

Role of Venous Wall Thickening Detected by B Mode Ultrasonography for Diagnosis of Deep Vein Thrombosis

Dr Muhammad Imran¹ Dr Ujala Ayub² Dr Sumaira Tasleem¹

1.House Officer Nishtar Hospital, Multan

2.House Officer Sir Ganga Ram Hospital, Lahore

Abstract

Objective: evaluate the role of B mode ultrasonography for early detection of deep venous thrombosis after hip fracture surgery when venous wall thickening detected preoperatively. **Study Design:** Prospective Experimental Trial. **Place and duration:** Study was conducted in the department of Gynaecology and Obstetrics Nishtar Hospital Multan and Ganga Ram Hospital ,Lahore from March 2017 to March 2018. **Methodology:** Study was started after ethical approval from ethical board of hospital and informed consent was obtained from patients. One hundred and ten patients were included in this study, both genders. Main outcome variables were duration of surgery, previous history of DVT, Varicose vein, venous wall thickening and deep venous thrombosis. SPSS version 24 was used for data analysis. **Results:** There were 11.8% patient's venous wall thickening and 88.2% patients no venous wall thickening. DVT, proximal thrombosis and DVT associated with pulmonary embolism for venous wall thickening was observed as 76.9%, 53.8% and 38.5%, respectively. DVT, proximal thrombosis and DVT associated with pulmonary embolism for no venous wall thickening was observed as 45.4%, 10.3% and 8.2%, respectively. The difference was statistically significant. **Conclusion:** Deep venous thrombosis is a common risk after hip fracture surgeries, ultrasonography of venous wall is reliable diagnostic criteria, and repeated examinations should be performed when venous wall thickening is detected.

Keywords: Deep venous thrombosis, Hip fracture, Venous wall thickening, Ultrasonography, Pulmonary embolism.

Introduction

Following the hip surgery venous thrombo embolism is most common and frequent complication which leads to high rate of morbidity and mortality if prophylactic therapy of anti coagulants was not given incidence of this disease is approximately 60% after hip and knee replacement surgeries^{1,2}. Most of the thrombi are asymptomatic in nature and about 40% of cases occur in proximal veins where a high risk of pulmonary embolism development. A risk of pulmonary embolism also found in hip arthroplasty but this ratio is much lesser in patients who were undergoing surgery of hip fracture³.

Administration of prophylactic therapy may reduce the incidence of deep vein thrombosis after surgery but still 37% of cases reported after hip replacement and 7 to 30% found after hip surgery fracture⁴. Many diagnostic criterias and methods are available for detection of this complication but most of them are inaccurate and are not reliable but venography is accepted as standard technique⁵. Venography is much painful, expensive and may produce some adverse effects. Another screening test got fame in previous decades known as radioactive fibrinogen leg scanning but some authors reported that it is inappropriate diagnostic test when applied for detection of venous thrombosis in post operative hip surgery⁶.

Venous ultrasonography is also a successful radiological investigation for the detection of thromboembolism after orthopedic surgeries with sensitivity of 62% and 97% specificity⁷. Phenomena of early DVT development and its contributing factors are unclear when it develops in patients who were given prophylactic anti co agulation⁸. In previous literature it was recommended that venous ultrasonography should be performed within first 10 days after hip fracture surgery⁹. Previous history of DVT is a main cause of DVT development in post operative period. For the detection of early DVT venous wall thickening should be investigated before going for operation especially in peoples of high risk population¹⁰.

This study was conducted to evaluate the role of venous ultrasonography by using B mode ultrasonography for early detection of deep venous thrombosis after hip fracture surgery.

Methodology

This prospective study was started after ethical approval from ethical board of hospital and informed consent was obtained from patients. Study was conducted in the department of Gynaecology and Obstetrics Nishtar Hospital Multan and Ganga Ram Hospital ,Lahore from March 2017 to March 2018. Non probability consecutive sampling was used. Patients who were presented with hip fracture and advised for surgical management, age above 20 years were included in the study. Patients with history of anti co agulation before fracture and who anti coagulation was contra indicated excluded from the study. After admission in the hospital anti biotics prophylaxis was given and low molecular weight heparin was started and graduated compression stockings mechanical prophylaxis was given. After the surgery patients were motivated for mild physical

activities. All the patients examined by the qualified physicians by using B mode ultrasonography on the 8th day after surgery and at the final day of discharge from the hospital. All these patients were also examined with venography. All patients were examining with B mode ultrasonography at the day of surgery and 2nd, 5th and 10th day of surgery. All ultrasonographic examinations were performed by qualified physician who have 5 years experience with B mode Doppler ultrasonography. Patients were examined at bed rest positions. Pre determined anatomical means which are examined include superficial and deep femoral veins were examined at lying positions calf and popliteal in prone positions. A gentle compression will transduce probe was applied to diagnose the DVT. If the vein compressibility was not found DVT labelled as present and it's diameter and marginal areas were measured. During venous wall thickening examination venous wall thickness was less than or equal to 3mm considered as normal for femoral vein. If DVT was diagnosed patients were treated with unfractionated or low molecular weight heparin. Early prophylaxis of anti coagulants was given.

Data was entered in SPSS version 24 and analysis of chi square test was performed. Qualitative data was presented in frequency and percentages and quantitative data was presented as numbers and percentages. P value ≤ 0.05 was considered as significant.

Results

One hundred and ten patients were included in this study, both genders. Gender distribution showed as n=81 (73.6%) males and n=29 (26.4%) females. The mean age, delay between injury and surgery and duration of anesthesia of the patients was 52.40 ± 3.62 years, 2.97 ± 0.62 days and 152.21 ± 3.68 minutes, respectively. Surgery was performed as hip arthroplasty for n=81 (73.6%) patients and open reduction and internal fixation for n=29 (26.4%) patients. Cancer, varicose veins, previous history of DVT and venous wall thickening was observed as n=20 (18.2%), n=18 (16.4%), n=15 (13.6%) and n=12 (10.9%), respectively. (Table. I).

There were n=35 (31.8%) patients early DVT and n=20 (68.2%) patients late DVT. The mean age of early DVT was 51.85 ± 3.30 years. Clinical symptoms, proximal thrombosis, DVT associated with pulmonary embolism and major thromboembolic event was noted as n=8 (22.9%), n=15 (42.9%), n=11 (31.4%) and n=21 (60%), respectively. While, the mean age of late DVT was 53.55 ± 3.80 years. Clinical symptoms, proximal thrombosis, DVT associated with pulmonary embolism and major thromboembolic event was noted as n=1 (5%), n=4 (20%), n=1 (5%) and n=3 (15%), respectively. The difference was statistically significant. (Table. II).

There were n=13 (11.8%) patients venous wall thickening and n=97 (88.2%) patients no venous wall thickening. DVT, proximal thrombosis and DVT associated with pulmonary embolism for venous wall thickening was observed as n=10 (76.9%), n=7 (53.8%) and n=5 (38.5%), respectively. DVT, proximal thrombosis and DVT associated with pulmonary embolism for no venous wall thickening was observed as n=44 (45.4%), n=10 (10.3%) and n=8 (8.2%), respectively. The difference was statistically significant. (Table. III).

Table. I

Variable	Presence
Age (years)	52.40 ± 3.62
Delay between injury and surgery (days)	2.97 ± 0.62
Duration of anesthesia (minutes)	152.21 ± 3.68
Gender	
Male	n=81 (73.6%)
Female	n=29 (26.4%)
Surgery	
Hip arthroplasty	n=81 (73.6%)
Open reduction and internal fixation	n=29 (26.4%)
Cancer	n=20 (18.2%)
Varicose veins	n=18 (16.4%)
Previous history of DVT	n=15 (13.6%)
Venous wall thickening	n=12 (10.9%)

Table. II

Variable	Early DVT n=35	Late DVT n=20	P-value
Age (years)	51.85±3.30	53.55±3.80	0.000
Clinical symptoms	n=8 (22.9%)	n=1 (5%)	0.000
Proximal thrombosis	n=15 (42.9%)	n=4 (20%)	0.000
DVT associated with pulmonary embolism	n=11 (31.4%)	n=1 (5%)	0.000
Major thromboembolic event	n=21 (60%)	n=3 (15%)	0.000

Table. III

Variable	Venous wall thickening n=13	No venous wall thickening n=97	P-value
DVT	n=10 (76.9%)	n=44 (45.4%)	0.000
Proximal thrombosis	n=7 (53.8%)	n=10 (10.3%)	0.000
DVT associated with pulmonary embolism	n=5 (38.5%)	n=8 (8.2%)	0.000

Discussion

Cracowski JL et al¹¹ conducted a study on B mode ultrasonography for detection of venous wall thickening in DVT diagnosis and reported that patients with previous history of DVT must be evaluated with b mode imaging, if venous wall thickening observed scanning should be repeated again. In patients with previous history of DVT history have greater chances of DVT recurrence. In these patients proper pharmacological and anticoagulant therapy required before hip surgery.

In another study by Barellicier et al¹² reported similar findings that repeated episodes b mode imaging should be performed on patients of previous DVT and venous wall thickening was observed at any scan. Venous wall thickening is an early sign of DVT development especially in patients who were performed major orthopedic surgery like hip replacement of hip fracture surgery this study is also comparable with our study.

Joseph A et al¹³ conducted a study on similar topic and concluded that there is a high incidence of unresolved thrombi which renders within all veins of leg and a great risk of embolization. Continuous ultrasonographic investigation is necessary in these patients because this provides an important information about desolution, mobilization and attachment of thrombi to the wall which increase the venous wall thickening.

Kearon C et al¹⁴ reported in his study that venous ultrasonography is the first choice for diagnosis of deep vein thrombosis. B mode ultrasonography have sensitivity and specificity 95% and 96% respectively for diagnosis of proximal DVT, non compressibility of venous wall is initial indicator of DVT suspicion. In calf vein thrombosis its sensitivity and specificity is 60 to 70% and diagnostic accuracy was reported 100%. In a study Hirsh J et al¹⁵ also reported similar findings that B mode scanning is the first line diagnostic priority in patients who suspected non compressibility of vein.

White RH et al¹⁶ conducted a study on role of duplex ultrasound for diagnosis of deep vein thrombosis and pulmonary embolism and recommended this investigation as gold standard. He reported that venous ultrasonography is a valuable and reliable test in patients of suspected DVT. Some limitations also reported in previous studies for use of B mode ultrasonography like patients of poor cardiopulmonary reserve and high risk of pulmonary embolism should be investigated precautionary¹⁷.

Another study was conducted by Maufus M et al¹⁸ and reported that ultrasound is the most useful and reliable diagnostic technique for early diagnosis of DVT or recurrent DVT cases. Changes in vein thickening on compression and comparison of two different repeated studies illustrate the presence of DVT. Further diagnostic technique like venography and CT imaging also useful and should be considered for diagnostic purpose. This study is also identical to our study in most of aspects.

Heather L et al¹⁹ conducted a study on use of B mode ultrasonography and deep vein thrombosis and reported that B mode ultrasonography with compression maneuver remains the gold standard for diagnosis of deep vein thrombosis absence of compressibility and change in Doppler abnormally indicates presence of DVT. He also reported that after B mode compression there is no need of any other diagnostic investigation after loss of vein compressibility. It is a gold standard diagnostic criterion. These studies are also comparable with study findings and conclusion about use and efficacy of B mode ultrasonography.

Prandoni P et al²⁰ conducted a study on diagnostic accuracy of use of simple ultrasound technique for detection of proximal deep vein thrombosis and concluded that venous ultrasonography remains the first choice for detection of suspected proximal DVT of lower extremity. All diagnostic criteria are less effective than

ultrasonography. We can compare this study with our conclusion.

Conclusion

Results of our study reveal that deep venous thrombosis is a common risk after hip fracture surgeries, ultrasonography of venous wall is reliable diagnostic criteria, and repeated examinations should be performed when venous wall thickening is detected.

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