

Prophylactic Trendelenburg position for Reducing Maternal Hypotension and neonatal acidosis post Spinal Anesthesia in Cesarean Delivery

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Abstract

Background: During caesarean section mothers can be in different positions. Theatre tables could be tilted laterally, upwards, downwards and wedges or cushions could be used. There is no consensus on the best positioning at present. Spinal block gives admirable and excellent anesthesia for cesarean delivery, but it is frequently accompanied by hypotension, which if untreated can pose serious risks to mother and baby. Strategies directed to increasing venous return, such as Trendelenburg position (lifting the lower extremities), in the treatment of arterial hypotension. **This study aims:** to investigate Utilization of trendelenburg position for decreasing maternal hypotension and fetal acidosis following spinal anesthesia in cesarean delivery. A Quasi-experimental design used. **Setting:** The research was done at cesarean delivery operating unit Alazhar University Hospital throughout the period from first June 2017 till June 2018. **Sample:** A total of 380 full-terms parturient with an uncomplicated pregnancy undergone planned cesarean delivery underwent spinal anesthesia recruited in both trendelenburg position group (T-group) leg elevation for 30 cm using two standard throw pillows placed under the heels by nurse for intervention group directly after spinal anesthesia and maintained till skin incision and control group were regular supine position were randomly allocated (190 women in each group). Protocol of pre-hydration and anesthetic technique standardized was followed. **Tools:** the data collected by structured interviewing questionnaire sheet, maternal record, and neonatal assessment sheet. **Results:** Hypotension was significantly less ($P = 0.001$) in study group when compared with control group. A highly statistical significant difference ($P = 0.001$) was acquired between group managed by trendelenburg position and control group considering mean arterial pressure and newly born acidosis. **Conclusion:** Incidence of hypotension can be reduced by trendelenburg position. Since Trendelenburg position is painless, easy, noninvasive, available, and not pharmacological method, **Recommendations:** usage of trendelenburg position during cesarean can be recommended for decreasing post spinal hypotension. **Keywords:** Cesarean Delivery, Trendelenburg position, Hypotension, Spinal Hypotension, Nursing.

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I. Introduction

Cesarean section (CS) is an operation that is performed for pregnant woman to deliver her baby by a surgical incision through the anterior abdominal wall and uterus. It is the most common major surgical procedure its rate has dramatically increased that beyond WHO recommended rate of 15 % for all deliveries.^[1] Latin America was the highest regions with CS rates followed by Northern America with a rate of 40.5% and 32.3%, 31.1% (a Europe (25%), Asia (19.2%) and Africa (7.3%).^[2] Nowadays Egypt has more than 50% of all deliveries were by CS according Ministry of Health and Populations reported data.^[3, 4]

Most parturient receive spinal anesthesia (SA) for Caesarean delivery as it considered as the best frequent anesthetic type evade complications and risks of general anesthesia also, enhance successful pain relief post-operatively layer the common advantages for using SA during caesarean delivery. Hypotension and tachycardia are the most prevalent side effects of SA. The prevalence of hypotension with SA during caesarean delivery (CD) is valued to be 80% which is high. Spinal hypotension can occur suddenly or precipitously and, if severe, can lead to perinatal adverse outcomes, as motherly nausea and vomiting, fetal acidosis and perhaps an chief contributory factor for maternal mortality. Mothers with pre-CS hypervolemia are at risk of cardiovascular collapse as the sympathetic blockade may severely diminish venous return. Accordingly, prevention of spinal hypotension has been a key inquiries research area within the field of maternity care.^[5, 6]

As a consequence, prolonged maternal hypotension causing a detrimental effect to the fetus as it could worsen the fetal Apgar scores; extend fetal acidosis and the time to sustained maintenance respiration. For the mother, it's frequently associated with maternal nausea and vomiting. However, severe SA hypotension can lead to serious complications to the mother such as loss of consciousness and to the fetus as hypoxia and brain damage. So that, avoiding hypotension amid spinal anesthesia for cesarean has been eluded as "golden rule" in obstetric.^[7]

During a CS the mother can be placed in a number of positions. For example, lateral, supine. Wedges and cushions can also be placed under the woman to alter the position. These are commonly placed under the left or right side of the mother to tilt her laterally or under her head or legs to tilt the head or legs upwards. It's believed that adjusting the position of the woman may improve the outcome for both the mother and baby.^[8]

Trendelenburg position described as the body is laid flat on the back with the feet higher than the head by 15-30 degree. It was previously used as a first aid maneuver in acute circulator collapse it has been also considered as a popular method for detection of fluid responsiveness.^[9] Trendelenburg position creates an increase in venous return by translocation of blood from lower extremities to the thorax. Thus, LE leads to increased stroke volume (SV) and consequently cardiac output (CO).^[10]

At present there is no study on the best positioning for the mother during CS. The evidence for a possible role for trendelenburg position in prevention of PSH is unclear. The purpose of this study is to assess if Trendelenburg position for the mother during CS that will improve the outcome for both the mother and neonates.

Aim of this study:

To examine prophylactic Trendelenburg position for decreasing hypotension and fetal acidosis postspinal anesthesia in cesarean section delivery

Hypothesis:

Trendelenburg position during cesarean section delivery expected to lessen and reduce incidence of motherly hypotension and reduce neonatal acidosis.

II. Methodology

Research design:

This study carried out using a quasi- experimental (Control group & Intervention group).

Area and period of study:

The present paper research was carried out at operating room, cesarean delivery next to obstetrical and gynecological department linked to Alazhar University Hospital, which is located in Damietta, Egypt. It is one of the largest government hospitals which is under the control of Alazhar University. The Hospital gives services for all specialty and women and children the study was completed from the beginning of June, 2017 till the end of June, 2018.

Study Population and Sample:

Elective CS mothers scheduled under spinal anesthesia and those who fulfill eligibility inclusion criteria included in the study. All ethical issues were taken into consideration during all phases of the study: the researchers maintained an anonymity and confidentiality of the subjects. The researcher introduced themselves to the women and briefly explained the nature and aim of the study to every woman before participation and women were assured that the study cause no actual or potential harm to her. Also, she can withdraw from the study whenever needed, the information obtained confidential and used for the research purpose only after consent had got from participant's. Mothers were randomly divided into two groups: Group B; the control group, non -legs elevation who receive routine hospital care during CD. Group A; the study group, who receive prophylactic trendelenburg position during CD.

Members were full term (between 37 weeks and 40 weeks 6 days) singleton parturient age of 18 and 39 years booked for CS under the spinal blocking. Avoidance criteria were hypertensive issue of pregnancy, cardiovascular disorders, weight record (BMI) over 30 kg/m², ladies with history of profound venous thrombosis of their lower appendages, ladies with shallow thrombophlebitis of their legs, ladies with hypersensitive response created to the neighborhood soporific some time recently, ladies with crisis cesarean segment, ladies who had contraindications for spinal anesthesia, patients with pattern hypotension (systolic circulatory strain (SBP) < 100 mmHg) or ante partum draining was likewise excluded.

Sample estimation size:

The calculation of sample by Cochran was used to calculate the sample⁽¹¹⁾

$$Z^2_{(1-\alpha/2)} \times P(1-P) \\ N = \frac{\quad}{d^2}$$

Where:-

N = Sample size

$Z^2_{(1-\alpha/2)}$ is the standard error of the mean corresponding to a 95% confidence interval and the corresponding value from a t-table is 1.96. z is the standard normal deviation at 95% confidence level is the proportion in the targets population i.e. incidence of spinal anesthesia at 64%. d is the target margin of error put at 0.05.

$$(1.96)^2 \times 0.66 \times 0.34$$

$$N = \frac{\quad}{0.05^2} = 346$$

As a result, 346, Due to the expected non-participating rate (10%), the final sample size was 380 women, 190 per each group were estimated. The systematic random sampling technique was used.

Tools

Tools were utilized for information gathering:

-An Interviewing Questionnaire: It was created by the researchers; it was utilized to gather demographic data for example; age, residence, educational level, mother weight, height, and age of gestational and so on.

-Record of maternal hemodynamic and signs of hypotension:

Used to record patient's hemodynamic data (Physiological dimensions measurements were completed using automated machines), and maternal hypotension signs (such as nausea, vomiting)

-Assessment sheet for neonates: Used by the researchers to assess pH of umbilical arterial & venous blood, and 1 and 5th minute Apgar score.

After validation of the tool and pilot study all sample gotten 500 ml of lactated ringer as a preloading liquid, and after that, every one of the patients got SA at levels between L4-L5 or L3-L4 inter-spaces. All ladies were cannulated in the left antecubital vein with 16G intravenous catheters (cannula), and checked by noninvasive circulatory strain (pressure), beat oximeter, and electrocardiography.

While in the sitting position giving hyperbaric bupivacaine 0.5% 2.5 mL (12.5 mg), and afterward the ladies were placed in the recumbent position with a 15°-30° remaining sidelong tilt soon after accepting the anesthesia. Control assemble had the conventional nursing care. Trendelenburg position was utilized until the end of CD. Each group of A and B had assessed for hemodynamic by noninvasive blood pressure, pulse oximeter, and electrocardiography arterial systolic blood pressure (ASP), diastolic blood pressure (DAP), and mean arterial blood pressure (MAP) baseline and every minute after still the finish of CD. The definition of baseline hemodynamic variables measures is the average of three following consecutive recordings with less than 10% variation over 10 min before pre-hydration. In the present study, hypotension was defined as diminish in any MAP measurement by extra or more than twenty percentage (20%) of the baseline.

First and after fifth minutes Apgar scores were also noted. Immediately after delivery, the leg elevation were removed and samples were collected from umbilical arterial and vein blood by the researcher by using heparin zed syringes and deliver to the laboratory within one hour of collection and analyzed for blood gases and pH detection to diagnose neonatal acidosis (means a high hydrogen ion concentration in the tissues). Apgar scores were too noted at first and after fifth minutes. Duration of surgery and any intraoperative complications were recorded.

III. Results

Table (1) illustrates Parturient in both groups (intervention) and controls (routine hospital care) were matched for socio-demographic characteristics. They had a close mean age 25.89 ± 3.19 and 25.97 ± 3.77 years. This table reveals that, there were no statistically significant difference between both groups regarding the mean score of height, weight, and body mass index.

Table (2) illustrates that there was not any significant difference between the groups in regard to estimated pregnancy age (weeks), the duration for surgery from block to delivery, delivery to end of surgery, total duration of surgery, period to get maximum sensory block height

Table (3) reveals hypotension incidence. Also, it was noted that there was a highly significant difference statistically amongst both control group and trendelenburg group - esteem < 000

Figure (1) represents presence of nausea and vomiting it was statistically significant amongst both control group and trendelenburg group P-esteem < 000

Figure (2) reveals heart rate changes during CS. Heart rate changes post SA before delivery of fetus at 2 min interval were compared between the two groups, significant difference was found at 4th ,6 th and 8 th min (P = 0.016, 0.010).

Figure (3) shows mean arterial blood pressure throughout the measured interval T group had higher mean arterial blood pressure throughout the measured interval. There was highly significant difference at 4th, 6th, and 8th min (P = 0.002, 0.001, 0.003),

Table (4) displays that, the neonatal attributes of the T group and the control. It was statistically significant with respect to Apgar score of the neonates, the neonatal acidosis and neonatal intensive care unit admission (p < .001**).

Table (1): Distribution of general characteristics of studied women

Personal characteristics	T Group (n=190)	Control Group (n=190)	Test of sig.	p
Age in years. Mean ±SD	25.89 ± 3.19	25.97 ± 3.77	t=0.234	0.815
Weight				
Min. – Max.	65.0 – 86.0	63.0 – 87.0		
Mean ± SD.	76.63 ± 5.03	77.64 ± 5.26	t=1.924	0.055
Height				
Min. – Max.	156.0 – 186.0	112.0 – 177.0		
Mean ± SD.	165.69 ± 5.05	165.70 ± 6.56	t=0.026	0.979
BMI				
Min. – Max.	25.40 – 30.0	25.40 – 30.0		
Mean ± SD.	28.01 ± 1.13	28.13 ± 1.07	t=1.090	0.276

t: t-test * Significant at P ≤0.05.

Table (2): Characteristics of time variable and sensory block of mothers

Variable	Group A(TP)n=(190)	Group B n=(190)	t test	P value
Cesarean section No.	1.59 ± 0.68	1.65 ± 0.75	0.544	0.587
Estimated gestational age (weeks).	38.48 ± 1.0	38.67 ± 1.11	1.637	0.102
Time between delivery to the end of cesarean delivery	32.5±4.30	32.4±3.8	1.567	0.916
Total duration of cesarean delivery(min)	48.4±4.48	47.6±5.68	1.237	0.615
Time between spinal block to delivery (min)	15.4 ± 6.3	15.4±1.75	1.635	0.64
Period to maximum cephalad sensory block T6 (T4-T7) height (min)	4.26±0.58	4.24±0.51	1.543	0.613
Consumption phenylephrine (mg)	5.1 ± 7.8	10 ± 10	11.40	0.001*

Table (3): Incidence of hypotension among studied mothers.

Variable	T group (n=190)		Control group (n=190)		P value
	No.	%	No.	%	
Incidence of hypotension	67	35.3	152	80	<0.001**
Incidence of hypotensive episodes					
1	38	20	61	32	<0.001**
2	21	11	40	21	<0.001**
3	3	1.5	13	7	<0.001**
Rescuedose with phenylephrine.	19	10	57	30	0.0003

** Highly statistical significant difference at <0.001.

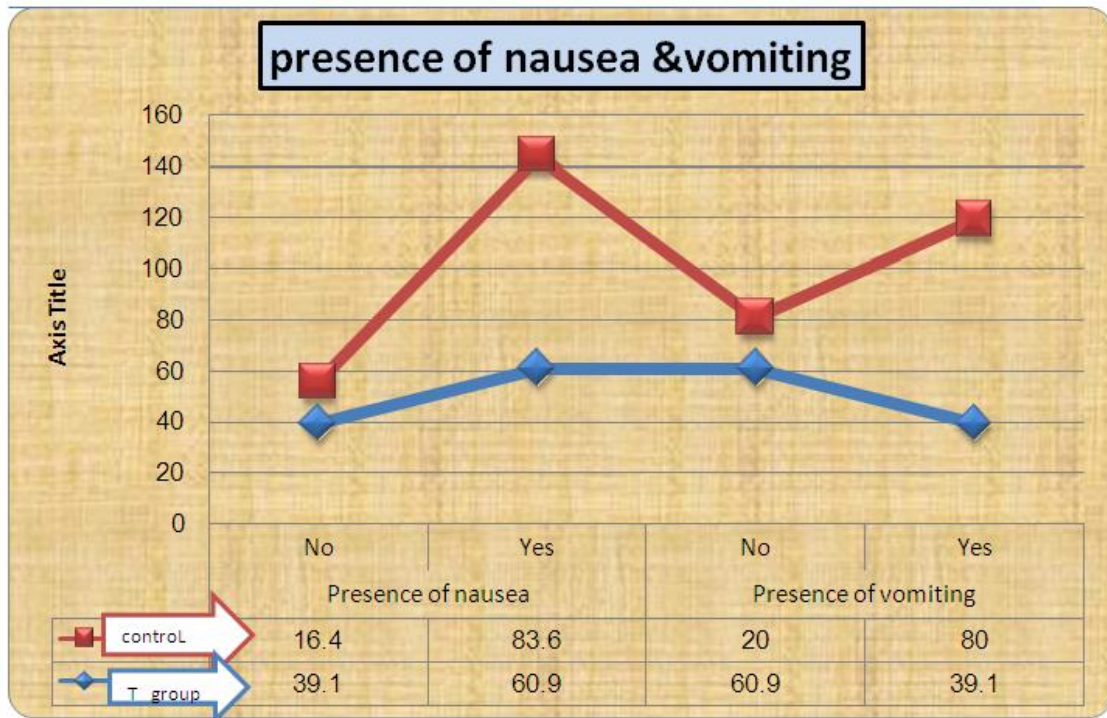


Figure (1): Presence of nausea and vomiting

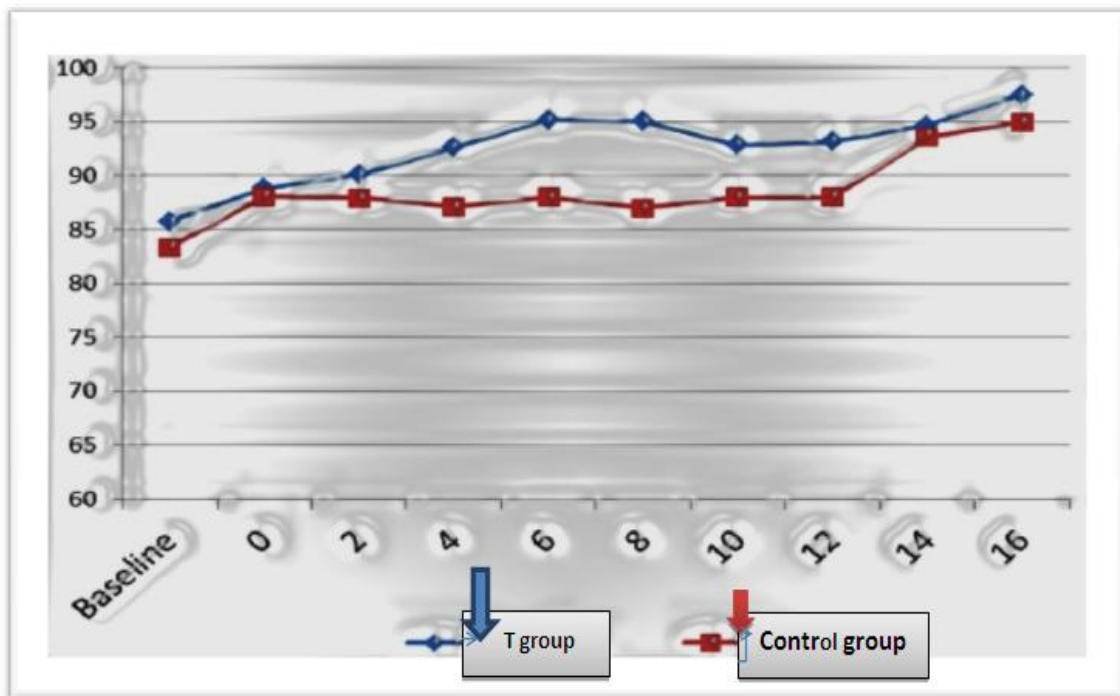


Figure 2 Heart rate changes during CS

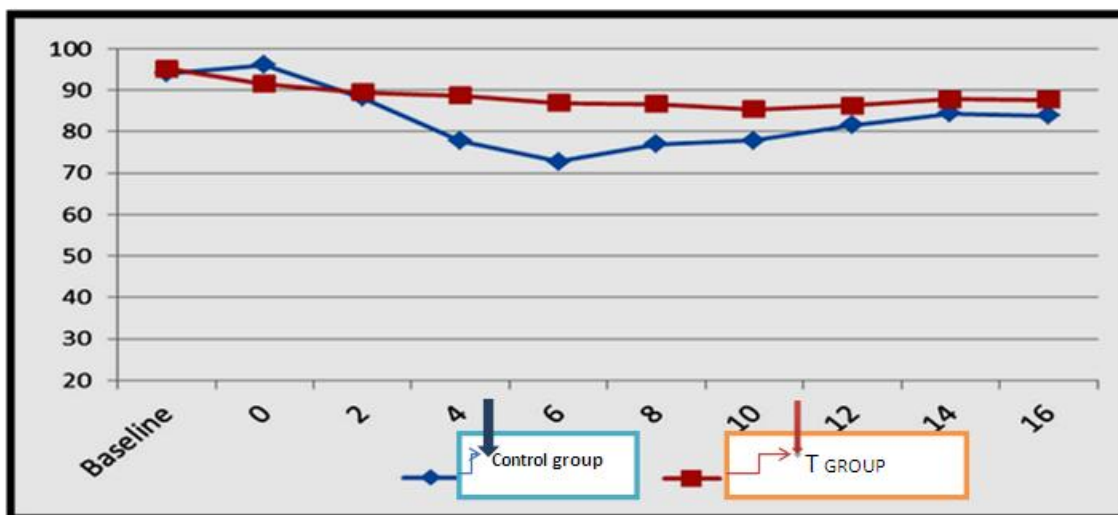


Figure (3) Mean arterial blood pressure throughout the measured interval

Table (4): Neonatal characteristics of studied women

	T Group (n=190)		Control Group (n=190)		p
	No.	%	No.	%	
Apgar score at 1st min					
Normal (7-10) Good	142	74.5	111	58.4	11.226
Moderate Risk (4-6)	29	15.3	48	24.3	
High Risk (0-3) Bad	19	10.2	31	16.3	
Apgar score at 5 min					
Normal (7-10) Good	153	80.5	120	63.2	14.129
Moderate Risk (4-6)	19	10.0	37	17.4	
High Risk (0-3) Bad	18	9.5	33	17.4	
Neonatal Acidosis					
No	155	81.6	169	88.9	4.098
Yes	35	18.4	21	11.1	
Admission to intensive care					
No	142	74.7	118	62.1	6.982
Yes	48	25.3	72	37.9	

* Significant difference at <0.05. ** Highly significant difference at <0.001.

IV. Discussion

Mothers' preparation and positioning are the main responsibilities of nurse's also; appropriate prophylaxis must be easily utilized and applied. In addition, avoidance of sophisticated and device expensive appropriate for hospitals with limited supplies and resources. This study finding gives an easy simple, non-pharmacological, fast, and efficient way to reduce of spinal related maternal hypotension with no effect of the spinal block level.

The current research revealed that there was a significant decrease in the incidence of hypotension among Trendelenburg position group 35% contrasted to the control group 80%. This result is similar to results of **Hasanin, et al., (2017)**^[12] who found an extremely statistically significant difference between the control groups and the study group about hypotension of the mean arterial blood pressure, systolic arterial pressure, and the blood pressure of diastolic arterial.

Trendelenburg position induces auto-transfusion of blood from the lower limbs to the central circulation; thus, it increases the cardiac preload and subsequently increases the cardiac output.^[13] Patients in the post-anesthesia unit with their trunk and legs elevated recovered faster than those in the supine position, either after spinal or after epidural anesthesia.^[14] Our results differed from **Meirowitz et al.**^[15] findings who reported no advantage for patients' leg elevation on the incidence of hypotension. **Meirowitz et al.** included only thirty one patients in each group so their study could be underpowered to prove this hypothesis.

It is to be noted that phenylephrine consumption was significantly lower in T group. Many protocols for increasing central blood volume included patient positioning protocols, leg wrapping, and sequential compression devices. Accordance with **Hasanin, et al.,**^[12] they found an extremely statistically significant

difference between the control group and the study group aboutephedrine consumption. Most of the recent protocols recommend phenylephrine as the drug of choice in management of PSH as vasopressor during CS.^[16] However, **Meiowitz et al.**^[15] did not report a clear evidence for the value of leg elevation in prevention of PSH.

Our findings are in the same line with **Fakhari, et al., (2018)**^[17] they studied the effect of passive leg-raising maneuver on hemodynamic stability during anesthesia induction: They reported that all protocol of mother position reduced the incidence of PSH but did not eradicate it.

Meanwhile, a difference significantly was noticed among (intervention group), and late onset time of hypotension in a study held by **Khedr, (2011)**^[18] in his study regarding assessment of prophylactic methods for diminishing hypotension post - spinal anesthesia used for planned CS.

Current study showed that there was highly significant difference in the MABP. This is in agreement with the study conducted by **Mohamed et, al., (2016)**^[19] our data in opposites to **Ceruti et al.(2016)**^[14] who assessed protocol zed care to reduce hypotension after spinal anesthesia founded that higher incidence of significant reduction in MAP among control group compared with the study group.

Therefore, maternal hypotension is associated with nausea and vomiting which unsafe to her and her fetus. Also, affect fetal general condition as Apgar scores, respiration distress and, fetal acidosis. The present study observation the control group affected with complications more than intervention group. These outcomes corresponding with data obtained from **Hasanin, et al., (2017)**.^[12]

Our research illustrated comparison between each group for neonatal condition regarding umbilical cord blood gases and, Apgar score evaluation at first & fifth minutes. We found that they were brilliant in control group with highly difference statistically significant. These findings were agreeing with reported data by **Hasanin et, al., 2017**^[12] in their study of leg elevation technique to decrease later risks for post spinal induced hypotension during cesarean delivery. Moreover, admission to intensive neonatal care unit of those neonates.

Acid-base balance of newly born affected by PSH thus, threatening fetal life. Neonates delivered to mother's affected by hypotension had a clear strong correlation with acidemia of neonates than those who didn't. These conclusions are agreed as well as with **Mohamed, et, al., (2016)**^[19] who reported that there is a significantly relation between neonatal acidosis and maternal hypotension. Moreover, the study result was in the same line with **Kinsella et al. (2018)**^[20] who reported in her study about prophylactic legs compression for reducing fetal acidosis post spinal anesthesia during CS the women who were suffering from hypotension had strong correlation with acidemia of neonatal.

Finally, CS is performed in every hospital in Egypt findings of us gives an effective, easy and proper prophylaxis from PSH during CS and its maternal and neonatal risks without affecting the level of spinal block. Thus, nurses with any level of experience can apply as well as it is suitable for setting with limited resources to avoid excessive use of phenylephrine or ephedrine.

V. Conclusion

trendelenburg position for mothers undergoing CSD after spinal block decreased threat of post spinal hypotension (PSH) and neonatal acidosis.

VI. Recommendations

Since trendelenburg position is simple and available during cesarean it can be recommended for decreasing the incidence of post spinal hypotension and its related maternal and neonatal risks.

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