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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)

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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 well-being 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, SPO_2), 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 preloading 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 $\leq$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 $\leq$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/m^2. 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 complain of intraoperative nausea and/or vomiting 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 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. Forty-six parturients complain IONV from parturients who were hypotensive at the 10th minute after spinal anesthesia (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, 7.1; 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) 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	</ = 500 ml	84	34.1
	>500 ml	162	65.9
Antibiotic given	Ampiciline	111	45.1
	Ceftriaxone	135	54.9
Preoperative oxytocin infusion	Yes	48	19.5
	No	198	80.5
Baseline MAP	89.8 ± 8.05		

NPO: Null per outh; 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 O_2 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
Uteretonic 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		
IONV	Yes	99	40.2
	No	147	59.8

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

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

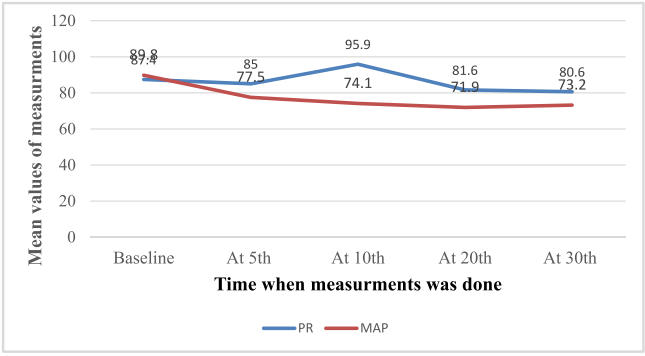

Fig. 1. Line graph represents the vital sign trends of parturients who gave birth with cesarean section under spinal anesthesia, 2021.

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 (99 (40.2%))	No IONV (147 (59.8%))	p-value
Age	≤30	69 (44.2%)	87 (55.8%)	0.11
	>30	30 (33.3%)	60 (66.7%)	
BMI	18.5–24.9	62 (42.8%)	83(57.2%)	0.35
	≥25	37(36.6%)	64(63.4%)	
Educational level	Illiterate	36(52.2%)	33(47.8%)	0.02
	Literate	63(35.6%)	114(64.4%)	
Marital status	Married	99(40.7%)	144(59.3%)	0.28
	Single	0	3(100%)	
Residency	Urban	54(36.7%)	93(63.3%)	0.19
	Rural	45(45.5%)	54(54.5%)	
Employment	Employed	21(41.2%)	30(58.8%)	0.87
	Unemployed	78(40.0%)	117(60.0%)	
Parity	Primipara	24(28.6%)	60(71.4%)	0.009
	Multipara	75(46.3%)	87(53.7%)	
Previous anesthesia	Yes	21(43.8%)	27(56.2%)	0.6
	No	78(39.4%)	129(60.6%)	
Motion sickness	Yes	48(55.2%)	39(44.8%)	0.001
	No	51(32.1%)	108(67.9%)	
Intraoperative pain	Yes	6(40%)	9(60%)	1
	No	93(40.3%)	138(59.7%)	
Type of surgery	Emergency	81(47.4)	90(52.6)	0.001
	Elective	18(24)	57(76)	
Dexamethasone	Yes	69(45.1)	84(54.9)	0.06
	No	30(32.3)	63(67.7)	
NPO hours	<6hrs	54(51.4)	514(8.6)	0.002
	≥6hrs	45(31.9)	96(68.1)	
Opioid adjuvants	Yes	36(57.1)	27(42.9)	0.002
	No	63(34.4)	120(65.6)	
Supplemental O_2	Yes	87(58)	63(42)	0.001
	No	12(12.5)	84(87.5)	
≥20 mmhg of baseline MAP	Yes	46 (50.5)	45 (49.5)	0.02
	No	53 (34.2)	102 (65.8)	

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

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 [2].

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 dose of medications and preload [14].

Another study showed 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].

Also, a study done on 209 patients to predict the possible factors of IONV revealed that the overall incidence of IONV was 77 (36.8%) patients experienced nausea during the cesarean operation and 19 (9.1%) suffered from vomiting [10].

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 Ethiopia 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 (AOR = 9.85; 95%CI = 3.19–30.38; p-value = 0.001). in agreement with this, the overall incidence of Nausea and vomiting was 29 and 9% respectively after the mothers had been given oxytocin infusion. IONV mainly occurs as a result of hypotension produced by oxytocin administration [15].

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 merely in the intraoperative period and a group of patients 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 = 0.021; 95% CI = 0.005–0.08; p-value = 0.0001). Oxygen concentration greater than

Table 5
Factors associated with the incidence of IONV for parturients who underwent cesarean section with spinal anesthesia at the governmental hospitals in South Gondar zone (Bivariable and Multivariable logistic regression), 2021.

Variables	Categories	COR, 95% CI & P-value	AOR, 95% CI & P- value
Age in year	>30	1.59; 0.92–2.72; 0.11	6.26; 2.2–17.78; 0.001
	≤30	1	
Parity	Primiparous	0.46; 0.26–0.82; 0.009	3.72; 1.35–10.24; 0.011
	Multiparous	1	
Motion sickness	Yes	2.61; 1.52–4.46; 0.001	7.1; 2.75–18.33; 0.001
	No	1	
Type of surgery	Emergency	0.35; 0.19–0.65; 0.001	9.85; 3.19–30.38; 0.001
	Elective	1	
O_2 supplementation	Yes	12.89; 6.03–27.56; 0.0001	0.021; 0.005–0.08; 0.0001
	No	1	
Uterotonic agent	Oxytocin	0.511; 0.297–0.897; 0.018	2.99; 1.24–7.22; 0.015
	Ergometrine, mixed	1	

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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Ethical approval

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

Sources of funding

No.

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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Basazinew Chekol Demilew (B.C. Demilew).

Provenance and peer review

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Availability of data

All the necessary data will be provided for reasonable request.

Declaration of competing interest

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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