

Incidence, Etiopathogenesis, and a Preventive Protocol of Deep Vein Thrombosis in Severe Burns Patients at a Tertiary Care Teaching Hospital

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ABSTRACT

Deep vein thrombosis (DVT) a consequence of thromboembolism can lead to life threatening pulmonary embolism. A study was carried over 4 years from January 2014 to January 2018 to determine the incidence of DVT in severe burns cases admitted to the Burns Unit of a 1200 bed tertiary care medical college teaching hospital. In the retrospective study of 100 consecutive cases of severe burns the incidence of DVT was found to inordinately high. This study was carried out to determine the causes of DVT in these patients and formulate a protocol for the prevention of DVT. A further prospective study of 116 cases were studied following the introduction of the protocol. A dramatic decrease in the incidence was found. This protocol is recommended to be followed in all burns centres especially in teaching institutions.

Keywords: Deep vein thrombosis, High incidence, Protocol for prevention, Severe burns patients, Teaching institution.

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INTRODUCTION

Deep vein thrombosis (DVT) is a multifactorial condition that develops in the deep veins of the lower limb. Venous thromboembolism (VTE) is a general term associated with DVT; its severe fatal consequence is pulmonary embolism (PE).¹⁻⁴ DVT is a semisolid clot formed usually in the deeper vein of the leg that under severe cases detaches and travels to the lungs to cause acute pulmonary inflammation.^{5,6} Painful edema and congestion in the leg occurs owing to the occlusion of the femoral vein. Extensive DVT of iliac and pelvic veins cause phlegmasia, in which either venous gangrene of infarction may threaten a part or the whole limb.³⁻⁶

A recorded occurrence of DVT in the western world is one per 1,000 population per year in the hospitalized general population.⁶⁻⁸ The incidence in India is higher in men (114/10,00,000) than in women (105/1,00,000).² Approximately, one-third of the patients with symptomatic VTE manifest PE; two-thirds of the patients manifest DVT.⁶⁻⁸

Statistics of burn patients with DVT are scarce owing to a dearth of literature and records available in this demographic setting. Though western literature has some works reporting an incidence of 0.25–23%, the studies are limited.⁷⁻¹¹ There are practically no studies available for the same in India.

Severe burn patients are at a higher risk of manifesting DVT owing to the intensity of burns and longer periods of hospitalization and immobilization. Some of the sequelae include death due to pulmonary edema and gangrene of the affected part.^{3,7,9,10}

Diagnosis is often missed in these cases. Diagnosis involves a combination of clinical awareness and examination combined with a Duplex scan for confirmation of DVT.¹⁰⁻¹³

Prophylaxis in the form of low molecular weight heparin (LMWH) has been advised to prevent DVT in critical cases.^{4,7,10,13} However, the problem of administering LMWH in burn patients is the extensive raw areas, which can lead to bleeding and severe anemia. It is not easy for heparinized patients and patients on anticoagulants with extensive burns to be taken up for surgery because of heavy bleeding from raw areas and donor site during

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surgery and this has prevented a lot of physicians treating burns from initiating prophylaxis for DVT.¹⁴

In view of the aforementioned sequelae of DVT and its complications, it was thought prudent to evaluate patients of burns presenting with DVT in this 18 bed burns unit of a 1,200 bed tertiary care hospital with an average admission of about 200 severe burns patients annually.

MATERIALS AND METHODS

This was a retrospective and prospective study from January 2014 to January 2018 in the burns unit of the Pravara Rural Hospital of the Pravara Institute of Medical Sciences, Loni, Maharashtra. The study was carried out after obtaining Institutional Ethics Clearance (IEC).

Enrolled patients were subjected to the following inclusion and exclusion criteria.

Inclusion Criteria

- Adult patients (age ranging from 1868) admitted with severe burns from January 2014 and diagnosed with DVT.

- Severe burns was a burn surface area of 20% and over.
- Patients of either gender.
- Patients with burns ready to give written informed consent.
- All hospitalized burns patients with DVT and ready to stay till considered fit for discharge.

Exclusion Criteria

- Pediatric-age-group patients.
- Patients with burns not willing to stay or be hospitalized for the entire duration of the treatment.
- Records of patients that were incomplete for retrospective study.
- Patients with burns with a prior history of ischemic heart disease, DVT, hypercoagulable states, malignancy, frequent blood transfusions, and absence of coagulation factors.
- Study conduct—all patients satisfying the above inclusion and exclusion criteria were subjected to the following variables.

Demographic Variables

- Age, gender
- Socioeconomic status
- Rural/urban area
- Educational status
- Body weight

History of Burns

- Degree of burns, total surface area, area involved

DVT Parameters

- Occurrence
- Location of thrombus
- Clinical presentation
- Complication
- Treatment protocol

Outcome of DVT

- Morbidity
- Mortality
- Status at discharge

Sample Size

100 retrospective cases and 116 prospective cases

Data Analysis

All the data related to above variables that were recovered from the case records forms tabulated in an excel sheet. Observation tables were prepared according to objectives to be satisfied and subjected to statistical tests.

Statistical Analysis

Descriptive statistics used were percentage mean, median and mode, inferential statistics, test of significance appropriate observation to draw inference.

The retrospective study was from the period January 2014–July 2015. The prospective study started from July 2015 after the initiation of a protocol for thromboprophylaxis of DVT by both mechanical and drug-based methods.

OBSERVATION AND RESULTS

Retrospective Study

A sample size of a 100 burn patients for the retrospective study was considered from the period starting from January 2014, and the incidence of DVT amongst them along with the correlation of each risk factor was measured. The incidence of DVT amongst burns patients was found to be 10 out of 100, amounting to 10% of the total study size (Table 1).

The age group considered was 18–68 for the study. Of the 34 patients (age: 18–28 years) suffered from burns, DVT was seen in 1 patient. In 37 patients ranging from the age group 29–38, 9 patients with DVT out of this study size was found. No DVT was found in any of the other age groups (Table 2).

In the gender-wise occurrence of DVT amongst the 10 affected people, 4 were female, amounting to a 40% occurrence and 6 were males, amounting to 60%. It can be observed that the incidence was almost the same in both females and males about 10% (Table 3).

The percentage of burns and its correlation to the occurrence of DVT was assessed. The percentage range was divided into a section of ten. No patients of DVT were seen in the percentages of burns ranging from 0 to 10% and from 10 to 20%. In the burns percentage, in the range of 20–30%, there was one patient with DVT. In the range of 30–40%, there were 3 patients with DVT. In the range of 40–50% and 50–60%, there were 2 patients each. Only 1

Table 1: Incidence of DVT; retrospective study

<i>Number of patients</i>	<i>Number of patients with DVT</i>	<i>Incidence</i>
100	10	10%

Table 2: Age-wise distribution of patients with DVT; retrospective study

<i>Age group</i>	<i>Number of burns patients</i>	<i>Patients with DVT</i>
18–28	34	1
29–38	37	9
39–48	13	0
49–58	9	0
59–68	7	0

Table 3: Gender distribution of patients with DVT; retrospective study

<i>Gender</i>	<i>Number of patients</i>	<i>Number of patients with DVT</i>	<i>Incidence (%)</i>
Female	43	4	9.4
Male	57	6	10.6

Table 4: Burns percentage with DVT distribution; retrospective study

<i>Percentage of burns (%)</i>	<i>Number of patients with DVT</i>
0–10	0
11–20	0
21–30	1
31–40	3
41–50	2
51–60	2
61–70	1
Electric burns	1

patient was found to have DVT in the range of 60–70% burns. The one patient with electric burns and DVT had a high-tension burn injury (Table 4).

Of the 10 patients with DVT, 8 were smokers, with 2 of them being women. Only 2 of 10 (20%) DVT patients were intubated for inhalational injuries. Intubation is known to be a factor for causation of DVT.

With the difference in time between the incidence of thermal injury and admission to PRH, Loni was found to be significant and relevant. An estimated 72 hours is the border for the setting of risk factors. Beyond 72 hours or 3 days is indicative of significance as a risk factor. Of the 10 (70%) patients, 7 were admitted within 72 hours of having sustained burns. Only 3 of 10 (30%) patients had beyond a 72-hours delay in admission (Table 5).

Femoral lines were being inserted when the percentage of burns are beyond 20%. It was found that all the 10 patients of DVT (100%) had femoral lines inserted in the casualty prior to admission into the ward, which is a prominent risk.

Prospective Study

The prospective study was started in July 2015 after a protocol was initiated for the prevention and management of DVT.

The incidence of DVT markedly dropped after the adoption of the new protocol. The only case was a 26 year female with about 56% thermal burns admitted on the fourth day after having sustained burns. She had been treated in another hospital and came with a femoral line in the affected limb.

Table 5: Time gap between incidence of burns and DVT; retrospective study

<i>Less than 72 hours</i>	<i>More than 72 hours</i>
7	3

Table 6: Age-wise distribution of patients with DVT; prospective study

<i>Age group</i>	<i>Number of patients</i>	<i>Patients with DVT</i>
18–28	39	1 (patient admitted with DVT)
29–38	41	0
39–48	16	0
49–58	13	0
59–68	7	0

Table 7: Gender distribution of patients with DVT; prospective study

<i>Gender</i>	<i>Number of patients</i>	<i>Number of patients with DVT</i>	<i>Incidence (%)</i>
Female	57	1	1.75
Male	65	0	0

Table 8: Burns percentage with DVT distribution; prospective study

<i>Percentage of burns (%)</i>	<i>Number of patients with DVT</i>
0–10	0
11–20	0
21–30	0
31–40	0
41–50	1
51–60	0
61–70	0
Electric burns	0

Parameters with reference to the age, sex, and percentage of burns are represented in the following tables (Tables 6 to 8).

DISCUSSION

Deep vein thrombosis is a consequence of venous thromboembolism, which on progression in certain cases leads to a life-threatening condition called pulmonary embolism.^{1,2,5,10} Deep vein thrombosis is a debilitating condition with an increase in worldwide occurrence found in various studies.^{2,7,8,11,13}

A number of factors predispose a patient to DVT, with the predominant factor being Virchow's triad, which comprises three aspects: hypercoagulability, stasis of blood, injury to vessel wall, or endothelial injury. Tobacco, oral contraceptives, cigarette smoking, HRT, and obesity are considerable causative risk factors for the disease.^{11,13,15,16}

Diagnosis starts with history (risk factors) and physical examination using a validated clinical prediction rule, such as the Wells DVT score.^{5,6,8,9} Patients with a high likelihood of DVT are tested with duplex compression ultrasonography, where the length of the proximal veins is sequentially compressed with an ultrasound probe.^{5,6,17} Normal veins are easily occluded with moderate external compression, but a DVT will prevent occlusion of the vein lumen. USG is both sensitive and specific for DVTs.¹⁷ Contrast venography is considered the gold standard for diagnosis of DVT, although rarely done owing to its invasiveness, expense, availability, and risks involved.^{5,6,9}

Prophylaxis should be started from admission.^{3,5,6,15,18}

Prophylaxis includes the use of foot or leg sequential compression devices in every patient. Pneumatic compression devices have been shown to reduce thromboembolic events by more than half without increasing bleeding risk by preventing venous pooling and activating fibrinolysis.¹⁹ In patients with higher risk factors such as extensive burns, genetic thrombophilia, and history of prior deep venous thromboembolism or pulmonary embolism, low molecular weight heparin (LMWH) is given. LMWH appears to be at least as effective as standard heparin in DVT prophylaxis with possibly less bleeding tendencies.^{17,18,20–23}

Treatment of DVT is in the form of pharmacological intervention assisted by mechanical intervention.^{18,21,23} Pharmacological intervention uses drugs like LMWH and warfarin as parenteral and oral anticoagulants respectively, while mechanical intervention includes the use of compression stockings. Blood thinners such as Fondaparinux and promoters of coagulation factors such as vitamin K are also to be given along with a protein-rich diet.^{18,21,23}

Purpose of this Study

This study was conducted in the hope of providing adequate information on the incidence and etiopathology of DVT in cases of burns, as there is not much literature available on this subject.^{7–11}

No study has been performed on DVT in burns patients in India to use as a template and corroborate as evidence or contradict in terms of the results obtained, though a study has been done on the role of thromboprophylaxis with low-molecular-weight heparin.¹⁴

The reason that this study was taken up was on account of an alarming incidence of DVT in the burns unit. The observations put forward are the results of a thorough study performed with the resources and the study size available at Pravara Rural Hospital, Loni in the burns unit.

It was found that the percentage of DVT patients in the sample size of 100 was 10%, which is high considering the global occurrence percentage of 0.25–23%.^{7–11}

The incidence of DVT was marginally higher in males when compared to females and this could be attributed to tobacco consumption. Tobacco consumption was found in a high percentage of 80% amongst the DVT patients; all of the men and two women were users of tobacco.

Oral contraceptives or HRT (another risk factor for DVT) was not seen as a positive finding in any of the female patients. Patients in rural areas consider oral contraceptives to be taboo and do not undergo any such reproductive interventions.

Obesity is another common risk factor for DVT as it may lead to deposition of cholesterol in the lumen of the vessels (possibly atherosclerosis), which again causes endothelial damage. None of the patients were found to be obese as obesity is a common finding among the affluent societies, which is not again usually found in rural areas.

An estimated 20% of the patients with DVT were intubated and on ventilator support, hence were totally immobile, predisposing to stasis in the lower limbs.

Only 30% patients were admitted 72 hours after the thermal injury, which is enough time for hypercoagulability to take place if adequate fluid resuscitation had not been done.

A very important finding in the study was that there was a tradition in the hospital of insertion of femoral lines for patients with burns over 20%. All 10 of 10 patients with DVT had femoral lines

inserted. It was found that the femoral lines, albeit inserted on time, were not inserted in the right manner or were either inserted after multiple attempts (Figs 1 to 4). This caused injury to major vessel walls, which then brought the Virchow's triad into play. A further investigation revealed that the root cause of this was the insertion of these lines performed in the casualty by the junior-most and unsupervised surgical residents.

There also was no practice of patients being placed on prophylactic therapy for the prevention of DVT. It was feared that in view of extensive raw areas in burn wounds, prophylactic treatment for DVT would increase bleeding during dressings.

There was no protocol as such for prevention of or detection of DVT.

Clinically all patients with confirmed DVT had shown the manifestations of DVT in terms of leg swelling, edema, gangrene, and pain in the lower limbs. Homan's and Moses' sign were positive. Vascular Doppler studies were performed on all the patients to confirm the DVT and were positive in all cases.

Protocols Initiated

No femoral line insertion was to be done in the casualty/emergency room. If considered necessary to be done by an experienced faculty.



Fig. 1: Exposed cannula femoral region

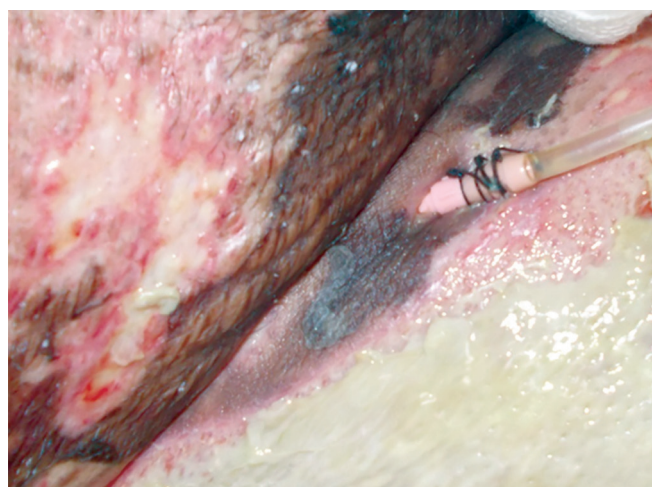


Fig. 2: Cannula inserted very close to the burnt area



Fig. 3: Multiple puncture attempts



Fig. 4: Exposed cannula inserted at an angle

DVT compression stockings were applied immediately on being received in the burns unit. If patients could not afford the TED stockings, crepe bandaging from the toes to the groin was done.

Ambulation of the patient was done at the earliest, ideally within 24 hours after resuscitation from the shock, unless the patient was being ventilated for inhalational injuries.

LMWH in the appropriate doses was started in the burns unit immediately on admission. This was done also for patients received from other hospitals but within 72 hours of having sustained burns.

Warfarin was started simultaneously again in the appropriate doses. LMWH was discontinued once the effect of warfarin had set in as determined by the PT/INR. Warfarin was continued for 2–3 weeks depending on the severity of the burn wound.

For cases planned for early excision and skin grafting, Warfarin was discontinued, and patients were shifted to LMWH.

Adequate blood products were kept standby along with protamine. Protamine however never had to be used during the period of the study.

Patients were given prophylactic doses of vitamin K. A very high-calorie high-protein diet (a minimum of about 4000 kcal and 200 g of proteins) is administered through a nasogastric feeding tube.

CONCLUSION

This is a relatively small and short study carried out over a period of 4 years only. It was started in what was a relatively newly established burns unit of a tertiary care teaching hospital. There were no protocols laid down for the management of burns patients as there was no plastic surgeon associated with the unit till 2013.

A relatively high incidence of DVT was noticed in this study. Analysis of the data collected resulted in the initiation of a strictly followed protocol for the prevention, a drug prophylaxis to prevent DVT, and guidelines for treatment of established DVT.

The results of the protocol were remarkable in that there was no incidence of DVT in fresh cases of severe burns admitted to the unit. The only patient in the prospective study was admitted with established DVT as no prophylaxis had been given in the referring hospital.

CLINICAL SIGNIFICANCE

Though DVT is a well-researched and reported condition, there is very little reliable literature or references available on the incidence or etiopathology of this completely preventable but clinically critical condition in burns patients.

The inordinately high incidence of DVT in a relatively unestablished burns unit was a matter of concern. Hence this study was carried out, and with the completion of the study the incidence of DVT in freshly admitted cases of burns came down to zero.

A well-researched protocol for the prevention of DVT in cases of severe burns has been introduced in the burns unit of the Pravara Rural Hospital with excellent results. It is recommended that a similar protocol may be adopted in various burn units and centres, where such a protocol does not exist. More research and studies may result in India being a pioneering country in the introduction of such a protocol.

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