Magnitude and associated factors of intraoperative nausea and vomiting among parturients who gave birth with cesarean section under spinal anesthesia at South Gondar zone Hospitals, Ethiopia

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ABSTRACT

Background: Intraoperative nausea and vomiting are common intraoperative events by which parturient feel discomfort and disturbed after spinal anesthesia.

Methods: Hospital-based cross-sectional study was conducted on mothers who underwent cesarean section with spinal anesthesia. Descriptive analysis and chi-square test were employed. Bivariable and multivariable logistic regressions were used to measure the association of factors with the outcome variable intraoperative nausea and vomiting. A p-value of ≤0.05 was used to decide statistical significance for multivariable logistic regression.

Result: A total of 246 parturients were participated in this study. The incidence of intraoperative nausea and vomiting was 40.2%. According to multivariable logistic regression, age greater than 30 years (AOR, 6.26; 95% CI, 2.2–17.78; p-value 0.001), primiparous (AOR, 3.72; 95%CI, 1.35–10.24; p-value, 0.011), having motion sickness (AOR, 7.1; 95%CI, 2.75–18.33; p-value 0.001), emergency cesarean sectin (AOR, 9.85; 95%CI, 3.19–30.38; p-value 0.001), oxygen suplimentation (AOR, 0.021; 95%CI, 0.005–0.08; p-value 0.0001) and uterotonic agent (AOR, 2.99; 95%CI 1.24–7.22; p-value 0.015) had statistically significant association with intraoperative nausea and vomiting.

Conclusion: In our study, the overall incidence of intraoperative nausea and vomiting after spinal anesthesia was 40.2%. Parturients with age greater than 30 years, having motion sickness, didn’t get intraoperative supplemental oxygen, oxytocin used for the uterotonic purpose, emergency surgery, and primiparous were at increased risk of intraoperative nausea and vomiting.

1. Background

Spinal anesthesia (SA) recently has gained popularity for cesarean section due to the change of attitude secondary to an increased awareness for the safety of regional block for both mother and newborns [1–4]. The extremely small dose of local anesthetic used nearly eliminates the possibility of a systemic toxic reaction and will not cross the placenta to any appreciable degree compared with epidural anesthesia [3,5].

Nausea and vomiting are common in a wide variety of surgical operations. However, this problem arises even more often in cesarean operations under SA. The incidence of intraoperative nausea and vomiting (IONV) is as high as 80% [4] This condition is affected by factors that are particular to the patient, anesthesia, and surgery. Prediction of IONV is important for enabling appropriate and timely use of antiemetics [6,7].

The stimulating factors of the vomiting mechanism can be stimulation of the vagal nerves, cerebral cortex, vestibular body, and the chemoreceptors trigger zone. The receptors of dopamine, serotonin, histamine, and muscarinic play a role in this process [4,8].

Increased intragastric pressure due to gravid uterus, hypotension, stretching the peritoneum (exteriorization of the uterus), excessive surgical manipulation and visceral stimulation, using opioids, using uterotonic agents, visceral type of pain, and the patient’s mental status play a role and place the patient at high risk for IONV [3,9,10]. Hypotension associated with spinal, epidural, and spinal-epidural (combined)
anesthesia is a particularly important contributing factor for IONV [4,7, 11].

Pregnant women are already likely to suffer from nausea and vomiting throughout their pregnancy due to the reduced tone of the esophagogastric junction and increased intraabdominal pressure.

Intraoperative nausea and vomiting after SA in cesarean delivery are a common occurrence and reported incidences are quite high. The wellbeing of patients may be severely compromised as 72% of patients are afraid of nausea and vomiting and 71% feel significant discomfort [2,6]. Nausea and vomiting with onset during the operation and persisting in the postoperative period cause reduced patient comfort, delayed discharge from the hospital, and an increase in cost [4].

To prevent IONV during cesarean section (C/S), blood pressure must be closely monitored, use of opioids must be kept to a minimum, the operative technique must be gentle with minimum displacement of the uterus (not exteriorizing through an incision), and uterotonics and antibiotics must be administered in dilute and slow infusions [10,12]. Knowing the magnitude and factors causing IONV helps urgent need of safety and treatment in the service of anesthesia to prevent its impact on surgery and patient satisfaction. Therefore this study aimed to determine the magnitude and associated factors of IONV during cesarean section under SA.

2. Methods

2.1. Study design, area and period

A multicentre institutional-based cross-sectional study was conducted in three primary and one specialized governmental hospitals found in South Gondar zone from February 01- April 30, 2020, to determine the magnitude and associated factors of intraoperative nausea and/or vomiting for parturients who gave birth with C/S under spinal anesthesia. This research was reported according to the STROCSS criteria [13] and it was registered at www.researchregistry.com with a research registry number of 6723.

2.2. Population

2.2.1. Source population

All mothers undergoing Cesarean delivery under spinal anesthesia in South Gondar zone Hospitals.

2.2.2. Study population

All mothers undergoing Cesarean delivery under spinal anesthesia in South Gondar zone Hospitals, during the study period, 2020.

2.3. Eligible criteria

The study was conducted on all mothers undergoing cesarean delivery under spinal anesthesia during the study period by excluding mothers having acute or chronic nausea and vomiting secondary to medical illnesses like gastritis, gall bladder disease, and bowel obstruction.

2.4. Sample size and sampling technique

A total of 246 parturients who gave birth with the cesarean section under spinal anesthesia were included in the study by non-probability consecutive sampling technique.

2.5. Study variables

2.5.1. Dependent variables

Nausea and or vomiting

2.5.2. Independent variables

Socio-demographic characteristics (age, weight, parity, history of smoking, history of motion sickness or previous IONV), premedication (oxytocin, for augmentation, antiemetic, antibiotics), hemodynamic changes (BP, HR, SPO2), Drugs (Oxytocin, Ergometrine, Opioids), Anesthesia-related factors (Baricity of LA, Dose of LA, Speed of injection, Level of block, and Position of the patient, adjuvants), Surgery related factors (manipulation, exteriorization of the uterus, Type of surgery)

2.6. Data collection tool and technique

Data were collected through observation and face-to-face interviews by the trained data collectors. The data collection tool was prepared from different literatures which were done on the related topic worldwide. The perioperative anesthetic and surgical management was continuously observed by data collectors that were not involved in the anesthetic management of the operated parturient. Vital signs of each participant were recorded during the surgery. The fluid used for pre-loading or co-loading and anesthetic and surgical interventions during spinal anesthesia in operation theatre was documented.

2.7. Data quality assurance

To ensure the quality of data, training for the data collectors and the supervisor was given and a pre-test was done. The supervisor has checked the data collectors and the completeness of the tool every day during data collection time.

2.8. Data entry and analysis

Data were coded and entered into Epi-data version 4.2 and was exported to SPSS version 23 for statistical analysis. Categorical socio-demographic data were summarized by frequencies and percentages of occurrence. The chi-square test was used to compare frequencies of respondents with categorical variables. Independent variables were analyzed using binary and multivariate logistic regression with the dependent variable. Variables with a p-value of ≤0.2 from the bivariable analysis were fitted to a multivariable logistic regression to check their association with dependent outcome. Adjusted Odds ratio with 95% confidence interval and the p-value of ≤0.05 was considered to have a significant association.

2.8.1. Ethical consideration

After the proposal was reviewed by the department of anesthesia reviewing committee, ethical clearance and permission to conduct the research was obtained from the research and community service coordinator office of the college of health science, Debre Tabor University. Written informed consent was presented and obtained from each study participant according to the principles of the Helsinki declaration.

2.9. Operational definition

Hypotension - Systolic blood pressures or mean arterial pressure decreases by more than 20% from the pre-anesthetic value.

Nausea and vomiting: To say the parturient has nausea and vomiting during cesarean section under spinal anesthesia, a patient must have at least one episode of nausea and/or vomiting in the intraoperative period.

Amount of preloaded fluid: Amount of intravenous fluid given within 30 min before block placement.

3. Result

3.1. Socio-demographic characteristics

In this study, a total of 246 parturients were participated. The
majority (63.4%) of the participants were aged ≤30 years and 58.9% of them have a BMI of between 18.5 and 24.9 kg/m². The mean age and BMI of the parturients were 29.57 ± 5.5 and 24.7 ± 3.6 respectively. Most of them (59.8%) were from the urban area who are unemployed (79.3%) in governmental workplaces (Table 1).

3.2. Clinical and parturition characteristics

Of the participants, 98.8% and 65.9% were ASA II and Multiparous respectively. Forty-eight (19.5%) parturients had previous exposure to anesthesia and surgery from whom 27 (56.3%) parturients had previous nausea and vomiting. From the participants, 71.1% and 62.2% of parturients were premedicated with antiemetics metoclopramide and dexamethasone respectively. The baseline MAP of the parturients with mean and standard deviation was 89.8 ± 8.05 (Table 2).

3.3. Intraoperative clinical conditions

All parturients were given 0.5% bupivacaine for spinal anesthesia purposes with or without opioid adjuvants. The majority (63.4%) of spinal anesthesia was done with greater than or equal to 2.5 ml bupivacaine. From all, around 99 (40.2%) of parturients develop nausea only, vomiting only, and both nausea and vomiting. Around 71.1% and 62.2% of parturients were hypotensive at the 10th minute after spinal anesthesia was administered with >20mmhg decrement from the baseline MAP (Table 3 and Fig. 1).

3.4. IONV and different independent factors

Parturients who are less than 30 years of age develop IONV more frequently than age greater than 30 years. From the illiterate participants around 36 (52.2%) were suffering from IONV after spinal anesthesia. From the participants, around 39 (15.9%), 12 (4.9%), and 48 (19.5%) of parturients develop nausea only, vomiting only, and both nausea and vomiting respectively. Around 91 (37%) of participants were hypotensive at the 10th minute after spinal anesthesia was administered with >20mmhg decrement from the baseline MAP (Table 4).

3.5. Factor analysis

According to multivariable analysis, age greater than 30 years (AOR, 6.26; 95%CI, 2.2–17.78; p-value 0.001), primiparous (AOR, 3.72; 95%CI, 1.35–10.24; p-value, 0.011), having motion sickness (AOR, 7.22; p-value 0.015) are significant factors for the development of IONV (Table 5).

### Table 1
Sociodemographic characteristics of participants who gave birth under spinal anesthesia in South Gondar zone governmental hospitals, 2021.

| Variable         | Categories | Frequency | Percentage |
|------------------|------------|-----------|------------|
| Age              | ≤30       | 90        | 36.6       |
|                  | >30       | 156       | 63.4       |
| BMI              | 18.5–24.9 | 145       | 58.9       |
|                  | ≥25       | 101       | 41.1       |
| Educational level| Illiterate | 69        | 28         |
|                  | Literate  | 177       | 72         |
| Marital status   | Married   | 243       | 98.8       |
|                  | Single    | 3         | 1.2        |
| Residency        | Urban     | 147       | 59.8       |
|                  | Rural     | 99        | 40.2       |
| Employment       | Employed  | 51        | 20.7       |
|                  | Unemployed| 195       | 79.3       |
| Smoking          | Yes       | 3         | 1.2        |
|                  | No        | 243       | 98.8       |
| Alcohol          | Yes       | 24        | 9.8        |
|                  | No        | 222       | 90.2       |
| Motion sickness  | Yes       | 87        | 35.4       |
|                  | No        | 159       | 64.6       |

### Table 2
Preoperative clinical and parturition characteristics of parturients who gave birth under spinal anesthesia in South Gondar zone governmental hospitals, 2021.

| Variable         | Category | Frequency | Percentage |
|------------------|----------|-----------|------------|
| ASA              | II       | 243       | 98.8       |
|                  | III      | 3         | 1.2        |
| Parity           | Primiparous | 84       | 31.1       |
|                  | Multiparous | 162     | 65.9       |
| Type of surgery  | Elective | 75        | 30.5       |
|                  | Emergency | 171       | 69.5       |
| Previous anesthesia | Yes | 48        | 19.5       |
|                  | No       | 198       | 80.5       |
| Plasil given     | Yes      | 175       | 71.1       |
|                  | No       | 71        | 28.9       |
| Dexamethasone given | Yes | 153       | 62.2       |
|                  | No       | 93        | 37.8       |
| NPO time         | <6hrs    | 105       | 42.7       |
|                  | ≥6hrs    | 141       | 57.3       |
| Preload          | <1000 ml | 84        | 34.1       |
|                  | ≥1000 ml | 162       | 65.9       |
| Antibiotic given | Ampicilne | 111     | 45.1       |
|                  | Ceftriazone | 135   | 54.9       |
| Preoperative oxytocin infusion | Yes | 48        | 19.5       |
|                  | No       | 198       | 80.5       |
| Baseline MAP     | 89.8 ± 8.05 |         |            |

NPO: Null per oueth; ASA: American Society of Anesthesiologist.

### Table 3
Intraoperative clinical and parturition conditions of mothers who gave birth under spinal anesthesia in South Gondar zone governmental hospitals, 2021.

| Variable         | Category | Frequency | Percentage |
|------------------|----------|-----------|------------|
| Intraoperative pain | Yes | 15        | 6.1        |
|                  | No       | 231       | 93.9       |
| Volume of LA (0.5% Bupivacaine) | <2.5 ml | 90        | 36.6       |
|                  | ≥2.5 ml  | 156       | 63.4       |
| Spinal opioid adjuvant | Yes | 63        | 25.6       |
|                  | No       | 183       | 74.4       |
| Level of block    | At & Below T10 | 165     | 67.1       |
|                  | Above T10 | 81        | 32.9       |
| Blood loss        | <1000 ml | 225       | 91.5       |
|                  | ≥1000 ml | 21        | 8.5        |
| Intraoperative O2 supplementation | Yes | 150       | 61         |
|                  | No       | 96        | 39         |
| Hypotension (%)20% of baseline MAP | Yes | 91        | 37         |
|                  | No       | 155       | 63         |
| Treatment of hypotension | Yes | 21        | 8.5        |
|                  | No       | 225       | 91.5       |
| Treatment of bradycardia | Yes | 27        | 11         |
|                  | No       | 219       | 89         |
| Uteroton agent    | Oxytocin | 166       | 67.5       |
|                  | Ergometrine alone, mixed | 80 | 32.5 |
| Left lateral tilt | Yes       | 102       | 41.5       |
|                  | No       | 144       | 58.5       |
| Duration of surgery | 48.3 ± 11.3 |         |            |

LA: Local anesthesia; MAP: Mean arterial pressure; IONV: Intraoperative nausea/vomiting.

2.99; 95%CI 1.24–7.22; p-value 0.015) are significant factors for the development of IONV (Table 5).

4. Discussion

Nausea and vomiting are common in a wide variety of surgical operations. However, this problem arises even more often in cesarean operations under regional anesthesia. The incidence of IONV is as high
as 80% in “high-risk” inpatients during the 24 h after operation [4], and is dependent on the anesthesia technique used, together with preventative and therapeutic measures employed by the anesthetist [5].

Intraoperative nausea and vomiting after spinal anesthesia in cesarean delivery are common occurrence high incidences. The well-being of patients may be severely compromised as 72% of patients are afraid of NV and 71% feel significant discomfort [4].

This study was performed to assess the magnitude and possible risk factors which are associated with intraoperative nausea vomiting during cesarean section under spinal anesthesia. This can help the clinical environment if we know the possible factors especially preventable factors and contribute to improve parturient’s satisfaction in the perioperative period. Knowledge of independent IONV risk factors is crucial for the optimal use of antiemetic prophylaxis and multimodal management strategies [4].

The overall magnitude of IONV in this current study was 40.2% which is almost similar to the study done at the University of Gondar on 373 parturients with an overall incidence of IONV 40.8%. This similarity might be due to similar characteristics in sociodemographic and clinical setups of the study areas [3]. But the result of the present study is quite higher than the study done in Cape Town on 258 parturients with the overall incidence of IONV was around 33%. This small variation might be due to differences in sociodemographic characteristics of the participants and the clinical setup difference. Also, the study was done only on elective type of surgery but the present study was done both on elective and emergency surgeries. The type of study can be the other possible justification for this variation by which the previous study was done under a controlled approach with different protocols which limit the incidence of IONV.

Another study also revealed that the incidence of IONV was 9.1% which is lower as compared to our study. Because the previous study was done by giving special concern and strict application for the prophylactic medications of nausea and vomiting and prevention of the possible risk factors of the complications. But in our study, 71% of parturients got antiemetic premedication [15].

Table 4
Incidence of IONV in related with different factors of participants who gave birth with cesarean section under spinal anesthesia (n = 246; with chi-square test), 2021.

| Variable | Categories Having IONV (95% CI) | No IONV (95% CI) | p-value |
|----------|-------------------------------|-----------------|---------|
| Age      | ≤30 (44.2%)                   | 87 (55.8%)      | 0.11    |
|          | >30 (33.3%)                   | 60 (66.7%)      |         |
| BMI      | 18.5–24.9 (42.8%)             | 83 (57.2%)      | 0.35    |
|          | ≥25 (36.6%)                   | 64 (63.4%)      |         |
| Educational level | Illiterate (52.2%) | 33 (47.8%) | 0.02 |
|          | Literate (35.6%)              | 114 (64.4%)     |         |
| Marital status | Married (40.7%) | 144 (59.3%) | 0.28 |
|          | Single (0)                    | 3 (100%)        |         |
| Residency | Urban (36.7%)               | 93 (63.3%)      | 0.19    |
|          | Rural (45.5%)                 | 54 (54.5%)      |         |
| Employment | Employed (41.2%)           | 30 (58.8%)      | 0.87    |
|          | Unemployed (40.0%)            | 117 (60.0%)     |         |
| Parity   | Primipara (24.8%)             | 60 (71.4%)      | 0.009   |
|          | Multipar (46.3%)              | 83 (53.7%)      |         |
| Previous anesthesia | Yes (41.8%) | 27 (56.2%) | 0.6   |
|          | No (39.4%)                    | 132 (60.6%)     |         |
| Motion sickness | Yes (55.2%) | 90 (44.8%) | 0.001  |
|          | No (51.3%)                    | 108 (67.9%)     |         |
| Intraoperative pain | Yes (60.0%) | 9 (60%) | 1     |
|          | No (93.0%)                    | 18 (6.9%)       |         |
| Type of surgery | Emergency (47.4%) | 90 (52.6%) | 0.001  |
|          | Elective (24.4%)              | 57 (73%)        |         |
| Dexamethasone | Yes (45.1%) | 84 (54.9) | 0.06 |
|          | No (30.3%)                    | 63 (67.7%)      |         |
| NPO hours | <6hrs (51.4%)                | 514 (48.6%)     | 0.002   |
|          | ≥6hrs (45.3%)                 | 66 (54.7%)      |         |
| Opioid adjuvants | Yes (45.1%) | 96 (54.1) | 0.002  |
|          | No (63.4%)                    | 120 (65.6%)     |         |
| Supplemental O2 | Yes (45.1%) | 63 (54) | 0.001  |
|          | No (12.8%)                    | 84 (87.5%)      |         |
| ≥20 mmhg of baseline MAP | Yes (50.5%) | 45 (49.5%) | 0.02  |
|          | No (53.4)                     | 102 (65.8%)     |         |

NPO: Null Per out; BMI: Body Mass Index; MAP: Mean Arterial Pressure; IONV: Intraoperative Nausea/Vomiting.

Fig. 1. Line graph represents the vital sign trends of parturients who gave birth with cesarean section under spinal anesthesia, 2021.

In our study, IONV was significantly associated with a maternal history of motion sickness (AOR = 7.1; 95% CI = 2.75–18.33 and p-value 0.001). Parturients having motion sickness are around seven times riskier to develop IONV. The possible mechanisms can best be justified by a spectrum of susceptibility to vestibular-mediated stimulus, which lowers the threshold for nausea and vomiting with motion. Changes in position and transfer on a stretcher at the end of surgery can stimulate afferent neural pathways that project to the vestibular nuclei, leading to activation of the brain stem nuclei, triggering the somatic and gastrointestinal components of emesis [10,15].

In this study mothers who underwent emergency cesarean section had significantly associated with IONV as compared with their elective counterparts (AOR = 9.85; 95% CI = 3.19–30.38; p-value = 0.001). Emergency-based C/S were approximately 10 times riskier for IONV and this finding is in line with a study done by Abere et al. at Addis Ababa University in determining the Magnitude and associated factors of nausea and vomiting during cesarean section under spinal anesthesia [16].

Most of the factors predisposing to IONV during cesarean section under spinal anesthesia which mostly are specific for CS. In our study parturients who took oxytocin for uterotonic purpose were significantly associated with IONV and this finding is in line with a study done by Abere et al. at Addis Ababa Ethiopia in determining the Magnitude and associated factors of nausea and vomiting during cesarean section under spinal anesthesia [16].

In our study younger age of the parturient was associated with nausea and vomiting in the intraoperative period (AOR = 6.26; 95% CI = 2.2–17.78; p = 0.001). Parturients being greater than 30 years of age were six times riskier for the development of IONV. This finding is supported by many literatures even though nausea and vomiting they encountered was not mainly in the intraoperative period and a group of parturients were different [17–19].

Our study also revealed that an administration of supplemental oxygen during cesarean section was significantly associated with a decreased outcome of IONV. Most of the parturients who had intraoperative 100% supplemental oxygen with facemask did not develop nausea and vomiting. Other studies also reported that supplemental oxygen is effective to prevent nausea and vomiting (AOR = 0.02; 95% CI = 0.005–0.08; p-value = 0.001). Oxygen concentration greater than
or equal to 80% can decrease nausea and vomiting it is found to be as effective or better than ondansetron [20,21]. But a systematic review and meta-analysis of controlled trials report revealed that an administration of a higher concentration of oxygen had a weak beneficial effect to prevent nausea and vomiting, but their study was among patients who underwent general anesthesia [22,23].

According to our study primiparous parturients were at high risk of developing IONV with an AOR of 3.72; 95%CI of 1.35–10.24 and p-value- 0.01. This might be due to psychological perspectives.

5. Limitations

This study was conducted within a short period with the small size of participants without sample size calculation/power analysis which leads to a wider confidence interval of the result. This study also failed to assess the long-rank effects of IONV on the quality of care and maternal satisfaction.

6. Conclusion

In our study, the overall incidence of intraoperative nausea and vomiting after spinal anesthesia was 40.2%, for this incidence, age greater than 30 years old, having motion sickness, didn’t get intraoperative supplemental oxygen, oxytocin used for the uterotonic purpose, emergency surgery, and primiparous were significant risk factors.

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The ethical approval was obtained from Debre Tabor University RCC office as a form of permission for data collection.

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Author contribution

This work was carried out in collaboration among all authors. B.C. Demilew contributed to the conception, the review and interpreted the literatures based on the level of evidence. F.Z, D.E. Adane, N.T. Ayenew and E. Molla in reviewing preparation of the manuscript. All authors participate in preparation and critical review of the manuscripts. In addition, all authors read and approved the manuscript.

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The authors have no conflict interest.

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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.2021.102383.

Abbreviation

AOR Adjusted Odds Ratio
BMI Body Mass Index
CI Confidence Interval
C/S cesarean Section
COR Crudes Odds Ratio
IONV Intraoperative Nausea and Vomiting
MAP Mean Arterial Pressure
SA Spinal Anesthesia
SPSS Statistical Package for Social Science

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