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NEGATIVE PRESSURE WOUND THERAPY IN THE TREATMENT OF SEVERE LEG INJURY IN 2-YEAR-OLD CHILD - CASE REPORT

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Abstract

Background: Negative pressure wound therapy (NPWT) is used for treatment of different type of acute and chronic wounds. This technique is commonly used for management of extremity soft tissue injuries. Sub-atmospheric pressure, from 75 to 125 mmHg is used in order to increase the blood flow and granulation tissue formation, to decrease the risk of infection by improving the bacterial clearance.

Case report: We report a case about 2-year old girl, a victim in a high-energy motor vehicle accident. Despite other injuries, the most important was a severe wound on left popliteal region. The wound underwent detailed exploration. There were evident signs of skin ischemia. There was partial laceration of biceps femoris muscle and lacerated subcutaneous blood vessels. Debridement for the necrotic tissue and reconstruction of the injured muscle were performed. Up to the 15th post injury day, there was a complete demarcation of necrotized zone of left popliteal region and proximal part of the lower leg. A wide skin, subcutaneous tissue and deep soft tissue structures surgical excision was performed. After the surgical debridement, VAC wound dressing was used for wound closure. After nine cycles of NPWT the wound was ready for skin grafting.

Conclusion: NPWT is successful and safe treatment for child injuries. This type of treatment shows many advantages, such as decreased morbidity, pain, cost, duration of hospitalization, antibiotic usage, analgesics usage, risk of infection, while, the patient comfort, esthetic and functional result are highly increased.

Keywords: Vacuum assisted closure, Negative pressure wound therapy, Sub-atmospheric pressure dressing

Background

Negative pressure wound therapy is used for treatment of different type of acute and chronic wounds. [1,2,3] This technique is commonly used for management of extremity soft tissue injuries, like traumatic, diabetic, postsurgical, and peripheral vascular disease-associated wounds.[4,5,6]

Sub-atmospheric pressure from 75 to 125 mmHg is used in order to increase the blood flow and granulation tissue formation, to decreased the risk of infection because it improve bacterial clearance.[7,8,9] This type of treatment is very useful for wounds that could not be easily closed by using the standard methods. [10,11]

The NPWT is an assembled device that consists of various components, such as a connecting tube, a semipermeable wound dressing, and a vacuum system. These components allow the vacuum system to deliver sub-atmospheric pressure directly to the wound surface. The polyurethane black foam that is used for this treatment has a high concentration of hydrophobic cells and is designed to stimulate the granulation tissue formation. It is placed into the wound and is typically used for wounds that have a lot of fluid drainage and it stimulate granulation tissue formation. NWPT dressing should be changed every two to three days, in order to prevent cross-contamination. [1,7,10]

Case report

We report a case about 2-years old girl, a victim in a high-energy motor vehicle accident. The girl was admitted to pediatric surgery department for further treatment. On initial physical examination, she was conscious, afebrile, stable vital parameters: SpO2-97%, HR- 127, TA 100/63, GCS 15, a wound on the frontal head region was detected, excoriations on chest and right knee. Also she had a severe wound on left popliteal region with dimensions cca 10x7cm, without active bleeding. A CT scan on

head, neck, thorax, abdomen, pelvis and both legs was obtained, and X-ray of pelvis and both legs. Laboratory findings were with no signs for significant blood loss.

The CT scan and X-ray showed non-dislocated fracture of VIII and IX right ribs, non-dislocated fracture of right iliac crest, non-dislocated fracture of both femurs and left tibia dislocated fracture. Surgical treatment was indicated for dislocated left tibia and severe left popliteal wound treatment. In OR, the wound underwent detailed exploration. There were evident signs of skin ischemia. (Fig.1) There was partial laceration of biceps femoris muscle and lacerated subcutaneous blood vessels. Debridement for the necrotic tissue and muscle reconstruction were performed. The subcutaneous tissue was closed with simple interrupted sutures. The skin was approximated with over and over sutures. Vacuum drainage was used for wound treatment. The next step was an open reduction of tibia fracture with intramedullary nailing. In order to treat the both femurs fractures, a cast immobilization was performed.

Figure 1. Ischemic and necrotic skin tissue

The wound was dressed regularly. On post injury day 5, there was a sign of necrotized skin zones. (Fig.2) On post injury day 15, after complete demarcation of necrotized zone of left popliteal region and proximal part of lower leg, a surgical debridement of the necrotic tissue was indicated.

Figure 2. Necrotized skin tissue

A surgical excision of the skin, subcutaneous tissue and deep soft tissue structures was performed. (Fig.3 and Fig.4) After the surgical debridement, NPWT dressing was used for wound closure.

Figure 3. Surgical soft tissue excision

Figure 4. Surgical soft tissue excision

Discussion

Before starting the NPWT, a wound swab was performed, it showed no bacterial growth. The NPWT dressing change was performed on every 3 days. At the beginning of the treatment, an intermittent NPWT mode was used (-125 and -75 alternately). (F.5) After the third NPWT treatment, the mode was switched to continuous on -125 mmHg. After every cycle of NPWT dressing, healthy and clean granulation tissue was formed more and more. After nine cycles of NPWT the wound was ready for skin grafting. On the last NPWT dressing, also control wound swab was performed. It showed no bacterial growth. After careful preparation on the wound site, a dermal substitute was used, in order to prevent skin contracture on the knee site. The dermal substitute is made of collagen, obtained from bovine dermis and contains the dermal collagen types I, III and V. [12,13,14,15] The elastin is obtained from bovine nuchal ligament by hydrolysis. It serves as a scaffold in the skin reconstitution and modulates scar tissue formation. [16,17,18,19]

Figure 5. NPWT dressing

When the wound was ready for skin grafting, the patient underwent split thickness skin grafting over the dermal substitute. (Fig.6 and Fig.7) The skin graft was successful and the wound was completely healed after 20 days.

Figure 6. The wound is ready for skin grafting

Figure 7. The wound is ready for skin grafting

Intensive physical therapy protocol stated soon after the hospital discharge. After two months, the child was completely recovered, normal active and passive knee movements, able to walk without assistance. The final step of the treatment was a long term local scar treatment.

Conclusion:

According to the presented case, and our prior experience, we conclude that NPWT is successful and safe treatment for child injuries. This type of treatment shows many advantages, such as decreased morbidity, pain, cost, duration of hospitalization, antibiotic usage, analgesics usage, risk of infection. The patient comfort, final esthetic and functional result are highly increased.

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