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SURGICAL TREATMENT OF PRESSURE ULCERS IN PARAPLEGICS

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Paraplegia may be caused by trauma or disease. The growing problem of people with spinal cord injury caused by motor accidents is very important and more attention should be paid to it. It is always necessary to pay attention to the rehabilitation of the paralyzed patient, which can be delayed by serious complications such as pressure ulcers in different regions of the body. Pressure sores can be avoided only by meticulous care, careful attention to simple bladder drainage and proper rehabilitation measures (*Gelb* 1952).

A pressure ulcer is usually the result of an excessively long compression of the skin and subcutaneous tissues between an underlying bony prominence and the bed or the chair upon which the patient is resting. Continued pressure interferes with the circulation of blood in the tissues and the resulting anoxia leads to necrosis. In deep ulcers, the underlying bone becomes exposed and infected (*Groth* 1942, *Blocksma, Kostrubala & Greeley* 1949, *Gelb* 1952).

The results of surgical closure of pressure ulcers has been reported by numerous authors. The main principles of surgery were already outlined 10–20 years ago (*Kostrubala & Greeley* 1947, *Conway & Griffith* 1956).

It is our intention to report on the management of pressure ulcers in paraplegics treated in the Orthopaedic Hospital of the Invalid Foundation.

MATERIAL

There is no special spinal cord injury centre for paraplegics in Finland. Patients with paraplegia are therefore taken care of in all hospitals. A selected group of patients admitted mainly for orthopaedic treatment and rehabilitation to the

Orthopaedic Hospital of the Invalid Foundation were also operated upon for pressure ulcers. During a 10 year period, 1956–1966, 75 patients were operated upon for pressure ulcers in the sacral area, the greater trochanter area, and the area of the ischial tuberosities. Altogether 127 ulcers were treated surgically.

Until 1961 there was no surgeon specialized in plastic surgery working at the hospital, but since then a consultant plastic surgeon has taken care of the most difficult pressure ulcer cases. Before 1961 all the operations were performed by the surgeon-in-charge of each department.

Table 1 shows the distribution of the patients with pressure ulcers. The material consists of 63 paraplegics and 12 quadriplegics.

Table 1. Distribution of patients with pressure ulcers treated at the Orthopaedic Hospital of the Invalid Foundation during the years 1956–1966.

Number of patients	75
with paraplegia	63
with quadriplegia	12
Age	
0–19 years	15
20–59 years	60
Sex	
Males	68
Females	7

Table 2. Etiology of the spinal cord injury.

Motor accidents	25 patients
Falls	24 „
Myelitis	8 „
Military service	4 „
Gunshot	3 „
Diving	1 „
Miscellaneous	10 „
Total	75 patients

ETIOLOGY

Only 4 patients sustained their spinal cord injuries during military service, but civilian motor accidents and falls together accounted for the largest number (49 patients, or 65 per cent). Eight patients had a paraplegia caused by myelitis (Table 2).

According to clinical tests and X-ray examinations, the level of the spinal cord damage in 20 cases was found to be in the cervical part, in

18 cases in the upper thoracic part, in 33 cases in the lower thoracic part and in 13 cases in the lumbar part. No accurate correlation could be found between the level of the damage and the site or the frequency of the pressure ulcers.

Site of occurrence. Knowledge of the sites of predilection is useful from the standpoint of prophylaxis. Numerous studies have been reasonably well documented (*Gelb* 1952, *Yeoman & Hardy* 1954 and *Guttman* 1955).

In this material, only sacral ulcers, greater trochanteric ulcers and ischial ulcers were taken into consideration. These ulcers give the patient most trouble and interfere with his rehabilitation program (*Griffith & Schultz* 1961 and *Harding* 1961).

Table 3 shows that among a total of 127 pressure ulcers, 46 were located in the sacral area, 48 in the area of the greater trochanter and 34 in the area of the ischial tuberosity.

We are usually inclined to think of these lesions in terms of their chronicity but it should be realized that there is often an acute phase in many of them. An incipient pressure ulcer may be mistaken for an abscess and may be incised for drainage of pus that is not present. In ulcers of the chronic form the tissue destruction often extends through fascia, muscle, synovial membrane and even into joints. In this material there was suppurating arthritis in the joint in 2 cases caused by extension of the pressure ulcer through the tissues.

SURGICAL TREATMENT

The patient should be prepared for surgery with a high-protein diet. The surgical closure of the pressure ulcer should be performed as soon as the patient's hemoglobin has reached the level of 12 grams, and the level of the plasma protein has been brought above 6 mg per 100 ml.

The elimination of muscle spasm is important, because spasm may contra-indicate operative repair. The spasm should be controlled by neurosurgical procedures, but some patients are very reluctant and do not want to accept flaccid paralysis. In this material there were only a few patients in whom the muscle spasm was relieved by alcoholic injection.

Urinary infection should be controlled before the patient is subjected to operation. Urological procedures to relieve urinary retention are performed before surgical repair.

Local preoperative preparations. Local treatment of the pressure

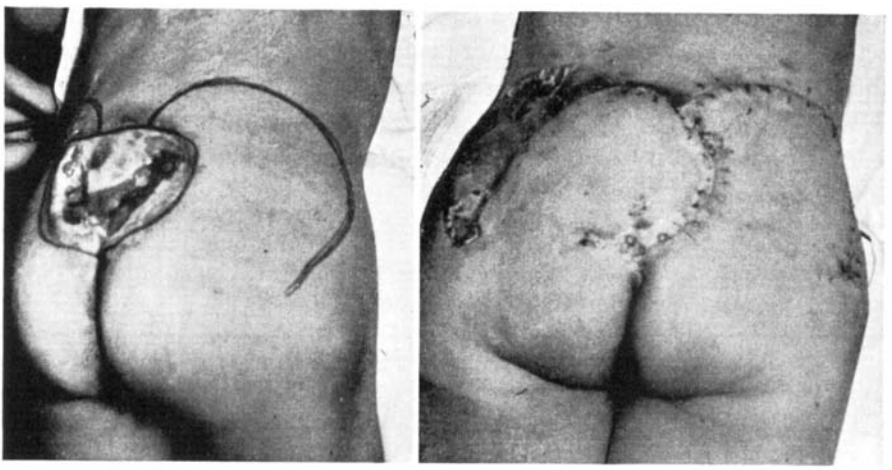

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Figure 1. A. *A very large sacral pressure ulcer with considerable surrounding scar tissue. The ulcer had previously been covered with split thickness skin grafts without success.* B. *Closure accomplished with to large rotation flaps after excision of the ulcer and the scar tissue. Thick split thickness skin grafts were used to cover one of the flap donor sites. There was no recurrence after two years.*

ulcer aims at securing a surgically clean wound. Most pressure ulcers require surgical debridement of the necrotic material. Enzyme preparations should not be relied on, because they do not clean the ulcer effectively. Moist dressings of 0.5 per cent of Dakin's solution are applied to the ulcer and changed every 4 to 6 hours. The surrounding skin is protected from irritation by a thick film of some protective ointment. The dressings are changed for moist saline dressings, applied for 24 to 48 hours before the operation.

Choice of procedure. The basic principles of the surgical treatment are excision of the ulcer and the affected tissue surrounding it, including removal of bony protuberances and restoration of an intact skin surface with adequate subcutaneous padding at the site of the former pressure ulcer (*Blocksma, Kostrubala & Greeley* 1949, *Guttman* 1955, *Conway & Griffith* 1956, *Campbell* 1959).

In most patients there was no need for any kind of anesthesia.

Although split-thickness skin grafts are not considered sufficient cover for pressure ulcers, they were quite often used as a dressing graft during the period 1956–1960 (Table 3).

Sacral ulcers: Thirty-two sacral ulcers and the surrounding scar

tissue were excised. The exposed bony prominence, however, was partly resected in only 8 cases, and a large rotation flap was used for covering the defect. In 14 ulcers, the defect was directly sutured (Table 3).

It is important to make the flaps large and not place the suture line directly over bone prominences. Very often a split-thickness skin graft was used to cover the flap donor area.

Table 3. Analysis of the surgical methods and the complications in 127 operated pressure ulcers.

Surgical methods		Number of operated ulcers			
		Operations	Complete healing	Early complications	Late complications
Sacral ulcers	46				
Excision and suture		14			
Excision and local flap repair		10		1	3
Excision with partial resection of the sacral bone and local flap repair		8	25 (54 %)	3	4
Free skin grafting		14		11	
Trochanteric ulcers	48				
Excision and suture		14		2	
Excision with trochanterectomy and local flap repair		18	18 (37 %)	9	
Free skin grafting		16		10	6
Ischial ulcers	34				
Excision and suture		12			5
Excision and local flap repair		7		2	4
Excision with partial ischiectomy and local flap repair		9	23 (67 %)	2	6
Free skin grafting		6		2	3

Trochanteric ulcers: The location of pressure ulcers over the greater trochanter area seems to present a most difficult problem. In this area, muscle spasm interferes very much with the wound healing, which complicates the postoperative treatment. Free skin-grafting was used in this group in 16 ulcers, but 10 ulcers did not heal primarily. This method was not considered satisfactory in the treatment of pressure ulcers in this area.

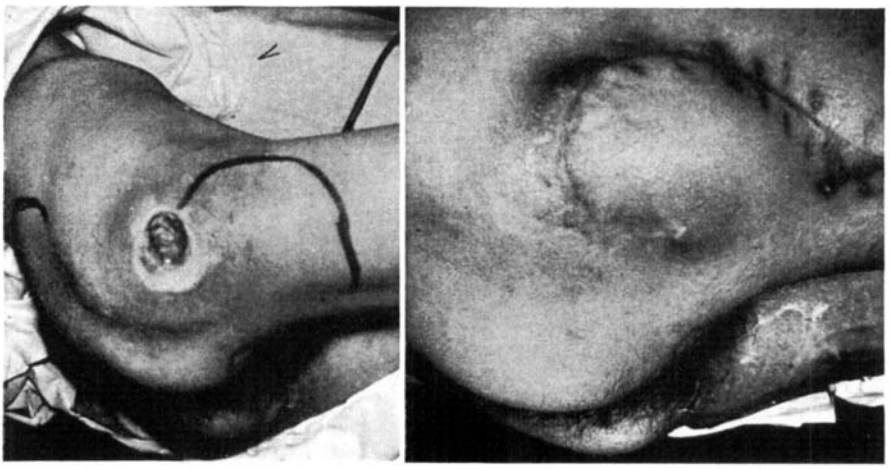

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Figure 2. A. Large recurrent trochanteric pressure ulcer following an inadequate trochanterectomy and direct closure without flaps. The flap used at reoperation is outlined. B. Closure after thorough resection of the greater trochanter. Complete healing occurred. A very small recurrent ulcer appeared 2 years later, but the original flap was rotated again to cover the defect.

For the repair of tissue defects over the greater trochanteric area after the excision of 32 pressure ulcers, a rotation flap based inferolaterally was preferred in 18 occurrences after resection of the greater trochanter. The flap donor defect was covered with split-thickness skin grafts.

In 14 cases, the tissue defect was small and the wound was sutured directily (Table 3).

Ischial ulcers: It is important to position the patient in a jack-knife fashion on the operating table. This position will determine the amount of skin and subcutaneous tissue required for closure after excision of the ulcer. In 9 occurrences out of 34, a partial ischiectomy in connection with excision of the ulcer was performed, whereas in 19 cases direct suture or local flap repair were performed without bony resection (Table 3).

No radical or total ischiectomy was performed at the first operative procedure.

Free skin-grafting was not so often used as in the other groups. It was used in only 6 occurrences.

It should be pointed out that a meticulous hemostasis is very im-

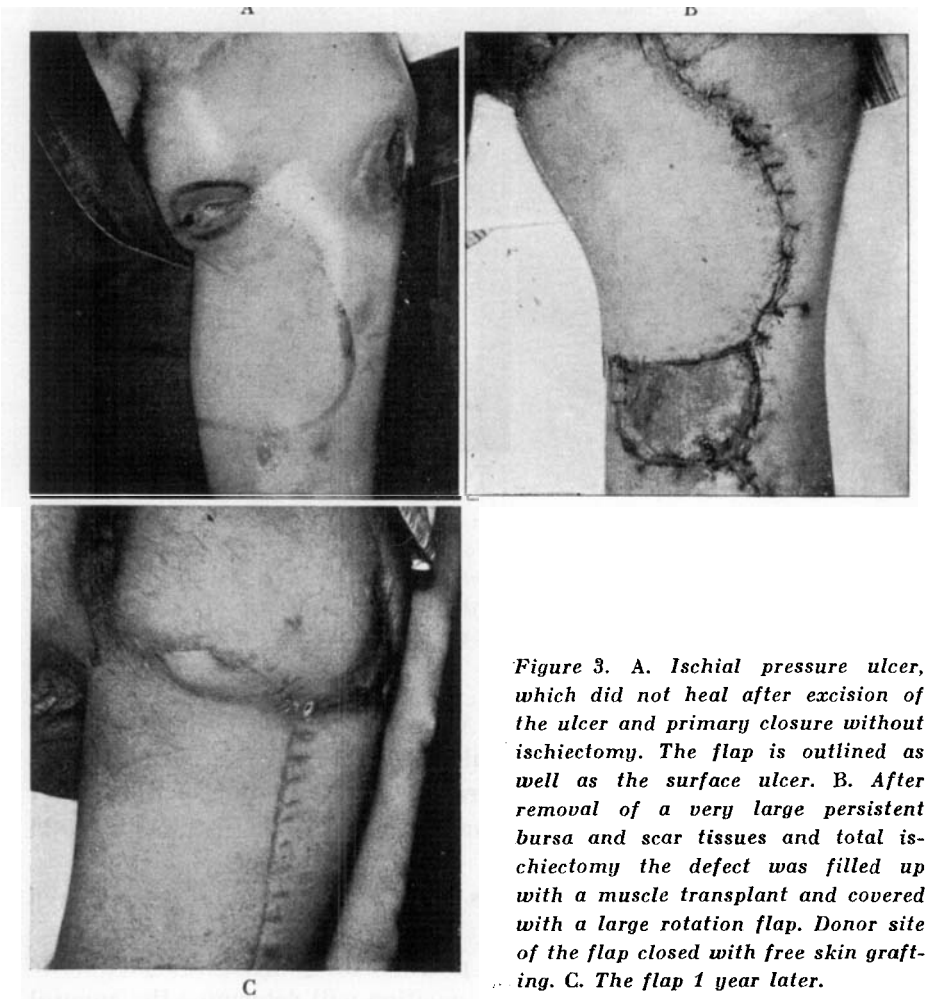

Figure 3. A. *Ischial pressure ulcer, which did not heal after excision of the ulcer and primary closure without ischiectomy. The flap is outlined as well as the surface ulcer.* B. *After removal of a very large persistent bursa and scar tissues and total ischiectomy the defect was filled up with a muscle transplant and covered with a large rotation flap. Donor site of the flap closed with free skin grafting.* C. *The flap 1 year later.*

portant. The problem of postoperative hematoma, however, was greatly minimized by continuous postoperative suction drainage left in for at least 4 to 5 days.

Postoperative treatment. All patients with operated pressure ulcers and flap repair were kept prone for 2 to 3 weeks. If the patient could not control his bladder a urethral catheter was used. A high-protein diet and vitamin supplements were given. If healing was uncomplicated the sutures were removed on the tenth to fourteenth postoperative day. By the 3rd week the patient was allowed to start sitting in his wheel chair for 15 to 30 minutes, a period extended gradually up to an hour.

RESULTS

A result was considered excellent only if there was primary healing and if sitting was resumed without recurrence.

A primary healing was observed in the sacral area in 25 cases (54 per cent), in the greater trochanteric area in 18 occurrences (37 per cent) and in the area of the ischial tuberosities in 23 occurrences (67 per cent) (Table 3).

The complications were mainly due to hematomas, infection and to dehiscence of the wound caused by muscular spasm.

The use of split-thickness skin grafts in the sacral and trochanteric area was not satisfactory. In 30 skin grafted ulcers there were early complications in 21 occurrences, mainly due to "poor take" of the skin graft, and caused by bad nutrition and infection in the transplantation bed.

All the late complications, *e.g.* recurrent ulcerations in the previously operated area, were due to persistent bony prominences.

Table 4. Analysis of the surgical methods used in reoperations on 39 recurrent pressure ulcers.

Surgical methods		Number of operated ulcers			
		Operations	Complete healing	Early complications	Late complications
Sacral ulcers	8				
Excision with partial resection of the sacral bone and local flap repair		5	7 (88 %)	1	2
Free skin grafting		3			
Trochanteric ulcers	19				
Excision and local flap repair		8	14 (73 %)		
Excision with trochanterectomy and local flap repair		11		2	
Ischial ulcers	12				
Excision with total ischiectomy and local flap repair		12	9 (75 %)		

REOPERATIONS

Thirty-nine recurrent pressure ulcers were reoperated. Most of these were operated during the period 1961–1966 (under supervision of a surgeon specialized in plastic surgery).

The surgical procedures were definitely more radical, with excision of the recurrent ulcer and surrounding scar tissue and very large flap repair. The application of one of the several methods of closure by flap were determined by the presence af scars adjacent to the pressure ulcer and the regional anatomy.

Table 4 shows the statistics of the reoperations performed.

In the ischial area 12 recurrent ulcers were treated by radical total excision of the ulcer, total ischiectomy and flap repair. Nine ulcers healed completely and 3 ulcers healed after dehiscence of the wound. There were no recurrences of these 12 ulcers in 1–3 years.

The results in the reoperated group show a considerable improvement and an increase in the success of complete primary healing. This certainly demonstrates that the following basic principles must be followed in repair: elimination of the ulcer and adequate replacement of skin and subcutaneous tissue without tension.

FOLLOW-UP

The follow-up time ranged from a few months to 5 years. There was no recurrence in 21 cases (45 per cent) in the sacral area, in 21 occurrences (43 per cent) in the greater trochanteric area and in 20 occurrences (58 per cent) in the area of the ischial tuberosities (Table 5).

Table 5. Relationship between primary healing, complications, reoperations and non recurrent ulcers in 75 patients operated upon for pressure ulcers.

Ulcers		Number of operated ulcers			
		Complete healing	Early compli-tions	Reope-rations	No recur-rence
Sacral ulcers	46	25 (54 %)	15 (32 %)	8	21 (45 %)
Trochanteric ulcers	48	18 (37 %)	21 (43 %)	19	21 (43 %)
Ischial ulcers	34	23 (67 %)	6 (17 %)	12	20 (58 %)

The operative success in these major sites of pressure ulcers was not satisfactory compared to the percentages reported in other series (*Gelb*

1952, *Griffith & Schultz* 1961). This must be partly due to use of split-thickness skin grafts and partly to the unresected underlying bony prominences left behind after the first operation.

CONCLUSION

1. The ulcer should be adequately prepared before surgery.
2. Free skin-grafting is not a method of choice in the surgical treatment of pressure ulcers. Routine excision of the ulcer and the underlying bony prominence and flap repair is desirable.
3. A meticulous hemostasis is important, because postoperative bleeding was the main cause of early complications.
4. Plastic surgery for pressure ulcers in paraplegics must be integrated with the entire rehabilitation program, the ultimate aim being to get the patient back to essential activities and to walk with braces or ambulate in a wheel chair.

SUMMARY

This is a report on 75 paraglegics treated at the Orthopaedic Hospital of the Invalid Foundation for pressure ulcers. A total of 127 ulcers in the sacral area, in the trochanteric area and in the area of the ischial tuberosities were operated upon by different methods. Free skin-grafting was used rather often but seemed to be unsatisfactory as a final treatment of the ulcer. Excision of the ulcer and the underlying bone prominence, and a large flap repair produced the best results.

RESUME

Il est rapporté 75 cas de paraplégie traités à l'Hôpital Orthopédique de la Fondation des Invalides pour ulcères de pression. Un total de 127 ulcères dans la région sacrée, dans la région trochantérienne et dans celle des tubérosités ischiatiques ont été opérés par différentes méthodes. Des greffes de peau libres ont été utilisées relativement souvent, mais semblent être peu satisfaisantes comme un traitement final de de l'ulcère. L' excision de l'ulcère et de la prominence osseuse qui se trouve au-dessous avec un large pan de réparation de la peau donne les meilleurs résultats.

ZUSAMENFASSUNG

Dies ist ein Bericht über 75 Paraplegiker, die im Orthopädischen Krankenhaus der Invalidenstiftung wegen Druckgeschwüren behan-

delt wurden. Insgesamt wurden 127 Geschwüre der Sacral- und Trochanterregion, sowie im Gebiet der tuberositas ischii operiert mit verschiedenen Methoden. Freie Haut-übertragung wurde auch ziemlich häufig angewendet, aber schien als Schlussbehandlung der Geschwüre nicht zufriedenstellend zu sein. Geschwürexcision und Unterlegung des vorstehenden Knochens mit weiter Lappenbedeckung ergaben die besten Ergebnisse.

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