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Standard of surgical venous thrombo-prophylaxis in admitted patients

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ABSTRACT

Objective: To determine the standard of venous-thrombosis prophylaxis at the Surgical Department of Khyber Teaching Hospital, Peshawar.

Methods: A retrospective clinical audit of patients admitted to the surgical department over a one-year period from July 2014 to July 2015 was carried out. Data on risk assessment for venous thrombosis and prophylaxis was collected, including indications for enoxaparin and graduated stockings, their prescription and use. The correct dose and timing for enoxaparin, review of prophylaxis and counselling was also noted.

Results: 157 patients, including 37 (23.6%) males and 120 (76.4%) females requiring thromboembolism prophylaxis were admitted to the emergency department during the audit period. Mean age was 50.97±12.74 years. Enoxaparin was indicated in all 157 patients, prescribed to 126 (80.3%) and administered in 120 (76.4%), respectively. Only 80 (51%) patients received the correct dosage and 85 (54.1%) patients received it at the required time. Graduated stockings were indicated in 110 (70.1%) patients, prescribed in 35(22.3%) cases and applied in 28 (17.8%), respectively. Review of prophylaxis was not performed in any of the patients at 72 hours. Counselling and information was provided to 31 (19.7%) patients. Thrombotic events occurred in 17 (10.8%) cases, of which 12 (7.6%) were lower limb deep venous thromboses and 5 (3.2%) were cases of pulmonary embolism.

Conclusions: The audit fell short of the guidelines. Enoxaparin was prescribed and administered only in certain cases, both with the wrong timing and dosage. Stockings administration was rare and its counselling was lacking. Review of management was not performed in any case. The proposed recommendations should be implemented and assessed afterwards with a second audit cycle.

Key words: Clinical audit, venous thromboembolism, prevention and control

Introduction

Venous thromboembolism is a collective term that includes deep venous thrombosis (DVT) and pulmonary embolism. Deep venous thromboses resulting in embolic dislodgement are associated with significant morbidity and mortality. It affects 900,000 people annually in the United States (US) [1]. Associated annual mortality in the US is 300,000 and in the United Kingdom (UK) up to 32,000[1], [2]. A significant portion of post-operative morbidity and mortality is caused by venous thromboembolism. This can reach 30% of all admitted patients undergoing at least intermediate or Grade 2 surgery who do not receive prophylaxis [3].

Prophylaxis for DVT can be subdivided into an-

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ticoagulation, mechanical prevention and filter devices[1]. Local practice utilizes a risk assessment tool for DVT prophylaxis based on modified Well's criteria for DVT and a combination of low molecular weight heparin; enoxaparin and graduated DVT stockings [4]. The number of patients at risk for DVT in the surgical department are high. An important reason is fewer numbers of patients are actually receiving proper DVT prophylaxis. The ENDORSE study showed that only 58.5% of surgical patients at risk of developing DVT actually receive appropriate prophylaxis and these figures were even lower in Pakistan at 10% [5].

The morbidity, mortality and economic impact from venous thromboembolism is high. If inappropriately treated, it leads to complications like post-thrombosis limbs, pulmonary embolism, heart failure and death. It can cause embolic events leading to re-admission after discharge and delayed heart failure. This spectrum of outcomes consumes a significant portion of health resources [6]. Management based on guidelines for venous thromboembolism will reduce this burden. Management guidelines are also associated with reductions in incidence, accurate treatment, morbidity and mortality, treatment costs and hospital stays [7].

In Pakistan, tertiary care centers differ in their approach to venous thromboembolism. Divergent guidelines are followed. Where prophylaxis is employed, it is inappropriate or incomplete and data regarding it is scarce [8]. The importance of venous thrombosis prophylaxis from evidence-based medicine is well established. The National Institute for Health and Care Excellence (NICE) proposed guidelines to this end in 2010 [9]. Despite such an initiative, there is a lack of implementation, accurate utilization and collection of data regarding this condition in Pakistan.

Materials and Methods

This clinical audit was carried out at the surgical department of Khyber Teaching Hospital Peshawar, a tertiary care hospital, from July 2014 to July 2015. Approval for the study from the hospital's ethical and research committees was obtained. The first audit cycle was planned over a one-year period with a follow-up audit after a suitable duration. Data was analyzed retrospectively.

Patients requiring venous thromboembolism prophylaxis were selected for the audit. Inclusion criteria consisted of all admitted patients requiring prophylaxis after risk assessment, being aged 18 years and older and of both male and female gender. All admitted patients were assessed for risk of thromboembolism using a risk assessment tool already printed on the patient chart. This is shown in Figure 1: DVT Risk Assessment Tool. A risk score was calculated on this sheet.

The 2010 NICE guidelines were used for the audit standards [9]. Data recorded for the audit included enoxaparin indication, its prescription and administration in each case. Correct dosage and timing for enoxaparin provision was also noted. Indication for graduated stockings, their prescription and proper application was recorded. In all cases, whether a review of prophylaxis and counseling about the importance of the correct methodology behind stocking usage was supplied was also made note of.

Data was analyzed using the statistical software SPSS version 20 (IBM Corporation, New York, USA). Results were expressed as frequency, mean, standard deviation and percentage.

Audit Standards

The 2010 NICE guidelines for venous thromboembolism prophylaxis in adults admitted to the hospital were used as the audit standards [9]. The guidelines include the following:

- All patients admitted to the surgical unit must be assessed for venous thromboembolism using the National Venous Thromboembolism Risk Assessment Tool (2010)[10].
- All patients at risk of venous thromboembolism must be regularly assessed for it. The first review should be at least at the end of the first 72 hours.
- Risk assessment for venous thromboembolism and repeat of this must be documented in patient charts [11].
- Assessment is followed by management in the following manner:
- If a patient is not at risk: there is no need for enoxaparin or graduated stockings. A repeat of the risk assessment must be performed after 24 hours.
- If patient is at increased risk: subcutaneous enoxaparin (40mg) at fixed timings each day should be supplied. There should also be the prescription and application of graduated stockings.

Table 1. Data analysis - venous thrombo-embolism risk assessment and prophylaxis.

Gender	Male	Female	
	37 (23.6%)	120 (76.4%)	
Age (Years)	Mean - Standard deviation	Minimum - Maximum	Range
	50.97±12.74	28-74	46
Enoxaparin	Indicated	Prescribed	Administered
	157 (100%)	126 (80.3%)	120 (76.4%)
	Correct dose given		Given on time
	80 (51%)		85 (54.1%)
Graduated Stockings	Indicated	Prescribed	Applied
	110(70.1%)	35(22.3%)	28(17.8%)
	Counselling, information and proper method of application supplied		
	31 (19.7%)		
Prophylaxis Review	Indicated	Performed	Documented
	157(100%)	0(0%)	0(0%)

- Enoxaparin dose should be reduced in patients with a glomerular filtration rate (GFR) <30ml/min. In patients weighing less than 50 kg, dosing should be reduced from 40 to 20mg twice daily at fixed times [11].

Results

A total of 157 patients were included and studied during the audit period from July 2014 to July 2015. The mean age was 50.97±12.74 years. There were 37 (23.6%) male patients and 120 (76.4%) female patients. The data analysis is shown in Table 1.

Enoxaparin was indicated in all 157 patients but prescribed in 126 (80.3%) patients and administered in 120 (76.4%). 80 (51%) patients received the correct dose of enoxaparin and in only 85 (54.1%) was it given on time.

Graduated stockings were indicated in 110 (70.1%) patients. These were prescribed in 35 (22.3%) patients and applied for 28 (17.8%). Only 31 (19.7%) patients received counselling and information about the proper method of application and importance of graduated stockings.

Review of prophylaxis was indicated in all patients but it was neither performed nor documented in any of the cases. Thrombotic events occurred in 17 (10.8%) patients. Of these, 12 (7.6%) were cases of lower limb deep venous thromboses and five (3.2%) were cases of pulmonary embolism. There was a single case (0.6%) of mortality. No complications associated with the use of enoxaparin were observed in any patients.

Table 2. Analysis of thrombotic events and the type.

Gender	Occurrence	Absence
	17 (10.8%)	140 (89.2%)
Type of Thrombotic Event	Lower limb DVT (deep venous thrombosis)	12 (7.6%)
	Pulmonary embolism	5 (3.2%)
	Superficial thrombophlebitis	0
	Splanchnic vein thrombosis	0
Complications Associated with the use of Enoxaparin	0	
Mortality	1(0.6%)	

Discussion

The importance of prophylaxis for venous thromboembolism was first demonstrated in 1959 with a randomized control trial. Sevitt et al. showed that prophylaxis reduced mortality and was not associated with life-threatening hemorrhage [12]. In the following years, multiple studies led to the development of the first guidelines for its management and prophylaxis in 1986 [13]. Since then, numerous guidelines have been proposed and are practiced throughout the world. These guidelines are designed to effectively manage venous thromboembolism. Adherence to the guidelines and their effectiveness have been demonstrated by clinical audits carried out in centers locally and nationally in various countries. This process requires regular auditing for update and effectiveness. The first audit cycle for prophylaxis of thromboembolism at the Surgical

RISK ASSESSMENT FOR VENOUS THROMBOEMBOLISM

Mobility – all patients (tick one box)	**Tick**		**Tick**		**Tick**
Surgical patient		Medical patient expected to have ongoing reduced mobility relative to normal state		Medical patient NOT expected to have significantly reduced mobility relative to normal state	
Assess for thrombosis and bleeding risk below				**Risk assessment now complete**	

Thrombosis risk

Patient related	**Tick**	**Admission related**	**Tick**
Active cancer or cancer treatment		Significantly reduced mobility for 3 days or more	
Age > 60		Hip or knee replacement	
Dehydration		Hip fracture	
Known thrombophilias		Total anaesthetic + surgical time > 90 minutes	
Obesity (BMI >30 kg/m^2)		Surgery involving pelvis or lower limb with a total anaesthetic + surgical time > 60 minutes	
One or more significant medical comorbidities (eg heart disease;metabolic,endocrine or respiratory pathologies;acute infectious diseases; inflammatory conditions)		Acute surgical admission with inflammatory or intra-abdominal condition	
Personal history or first-degree relative with a history of VTE		Critical care admission	
Use of hormone replacement therapy		Surgery with significant reduction in mobility	
Use of oestrogen-containing contraceptive therapy			
Varicose veins with phlebitis			
Pregnancy or < 6 weeks post partum (see NICE guidance for specific risk factors)			

Bleeding risk

Patient related	**Tick**	**Admission related**	**Tick**
Active bleeding		Neurosurgery, spinal surgery or eye surgery	
Acquired bleeding disorders (such as acute liver failure)		Other procedure with high bleeding risk	
Concurrent use of anticoagulants known to increase the risk of bleeding (such as warfarin with INR >2)		Lumbar puncture/epidural/spinal anaesthesia expected within the next 12 hours	
Acute stroke		Lumbar puncture/epidural/spinal anaesthesia within the previous 4 hours	
Thrombocytopaenia (platelets< 75x10^9/l)			
Uncontrolled systolic hypertension (230/120 mmHg or higher)			
Untreated inherited bleeding disorders (such as haemophilia and von Willebrand's disease)			

Figure 1. DVT Risk Assessment Tool.

Department of Khyber Teaching Hospital, Peshawar, fell short of the audit standards in all categories.

For the first audit cycle, a period of one year was selected to include a wider range of patients from the Surgical Department. This included benign and malignant, trauma and non-trauma patients. Utilizing a risk assessment tool based on the National Venous Thromboembolism Risk Assessment Tool (2010)[10],

management of this condition with enoxaparin and graduated stockings was already in practice before the commencement of the audit. Local practices generally follow NICE guidelines. However, variations do exist from that outlined in the NICE guidelines and differences and shortcomings were expected.

Analysis of patient charts showed that based on NICE guidelines, enoxaparin was indicated in all 157 patients selected for the study using the risk assessment tool [10]. However, the prescribing doctors accurately assessed its indication in only 126 (80.3%) of the cases. Therefore, 31 (19.7%) patients were left without enoxaparin prophylaxis. This can be attributed to inexperience and unfamiliarity of the concerned doctors with the guidelines and factors that developed later in these cases requiring a review. The review as described later was not carried out. Yet, review of each case is essential as venous thromboembolism is a dynamic process. Cases where enoxaparin was not indicated initially often require pharmacological prophylaxis later on. Factors responsible for this include immobility after admission, any and the type of operative procedure performed and changes in body chemistry associated with hospital management, including starvation, dehydration, etc..

Medical prescription is effective with compliance. Enoxaparin was prescribed to 126 (80.3%) patients but it was administered by nurses in only 120 (76.4%) cases and, therefore, in six (3.9%) cases, analysis of patient charts showed that there was no documented evidence of enoxaparin usage. There are two reasons for this: 1) documentation was not carried out; or 2) enoxaparin was not administered. Both are possible, however poor documentation is more likely. That said, the audit did not originally include assessment of these potential factors. This can be included, though, in the second audit cycle.

Patients indicated for treatment with enoxaparin require accurate dosing with the drug. Studies have shown that the usual adult dose of enoxaparin should be 1mg/kg subcutaneously every 12 hours or 1.5mg/kg subcutaneously once daily at the same time each day [9,14]. In local practice, this time is usually fixed at 6:00 AM or PM. Both once daily and twice daily regimens have been shown to be equally effective [14]. However, in critically ill trauma and surgical patients, the once daily regimen should be replaced with a twice daily weight-based regimen for optimal dosing [15]. In morbidly obese patients with a body mass index (BMI) greater than 40kg/m^2, a once daily regimen of 0.5mg/kg has been shown to be effective and safe [16].

Data analysis revealed that accurate dosing with enoxaparin was achieved in 80 (51%) cases and it was administered at the required time in 85 (54.1%) cases. Inaccuracies in dosing can be attributed to non-familiarity of junior doctors prescribing the treatment. Accurate dosing, as described earlier, requires review by senior doctors, such as registrars and consultants. The discrepancies in timing of the dose is most likely the result of the delay between drug prescription and retail supply as enoxaparin is not available to patients from the hospital and has to be purchased by them individually. Evidently, this practice needs to change. In addition, the drug is administered by nurses and, in most cases, delay or administration at non-prescribed timings were because of faulty nursing. Both the correct dosage and timing of administration represented a major proportion of the shortcomings established in the audit. Inaccurate dosing was seen in 77 (49%) patients and inaccurate timings were apparent in 72 (45.9%) of the cases.

Analysis uncovered that based on NICE guidelines, graduated stockings were indicated in 110 (70.1%) patients but they were prescribed in just 35 (22.3%) cases, while documented application of the stockings by nurses was found in only 28 (17.8%) cases. This very different from what is put forth in the NICE guidelines. It appeared that prescribing doctors were unaware of the importance of graduated stockings and their indication in prophylaxis of thromboembolism. In some cases, junior doctors did not prescribe these as this was considered a decision for the consultants or registrars. Lack of review by consultants and registrars, in a number of cases, was also an important cause for these deficits. The difference between prescription of stockings (35 [22.3%] cases) and actual application (28 [17.8%] cases) was most probably from lack of documentation and nursing errors.

Stockings for prophylaxis of venous thromboembolism are an effective means for its prevention. Their effectiveness depends upon several factors. These include patient mobility, accurate thromboembolism

risk assessment, accurate sizing for limb measurement, correct fitting and wearing, garment size and thickness. It also involves counselling and information to patients and their attendants on the importance and role of graduated stockings in prevention of venous thromboembolism. Practices related to each of these details must be determined by evidence-based guidelines. Daily routine skin inspection should supplement and guide the use of stockings. Patients and their attendants should receive information, including printed or written, about this aspect of management [17].

All factors associated with the use of stockings as described previously were not assessed as part of the present audit. The aspects covered in the present audit based on NICE guidelines were counselling and information provided to patients and attendants, including proper method of application, documented in 31 (19.7%) cases. This is well below the standards of the guidelines and requires much improvement.

NICE guidelines consider a regular review of risk assessment and prophylaxis management for venous thromboembolism to be an important part of the process. The guidelines state that risk assessment and prophylaxis management should be reviewed regularly, especially at the end of the first 72 hours, in all cases. However, a review or its documentation was not carried out in any of the cases from this study.

Study Limitations

The present study represents the first cycle of a clinical audit of venous thrombo-prophylaxis. Clinical audits reach completion when the audit cycle is completed. In this regard, the first cycle will soon be followed by a second cycle to assess the deficiencies highlighted and the change in practices that will come from implementation of the recommendations made.

In the present study, various reasons were responsible for the shortcomings noted in the audit standards. For example, enoxaparin and stockings were administered in far less cases compared to their indication and prescription. Whether this was from the lack of documentation or administration was not recorded in the original data collection requirements. With this, both possibilities equally exist. This can be included in the second cycle.

In the first cycle, the provision of counseling and information on and the correct method of application of stockings was assessed. Other related factors, such as patient mobility, accurate sizing for limb measurement, correct fitting and wearing, garment size, daily routine skin inspection and information in printed or written form, were not included. Their lack of inclusion was because they do not form part of the audit assessment in the NICE guidelines.

Conclusions

The audit yielded results that fell short of the NICE guidelines in all aspects of venous thrombo-prophylaxis. Enoxaparin was indicated in all patients but was prescribed and administered in only a portion of the cases. When it was administered, the dosage and timing were determined to be inaccurate. Compared to the guidelines, the stockings were administered in only a minor fraction of patients and counselling in this regard was lacking. Review of risk assessment and prophylaxis was not performed in any of the cases.

Recommendations

To comply with the standards set forth by the 2010 NICE guidelines for the assessment of risk and prophylaxis of venous thromboembolism, the following recommendations must be implemented:

- Findings of the present audit and education about the 2010 NICE guidelines should be provided to junior doctors and nurses. This can be achieved with presentations and posters set up in the Surgical Department.
- Doctors should be trained in proper use of the risk assessment tool together with indication and use of enoxaparin and stockings.
- Timing of enoxaparin dosing at 6:00 AM or PM should be strictly followed by the nursing staff. The nurses must also ensure this is followed in combination with correct application of stockings where indicated.
- Staff nurses trained in the proper application of stockings should impart such knowledge to junior doctors and nurses so they can make use of it and educate patients and their attendants.
- A separate sheet should be dedicated in patients' charts for review of risk assessment and prophylaxis of thromboembolism.
- All aspects of management should be reviewed by

registrars and consultants.

Author's contributions

- Conceived and designed the experiments: MSR, MIR, MR, SGS, SH.
- Analyzed the data: MSR, MIR, MR, SGS.
- Wrote the paper: MSR, MIR, MR, SGS.
- Data collection: MSR, MIR, MR, SH, SGS, SH.
- Critical revision: MSR, MIR, MR.
- All authors read and approved the final manuscript.

Conflict of interest

The authors have no conflicts of interest to declare.

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