

Effect of Range of Motion Exercises on Prevention of Deep Vein Thrombosis among Neurosurgical Patients

Hincy Francis¹, Kanmani Job²

¹2nd year M.Sc Nursing Student, Amrita College of Nursing, Amrita Vishwa Vidyapeetham, Health Sciences Campus, AIMS-Ponekkara P.O, Kochi, ²Professor, Amrita College of Nursing, Amrita Vishwa Vidyapeetham, Health Sciences Campus, AIMS-Ponekkara P.O, Kochi.

Abstract

Deep Vein Thrombosis, commonly referred to as the ‘silent killers’, the third leading cause of morbidity among critically ill patients and occurs after the neurosurgery, needs comprehensive care for the prevention of DVT during postoperative periods.

Objectives: The objectives of this study were to identify the risk of DVT among the neurosurgical patients in experimental and control group, to compare the risk of DVT among the neurosurgical patients in the experimental and control group and to find out the association between risk of DVT with the selected demographic and clinical variables.

Methods: A quantitative, quasi experimental study was done among 62 (31 experimental and 31 control) samples using semi structured questionnaire to collect the demographic and clinical data and standardized tool (Autar risk assessment scale) to assess patient at risk for DVT.

Results: The results revealed that among 31 subjects in each group, the experimental group bears 25 (80.6%) subjects with low risk whereas in the control group only 5 (16.1%) of subjects had low risk. The risk level of DVT was significantly lower than the control group, the difference was statistically significant ($p < 0.001$). The risk level of DVT had significant association with selected clinical variables like co morbidity of Coronary Artery Disease at $p < 0.05$ level.

Conclusion: The result obtained in this study indicated that ROM exercise found to be effective to prevent the risk level of DVT in the postoperative period in spite of pneumatic compression devices and compression stockings.

Key words: ROM exercise, Deep Vein Thrombosis, Autar risk assessment scale

Introduction

Deep Vein Thrombosis (DVT) is a blood clot or thrombus that develops in deep vein usually in leg. It tends to occur in the popliteal or femoral veins, as well as deep veins within the pelvis but it can also occur in the arm. This condition can be fatal, if a part of the clot breaks off and blocks blood vessels. DVT of the lower extremity is a relatively common diagnosis made in the emergency department and up to 6, 00,000 Americans are hospitalized

with this diagnosis each year^{1, 2}. DVT is the third leading cause of morbidity among critically ill trauma patients but it can be prevented by appropriate risk assessment and preventive strategies³. Almost 50-60 % of DVT cases do not show any visible symptoms and hence are commonly referred to as the ‘**silent killers**’⁴. Higher incidence, underestimation of risk, low level of clinical suspicion, under used prophylaxis with high fatality has made DVT a worldwide for concern⁵.

DVT prevention is important because it is often asymptomatic and difficult to detect. It is important to know about DVT because it can happen to anybody and can cause serious illness, disability and in some cases death may occur⁵. DVT can be prevented by both chemical and mechanical methods. Chemical methods of prophylaxis are primarily directed towards decreasing coagulability; mechanical methods attempt to decrease stasis⁶. In chemical anticoagulants are very useful medications but

Corresponding Author:

Kanmani Kanmani Job

Professor & HOD, Department of Medical Surgical Nursing, Amrita College of Nursing, Amrita Vishwa Vidyapeetham, Health Sciences Campus, AIMS-Ponekkara P.O, Kochi-41, Kerala

Email: kanmanijob@aims.amrita.edu,

Contact no. 09446986374

can also lead to haemorrhagic as well as thrombo embolic complications when not used correctly or without proper medical attention⁷. Many reports have documented the ability of anticoagulation management services by clinical pharmacist to help patients receiving anticoagulants especially warfarin therapy achieves better outcomes⁸. The mechanical methods for preventing venous stasis include graduated compression stockings, intermittent pneumatic compression devices and the ankle and foot exercises. Ankle exercises in the form of repetitive dorsi flexion and plantar flexion is another option for reducing venous stasis⁷.

Nurses are the front liners in terms of delivery of the therapeutic regimens of both prevention and treatment for DVT. Neuro intensive care patients are vulnerable to the development of DVT because they tend to have a higher degree of immobility due to their neurological deficits which can be compounded by lengthy stays in the ICU. Immobility and paralysis leads to stasis of the veins which in turn occurs as DVT. Early mobilization has been shown to improve outcomes, and ROM exercises improve blood flow to the lower extremities. Active and passive ROM proved to be the best methods to decrease the one’s risk of DVT. Nurses are the key persons to incorporate these exercises into the daily plan of care for their patients. Efforts to improve nursing compliance with this ROM exercise programme should be the focus of nursing care.

Materials and Methods

A quantitative quasi experimental two group post test only design was used for the present study. The study involved two groups, an experimental and a control group. The samples were post operative patients in the Neurosurgical ICU who were with pneumatic compression devices and compression stockings and were selected through purposive sampling. The sample size was 62 (31 in each group). The setting was Neurosurgical ICU, Tertiary care hospital, Kochi.

The data collection instruments were semi structured questionnaire which includes two sections. Section I consists of demographic data; Section II consists of clinical data and the Autar Risk assessment scale. The content validity index for semi structured questionnaire was 1 and for Autar risk assessment scale was 0.88-0.95. The intra class correlation coefficient values of 0.94-0.99 confirmed the inter rater reliability of the DVT scale. The pilot study was conducted among 6 patients (3 in each group) followed by main study among 62 patients (31 in each group).

Results

The data obtained were analyzed using descriptive and inferential statistics.

Table 1: Distribution of subjects based on socio-demographic variables

Demographic data	Experimental group (n=31)		Control group (n=31)	
	Frequency	%	Frequency	%
Age in years				
21-30	4	12.9	3	9.7
31-40	1	3.2	5	16.1
41-50	8	25.8	3	9.7
51-60	7	22.6	7	22.6
61-70	10	32.3	8	25.8
>70	1	3.2	5	16.1
Diet				
Non vegetarian	31	100	31	100
Alcohol				
Yes	15	48.3	15	48.3
No	16	51.61	16	51.61
Smoking				
Yes	15	48.3	15	48.3
No	16	51.61	16	51.61
Drug abuse				
Yes	1	3.23	0	00
No	30	96.8	31	100

Data presented in table 1 depicts the characteristics of the sample based on socio-demographic variables. The data shows that 8(25.8%) of the subjects in the control group and 10(32.3%) in the experimental group are in the

age group of 61-70. All samples were non vegetarian in both groups, and about the smoking and drinking habits, 15(48.3%) were in experimental group and 16(51.61%) were in control group

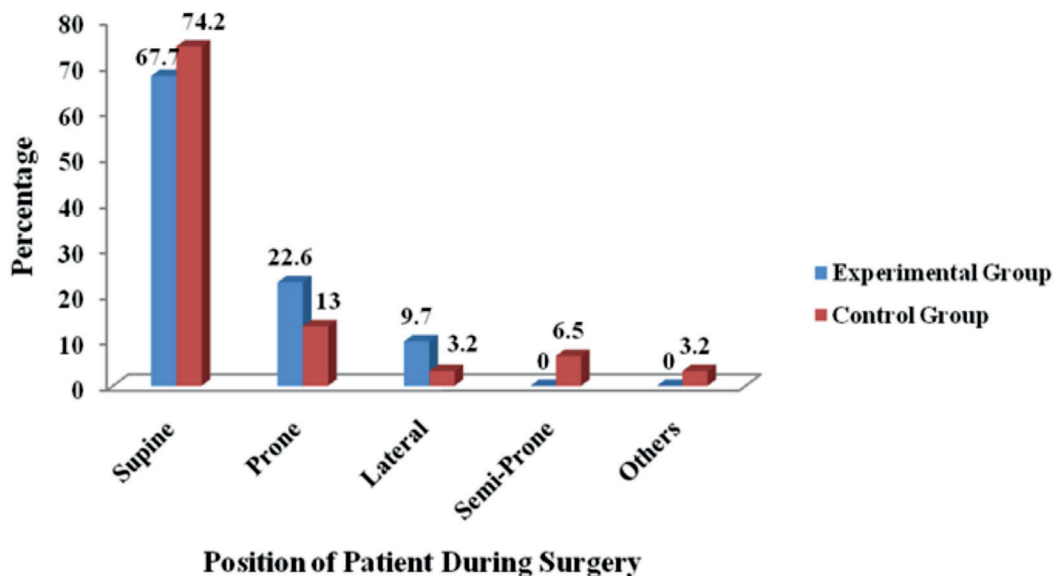


Fig. 1: Bar diagram of distribution of samples based on position of patient during surgery.

Fig. 1 shows 21 (67.7%) in the experimental group and 23 (74.2) in the control group were in supine position during surgery, 7 (22.6%) and 4 (13%) in the experimental and control group were in prone position respectively..2

(6.5%) samples from control group were positioned in semi prone during the surgery but in experimental group no one was positioned semi prone.

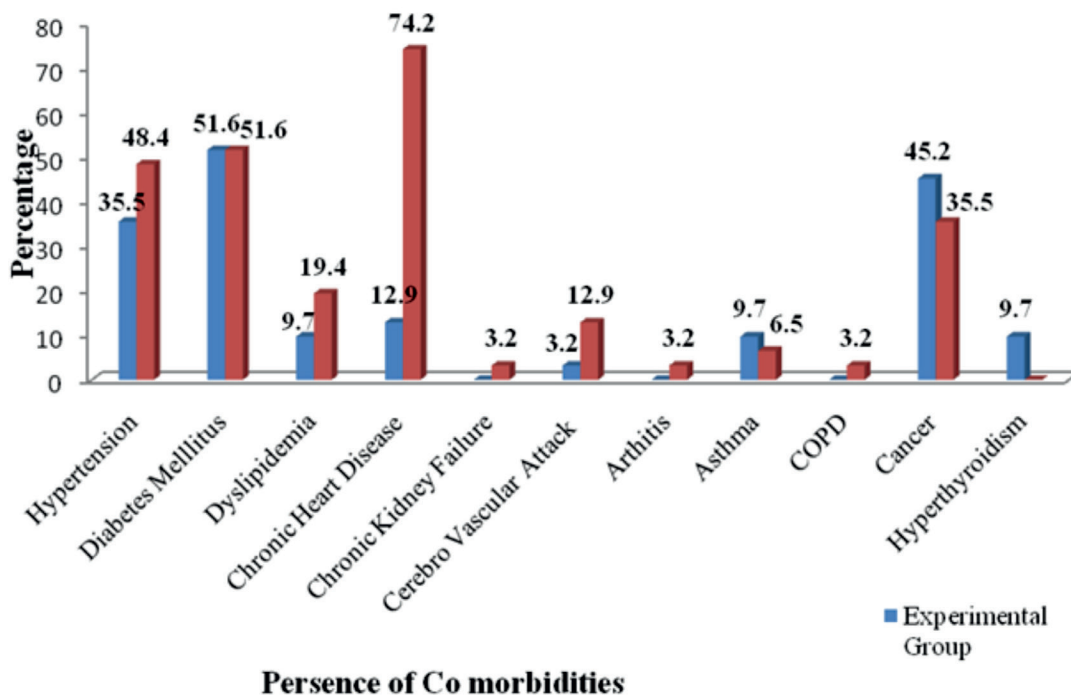


Fig. 2: Column diagram of distribution of samples based on the presence of co- morbidities

Fig. 2 depicts, the hypertension is present in 11 (35.5%) samples of experimental group and 15 (48.4%) of control group. Diabetes Mellitus was present equally

in both groups 16(51.6%). The number of samples with chronic heart disease and dyslipidemia in control group was 23 (74.2%) and 6 (19.4%) respectively..

Table 2: Comparison of risk of DVT in experimental and control group using chi-square test

Risk	Experimental Group n= 31		Control Group n=31		χ^2	p value
	Frequency	%	Frequency	%		
Low risk	25	80.6	5	16.1	40.86**	0.001
Moderate risk	4	12.9	0	0		
High risk	2	6.5	26	83.9		

Tab $\chi^2(2) = 13.82$ **significant at 0.01 level

Table 2 shows the computed χ^2 value 40.86 is greater than the table value 13.82, the test is statistically significant ($p < 0.001$). So there is a significant difference between the risk of DVT among the samples in experimental and control group.

Table 3: Effect of range of motion exercise on prevention of DVT

Groups	Mean \pm Standard Deviation	t value	p value
Experimental group	9.48 \pm 2.67	6.78**	0.001
Control group	14.97 \pm 3.63		

tab $t(60) = 2.58$ ** significant at 0.01 level

Table 3 depicts the effect of range of motion exercise on prevention of DVT. The mean score of experimental group was 9.48 with standard deviation of 2.67 and for control group 14.97 with standard deviation of 3.63. The t value for the above mean was 6.78 which is greater than table value of 2.58, the test is statistically significant ($p < 0.01$).

Discussion

The first objective was to identify the risk level of DVT among neurosurgical patients in the experimental group and the control group.

It was observed that the risk level of DVT was experienced by all the subjects in varying degrees. As the number of the exercise therapy sessions increased the risk level of DVT has also changed. In the control group, treating the risk of DVT with pneumatic compression devices or compression stockings alone the number of

subjects experiencing great risk of DVT is high. In the experimental group who received foot and ankle range of motion exercises the number of subjects experiencing high risk of DVT is less compared with low and moderate risk of DVT.

Irrespective of whether the subjects received an intervention or not, all the subjects who undergone neurosurgery experienced risk of DVT in varying degrees. Among 31 subjects in each group, the experimental group bears 25 (80.6%) subjects with low risk, 4 (12.9%) of them with moderate risk and 2 (6.5%) of them with high risk of DVT. Where as in the control group 5 (16.1%) of subjects had low risk, none of them had moderate risk and 26 (83.9%) subjects had high risk.

This finding was supported by similar study conducted by Jing M *et al.* in China on effects if early exercises of care in the prevention of cerebral haemorrhage patients with Deep Vein Thrombosis, the patients were observed for femoral vein blood flow velocity and the occurrence of DVT results after the first seven days of the exercise group femoral vein blood flow velocity was significantly higher compared with the control group ($P < 0.05$), postoperatively. The incidence of DVT was significantly lower than the control group ($P < 0.05$). The study findings shows that early postoperative care given to patients with cerebral haemorrhage movement can improve venous blood flow velocity, and can significantly reduce the incidence of cerebral haemorrhage patients of lower extremity DVT ⁹.

Lee et al conducted a randomized control trial to find out the effect of pressure therapy combined with exercise therapy on cerebral haemorrhage prevention of postoperative deep vein thrombosis in 2012 in Gaoyang, 40 cases of cerebral haemorrhage patients were randomly divided into experimental and control groups, the control group was given conventional treatment and care, the

experimental group was given pressure therapy plus exercise therapy and pressure in the conventional treatment and care. The results show that after the treatment comparing with venous blood flow velocity, the blood flow velocity was higher in the experimental group, the difference was statistically significant ($P < 0.05$), deep vein thrombosis in the control group was higher than in the experimental group, the difference was statistically significant ($P < 0.05$)¹⁰.

In the light of the above mentioned study findings, which support the present study, it can be concluded that foot and ankle range of motion exercises are more effective and a powerful nursing intervention used by the nurses to prevent the risk of DVT among patients undergone neurosurgery.

The second objective was to compare the risk level of DVT among patients receiving foot and ankle ROM exercises and patients not receiving foot and ankle ROM exercises.

On comparing the risk level of DVT between the experimental and control group it was evident that the experimental group had experienced more low risk level. Even though 4(12.9%) and 2(6.5%) of total subjects in experimental group had moderate to high risk level, none had experienced moderate risk level and 26(83.9%) experienced high risk level in the control group.

The study findings show the fact that the group who are not receiving the foot and ankle pump exercises were at high risk level. The experimental group who were receiving add on therapy experienced low risk level more. So there was a statistically significant ($\chi^2(2) = 40.86$ $p < 0.001$) difference between the subjects who were receiving the foot and ankle pump exercises and who were not receiving the foot and ankle pump exercises using this test.

Another important study finding was the statistical significant (Z value = 2.992 $p < 0.01$) difference between the mobility score in both the groups, who were receiving the foot and ankle pump exercises and who were not receiving the foot and ankle pump exercises. The computed Z value 2.992 was greater than the table value 2.58 the test was statistically significant at 0.01 level. There was significant difference between the mobility score among subjects in the experimental group and control group.

This strengthens the nurse's point of view that the early mobilization after the neurosurgery plays an important

role. So passive foot and ankle pump exercises after the neurosurgery had a promising role in the ICU settings.

Weiming H, Lili Z, Aiwen Li, and Chunlei X conducted a study on effects of early activity on the prevention of DVT among 100 cases of postoperative cerebral haemorrhage in Guangdong, divided into experimental and control groups all 50 cases, the test group except cerebral haemorrhage after giving routine care. The incidence of DVT in the results of the test group was significantly higher, while the incidence of postoperative DVT was significantly lower than the control group¹¹.

Wu Liu et al conducted a randomized control trial on effects of early exercise of care in the prevention of cerebral haemorrhage patients with deep vein thrombosis in Changsha. 80 cases of cerebral haemorrhage patients undergoing brain surgery divided into the test group and the control group, 40 cases in each case, Test group deep vein thrombosis after surgery were significantly less than the control group, a significant difference between two groups with statistical significance, $p < 0.05$. The study concludes that early mobilization of scientific and reasonable care patients with intra cerebral haemorrhage can safely and effectively prevent post-operative deep venous thrombosis, thereby reducing unnecessary suffering and medical expenses, have greater social, economic and clinical importance¹².

On comparing the present study findings with the above studies, it can be interpreted that foot and ankle range of motion exercises was very effective intervention in reducing the risk level of DVT after the neurosurgery in the postoperative period.

The third objective was to find the association between risk level of DVT with selected demographic and clinical variables.

The association between the risk level of DVT with selected demographic and clinical variables like age, gender, education, occupation, alcohol use, smoking, diet, family history of diseases, co morbidities, type of surgery, type of admission, position during surgery, GCS score, preoperative treatment, previous history of vascular diseases etc. were done using chi-square test the risk level of DVT had significant association only with co morbidity CAD at $p < 0.05$ level.

These findings were supported by a study conducted by Prandoni P, Bilora F, Marchiori A, Bernardi E *et al* to

find the association between atherosclerosis and venous thrombosis. The result revealed, at least one carotid plaque was detected in 72 of 153 patients with spontaneous thrombosis (47.1%; 95% confidence interval, 39.1 to 55.0), 40 of the 146 with secondary thrombosis (27.4 %; 95% confidence interval 20.2 to 34.6)¹³.

Conclusion

The foot and ankle ROM exercises found effective to prevent the risk level of DVT in the post operative period in spite of pneumatic compression devices and compression stockings. The nurses have a promising role in the comprehensive care of patients after neurosurgery. So early mobilization and exercise therapy was more important than other mechanical devices.

Conflict of Interest: Nil

Source of Funding: Self

Ethical Consideration: Permission had been taken from the research committee of Amrita College of Nursing and Thesis Review Committee of AIMS, Kochi. Informed Consent was obtained from the subjects.

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