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Role of Negative Pressure Wound Therapy In Development of Healthy Granulation Tissue In Acute and Chronic Wounds

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ABSTRACT

Objective — *To find out the role of negative pressure wound therapy (NPWT) in development of healthy granulation tissue in acute and chronic wounds and preparation of wound bed for grafting.*

Study design — *Descriptive case series.*

Place & Duration of study — *Department of Plastic and Reconstructive Surgery, Bahawal Victoria Hospital Bahawalpur, from June 2018 to September 2018.*

Methodology — *Patients were divided into two groups having acute and chronic wounds. Further division was done according to the cause into traumatic, non traumatic and septic, aseptic wounds. VAC was applied for 48-72 hours using foam and Nelton drain, with a pressure up to minus 150 mmHg. Descriptive statistics were applied for analysis.*

Results — *Out of 20 patients 12 were males and 8 females. Fourteen wounds were acute and 6 chronic in nature. Among 14 acute wounds four patients were with comorbids. Two of these developed granulation tissue. Nine acute wounds were traumatic in nature of which eight developed granulation tissue. Among five non traumatic acute wounds, three developed granulation tissue. Among six chronic wounds all developed healthy granulation tissue.*

Conclusions — *Negative pressure wound therapy was well tolerated by patients without developing complications. This resulted in better development of healthy granulation tissue and preparation of wound bed for grafting.*

Key words — *Negative pressure wound therapy, Granulation tissue, Acute wounds, Chronic wounds.*

INTRODUCTION:

Trauma and infection can result in acute and chronic wounds of different shapes and types, according to which management differs. With the passage of time many new methods have been introduced. One of them is vacuum-assisted closure, (VAC) also known as micro deformational wound therapy but commonly called negative pressure wound therapy (NPWT). It is now commonly used for various acute and chronic wounds like pressure ulcers, burn and diabetic foot. It is a device that tightly seals the wound area resulting in an air tight environment which is then connected to a vacuum. This results in a series of biological reactions that enhance wound healing.[1-3] Basically there are four primary mechanisms (i) macro deformation (ii) micro deformation (iii) removal of fluid (iv) changing the environment of wound and secondary mechanisms including angiogenesis, neurogenesis and alteration in bio burden. In NPWT wound site is covered with material having pores e.g. foam or gauze over which a drainage port is applied and wound site is sealed with an adhesive dressing. Porous material helps in pressure transmission in wound. Drainage port is attached to a vacuum pump to built and maintain a negative pressure ranging

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from -50 to -150. Pressure can be applied continuously, intermittently or in a variable mode in which suction level changes but pressure is applied continuously.[4,5]

NPWT is used prior to a skin graft or flap and also secondary closure to enhance up take of graft and wound healing. It is used in postoperative period in lymphangioma and in open fractures. It can be used as an augmented surgical drain to remove fluid accumulated in anatomical cavities and abscesses. There are some contraindications like untreated osteomyelitis, malignancy, direct contact of exposed tendons, nerves and vasculature.[6] It is contraindicated in those with bleeding tendency and on chronic anti-coagulation or anti-platelet treatment.[7] Complications occur rarely but include sepsis, foam retention, tissue adherence, bleeding and pain.[8] This study was conducted to report outcome of negative pressure wound therapy in the treatment of acute and chronic wounds.

METHODOLOGY:

A descriptive case series was conducted in the Department of Plastic and Reconstructive Surgery, Bahawal Victoria hospital, Bahawalpur from June 2018 to September 2018. Data of 20 patients was included. Study was performed after the approval from IRB. Prior consent was obtained from patients for its usage in future for research purpose. Moreover photographs were also taken after consent. Patients having cutaneous fistulae, vascular problems, osteomyelitis, haemorrhagic tendency and on antiplatelet therapy were excluded from the study.

In all acute wounds VAC was applied after washing wound properly following aseptic measures. In patients having skin infections with dead tissue, the procedure was done after debridement of dead slough. Chronic wounds were debrided and margins refreshed before application of VAC. Two layers of foam were placed over all wounds. Nelton drain was placed in between two layers of foam. Foam dressing over wound was sealed with opsite to maintain negative pressure environment. Drain was attached to vacuum and pressure up to -150 mmHg was maintained and applied intermittently. Dressing was applied for 48-72 hours after which it was removed and reapplied for next 48 hours. Wound was assessed for development of healthy granulation tissue and preparation of wound bed for grafting. Duration of hospitalization was noted. Patients were followed in out patient department up to five weeks to assess outcome of the treatment.

RESULTS:

A total of 20 patients, including 12 males and 8 females were included. In 14 patients the wounds were acute and six had chronic wounds. Among 14 acute wounds four patients had comorbids. One had hypertension three were diabetics. Nine wounds resulted from trauma, one was diabetic foot and four were due to necrotizing fasciitis. Seven acute wounds were infected. Among six chronic wounds, two patients had morbid conditions. Three wounds resulted from trauma, one had diabetic foot.

Period of hospitalization was from 1-3 weeks and duration of follow up was up to 5 weeks. Two diabetic patients did not develop granulation tissue within 5 days and required further debridement of necrotic slough. Out of nine acute wounds that were traumatic, eight developed granulation tissue. Among other five acute wounds one had diabetic ulcer on the foot which did not develop granulation tissue. In this debridement was done. In all such conditions VAC was applied just after the debridement of wound to avoid pseudo eschar formation and necrosis, which required further debridement. This approach improved the condition of the wound in three patients while fourth needed further debridement. So as a whole out of 14 acute wounds of different types eleven developed healthy granulation tissue within five days. All the chronic wounds developed healthy granulation tissue within 5 days. There were total of ten infected wounds of which three acute septic wounds needed debridement but finally all other septic and aseptic wound developed granulation tissue (Fig Ia & b).

Fig-I (a)

Fig I (a) Before applying VAC and
Fig I (b) After applying VAC

DISCUSSION:

Historically for treatment of wounds different mechanical forces were used to increase the vascularity and tissue growth. In world war I envelope method was used. In USA, negative-pressure wound therapy (NPWT) became popular due to work of Argenta and Morykwas. In almost all fields of surgery they applied this method over 300 wounds. Black polyurethane foam and silver impregnated foam are two types of foam dressings that were used.[9-11]

According to published data dressing is changed every 3-5 days. But in our study dressing was changed every 48 hours. Many techniques were used during primary and secondary wound closure.[12,13] In our study VAC was used to find out if healthy granulation tissue develop as a preparation of wound bed for grafting and results were encouraging.

Necrosis of the subcutaneous tissue and fascia which is known as necrotizing fasciitis is a dangerous condition. Risk factors include infection of wound site, trauma and diabetes mellitus.[14,15] After removal of necrotic fascia and surrounding nonviable tissue, application of VAC was done at wound site. This helped in development of granulation tissue. Decreased vascularity, uneven surface of wound bed, presence of blood clots and excessive serous fluid usually results in poor up take of skin grafts.[16,17]

In all conditions when there are more chances of poor graft up take, the cost of VAC should be ignored. Successful up take of skin graft is reported after VAC therapy. Same was the main purpose of our study to find out development of healthy granulation tissue and wound bed for grafting. This therapy was found effective. More surgical intervention is required in case of acute wounds as compared to chronic wounds.[18,19] Published data is in favor of using VAC in cases of acute wounds. In the reconstructive ladder there are various methods used for healing of acute wounds so instead of using VAC therapy solely it should be combined with other options to make their results more successful. It can be said that VAC therapy should be used as an exclusive option for wounds which are problematic or have shown failure towards other options of reconstruction.[20-22].

CONCLUSIONS:

VAC therapy was found effective in all types of surgical wounds. This method is costly but found cost effective in long run as it promoted development of healthy granulation tissue for early grafting or flap repair in all types of acute and chronic wounds with reduction in morbidity and hospitalization.

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