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Effect of Mechanical Measures on Prevention of Deep Vein Thrombosis among Postpartum Cesarean Section

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Abstract
Background:*Deep vein thrombosis (DVT) is a major cause of maternal morbidity and mortality during pregnancy and postpartum period. It can be prevented through performed of intermittent pneumatic compression and following by preventive measures.* ***The aim of this study:*** *was to evaluate the effect of mechanical measures on prevention of deep vein thrombosis among postpartum cesarean section.* ***Research design:*** *A quasi-experimental design.* ***The sample:*** *A study and control groups had contained about 200 postpartum women after cesarean section.* ***Setting:*** *The research was completed at antenatal and postnatal wards of Maternity and children's Hospital in Al Madinah Al Munawarh, Saudi Arabia.* ***Tools of data collections:*** *four tools were used.* ***Tool (1):*** *An interviewing questionnaire.* ***Tool (II):*** *Author DVT risk assessment scale.* ***Tool (III):*** *intermittent pneumatic compression and preventive measures questionnaire.* ***Tool (1V):*** *DVT and its appearances questionnaire. Results: The average age of this study and the control groups were (26.14±6.93) and (26.57±6.42) years old respectively. There were elevate statistically considerable variation among the study and control groups regarding the level of information, and the performance of intermittent pneumatic compression and following preventive measures after the intervention (P<0.05*). Meanwhile there weren't significant differences were found between study and control groups in relation to DVT and its manifestations during the 4th week postpartum.* ***Conclusion:*** *The study group had higher score regarding the level of knowledge, the performance of intermittent pneumatic compression, and following protective measures than the control group. Postpartum women who performed intermittent pneumatic compression and followed the protective measures had a considerable lowering in the appearance of DVT and its demonstration compared with those who did not.* ***Recommendation:*** *Health education should be increased awareness of women about the risk factors and preventive measures for DVT during pregnancy, labour, and postpartum. Strengthen the nurses' role in providing preventive measures for prevent DVT and its complications.*

Keywords: *Venous thromboembolism (VTE), Deep vein thrombosis (DVT), intermittent pneumatic compression, preventive measures, postpartum cesarean section.*

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I. Introduction

Venousthromboembolism (VTE) is the term that describes two clinical conditions: Deep vein thrombosis (DVT) and pulmonary embolism (PE)**(American Medical Association, 2016)**. Deep vein thrombosis (DVT) occurs when a blood clot or thrombus forms in a deep vein, usually restricting blood flow. Pulmonary embolism occurs if the thrombus is dislodges and travels to the lungs. DVT of the lowerlimbs and PE continue to be significant causes of postoperativemorbidity and mortality **(American Academy of Orthopaedic Surgeons, 2019)**.

Every postpartum woman after normal vaginal or cesarean section delivery is at risk for a thromboembolic complication **(William, 2006 &Bates et al., 2012)**. Venous thromboembolism (VTE) complicates 0.5–2.2 per 1000 deliveries, depending on the population studied. During pregnancy, the risk of VTE is increased five to tenfold compare to non-pregnant women of comparable age (**Wik et al., 2012**).

The postpartum period poses a higher risk and during this time frame, the daily risk of VTE is increased 15- to 35-fold compared to age-matched non-pregnant women**(Centre for Maternal Child Enquiries., 2011)**. The daily risk of pregnancy-associated VTE appears greatest during the first 3–6 weeks postpartum. After that, the risk declines rapidly, although a small residual risk increase may persist for 12 weeks after delivery **(Kamel et al., 2014)**. Although the absolute VTE rates are low, pregnancy-associated VTE is an important cause of maternal morbidity and mortality **(Younesset al., 2016)**.In Egypt, the estimated incidence of VTE is 1 every 5.000 pregnant women every year. Therisk of DVT is highest during the postpartum period, **(Egyptian Demographic and Health Survey, 2014).**

Furthermore, risk for developing DVT increase with age, individual or family history of DVT, smoking, dehydration, cancer, obesity, neurological deficit, varicose veins, surgery or other hospitalization, certain heart or respiratory disease, obesity and pregnancy **(Strom &Frempong-Boadu, 2013&Marissa, 2016)**. The hormones found in birth control pills or hormone replacement therapy, especially estrogen, is assumed to increase the risk of clot formation by 3 to 4 times**(Shahin, 2017)**.The increased DVT risk requires special attention in pregnant woman. The haemostatic system changes from the second trimester in order to prepare for the haemostatic challenge of delivery (**Yaakobche et al., 2010**).

Despite increased awareness of the risks of VTE and use of prophylaxis, deep vein thrombosis and pulmonary embolism comprising different manifestations of the same clinical entity referred to as venous thromboembolism, are a significant cause of morbidity and mortality. Despite pulmonary embolism being considered the most preventable cause of in-hospital death, the use of appropriate thromboprophylaxis remains suboptimal in many patients. With DVT, pain or swelling of the leg (particularly the left leg) are the common presenting complaints. Other features include tenderness, increased temperature, lower abdominal pain or a raised white cell count **(Okuhara et al., 2015).**

Approximately 80% of events occur in the first 3 weeks after delivery likely because of the addition of trauma to the pelvic vessels in the course of delivery causing endothelial damage compared with the non-pregnant woman, in whom distal DVT is more common, most events in pregnancy are ileofemoral and left sided **(Pollack, 2011)**. Pregnant women are prone to forming blood clots, leading to an increased risk of developing DVT, pulmonary embolism, or thrombosis at other more rare sites which can be caused by hormonal changes and pressure on the veins by the uterus.**(Virkus et al., 2011)**.

Prevention of DVT is more effective than treatment and is an important aspect of patient care before, during, and after labor. Identification of risk factors should be used as a basis to determine if pharmacological and/or mechanical thrombopro-phylaxis should be initiated.Mechanical measures for DVT prevention include exercises, early ambulation, stockings, adequate hydration and dietand pneumatic compression devices **(Boadu, 2013)**.

Intermittent pneumatic compression (IPC) of the lower limbs, including the thigh, calf, and foot pumps, have been in use to prevent deep vein thrombosis (DVT) for many decades. IPC is recommended as thromboprophylaxis for patients who are at risk of bleeding, and if venous thromboembolism risk persists and risk of bleeding subsides, pharmacological thromboprophylaxis can be substituted for mechanical thromboprophylaxis for patients at low or moderate risk of venous thromboembolism and added to mechanical prophylaxis for women at high risk of venous thromboembolism**(Guyatt et al., 2012)**.

Intermittent pneumatic compression (IPC) devices composed of sleeve- or boot-shaped chambers that fill with air and electrical pumps with gauges that provide intermittent compression to the lower extremities. The compression force may be applied either uniformly to the calf using a single chamber device or through a series of chambers inflated in a sequential manner from the ankle to thigh to achieve venous emptying**(Morris & Woodcock, 2010)**. The efficacy of IPC in the treatment of varicose veins is well documented. It reduces venous stasis by promoting venous blood flow and it stimulates fibrinolytic activity. It had been found to be an effective modality for treatment for venous ulceration**(Catarinella et al., 2015)**.

Nurses can play a major role in DVT prevention, if well-educated and empowered to increase the level of knowledge among postpartum women. Prevention ofDVT is an effective to reduce the morbidity rate from DVT and mortality rate from PE. Prevention decreases the duration of hospital stay, improves the quality of life, decreases rehabilitation time and decreases the economic burden **(Khoon, 2010)**. nursing care is provided to the patients should be focused on DVT prophylaxis in addition to implementing the appropriate preventive measures to control DVT, & its manifestation and decrease the morbidity rate effectively**(Qiu et al., 2013)**.

The nurses are the frontlines in terms of delivery of the therapeutic regimens of both prevention and treatment for DVT. They must follow the standards of care and the intervention to prevent this life-threatening complication **(Anthony, 2013)**. While **Schreuders et al. 2013)** emphasized that, the means that are used inorder to recognize the patients at high risk for DVT are essential in order to be able to apply the proper preventive measures early enough to allay the associated morbidities and mortalities among them.nurses are playing an essential role in diagnosis of DVT and identify risk assessment, applying timely preventive methods and

providing vital educational and psychological support for patients with venous thromboembolism, so skilled nursing intervention can be lifesaving of women**(Tooher, et.al, 2010)**.

Significance of the study

Deep vein thrombosis is a serious condition with potentially fatal consequences ***(Pollack, 2011)***. Many studies recommended that,mechanical measures are effective in preventing DVT. Mechanical measures for DVT protection involve exercises, early ambulation, stockings, pneumatic compression devices, enough moisture, and diet. All become a better venous go back and decreases venous stasis in the leg veins ***(Hyers et al., 2004)***. Knowledge about DVT also allows the patients to self-assess and self- report about DVT symptoms and enabling the patients to obtain timely medical assistance and advice ***(Kehl-Pruett, 2006)***. An awareness of all aspects of DVT is vital in providing the optimal nursing care for the women who were undergoing delivery or CS in order to improve the patients' outcomes, reduce the incidence and potentially life-threatening complications of DVT **(Anthony, 2013 & Van Wicklin et al., 2006).** So, this study concerned on with the evaluation of the effect of mechanical measures on prevention of deep vein thrombosis among postpartum cesarean section.

II. Aim of the study

The aim of the study was to evaluate the effect of mechanical measures on the prevention of deep vein thrombosis among postpartum cesarean section women.

Operational definition:

A mechanical measure for DVT prevention includes turning and positioning at least every 1 to 2 hours, exercises (foot and ankle exercises and deep breathing exercise), early ambulation, stockings and adequate-hydration.

Hypothesis.

(1). Postpartum women who received intermittent pneumatic compression and prophylactic mechanical measures will have a decrease the incidence of DVT and its manifestations than those who do not.

(2). The study group who is received the care will have a higher level of knowledge about DVT & its prevention than control group.

Subjects and Methods

Research Design: A quasi-experimental design was utilized to achieve the aim of the present study.

Setting: This study was conducted at antenatal and postnatal wards at Maternity and children's Hospital in Al Madinah Al Munawarh, Saudi Arabia.

Sampling:

A purposive sample of 200 postpartum women who undergone cesarean section. They were assigned randomly and divided alternatively into two equal groups, 100 women for each groups: A-Study group (I): Exposed to mechanical measure (turning and positioning at least every 1 to 2 hours, early ambulation, exercises (foot and ankle exercises and deep breathing exercise, stockings, and adequate hydration) along with routine hospital care and performed intermittent pneumatic compression. B-Control group (II): Exposed only to routine postpartum hospital care. . The women had been selected according to the following criteria:

- Postpartum women after cesarean (elective and selective C.S.)
- Agree to participate in the study
- Ambulatory with or without assistance.

Postpartum women with complications during delivery and postpartum period were excluded from the study.

Sample size

The estimated sample size was calculated to be 200 postpartum women.

The researcher calculated the number of the target population based on the flow rate of the subjects with this specific inclusion and exclusion criteria. level and ratio of case/control 1: 1. $n = (\frac{r+1}{r}) \frac{\sigma^2 (Z_\beta + Z_{\alpha/2})^2}{(\text{difference})^2}$. the

sample size was equal to 212 women. They were assigned randomly and alternatively divided into two equal groups, and 12 women dropped out due to losing at the follow-up during the postpartum period. So, the final total sample became 200 postpartum women. The confidence level 95% and a power of study 80%.

Tools of data collection

Four tools were used for data collection.

These tools are:

Tool I: An interviewing questionnaire:

It was developed and used by the researcher based on review of the related literature, to assess women's knowledge about deep vein thrombosis. It comprised of four parts:

Part one: Socio-demographic data. It included information about women's age, educational level, occupation and residency.

Part two: past and present obstetric history such as gravidity, parity, number of children, number of abortions, the duration of current pregnancy and mode of delivery.

Part three: past medical /surgical history such as previous chronic disease, and surgery.

Part four: **Women's knowledge assessment questionnaire.** It was comprised of questions related to women's knowledge regarding deep vein thrombosis definition, causes, risk factors, signs and symptoms, diagnosis, complication, method of prevention, and treatment.

Scoring systems: The total score of knowledge was 26degrees. Each correct answer had one mark while the incorrect one had zero. These scores were converted into a percent score. **The total score was divided into three categories as follows: The total score was divided into three categories as follows:**

- **Poor knowledge:** when the score percentage less than 50%.
- **Fair knowledge**: when the score percentage more than or equal 50% and less than 80%.
- **Good knowledge*:*** when the score percentage more than or equal 80%.

Tool II: Deep vein thrombosis risk factors assessment sheet (scale).

It was developed and modifiedfromAutar, (1998)and utilized by the researcher to identify women at risk for the occurrence of DVTand classified them into groups according to predisposing factors.

Scoring system: The Scale total score is 31 points: it consistedof the following seven distinct risk categories of factors; identified as age, mobility, body mass index, special risk, trauma risk, surgical intervention and high-riskdiseases.

The scale has four risk levels:

- **No risk**: when score≤6
- **Low Risk (<10%)**: when score 7-10
- **Moderate Risk (11-40%):** when score 11-14
- **High Risk (>41%)**: when score ≥15

Tool III: intermittent pneumatic compression and mechanical measures questionnaire.

It was developed by the researchers after reviewing the related literature. They concerned with intermittent pneumatic compression and preventive measuresbefore and after implementation of the intervention and use intermittent pneumatic compression.

Scoring system:

Questionnaire used the 5-points Likert scale as never=1, rare=2, sometimes=3, often=4, and always=5. The**total score was *divided into three categories as follows:***

- **poor mechanical measures & intermittent pneumatic compression**: when the total score was less than 50%.
- **Fair mechanical measures & intermittent pneumatic compression:** when the total score was more than or equal50% and less than80%.

- **Good mechanical measures& intermittent pneumatic compression:** when the total score was more than or equal80%.

Tool 1V:Deep vein thrombosis clinical assessment sheet:
It was developed and used by the researcher based on review of the related literature except part one it was developed by **(Hirsh and Lee, 2002)**. The objective of this tool was to evaluate the patient's sign and symptoms of DVT. It was comprised of 2parts: Part one: Clinical assessment. It was developed and used by the researcher based on review of the related literature. It was comprised of signs and symptoms of DVT as presented by: •Pain in the calf.
•Leg edema or swelling.
•Erythema or cyanosis, warmth, dilated superficial vein.
•Localized redness, pallor and a loss of the dorsalispedis pulse.
•Tenderness along the distribution of the affected deep leg veins.

Part two: Homan's test:
It is an active and subjective test in which the women are asked to dorsiflex his or her foot. If pain in the calf, it was indicative of positive result and presence of deep vein thrombosis, negative human's test does not exclude DVT.

Validity and reliability:
For validity purposes, the researcher conducted an extensive literature review and developed the questionnaires from the previously used instruments and reviewing the pertinent reviews. Instruments I, III, IV and V was designed by the researchers and revised by five experts in the field of maternal & newborn health nursing and medical-surgical nursing in the Faculty of Nursing of Taibahu University (for content validity), while instrument II was adapted from Autar (1998). Reliability analysis was ascertained with Cronbach'salphato determine the extent to which the items in all instruments are related to each other.

Pilot study:
A pilot study was conducted to assess the applicability of the instruments, the feasibility of the study and to estimate the time needed for data collection. It was conducted on 10 % of the total participants according to the selection criteria. All women participated in the pilot study excluded from the study sample. Based on the results of the pilot study and expert's opinion, modifications and omissions of some details were done and then set the final fieldwork schedule.

Administrative and ethical considerations:
Official letter from the Faculty of Nursing was delivered to the responsible authorities of hospitals (the hospital chief executive and the directors of maternity department) and approval to conduct this research got after a demonstration of the aim of the research. The patient's verbal confirmed participation in this research was got after a demonstration of the objective of the research. Each patient was comforted that any knowledge get would be confidential and would only be utilized for the research objective. The researcher confirmed that involvement in the research was completely willing and the anonymity of the women was confirmed during coding information. Women were also aware of that rejection to involvement wouldn't impact their care

Field work
- The study was conducted during the period September 2018 to the end of May 2019. Patients who agreed to participate in the study and fulfilling the inclusion criteria were included in the study
- Informed consent to participate in the study was obtained from the subjects. Modifications of the tools were done accordingly.
- the researchers explained the purpose of the study, components of preventive measures, intermittent pneumatic compression and its technique and the importance for the prevention of DVT. The time needed for completing the questionnaire was ranged from 30 -45 minutes for each women
- Initiation of data collection by using tool 1, in which the studied patients (study and control) were interviewed by the researcher. the selected women who were recruited are randomly assigned to two equal groups (100 womenper each). The first group (100) women were the control group which received the routine hospital postpartum care after delivery. While the study group (100) women interviewed individually by the researchers during the third trimester of pregnancy before labour. then the researchers start teaching the women the preventive measures and how to performed intermittent pneumatic compression, using some illustrating video films and how to do it. The intermittent pneumatic compression

was performed after the recovery from the anesthesia and in the presence of the researchers to clarify any questions. Each session lasted from 20-30 minutes.

- Deep vein thrombosis risk factors assessment. This session took about 30- 45 minutes for each patient.
- to assess women' knowledge about deep venous thrombosis definition, possible causes, signs and symptoms, risk factors, different treatment modalities, complications. This session took about 20- 30 minutes for each patient.
- Health instruction about deep venous thrombosis (DVT), the researcher meets each participant of study group on admission to teach women knowledge about DVT that include (definition, causes, signs and symptoms, prevention, complications, and treatment) and it took about 30- 45 minutes, after estimating the effect of the intervention on women's level of knowledge, performance of intermittent pneumatic compression and following preventive measures, and occurrence of DVT and its manifestations. The post-test was done for both groups during the post-partum period (early and late through 4 weeks' post-caesarean section).
- Follow up for the women was done by meeting them in the out-patient's clinic for postpartum and post CS. Both groups were asked about the presence of any signs and symptoms of DVT. The postpartum follows up by telephone was done at the end of the first week, up to 4^{th} week, and up to8^{th} weeks postpartum
- Every patient in both groups (study and control) was physically assessed 3 times (after delivery, 4 weeks after delivery and after 8 weeks) by using tool 4. It took about 30- 45 minutes.
- The collected data were categorized, tabulated and made ready for use. The tools of data collection were translated into Arabic by the researchers, tested and verified by bilingual persons.

Statistical analysis: The information collected was analyzed by SPSS statistical package version 20 on IBM compatible computer. Quantitative information was illustrated as average and standard deviation (X±SD) and analyzed by using student t-test and the Mann-Whitney test for comparison of two groups of normally distributed variables. Qualitative information was illustrated as number and percentage and analyzed by using chi-square test and for 2×2 table and one cell has expected number less than 5 fisher's exact test was used for comparison between the quantitative data at interval for the same group at different sessions. Repeated measures Anova test was applied. P-value at 0.05 was used to determine significance regarding:

III. Results

Table (1): illustrated the distribution of both study and control groups according to their soci-demographic characteristics. The table showed that more than two third (67.0%) of the study group was in the age of (20-30) years with a mean age (26.14±6.93) years as compared to (64.0%) of the control group with a mean age (26.57±6.42) years. Regarding to occupation, about two third (66.0%) of the study group as compared to (61.0%) of the control group were housewife. As regards the level of education, about (44.0%) of the study group as compared to (45.0%) of the control group were University. About (38.0%) of the study group as compared to (43.0%) of the control group were from the urban area. There is no statistical significant differences were seen between both study and control groups in relation to above mentioned socio-demographic characteristics.

Table (2):demonstrates thedistribution of both study and control groups according to their obstetrical history. The percentage of gravida 2 and more were higher in the study group than to those in the control group (63.0 vs. 47.0%). The difference observed is statistically significant (t =2.8, P=0.005). Regarding parity, among the 64.0% of study group compared to (46.0%) of control group was multiparous. As for the history of previous abortion, it was present in almost two fifth of the two groups. Concerning to the present obstetric history, all women of the study participants were reached to full term pregnancy with the mean duration of the present pregnancy (39.23±.564) in the study group and (39.31± .655) weeks in the control group.

Table (3) : Describe the distribution of both study and control groups according to their medical data. Concerning to history of systemic disease, the majority of the study group (84.0%) had not previous health problems compared to (77.0%) in control group. while Near to two thirds of the study and control groups had previous surgery (61% & 64%) respectively. As regards the type of present labour, the majority of the study and control groups delivered by elective cesarean section (81% & 87%) respectively. There is no statistical significant differences were seen between both groups in relation to above mentioned medical data.

Table (4):cleared that there was an improvement of a mean total knowledge score about DVT of the study group (2.89±1.48 to become 3.91±1.27 at 1st week post intervention and 3.78±1.68 at the 4th weeks post intervention) than the control group at 1st week and the 4th weeks post intervention. There was a highly statistical significant improvement of a mean total knowledge score regarding DVT knowledge of the study and control at 1^{st} t and 4^{th} week post intervention. P value (<0.001)

table (5)shows that neither one of the control group (0.0%) had a high level of performed of IPC nor following preventive measures for DVT**.** Less than two fifths of the study group (33.0%) had a high level of performed of IPC and followed the preventive measures for DVT with statistically significant differences between the two groups P<0.000*.

table (6) clarified that regarding calf pain (2.0%) of the study group suffered from calf pain compared to (3.0%) of the control group during 4th week postpartum. Regarding to leg edema, (1.0%) of the study group compared to (2.0 %) of the control group during 4th week of postpartum intervention. As regards to tenderness of the leg (3.0%) of the study group suffered from tenderness of the leg compared to (4.0%) of the control group during 4th week postpartum intervention. There weren't significant differences were found between study and control groups in relation to calf pain, leg edema, and tenderness in the leg.

Figure (1)**:** revealed that less than one-tenth of the study and the control group were low risk for the occurrence of DVT (5.0% 4.0% respectively), a round two third of both groups (63.0%) of the study group and (66.0%) of control groups were at moderate and high risk for developing DVT. There were no statistical considerable differences among study and control groups concerning danger agent of DVT.

Figure (2) explained that all of each study and control groups had a negative sign of humans exam pre intervention, while after 1st week of intervention, the study group still had a negative sign of human test while (4.0%) of the control group had positive signs of humans test.

IV. Discussion

Venous thromboembolism is a major cause of maternal morbidity and mortality with most fatal events occurring during the postpartum period. Delivery by CS is associated with a further increasing maternal thrombotic risk, resulting in a higher incidence of venous thromboembolism **(Lidegaard et al., 2013)**. The serious complications of DVT can be reduced when raising awareness and education among pregnant &labouring women when using standards preventive measures **(RIE et al., 2013)**. so, the purpose of the current study was to evaluate the effect of preventive measures on the prevention of deep vein thrombosis (DVT) among a postpartum cesarean section.

The current study revealed that the range of age among the study group was 18-42 years compared to 19-43years of the control group This finding agreement with **Ramadan et al., (2019)** who reported that the range of the study participants 'age was 19-42 years for the control group and19-41 years for the study group. On the same line **Brown et al., (2016)** mentioned that the range of age of the pregnant and non-pregnant women at reproductive age was 12–44 years old. Regarding to occupation, about two third of the study and control groups were housewife. This similar with **Youness et al., (2016)** who founded that, most of the studied women were housewives with no considerable variation was shown between women of each group. While, **Rimet al., (2017)** stated that the majority of women at reproductive age in his study were working.

Concerning the level of education and residence, more than two-fifths of the study and control groups were highly educated and less than two-fifths of the study group and control groups were from the urban area. There are no statistical significant differences were seen between both study and control groups in relation to their age, occupation, education and their residence areas. On the same line **Ramadan et al., (2019)** noticed that more than two-fifths of the control group and the study group were highly educated and less than half of the study group and more than two-fifths of the control group were from the urban area. This finding is not corresponding with **Youness et al., (2016)** who reported that more than one-fifth of the postpartum women in her study were highly educated and less than one-fifth of them were from the urban area with no considerable variation was shown between women of each group concerning their age, profession, and teaching in their residential areas.

Concerning obstetrical history among the women, the present study found that the percentage of multigravida and para in both groups were higher and all the pregnant women were reached to full term pregnancy with mean duration of the present pregnancy (39.23±.564) in the study group and (39.31± .655) weeks in the control group with no previous systemic chronic disease among both groups. In the same context, **Ramadan et al., (2019)** indicated that all women were multigravida and para in both groups and all the pregnant women were reached to maturity (full term pregnancy) weeks in the study and control group with no previous chronic disease among the groups.

As regards the type of present labour, the majority of the study and control groups delivered by elective cesarean section respectively. There were no statistical significant variation were seen among both groups in connection to mode of present delivery. In agreement with foregoing present study findings, **Hamilton et al., (2005)** who found that increase in the caesarean section rate had been a global phenomenon and also the maternal autonomy in the decision-making regarding mode of delivery in many cases. Also, in the study conducted by **Youness et al., (2016)** assured the mean of the women in the control and the study groups delivered by elective cesarean section.

Connection danger agents estimate for deep vein thrombosis, it was shown from the current research that two-third of the study and of control groups were at average and high danger for developing DVT. The estimate allows the investigator to average the women's danger as low, moderate or high. The researcher should concentrate on protection by the early confession and enough prophylaxis of those at increased risk. This finding is in agreement with **Gad & EL-SHeilkh (2013)** who reported that no statistically considerable differences among control and study groups concerning the danger agent of DVT. Similarly, **Abd El-Salam (2009)** noticed that more than three fourth of the study and control groups were at great danger for improving DVT. Additionally, **Mohamed et al, (2017)** reported that the plurality of the patients in the study and control groups were at great danger of DVT, and no statistically considerable variation among the two groups (p=0.67). While, Ramadan et al., (2019) shown that less than one-tenth of the control and the study groups were low risk for the occurrence of DVT.

The present study detected that there was a highly statistically considerable advancement of a mean total information score of women related to DVT after intervention. Similar study conducted by **Serpici&Gürsoy, (2018)** who emphasized that the patients who received nurse training courses had improvement of deep vein thrombosis knowledge and self-care practices. In addition to a study by **Youness et al., (2016)** who initiated that, do not enough level of information on VTE between the involvements of the intervention or (study) group through the pre-test phase. They demonstrated that also there was an improvement in the level of knowledge significantly around signs and symptoms, the opportunity to have DVT, how to protect DVT after the implementation of the intervention, On the same line this result was in agreement with **Gad & El-Shikh, (2013)** who reported that, there was a considerable variation among study and control groups related to total knowledge score after education related to VTE. This is similar to **Green &Bernhofer, (2018)** who stated that, a higher level of information degrees in the study group, with the percentage of the involvements in the study group answering all questions regarding to DVT correctly rising from less than two fifths correct to less than three quarters correct. These results are consistent with result of **Abd El-Salam (2009)** who estimated that after involvement there was a considerable become well in total information degree of the study group than to the control group. Also, **Bader (2002)** showed that patients of the study group had a considerable difference in their information from preoperative to discharge period than to the control group. Moreover, **Bonner (2004)** confirmed that patients required information around DVT, anticoagulation, compression stockings, and the possible complications of these. Therefore, they could be having knowledge of how and when to arrival help. The diagnosis of DVT may also mean a variation in lifestyle and this knowledge should be given verbally and supported with written knowledge to excess harmony with therapy.

Considering the performance of intermittent pneumatic compression (IPC) of the study and the control groups, the present study findings revealed that there were statistically significant differences between the study and the control groups after implementation of the intervention. This finding was in accordance with **Mohamed et al., (2017)** who proved that IPC for the postpartum women with varicose veins was adequate for the study group. A IPC has significant effects on venous blood flow by increases the velocity of venous return and reduces the amount of blood inside the veins at any time. In agreement with this finding, **Figueiredo et al., (2008) and Delis et al., (2000**) emphasized that IPC applied to the foot and calf produced maximal venous emptying from the leg. Similarly, **Garcia et al., (2011)** showed that the mechanical measures excess the venous blood flow in the fewer limbs and prevent venous stasis. Also, all patients should have a plan for active and negative down extremity activity except if contraindicated containing flexion and extension of the ankle, knees, and hips. Intermittent pneumatic compression devices decrease venous stasis for this reason leg muscle contractions compress the veins and pump blood up towards the heart. Also **Rodericket al., (2005)** stated that the study group who received mechanical compression methods reduced the risk of DVT.

In relation to preventive measures of the study and the control groups, there was statistically considerable variation among the study and control groups regarding the following preventive measures. This result might be due to the implementation of the intervention and women's desire to attain remission without complications. This was supported by **Gad & EL-SHeilkh (2013)** who reported the study group who received intervention did not have DVT compared of the control group who follow the routine care only, the risk for DVT is prevented this due to giving instruction to the patient about mechanical measures. Similarly this results in accordance with what has been reported by **Arnaoutakis et al., (2016)** who mentioned that providing personal clinical effectiveness feedback including data and peer-to peer coaching improves resident performance, and results in a significant reduction in harm for patients. On other hand **Michtalik et al., (2015)** added that direct feedback using dashboards provided venous thromboembolism prophylaxis was associated with significantly improved the compliance and appropriate VTE prophylaxis.

Result of the present study showed that there weren't significant differences were found between study and control groups in relation to DVT and its manifestations during the 4th week postpartum. This is might be related to the skills and knowledge acquired from the intervention that might prevent DVT and its manifestations. This finding was supported by **Mohamed et al., (2017)** who found that implementing the

designed nursing guidelines for DVT prevention decrease the incidence of DVT in the group followed by guidelines. Moreover, **El-SayedEad et al., (2017)** demonstrated that, there was decrease in all items related to the signs and symptoms of DVT in the study group than in the control group during and after one month from discharge and with statistically significant differences observed as ($P \leq 0.001$ & $P<0.05$)

V. Conclusion

Based on the results of this study, it could be concluded that postpartum women who performed intermittent pneumatic compression and followed preventive measures had a higher level of knowledge about DVT & its prevention than those who did not Also, the current study showed that postpartum women who performed intermittent pneumatic compression and followed preventive measures had a significant reduction in the occurrence of DVT and its manifestation than those who exposed to routine hospital care only.

VII.Recommendations

Based on the outcomes of this research, it is highly recommended that:

- Health education should be increased awareness of women about the risk factors and preventive measures for DVT during pregnancy, labour, and postpartum.
- Follow up of high-risk women for DVT during pregnancy, labour, and post-partum.
- Strengthen the nurses' role in providing preventive measures for prevent DVT and its complications
- A booklet for keeping DVT should be obtainable and distributed for high-risk women.
- Further research for performed intermittent pneumatic compression as preventive mechanical measures to addressing high risk women's health needs and can be generalized for other hospitals within the community.

Table (1): Distribution of both study and control groups according to their socio-demographic characteristics.

Socio-demographic characteristics	**Study group (n=100)**		**Control group (n=100)**		***χ2 Test***	**P- value**
	No	**%**	**No**	**%**		
Age (years):						
Less than20 years	14	14.0	13	13.0		
20- 30	67	67.0	64	64.0	1.80	0.61
31-40	16	16.0	19	19.0		NS
More than40 years	3	3.0	4	4.0		
Mean±SD	26.14±6.93		26.57±6.42		1.91	0.06
Range	18 – 42		19 – 43			NS
Occupation:						
working	34	34.0	39	39.0	1.11	0.29
housewife	66	66.0	61	61.0		NS
Levels of education:						
Illiterate	2	2.0	1	1.0		
Primary	5	5.0	7	7.0	1.12	0.90
Preparatory	6	6.0	12	12.0		NS
Secondary	43	43.0	35	35.0		
University	44	44.0	45	45.0		
Residence						
Rural	62	62.0	66	66.0		
Urban	38	38.0	34	34.0	0.22	0.90

* Fisher's exact test P value: NS= non-significant

Table (2): Distribution of both study and control groups according to their obstetrical history.

Obstetric history	**Group**				***χ2 Test***	**P-value**
	study (n=100)		**Controls (n=100)**			
	No	**%**	**No**	**%**		
Gravidity					14.2	0.003*^
Primigravida	11	11.0	33	33.0		
2+	63	63.0	47	47.0		
5 & more	26	26.0	20	20.0		
Mean ± SD	3.6 ± 1.7		2.9 ± 2.0		t=2.8	0.005*
Parity					3.1	0.067
Nulliparous	16	16.0	35	35.0		
Primipara	20	20.0	19	19.0		
2 & more	64	64.0	46	46.0		
Mean ± SD	2.4 ±1.4		2.2 ± 1.1		t=1.4	0.171
Abortion	n=89		n=67		0.03	0.873
No	52	58.4	40	59.7		

Yes	37	41.6	27	40.3		
Duration of the present pregnancy (weeks).	39.23±.564		39.31± .655		T= -.35	0.079

< 0.05 (significant)

Table (3): Distribution of both study and control groups according to their previous history of disease & surgery and the type of present labour.

History	Study group (n=100)		Control group (n=100)		χ^2 Test	P- value
	No	%	No	%		
History of systemic disease:						
DM	16.0	16.0	20	20.0		
Bronchial asthma	0.0	0.0	2	2.0	1.26	0.74
Hepatic disease	0.0	0.0	1	1.0		NS
No previous health problems	84	70.0	77	66.0		
Previous surgery	61	61.0	64	64.0	1.13	0.09
Type of Present Labor:						
Elective CS	81	81.0	87	86.0		0.44
Selective CS	19	19.0	13	13.0	1.65	NS

Table (4): Distribution of both study and control groups as regards to patients' knowledge about DVT (Definition, Causes, Manifestation prevention, complication and treatment) at 3 times intervals (pre intervention, 1st week post intervention, and at the 4th weeks postpartum).

Knowledge	Pre intervention				post intervention (1st week)				post intervention(4th weeks)			
	Study group (n=100)		Control group (n=100)		Study group (n=100)		Control group (n=100)		Study group (n=100)		Control group (n=100)	
	No	%	No	%	No	%	No	%	No	%	No	%
Total score of knowledge about disease:	2.89±1.48		2.54±1.13		3.91±1.27		2.66±0.92		3.78±1.68		2.46±0.97	
Mean ± SD	1.03 0.31 NS				4.37 * <0.001 HS				3.73 <0.001 HS			
Mann-Whitney test (U) P value												
Total score categories:	76	76.0	66	66.6	20	20.0	70	70.0	26	26.0	67	67.0
Poor (< 50%)	14	14.0	27	27.0	24	24.0	20	20.0	20	20.0	23	23.0
Fair (50-< 80%)	10	10.0	7	7.0	56	56.0	10	10.0	54	54.0	10	10.0
Good (≥ 80 %)												
χ^2 P value	1.74 0.42 NS				18.21 <0.001 HS				14.11 <0.001 HS			

P value: NS= non-significant HS= highly significant

Table (5): Comparison between both studied groups regarding uses of IPC and Preventive measures.

Variables	IPC (n= 100)				Preventive measures (n= 100)			
	Study group (n=100)		Control group (n=100)		Study group (n=100)		Control group (n=100)	
	No	%	No	%	No	%	No	%
Total score:								
Poor (< 50%)	25	25.0	100	100.0	25	25.0	80	80.0
Fair(50- < 80%)	42	42.0	0	0.0	42	42.0	20	20.0
High (≥ 80 %)	33	33.0	0	0.0	33	33.0	0	0.0
χ^2 **P value**	119.869 <0.001 HS				87.081 <0.001 HS*			

P value: HS= highly significant

Table (6): Distribution of both study and control groups as regards to clinical manifestations of DVT at 3 times intervals (1st week postpartum, 4th week postpartum, and 8th week postpartum).
P value: NS= non-significant S= significant

Clinical manifestations of DVT	1st week postpartum				4th weeks postpartum				8th weeks postpartum			
	Study group (n=100)		Control group (n=100)		Study group (n=100)		Control group (n=100)		Study group (n=100)		Control group (n=30)	
	No	%	No	%	No	%	No	%	No	%	No	%
Calf pain:												
Present	0	0.0	4	4.0	2	2.0	3	3.0	1	1.0	0	0.0
Not present	100	100.0	96	96.0	98	98.0	97	97.0	99	99.0	100	100.0
Fisher's exact test	0.35				4.03				0.52			
P value	0.55 NS				0.43 NS				0.47 NS			
Leg edema:												
Present	0	0.0	0	0.0	1	1.0	2	2.0	0	0.0	2	2.0
Not present	100	100	100	100	99	99.0	98	98.0	100	100.0	98	98.0
Fisher's exact test	---				0.67				1.02			
P value	---				0.09 NS				0.31 NS			
Redness in the leg skin												
Present	0	0.0	0	0.0	1	1.0	3	3.0	0	0.0	1	1.0
Not present	100	100	100	100	99	99.0	97	97.0	100	100	99	99.0
Fisher's exact test	----				1.07				1.02			
P value	----				0.30 NS				0.31 NS			
Tenderness in the leg:												
Present	0	0.0	0	0.0	3	3.0	4	4.0	0	0.0	2	2.0
Not present	100	100	100	100	97	97.0	96	96.0	100	100.0	98	98.0
Fisher's exact test	-----				4.04				0.52			
P value	-----				0.48 NS				0.44 NS			
Warm leg skin:												
Present	0	0.0	3	3.0	0	0.0	0	0.0	0	0.0	0	0.0
Not present	100	100	97	97.0	100	100	100	100.0	100	100.0	100	100.0
Fisher's exact test	1.04				---				---			
P value	0.37 NS				---				---			

Fig. (1): Autar risk assessment scale of the study participants

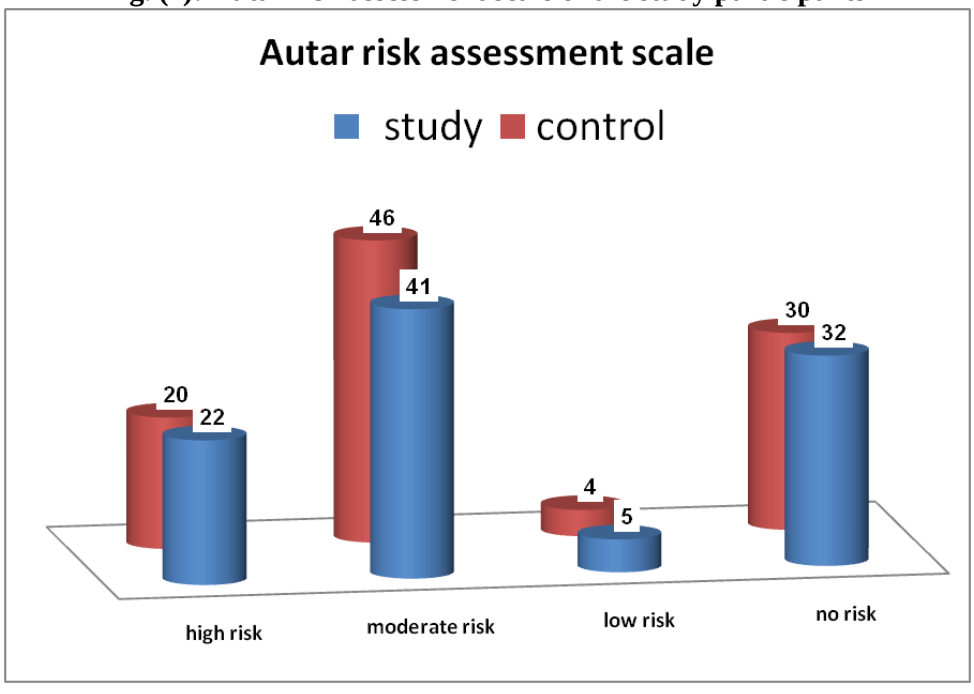
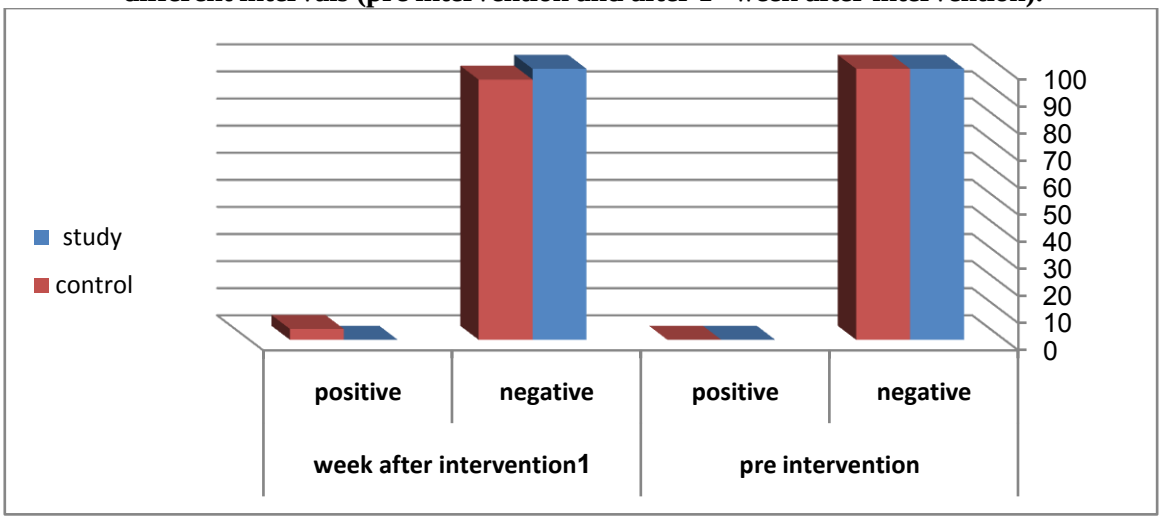


Figure (2): Results of homan's test as presented by both study and control group at two different intervals (pre intervention and after 1st week after intervention).



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