Review

The operative treatment of pressure sores in the pelvic region: A 10-year period overview

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Context: Pelvic region pressure sores often develop following spinal cord injury. Surgery is often necessary for long standing, large-sized pressure sores not responding to conservative treatment. Authors analyze their results of a 10-year period, and identify factors contributing to the reduction of the recurrence rate.

Methods: A total of 119 pressure sores were operated on 98 patients in two institutions during a 10-year period (1 January 2003 to 31 December 2012). The encountered perioperative complications are summarized, and the recurrence rate is analyzed with a patient follow-up questionnaire.

Results: We experienced 15 perioperative complications (12.6%). All complications were fully resolved by conservative treatment. Fifty-eight returned patient replies were processed. The average follow-up time after surgery was 5.2 years. The recurrence rate was 5.47%.

Conclusion: The strict adherence to surgical indications, full patient compliance, specialized pre- and post-operative patient care, our routinely used preferred surgical method, all contribute to a low post-operative complication rate, long-term flap survival, and an extended recurrence free period.

Keywords: Decubitus ulcer, Pelvic region, Gluteus maximus flap, Tensor fascia lata flap, Hamstring flap, Musculocutaneous hatchet flap

Introduction

Pressure sore treatment requires time, patience, and adequate human and financial resources. This holds particularly true for the large number of pelvic region pressure sores, the successful surgical treatment of which poses a great challenge to the plastic surgeon. Surgery is performed to achieve complete wound healing, an extended pressure sore free period, which ultimately improves the quality of life for the patient. The surgeon has to choose the most appropriate, routinely performed surgical treatment tailored to each individual patient in such a way that the correct decision is reflected in the long-term result of the well-executed operation. It is important to note the significance of well-trained personnel guiding the post-operative period, preferably in specialized institutions, the gradual weight bearing of the flaps, the high level of patient compliance, without which, good results and long-term recurrence free intervals are difficult to

attain. The senior author has previously published his results on pressure sore surgery in the pelvic region. Current study reviews and analyzes the most recent results overviewing a 10-year period of consecutive, non-selected patients with pressure sores operated between 2003 and 2012.

Patients and methods

A group of 98 patients with 119 pressure sores, all stage III or IV, were operated in a total of 110 surgical sessions during a 10-year period spanning from 1 January 2003 to 31 December 2012. The procedures were carried out at the National Medical Rehabilitation Institute, and the Szent Imre Teaching Hospital, both located in Budapest, Hungary. Patients who were operated on consisted of 25 females and 73 males. The patients' ages ranged from 16 to 72 years, the mean age of the female and male patients was 42.1 and 40.5 years, respectively. Thirty-two pressure sores occurred in the sacral, 13 in the trochanteric, and 74 in the ischial region (summarized in Table 1). The mean defect size after sacral, trochanteric, and ischial pressure sore

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Table 1 Pressure sore data

Region	No. of pressure ulcers	Sex (M/F)	No. of complications
Sacral	32	21/11	4
Trochanteric	13	11/2	2
Ischial	74 (7 bilateral)	56/18	9
Total	119		15 (12.6%)

excision was 77 cm² (range 36–248 cm²), 58 cm² (range 35–115 cm²), and 47 cm² (range 30–110 cm²), respectively.

Eighty-one patients had one region, 14 patients had two regions, 2 patients had three region decubitus, and 1 patient had decubitus in four regions. Some of the patients with more than one pressure sore developed decubitus at different times, resulting in surgery being performed at different times as well. Of the 98 patients, 84 patients were paraplegic (85.7%), 11 tetraplegic (11.2%), and 3 were ambulant (3.1%). Fig. 1 shows the pressure sore distribution by region along with the extent of patient disability.

The leading cause of disability was trauma (52%), followed by multiple sclerosis, transverse myelitis, epidural hemorrhage, epidural abscess, and spinal canal stenosis. Sacral pressure sores were covered with either single or double gluteus maximus flaps performed as classic V-Y, or as hatchet flaps (Fig. 2). Reconstruction of the defect left after the excision of the trochanteric pressure sore was performed exclusively with a hatchet shaped tensor fascia lata musculocutaneous flap (Fig. 3). Ischial pressure sores were covered with either the biceps femoris musculocutaneous hatchet flap (Fig. 4), the gluteus maximus musculocutaneous hatchet flap, or in some well-selected cases with direct suture following excision (Table 2).

A questionnaire and response instructions were sent to all patients with a return envelope to assess the long-term results of surgical treatment.

Results

All patients were discharged fully healed following pressure sore surgery from both institutions. The average hospital stay for the entire patient group was 8 weeks. The number of complications was 12.6% for the 119 operated pressure sores. Table 3 details the complications by region and the average time to heal. There was no flap necrosis in area larger than 1 cm² observed, and there were no cases of severe deterioration of general patient condition following surgery. Post-surgical complications were treated according to accepted, regular surgical practice.

Sixty-six replies were received to the 98 posted questionnaires. Fifty-eight of the 66 replies were received fully completed, and were thus included in the review. These 58 patients had a total of 73 pelvic pressure sores: 20 pressure sores were localized in the sacral-, 8 in the trochanteric-, and 45 in the ischial region.

There were 4 recurrences out of the 73 operated pelvic pressure sores. The long-term recurrence rate in the group of patients included in the review with a mean follow-up time of 5.2 years (62.4 months, range 7–125 months) was 5.47%.

Discussion

Various methods have been described since the first half of the twentieth century for pressure sore treatment ranging from skin grafts to skin flaps.^{1–3} A new era came from the work of Mathes and Nahai, and Pontén, which paved the way to the use of musculocutaneous and fasciocutaneous flaps, respectively. These flaps are to this day widely used for the surgical treatment of pressure sores.^{4–6} Free flaps are seldom used

Figure 1 Pressure ulcer regional distribution and patient disability level.

Figure 2 (A) A 36-year-old male (ZS.D.) tetraplegic patient with an extended sacral pressure sore. (B) Bilateral gluteus maximus musculocutaneous flap transposition and skin sutures at the end of surgery. (C) Four months after surgery with both flaps healed. (D) Healed gluteus maximus flaps and a 6-month post-operative view of the tensor fascia lata flap used to cover a trochanteric pressure sore on the left side.

Figure 3 (A) A 69-year-old male (M.K.) ambulant patient with a trochanteric pressure sore on the right side, with the excisional border marked on the skin. (B) Transposition of the raised tensor fascia lata hatchet flap into the defect. (C) The suture lines at the end of surgery. (D) The patient 3 months after surgery.

Figure 4 (A) I.S. 52-year-old female paraplegic patient with bilateral ischial pressure sores (operated in 2012). (B) The raised and transposed hamstring hatchet flaps, with two deep layer running rows of sutures. (C) The running skin sutures and drains in place at the end of surgery. (D) Six weeks after surgery. (E) Healed trochanteric pressure sore previously operated in 2005, covered with a tensor fascia lata hatchet flap. (F) Healed sacral pressure sore operated in 2004, covered with bilateral gluteus maximus hatchet flap.

and usually only in special cases.⁷ Koshima *et al.*⁸ was the first to describe the use of a fasciocutaneous perforator flap based on the superior gluteal artery to cover a sacral pressure sore in 1993.

In our series the indication for the operative treatment of pelvic pressure sores was jointly set up by the rehabilitation medicine specialist and the plastic surgeon. Only

patients with properly prepared wounds, who were considered suitable for cooperation in the pre- and post-operative treatment protocol, and patient education were offered surgery. The primary goal of pressure sore surgery is proper debridement, cessation of inflammation and wound discharge, elimination of dead space, the reliable coverage of bony prominences, and closure

Table 2 Ischial pressure ulcer data

Surgical technique	No. of pressure ulcers	No. of complications
Biceps femoris MC flap	56 (6 bilateral)	7
Gluteus maximus MC flap	10	2
Excision and direct closure	8 (1 bilateral)	0
Total	74	9

MC, musculocutaneous.

of the defect, with the replacement of skin and soft tissue. Naturally, this leads to the improved quality of life of the patient.

We reached predictable good results over the last 20 years with the use of musculocutaneous and musculo-fasciocutaneous flaps, in most cases harvested as hatchet flaps. Following the excision of the decubitus cavity and resection of the bony prominence, these flaps ensure a thick, well-vascularized tissue cover layer. Similar to other authors, we have not observed a higher incidence of post-operative complications or recurrence in patients with chronic osteomyelitis.⁹ This diagnosis was based on a radiographic studies and occasionally histopathology. We resected the bone in all cases until we reached viable, intact bone structure. Bone resection has been shown to be effective in decreasing the recurrence rate following pressure sore surgery.¹⁰

We performed direct closure after excision only in exceptional, well-selected cases of ischial pressure sores. Larson *et al.*¹¹ had a 16.8% recurrence rate on a large patient series, where the primary closure rate was almost 46%. In our opinion, however, skin grafting and local skin flaps are in most cases not appropriate for the treatment of pelvic pressure sores.

Our protocol for the various flaps in the different pelvic regions, surgical technique, results, and experience have been detailed in previous publications.^{12–14}

The post-operative patient care had a profound effect on the rate of late recurrences. Ideally, patients were placed on a fluidization bed following surgery. As we only had occasional access to one such bed for the post-operative care, we reserved use of this bed primarily

for tetraplegic patients, and those who could not be placed in a prone position. All other patients were either placed on a low air loss mattress bed, or in most instances on a conventional bed in the prone position following surgery. Operations were performed in 24-hour multiple dose surgical antibiotic prophylaxis. Patients were allowed to assume a supine position only after the third week following surgery. The patients were not turned mechanically on the flap prior to that time. The seating process was started after the fifth week with gradual, half hour daily increments of three sittings a day. This helped prevent the immediate breakdown or separation of the flap wound. Full weight bearing for 3–4 hours was allowed 3 months after surgery. Paraplegic patients were trained to lift themselves out of the wheelchair every 5 minutes, the tetraplegic patients were instructed to make body movements according to their movement abilities.

The gradual flap conditioning and entire seating process was coordinated and overseen by a specialist in rehabilitation medicine. This ensured lower number of early and late complications and contributed to the lower number of recurrences. Prior to discharge, all patients received skin care education and were familiarized with the early signs and symptoms of recurrence needing urgent attention. Regular clinic visits were scheduled according to our protocol at 3 and 6 months after discharge, and then once yearly with the same rehabilitation medicine specialist.

There were 4 recurrences out of the 73 operated pelvic pressure sores (3 in the ischial region and 1 in the sacral region). Two ischial pressure sores healed after repeated surgery, by the raising and further advancement of the primarily used hatchet flap. Both of these patients took part on regular clinical visits. Both recognized the signs of recurrence and promptly returned to the clinic for treatment. The first patient had the ischial pressure sore recurrence at 8 months, and the second at 28 months after surgery. At the time of receiving the replies to the questionnaires, these two patients were recurrence free for 49 months and 66 months, respectively.

One of these recurrences was caused by the too early, and prolonged loading, the other was caused by the

Table 3 Complication details by region

Region	Haematoma (No./days to heal)	Seroma (No./days to heal)	Dehiscence (No./days to heal)	Suppuration (No./days to heal)	Necrosis (<1 cm ²) (No./days to heal)	Total
Sacral	1/6		1/14	1/12	1/15	4
Trochanteric		2/21				2
Ischial	2/9		4/18	2/15	1/17	9

Table 4 Long-term results of various authors

Author	No. of patients	No. of pressure sores	Follow-up (years)	Recurrence rate (%)
Yamamoto <i>et al.</i> ¹⁷	53	69	3.5	39
Kierney <i>et al.</i> ¹⁵	158	268	3.7	19
Tavakoli <i>et al.</i> ¹⁸	19	29	5.2	41.4
Jósvay ¹⁹	47	60	2.4	10
Singh <i>et al.</i> ²⁰	15	20	5.3	5
Bilkay <i>et al.</i> ¹⁶	66	100	3	22
Srivastava <i>et al.</i> ²¹	25	39	1.5	17
Keys <i>et al.</i> ²²	135	227	4.4	39
Grasetti <i>et al.</i> ²³	143	143	2	22.4
Jósvay (2013)	58	73	5.2	5.47

extensive, uninterrupted loading of the flap. The two other patients with recurrences declined further surgery as the pressure sore did not impose limitations on daily activities and advanced patient age. As these patients did not take part on the regularly scheduled clinical visits, the fact that recurrence had occurred was only documented by their questionnaire reply.

We identified several important factors that contributed to our results. Special pre- and post-operative patient care and experience in pressure sore surgery are necessary for good results. We place emphasis on the close cooperation between rehabilitation medicine and plastic surgery when choosing between the surgical or conservative treatment for the patient. The significance of this type of close collaboration and a multidisciplinary effort had been described by Kierney *et al.*¹⁵ already in 1998.

The timing of surgery is important: a clean, well-prepared wound bed free of necrosis without local inflammation is imperative. Patient compliance is also evaluated prior to surgery, as lack of this can compromise the reconstructive results. Unlike most authors and protocols, we almost exclusively used musculocutaneous and musculofasciocutaneous flaps, with direct sutures only in exceptional cases. We feel this is one of the reasons behind the low number of recurrences. An earlier and higher number of recurrences are noted by other authors as well when thin tissue layer is used for defect coverage (such as split thickness skin graft or various cutaneous flaps).^{15,16} Sutures are not left in the wound for a protracted period, all multilayer (3–4) monofilament non-absorbable running sutures are removed at 3 weeks after surgery. Suction drains are regularly used and left in for 7 days. The long-term results were further improved with the use of a fluidization bed, modern wheelchair cushions, proper post-operative patient care, and training.

There are only a limited number of publications analyzing the late results and recurrences on a larger patient population in the literature. The reviewed articles in

Table 4 have patient numbers ranging from 15 to 158, number of operated pressure sores from 20 to 268, and follow-up times from 1.5 to 5.3 years. The recurrence rates varied greatly from 5 to 41.4%.^{15–23} The lowest recurrences were observed on a pediatric population consisting of a relatively small number of cases by Singh.

In our retrospective analysis of the last 10 years, our recurrence rate based on a 5.2-year average follow-up was 5.47%.

Conclusion

Authors set out to evaluate their long-term recurrence rate result of the last 10 years in pressure sore surgery of the pelvic region. Adequate patient selection, patient compliance, choosing the right procedure for the patient, surgeon experience and technique, a well executed operation, and high level post-operative care were all identified as key factors for good results. With strict compliance to these directives, the long-term recurrence rate in the reviewed period was 5.47%.

Disclaimer statements

Contributors JJ: conceiving and designing the study, analyzing the data, interpreting the data, writing the article, revising the article; AK: conceiving and designing the study, revising the article; BB: collecting the data, analyzing the data; PK: analyzing the data, interpreting the data; ZV: analyzing the data, interpreting the data; PP: writing the article in part, revising the article.

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