Operative treatment of pressure ulcers using pedicled flaps

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ABSTRACT

Purpose: The objective of this paper was to present the results of surgical treatment concerning pressure ulcers.

Materials and methods: All patients underwent surgical treatment at the Orthopedics and Traumatology Clinic during the period of 1997-2016. The procedures were performed by one operator. A total of 28 pressure ulcers were operated (25 patients). The clinical material consisted of: 15 pressure ulcers located in lower back area, 6 pressure ulcers located in ischial area, 3 pressure ulcers located in trochanteric area and 4 pressure ulcers located in heel area.

Results: One conducted the result evaluation based on the criteria of complications proposed by Seiler. In case of all surgically treated patients pressure ulcers healed after 2-5 weeks after the surgery. One patient experienced hematoma below the flap. One could observe seroma in case of 5 patients. In this situation it was required to apply a local postoperative puncture. 4 patients experienced marginal skin necrosis (2 of them required resection of dead skin edges in operating theatre which were later re-stitched using "side to side" technique). During the 3-year follow-up there was no recurrence of operated pressure ulcers.

Conclusion: Deep septic pressure ulcers, according to the division introduced by Seiler, connected with bone infection require the application of musculocutaneous flaps. This procedure is aimed at improving local tissue blood supply. Proper preoperative preparation of the patient, careful planning of the surgery and suitable postoperative treatment of the patient are as significant as the surgery itself.

Keywords: surgically treated pressure ulcers, sacral pressure ulcers, ischial pressure ulcers, heel pressure ulcers, pedicled flaps, musculocutaneous flaps

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INTRODUCTION

Pressure ulcers constitute a serious complication in case of patients who stay in supine position for a long time, especially in case of the elderly. Pressure ulcers appear as a result of the external pressure caused by the bed or a wheelchair on subcutaneous bone prominences – in majority of cases in the iliac area (pressure ulcers located in sacral, ischial or trochanteric area). Initially pressure ulcers affect superficial soft tissues. However, if the process progresses they reach the bone causing infection of the bone tissue. Pressure ulcers located in the sacral, ischial and trochanteric area constitute statistically 62% of all pressure ulcers. There are many classifications devoted to pressure ulcers depending on their depth. The most commonly known classifications cover the advancement classes created by Guttman, Shea, Seiler, Campell and Daniel. One of the newer classifications devoted to pressure ulcers is the classification prepared by NPUAP [1].

The shallow pressure ulcers can be treated without the need of undergoing surgery while deep ones reaching the bones should be treated surgically.

In recent years one can observe an increasing interest in treating chronic wounds, soft tissue defects using so called V.A.C. method - vacuum-assisted closure (V.A.C. therapy, N.P.W.T. negative-pressure wound therapy) is another name applied to this method. V.A.C. method involves healing of tissues in a confined space produced in vacuum which results in the evacuation of inflammatory secretions from the wound which, consequently, increases the inflow of arterial blood to the wound [3].

Negative pressure causes tissue deformation, increases metabolic activity, fibroblast migration as well as cell proliferation [4].

V.A.C. method has become more and more recognized in recent years as regards the treatment of chronic wounds and pressure ulcers. What is more, there have been disputes regarding the surgical treatment of pressure ulcers: pedicled flap plastic procedure or V.A.C. method? Each method has its own indications but also its limitations.

We have been treating patients with pressure ulcers in the Orthopedics and Traumatology Clinic at the University Clinical Hospital in Bialystok for over 20 years using local plastic surgery applying pedicled flaps. This method is used in reference to pressure ulcers of the ischial, sacral, trochanteric areas as well as other parts of the body. Pressure ulcers located in the ischial and trochanteric areas occur more frequently in case of patients with a spine fracture accompanied by spinal cord injury and paralysis of the limbs. The objective of this paper was to present the results of surgical treatment concerning pressure ulcers.

MATERIALS AND METHODS

The author analyzed clinical material concerning surgical treatment of pressure ulcers covering the period of 1997-2016. In total 28 ulcers were treated surgically at the Orthopedics and Traumatology Clinic in Bialystok (25 patients). The group of patients consisted of 20 women and 5 men. The youngest patient was 19, the oldest was 85.

The clinical material covered 15 pressure ulcers located in lower back area , 6 pressure ulcers located in ischial area, 3 pressure ulcers located in trochanteric area and 4 pressure ulcers located in heel area. Pressure ulcers were observed in 12 elderly patients treated in the Clinic as a results of a fracture of the proximal femur, in case of 4 patients after severe craniocerebral injuries (originally treated at the Intensive Care Unit of USK in Bialystok), in case of 9 patients with lower limb paralysis after spinal fractures. In most cases, a single deep pressure ulcer was treated surgically. As regards 5 clinical cases numerous pressure ulcers suffered by one patient were treated. Co-existent pressure ulcers located in the lower back area with a pressure ulcer of the trochanteric region, pressure ulcer of the trochanteric area and the ischial area, finally pressure ulcers located in lower back area with pressure ulcers located in the heel area. Six patients were admitted to the Clinic from other hospitals to undergo surgical pressure ulcer treatment. In 17 cases the fasciocutaneous flaps were applied, 11 patients required musculocutaneous flaps, no grafts concerning split thickness skin graft were applied in case of any patient.

The surgical methods of treating pressure ulcers located in the sacral area include: grafts concerning split thickness skin, local plastic surgery procedures, large rotation flaps obtained from the gluteal region (skin flaps, fasciocutaneous flaps and musculocutaneous flaps), and finally flaps transplanted using microsurgical methods.

In case of transplants of split thickness skin there is a high risk of pressure ulcer recurrence. Rotation flaps constitute the most reliable and convenient method of treating deep pressure ulcers of the lower back area. Depending on the depth and size of pressure ulcers the specialists apply fasciocutaneous ot musculocutaneous flaps. The various stages of the surgery include the excision of infected ulcers and all of its pockets applying Guttmann's pseudo-tumor technique. All bony prominences located in the bottom of the wound, such as the spinal protuberances in the lower back should be chiseled to reach live bleeding bone. In many cases the resection of coccyx is recommended as well. After cutting the edges of the wound the professional usually plans a large one-sided distally pedicled flap (it is recommended to perform an intra-operative outline on the skin using a marker). The planned flap reaches the upper edge of the wing of

ilium (the patient lies on the abdomen during the procedure). Flap formation takes place in the spot located above the fascia (skin flap) or below the fascia (fasciocutaneous flaps). Fasciocutaneous flaps have better blood supply but this area is less mobile and movable compared to skin flaps. Under the transposed flap in the wound 4 Redon drains are left after the surgery. The aforementioned drains should remain in the wound for 6-8 days after the procedure. The surgical procedure is completed with layered stitches of the wound without placing excessive seam tension at the edges of sewn tissues. This involves some inconvenience for the patient as the body in the lying position – the patient is on his or her abdomen up to 10 days after the procedure. This position of the body relieves the tension from the operated area. It is obvious that it is less difficult to obtain the aforementioned body position in case of younger people than in case of bedridden elderly patients suffering from internal health issues. In the case of older people it is possible to arrange lateral position after the procedure (the position has to be changed every 2 hours). Four degree pressure ulcers (according to Seiler) with the exposed infected aitchbone require rotation muscle or musculocutaneous flap. Proper planning as regards large rotation flaps enables convenient displacement and then sewing of the edge of that flap without placing excessive tension onto the suture line. The recipient site - from where the flap was transferred can be closed (without the need for applying split thickness skin transplants) (Figure 1- application of the rotary-transposition flap from the sacral area).

a)

b)

Figure 1. a) 81-year-old woman with trochanteric fracture of femur bone and present pressure ulcer localized in the sacral area b) right-sided skin graft sutured without excessive tension on the edges performed at the end of the operation; 4 Redon drains left under the skin.

Pressure ulcers concerning ischial area occur most frequently in case of people with spinal cord injury suffering from paraplegia who have been in the sitting position for too long. These kinds of pressure ulcers are classically created from inside "to outside" (muscle and subcutaneous tissue necrosis takes place before the ulcer is created and only later the patient experiences secondary skin damage). In such a case one conducts a deep excision of the pressure ulcer pocket, scarred, infected bursa, together with a portion of the ischial tuberosity (5-10 mm tumor thickness). After cutting the ulcers and their pockets the professional performs: small transposition flaps - in case of treating minor pressure ulcers located over the ischial tuberosity or large rotation flaps (such as a posterior fasciocutaneous flap of the thigh). If a large tissue defect occurs at the ischial tuberosity region after cutting scarred and infected deep tissues – one should apply plastic procedure supported with a proximally pedicled biceps muscle, semitendinosus muscle or semimembranosus muscle - depending on the dead space size. The resection of the ischial bone should not be too radical as the contralateral ischial bone can experience too high level of stress (after surgery) which can expose the patient to the creation of a new pressure ulcer [5].

Bilateral ischiectomy is to be avoided due to the risk of developing a pressure ulcer near the anus area. The risk of recurrence of surgical treated ulcer in ischial area is significant. For that reason firstly a rotation thigh flap should be applied. In case of failure this procedure will ensure the possibility of using the lower part of the gluteal muscle. Figure 2 presents the example of the application of the posterior thigh flap in the treatment of the ischial ulcer.

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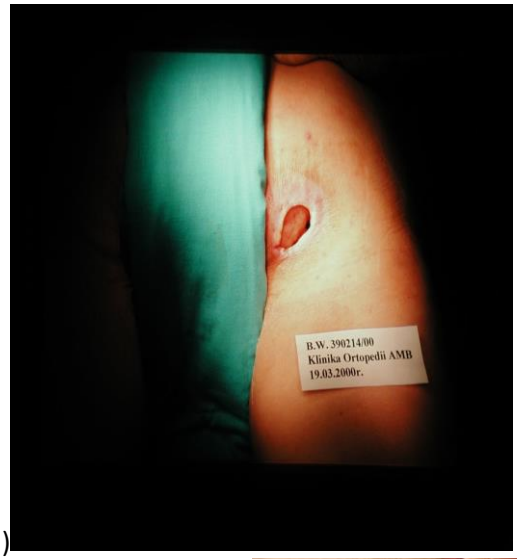
a) 


b)


c)

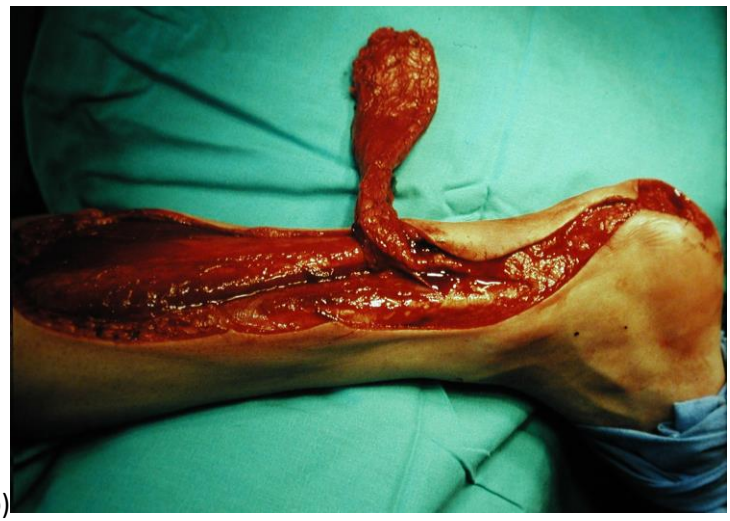
Figure 2. 61-year-old woman with lower limbs paresis after fracture of Th12 - pressure ulcer caused by the sitting on the ischial tuberosity a) pressure ulcer before wound margin excision, b) 14 days after the reconstruction of pressure ulcer - skin graft localized on the back of the thigh, c) final result of the operation (5 years after the procedure).

Pressure ulcers located in trochanteric area are less frequent and this phenomenon is usually not accompanied by large skin loss. The surgical procedure requires (similarly to treatment of ulcers concerning other parts of the body) - a pseudotumor-like excision of the entire pressure ulcer with its pockets and chiseling the greater trochanter. The treatment of choice is transposition of the tensor fasciae late flap. The tensor fascia latae flap is nourished by arterial inflow through arteria circumflexa femoris lateralis. The tensor fascia latae flap has the length of about 13 cm, width of 3 cm and thickness of 2 cm. Other options as regards trochanteric pressure ulcer reconstruction include: lateral musculocutaneous thigh flap, gluteal muscle flap and anterior thigh flap.

Pressure ulcers located in the heel area occur mostly in people with paraplegia and quadriplegia. Proven and reliable methods of treating pressure ulcers include distally based sural artery flap. The distally based sural artery flap is supplied by the superficial sural artery with the sural nerve. The artery has many tiny skin branches covering up to 2/3 of the distal part of the shin [6,7]. The central part of the elevated flap should project to the posterior midline of the shin. During the procedure the patient has to lie on his or her stomach, the size of the flap corresponds to the size of the defect to be reconstructed [6,7]. The turning point should be at a minimum distance of 5 cm from the top of the lateral malleolus. In the proximal pole of the flap, the vein and artery are tied and the sural nerve is cut. The sural flap is lifted together with the underlying fascia. The recipient site can be closed by stitching the edges of created gap. However, the width of the flap cannot exceed 3 cm (Figure 3). In case of flaps with a larger width, the recipient site has to be covered with a split thickness skin transplant.

a)

b)



c)

Figure 3. Pressure ulcer of the heel of the 33-year-old male after polytrauma (femur fracture, T12 fracture with lower extremities paresis and forearm fracture). a) the beginning of the operation – before the excision of the wound margins b) distally pedicled sural flap after elevation, c) 14 days after the operation – skin graft is healed and well supplied with blood.

RESULTS

One operated patient suffered from hematoma located under the transposed flap (1 sacral pressure ulcer), in case of 5 patients "seroma" was observed and, consequently, they required local postoperative punctures (3 sacral pressure ulcers and 2 ischial pressure ulcers), 4 patients developed marginal skin necrosis (4 sacral pressure ulcers). The marginal skin necrosis is treated by cutting the edges of dead skin area at the operating theater and then by re-stitching the skin "side by side". In case of all surgically treated patients pressure ulcers healed after 2-5 weeks after surgery without recurrence within 3 years of post-surgery period. Pressure ulcers in sacral area developed mainly in case of older women with a fracture of the proximal femur. Pressure ulcers in the ischial area occurred in case of younger women and men. In 2 cases pressure ulcers reappeared after more than 5 years (one in the place of previously treated ischial pressure ulcer) – after 12 years; in one case in the place previously surgically treated ischial ulcer (after 15 years). Reconstructive surgery required the application of pedicled musculocutaneous flaps).

Discussion

Although the scientists have been searching for more and more advance methods of treating III and IV degree pressure ulcers, the fastest and more effective method of treating pressure ulcers is surgery with the application of pedicled flaps: fasciocutaneous flaps and musculocutaneous flaps. The selection of the applied flap depends on the location and depth of the pressure ulcer to be treated. Treatments involving direct closure of the wound margins after its surgical excision (debridement) and cutting out the bursa usually fail. The tension at the suture line is too high and, consequently, the edges of the skin do not have sufficient blood supply. Reconstructive surgery consists of the following key elements: radical resection of bone prominences as well as dead bone, filling dead spaces using pedicled flap, well-vascularized tissue and the simultaneous application of large pedicled flaps. It is significant to stitch the edges of the wound without causing the tension. It is obtained by using reliable drainage of the post-operative wound (preferably 4 drains).

Non-treatment of pressure ulcers can result in cancer transformation of an ulcer called Marjolin's ulcer. The discussed types of cancer

(well-differentiated "squamous cell carcinoma") are more malignant compared to the cancer changes observed in case of burns and osteomylitis. Professional literature suggests that 12 out of 18 patients diagnosed with a pressure ulcer related cancer die within 12 years. Therefore, surgical treatment of deep pressure ulcers and cancer changes originating from pressure ulcers should be indeed radical. Adverse consequences of a chronic pressure ulcer include renal failure and amyloidosis [9]. The highest mortality rate was discovered among patients with a new pressure ulcer appearing after a therapeutic failure.

In recent years much attention has been devoted to the treatment of deep wounds using vacuum-assisted closure *therapy* (*V.A.C.*) [4]. In some cases this type of therapy can replace surgical treatment of pressure ulcers involving pedicled flaps. However, one should bear in mind that there are contraindications for applying V.A.C. therapy such as: cancerous transformation of pressure ulcer, untreated bone infection, surgically untreated fistula located in the wound, pressure ulcer covered with dead tissue, sometimes with dry scab, presence of large blood vessels or internal organs walls at the place where V.A.C. is to be applied [10]. Naturally, anaerobic colony infections also constitute contraindications to using V.A.C.

V.A.C. therapy is more frequently applied in general surgery as well as at vascular surgery departments. Treatment of deep ulcers using pedicled flaps is still a less known method of treatment of deep ulcers among general surgeons. Plastic surgery departments in Poland are usually not interested in treating patients suffering from deep, extensive pressure ulcers. In most cases these patients are sent to surgical wards. It is advisable to educate the surgeons not only as regards the currently popular V.A.C. therapy but also as regards methods of covering extensive pressure ulcer tissue defects with pedicled flaps as this technique has been proven successful in the faster proper surgical treatment of deep pressure ulcers for many years now.

CONCLUSIONS

Localized, pedicled flaps constitute the best method of surgical treatment as regards pressure ulcers located around the iliac area (sacral, ischial and trochanteric area). Deep pressure ulcers located in the heel area are more frequently qualified for applying pedicled flap on vascular pedicle due to the lack of movable tissues in this part of the body. Distally based sural artery flap is rotated by 180 degrees as regards axis of the leg. Before lifting and moving the flap – one should perform a radical surgical excision of the pressure ulcer (debridement) – applying pseudo-tumor technique. Deep septic pressure ulcers complicated with bone infection, according to categories introduced by Seiler, require plastic procedures using pedicled musculocutaneous flaps. This procedure is aimed at improving local blood supply to tissues. Proper pre-operative preparation of the patient, accurate surgery planning as well as suitable postoperative treatment of the patient is as significant as the surgery itself.

Conflicts of interest

The authors have no conflicts of interest.

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