

A PROSPECTIVE STUDY TO EVALUATE THE FREQUENCY OF LOWER LIMB DEEP VEIN THROMBOSIS IN PATIENTS FOLLOWING GENERAL SURGERIES AND THEREBY DETERMINE THE NEED FOR ROUTINE PHARMACOLOGICAL THROMBOPROPHYLAXIS IN ALL GENERAL SURGICAL PATIENTS

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ABSTRACT

BACKGROUND

Deep Vein Thrombosis (DVT) is a potentially fatal, but preventable complication in patients undergoing major surgery. Studies have shown it to be a common complication following oncosurgeries and orthopaedic surgeries of the lower limbs. Where thromboprophylaxis is indicated, although low molecular weight heparins are currently recommended, they have potential disadvantages such as increase in the cost of treatment and bleeding complications. In contrast to other methods, not much is said about the value of elastic compression bandages in reducing DVT particularly in high-risk patients.

The aim of the study is to evaluate the risk factors and relative frequency of lower limb DVT in patients undergoing general surgery while using mechanical thromboprophylaxis in the local population and thereby determine the need for routine chemical thromboprophylaxis in all high-risk patients.

MATERIALS AND METHODS

The study was conducted at Yenepoya Medical College Hospital between July 2010 and January 2012 where 108 patients expected to undergo major elective general surgeries were initially evaluated by a thorough history and examination for risk factors and signs of pre-existing DVT confirmed by preoperative lower limb venous duplex scans. The indication, nature and duration of the surgery including the type of anaesthesia used were recorded for every patient. Elastic compression bandages were applied to both lower limbs of all patients just prior to surgery and continued postoperatively till the patient was mobilised. Following surgery, the patients were examined daily for clinical signs of DVT and the day of mobilisation postoperatively was also taken into account. A bilateral lower limb duplex venous ultrasound was repeated between the sixth and tenth days postoperatively before discharging the patient.

RESULTS

Out of a total of 108 patients participating in the study, although 4 patients (3.70 per cent) showed clinical signs of lower limb oedema, none of the patients showed radiological evidence of DVT.

CONCLUSION

DVT following major general surgical procedures can be prevented using mechanical thromboprophylactic methods. In our opinion, although routine pharmacological thromboprophylaxis is perhaps not justified in every patient undergoing major general surgical procedures, a high level of suspicion and close clinical monitoring is mandatory, particularly in patients with risk factors given the high mortality and morbidity associated with the complication.

KEYWORDS

Deep Vein Thrombosis, Venous Thromboembolism, Pharmacological Thromboprophylaxis.

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BACKGROUND

Acute Deep Vein Thrombosis (DVT) is recognised as a major cause of morbidity and mortality in the hospitalised patient particularly in the surgical patient. The triad of venous stasis, endothelial injury and hypercoagulable state first postulated by Virchow in 1856 has held true a century and a half later.

The complications of acute DVT, pulmonary embolism and the post thrombotic syndrome are important not only as the most common preventable cause of hospital death, but also as a source of substantial long-term morbidity in terms of chronic venous insufficiency.

An understanding of the underlying epidemiology, pathophysiology and natural history of DVT is essential in guiding appropriate prophylaxis, diagnosis and treatment. Knowledge of underlying risk factors may assist in recognising situations likely to provoke thrombosis in high risk individuals. Also, the relative risk and benefits of anticoagulation as well as the duration of treatment in individual patients can be defined.

Prolonged immobilisation and major surgery have been listed among the significant risk factors in the development of DVT surgery and above all the type of surgery is one of the most important risk factors for Venous Thromboembolism (VTE). The duration of the operation as a risk factor is difficult to evaluate as a long duration is associated with other risk factors related to thrombosis, such as longer time for venous outflow obstruction, more complicated and traumatic surgery, major blood loss and transfusion, vein trauma, etc. Some standardised orthopaedic operations, e.g. hip arthroplasty have been used as a model for studies of postoperative thromboembolic problems and prophylaxis efficacy.

The prophylaxis of DVT comprise commonly of mechanical methods, which include graded compression stockings and compression devices and pharmacological methods of which Low Molecular Weight Heparins (LMWH), which is currently recommended to be one of the preferred drugs for thromboprophylaxis has many potential disadvantages such as increase in the total cost of treatment and bleeding complications.

During the past years, the frequency of laparoscopic surgery has increased dramatically. Laparoscopy and laparoscopic procedures may have an increased risk for the development of thrombosis due to increased abdominal pressure and negative Trendelenburg position Prophylaxis has been introduced and is widely practiced, but with the small, though significant and undesirable risk of haemorrhagic complications. Recent shifts in prophylaxis administration are occurring among surgical speciality groups after observing a lower rate of venous thromboembolism among patients undergoing elective surgeries.

In our institution, pharmacological thromboprophylactic measures are not routinely used in all major surgical procedures given the high cost factor, patient unaffordability and the risk of bleeding complications associated with pharmacological agents.

An estimate of the incidence and true risk of this complication in the local population and its incidence following elective general surgeries would determine the need for routine pharmacological prophylaxis particularly in high-risk patients. Combining the concept of evidence based medicine with patient affordability and compliance would be desirable particularly in patients coming from lower socioeconomic backgrounds.

AIMS AND OBJECTIVE OF THE STUDY

- To evaluate the risk factors and relative frequency of lower limb DVT in patients undergoing general surgery

while using mechanical thromboprophylaxis in the local population.

- To discern the need for routine pharmacological thromboprophylaxis in all high-risk patients.

MATERIALS AND METHODS

A prospective observational study was conducted in Yenepoya Medical College Hospital, Mangalore, during the period from August 2012 to July 2014. A total of 108 patients between the ages of 35 and 80 years undergoing elective major general surgeries defined as all work requiring a general anaesthetic; all operations, which involved openings into the great cavities of the body; all operations in the course of which hazards of severe haemorrhage were possible; all conditions in which the life of the patient was at stake; all conditions, which required for their relief manipulations for the proper performance of which special anatomical knowledge and manipulative skill are essential¹ were analysed.

Patients found to have lower limb DVT on duplex venous ultrasound done prior to surgery and patients on long-term anticoagulants for other indications were excluded from the study.

All patients included in the study were initially evaluated by a thorough history pertaining to the possible risk factors associated with DVT, particularly, increased age, previous venous thromboembolism, obesity, pregnancy and postpartum period, malignancy, cancer therapy (chemotherapy, radiation, hormonal), acute medical illness, hereditary hypercoagulable states, femoral venous catheterisation; and were examined for signs of pre-existing DVT or chronic venous insufficiency. The lower limb venous systems of the patients in the study were evaluated prior to surgery using duplex venous ultrasound to confirm the absence of pre-existing or asymptomatic DVT in these patients. The indication, nature and duration of the surgery including the anaesthesia given were recorded for every patient. Elastic compression bandages were applied to both lower limbs of all patients just prior to surgery and continued postoperatively till the patient was mobilised. Following surgery, the patient was examined daily to detect any clinical signs of DVT and the time of ambulation was recorded. A bilateral lower limb duplex venous ultrasound was repeated for all the patients in the study between the sixth and tenth days postoperatively before discharging the patient. The data so obtained was tabulated and analysed.

OBSERVATION AND RESULTS

A total of 108 patients undergoing major general surgical procedures participated in this study. The mean age was 48 years with a range from 35-72 years.

Among the risk factors taken into consideration, 14 patients had a history of a previous major surgery, 1 patient had a past history of prolonged immobilisation, 32 patients had a history of malignancy were admitted for management of malignancy, which included cancer therapy and 38 of the patients were obese defined by a body mass index of >30. Among those in the study, none of the patients had a history of previous VTE, hereditary hypercoagulable states, femoral

vein catheterisation or were pregnant at the time of surgery (Table 1).

Risk Factors	No. of Patients	(%)
History of previous major surgery	14	12.9
History of prolonged immobilisation	1	0.9
History of malignancy/cancer therapy	32	29.6
Previous venous thromboembolism	0	0
History of hereditary hypercoagulable states	0	0
Obesity	38	35.1
Femoral vein catheterisation	0	0

Table 1. Frequency of Risk Factors

Of the 108 patients, 76 (70.4%) patients underwent surgery for benign disease and 32 (29.6%) patients underwent surgery for malignant disease. The types of surgeries taken into consideration included laparoscopic and open cholecystectomy, laparoscopic appendectomy, thyroidectomy (total, near-total and hemithyroidectomy), modified radical mastectomy, truncal vagotomy with gastrojejunostomy for peptic ulcer disease, gastrectomy, bilateral hernioplasty, resection for GIST, Whipple procedure, oesophagectomy, hemicolectomy and cystogastrostomy for pseudocyst of pancreas. The number of patients undergoing each type of surgery, their mean age, type of anaesthesia, mean duration of surgery and day of mobilisation postoperatively are as given in Table 2.

Sl. No.	Type of Surgery	No. of Patients (n)	Mean Age (Years)		Anaesthesia	Mean Duration of Surgery (Hours)		Mean Postoperative Mobilisation (Days)	
			(x)	(s)		(x)	(s)	(x)	(s)
1	Laparoscopic Cholecystectomy	26	48.41	6.99	GA	2.07	0.30	2.26	0.45
2	Thyroidectomy	15	43.8	3.16	GA	3.06	0.28	2.13	0.35
3	Mastectomy	14	53.71	7.66	GA	3.49	0.22	2.71	0.46
4	Laparoscopic Appendectomy	16	36.37	1.92	GA	1.36	0.08	1.25	0.44
5	TVGJ	4	50	4.61	GA	3.85	0.50	3.5	0.57
6	Hemicolectomy	5	54.8	12.29	GA	3.7	0.50	5.6	0.54
7	Open Cholecystectomy	5	52	5.09	GA	3.04	0.38	3.6	0.54
8	Hernioplasty	10	52	8.62	SA/GA	2.88	0.41	2.5	0.52
9	Gastrectomy	4	64.75	5.73	GA	3.81	0.37	2.25	0.50
10	GIST	3	60.33	2.51	GA	3.65	0.30	4.33	0.57
11	Whipple's Procedure	2	63.5	6.26	GA	7.15	0.21	8.5	0.70
12	Cystogastrostomy	2	41.5	4.94	GA	3.15	0.21	3.5	0.70
13	Oesophagectomy	2	69.5	3.53	GA	7.15	0.21	8	1.41

Table 2. Perioperative Data and Postoperative Mobilisation

n-Sample size; x-mean; s-standard deviation; GIST-Gastrointestinal Stromal Tumours; GA-General Anaesthesia; SA-Spinal Anaesthesia.

The duration of surgery ranged from 1 hour and 25 minutes to 7 hours and 30 minutes with a mean of 2 hours and 50 minutes. The day of postoperative mobilisation of the patient ranged from 1 day to 9 days with a mean of 3 days.

Elastic compression bandages were applied to both lower limbs of all patients just prior to surgery, at the time of induction with anaesthesia and continued postoperatively till the patient was mobilised. Both the lower limbs of all patients were examined daily for signs of DVT and the bandages reapplied (Table 4).

Clinical Signs	Preoperative (No. of Patients)		Postoperative (No. of Patients)	
	Right Leg	Left Leg	Right Leg	Left Leg
Calf Tenderness	0	0	0	0
Pitting Oedema	0	0	4	4
Superficial Thrombophlebitis	0	0	0	0
Blanching of Skin	0	0	0	0

Table 4. Clinical Features on Examination of Both Lower Limbs Before and After Surgery

Of the 108 patients participating in the study, 4 patients were found to develop pitting oedema of both lower limbs after mobilisation and once the compression bandages were removed. However, a duplex venous ultrasonogram of both lower limbs done between the 6th and 10th postoperative day revealed no evidence of DVT in any of the 108 patients participating in the study including those in whom pedal oedema was observed.

DISCUSSION

Venous Thromboembolism (VTE), which includes Deep Vein Thrombosis (DVT) and pulmonary embolism is a significant healthcare problem causing considerable morbidity, mortality and resource utilisation. It was first depicted in the thirteenth century, but was not described in the medical literature until the late 1600s.^{2,3} In 1916, VTE became a treatable disease with the discovery of heparin. The presence of an effective therapy heightened the importance of diagnosing VTE, fuelling medical research and technologic developments over the next century. Despite advancements, VTE remains an elusive entity because of atypical presentations and associated diagnostic challenges.

In the mid to late twentieth century, autopsy and inpatient studies found Pulmonary Embolism (PE) was often deadly with an untreated mortality of 26% to 30%.^{4,5,6} Up to 70% of PE was diagnosed on autopsy that had not been suspected clinically.⁷ The high frequency of missed diagnosis and mortality has since led clinicians aggressively to seek and treat this disorder.

Studies of ambulatory patients who did not receive anticoagulation for VTE failed to document negative outcomes of death or thrombus progression, challenging the idea that anticoagulation is beneficial to all patients with VTE.^{8,9} Heparin was initially accepted as the standard of care without studies validating its efficacy. A growing school of thought suggests that although PE is certainly fatal in some patients, it is a normal physiologic event in others that does not require treatment and aggressive searches will likely identify patients with clinically insignificant VTE.^{9,10} Unfortunately, no methods yet exist to identify patients who can safely be managed without anticoagulation.

Whether clinically significant or not, the occurrence of missed Deep Venous Thrombosis (DVT) and PE is high^{11,12} and when it is clinically suspected it is diagnosed only up to 50% of the time.¹³ Classic presentations occur less frequently than atypical presentations and asymptomatic DVT is common. One recent study found 40% of patients in the study developing DVT following major surgery¹⁴ with an increased risk in cancer patients.^{12,14} However, a majority of studies have found that the proportion of patients developing DVT/PE is higher following orthopaedic surgeries when compared to major general surgeries.

An understanding of the underlying epidemiology, pathophysiology and natural history of DVT is essential in guiding appropriate prophylaxis, diagnosis and treatment. Recognition of the underlying risk factors and an appreciation of the multifactorial nature of DVT may facilitate the identification of situations likely to provoke

thrombosis in high-risk individuals. An understanding of the natural history of DVT is similarly important in defining the relative risk and benefits of anticoagulation as well as the duration of treatment in individual patients.

Surgery and immobility are recognised as important acquired risk factors for the development of Deep Vein Thrombosis (DVT) and Venous Thromboembolism (VTE). Providing thromboprophylaxis to patients at moderate-to-high VTE risk has thus become an important patient safety initiative. Equally important has been a growing interest in identifying patients at low risk for VTE who do not need thromboprophylaxis and who potentially maybe unnecessarily subjected to the risks, costs and inconvenience associated with thromboprophylaxis.

General surgical procedures have similarities with orthopaedic procedures particularly lower limb surgeries, the potential for vascular injury and some degree of postoperative immobilisation. Given the high-quality evidence supporting thromboprophylaxis in orthopaedic patients, one might predict that thromboprophylaxis may be appropriate for patients undergoing general surgery. However, on closer examination, there are differences in general surgical procedures that place these patients at lower risk of VTE. Patients undergoing orthopaedic procedures of the hip and knee may experience traumatic injury of the deep veins of the lower extremity, which may predispose them to Deep Vein Thrombosis (DVT) of the leg. Orthopaedic procedures are usually longer in duration and may involve the use of a tourniquet both of which are factors that increase venous stasis in the lower extremities. In contrast, general surgical procedures do not involve the proximal deep veins and rarely involve the calf veins.

Associated malignancy, a history of cancer therapy, obesity, pregnancy, prolonged immobilisation, prolonged venous catheterisation, increased age and a history of hereditary hypercoagulable states puts patients at a higher risk for the development of postoperative DVT in following major surgery.

In our institution, the use and indication for use of thromboprophylaxis in patients varies among surgeons and given the increased cost and complications associated with pharmacological thromboprophylaxis, it is not routinely used in most patients undergoing general surgical procedures. In this study, we chose to evaluate the risk factors and frequency of DVT in patients following major general surgery in the local population, so that it would help us formulate suitable guidelines for prophylaxis were indicated in the General Surgery Department of our institution.

A total of 108 patients volunteered participation in the study during the allotted time. The mean age of the study group was 48 years with a range from 35-72 years.

Among the risk factors taken into consideration, 14 (12.9%) patients had a history of a previous major surgery, 1 (0.9%) patient had a history of prolonged immobilisation, 32 (29.6%) patients had a history of malignancy, which included cancer therapy, and 38 (35.1%) of the patients were obese defined by a body mass index of >30. Among those in the study, none of the patients had a history of

previous VTE, hereditary hypercoagulable states, femoral vein catheterisation are were pregnant at the time of surgery.

In the absence of any clinical signs of DVT, the lower limb venous systems of all 108 patients were assessed using duplex venous ultrasonography to confirm the absence of pre-existing or asymptomatic DVT. The venous duplex was done by postgraduates and the teaching staff from the Department of Radiology, Yenepoya Medical College Hospital. Although, venography is considered the gold standard for the diagnosis of DVT, this procedure is invasive, not always technically possible and it carries a small risk of an allergic reaction or venous thrombosis.¹⁵ Combining clinical probability and D-dimer with a single ultrasound in the diagnostic workup of patients with possible deep vein thrombosis is found to be highly cost-effective allowing a reduction in costs and resource use without any substantial increase in mortality.¹⁶ We chose duplex venous ultrasonography as it is noninvasive, inexpensive, easily available to patients and has less associated complications while giving a fairly accurate result.

We considered a variety of general surgical procedures as are being done in our department. 76 (70.4%) patients underwent surgery for benign disease and 32 (29.6%) patients underwent surgery for malignant disease. Postoperatively, the patients were mobilised as early as possible depending on patient compliance.

It was found that 4 (3.70%) patients developed pitting oedema of both lower limbs around the 8th to 10th postoperative day following mobilisation and removal of the elastic compression bandages in the absence of pain or tenderness, discolouration of limbs or signs of superficial thrombophlebitis. All 4 patients had an associated risk factor of malignancy and had undergone abdominal surgeries of duration ranging from 4 hours and 25 minutes to 7 hours and 30 minutes. Also, the time of ambulation in these patients had been delayed (7th to 9th postoperative day) due to the nature of the surgery, the delay in the initiation of feeding and the general condition of the patient. The results were confirmed by a senior teaching staff from the Department of Radiology. We considered the lower limb oedema reported following surgery to be due to the poor nutritional status of the patient rather than to venous disease.

Of the 108 patients participating in the study, it was found that none of the patients had DVT at the time of the postoperative venous duplex scan, which was done by the 10th postoperative day. None of the patients were subject to any form of pharmacological thromboprophylaxis during the study though a high level of clinical vigilance was observed throughout.

Although, the result of this study appears to conflict with studies conducted in the western population and among orthopaedic patients, we think it may be attributed to a decrease in the prevalence of certain associated risk factors such as a history of prolonged immobilisation, previous VTE and hereditary hypercoagulable states, femoral vein catheterisation and pregnancy in the present study group.

Furthermore, despite of the indication and duration of surgery and type of anaesthesia used, all patients were encouraged active movement of limbs while in bed following surgery and most patients (81%) participating in the study were mobilised by the 3rd postoperative day.

Some of the limitations of this study include a smaller sample size, which is insufficient to make an accurate assessment of the actual incidence of the disease state in the present population and to study the association of the suggested risk factors with the disease. Also, a longer postoperative follow up will be more desirable to confirm the absence/relatively low risk of postoperative DVT following major general surgeries in the local population.

CONCLUSION

We believe that though there is evidence in western literature to substantiate a significant risk of postoperative DVT in patients undergoing orthopaedic surgery and major general surgeries, particularly laparoscopies and major abdomen surgeries for malignancies.^{17,18,19,20} There is not yet enough evidence to justify the same in the Indian population undergoing general surgical procedures. Though it is perhaps not appropriate to make any definite recommendation about pharmacological thromboprophylaxis only on the basis of this study, we would agree with surgeons in using the heparins or low-molecular weight heparins only in high-risk patients (advanced age, past history of DVT, obesity, malignancy, prolonged recent immobilisation and hereditary hypercoagulable states) in whom the potential benefits clearly appear to outweigh the risks, mechanical methods being preferable and utilised where indicated.

From the results of this study, we conclude that use of compression stockings in the intraoperative and early postoperative period and active and passive limb exercise along with early ambulation is necessary and recommended in all patients undergoing major general surgical procedures as an affordable and safe prophylactic measure against venous thromboembolism together with close clinical monitoring with a high level of suspicion for DVT and pulmonary embolism. Duplex venous sonography combined with a D-dimer maybe considered as recommended by studies^{15,16} on elderly and high-risk patients undergoing major general surgical procedures to rule out the presence of asymptomatic DVT even in the absence of positive clinical signs particularly when no form of thromboprophylaxis is being used.

Trials involving larger number of patients in future are required to confirm the findings of this study and to ascertain the benefits of pharmacological prophylaxis versus mechanical prophylaxis in the prevention of postoperative DVT in high-risk patients when indicated.

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