

## Effect of Using Elastic Compression Stocking in Prevention of Deep Vein Thrombosis after Hip Surgery in Orthopedic Units at Zagazig University Hospitals

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**Abstract:** Deep-vein thrombosis (DVT) is a serious problem that affects millions of people annually. Prophylaxis against (DVT) following major orthopaedic surgery can save life. Proper application of the prophylactic regimen by nursing and the interdisciplinary team can be a major key in affecting the outcome of the orthopaedic patient. Prevention of deep-vein thrombosis (DVT) and its complication, pulmonary embolism (PE), is a primary focus of the daily care of the postoperative orthopaedic patient. Compression stockings improve the return of blood from the veins back to the heart and reduce the occurrence of deep vein thrombosis as well. The aim of this study is to determine the effect of using elastic compression stockings in preventing deep vein thrombosis after hip surgery in orthopedic units at Zagazig university hospitals. The sample consists of 80 adult patients admitted to orthopaedic units at Zagazig University Hospitals. Patients who were scheduled for hip surgery and accepted to participate in the study were the subjects of the study. Both gender were included, Patients having the following criteria were excluded such as massive edema/swelling of leg, pulmonary edema or (cardiac failure), severe peripheral arterial disease, severe peripheral neuropathy, major leg deformity, and certain types of skin disease (e.g. weeping skin lesions/dermatitis). The selected sample was divided randomly into two equal groups (control group and study group) Significant changes were detected between the two groups.

### INTRODUCTION

Deep vein thrombosis (DVT) is the post-thrombotic syndrome, or a life-threatening pulmonary embolism (PE). In thrombus in the deep leg vein. It is a very the United States alone, 2.5 million new serious condition that can cause cases are diagnosed each year. DVT and permanent damage to the leg, known as PE are silent and difficult to detect by

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clinical examination, however, DVT rarely occurs in the absence of risk factors <sup>(1,2,3)</sup>. It is a potentially deadly condition and it is a common complication in patients who are hospitalized or bed ridden, especially orthopaedic patients undergoing lower extremity surgery are at risk for deep venous thrombosis. The risk to patients is greatest for hip surgery and knee reconstruction, where DVT rates range from 45 to 70 percent <sup>(4)</sup>.

Deep vein thrombosis (DVT) has serious consequences, if the thrombus partially or completely blocks the flow of blood through the vein; blood begins to pool and build-up below the site. So chronic swelling and pain may develop. The valves in the blood vessels may be damaged leading to venous hypertension. A person's ability to live a full, active life may be impaired, If the thrombus breaks free and travels through the veins, it can reach the lungs, where it is called a pulmonary embolism (PE). A pulmonary

embolism is a potentially fatal condition that can kill within hours <sup>(5)</sup>.

Several groups of patients at high risk for developing deep venous thrombosis, these include patients undergoing various types of surgery, orthopedic, gynecologic, urologic and neurosurgical. Of these groups, orthopaedic patients appear to be especially prone to thrombosis, particularly patients with hip replacement and knee reconstruction. Patients with various medical diseases, usually chronic, also at risk for thrombotic events, and obesity <sup>(6,8)</sup>.

The most common manifestations of the DVT in the leg are swelling and pain. Which caused by accumulation of blood that is unable to get past the clot in the vein and the resulting leakage of fluid from the blood into the muscle. Other symptoms as discoloration or redness of the affected area, tenderness and warmth of skin, and the calf or thigh may ache or squeeze it when you touch or move <sup>(6,7)</sup>.

Physical examination might also reveal

distention of collateral veins and a palpable cord if there is an associated superficial vein thrombosis. Homans's sign (calf pain upon sudden dorsiflexion of the foot) and Lowenberg's sign (calf pain in response to lower pressure than expected upon inflation of a sphygmomanometer cuff) are insensitive and nonspecific findings <sup>(7)</sup>.

Prevention of deep vein thrombosis is directed at preventing the stagnation of blood in the veins and to diminish the coagulation tendency of the blood <sup>(9)</sup>.

Nurses play the important role in prevention of deep vein thrombosis by helping patients to start early muscle activity. Most patients with total hip or knee replacement can get out of bed already the day after the operation day and attend physical and occupational therapy sessions. Simple leg lifts and active and passive ankle motions also increase blood flow through the leg veins plus wear and use of elastic compression stockings, because compression stockings attempt to

prevent DVT by affecting the three etiological factors, venous stasis, vessel injury and coagulation <sup>(10)</sup>.

Elastic compression stockings assist the calf muscle pump and reduce venous hypertension and reflux, thereby reducing edema and improving tissue microcirculation and have more efficacies in early prevention of proximal DVT especially after orthopaedic surgery in addition to it is have proven efficacy in reducing risk of calf vein thrombosis and are particularly useful in moderate risk and high risk patients in who anticoagulation is contraindicated <sup>(11)</sup>.

From researcher clinical experience and empirical observation as a supervisor with students, it was found that postoperative orthopedic patients suffering from some complications especially deep vein thrombosis, so the current study implemented and used elastic stock as a method of decrease or prevention occurrence of deep vein thrombosis.

**Aim**

The aim of this study is to determine the effect of using elastic compression stockings in preventing deep vein thrombosis after hip surgery.

**Material and Methods:****1- Material****A. Design:**

Quasi experimental design was used.

**B. Settings:**

This study was conducted in the orthopedic departments at Zagazig University hospitals. The setting is teaching hospitals which provide its services for delta region.

**C. Subjects:**

The sample included 80 adult patients admitted to orthopedic department at Zagazig University hospitals. Those patients who were scheduled for hip surgery and accepted to participate in the study were involved. Patients with any of the following disorders; massive edema/swelling of leg; pulmonary edema

(cardiac failure); severe peripheral arterial disease; severe peripheral neuropathy; major leg deformity; certain types of skin disease (e.g. weeping skin lesions/dermatitis) were excluded, because of wearing elastic compression stock is contraindicated in those cases. Both genders were included. The selected sample was divided randomly into two equal groups, control group received only routine DVT prophylaxis from medications, early mobilization and exercise according hospital policy. The second group, study group received routine DVT prophylaxis plus wearing elastic compression stocking.

**D. Tools of the study:**

Two tools were used to collect data in this study

**Tool I:** is structured questionnaire was developed by the researchers to collect the data and consisted of three parts:

**Part (1):** It concerned with socio-demographic characteristics of the subjects such as age, gender, marital status,

educational level, and occupation.

**Part (2):** It included data related to health history and health condition of the study subjects as, kind of surgery, history of regular intake of medications, signs and symptoms appeared on the subjects related to DVT and diagnostic studies for occurrence of DVT<sup>(6,7)</sup>.

**Part (3):** It concerned with assessment of risk factors for DVT and postoperative mobilization.

**Tool Π:** Elastic stockings compliance questionnaire sheet, it developed by researchers after reviewing the relevant literature and taking guidance of the experts in orthopedic surgical filed. This tool used to assess patient compliance for wearing elastic stoking including, postoperative day of start, number of days used, problem with use such as: pain; heat sensation; discomfort; itching; sore of the leg; and sore of the toes, satisfaction of use, and wear remittent.

## 2- Methods

- Official permission to conduct the study was taken from the hospitals responsible authorities after explanation of the aims of the study.
- The tools were developed by researchers after reviewing relevant literatures <sup>(6, 7, 8)</sup>.
- A jury of 5 experts in the filed of nursing was done to ascertain the content validity of the tool, necessary modifications were carried out accordingly.
- A pilot study was carried out on 10 patients were chosen randomly from selected hospital to ensure the clarity and applicability of the tools.
- All participants (in control and study groups) were interviewed individually preoperative to explain the purpose of study and obtain their oral informed consent, and then the baseline data were collected using relevant tools

- (Part 1, Part 2, and part 3) and explain for all patients to have a right to withdraw form the research at any time
- The study group was exposed to educational and training session related to the importance of wearing elastic stock and proper technique of wearing elastic stock.
- The patients were instructed to wear elastic stock before surgery until surgical day to improve acceptability of elastic stock usage. Also they were instructed to wear it immediately after operation and continued their use until they became freely mobile or released from the hospital.
- The researchers recollect data on the fourth and fourteen days after operation using two tools (part 2 and part 3 from Tool I and Tool II).

### Data Analysis

Data entry and analyses were performed using SPSS statistical package

version 10 (SPSS, Inc., Chicago, IL, USA). Qualitative data were presented as number and percentage while, quantitative data were presented as mean, standard deviation and range. The chi-square ( $\chi^2$ ) was used to test the association between row and column variables of qualitative data. Student t- test was used to compare means of two groups. Disease free survival estimates were calculated using Kaplan and Meier procedure and were compared by the Log rank test. P value of  $< 0.05$  and of  $< 0.001$  indicate a significant result and a high significant result respectively while P value of  $>0.05$  indicates non significant result.

### Results:

**Table (I):** Shows the percentage distribution of the studied sample according to their socio-demographic characteristics. The table shows that there is no statistical significant difference between both groups.

**Table (II) :**The table showed that there is no statistical significant difference between

both groups of the studied sample regarding their clinical health data and related to types of surgery, the majority of patients were had fracture internal fixation in both groups ( 55% , 47% respectively ).

**Table (III):** Regarding diagnostic test and physical examination to both groups the table showed that there is statistical significant difference between the two groups of the studied sample (0.5%, 10.0% respectively) when Doppler test is used in diagnosis.

**Table (IV):** Illustrated the elastic stock compliance of studied patients. The majority of patients (80%) wore the stock in the first day after operation and satisfied while (2.5%) were unsatisfied for wore elastic stock and 92% wore elastic stock for fifteen days after operation.

**Fig (I):** Both groups were matched regarding the possible risk factors contribute in the development of post operative DVT (P values >0.05), and found the majority of two groups of studied

sample had major surgical procedure and major trauma (95%, 57.5) respectively.

**Fig(2):** 21 days DVT free survival was significantly higher among Elastic stock users(or trial) compared with non users(or control) (95% and 72.5% respectively)

## Discussion

Deep venous thrombosis (DVT) is a common complication of orthopedic surgical procedures. The risk for DVT in hip surgical patients is determined by the combination of individual predisposing factors and the specific type of surgery. Prophylaxis with mechanical and pharmacological methods has been shown to be effective and safe in most types of orthopedic surgery and should be routinely implemented <sup>(12, 22)</sup>.

This study has shown the effectiveness of external compression stocking in prevention of DVT in hip orthopedic surgery. A concerted effort to educate patients must be a priority when these devices are used.

Regarding types of surgery the majority of patients were had fracture internal fixation and total hip arthroplasty in both groups (55%, 47.5%, 30% and 37.5% respectively ), this supported by Jary, who mentioned that total hip operation is the most important risk factor for the development of DVT. There are four different mechanisms that together are responsible for the formation of the thrombi during and after surgery <sup>(24)</sup>.

- One is the prolonged lameness of lower extremity muscles during and after the operation, the anesthesia impairs the function in calf muscles, which is the motor that maintains the blood circulation in the deep veins of the calf. The blood stagnates and has long contact time with the walls of these veins which encourages formation of a thrombus.
- Second, the reaming and cutting of bone during total joint replacement releases substances that encourage

clotting (coagulation) of the blood in the blood system

Hip replacement surgery is associated with a particularly high risk for acute deep venous thrombosis (50% to 65%) in patients who are not wearing elastic stock before and after operation or not receiving antithrombotic prophylaxis <sup>(14, 23)</sup>.

Regarding assessment of risk factors, this study showed that, the majority of the studied sample have a major surgical procedure and major trauma for both group (95%) and (57.5%) in both group respectively. Hohlt, who mentioned that DVT assessment tools can provide systemic data on which to base nursing care plans, and specific to hip surgery to know the medical disorders, Patients presenting with one or more factors are at risk of developing a DVT. Those who score two or more risk factors are placed in the moderate to high-risk category and those with more than four factors identified are at high risk of developing a DVT. Prophylaxis



is aimed at reducing the incidence of DVT, especially post-operatively<sup>(14)</sup>.

Patients who undergo total joint arthroplasty are at high risk for the development of venous thrombo-embolism. Without either mechanical or pharmacologic prophylaxis, asymptomatic deep venous thrombosis will develop after 40% to 60% of total hip and knee arthroplasties. Proximal deep vein thrombosis will develop after 15% to 25%.

Regarding assessment of the signs and symptoms of DVT after 4<sup>th</sup> day post operative found that the majority of signs and symptoms appear in 4 cases of the control group and increase the case to reach 7 after assessment 2 after 14 days in the same group and found 1 cases appears in the intervention group. This finding agree with Jain, who added that the highest risk of occurrence of DVT has been reported to be on the fourth postoperative day, and the second highest on the 13<sup>th</sup> day<sup>(15)</sup>.

Michael, stated that there may no symptoms referable to the location of the

DVT, but the classical symptoms of DVT include pain, swelling and redness of the leg and dilatation of the surface veins, in up to 25% of all hospitalized patients in the 4<sup>th</sup>. Day of hip surgery (16). So Eikelboom, supported that, DVT may show symptoms (up to 50% of patients) as pain, swelling, discoloration (bluish) and the appearance of bulging veins in the affected area, usually the legs or extremities. In extreme cases, there may be severe discoloration, edema (swelling due to fluid retention) and eventually gangrene (tissue breakdown)<sup>(17)</sup>.

This study have shown importance of using the elastic compression stock in the prevention of DVT and the small numbers in the study are reflected in some problem with hip surgery, so a concerted effort to educate patients must be a priority when this device was used. This finding supported by Goldhabe, who stated that patient with hip surgery often using a compression stock device and patient education is extremely important, and additional effort in this area by all medical personnel should improve

compliance rates with using elastic stock compression devices (18). In addition, Goldhaber added the advantages of these devices are that no laboratory monitoring is required and there is no risk of bleeding (19).

Elastic stockings have been used to treat varicose veins and their complications for over 150 years. In more recent times, elastic stockings attempt to prevent DVT by affecting the three etiological factors, venous stasis, vessels injury and coagulation (21).

According to the present study findings, patient's compliance regarding to elastic stockings. The majority of patients (80%) wore the stock in the first day after operation and satisfied while (2.5%) were unsatisfied for wore elastic stock and 92% wore elastic stock for fifteen days after operation (20, 21). Lachiewicz clarified that elastic stockings devices are designed to decrease venous stasis, improve blood flow velocity, and increase the level of circulating fibrinolysins. Elastic stockings devices have the advantage of requiring no monitoring, with no increase in bleeding. These devices come in a wide

variety and can be applied to the foot, calf, or thigh (25). Patient compliance is an issue with elastic stockings devices, and the efficacy is dependent on the time of use and examining the foot, check the warmth and color of the skin, which gives circulation information for each patient. Any edema or swelling in the ankles or feet should be noted. The patient should be questioned about how long the swelling has been present, and whether it changes during the 7<sup>th</sup>. Day. Patient compliance is increased when devices fit properly. Ultimately, improved circulation will keep the extremity healthier (26).

### **Conclusion**

In conclusion the use of compression elastic stockings lowers the risk of DVT and therefore this device should be considered in all patients at risk of development of DVT unless they contraindicated.

All patients having orthopedic surgery should be assessed of the risk factors for DVT and early use of elastic stocking to reduce risk factors and treatment of potential complications.

**Recommendation**

- The effect of compression stock need to be explored more fully with a larger sample in surgical versus.
- Studies are needed to address the problems of duration DVT prophylaxis

after discharge from hospital to prevent DVT episodes at home.

- Preoperative health teaching about importance and wearing technique of elastic stocking should be implemented to all patients prepared for orthopedic surgery especially hip and knee surgery.

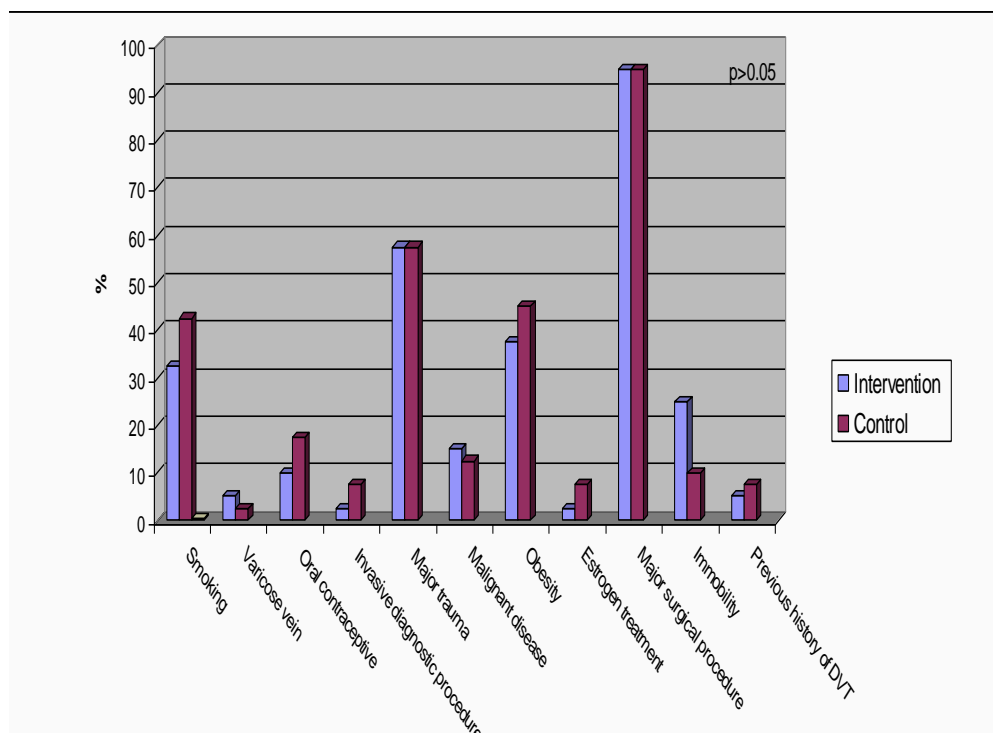
**Table 1: Demographic characteristics of patients in two groups (control and intervention)**

Items	Group				X2 Test	P- value
	Study group N= 40		Control group N= 40			
	No	%	No	%		
<b>Age ( years):</b>						
20- 29	12	30.0	3	7.5	7.075	.07
30-39	10	25.0	16	40.0		
40-49	14	35.0	17	42.0		
50-60	4	10.0	4	10.0		
<b>Gender:</b>					.000	1.000
Male	29	72.5	29	72.5		
female	11	27.5	11	27.5		
<b>Education:</b>					.247	.970
Illiterate	10	25.0	9	22.5		
Basic education	4	10.0	5	12.5		
Secondary	17	42.5	16	40.0		
University	9	22.5	10	25.0		
<b>Occupation:</b>					2.011	.366
Employee	18	45.0	24	60.0		
Manual worker	14	35.0	9	22.5		
House wife unemployed	8	20.0	7	17.5		
<b>Marital status</b>					2.279	.320
Single	14	35.0	8	20.0		
Married	25	62.5	31	77.5		
Divorced/ widow	1	2.5	1	2.5		

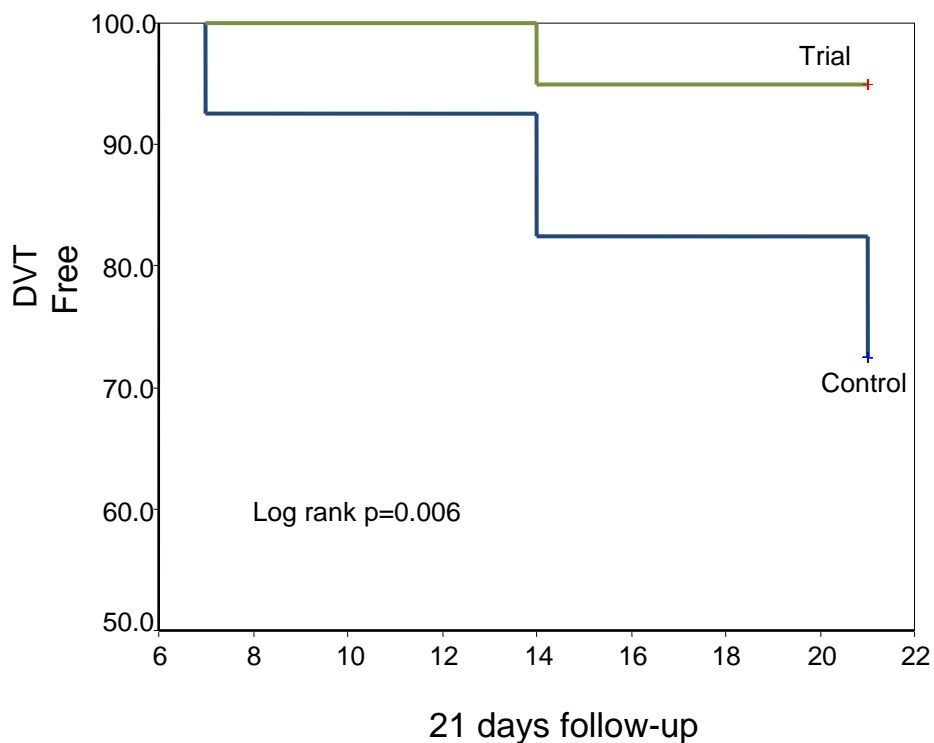
**Table 2: Clinical health data of both groups (control and intervention)**

Health data items	Group				X2 Test	P- value
	Study group N= 40		Control group N= 40			
	No	%	No	%		
<b>Kind of hip surgery:</b>						
Total hip arthroplasty	12	30.0	15	37.5	.553	.758
Fracture internal fixation	22	55.0	19	47.5		
Resection	6	15.0	6	15.0		
<b>History of chronic diseases :</b>						
Hypertension	9	22.5	8	20.0	.075	1.000
Diabetes	8	20.0	8	20.0	.000	1.000
Heart disease	3	7.5	1	2.5	1.053	.615
Renal disease	5	12.5	4	10.0	.125	1.000
Liver disease	5	12.5	3	7.5	.556	.712

Assessment of risk factors for both groups (control and intervention)



(Figure 1): Comparison of deep vein thrombosis incidence between both groups (control and intervention) after 15 days from hip surgery



(Figure 2)

**Table 3: Diagnosis and physical examination of both groups (control and intervention)**

Signs and Symptoms	group						X2 Test	P-value
	Intervention group N= 40			Control group N= 40				
	%			%				
	1 <sup>st</sup> week	2 <sup>nd</sup> week	3 <sup>rd</sup> week	1 <sup>st</sup> week	2 <sup>nd</sup> week	3 <sup>rd</sup> week		
◇ Leg fatigue	2.5%	17.5%	2.5%	22.5%	12.5%	7.5%	8.919	.030
◇ Pain in the calf or leg	---	5.0%	---	15.0%	10.0%	5.0%	.017	10.182
◇ Tenderness along the vein	---	5.0%	---	7.5%	15.0%	7.5%	.023	9.515
◇ Prominent surface veins	2.5%	2.5%	---	5.0%	7.5%	10.0%	.110	6.043
◇ Discoloration of the leg	2.5%	2.5%	---	5.0%	15.0%	5.0%	.077	6.846
◇ Swelling of the leg	5.0%	25.0%	---	12.5%	15.0%	7.5%	.147	5.360
◇ Warm skin	---	15.0%	---	12.5%	15.0%	7.5%	.028	9.067
◇ Doppler	---	5.0%	---	7.5%	10.0%	10.0%	.031	8.876

**Table 4: Assessment of elastic stockings compliance among intervention group of patients**

Items	Study group No ( 40 )	
	No	%
<b>Post operative day of start:</b>		
1st. day	32	80.0
2nd. Day	8	20.0
<b>Number of days used:</b>		
9 days	2	5.0
14 days	1	2.5
15 days	37	92.5
<b>Problems with use:</b>		
Pain	2	5.0
Heat sensation	12	30.0
Uncomfortable	6	15.0
Itching	8	20.0
Sore of the leg	0	0.00
Sore of the toes	1	2.0
<b>Satisfaction with use:</b>		
Satisfied	32	80.0
Uncertain	6	15.0
Dissatisfied	2	2.5
<b>Wear remittent:</b>		
After 1st. week	2	5.0
Before the end of 2nd.week	4	10.0
During sleep	2	5.0

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