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Evaluation of V-Y versus rotational flaps for sacral pressure sore reconstruction: a comparative study

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Tiivistelmä suomeksi

Johdanto

Sakraalisten painehaavojen leikkaushoidossa niiden peittoon käytetään yleisesti kahta eri tekniikkaa, V-Y- tai rotaatiokielekettä. Kieleketekniikoiden eroista on olemassa vain vähän tutkimustietoa. Leikkauksen onnistuminen ja tehdyn kielekealueen säilyminen ehjänä on painehaavapotilailla erityisen tärkeää, sillä leikatuilla potilailla on kasvanut riski uuteen painehaavaan (1). Tämän tutkimuksen tavoitteena on vertailla V-Y- ja rotaatiokielekettä sakraalisten painehaavojen peittoleikkauksissa.

Metodit

Tutkimuksessa tarkasteltiin potilaita, joilla oli luokan III-IV sakraalinen painehaava ja joille suoritettiin korjausleikkaus V-Y- tai rotaatiokielekkeellä TYKS:ssä vuosina 2007–2021. Potilaat jaettiin kahteen ryhmään (A ja B) riippuen siitä, kummalla tekniikalla leikkaus suoritettiin. Ensisijaisesti tarkasteltiin kirurgisia komplikaatioita. Toissijaisesti tarkasteltiin sekä sairaalajakson pituutta että tarkemmin postoperatiivisia komplikaatioita ja niiden ilmaantuvuustiheyttä.

Tulokset

Tutkimuksessa tarkasteltiin 75 potilasta, joista 34 oli V-Y- ryhmässä ja 41 rotaatiokielekeryhmässä. Komplikaatioita arvioitiin Clavien–Dindo-luokituksen avulla. Komplikaatioiden esiintyvyydessä ei havaittu merkittävää eroa ryhmien välillä. Kirurgisten komplikaatioiden määrä oli samankaltainen kummassakin ryhmässä (38.2 % vs 39.0 %, $p = 0.944$). V-Y- ryhmässä oli havaittavissa vähäisempää serooman määrää, pienempää verensiirtotarvetta sekä pidempi aika mahdollisen uuden painehaavan syntyyn (0.0% vs 9.8%, $p=0.061$; 0.0% vs 12.5%, $p=0.058$ ja 57 vs 48 päivää $p=0.846$) kuin rotaatiokielekeryhmässä, vaikkakaan ero ei ollut tilastollisesti merkittävä.

Johtopäätökset

Kumpikin leikkaustekniikka on turvallinen ja luotettava sakraalisten painehaavojen peittoleikkauksiin. Gluteaalisen rotaatiokielekkeen käyttöön vaikuttaisi liittyvän korkeampi seroomariski, lisääntynyt tarve postoperatiiviselle verensiirrolle ja lyhyempi aika

haavaresidiiviin kuin V-Y- kielekkeen käyttöön. Kaiken kaikkiaan komplikaatioiden lukumäärä kummallakin leikkaustekniikalla on yhtä suuri.

Abstract

Background

Coverage of pressure sores in the sacral area can be performed with different types of flaps. Little knowledge is available on which flap design is better than another. Available local flaps should be preserved as far as possible for these patients are susceptible of pressure sore recurrence. The aim of this study was to compare the V-Y flap versus the gluteal rotation flap for sacral pressure sore reconstruction.

Methods

All patients who had sacral pressure sores of grades III–IV underwent reconstructions with V-Y flaps or gluteal rotation flap were retrospectively reviewed. Patients were divided into two groups according to the flap performed. The primary outcome measure was the surgical site occurrence (SSO). Secondary outcome measures were the length of hospital stay (LOS), specific postoperative complications and recurrence incidence.

Results

A total of 75 patients were included in the study: 34 patients in V-Y group and 41 patients in rotational flaps group. No significant differences between the study groups were found in respect to demographics, comorbidities, defect sizes and complications (according to Clavien-Dindo Classification). Similarly, no differences were noticed in the length of hospital stay. There was a similar rate of SSOs in both groups (38.2 % vs 39.0 %, $p = 0.944$).

Although not statistically significant, a trend toward reduction of seroma occurrence, blood transfusion need, and longer time to recurrence was detected (0.0% vs 9.8%, $p=0.061$; 0.0% vs 12.5%, $p=0.058$; and 57 vs 48 days $p=0.846$, respectively), favoring V-Y flaps.

Conclusion

Both flap patterns are safe and reliable for sacral pressure sore defect coverage. Gluteal rotational flaps seem to be associated to a higher seroma occurrence, blood transfusion need and shorter time to recurrence. Complication rates are very comparable in both designs; thus, they can be used at surgeon's preference.

Key words: Fasciocutaneous flap; Rotational flap; Sacral pressure sore; V-Y flap

Introduction

Pressure ulcers are found in 5-15% of all patients in care facilities, hospitals, and domiciliary care. They represent a great challenge for multiple specialties including a huge economic burden. In Finland alone, the yearly cost caused by pressure ulcers is estimated to be around 200 million euros (2).

Risk groups for pressure ulcers are especially represented by elderly people and paralytic patients who are immobilized. In addition of age and immobilization, other risk factors for pressure sores are decreased tissue perfusion, poor nutrition and medical comorbidities (3) (4) (5) (6). Sensory deficit and immobilization together with the pressure targeted to the tissue are the typical origin of pressure sores. The most common sites for pressure ulcers are heel, sacrum, ischium, trochanter major and shoulder blade, depending on the lying position of the patient (7).

The most important factors in prevention of pressure ulcers are decreasing the pressure of the tissue and nutritional support (3) (5). Common serious complications for pressure ulcers are wound infections and sepsis. Furthermore, the pain and discomfort caused by pressure sores decrease the quality of life (8).

Pressure ulcers are classified on a scale from I to IV, according to their depth. In stage I-II pressure ulcers are curable and do not extend till dermis. Primary treatment for these sores is conservative. Stage III-IV sores extend through dermis, and primary treatment for them is surgical (5). Reconstruction of the defect area is generally performed using myocutaneous or fasciocutaneous flaps (8). The goal of the reconstruction is to provide a durable coverage of the defect and a good vascular supply of the treated area. The most common complications for reconstructive surgery of pressure ulcers are post-operative infections that can cause necrosis and eventually lost of the flap (9).

It is important to evaluate the possible differences between surgical techniques and incidence of complications to enable science-based evidence for surgeons when they decide which technique to use. Considering Finnish demographic structure, the incidence of pressure ulcers will continue to rise in the future (10) thus, it is important to implement the surgical outcomes in order to ease the economic burden that pressure ulcers yearly cause. Also elaborate study on possible complications and co-morbidities is helpful when deciding whether the patient is eligible for surgical treatment. The most common flap designs are rotational and V-Y flaps. V-Y flap advancement technique is efficient in cover the defect keeping limited the dead

space of the wound, while rotational flaps can reach farther defect but they include larger dead space, increasing a potential risk of seroma.

The aim of this study is to compare two different stage III-IV sacral pressure ulcer reconstruction techniques and their complications. In comparison, we use two most common techniques, the gluteus maximus fasciocutaneous V-Y advancement flap and gluteal fasciocutaneous rotation-advancement flap. We hypothesized that V-Y- technique might be associated with less surgical postoperative complications.

Material and Methods

This is a retrospective review which is comprised of patients from Turku University Hospital who had undergone surgical closure treatment for sacral pressure ulcers between 2007 and 2021. The patients were identified through the hospital surgery registry using the ICD-10 diagnose code. Patients who were included had had a sacral pressure ulcer stage III-IV that was treated with a flap reconstruction. Patients who had pressure ulcer in other location than sacrum were excluded, as well as patients who had not undergone surgical reconstruction but were treated conservatively or with surgical debridement.

The patients accepted to review (n=75) were divided into two groups depending on which technique was used: V-Y- or any type of rotational flap.

Endpoints

The primary outcome measure was the surgical site occurrence (SSO). Secondary outcome measures were the length of hospital stay (LOS), specific postoperative complications, like wound healing complications and recurrence incidence.

Patients

75 patients (29 females and 46 men) were divided into two groups; group A (V-Y- flap) and group B (rotational flap). Mean age \pm standard deviation in group A was 67.7 ± 16.7 and in group B 68.9 ± 17.0 . Patients were analyzed for general factors including sex, age, follow-up time, BMI, defect size, grade of the ulcer, comorbidities (diabetes, high blood pressure, smoking, blood thinning medication). Patient's state of nutrition was taken in consideration by including peri-operative Pre-Albumin and peri-operative Albumin in analysis.

Definitions

Complications were defined and graded according to Clavien– Dindo classification (11).

SSO was defined as any complication involving the operated region.

Hematoma was defined as hematoma that required operation and/or blood cell transfusion.

Superficial infection was an infection that was treated by oral antibiotic administration, deep

infection was an infection that required fistula- debridement and/or intravenous antibiotics.

Suture fistula was a fistula at the operation site that required operation, fat and skin necrosis were taken in consideration only if they needed an operation. Wound dehiscence was taken in consideration if it needed treatment at wound polyclinic or operation.

Surgical technique

Pressure ulcer reconstructions in sacral and ischial sites are performed in general anesthesia with the patient in either the prone or the lateral position. Depending on the surgeon, local anesthetic infiltration is used. The subcutaneous dissection is performed either until the bony surface or shallower, depending of the depth of the wound, until total wound capsule removal is achieved (12). Gentian violet is used to aid and ensure complete excision. If needed, any bony protuberances are flattened to achieve a smooth surface (12). If osteomyelitis is suspected, bone samples are collected for bacterial culture. Then, a flap composed of only subcutis and skin or subcutis, skin and muscle is harvested and mobilized (13). After mobilization a flap advancement is performed, usually by sliding the flap onto wound excision site. Then subcutaneous fascia and deep dermis are closed in one to three layers, to the surgeon's preference.

Patient is placed in prone or lateral decubitus position for 3 weeks after the surgery, during which the hip flexion is avoided. Use of a high risk- pressure ulcer mattress is recommended for 6-8 weeks in order to implement the healing process and to prevent further pressure ulcers (14)

Statistical Analysis

The results of parametric and non-parametric continuous data were expressed as mean +/- standard deviation (SD). Normality assumptions were demonstrated with histograms, Skewness, Kurtosis, and Kolmogorov/Smirnov tests. Pearson's chi-square test, Fisher's exact test, and the Mann-Whitney test or t-test were used for univariate analysis, as appropriate, to

compare the two study groups. The survival function of pressure sore recurrence was evaluated by Kaplan-Meier's methods.

P-values less than 0.05 were considered statistically significant. All analyses were carried out using SPSS statistical software (IBM SPSS Statistics, version 28, Armonk, NY).

Results

A total of 75 patients were included in the study: 34 patients in V-Y group and 41 patients in rotational flap group. The two groups were well balanced and by most parts comparable. No significant differences between the study groups were found in respect to demographics, comorbidities, defect sizes and complications (according to Clavien–Dindo Classification). Similarly, no differences were noticed in the length of hospital stay. There was a similar rate of SSOs in both groups (38.2 % vs 39.0 %, $p = 0.944$). Although not statistically significant, a trend toward reduction of seroma occurrence, blood transfusion need, and longer time to recurrence was detected (0.0% vs 9.8%, $p=0.061$; 0.0% vs 12.5%, $p=0.058$ and 57 vs 48 days $p=0.846$, respectively), favoring V-Y flaps.

Discussion

SSO complication rates (38.2 % vs 39.0 %) in this study were similar to previous studies reviewing complication rates following surgical repair of pressure ulcers (15) (16). Both designs have relatively low complication rates considering that the patients operated are usually multi-morbid and elderly (6). Although the two groups had no statistically significant difference in complication rates, the study suggested that there might be lower risk for seroma occurrence, blood transfusion need and a longer time to recurrence in V-Y-group. This would favor the use of the V-Y-flap especially with patients who are prone to complications. In VY- group among 13 patients who had SSO complications there was no seroma occurrence nor need for blood transfusion.

Major risk group for pressure ulcers are known to be multimorbid patients who have decreased mobility (1). This was seen in patient material since among 75 patients there was only one person without any known comorbidity. Roughly half of the patients had a blood thinning medication, which speaks for comorbidities but also increases risks for post- or perioperative complications such as bleeding and infections (17) (18). In two groups both perioperative Pre- Albumin (0.18 and 0.16), and Albumin (28.2 and 25.7) averages were

under reference values, speaking for poor nutrition which is also a known risk factor for pressure sores (3) (5). According to studies, lowered serum albumin level is but a risk factor for pressure ulcers, it also increases the risk for flap failure and other complications after the surgery (19) (20).

VY- and rotation flaps have both been proven safe for sacral pressure ulcer reconstruction (21) (22), but little research has been done comparing complications between these two designs. Djedovic et al (23) did a critical single center appraisal with 41 patients who had sacral pressure ulcer. The appraisal compared complications in gluteal rotation flap or gluteal V-Y flap. Analyzed factors were average length of hospital stay, follow-up time, complications and comorbidities. The study found no significant difference in complications between two designs, similar to the conclusion in our study. According to Djedovic et al. study, gluteal rotation flaps seem to be more useful for larger ulcers. Djedovic et al did not specify the complications in their study, so further comparison is not possible. Kuo et al (16) compared the differences in complication rates between local perforator flaps, perforator-based rotation fasciocutaneous flaps, and musculocutaneous flaps with 99 patients but found no significant difference between the three designs.

The study has some pitfalls that must be taken into consideration while valuating its findings. Major drawbacks are small number of patients as well as retrospective nature of the study, which was especially challenging due to lacking information in medical reports.

The strength of this study was that we could evaluate patients operated in TYKS, so all patients were operated under similar circumstances and post-operational care-instructions were similar. Since patients were operated in the same hospital district, patient records were comprehensive and evaluating the co-morbidities retrospectively was possible.

In the future it would be interesting to complete this study with larger patient material, possibly from different hospital districts and see if that would affect the occurrence of complications or if there would be statistically significant difference between rotation and V-Y flaps when evaluating larger patient material. Also, usage of different instruments during operation (such as Ligasure and PlasmaPeak) and their effect on complication rates would be an interesting research subject, since at the moment they are used only on surgeons' preference.

Conclusions

Our study suggests that both flap patterns are safe and reliable for sacral pressure sore defect coverage. Gluteal rotational flaps seem to be associated to a higher seroma occurrence, blood transfusion need and shorter time to recurrence. Complication rates are comparable in both designs. Thus, both techniques can be performed safely at surgeon's preference. Further larger studies on this topic are warranted to better define the type of flap indications for sacral pressure sores.

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Table 1. Demographics of patients at time of study.

	<i>Group A (V-Y flap)</i> <i>n = 34</i>	<i>Group B (rotational flap) n = 41</i>	<i>p-value</i>
Age (mean \pm SD)	67.7 \pm 16.7	68.9 \pm 17.0	0.767
Sex ratio (F:M)	13:21	16:25	0.944
Follow-up time (months)	9.1 \pm 20.4	6.9 \pm 18.9	0.636
Mean BMI (kg/m ²)	25.5 \pm 7.7	26.5 \pm 8.2	0.668
Defect size (cm ²)	39.3 \pm 49.0	36.6 \pm 68.9	0.859
Paraplegic (n=)	7	11	0.529
Tetraplegic (n=)	1	2	0.670
Other (n=)	26	28	0.432
Grade III (n=)	14	19	0.851
Grade IV (n=)	20	22	0.815
Any comorbidity	34 (100.0%)	40 (97.6%)	0.359
Diabetes n=(%)	5 (14.7%)	9 (22.0%)	0.423
Blood-thinning medication n=(%)	18 (52.9%)	21 (51.2%)	0.882
Smokers n=(%)	5 (14.7%)	2 (5.0%)	0.236
Peri-Operative Pre-Albumin (mean \pm SD)	0.18 \pm 0.32	0.16 \pm 0.09	0.619
Peri-Operative Albumin	28.2 \pm 3.0	25.7 \pm 5.4	0.113

Table 2. Comparison of perioperative parameters in the two groups of patients.

	<i>Group A (V-Y flap)</i> <i>n = 34</i>	<i>Group B (rotational flap) n = 41</i>	<i>p-value</i>
Operative time (min, mean \pm SD)	152.2 \pm 29.0	148.0 \pm 48.1	0.566
Preoperative VAC	5 (14.7%)	13 (37.7%)	0.108
VAC duration (days, mean \pm SD)	73.8 \pm 47.4	65.4 \pm 36.7	0.692
Estimated blood loss (ml, mean \pm SD)	181.9 \pm 165.3	440.3 \pm 707.3	0.135
Fascio cutaneous flap	13 (38.2%)	7 (17.1%)	0.039
Hospital stay (days, mean \pm SD)	7.8 \pm 5.4	7.9 \pm 6.1	0.966
Total ward drainage (ml, mean \pm SD)	246.6 \pm 156.0	436.4 \pm 466.6	0.106
Mean Drainage duration (days, mean \pm SD)	6.5 \pm 2.5	6.5 \pm 3.7	0.934
Time of wound healing	96.3 \pm 126.9	89.8 \pm 92.5	0.808
Pressure sore recurrence	8 (23.5%)	11 (26.8%)	0.795
Time to recurrence	56.9 \pm 120.0	47.8 \pm 80.1	0.846

Table 3. Postoperative complications at follow-up.

	<i>Group A (V-Y flap)</i> <i>n = 34</i>	<i>Group B (rotational flap) n = 41</i>	<i>p-value</i>
SSO n (%)	13 (38.2%)	16 (39.0%)	0.944
Complications			
<i>Clavien-Dindo grade I</i>			
Superficial wound infection	7 (28.9%)	11 (20.6%)	0.413
<i>Clavien-Dindo grade II</i>			
Seroma	0 (0.0%)	4 (9.8%)	0.061
Blood Transfusion	0 (0.0%)	5 (12.5%)	0.058
<i>Clavien-Dindo grade III</i>			
Hematoma	4 (7.5%)	21 (14.1%)	0.330
Deep wound infection	4 (11.8%)	3 (7.5%)	0.696
Wound dehiscence	4 (11.8%)	9 (22.0%)	0.360
<i>Clavien-Dindo grade IV</i>			
None	0 (0.0%)	0 (0.0%)	
<i>Clavien-Dindo grade V</i>			
Death	1 (2.4%)	1 (2.9%)	0.893