

## Prospective Analysis of Pressure Injuries Patients in Relation to Deep Venous Thrombosis

Fawzy Ahmed Hamza, Abd Elnaser Mohammad Abdelrahman, Mahmoud Zidan Abdelaziz

Department of Plastic and Burn Surgery, Faculty of Medicine - Al Azhar University

Corresponding author: Mahmoud Zidan Abdelaziz, Mobile: (+20)01114398065, E-Mail: drmahmoud59@yahoo.com

### ABSTRACT

**Background:** Pressure injuries are a serious complication of multimorbidity and immobility. They are defined as a wound that develops in the upper layers of the skin as the result of sustained, externally applied pressure and then enlarges both radially and into the deeper tissue layers. **Objective:** It is prospective analysis of the possibilities of occurrence of deep venous thrombosis in pressure injures patients. **Patients and methods:** This study was conducted to analyze the possibilities of incidence of DVT in pressure injuries patients at AlAzhar University Hospitals; ElHussein and Sayed Galal Hospitals. This study was performed on 30 patients complaining of pressure injuries. The age of the patients ranged from 19 to 59 years and there were 20 males and 10 females. **Results:** The results of the study revealed that there was no incidence of deep venous thrombosis in 29 patients with pressure injuries during the follow up period. The incidence of DVT of this present research was not statistically significant with only one case of DVT with 0.03% ( $p = 0.08$ ). **Conclusion:** From all the above-mentioned data, we might conclude that all patients with pressure injuries had less incidence of deep venous thrombosis. Therefore, we encourage further research and exploration in this promising field that may help in discovering a solution for deep venous thrombosis. **Keywords:** Pressure Injuries Patients, Deep Venous Thrombosis.

### INTRODUCTION

Pressure injuries are a serious complication of multimorbidity and immobility. They are defined as a wound that develops in the upper layers of the skin as the result of sustained, externally applied pressure and then enlarges both radially and into the deeper tissue layers <sup>(1)</sup>. Injuries are not always preventable or curable. Impaired perfusion, among other factors, increases the risk of decubitus injuries, and cognitive disturbances can make prophylactic measures more difficult <sup>(2)</sup>.

The prevalence of high-grade decubitus injuries (grades 3 and 4) is as high as 3% and may reach 4% among elderly persons receiving nursing care in institutions. There has been no significant decline in the prevalence of decubitus injuries over the last 10 years, as a study from Hamburg has shown <sup>(3)</sup>.

Risk factors should be assessed at the first contact of an immobile patient with a health-care professional. The appropriate measures to be taken can then be determined based on the patient's individual risk profile <sup>(4)</sup>. With an emphasis on two cardinal principles; active promotion of movement and passive pressure reduction through frequent changes of position. Furthermore, malnutrition, impaired perfusion, and any underlying diseases that restrict mobility should be addressed with specific therapy, and accompanying symptoms, such as pain and should be treated symptomatically <sup>(5)</sup>.

A decubitus injury is usually accompanied by an inflammatory reaction, and often by local bacterial colonization or systemic infection. Exudation from large areas of damaged skin leads to fluid and protein loss. Since decubitus injuries first arise in the upper layers of the skin, then extend outward and downward,

their severity is classified according to the depth of extension <sup>(6)</sup>.

The damage can be reversed by removing the excessive pressure that caused it, as long as there is no open wound. As soon as a grade 1 decubitus injury (L89.0) is found, pressure-reducing measures such as pressure-free positioning, frequent changes of position, and frequent inspections should be ordered and carried out <sup>(7)</sup>.

A deep vein thrombosis (DVT) is a blood clot in a vein, deep in the body. Veins are blood vessels with valves that help blood flow in one direction. When your muscles contract the blood is pushed through the veins in your legs and arms. Blood clots can block the flow of blood through the body. This can cause swelling and other problems in the body. Another concern is that the clot may break loose, travel through the bloodstream and block blood flow in the lungs, heart, or brain <sup>(8)</sup>.

### AIM OF THE WORK

It is prospective analysis of the possibilities of occurrence of deep venous thrombosis in pressure injures patients.

### PATIENTS AND METHODS

#### Study design

**Type:** Prospective cohort study.

**Site:** This study was conducted on 30 pressure injuries patients at the Plastic and Burn Surgery Department of Al-Azhar University Hospitals (Alhussien and Sayed Galal University Hospitals).

**Period:** from December 2017 to October 2018.

**Ethical approval:** Study approval was given by the Research Ethics Committee of Al-Azhar Faculty of Medicine, Cairo, Egypt on December 2017.

**Inclusion criteria:**

- Patients with pressure injury
- With or without spine or brain injury
- Patients with grade 1, 2, 3 and 4 pressure ulcers
- No age or sex limits-
- No anticoagulants therapy during course and precourse study period

**Exclusion Criteria:**

- Patient with history of deep venous thrombosis
  - Patient under anticoagulation therapy
  - Patient associated with advanced medical diseases
- Pre-operative and peri-operative patients' characteristics were prospectively recorded in a local database.

At time of admission, each patient had been evaluated through:

[1] **History:** Detailed history (personal history, history of present illness, past and family history)

[2] **Examination:**

**General examination** (General appearance, color, decubitus, any general disease, cardiac consultation, chest and abdominal consultation)

**Local examination** of the lesion (site, size, borders, consistency, edges, tenderness, temperature)

[3] **Investigations;** Coagulation profile, and duplex were done in both pre- and post-operative

**Laboratory investigations**

**Imaging: Vascular Duplex**

All patients were followed after hospital discharge with mean 2-3 months of follow-up duration. Laboratory investigation was done at time of admission and post-operatively including prothrombin time (PT), partial prothrombin time (PTT), factor 8 and international normalized ratio (INR). In addition, duplex was undertaken for all injuries' sites.

All samples were collected in the laboratory using an evacuated tube system, Vacuette (Greiner) into citrate anticoagulant at the ratio of 1:9 following the proper order of draw, and processed for 30 minutes of the collection after double centrifugation. F VIII: C is assayed through 1-2 hrs of the sample collection and for rest of the assays like phosphatidylcholine (PC), phosphatidylserine (PS), the citrated samples are frozen in vials and stored at  $-800^{\circ}\text{C}$ .

Immediately upon patient admission to the ultrasound (US) department, all patients were assessed for DVT by venous duplex ultrasound (using a Sonoline G 60S US imaging system; Siemens – Germany, equipped with a high frequency (7–10 MHz) linear probe). Gray-scale images and color and spectral waveforms were recorded without and with compression and from the long axis respectively [using UP-D898MD digital, black and-white A6 printer; Sony and UPP-110S high density standard US thermal paper roll (110 mm × 20 m)]. Distal augmentation

maneuvers were performed with manual calf compression while investigating the common femoral vein (CFV), superficial femoral vein (SFV), and popliteal vein (POPV) segments. Foot compression was used to evaluate the posterior tibial veins (PTVs). US examination was considered to be negative if there was a normal blood flow in CFV, SFV, POPV, and PTVs, with the vessel lumen fully compressible and completely filled with color. DVT was diagnosed if the vessel wall was not compressed. Because color ultrasound (CDUS) is operator dependent, all scans were performed by an experienced musculoskeletal US sonologist.

US scanning was conducted with the patient in the supine position with the head raised from 15 to 30 degrees and the examination table tilted by 5 to 10 degrees (reverse Trendelenburg tilt). The investigated leg was outwardly rotated at the hip with the knee slightly. In the short axis, starting at CFV and advancing into the distal external iliac vein (EIV). The transducer was moved moderately inferiorly to completely scan CFV and SFV throughout the thigh and to scan POPV from a posterior approach throughout the popliteal fossa. From a posteromedial access in the lower extremity, PTVs were evaluated. Probe compression was applied at 1 to 2 cm intervals for all vein sections, with each section evaluated for complete compressibility and for the presence of any intraluminal echoes suggestive of thrombus. Longitudinal inspections were applied to assure the presence of intraluminal echoes seen on short axis imaging and to obtain spectral waveforms of venous hemodynamics in CFV, SFV, POPV, and PTVs.

[4] **Management**

**a) Conservative**

**Indications:**

Grade I and Grade II pressure injuries. It was used in grade II and II pressure sores, which was in 4 patients during our study period with 3 trochanteric and one sacral pressure injury. It is essential to be started with local wound care with debridement and cleaning the wound. Furthermore, topical medications is introduced along with antibiotics.

**b) Surgical**

**Indications:**

Grade III, Grade IV pressure injury and complications as osteomyelitis and malignancy.

The patients of pressure injuries is either ambulated or non-ambulated. In ambulated patients we preferred fascio-cutaneous flaps as the priority. In non-ambulated patients, muscle flap is preferred for those patients because of low range of movement in those patients. The patients of pressure injuries were 12 patients with ischeal pressure ulcer, which was covered by gluteus maximus muscle flap in 6 patients while 2 cases had V-Y flap and 2 cases had inferior gluteal flap. Furthermore, one case had posterior thigh flap and another had gracilis and posterior thigh flap.

On the other hand, 6 patients had sacral pressure sores who were covered by bilateral V-Y flap.

### Results

In the present work, 30 patients with pressure injuries were included. All patients' data of preoperative were reported in details. 29 patients were committed to the follow-up to the end and only one

**Table (1):** The ages of the patients

	Number of patients	Range of age
Case	30	19-59 years old

**Table (2):** The sex of the patients

	Male	Female
Case	20 (66.6%)	10 (33.3%)

**Table (3):** Cause of pressure sores

Cause	Number	%
Traumatic	22	73.3
Neurodegenerative	1	3
Cerebral Stroke	4	13.3
Hepatic (Hepatolenticular degeneration)	1	3
Cardiac (Heart failure)	1	3
Metabolic	1	3

Table (3) showed that the causes of pressure injuries were; trauma in 22 cases, 4 cases were of preoperative cerebral stroke and one case was for each neurodegenerative cause, hepatic, cardiac and metabolic.

**Table (4):** Pressure site and grade of the included patients

Pressure site	Number	%
Sacrum	7	20
Ischium	12	30
Trochanteric	3	26.7
Heel, Scapular	3	20
Scalp, Heel	1	3
Ischium, Trochanteric	2	6
Trochanteric, Scalp	1	3
Elbow, Heel, Trochanteric	1	3
Grades of Pressure injuries		
Grade I	2	26.7
Grade II	2	33
Grade III	12	23
Grade IV	14	10

Regarding the sites of pressure sores, the most common site was ischium with 12 cases and 7 cases

patient died. Range of age was 19-59 years old. 20 patients were male and 10 patients were female. The incidence of DVT of this present research was not statistically significant with only one case who was lost during follow up.

### Socio Demographic Data

Table (1) Showed the age of all included patients were for sacrum. The rest of sites were presented in table (4) as follows; 3 at the trochanters, 3 at the heel and scapula, 1 at the scalp and heel, 2 at the ischium and trochanter, 1 at the scalp and trochanter and 1 at the elbow and heel and trochanter.

### Investigations

#### Laboratory Investigations

- CBC

Most of included patients (16) were anemic at the time of admission and corrected by blood transfusion before the operation while the rest had normal hemoglobin.

- **Liver Function:** Liver function was normal in almost all patients.

- **Kidney function:** Kidney function was normal in almost all patients

- **Coagulation profile:** normal coagulation profile was detected as well. Factor VIII was normal for all patients except for one patient that we couldn't assess it.

- **Imaging: Vascular Duplex:** Duplex was normal for all patients either pre-operative or post-operative except for one patient who was not done. As expected comparing pre-operative and post-operative investigations, there were no statistical difference between both time points.

**Outcome of the study:** 29 patients were free from venous thromboembolism while only one case who died during follow up (septicemia) and his postoperative laboratory test couldn't be done. All other patients included in the study were normal as of pre and post-operative except one did not catch DVT either pre or post-operative.

**Follow-up:** 4 patients with grade I and II had been treated with medical treatment in form of antibiotic prescription, proper dressing and anti-edematous medications. One patient out of 4 had recurrence of their conditions. 26 patients with grade III and IV had been treated with surgical operation in form of either propeller flap or standard flap based on the several factors such as the size and diameter of the pressure injury and the mobility condition of the patient too. The surgical treatment had no recurrence rate reported (Tables 5 and 6).

**Table (5):** Follow-up results and recurrence rate

Treatment	Patients	Recurrence
Medical	4	1
Surgical	26	0

**Table (6):** Summary of patient's characteristics

ID	Age (year)	Sex	Site of injury	Cause of pressure sore	Duration (year)	Grades	PT, PTT, INR	Factor VIII	Duplex
1	20	Male	Sacrum	Neuro degenerative	3	3	normal	normal	abnormal
2	43	Male	Sacrum	Traumatic	2	2	normal	normal	normal
3	49	Male	Sacrum	Traumatic	4	4	normal	normal	normal
4	49	Female	Sacrum	Traumatic	2	3	normal	normal	Normal
5	34	Male	Ischium	Traumatic	5	3	normal	normal	Normal
6	29	Female	Ischium	Traumatic	4	3	normal	normal	Normal
7	19	Male	Ischium	Traumatic	5	4	INR:4	-	Normal
8	39	Male	Trochanteric	Traumatic	6	2	normal	normal	Normal
9	25	Female	Trochanteric	Traumatic	3	1	normal	normal	Normal
10	36	Female	Sacrum	Traumatic	3	3	normal	normal	Normal
11	34	Male	Sacrum	Traumatic	2	4	normal	normal	Normal
12	20	Male	Trochanteric	Traumatic	1,5	4	normal	normal	Normal
13	24	Male	Heel, Scapular	Traumatic	2,5	4	normal	normal	Normal
14	36	Male	Ischium, Trochanteric	Traumatic	4	3	normal	normal	Normal
15	25	Male	Ischium	Traumatic	4	4	normal	normal	Normal
16	45	Male	Ischium	Traumatic	6	4	normal	normal	Normal
17	29	Female	Heel, Scapular	Traumatic	1,5	4	normal	normal	Normal
18	47	Female	Ischium	Hepatic	4	3	normal	normal	Normal
19	63	Male	Ischium	Stroke	3	4	normal	normal	Normal
20	42	Male	Ischium	Traumatic	2	4	normal	normal	Normal
21	53	Male	Trochanteric	Traumatic	5	1	normal	normal	Normal
22	39	Female	Trochanteric, Scalp	Metabolic	5	4	normal	normal	Normal
23	40	Female	Heel, Scapular	Cardiac	4	4	normal	normal	Normal
24	34	Female	Ischium	Traumatic	2	4	normal	normal	Normal
25	45	Female	Sacrum	Traumatic	2	3	normal	normal	Normal
26	56	Male	Ischium	Traumatic	3	4	normal	normal	Normal
27	43	Male	Elbow, Heel, Trochanteric	Stroke	4	3	normal	normal	Normal
28	45	Male	Ischium	Traumatic	4	3	normal	normal	Normal
29	59	Male	Ischium, Trochanteric	Stroke	4	3	normal	normal	Normal
30	55	Male	Ischium	Stroke	5	4	normal	normal	Normal

## DISCUSSION

Surgical practice have many complications as venous thromboembolic disorders that resemble one of the major causes of morbidity and mortality especially in prolonged operations. This is due to prolonged stasis and increased blood viscosity in these patients. Pressure injuries patients are bed ridden and suffer from prolonged stasis. It was noticed that those pressure injuries patients show no incidence of venous thromboembolism.

This study was conducted to analyze the possibilities of incidence of DVT in pressure injuries patients at Al-Azhar University Hospitals; ElHusseini and Sayed Galal Hospitals. This study was conducted on 30 patients complaining of pressure injuries. The

age of the patients ranged from 19 to 59 years old. They were 20 males and 10 females.

The pressure injuries sites varied as there were 7 at the sacrum, 12 at the ischium, 3 at the trochanters, 3 at the heel and scapula, 1 at the scalp and heel, 2 at the ischium and trochanter, 1 at the scalp and trochanter and 1 at the elbow and heel and trochanter. The grades of the pressure injuries were 2 patients of grade I, 2 patients of grade II, 12 patients of grade III and 14 patients of grade IV.

The etiology of the pressure injuries in the patients were; 22 patients post-traumatic, 1 patient neurodegenerative, 4 patients cerebral stroke, 1 patient hepatolenticular degeneration, 1 patient heart failure and 1 patients metabolic disease.

The diagnosis of venous thromboembolism in these patients, was performed through full laboratory investigations: Complete blood count, prothrombin time and concentration, partial thromboplastin time, international normalized ratio, liver and kidney functions and Von Willebrand factor together with the vascular duplex ultrasound for all patients pre-operatively and post-operatively that was in agreement with **Dakson *et al.*** <sup>(9)</sup> who stated that the diagnosis of deep vein thrombosis (DVT) or pulmonary embolism (PE) was based on diagnostic imaging (Doppler ultrasound or CT pulmonary angiography, respectively) and was only performed upon clinical suspicion from the treating physician.

All patients didn't receive any prophylaxis for venous thromboembolism during the study period, which was in agreement with **Powell *et al.*** <sup>(10)</sup>, who stated that many SCI patients did not receive DVT prophylaxis in the care setting, perhaps secondary to concomitant medical problems that may enhance the risk of bleeding.

The Treatment strategy varied according to the grade of the pressure injury and patients compliance as 4 patients with grade I and grade II received medical treatment in the form of systemic and topical antibiotic creams with the conventional dressings and anti-edematous medications. 26 patients with grades III and IV were treated surgically by fasciocutaneous flaps or myocutaneous flaps or both.

29 patients were followed up for 2 months after beginning of the medical or surgical treatment, one patient dropped out from the study because of death from septicemia.

The results of the study revealed that there was no incidence of deep venous thrombosis in the 29 patients with pressure injuries during the follow up period.

The incidence of DVT of this present research was not statistically significant with only one case of DVT with 0.03% ( $p = 0.08$ ).

This phenomena that there was no incidence of deep venous thrombosis in pressure injuries patients may be attributed to anemia, which was found in most of the patients that decrease blood viscosity. In addition,

most of the patients were post- traumatic with spinal cord injury (spastic muscles) that squeeze blood vessels and reduce blood stagnation.

From all the above mentioned data, we concluded that all patients with pressure injuries have less incidence of deep venous thrombosis. Therefore we encourage further research and exploration in this promising field that may help in discovering a solution for deep venous thrombosis.

## REFERENCES

1. **Anderson FA, Wheeler HB, Goldberg RJ *et al.* (1991):** Physician practices in the prevention of VTE. *Annals of Internal Medicine*, 115: 591-595.
2. **Norman G, Dumville JC, Moore ZE *et al.* (2016):** Antibiotics and antiseptics for pressure ulcers. [https://www.cochrane.org/.../WOUNDS\\_antibiotic-s-and-antiseptics-pressure-ulcers](https://www.cochrane.org/.../WOUNDS_antibiotic-s-and-antiseptics-pressure-ulcers)
3. **Ruzzo A, Graziano F, Kawakami K *et al.* (2006):** Pharmacogenetic profiling and clinical outcome of patients with advanced gastric cancer treated with palliative chemotherapy. *J Clin Oncol.*, 24 (12): 1883-91.
4. **Harvey RL, Lovell LL, Belanger N *et al.* (2004):** The effectiveness of anticoagulant and antiplatelet agents in preventing venous thromboembolism during stroke rehabilitation: a historical cohort study. *Archives of physical medicine and rehabilitation*, 85(7):1070-1075.
5. **Cohen AT, Tapson VF, Bergmann JF *et al.* (2008):** Venous thromboembolism risk and prophylaxis in the acute hospital care setting (ENDORSE Study): a multinational cross-sectional study. *Lancet*, 371: 381-394.
6. **Lala D, Dumont FS, Leblond J *et al.* (2014):** Impact of pressure ulcers on individuals living with a spinal cord injury. *Arch Phys Med Rehabil.*, 95: 2312-2319.
7. **Nossent AY, Eikenboom JC, Bertina RM *et al.* (2007):** Plasma coagulation factor levels in venous thrombosis. *Semin Hematol.*, 44 (2): 77-84.
8. **Tripodi A (2003):** Levels of coagulation factors and venous thromboembolism. *Haematologica*, 88 (6): 705-11.
9. **Dakson A, Brandman D, Thibault-Halman G *et al.* (2016):** Venous thromboembolism and pressure ulcers in acute spinal cord injury: a retrospective review. *JSM Spine*, 1 (1): 1001.
10. **Powell M, Kirshblum S and O'Connor KC (1999):** Duplex ultrasound screening for deep vein thrombosis in spinal cord injured patients at rehabilitation admission. *Arch Phys Med Rehabil.*, 80: 1044-1046.