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Clinical Case of the Month

Pressure ulcer treatment

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Introduction

The complicated case story below was presented to and discussed by senior colleagues from Brazil, England, Japan and USA. None of the the responders knew that the patient had sustained his injury in 1981, and the initial report stopped at the New Year 1986/87. A review of the patient's medical history for the following years up to date is presented. Finally a short discussion of the possibilities of treatment is given.

Case story

The patient, a man aged 18 years, sustained a spinal cord injury (SCI) in a motorcycle accident. Spinal X-rays showed a fracture dislocation of 1 cm at vertebrae Th6/7, with a complete spinal cord lesion at Th6. The fracture was stabilised in a neurosurgical department with Harrington rods. Before being transferred for rehabilitation he developed a small superficial sacral pressure ulcer, which healed by conservative means during the primary rehabilitation. During the initial weeks he was treated for pneumonia and urinary tract infection. During the rehabilitation he was generally difficult regarding cooperation, but he obtained independence in a wheelchair and was going to proceed with the use of long leg calipers. After a prolonged weekend visit at his home he returned with superficial pressure ulcers over the sacrum, both trochanteric regions, and both lateral malleoli. They all healed within a couple of weeks. Continuously the patient did not want to follow the directions given by the staff, and he ended up with a urethral catheter for bladder drainage and he had bilateral trochanteric and sacral pressure ulcers 7 months after injury. At the left trochanter a 1.5 cm large necrotic ulcer and at the right trochanter a 5×5 mm superficial ulcer were found. Over the sacrum there was an ulcer measuring 2.5×1.5 cm with bone at the base. The plastic surgeon concluded, not least because of the patient's mental habitus, not to operate, but to try conservative treatment. X-ray gave no indication of osteitis. Three weeks later the left trochanteric ulcer measured 3.5 cm in diameter and 3.5 cm in depth with necrosis and an iliotibial tract at the base. Over the right trochanter an area of 1.5 cm $\times$ 2.5 cm had defective epithelium. The sacral ulcer was undermined 3 cm in a proximal direction. Again he was strenuously informed of the seriousness of the condition and of the importance of total pressure relief. Despite this he used his wheelchair several times. Due to his lack of cooperation and motivation, he was 8½ months after injury, finally transferred from the Centre for Spinal Cord Injured to a local general hospital. At this time his indwelling catheter had to be changed each week because of encrustations. He was treated with baclofen 20 mg qid for spasticity and spasms.

In the local hospital he accepted the total pressure relief regime, and the sacral and the right trochanteric ulcers healed. The plastic surgeon then, approximately 10½ months after injury, performed a resection of the left greater trochanter and a musculocutaneous transposition of the left tensor fascia lata muscle. A small secondary defect healed within two months.

Because of various social, psychological, as well as somatic reasons, he came to live in a nursing home. A few months later he again had bilateral trochanteric ulcers. He continued with the indwelling catheter, and 17 months post-injury cystoscopy and cystolithotripsy of 20–25 urinary calculi was performed. Eight months later additional urinary calculi were removed via a cystotomy. The patient still had the bilateral trochanteric ulcers, each now measuring 6×9 cm. In addition subluxation of the left hip had developed resulting from contracture of the iliopsoas muscle and spasticity of the adductor muscles.

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Two years and three months after the SCI, orthopaedic surgeons performed tenotomies of the adductor and psoas muscles bilaterally. At the operation the left hip was totally luxated, but was easily repositioned.

Nearly 3 years after injury the patient was admitted to the department of plastic surgery. The right trochanteric ulcer measured 1 cm in diameter with an undermining of 4–5 cm. The left trochanteric ulcer measured 7×7 cm. A right ischial pressure ulcer measured 1 cm with 3–4 cm undermining. All the ulcers were excised. The right trochanteric ulcer was covered with a fasciocutaneous tensor fascia lata flap. On the left side the defect was covered after remobilisation of a tensor fascia lata flap. The secondary defects were covered with meshed split-thickness skin graft. The right ischial ulcer was closed directly. Afterwards he was transferred to the centre for SCI. At discharge he still had a fistula over the left trochanter. He was now living with his mother in a house, but shortly afterwards he moved into his own apartment.

During the following year the patient was admitted to the local hospital twice because of an ulcer on the right heel and the fistula in the left trochanter region.

Four and a half years after the SCI, he was again admitted to the department of plastic surgery because of superficial ulceration over the right heel and defects in the trochanteric regions with a fistula on the left side. A revision was performed including split-skin transplantation to the heel and the right trochanter region. The fistula was excised and closed.

Six months later he was readmitted because of the two trochanteric ulcers and a recurrence of a right calcaneal ulcer. Again excision and transplantation was carried out in a total of three times, and a transposition of part of the adductor muscles was carried out to fill a defect in the left inguinal region, which had its origin from a fistula to the trochanteric ulcer.

About two months later the patient was admitted again with recurrence of both trochanteric ulcers now measuring about 10×10 cm with trochanteric bone in the central parts. After revision, a free dorsalis pedis island flap was used to cover the right hip defect after interposition of a free saphenous magna vein to supply the flap from the femoral vessels. The flap was torn by spasms and was resutured after 4 days. However, the flap was totally necrotic after a week. Bilaterally the femoral bones were luxated proximally out of the hip joints. On the right side a defect of 8×10 cm with an undermining of 2 cm posteriorly with femoral bone in the central part was found. The proximal femoral bone showed clinical signs of osteitis and was surrounded by heterotopic ossifications. No necrosis but gray granulation tissue was present in the cavity. In the left trochanteric region a similar defect of 7×7 cm was found with communication to the hip joint. The cavity around the femoral bone was without necrosis but was walled by gray granulation tissue.

From this stage in this patient what would your management be?

Response I

K Shibasaki, MD

The difficulties of treatment relate to his personality; the development of recurrent pressure ulcers with bone and joint involvement, and in lack of donor sites of musculocutaneous flaps in this special case.

Treatment should be directed to control the severe degree of spasticity, to manage the infection of the femur and of the hip joint, and to close the skin defects of the bilateral pressure ulcers. For the management of spasticity in paralysed limbs, rhizotomy or myelotomy would be recommended. As far as the recurrence of spasticity is concerned, myelotomy would be preferable. The problem of myelotomy would be the postoperative change in bladder function in this patient, but it would not be necessary to preserve his automatic bladder function, as the patient is still using an indwelling catheter.

Secondly, treatment for the right trochanteric ulcer should be performed. After excision of the pressure ulcer, removal of upper part of the right femur is necessary, including the femoral head and greater trochanter. To control the local infection local irrigation of sterile normal saline should be continued for at least 2 weeks. Prior to the closure of the skin defect using a musculocutaneous flap, tubes for irrigation should be placed in the wound. To cover the skin defect a musculocutaneous flap of the tensor fascia lata muscle is no longer useful and V-Y advancement of the gluteus maximus myocutaneous island flap is helpful in this case (Figure 1). The lower part of gluteus maximus muscle is supplied by the inferior gluteal artery, and as Scheflan *et al.* reported in 1981,[1] downward or outward rotation of this myocutaneous island flap is available to cover a pressure ulcer of the ischium or of the greater trochanter. Saline irrigation should be continued for two or three weeks post-operatively.

The third procedure is the treatment for the pressure ulcer of the left greater trochanter associated with a communication to the hip joint. Removal of infected bone and cartilage, and thorough curettage of infected granulation would be necessary around the left hip joint, followed by local saline irrigation with medication of appropriate antibiotics. The advanced V-Y myocutaneous island flap of the gluteus maximus is also available for closure of the skin defect on this side. Generally, complete healing of joint infections is especially difficult in paralysed limbs and one should bear in mind the recurrence of a fistula. Repetition of the local irrigation and selection of sensitive antibiotics might be necessary. Depending on the progress after intensive curative procedures, finally disarticulation of the left hip joint might be a choice for treatment.

However, the prognosis of these therapies does not allow much room for optimism.

Response II

AA Monteiro, MD and TEP Barros, MD

This is a particularly difficult case, and in face of the patient's clinical evolution, with poor results from the previous treatments, we think that the surgical procedure now recommended should be more aggressive. He now presents with bilateral femoral head dislocation, with a defect of 8×10 cm, bone exposition, proximal osteitis and heterotopic ossification on the right side, and a defect of 7×7 cm communicating with the joint on the left side.

Both of the pressure sores could be classified as grade 4 and obviously, general support measures are essential, with blood transfusion, intravenous fluids with antibiotics and vitamins, correction of electrolyte abnormalities and a high protein diet.[2]

We would recommend for both sides a more aggressive procedure as follows: a wide surgical debridement, with resection of all necrotic tissue plus a head and proximal femoral resection, with an osteotomy below the greater trochanter. For the closure of the wound we would employ a vascularized myocutaneous flap from the rectus femoris muscle, as we have been employing for special cases for more than 10 years, with satisfactory results.

Response III

SM Shenaq, MD

Recurrence following surgical closure of pressure ulcers remains one of the most formidable complications of treatment.[3] The case for discussion presents with recurrent bilateral trochanteric grade 4 pressure ulcers five years after the initial spinal cord injury. Both tensor fascia lata flaps and the adductor muscles on the left side were used for previous closures. Both hip joints are dislocated and right side has heterotopic ossification and osteomyelitis. The leftsided ulcer has joint communication. Both ulcers are covered with infected granulation tissue.

At this stage of a recurrent pressure ulcer with osteomyelitis, there are two surgical options. The less attractive choice is bilateral hip disarticulation and reconstruction with fillet thigh flaps. This is not a favourable choice for most patients and the surgery is complicated by extensive blood loss. This patient, especially with his history of non-compliance and recurrent ulcers, is a questionable candidate, as is described in the literature.[4–6] Additionally, for bilateral pressure ulcers, as is the case here, the weight shift is to the perineum postoperatively. This situation predisposes to new ulcer formation. In my opinion, proximal femurectomy, as originally described by Girdlestone[7] and applied to paraplegic patients by Ducharme[8] is a much less traumatic type of surgery in regard to morbidity and body image. Transfusion is often still required, and the presence of heterotopic ossification significantly compounds the blood loss.[9] The procedure leaves a considerable soft tissue defect, which in the past has resulted in high failure rates.[10] Minami *et al.*[11] published improved results with the use of the vastus lateralis muscle flap

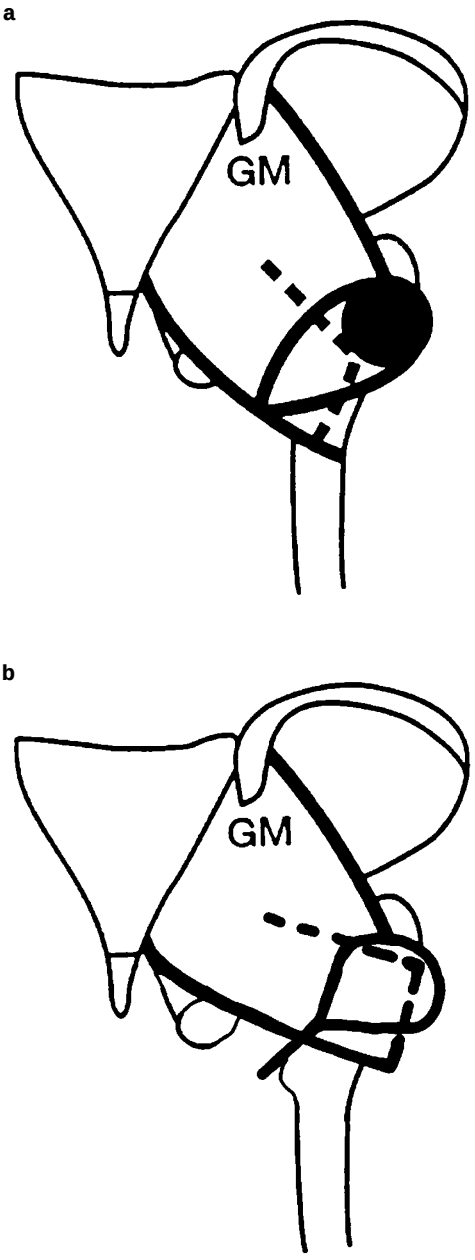

Figure 1 V-Y advancement of a gluteus maximus myocutaneous island flap. Downward or outward rotation of this flap is available to cover the pressure ulcer of the ischium or the greater trochanter. Dark spot: pressure ulcer, GM: Gluteus maximus muscle. a: design of myocutaneous island flap. b: after surgery

for obliteration of this dead space, and this has become the procedure of choice. If the surgery is performed properly, wheelchair sitting is possible.

In our opinion the management of this patient involves qualitative cultures of the infected granulation tissue and adequate control of muscle spasms with medication as the first step. After culture results are obtained, proper antibiotic coverage is arranged and the patient is taken to the operation room for proximal femoral resection and acetabular curretage (Girdlestone procedure). Bone is sent for cultures and pathology. A central line is placed and intravenous antibiotic therapy is initiated in the postoperative period depending on the sensitivity results of bone culture and the presence of active osteomyelitis in the pathology specimen. The patient has either wet or dry dressing changes[9,12] or antibiotic bead replacement,[13] and after a few weeks of treatment, at which time wound contraction takes place and the wound is covered with granulation tissue, the patient is taken back to the operating room. A second choice is to achieve primary closure of the defect following excision of the involved bone; however, this is sometimes associated with increased postoperative infection or recurrence.[14] Following excision of the present ulcer, bilateral vastus lateralis flaps are used to fill in the defect with skin graft coverage. This muscle has a reliable anatomy, is easy to raise, and has enough bulk to fill in the cavity. Multiple drains are placed and kept in place for at least 2 weeks, depending on the amount of drainage, to prevent seroma formation.[12] An air-fluidized bed is used during the non-weight bearing postoperative course. The patient is then started on a gradual sitting program, 6 weeks after surgery. At this stage cushion evaluation is of utmost importance to facilitate proper weight shifts and to prevent recurrence.

Response IV

I Nuseibeh, MD

My reply to the medical report on this unfortunate patient includes the following:

1 Doctors who treat patients with spinal injuries must expect patients who do not accept their disability and will ignore any medical advice which is given to them. Therefore, the support of a psychologist must go hand in hand with the management of the patient.
2 This case illustrates clearly the important principle in the treatment of pressure sores in patients with spinal injuries, ie conservative treatment should be seriously considered if it is possible and practical, otherwise the simple excision of the sore and direct closure should be the method of choice even for recurrent sores. Flaps operations should very rarely be applied. This will spare the mutilation of the patient's body by extensive and unnecessary surgery.
3 Posture and pressure points in the human body are important precipitating factors. I therefore wonder if, fixing the spine with Harrington rods was a long fixation, thus exposing the patient's pressure points in his body to more pressure and restricting the back mobility.
4 As regard to 'what to do now', I suggest the following: Excision of the proximal part of both femurs ie head, neck and both greater and lesser trochanters. This will exclude the rigidity of the hip areas and allow direct closure of both trochanteric sores. Both lower limbs become flail and can be easily adjusted whilst sitting or lying in bed.

   I believe that the Roho cushion should be the best one to use when sitting and also as a mattress, unless his balance becomes lacking.
5 Removal of the coccyx is essential if his sacral skin is breaking down.

What happened – case story continued

F Biering-Sørensen, MD and JL Sørensen, MD

Three weeks after the last operation the proximal part of the left femoral bone was excised distal to the lesser trochanter, and the cavity was closed directly. After a few days the sutur line partially ruptured because of spasms. Three weeks later the right femoral bone was excised at the same level. Split-thickness skin graft was used to cover the defect. Uncomplicated healing occurred.

After another 2 weeks a 6 cm long slit-shaped defect over the left proximal femoral bone was revised, and delayed closure with a musculocutaneous flap based on the medial gluteal muscle was carried out.

A review of the main points in the medical history of the patient in the following years is given in Table 1.

At the time of the last discharge, 15 years and 5 months after his spinal cord injury, he had in all been admitted to hospitals 5 years and 8 months, or nearly 37% of his lifetime after his SCI:

1056 days, 18 admissions in Department of Plastic Surgery
741 days, 16 admissions in Centre for Spinal Cord injured
122 days, 5 admissions in the local hospital
90 days, 6 admissions in Department of Orthopaedic Surgery
43 days, 5 admissions in Department of Neurosurgery
19 days, one admission in Department of Urology

Discussion

This very complicated case contains many of the difficulties that may be found in treating pressure ulcers in spinal cord injured patients. The reiteration of pressure ulcer development highlights the importance

Table 1 Major points in the medical history of the patient by year/month after the initial case story ended.

Time	*Ulcer/problem*	*Treatment*	*Result*
5/4	Left trochanter	Proximal femurectomy	Rupture
	Right trochanter	Proximal femurectomy	Healing
5/5	Left trochanter	Medial gluteal MC flap	Healing
5/6	Loosening of Harrington rods	Partial removal of spondylodesis implant	Healing
	Right trochanter	Split skin	Healing
6/9	Right trochanter	Biceps muscle flap and split skin	Partial necrosis
	Crura	Revision	No healing
	Right trochanter	Femurectomy and suture	Rupture
		Osteotaxis + split skin × 2	Defect
7/6	Right tuberosity	Suture	Defect
	Left crus	Split skin × 2	Healing
8/5	Crura	Split skin on several locations	Prolonged healing
	Right trochanter	Suture	Healing
	Right tuberosity	Scrotal flap, osteotaxis	Rupture
		Split skin	Healing
	Left tuber	Rectus muscle + split skin	Healing
9/0	Urinary incontinence	Uretero-ileo-cutaneostomy a.m.Bricker	
9/8	Left leg	Split skin on several locations	Healing
9/10	Right tuberosity	MC gluteus max. flap	Prolonged healing
10/10	Left curvature	Suture	Healing
11/11	Right trochanter	Hip exarticulation + local muscle transposition	Healing
12/4	Spinal collapse	Spondylodesis vTh8-Sacrum	Healing
12/10	Spine infection	Refixation	Healing
13/6	Left tuberosity	Mk hamstring flap	Fistula
	Sacral	Mk gluteal max. island flap	Healing
14/0	Spine infection	Removal of spondylodesis implant	Defects
		fasciocutaneous back flaps	Healing
14/1	Left inguinal	Split skin on three locations	Healing
	Left foot		
15/4	Perineum	Scrotal flap	Defect

Time: 0/0 = time after spinal cord injury was sustained. MC: myocutaneous

of long-term planning of surgery and the necessity of intense prevention.

The surgical problems in this patient have been tremendous, and there is more than one qualified solution to the problems in question.

The suggestions range from conservative treatment whenever possible (Nuseibeh), to thorough surgical approach with bone resection (all).

Closure of the defect after revision and bone resection can be obtained by direct closure (Nuseibeh, our own choice) or by flap surgery (Shibasaka, Monteiro). The latter methods have the advantage of supplying the cavity for healing and controlling infection.[11,14–20] However, direct closure can be used,[21] since the resection of femoral bone compensates for the lack of soft tissue volume eg by pistoning the femur proximally into the defect. Not all investigations prove the superiority of musculocutaneous flaps in the closure of pressure ulcers,[22] and the long-term results of musculocutaneous flaps in comparison to other methods is not unequivocal.[23] High rates of complications and relapses are common among patients treated both with musculocutaneous flaps and by other methods.[22,24,25]

We almost always prefer to divide the revision and the reconstruction into two independent operations in an attempt to reduce the risk of haematoma formation and infection.[26] Others prefer a one stage procedure.[27] Documentation for the superiority of the one or the other procedure is not available.[23]

As is seen from the continuation of the present case the proximal ends of the femoral bones were removed to clear the area of infected or otherwise substandard tissue and to ease closure. In the suggested treatments of this particular patient there was an agreement about the necessity for proximal femurectomies, and this is an accepted treatment in such instances.[14,19,21]

We found it necessary to stabilise the region with osteotaxis as did Klein *et al*.[19] Others have not found an indication for external fixation.[14]

Many risk factors for the development of pressure ulcers are recognised.[28] Psychological factors are indeed included. Thus, depression and related symptoms are overrepresented in the spinal cord injured population.[29,30] This is another challenge which has to be taken up by those involved with the management of spinal cord injured patients. In the prevention and treatment of pressure ulcers this

additional issue may sometimes, as in the presented case, leave little room for an optimistic prognosis, as is stated by Shibasaki.

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