대한성형외과학회지. 제 38 권, 제 3 호
J Korean Soc Plast Reconstr Surg
Vol. 38, No. 3, 235 - 240, 2011

상·하둔동맥 천공지피판을 이용한 대전자부 욕창의 치료

탁우현 · 이원재 · 윤인식 · 나동균

연세대학교 의과대학 성형외과학교실

The Treatment of Trochanteric Pressure Sore Using Superior or Inferior Gluteal Artery Perforator Flap

Woo Hyun Tark, M.D., Won Jai Lee, M.D.,
In Sik Yun, M.D., Dong Kyun Rah, M.D.

Department of Plastic and Reconstructive Surgery, Institute for Human Tissue Restoration, Yonsei University College of Medicine, Seoul, Korea

Purpose: Management of pressure sores has been improved, along with development of musculocutaneous flaps and perforator flaps. Nowadays, the treatment of pressure sore with perforator flaps has shown several advantages, including minimal donor site morbidity, relatively versatile flap design not only in primary cases but also in recurred cases and minimized anatomical rearrangement of regional muscle position. In this study, we report our clinical experience of gluteal perforator flap used in the treatment of a greater trochanteric pressure sore.

Methods: A clinical study was performed on 7 patients who underwent total 10 operations. 1 superior gluteal artery perforator flap and 9 inferior gluteal artery perforator flaps were used to reconstruct the defect, followed by the mean observation duration of 22 months.

Results: There were no total flap loss. We treated 2 cases of partial flap loss with debridement and primary repair. 2 recurred cases were successfully treated using the same method. Donor sites were all primarily repaired.

Conclusion: The gluteal perforator flap could be considered as a safe and favorable alternative in the treatment of soft tissue defects in the greater trochanteric area. The advantages of the flap include low donor site morbidity and the possibility of versatile flap design not only in primary cases but also in recurred cases.

Key Words: Greater trochanteric pressure sore, Soft tissue reconstruction, Perforator flap

Received March 19, 2011
Revised April 11, 2011
Accepted April 14, 2011

Address Correspondence: Won Jai Lee, M.D., Department of Plastic and Reconstructive Surgery, Severance Hospital, Yonsei University Medical College, 134 Shinchon-dong, Seo daemoon-gu, Seoul 120-752, Korea. Tel: 02) 2228-2210 / Fax: 02) 393-6947 / E-mail: pswjlee@yuhs.ac

I. INTRODUCTION

The treatment of grades III to IV pressure sores has been improved throughout decades, along with development of musculocutaneous flaps. For the greater trochanteric sores, various models of the myocutaneous tensor fasciae latae flap have been used for reconstruction. These flaps have bulky volumes, convenient locations, and well-known anatomy.[1,2] Otherwise, a use of the tensor fasciae latae muscle can destabilize the femoral quadriceps muscle and cause a functional deficit in patients with the ability to walk. Furthermore, it causes rearrangement of regional anatomy, which might jeopardize future flap planning.

The recurrence rate of pressure sores after surgical treatment has been reported as 13~61%.[3-5] Because of the high recurrence rate of pressure sores in paraplegic and tetraplegic patients, the possibility of future reconstructive procedures should be considered during flap selection. Focused on this requirement, as well as recent developments and advances of perforator concept, perforator flaps have been introduced as a valuable option.[6,7]

Nowadays, the perforator flaps are used in various fields of reconstruction, including treatment of some cases of pressure sores.[7-9] Compared to the conventional musculocutaneous flaps, the perforator flaps have shown several advantages, which include minimal donor site morbidity, relatively versatile flap design and minimized anatomical rearrangement of regional muscle position.

For these reasons, using the perforator flaps in the greater trochanteric area could be a valuable surgical option for the treatment. However, because of the relatively less perforator distribution, there are not many reports focused on perforator flap in the greater trochanteric area.[7,8]

In this study, based on the distal branches of superior and inferior gluteal artery perforators (SGAP and IGAP), we used the transpositional flaps to cover trochanteric

sores, including the recurred ones. Here we report the results of our clinical experiences with gluteal perforator flaps in the treatment of greater trochanteric pressure sores with literature review.

II. MATERIALS AND METHODS

Patients

Between May 2005 and July 2007, 10 gluteal perforator flaps were used for pressure sores in the greater trochanter area in 7 patients (7 males; mean age, 40.4 years; age range, 22~58). One Patient had bilateral lesions, two patients had recurrence and was managed using the same operation. Three patients were quadriplegic, and four were paraplegic. The mean follow up duration was 26 months (Table I).

Operation

In the posterior aspect of the lesion, 1-3 gluteal artery perforators close to the lesion were marked with a unidirectional Doppler probe (8 MHz, ES-1000 spm Smartdop®). Total bursectomy was done with ostectomy removing the bony prominence, which caused the lesion. A transposition flap containing marked perforators was designed considering primary closure of the donor site (Fig. 1). Long axis of the flap was parallel to the gluteal fold and length of the flap was determined with the distance between perforators and the farmost point in the lesion. The shape and the width of the flap was controlled by the shape of the wound and consideration of primary closure. The flap was elevated from the distal side along with the underlying deep fascia. When the flap reaches the nearby marked portion of the pedicle, meticulous procedure with frequent reconfirming of pedicle with Doppler probe was done (Fig. 2). After identifying and preserving the perforators, the opposite margin of the flap was elevated to make a perforator

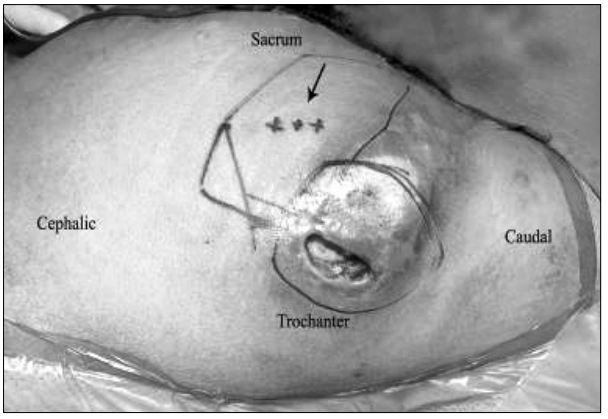

Fig. 1. Design of the flap (Patient 3). In the posterior aspect of the lesion, 1-3 gluteal artery perforators close to the lesion were marked with a unidirectional Doppler probe (8 MHz, ES-1000 spm Smartdop®), and a transposition flap containing the perforators was designed considering primary closure of the donor site (arrow-marked location of perforators).

Table I. Summary of Patients

Case	Sex	Age	Status	Flap size (cm)/shape	Pedicle	F/U duration (months)	Rotation angle (Degree)	Complication
1	M	35	Quadriplegia	13 × 8 / elliptical	SGAP	55	122	None
2	M	22	Paraplegia	7 × 4 / elliptical	IGAP	12 (recurred)	127	Partial flap necrosis (distal 1/5)
3				14 × 7 / rectangular	IGAP	35	105	None
4	M	45	Paraplegia	7 × 4 / elliptical	IGAP	6 (recurred)	85	None
5				13 × 8 / elliptical	IGAP	35	60	None
6	M	58	Quadriplegia	12 × 9 / rectangular	IGAP	37	90	None
7	M	55	Quadriplegia	13 × 8 / elliptical	IGAP	29	70	Partial flap necrosis (distal 1/4)
8	M	34	Paraplegia	12 × 6 / triangular	IGAP	15	110	None
9	M	34	Paraplegia	7 × 6 / triangular	IGAP	8 (right)	75	None
10				6 × 4 / elliptical	IGAP	7 (left)	110	Donor wound dehiscence(3 cm)
						Mean: 26	Mean: 95	

SGAP, superior gluteal artery perforator; IGAP, inferior gluteal artery perforator.

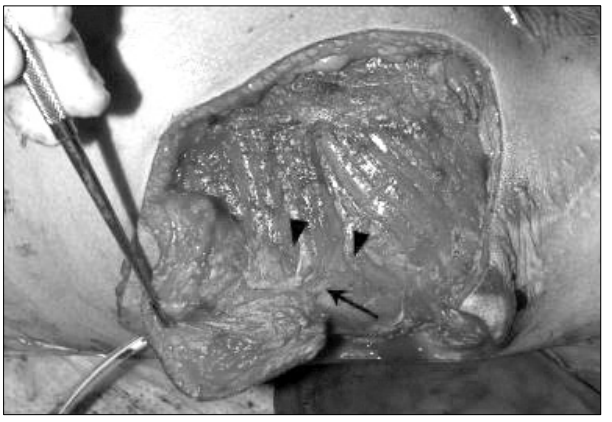

Fig. 2. Elevation of the flap (Patient 3). The flap was elevated from the distal side along with underlying deep fascia. When the elevated end of the flap reaches the marked portion of the pedicle, meticulous dissection with frequent reconfirming of pedicle with Doppler probe was done (arrow-perforator vessels, arrow head-lateral margin of the gluteus maximus muscle).

based-island flap. If the rotation angle is sufficient, the pedicle skeletonization was not done completely, and some soft tissues were left around in the most cases. The donor site was closed without skin graft.

III. RESULTS

The surgical wounds eventually healed in all cases. During the healing process, three minor complications were observed. Two were partial flap necrosis due to venous congestion, and another one was donor wound dehiscence. All cases were treated with simple surgical debridement and primary repair. In other two cases, sore was recurred in the same place 6 and 12 months after complete healing, respectively. The cases were surgically treated in the same manner as the previous surgery. No additional recurrence was observed over the following 35 months. The donor sites were all repaired primarily without any complication. The mean rotation angle of the flaps was 95° (range, 60~127°). The largest flap size was 12 × 9 cm (Table I).

Case reports

Case 1 (Patient 6)

A 58-year-old quadriplegic man had a left trochanteric grade IV sore. We identified one perforator vessel using Doppler probe in the distal IGAP area and designed a 12 × 9 cm sized rectangular flap. His wound was successfully covered with the flap, and the donor site was directly closed. No postoperative complication was observed in 3-years follow-up (Fig. 3).

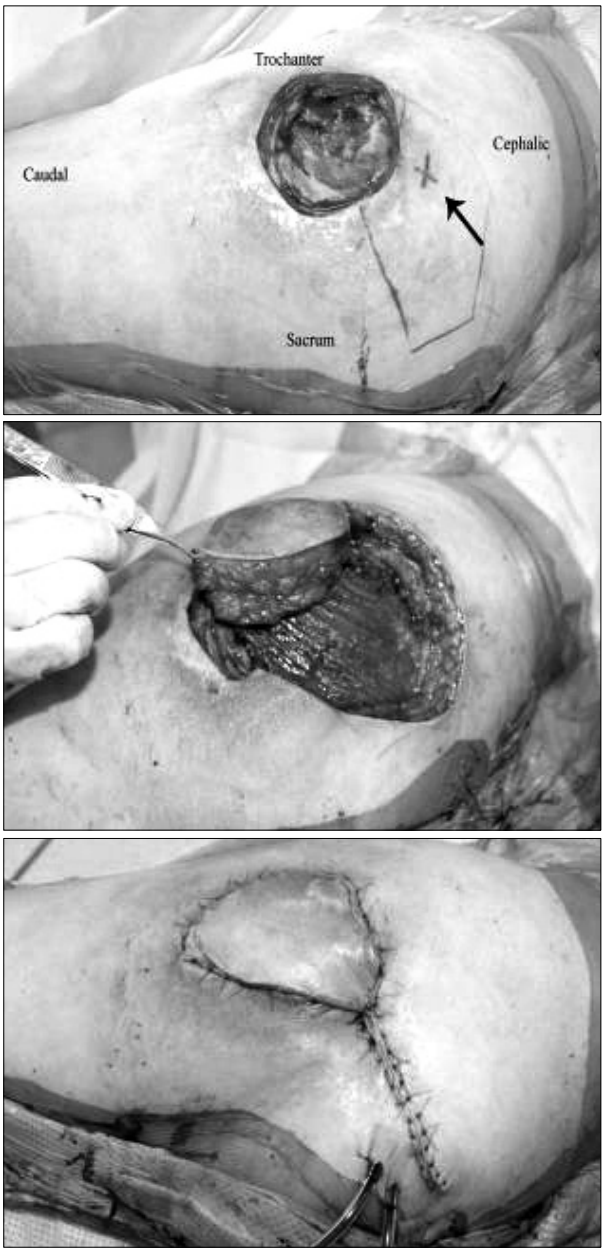

Fig. 3. (Patient 6) (Above) A trochanteric pressure sore and a 12 × 9 cm flap design. (arrow-marked perforator) (Center) The flap was dissected with one preoperatively targeted perforator vessel. We found 0.8 mm diameter perforator vessel at the point we marked preoperatively. (Below) The donor site was closed with primary suture.

Case 2 (Patient 3)

A 22-year-old paraplegic man had a left trochanteric grade IV sore, and we covered the sore with a 7 × 4 cm sized elliptical IGAP flap. The surgical wound completely healed after 3 weeks, but a sore recurred 11 months

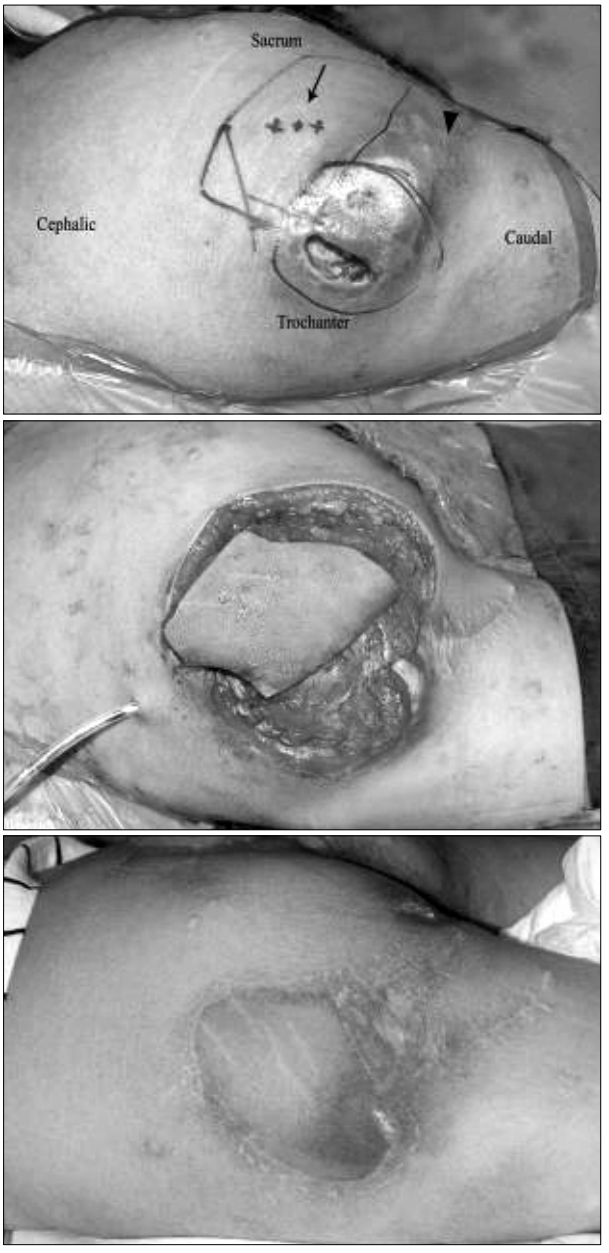

Fig. 4. (Patient 3) (Above) Trochanteric pressure sores and the flap design. Note the scars of previous operation below the designed flap. (arrow-marked perforators, arrow head-scars of previous operation) (Center) The flap was raised to include 2 of the 3 marked perforator vessels. (Below) 14 months after operation.

postoperatively. For the second surgery, we searched for another perforator avoiding the previous full thickness scar. We designed a 14 × 7 cm sized flap containing 3 perforators, which was located above the previous scar, and used the flap to cover the sore (Fig. 4).

IV. DISCUSSION

The treatment of pressure sores has been improved throughout decades, along with development of musculocutaneous flaps. Muscles in the gluteal area, lateral and posterior thighs, such as gluteus maximus, hamstrings, tensor fascia latae and vastus lateralis have been used for reconstruction of sacral, ischial and trochanteric pressure sores.[10,11]

After the introduction of tensor fasciae latae myocutaneous flap, various modification of the flap has been the treatment of choice for trochanteric pressure sores.[1,2] Although these alternatives were successful, it was difficult to cover the recurred sore if the myocutaneous flap was used for the previous operation. The tensor fascia latae muscle maintains tension on the fascia lata to stabilize the thigh muscles during contraction and on the iliotibial tract so that the gluteus maximus muscle maintains the knee joint extended. In addition, when in the seated position, the muscle stabilizes the trunk over the thigh. Also, for patients who can walk, preservation of the regional muscles and local innervation leads to minor functional deficits and better rehabilitation. Furthermore, as mentioned in the above, the recurrence rate of pressure sores after surgical treatment has been reported as 13~61%.[2-4] Due to the high recurrence rate, a flap should be selected considering the possibility of future reconstructive procedures, especially with the paraplegic and the tetraplegic patients.

Since Koshima et al. began developing flaps based on perforator vessels, some clinical studies on perforator flaps were performed with the successful results. The studies of perforators in the gluteal region showed several perforators penetrating the lateral fascial margin of the muscle, even on the lateral border of the gluteus maximus muscle.[6,9] The inferior gluteal artery exits the pelvis through the infrapiriform aperture and supplies the lower two-thirds of the gluteus maximus muscles as well as the overlying skin by numerous musculocutaneous perforators. Its descending branch enters the posterior fascia of the thigh at a midpoint between the ischium and the greater trochanter, where it sends off a cutaneous branch that courses around the inferior border of the gluteus maximus, perforates the fascia lata, and penetrates the subcutaneous tissue. The muscle anatomies could be saved by using these perforators, which in turn reduces donor site morbidity mentioned above.

In our study, two paraplegic patients recurred after complete healing. It was impossible to perfectly prevent

future sores in the paraplegic patients because they have many risk factors described in the above, including poor socio-economical status. The recurred cases were successfully treated with the same method, which could be also used for the future recurrence. Because sores can recur repeatedly in certain patients, perforator flaps might be more helpful than conventional musculocutaneous flaps.

In the previous studies, in which perforator flaps were used for reconstruction, the complication rate was 10~20%.[6-9,12] Our study showed 3 cases of minor complications without total flap necrosis. Two cases of partial flap necrosis were due to venous congestion of distal flap. In these cases, more consideration could be given for a flap design with its proper size and sutures without tension or trauma. Donor site wound dehiscence occurred in a patient who underwent bilateral IGAP flaps with 3 weeks interval. The negative drainage might have been mislocated, because there was focal seroma under the dehiscence site.

Luis et al. presented another possible use of ascending branches of the lateral circumflex femoral artery as a pedicle.[12] According to the authors, the flap could reduce the donor site suture tension, allowing more compatible flaps with proper sizes as well as reducing operative and postoperative recovery time, and thus hospital costs. This method might be one of the surgical choices for the trochanteric sores, which approaches from arteries from the external iliac artery whereas almost all flaps are based on arteries from the internal iliac artery.

Furthermore, the free-style local perforator flaps have been recently reported, where unlimited anatomical landmarks could be used.[13] Such flaps offer greater freedom in choosing donor-sites because the flap selection is based on the quality and the volume of soft tissue required at the recipient site. For the free-style local perforator flaps, Doppler mapping was used for flap design and harvest as described in the above. Our study was more likely performed based on the free-style local perforator flap. As a result, we used the perforators on the lateral border of the gluteus maximus muscle as a pedicle for the reconstruction of the cases, and obtained flaps with sufficient sizes to cover the trochanteric area.

In the study performed by Blondeel et al.,[14] Doppler tracing used for 30 gluteal artery perforator flaps showed 80.6% true positive rate and a positive predictive value of 91.9%. With the result of the study, a more constant course of the branches of the superior gluteal artery allows us to use easier and cheaper unidirectional Doppler flowmetry for planning a gluteal artery perforator flap.

The main disadvantage of this flap is the fragility of its pedicle. Therefore, it demands more attention and the learning curve on the part of the surgeon when dissecting and positioning the flap to prevent pedicle damage or tension. In the postoperative period, the patient must not lie over the flap to prevent traction and/or rupture of the pedicle.

V. CONCLUSION

The gluteal perforator flap could be considered as a safe, favorable alternative for the soft tissue defects in the greater trochanteric area, which has advantages such as lower donor site morbidity and possibility of versatile flap design not only in primary cases but also in recurred cases.

REFERENCES

1. Paletta CE, Freedman B, Shehadi SI: The VY tensor fasciae latae musculocutaneous flap. *Plast Reconstr Surg* 83: 852, 1989
2. Lynch SM: The bilobed tensor fascia lata myocutaneous flap. *Plast Reconstr Surg* 67: 796, 1981
3. Disa JJ, Carlton JM, Goldberg NH: Efficacy of operative cure in pressure sore patients. *Plast Reconstr Surg* 89: 272, 1992
4. Mandrekas AD, Mastorakos DP: The management of decubitus ulcers by musculocutaneous flaps: a five-year experience. *Ann Plast Surg* 28: 167, 1992
5. Tavakoli K, Rutkowski S, Cope C, Hassall M, Barnett R, Richards M, Vandervord J: Recurrence rates of ischial sores in para- and tetraplegics treated with hamstring flaps: an 8-year study. *Br J Plast Surg* 52: 476, 1999
6. Koshima I, Moriguchi T, Soeda S, Kawata S, Ohta S, Ikeda A: The gluteal perforator-based flap for repair of sacral pressure sores. *Plast Reconstr Surg* 91: 678, 1993
7. Cos¸kunfirat OK, Ozgentas HE: Gluteal perforator flaps for coverage of pressure sores at various locations. *Plast Reconstr Surg* 113: 2012, 2004
8. Seyhan T, Ertas NM, Bahar T, Borman H: Simplified and versatile use of gluteal perforator flaps for pressure sores. *Ann Plast Surg* 60: 673, 2008
9. Scheufler O, Farhadi J, Kovach SJ, Kukies S, Pierer G, Levin LS, Erdmann D: Anatomical basis and clinical application of the infragluteal perforator flap. *Plast Reconstr Surg* 118: 1389, 2006
10. Bauer J, Phillips LG: MOC-PSSM CME article: pressure sores. *Plast Reconstr Surg* 121: 1, 2008
11. Sorensen JL, Jorgensen B, Gottrup F: Surgical treatment of pressure ulcers. *Am J Surg* 188: 42, 2004
12. Ishida LH, Munhoz AM, Montag E, Alves HR, Saito FL, Nakamoto HA, Ferreira MC: Tensor fasciae latae perforator flap: minimizing donor-site morbidity in the treatment of trochanteric pressure sores. *Plast Reconstr Surg* 116: 1346, 2005

13. Bravo FG, Schwarze HP: Free-style local perforator flaps: concept and classification system. *J Plast Reconstr Aesthet Surg* 62: 602, 2009

14. Blondeel PN, Beyens G, Verhaeghe R, Van Landuyt K, Tonnard P, Monstrey SJ, Matton G: Doppler flowmetry in the planning of perforator flaps. *Br J Plast Surg* 51: 202, 1998