

# Sacral pressure sore reconstruction – the pedicled superior gluteal artery perforator flap

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## Summary

**Objective.** To report the use of the pedicled superior gluteal artery perforator (SGAP) fasciocutaneous flap as a reliable surgical option for sacral pressure sore reconstruction.

**Methods.** A prospective study was conducted between September 2008 and September 2010 of 10 patients with stage 3 or 4 sacral pressure sores treated with a unilateral pedicled SGAP flap.

**Results.** All flaps survived completely with no complications in 9 patients. One patient had a haematoma below the flap that was easily drained. No recurrence of the bedsore occurred during follow-up.

**Conclusion.** We suggest that the pedicled SGAP fasciocutaneous flap is a reliable surgical option for sacral pressure sore reconstruction.

Pressure sore reconstruction has always been challenging. Immobile patients are prone to develop pressure sores from unrelieved pressure on tissue over the sacral area, with shear, friction, moisture and malnutrition as contributing factors. Up to one-third of immobilised patients in long-term care facilities will develop pressure sores.<sup>1,2</sup> These defects have traditionally been reconstructed with gluteus maximus musculocutaneous flaps. However, there has been a change from the musculocutaneous flap to the fasciocutaneous flap, with the pedicled superior gluteal artery perforator (SGAP) fasciocutaneous flap adapted for sacral pressure sore reconstruction.

## Materials and methods

### Clinical details

Between September 2008 and September 2010, we treated 10 patients (7 males, 3 females) with sacral pressure sores with a unilateral pedicled SGAP fasciocutaneous flap. The average age was 53.4 years (range 42 - 62 years). Eight patients were paraplegic and 2 ambulatory. One patient was diabetic. The cause of paralysis was traumatic spinal cord injury in 4 patients, ischaemic spinal cord injury in 4 and long-term hospitalisation in ICU in 2. Seven patients had stage 4 sores while 3 had stage 3 sores (staging by NPUAP system).

### Surgical technique

The patient was placed in a prone position and the following landmarks were marked: posterior superior iliac spine (A), ischial tuberosity (B), greater trochanter (C). Lines connecting these three landmarks were drawn. The junction of the upper and middle thirds of the line AC was marked D. This corresponds

to the emergence of the superior gluteal artery from the upper part of the greater sciatic foramen. Using a hand-held Doppler probe, all the perforator vessels around the point D were detected and marked on the skin. The most lateral perforator giving the highest Doppler signal was marked E. The sacral sore was then thoroughly debrided with complete bursectomy. According to the resultant sacral defect, the SGAP flap was fashioned in an elliptical design of corresponding size over perforator E. The skin, subcutaneous tissue and deep fascia were incised at the superior border of the flap. Elevation was performed in a subfascial plane from lateral to medial. Perforator E was carefully dissected through the gluteus muscle. Any other suitable encountered perforators may be dissected and included in the flap. After incising the medial and inferior border of the flap, the pedicle was traced more proximally until the required pedicle length was achieved. Good haemostasis was secured after the flap circulation was ensured. The SGAP flap was either advanced or transposed into the sacral defect, taking care to avoid any twisting, kinking, compression or undue tension on the pedicle. The donor site was closed primarily. Two drains were placed, one under the flap and one in the donor area. The patient was maintained in a prone position for 2 weeks after which suture removal and gradual mobilisation was allowed.

## Results

The size of the pedicled SGAP flaps ranged from 6×10 cm to 8×17 cm. All flaps survived completely without major complications. The donor site was closed primarily in all cases. One case of postoperative haematoma below the flap was encountered; drainage of the haematoma was followed by uneventful recovery. No recurrence of a bedsore occurred after an average follow-up of 14 months (range 4 - 22 months).

## Discussion

Hospitalised surgical patients, immobilised patients in long-term care facilities with neurological or cardiovascular diseases, and paraplegics have a high risk of developing pressure sores. A conservative approach still remains the first line of management. Pressure relief, daily wound dressing, and optimising the patient's nutrition aim at prevention of infection and enhancing wound healing. Conservative treatment is mostly effective in stage 1 and 2 pressure sores. Stages 3 and 4, as well as failure of conservative treatment in treating stage 1 and 2 sores, require surgical management. Common options include primary closure, skin grafting, local random flaps, muscle flaps and the recently developed pedicled perforator flap.

Surgical management has always been a challenge, with the ideal operation still being sought. The most commonly used method of sacral pressure sore reconstruction is the gluteus maximus musculocutaneous flap, which has a good reliable vascularity and greatly reduces postoperative wound complication. However, because this flap may cause gait disturbances in ambulatory patients, Ramirez *et al.* reported the sliding gluteus maximus flap, whereby structural and functional integrity of the muscle was preserved.<sup>3</sup> Other disadvantages such as intra-operative blood loss and limitation of future reconstructive options in case of recurrence encouraged surgeons to try new methods of reconstruction, which marked the beginning of the pedicled perforator flap era. In 1993, Koshima *et al.* described the gluteal artery perforator flap based on parasacral perforators.<sup>4</sup> The pedicled SGAP fasciocutaneous flap evolved on further development of the work of Koshima *et al.*<sup>4</sup> and Kroll and Rosenfield.<sup>5</sup> The pedicled SGAP flap was elevated on perforators from the superior gluteal artery by careful dissection of the musculocutaneous perforators from the gluteus maximus muscle. This yielded a fasciocutaneous flap consisting exclusively of skin and subcutaneous fat, which retains the reliable blood supply of the musculocutaneous flap but is associated with reduced donor site morbidity.

Nowadays, many plastic surgeons consider the pedicled SGAP flap to be the flap of choice for sacral pressure sores. An anatomical study of the gluteal region by Ahmadzadeh *et al.*<sup>6</sup> revealed the following: (i) the superior gluteal region is supplied by 5±2 cutaneous perforators arising from the superior gluteal artery; (ii) all perforators are musculocutaneous, with 50% passing through the gluteus maximus muscle while the remaining 50% pass through the gluteus medius muscle; (iii) the average diameter of the perforators arising from the superior gluteal artery is 0.6±0.1 mm and the average pedicle length from the deep fascia is 23±11 mm; and (iv) the average cutaneous vascular territory for the superior gluteal artery is 69±56 cm<sup>2</sup> with each perforator supplying an area of 21±8 cm<sup>2</sup>. The superior gluteal artery perforating vessels are vertically orientated, travelling directly to the superficial tissue up through the muscle. Generally laterally placed perforators are preferred, as they yield a longer vascular pedicle after dissection of the perforator and its main source. Our experience shows that the SGAP flap can be elevated on a single perforator without fear of flap necrosis. An additional perforator of adequate size encountered along the line of dissection may also be included. A debatable aspect concerning the dissection of the perforator is perforator skeletonisation. Some authors<sup>7</sup> recommend full-vessel skeletonisation, while others,<sup>4</sup> aiming to prevent kinking or twisting of the pedicle with subsequent flap necrosis, do not. In this series, we performed full-vessel skeletonisation in 8 cases without any postoperative complications. After the SGAP flap is elevated, it can either be advanced or transposed into the defect. Advancement is preferred to transposition, which can cause torsion of the pedicle. However, if the pedicle length is inadequate, transposition of the flap is considered with a rotation angle up to 180°.<sup>8</sup> Flap width should not exceed 12 cm in order to achieve primary closure of the donor site, while the maximum flap length is between 24 and 26 cm.<sup>9</sup>

Pre-operative preparation is the most important factor for maintaining a healed wound after flap closure. Paraplegic patients are especially prone to postoperative recurrence of their sores. The pedicled SGAP flap, being a fasciocutaneous flap, lacks muscle 'cushioning' and continued pressure over it will lead

to recurrence of the sore. Pre-operative pressure relief protocols and surfaces as well as ensuring patient compliance are therefore mandatory before planning a SGAP flap. Physical medicine and rehabilitation services may also be involved. Adequate home and social support should be ensured. We also recommend the following guidelines for ensuring flap success and preventing recurrence: (i) strict pre-operative as well as postoperative control of medical conditions such as diabetes mellitus and hypertension; (ii) good pre-operative mapping of perforator vessels using a Doppler probe; (iii) adequate intra-operative debridement of the sore with complete bursectomy; (iv) maintaining a prone position for 2 weeks postoperatively; and (v) pre-operative and post-operative optimisation of nutrition.

The pedicled SGAP flap is muscle-sparing and therefore beneficial in ambulatory patients. Higgins *et al.* suggest that muscle sparing should be considered not only in ambulatory and sensate patients, but in paraplegic patients as well.<sup>10</sup> Muscle sparing is also advantageous in that future reconstructive options still exist in the case of failure of the perforator flap or recurrence. The likelihood of perforator flap failure is minimal, and Yamamoto *et al.* found that fasciocutaneous flaps provide better long-term results in surgical reconstruction of pressure sore than musculocutaneous flaps.<sup>11</sup> We emphasise the importance of strict compliance to postoperative pressure relief protocols to prevent recurrence of sores. Elevation of the SGAP flap involves only splitting of the muscle fibres, thus avoiding much bleeding and any need for blood transfusion. Ambulatory patients therefore experience less postoperative pain and a quicker recovery with early mobilisation. Placement of the suture line away from pressure-laden prominences also improves the success of the operation. The donor site can be primarily closed without skin grafting, yielding a better cosmetic outcome.

In this series, no major complications were encountered. Seroma formation was expected but did not occur. We had one case of a haematoma below the flap on the 3rd postoperative day. The haematoma was evacuated and a moderate-pressure dressing was applied, and the patient recovered uneventfully. After a mean follow-up of 14 months, there were no recurrences.

Complete flap survival with stable wound coverage, muscle-sparing properties for future reconstructive options, minimal intra-operative blood loss and minimal donor site morbidity make the pedicled SGAP flap a reliable option for sacral pressure sore reconstruction.

**Author contributions.** A. Hurbungs and H. Ramkalawan contributed equally to this work.

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