

## **AIM OF THE WORK**

The purpose of this study was to assess the role of the vacuum assisted closure (VAC) therapy in the management of complicated wounds.

## **PATIENTS**

This study was carried out for 30 patients with complicated wounds admitted to the Casualty Department and Plastic Surgery Department at Alexandria Main University hospital.

The complicated wounds in the study refer to a variety of wounds including; diabetic foot infections, bed sores, burst abdomen, delayed non-healing wounds, post burn raw areas and post traumatic raw areas.

## **MATERIAL AND METHODS**

All patients were subjected to the following:

### **I-Pre-VAC study:**

#### **A) Personal history:**

##### **1- Personal data:**

This includes name, age, residence, occupation, marital status, number of children and their ages.

##### **2- Family history:**

Family history included diabetes mellitus, cardio vascular diseases.

##### **3- Drug history:**

Corticosteroid, chemotherapy, non steroidal anti inflammatory drugs.

##### **4- Medical history:**

Medical history including: diabetes mellitus, cardiovascular diseases, bronchial asthma.

##### **5- Surgical history:**

For previous surgical procedures.

##### **6- History of trauma:**

#### **B) History of the wound:**

##### **1-Etiology of the wound:**

Diabetic foot infections, bed sores, burst abdomen, delayed wounds, post burn raw areas and post traumatic raw areas.

##### **2-Duration of the wound:**

##### **3-Previous interventions:**

Surgical debridement, other types of dressings, previous coverage by flap or graft.

#### **C) Clinical examination:**

Local and systemic clinical examination has been done to rule out any associated diseases.

**D) Informed written consent:**

Informed written consent has been taken.

**E) Routine laboratory investigations:**

Complete blood picture, bleeding time, clotting time, prothrombin time and activity, renal and liver functional tests and random blood glucose.

**II- procedure**

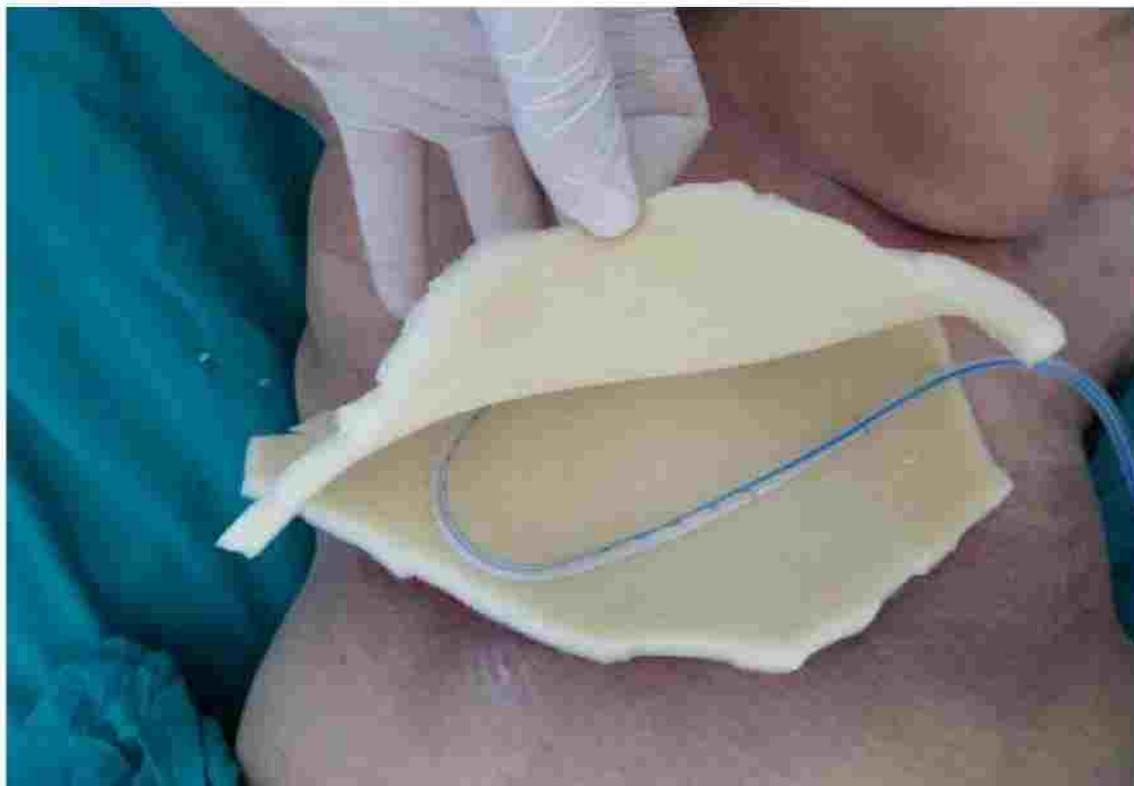
**1. Wound Preparation.**

Any dressings from the wound were removed and discarded. A swab for microbiology culture and sensitivity was taken before wound irrigation with normal saline.

In case of necrotic tissues surgical debridement was done, and adequate haemostasis was achieved. Prior to application of the drape, it was essential to prepare the peri-wound skin and ensure that it was dry.

**2. Placement of Foam.**

Double layers of 1 cm thickness open-pore foam sterilized by autoclave, into which was embedded an evacuation tube of 16 or 18 Fr. were gently placed into the wound cavity. Then the tube was connected to a container of vacuum pump. (**Figure 7**).



**Figure (7): Placement of foam**

### **3. Sealing with Drapes.**

The site was then sealed with an adhesive drape covering the foam and all around the tube and at least three to five centimeters of the surrounding healthy tissue to ensure an airtight seal. (**Figures 8 and 9**).



**Figure (8): Sealing the foam**



**Figure (9): Sealing the tube**

#### **4. The Application of Negative Pressure.**

Controlled intermittent pressure was applied to the wound. The vacuum pump delivers a negative pressure of  $-125\text{mmHg}$ . The cycle was of one hour on and one hour off. (Figure 10).



**Figure (10): Application of negative pressure**

#### **5. Follow up of the patient.**

After 3-4 days, the VAC dressing was changed. The wound was washed thoroughly with normal saline and VAC was re-applied in most cases at bedside.

The same routine was continued until full healing or satisfactory clean, granulating wound bed was obtained for the definitive procedure.

Data were collected using a pre-designed proforma. Demographic information collected includes age, sex and co-morbid condition. Information noted for wound includes site and etiology of the wound, size before and after application of VAC. Mean, frequency, ratio and percentages were calculated and data were tabulated also in the form of tables

#### **Statistical analysis of the data <sup>(75)</sup>**

Data were analyzed using IBM SPSS software package version 20.0. <sup>(76)</sup> Qualitative data were described using number and percent. Quantitative data were described using range (minimum and maximum), mean, standard deviation and median.

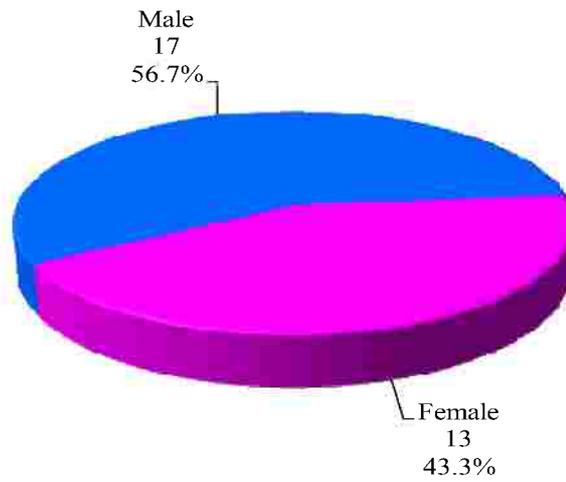
## RESULTS

The study was conducted for thirty patients with complicated wounds admitted to the Casualty Department, Plastic Surgery Department and Burn Unit at Alexandria Main University hospital.

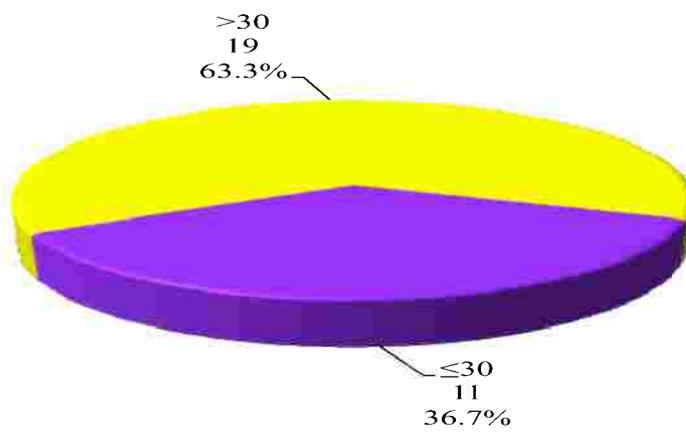
The study included 17 males (56.7%) and 13 females (43.3%). Their ages ranged from 3 years old to 70 years old with 19 patients (63.3%) above 30 years and 11 patients (36.7%) below 30 years. The mean age was 38 years. (Table 1, Figure 11 and 12)

**Table (1): Distribution of studied sample according to demographic data (n=30)**

	No.	%
<b>Sex</b>		
Male	17	56.7
Female	13	43.3
<b>Age</b>		
≤30	11	36.7
>30	19	63.3
Min. – Max.	3.0 – 70.0	
Mean ± SD.	38.13 ± 21.46	
Median	36.50	



**Figure (11):** Distribution of studied sample according to sex



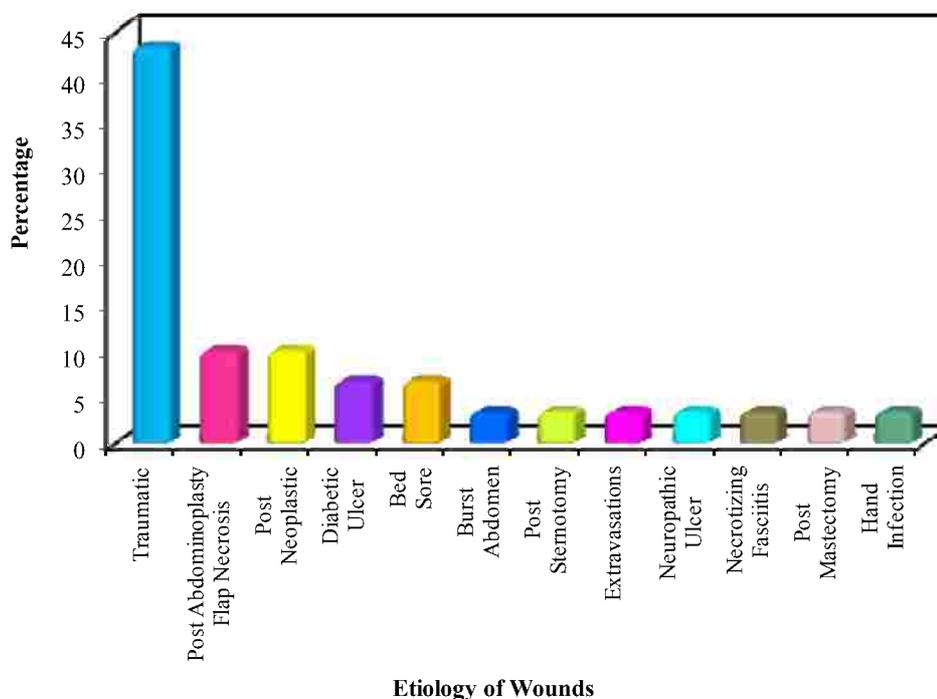
**Figure (12):** Distribution of studied sample according to age

## Results

Among the 30 patients, the commonest cause was trauma, with 13 patients were due to road traffic accident, 3 patients were due to post-abdominoplasty flap necrosis, 3 patients due to post operative raw area secondary to neoplastic excision, two patients secondary to diabetic foot infections, two patients due to pressure sores, two patients due to post operative wound dehiscence( sternotomy wound and burst abdomen ) one patient due to hand infection, one patient after extravasations, one patient after mastectomy, one patient due to neuropathic ulcer and other one after necrotizing fasciitis.(Table 2, Figure 13)

**Table (2): Distribution of studied sample according to etiology of wounds (n=30)**

Etiology of Wounds	No.	%
Traumatic	13	43.3
Post Abdominoplasty Flap Necrosis	3	10.0
Post Neoplastic	3	10.0
Diabetic Ulcer	2	6.7
Bed Sore	2	6.7
Burst Abdomen	1	3.3
Post Sternotomy	1	3.3
Extravasations	1	3.3
Neuropathic Ulcer	1	3.3
Necrotizing Fasciitis	1	3.3
Post Mastectomy	1	3.3
Hand Infection	1	3.3



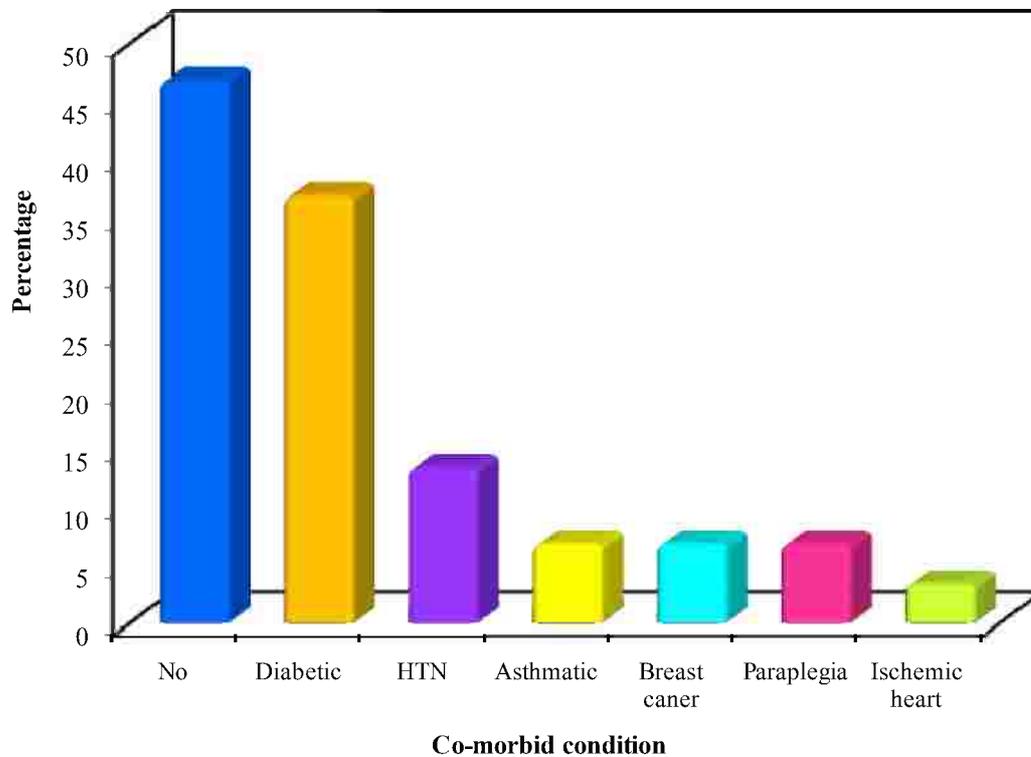
**Figure (13): Distribution of studied sample according to etiology of wounds**

## Results

Multiple associated medical conditions were encountered in the patients, 11 patients with diabetes mellitus, 4 patients with hypertension, two patients with chronic bronchial asthma, two patients with breast cancer, two with paraplegia and one ischemic heart disease. (Table 3, Figure 14)

**Table (3): Distribution of studied sample according to associated medical condition**

Co-morbid condition	No.	%
No	14	46.7
Diabetic	11	36.7
Hypertension	4	13.3
Asthmatic	2	6.7
Breast caner	2	6.7
Paraplegia	2	6.7
Ischemic heart	1	3.3



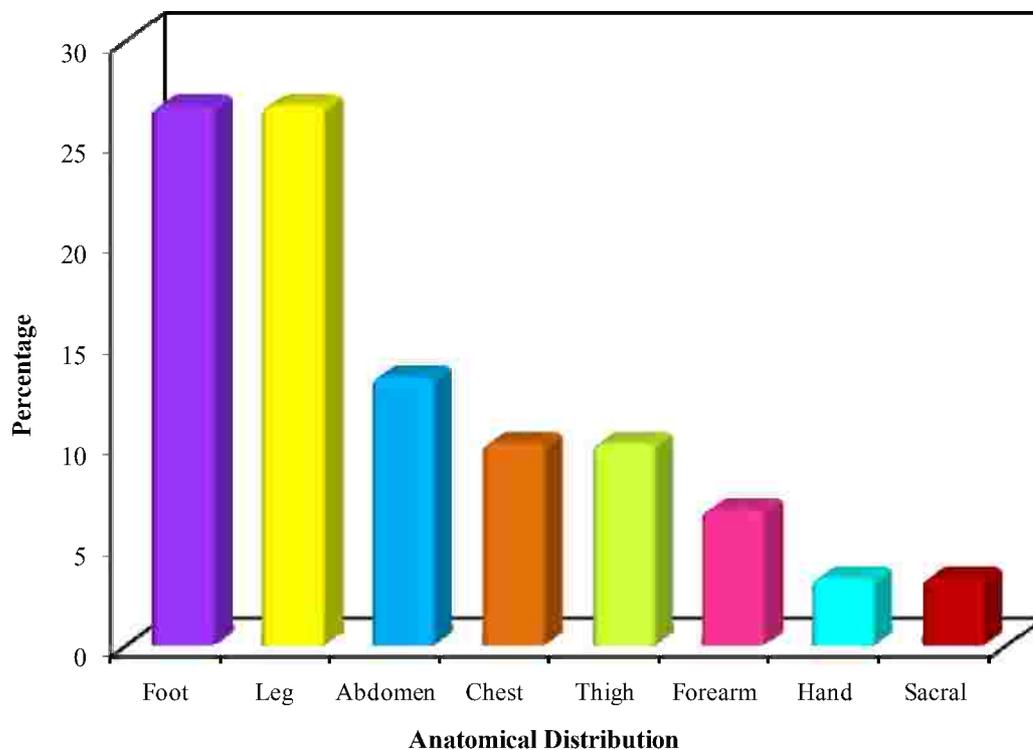
**Figure (14): Distribution of studied sample according to Co-morbid condition**

## Results

The most common anatomical site of the wounds was the lower limb , with 8 patients with wounds in the leg, 8 patients in the foot, 4 patients in the abdomen , 3 patients in the chest , 3 in the thigh, 2 in the forearm, one in the hand and one in the sacrum. (Table 4, Figure 15)

**Table (4): Distribution of studied sample according to anatomical distribution (n=30)**

Anatomical Distribution	No.	%
Foot	8	26.7
Leg	8	26.7
Abdomen	4	13.3
Chest	3	10.0
Thigh	3	10.0
Forearm	2	6.7
Hand	1	3.3
Sacral	1	3.3



**Figure (15): Distribution of studied sample according to anatomical distribution**

## Results

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The longest diameter of the wounds ranged from 3 cm to 44 cm, with mean size of 20.3cm. The reduction in the wound size ranged from 10% to complete healing with mean reduction of 43.6 %. (Table 5)

**Table (5): Descriptive analysis of studied sample according to initial size of wound (cm) and percentage of size reduction (n=30)**

	<b>Min. – Max.</b>	<b>Mean. ± SD.</b>	<b>Median</b>
<b>Initial size of wound (cm)</b>	3.0 - 44.0	20.33 ± 11.55	17.50
<b>Percentage of size reduction (%)</b>	10.0 – 100.0	43.67 ± 34.46	25.0

The number of VAC dressings ranged from 4 to 16 times, with mean 6.9 dressings. The duration of these dressings took from 2 to 8 weeks with mean duration of 3.5 weeks. (Table 6)

**Table (6): Descriptive analysis of studied sample according to No. of VACs and Duration of VAC (n=30)**

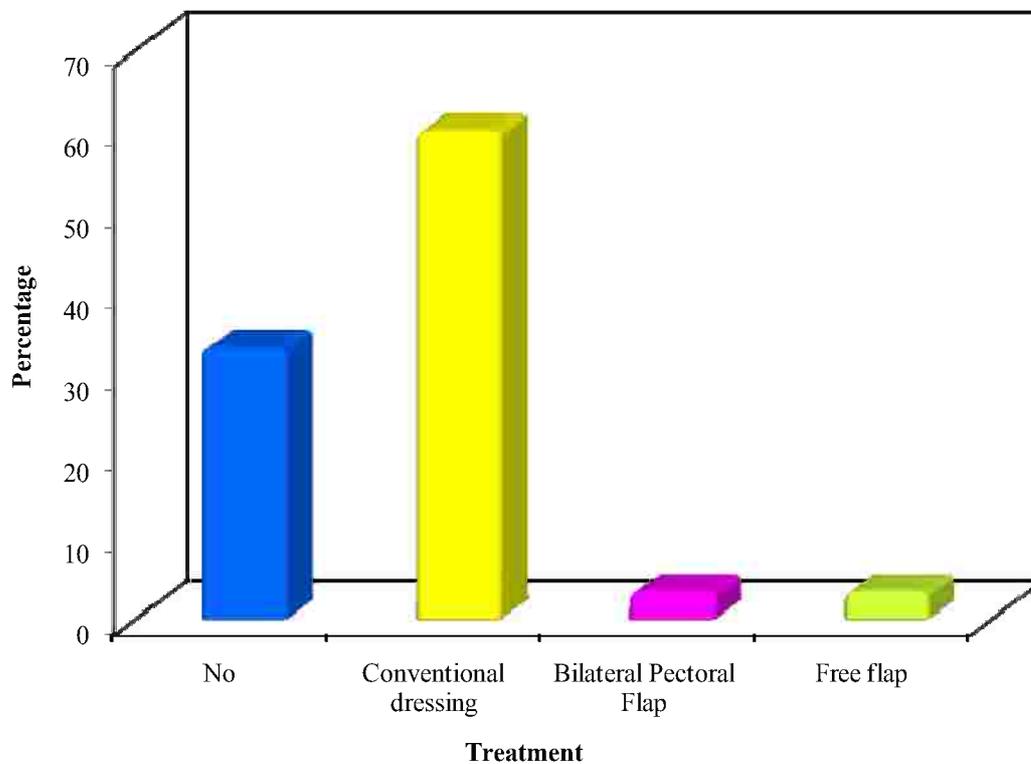
	<b>Min. – Max.</b>	<b>Mean. ± SD.</b>	<b>Median</b>
<b>No. of VACs</b>	4.0 – 16.0	6.90 ± 2.77	6.0
<b>Duration of VAC (weeks)</b>	2.0 – 8.0	3.50 ± 1.33	3.0

**Results**

The application of VAC dressing was the 1<sup>st</sup> procedure to be done in 10 patients (33.3%) and 18 patients (60%) tried conventional dressing with mean time of 1.97 months before VAC dressing while other 2 patients (6.6%) VAC was applied after failure of reconstruction by flap. (Table 7, Figure 16)

**Table (7): Distribution of studied sample according to pre VAC treatment and pre VAC treatment months (n=30)**

Pre VAC	No.	%
<b>Treatment</b>		
No	10	33.3
Conventional dressing	18	60.0
Bilateral Pectoral Flap	1	3.3
Free flap	1	3.3
<b>Duration (months)</b>		
Min. – Max.	1.0 – 6.0	
Mean ± SD.	2.37 ± 1.12	
Median	2.0	



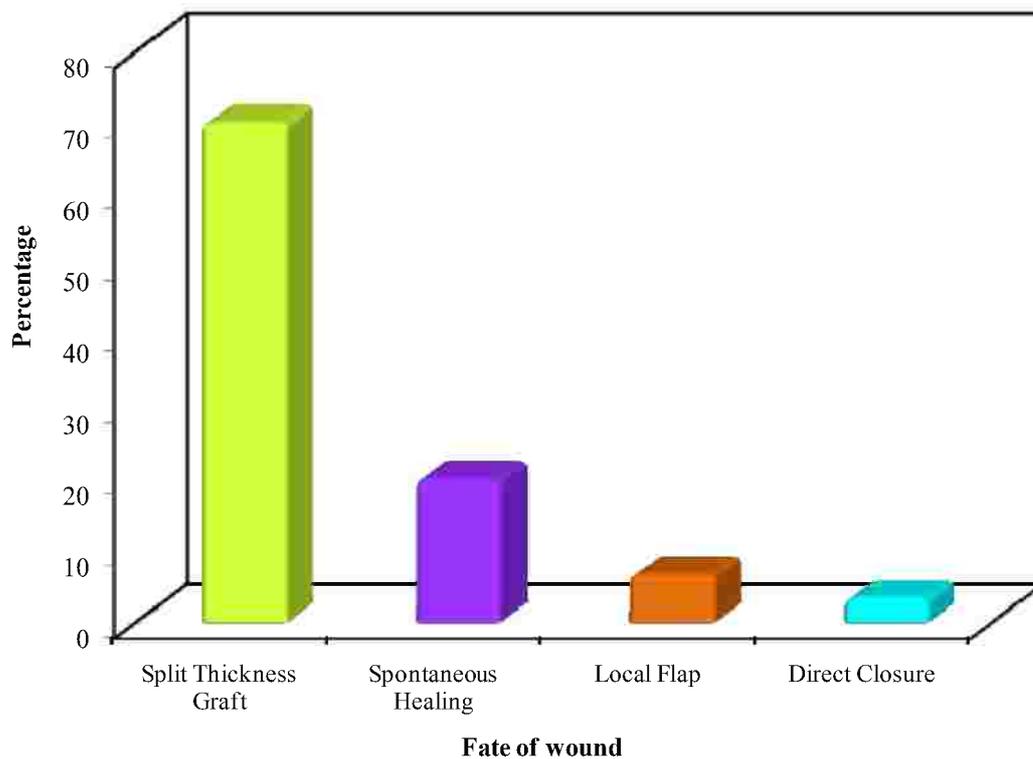
**Figure (16): Distribution of studied sample according to pre VAC treatment**

## Results

Among the 30 patients with VAC dressings, 21 cases (70%) proceeded to split thickness graft, 6 cases (20%) showed spontaneous healing, while two cases (6.7%) underwent local flaps and one case was closed directly. (Table 8, Figure 17)

**Table (8): Distribution of studied sample according to fate of wound (n=30)**

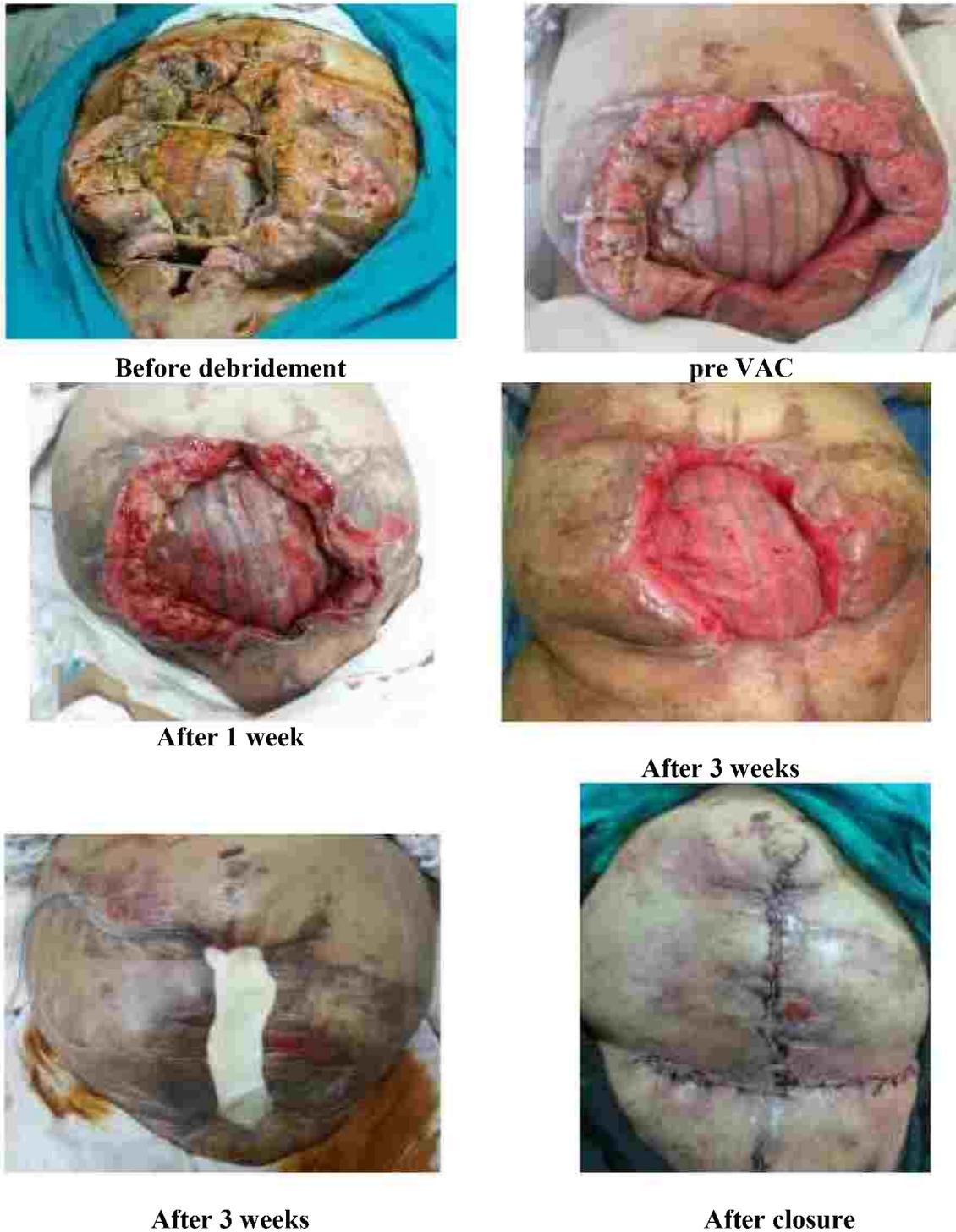
Fate of wound	No.	%
Split Thickness Graft	21	70.0
Spontaneous Healing	6	20.0
Local Flap	2	6.7
Direct Closure	1	3.3



**Figure (17): Distribution of studied sample according to fate of wound.**

**Case (1):**

A 65 years old female presented with a non healing burst abdomen wound after left hemicolectomy for 3 months (**Figure 18**). The VACs were applied, resulting in shrinkage of size of wound and healthy granulation tissue formation. The wound was closed directly by locally advancement flaps.



**Figure (18): Case (1) burst abdomen**

**Case (2):**

A 40 years old male presented with a non healing post-abdominoplasty flap necrosis wound for last 2 months (**Figure 19**). The VACs were applied, resulting in healthy granulation tissue formation and shrinkage of size of wound.



**Pre VAC**



**After 3 days**



**After 4 weeks**



**After 8 weeks**

**Figure (19): Case (2) abdominal flap necrosis**

**Case (3):**

A 62 years old male presented with a non healing poststernotomy wound infection after CABG for last 2 months after failed trial of bilateral pectoral flap (**Figure 20**). The VACs were applied, resulting in shrinkage of size of wound and healthy granulation tissue formation. The wound was finally skin grafted.



**Pre VAC**



**Pre VAC**



**After 4 weeks**



**After skin graft**

**Figure (20): Case (3) post sternotomy wound**

**Case (4):**

A 35 years old male presented with a non healing diabetic foot ulcer for last 3 months (**Figure 21**). The VACs were applied, resulting in spontaneous healing of the ulcer.



**Pre VAC**



**Pre VAC**



**After 1 week**



**After 3 weeks**



**After 8 weeks**

**Figure (21): Case (4) diabetic foot ulcer**

**Case (5):**

A 37 years old male presented with a non healing 12×6 cm wound after a road traffic accident (**Figure 22**). The wound did not respond to conventional treatment. The VACs were applied, resulting in shrinkage of wound and healthy granulation tissue formation that was covered with split-thickness graft.



**Pre VAC**



**Pre VAC**



**After 1 week**



**After 3 weeks**



**After skin graft**

**Figure (22): Case (5) traumatic raw area left ankle**



**Case (7):**

A 52 years old female presented with a non healing post-abdominoplasty flap necrosis wound for last 3 months (**Figure 24**). The VACs were applied, resulting in healthy granulation tissue formation which was covered by split thickness graft.



**Pre VAC**



**After 3 days**



**After 3 weeks**



**After skin graft**

**Figure (24): Case (7) abdominal flap necrosis**

**Case (8):**

A 65 years old male presented with a non healing wound after a road traffic accident (**Figure 25**). The wound did not respond to conventional treatment. The VACs were applied, resulting in healthy granulation tissue formation that was covered with split-thickness graft.



**Pre VAC**



**Pre VAC**



**After 2 weeks**



**After skin graft**

**Figure (25): Case (8) traumatic raw area in left popliteal fossa**

**Case (9):**

A 6 years old male presented with a traumatic wound in the popliteal fossa after a road traffic accident (**Figure 26**). The VACs were applied, resulting in healthy granulation tissue formation that was covered with split-thickness graft.



**Pre VAC**



**After 2 weeks**



**After 3 weeks**



**Early after skin graft**



**After 4 months of skin graft during flexion**



**After 4 months of skin graft during extension**

**Figure (26): Case (9) traumatic raw area in right popliteal fossa**

**Case (10):**

A 45 years old diabetic female presented with a non healing post-abdominoplasty flap necrosis wound for last 3 months (**Figure 27**). The VACs were applied, resulting in decrease in size and depth of wound and healthy granulation tissue formation.



**Pre VAC**



**After 1 week**



**After 8 weeks**

**Figure (27): Case (10) abdominal flap necrosis**

**Case (11):**

A 3 years old female presented with a traumatic wound after a road traffic accident (**Figure 28**). The VACs were applied, resulting in healthy granulation tissue formation that was covered with split-thickness graft.



**Pre VAC**



**After 15 days**



**Early after skin graft**



**Late after skin graft**

**Figure (28): Case (11) traumatic raw area in dorsum of left foot**