Introduction

Venous thromboembolism (VTE), which encompasses deep venous thrombosis (DVT) and pulmonary embolism (PE), is a life threatening condition. About 79% of patients who present with pulmonary embolism have evidence of deep vein thrombosis in their legs. About half of patients with pelvic vein thrombosis or proximal leg DVT develop PE, which is usually asymptomatic. Chronic sequelae of venous thromboembolism include post-thrombotic/post-phlebitic syndrome and chronic thromboembolic pulmonary hypertension. VTE is a worldwide problem; the magnitude of the problem can be judged from data from the United States. The average annual incidence is 1 episode per 1000 registered patients and estimated 300000 deaths from acute PE annually. In our tertiary care institute, geriatric admissions constitute at least 10-15% of indoor medical admissions. An acute medical illness may warrant inpatient admission, this superimposed on pre-existing surgical, orthopaedic, and general debility in geriatric population may increase susceptibility to VTE. Traditionally VTE is thought to be more common in surgical and orthopaedic wards related to prolonged immobilization. However, recently it has been highlighted that acute medical illnesses are high risk for DVT. To our knowledge, the data on DVT in Indian setting and in geriatric population, both in India and the western world is lacking. Hence in this study we decided to score the indoor geriatric population for DVT risk, assess them for the presence of DVT/PE and correlate DVT risk score with inpatient mortality.

Material and Methods

All indoor geriatric patients (60 years and above) serially admitted for ≥72 hours in medical intensive care unit (MICU), intensive cardiac care unit (ICCU) and general medical wards (GMW) over a period of 15 months were included. The patients with evidence of venous thromboembolic disease on clinical suspicion or on hand-held microDoppler (HHMD) at admission were excluded. On admission, patients were screened with HHMD for the presence of DVT; those with evidence of lower limb DVT were excluded. DVT risk was stratified using the SMART Tool and patients classified into mild (1), moderate (2), high (3-4) and very high (≥5) risk groups. Patients were screened periodically clinically and with HHMD for DVT till discharge. The effect of thromboprophylaxis (heparin) on all-cause mortality was correlated. Levene’s test for equality of variances and Pearson’s Chi-square test were used for statistical analysis.

Results: Mean risk score (SMART TOOL) in study group was 5.15. Among 111 patients, 75 (67.56%) had high to very high risk for DVT. Immobilization, sepsis, heart failure, and acute coronary syndrome were most common risk factors for DVT. Only 2.7% of indoor geriatric patients had clinical evidence of DVT while 13.5% had presumptive evidence of DVT as detected by HHMD. The mean risk score for DVT in expired patients was higher than in discharged patients (p=0.052). ICU patients receiving thromboprophylaxis had significantly lower mortality (9.5%) compared to those who did not (50%). (p=0.004). Patients with presumptive evidence of DVT on HHMD had significantly higher mortality (53.33 percent) compared to those without evidence of DVT (15.62 percent); p<0.05.

Conclusions: Indoor geriatric patients constitute high risk group for DVT. There could be an increased risk of mortality in patients with presumptive evidence of DVT on HHMD.
Score 3: Major surgery with myocardial infarction or congestive heart failure or severe sepsis/infection.

Score 4: Medical patient with additional risk factors

Score 5: Elective major lower extremity arthroplasty; Hip, pelvis or leg fracture; Stroke; Multiple trauma; Acute spinal cord injury (paralysis)

Risk factors associated with patient (B)

I. Clinical:

Score 1: Age 41 to 60 years; History of prior major surgery; Pregnancy or post partum< 1 month; Varicose veins; Inflammatory bowel disease; Obesity (>20% of ideal body weight); Oral contraceptives or hormone replacement therapy

Score 2: Age >60 yrs; Malignancy; Score 3: History of DVT/PE

II. Hypercoagulable States (Thrombophilia):

Inherited

Score 3: Factor V Leiden/ Activated Protein C resistance; Antithrombin III Deficiency; Protein C or S deficiency; Dysfibrinogenemia; Prothrombin 20210A; Homocysteinemia

Acquired

Score 3: Lupus Anticoagulant; Antiphospholipid antibodies; Myeloproliferative disorders; Disorders of plasminogen and plasmin activation; Heparin induced thrombocytopenia; Hyperviscosity syndrome; Homocysteinemia

Total Risk Factor Score= (A+B)

On the basis of risk assessment scores eligible patients were classified into four risk groups:

<table>
<thead>
<tr>
<th>Risk Category</th>
<th>Risk Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mild</td>
<td>1</td>
</tr>
<tr>
<td>Moderate</td>
<td>2</td>
</tr>
<tr>
<td>High</td>
<td>3-4</td>
</tr>
<tr>
<td>Very High</td>
<td>5 or more</td>
</tr>
</tbody>
</table>

For patients included thorough screening, clinical examination, and routine investigations were carried out. All patients were screened with HHMD (model MDK-51) for presence of DVT

| Table 1: Risk factors in geriatric patients (n=111) screened for DVT |
|-----------------|----------------|
| Risk Factors    | Frequency(n)  |
| Age ≥ 60 years | 111           |
| Immobilization | 60            |
| Sepsis          | 25            |
| Heart failure   | 20            |
| Acute Coronary Syndrome | 13         |
| Stroke          | 8             |

Chart 1: ICU and ward : Incidence of DVT (n=111)

Either on clinical suspicion or routinely every third day after 72 hours of admission (since the risk factor for DVT being indoor stay for at least 72 hours) and also prior to discharge.

Criteria for clinical evidence of DVT/PE (any one)

Unilateral limb swelling, redness or tenderness on palpation, and characteristic ECG findings (sinus tachycardia, atrial fibrillation or flutter, right axis deviation, incomplete or complete right bundle branch block, S1Q3T3 pattern, inverted T waves in leads III, aVF, V1-4).

Criteria for positive test on micro-Doppler

Lack of augmentation of sound on distal limb compression during screening lower limb venous micro-Doppler, the probe being placed over the popliteal fossa or proximally just medial to the mid-inguinal point (over the femoral vein), gives presumptive evidence of impaired patency of the underlying deep vein. Using this principle, patients included in the study were periodically screened for the presence of DVT.

Administration of heparin (unfractionated-UH or low molecular weight-LMW heparin) to patients for their underlying medical illness or as a prophylaxis for DVT by the treating physician was noted. However, the use of above was left to treating physician and no attempt was made to randomize the patients.

Patients were monitored till discharge and the mortality rate was noted. The all-cause mortality, mortality in patients with clinical suspicion of DVT, in those with positive result for DVT on hand held micro-Doppler was tabulated. The effect of pharmacological prophylaxis with heparin on the mortality in patient groups in ICUs and general medical ward was correlated. The study was approved by the Institutional Review Board (Ethics Committee) of our hospital.

The statistical tests used were Chi-square test, Levene’s test for equality of variances, Pearson’s Chi-square test and Independent samples test.

Results

Fifty one of 111 patients were from various ICU’s with 28 males and 23 females, while 60 patients were from GMW with 39 males and 21 females. Mean age of study population was 65.88 years. Eighty two percent of patients in the study were in the age group of 60-70 years. About 32% of indoor geriatric patients had age as the sole risk factor for DVT while the rest had multiple risk factors (Table 1). The mean duration of in-hospital stay of the study population was 7.2 days.

The mean risk score for DVT in study population (n= 111) using the SMART TOOL² was 5.15. Seventy five of 111 patients were from high to very high risk category, while 30 patients belonged to moderate risk and only 6 were in the mild risk category. Hence, majority of patients (68 of 111-61.26 percent) had a very high risk (SMART score ≥5) for DVT, and 75 of 111 i.e. 67.56 percent have high to very high risk (SMART score 3-4). In the ICUs, 48 of 51 patients belonged to high and very high risk category. Patients admitted in ICUs had significantly higher mean risk score for DVT as compared to their counterparts admitted in GMW (6.45 ± 1.94 vs. 4.05 ± 2.80)(p < 0.005).

Only 3 of 111 patients (2.7%) of the study group had clinical evidence of DVT (Chart 1). About 13% of study population was found to have presumptive evidence of DVT as detected by HHMD.
Table 2: DVT incidence by HHMD and overall mortality in relation to age

<table>
<thead>
<tr>
<th>Age range</th>
<th>No. of patients</th>
<th>DVT evidence on HHMD</th>
<th>Mortality</th>
</tr>
</thead>
<tbody>
<tr>
<td>60-69 years</td>
<td>84</td>
<td>9</td>
<td>14</td>
</tr>
<tr>
<td>70-79 years</td>
<td>23</td>
<td>5</td>
<td>8</td>
</tr>
<tr>
<td>≥80 years</td>
<td>4</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>111</td>
<td>15</td>
<td>23</td>
</tr>
</tbody>
</table>

DVT incidence in the age groups of 60-69, 70-79 and ≥80 years was 10.7, 21.73 and 25 percent respectively while mortality in these age groups was 16.66, 34.78 and 25 percent respectively (Table 2).

Of 111 patients, 23 expired suggesting high mortality of 20.7%. As expected, geriatric patients admitted in ICUs had a higher mortality 33.3%, compared to those admitted in GMW with mortality of 10% (p=0.003).

Expired patients had higher DVT risk score of 6.13 versus 4.90 for survivors. Applying Levene’s Test for Equality of variances, this difference of mean risk score for DVT among patients between expired and discharged patients was close to significance (p=0.052).

There was no mortality in 16 patients who received UFH and only 2 of 8 patients who received LMWH expired. Patients receiving prophylaxis had lower mortality of 7.7% versus those who did not receive prophylaxis had 24.7% mortality (p=0.061). The subset of patients admitted in the ICU receiving pharmacological thromboprophylaxis had significant reduction in mortality (p=0.004) (Chart 2).

Patients with presumptive evidence of DVT on HHMD had significantly higher mortality (53.33 percent) compared to those without any evidence of DVT (15.62 percent) (p<0.05) (Table 3).

Discussion

Venous thromboembolism (VTE) is a major cause of in hospital mortality in non surgical patients. Autopsy studies indicate that pulmonary embolism is associated with up to 10% deaths in hospitalized patients and only about a quarter of these deaths occur following surgery. This suggests that, although VTE is often regarded as a complication of surgery, about three-fourths of hospitalized patients who suffer a fatal PE are in fact medical patients. Despite consensus group recommendation that at risk medical patients should receive thromboprophylaxis, currently there are no clear guidelines as to which patients are at risk and many patients may not receive appropriate thromboprophylaxis. There have been several studies in literature on the prevalence and prevention of DVT in surgical setting however, very few studies, if any, have been carried out on medically ill patients particularly in the elderly age group.

Our study aimed at evaluating DVT in indoor geriatric patients, considering the relative paucity of data on this demographically growing elderly population.

Age ≥60 years, immobilization, sepsis, heart failure, acute coronary syndrome and stroke were the most common risk factors in our study cohort (Table 1). In one study, 80% of patients with first diagnosis of VTE had ≥3 risk factors including age ≥40 years, cancer, congestive cardiac failure, chronic obstructive pulmonary disease, obesity, stroke and myocardial infarction. In another study, independent risk factor for VTE included increasing age, institutionalization (hospitalization or residence in a nursing home), malignancy, neurological disorders with extremity paresis and the presence of central venous catheters or transvenous pacemakers.

Our study shows that DVT risk increases with age. At age ≥80 years, patients were found to be twice as more likely to have DVT compared to those in the age group 60-69 years. A post hoc analysis of the PREVENT study also showed that age ≥75 years is associated with development of proximal DVT in acutely ill medical patients.

A majority of the study cohort were found to be at high risk of VTE according to the SMART tool.

The prevalence of DVT in ICU patients depends on the methods used for its detection. Approximately 10-100% events of DVT in ICU patients can be clinically silent. In our study, only 2.7% of patients had clinical evidence of DVT consistent with its silent occurrence.

The difference in the mean risk score of discharged (mean score: 4.9) versus expired patients (mean score: 6.13) was found close to significance (p=0.052). As expected, the patients admitted in ICUs had higher mean risk score of 6.45; compared to those admitted in GMW (mean risk score: 4.05) and had a higher mortality (33.3 versus 10.0 percent respectively) (p=0.003). This identifies geriatric patients admitted in ICUs as a particularly high-risk group and emphasizes the need to stratify patients at admission for risk of VTE and offer appropriate thromboprophylaxis.

Studies suggest that the presence of proximal DVT on admission to medical-surgical ICU is about 10% and the incidence of DVT developing over ICU stay based on systematic screening and compression ultrasound ranges from 9 to 40%. We used HHMD, a portable modification of conventional duplex for DVT screening. The DVT prevalence rate was 13.5%, with 12.6% having proximal DVT. Patients with presumptive evidence of DVT on HHMD had significantly higher mortality. Proximal DVT being a harbinger for pulmonary embolism, is a more accurate marker for thromboprophylaxis, morbidity, and mortality and hence it is the sought after marker for pulmonary embolism. HHMD may be able to detect proximal DVT and
predict higher mortality risk. The operator friendliness, easy availability, and low cost, make HHMD a good screening tool particularly in resource poor settings.

In a study by Jean Luc Bosson et al., it was found that the incidence of DVT in elderly patients receiving thromboprophylaxis versus those not on any thromboprophylaxis was 13.8 and 20.8 percent respectively, compared to that in our study (7.69 and 14.11 percent). This apparent difference may be due to the larger study population (n=852) and longer post hospital follow up (31.33 days) in that study as compared to our study (n=111) and in which follow up of patient was limited to period of indoor stay.

In patients who received thromboprophylaxis, the incidence of DVT by HHMD was only 7.69 percent versus 14.11 percent in those who did not receive thromboprophylaxis while the mortality in these groups was 7.7 and 24.7 percent respectively (p=0.061). In the outcome analysis of ICU study population, (n=51) (Chart 2) the administration of thromboprophylaxis (UFH or LMWH) showed a significant reduction in all cause in hospital mortality from 50 percent in patients not receiving prophylaxis to 9.5 percent in those receiving either UFH or LMWH (p=0.003). Thus, the incidence of DVT by HHMD and overall mortality was consistently lower in the subgroup receiving thromboprophylaxis, though the overwhelming reduction in mortality in a subset of ICU patients may be due to chance due to small numbers.

Conclusions

Geriatric patients admitted in medical wards and ICUs constitute a high risk for DVT, most cases being clinically silent. Advancing age increases the risk for DVT and overall mortality. Administration of pharmacological thromboprophylaxis was found to be associated with lower mortality in geriatric patients particularly in the ICU. A hand held micro-doppler may be a good screening tool to detect proximal DVT and may predict higher mortality risk in the inpatient setting for elderly population. This requires confirmation with a larger study and head-to-head comparison with standard screening methods.

Limitations

Patient deaths related directly to pulmonary embolism could not be accurately determined. In addition, positive findings on HHMD could not be confirmed with conventional venous duplex ultrasound due to limited resources and poor patient population.

References