitations. Some of the included studies had poor methodological quality and low sample size. Even though the objective of this review is to determine the prevention and management strategies of PONV after cesarean section, there were no adequate studies reviewed on the PONV management strategies specifically on obstetrics populations. Most of the studies focused on prevention through prophylactic administration of a different group of antiemetic agents. This limits our review to meet its objective on the management part in detail.

Ethical approval

This Systematic Literature review has been exempted by the Institutional Review Board of Dilla University College of Medicine and Health Science from requiring ethical approval.

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There is no financial support needed to write this systematic literature review.

Author contributions

All authors have made substantial contributions to conception, design, participated in the critical review, and editing of the manuscript drafts for scientific merit and depth.

Guarantor

Seyoum Hailu.

Review registration number

It has been registered with the unique identifying number is: reviewregistry1277

(<https://www.researchregistry.com/browse-the-registry#registryofsystematicreviewsmeta-analyses/>).

Provenance and peer review

Not commissioned, externally peer-reviewed.

Declaration of competing interest

Nothing to declare.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.amsu.2022.103433>.

References

- [1] C.C. Apfel, F.M. Heidrich, S. Jukar-Rao, L. Jalota, C. Hornuss, R.P. Whelan, et al., Evidence-based analysis of risk factors for postoperative nausea and vomiting, *Br. J. Anaesth.* 109 (5) (2012) 742–753.
- [2] A.T. Bantie, M. Woldeyohannes, Z.A. Ferede, B.A. Regasa, The magnitude and associated factors of nausea and vomiting after cesarean section under spinal anesthesia in Gandhi Memorial Hospital, Addis Ababa, Ethiopia. A cross-sectional study, *Studies* 3 (7) (2020).
- [3] H.S. Tan, A.S. Habib, The optimum management of nausea and vomiting during and after cesarean delivery, *Best Pract. Res. Clin. Anaesthesiol.* 34 (4) (2020) 735–747.
- [4] X. Cao, P.F. White, H. Ma, An update on the management of postoperative nausea and vomiting, *J. Anesth.* 31 (4) (2017) 617–626.
- [5] P. Singh, S.S. Yoon, B. Kuo, Nausea: a review of pathophysiology and therapeutics, *Ther. Adv. Gastroenterol.* 9 (1) (2016) 98–112.
- [6] L. Denholm, G. Gallagher, Physiology and pharmacology of nausea and vomiting, *Anaesth. Intensive Care Med.* 19 (9) (2018) 513–516.
- [7] S. Pierre, R. Whelan, Nausea and vomiting after surgery, *Cont. Educ. Anaesth. Crit. Care Pain* 13 (1) (2013) 28–32.
- [8] M. Jabalumeli, A. Honarmand, M. Safavi, M. Chitsaz, Treatment of postoperative nausea and vomiting after spinal anesthesia for cesarean delivery: a randomized, double-blinded comparison of midazolam, ondansetron, and a combination, *Adv. Biomed. Res.* 1 (2012).
- [9] B. Chekol, F. Zewudu, D. Eshetie, N. Temesgen, E. Molla, Magnitude and associated factors of intraoperative nausea and vomiting among parturients who gave birth with the cesarean section under spinal anesthesia at South Gondar zone Hospitals, Ethiopia, *Ann Med Surg* 66 (2021) 102383.
- [10] T.J. Gan, K.G. Belani, S. Bergese, F. Chung, P. Diemunsch, A.S. Habib, et al., Fourth consensus guidelines for the management of postoperative nausea and vomiting, *Anesth. Analg.* 131 (2) (2019) 411–448.
- [11] N. Yilmaz, N. Çekmen, F. Bilgin, E. Erten, M.Ö. Özhan, A. Coşar, Preoperative carbohydrate nutrition reduces postoperative nausea and vomiting compared to preoperative fasting, *J. Res. Med. Sci.: Off J Isfahan Univ Med Sci* 18 (10) (2013) 827.
- [12] T.K. Allen, C.A. Jones, A.S. Habib, Dexamethasone for the prophylaxis of postoperative nausea and vomiting associated with neuraxial morphine administration: a systematic review and meta-analysis, *Anesth. Analg.* 114 (4) (2012) 813–822.
- [13] B.M. Mishriky, A.S. Habib, Metoclopramide for nausea and vomiting prophylaxis during and after Caesarean delivery: a systematic review and meta-analysis, *Br. J. Anaesth.* 108 (3) (2012) 374–383.

- [14] T.J. Gan, P. Diemunsch, A.S. Habib, A. Kovac, P. Kranke, T.A. Meyer, et al., Consensus guidelines for the management of postoperative nausea and vomiting, *Anesth. Analg.* 118 (1) (2014) 85–113.
- [15] M.J. Page, J.E. McKenzie, P.M. Bossuyt, I. Boutron, T.C. Hoffmann, C.D. Mulrow, et al., The PRISMA 2020 statement: an updated guideline for reporting systematic reviews, *Int. J. Surg.* 88 (2021) 105906.
- [16] J.P. Higgins, D.G. Altman, P.C. Gøtzsche, P. Jüni, D. Moher, A.D. Oxman, et al., The Cochrane Collaboration's tool for assessing the risk of bias in randomized trials, *BMJ* 343 (2011).
- [17] B.J.R.B. Shea, G. Wells, M. Thuku, C. Hamel, J. Moran, D. Moher, P. Tugwell, V. Welch, E. Kristjansson, D.A. Henry, Amstar 2: a critical appraisal tool for systematic reviews that include randomized or non-randomized studies of healthcare interventions, or both, *BMJ* 358 (2017 Sep 21) j4008.
- [18] A. Direkvand-Moghadam, A. Khosravi, Effect of acupressure on postoperative nausea and vomiting in cesarean section: a randomized controlled trial, *J. Clin. Diagn. Res.: J. Clin. Diagn. Res.* 7 (10) (2013) 2247.
- [19] H. Noroozinia, A. Mahoori, E. Hasani, M. Gerami-Fahim, N. Sepehrvand, The effect of acupressure on nausea and vomiting after cesarean section under spinal anesthesia, *Acta Med. Iran.* (2013) 163–167.
- [20] A.M. El-Deeb, M.S. Ahmady, Effect of acupuncture on nausea and/or vomiting during and after cesarean section in comparison with ondansetron, *J. Anesth.* 25 (5) (2011) 698–703.
- [21] H. Pakniat, F. Lalooha, F. Movahed, A. Boostan, M.B. Khezri, C. Hedberg, et al., The effect of ginger and metoclopramide in the prevention of nausea and vomiting during and after surgery in the cesarean section under spinal anesthesia, *Obstet Gynecol Sci* 63 (2) (2020) 173–180.
- [22] H. Zeraati, J. Shahinfar, S.I. Hesari, M. Masrormiya, F. Nasimi, The effect of ginger extract on the incidence and severity of nausea and vomiting after cesarean section under spinal anesthesia, *Anesthesiol. Pain Med.* 6 (5) (2016).
- [23] A. Kalava, S.J. Darji, A. Kalstein, J.M. Yarmush, J. SchianodiCola, J. Weinberg, Efficacy of ginger on intraoperative and postoperative nausea and vomiting in elective cesarean section patients, *Eur. J. Obstet. Gynecol. Reprod. Biol.* 169 (2) (2013) 184–188.
- [24] S. Rasooli, F. Moslemi, M. Gogazadeh, Preventing nausea and vomiting using ondansetron and metoclopramide-phenylephrine in cesarean section using spinal anesthesia, *Crescent J Med Biol Sci* 6 (1) (2019) 61–65.
- [25] M. Voigt, C.W. Fröhlich, C. Hüttel, P. Kranke, J. Mennen, O. Boessneck, et al., Prophylaxis of intra- and postoperative nausea and vomiting in patients during cesarean section in spinal anesthesia, *Med. Sci. Mon. Int. Med. J. Exp. Clin. Res.: Int Med J Exp Clin Res* 19 (2013) 993.
- [26] M.A. Rasheed, A. Sarkar, V. Arora, Evaluation of efficacy of metoclopramide, dexamethasone and their combination for the prevention of postoperative nausea and vomiting (PONV) in patients undergoing cesarean section, *Anesth Crit Care* 1 (1) (2019) 1–9.
- [27] H. Modir, E. Moshiri, A. Kamali, M. Shokrpour, N. Shams, Prophylactic efficacy of dexamethasone, ketamine and dexmedetomidine against intra- and postoperative nausea and vomiting under spinal anesthesia, *Formosan J Surg* 52 (1) (2019) 17.
- [28] E.S. Endalew, E. Gebremedhn, A. Gebreegzi, H. Kassahun, A. Kassa, Effectiveness of intravenous metoclopramide prophylaxis on the reduction of intraoperative and early postoperative nausea and vomiting after emergency cesarean section under spinal anesthesia, *J. Anesth. Clin. Res.* 9 (809) (2018) 2.
- [29] P.C. Patel, D. Parmar, U. Patel, R.S. Shah, Comparison of injection granisetron versus injection ondansetron for control of intraoperative nausea and vomiting and postoperative nausea and vomiting among the women undergoing lower segment cesarean section under spinal anesthesia, *Adv Hum Biol* 11 (2) (2021) 172.
- [30] M. Dasgupta, B. Biswas, S. Chatterjee, P. Mazumder, M.B. Chowdhury, Randomized, placebo-controlled trial of granisetron for control of nausea and vomiting during cesarean delivery under spinal anesthesia, *J. Obstet. Gynaecol. India* 62 (4) (2012) 419–423.
- [31] S. Chattopadhyay, S. Goswami, Palonosetron versus ramosetron prophylaxis for control of postoperative nausea and vomiting after cesarean delivery under spinal anesthesia, *J. Obstet. Gynaecol. India* 65 (1) (2015) 28–33.
- [32] S. Kampo, A.P. Afful, S. Mohammed, M. Ntim, A.D. Buunaaim, T.W. Anabah, Sub-hypnotic dose of propofol as antiemetic prophylaxis attenuates intrathecal morphine-induced postoperative nausea and vomiting, and pruritus in parturient undergoing cesarean section—a randomized control trial, *BMC Anesthesiol.* 19 (1) (2019) 1–10.
- [33] E. Abdalla, E.Z. Kamel, W.S. Farrag, Intravenous dexamethasone combined with intrathecal atropine to prevent morphine-related nausea and vomiting after cesarean delivery: a randomized double-blinded study, *Egypt. J. Anaesth.* 35 (1) (2019) 65–70.
- [34] 2011. RCoOaGhotCSNCG, Accessed Afhwnoug, July 03.
- [35] Majhi D, Das M. A Comparative Study of Metoclopramide, Dexamethasone, and Ondansetron in Control of Nausea and Vomiting after Spinal Anesthesia for Cesarean Section.
- [36] D. Teshome, E. Fenta, S. Hailu, Preoperative prevention and postoperative management of nausea and vomiting in a resource-limited setting: a systematic review, *Int J Surg Open* 27 (2020) 10–17.