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A COMPARATIVE STUDY BETWEEN V-Y AND ROTATIONAL FLAPS FOR
ISCHIAL PRESSURE ULCER RECONSTRUCTION

Syventävien opintojen kirjallinen työ
Kevätlukukausi 2022

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Kirurgian laitos

Kevätlukukausi 2022

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A comparative study between V-Y and rotational flaps for ischial pressure ulcer reconstruction

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ABSTRAKTI

Tutkimuksen tarkoitus: Potilaille, jotka istuvat tai makaavat pitkiä aikoja samassa asennossa, muodostuu helposti painehaavoja. Painehaavat ovat suuri ongelma erityisesti pyörötuolipotilailla, jotka istuvat pitkiä aikoja samassa asennossa. Tällöin kehon paino keskittyy istuinkyhmyjen alueella pienelle pinta-alalle, jolloin kudosten verenkierto häiriintyy ja krooninen haava alkaa hiljalleen muodostua. Jatkuvan istumarasituksen vuoksi, näiden potilaiden painehaavojen korjaaminen on hankalaa. Painehaavoja on jopa 5–15 %:lla hoitolaitosten potilaita, mutta tutkimusta aiheesta on tehty vain vähän. Tämän tutkimuksen tarkoituksena oli vertailla V-Y-kielekeplastialla ja rotaatiokielekeplastialla hoidettujen istuinkyhmyyn painehaavojen hoidon lopputulosta ja esiintyneitä komplikaatioita.

Aineisto ja menetelmät: Tutkimukseen otettiin mukaan kaikki potilaat, joilla oli III-IV luokan istuinkyhmyypainehaava ja jotka hoidettiin V-Y-kielekeplastialla ja rotaatiokielekeplastialla vuosien 2007 ja 2021 välillä. Leikkauskertomukset käytiin läpi retrospektiivisesti ja potilaat jaettiin kahteen ryhmään tehdyn kieleketyypin mukaan. Primaarisiksi päätetapahtumaksi katsottiin leikkausalueen komplikaatiot ja sekundaarisiksi lopputapahtumiksi sairaalassaoloaika, postoperatiiviset komplikaatiot ja painehaavan uusiutuminen.

Tulokset: Aineistossa mukana oli 47 potilasta: 20 V-Y-kielekeryhmässä ja 27 rotaatiokielekeryhmässä. Ryhmiä vertailtiin demografisten tekijöiden (ikä, sukupuoli, BMI), komorbiditeettien (diabetes, verenohennuslääkitys, tupakointi, verenpainetauti), sairaalassaoloajan, haavojen koon ja Clavien-Dindo-luokituksen mukaisten komplikaatioiden

suhteen. Ryhmissä esiintyi yhtäläisesti leikkausalueen komplikaatioita (40.0 % vs. 25.9 %, $p = 0.355$). V-Y-kielekkeellä hoidetuilla potilailla esiintyi hieman vähemmän uusiutuneita painehaavoja (10.5 % vs. 22.2 %, $p=0.440$) ja uusiutuminen oli hitaampaa (130.5 vs. 70.9 päivää, $p=0.074$). Tilastollisesti merkitseviä eroja edellä mainittujen tekijöiden suhteen ryhmien välillä ei kuitenkaan löytynyt.

Loppupäätelmät: Molemmat tekniikat vaikuttavat olevan yhtä luotettavia istuinkyhmyn painehaavan korjauksessa. V-Y-kielekkeeseen näyttäisi liittyvän vähemmän uusiutuneita painehaavoja, jotka lisäksi muodostuvat hitaammin. Leikkauskomplikaatioiden suhteen vaihtoehdot eivät eronneet toisistaan, joten kieleketyypin valinta voitaneen tehdä leikkaavan kirurgin mieltymysten mukaan.

Asiasanat: Istuinkyhmyn painehaava; V-Y kieleke; Rotaatiokieleke; Kielekeplastia

ABSTRACT

Background: Coverage of the ischial region pressure ulcers is challenging because it is the primary weight-bearing area in wheelchair patients, often very susceptible to mobility. Comparative studies available on which flap design is better are warranted. Available local flaps should be preserved as far as possible for these patients susceptible of pressure sore recurrence. The aim of this study was to compare the V-Y flap versus the inferior gluteal rotation flap ischial pressure ulcer reconstruction.

Methods: All patients with ischial pressure ulcer graded III–IV who underwent reconstructions with V-Y hamstring or fascio-cutaneous flaps, or inferior 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 included the length of hospital stay (LOS), specific postoperative complications and recurrence incidence.

Results: A total of 47 patients were included in the study: 20 patients in V-Y group and 27 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 (40.0 % vs 25.9 %, $p = 0.355$). Although not statistically significant, a trend toward reduction of ulcer recurrence and time to recurrence was noticed (10.5% vs 22.2%, $p=0.440$; 130.5 vs 70.9 days, $p=0.074$, respectively), favoring V-Y flaps.

Conclusion: Both flap designs appear to be similarly reliable for pressure sore defect coverage in the ischial area. V-Y flaps seem to be associated to a lower ulcer recurrence and a longer time to recurrence. Complication rates are very comparable in both designs; thus, they can be used at surgeon's preference.

Key words: Fasciocutaneous flap; Posterior thigh flap; Ischial pressure sore; V-Y flap

INTRODUCTION

Pressure ulcers are found in 5-15% of all patients in care facilities, hospitals and domiciliary care. They are a great challenge for multiple specialties and a huge economic burden. In Finland alone the yearly costs for pressure ulcers are 200 million euros. [1] Considering Finnish demographic structure, the incidence of pressure ulcers will continue to rise in the future when people live longer and the proportion of the elderly in the population continues to increase.

Risk group for pressure ulcers are especially elder 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 comorbidities. [2] Sensory deficit and immobilization together with the pressure targeted to the tissue are the typical origin of pressure sores. The typical sites for pressure ulcers are heel, sacrum, ischium, trochanter major and shoulder blade, depending on the lying position of the patient. [3]

The most important factor in the prevention of pressure ulcers is decreasing the pressure of the tissue and after that comes other therapeutic measures such as nutritional support and wound dressings [4]. The most common serious complications for pressure ulcers are wound infections and sepsis. In addition, the pain and uncomfotability of pressure sores decrease the quality of life of the patients. 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. The primary treatment for these sores is conservatory. Stage III-IV sores extend through dermis, and primary treatment for them is surgical. In surgical treatment the area of the wound is usually covered with myocutaneous or fascicutaneous flap. [5] The most common complications for reconstructive surgery of pressure ulcers are post-operative infections that can cause necrosis and eventually losing the flap. [6] [7]

There are no clear criteria for choosing the flap technique. The selection between V-Y flap and rotational flap is mainly based on operating surgeon's own preferences and observational evidence. If there were notable differences in healing process, complications or recurrence rate, identifying them would help in the selection of technique and ischial pressure ulcer treatment would be more effective in its entirety. It is important to cover the soft tissue and provide an excellent blood supply in order to reduce the risk of recurrence. Rotational flaps might give a better mobilization but with a large dead space underneath the flaps, while V-Y flaps provide an easy advancement of the available tissue with reduced wound dead space.

Our hypothesis in this study is that there are fewer complications, shorter hospital stays, and lower recurrence rate associated with V-Y-flaps so i.e. V-Y-flaps would be superior to rotational flaps in ischial pressure sore reconstruction.

The purpose of this study is comparing stage III-IV ischial pressure ulcer reconstruction techniques and their complications. In comparison, we use two most common techniques, V-Y hamstring or fascio-cutaneous flaps and inferior gluteal rotation flap.

MATERIALS AND METHODS

PATIENTS

A retrospective analysis was performed of all patients with ischial pressure ulcer graded III-IV (NPUAP-classification) [8] and who underwent reconstruction procedures at Turku University Hospital between years 2009 and 2021. From these patients we excluded those who were treated with direct closure or with other types of flaps than V-Y hamstring / fascio-cutaneous flap or inferior gluteal rotation flap. With these criteria total of 47 patients were found and then divided into two groups according which flap was used: group A (V-Y-flap) 20 patients and group B (rotational flap) 27 patients. Mean age $\pm$ standard deviation (SD) in group A was 55.5 ± 14.4 and in group B 56.4 ± 17.0 .

Patients were analyzed for general factors including sex, age, follow-up time, BMI, size of defect, grade of the ulcer and comorbidities (diabetes, blood thinning medication, high blood pressure, smoking,). Peri-operative Pre-Albumin and peri-operative Albumin were also included in analyzes to take patients state of nutrition into account.

The primary outcome measure was surgical site occurrence (SSO), defined as any complication occurred at the operated area. Secondary outcome measures included the length of hospital stay (LOS), specific postoperative complications (e.g. hematoma, seroma, infections, wound dehiscence) and recurrence incidence.

DEFINITIONS

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

Superficial antibiotic was an infection that was treated by per os antibiotics, deep infection was an

infection that needed intravenous antibiotics and/or debridement. Suture fistula was a fistula at the operation site that required operation, fat and skin necrosis were also taken in consideration only if they needed an operation. Wound dehiscence was taken in consideration if it needed treatment at wound polyclinic or in operating room. Complications were defined and graded according the Clavien-Dindo classification [9].

TREATMENT PROTOCOL

All the patients with pressure ulcers were first treated with conservative treatments such as correct patient positioning, wheelchair paddings and time limits in sitting, also alternating pressure air mattress was used. After the surgery drains were kept in wound area at least 3 days and longer if drainage was more than 20 milliliters per day. Patients also had follow-up care in plastic surgery clinic so long that the treating surgeon was satisfied with the healing process.

SURGICAL TECHNIQUE

All patients had ischial pressure ulcer graded III–IV which needed operational reconstruction. Patients in group A were treated with V-Y hamstring or fascio-cutaneous flaps, and patients in group B were treated with inferior gluteal rotation flap.

Operations are done under the general anesthesia and Patients are placed in prone position. Before reconstruction pressure ulcer were cleaned and all non-vital tissue and/or bone was removed. Ulcer revisions were made beforehand or at the same time with reconstruction. X-ray images of the operational site were taken to discover possible osteomyelitis in nearby bone. Inferior gluteal rotation flap design is drawn on posterior thigh laterally and distally to the ulcer. The horizontal width of the flap must be equal to the lateral width of the ulcer. Lateral length of the flap depends on the arc of rotation needed to cover ulcer. Flap is dissected carefully and rotated from longitudinal position into horizontal position. Then flap and the donor site are closed usually in three layers. [10]

For V-Y flap two slightly curved lines are drawn on posterior thigh starting from the distal edge of the ulcer and ending on lower third of the thigh. One line is placed medially and other laterally to the ulcer and they meet at the endpoint forming “V-shape”. Flap is dissected with care and with or

without hamstring muscle. After that flap is inserted into the proximal direction over the ulcer. Lastly flap and doner site are closed. [10]

STATISTICAL ANALYSIS

The results of parametric and non-parametric continuous data were expressed as mean $\pm$ 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 ischial pressure sore recurrence was evaluated by Kaplan-Meier's methods. P-values less than 0.05 were considered statistically significant. SPSS statistical software (IBM SPSS Statistics, version 28, Armonk, NY) was used for all the analysis.

RESULTS

The two groups were well balanced (Table 1).

In group A there was total of 20 patients (3 females and 17 males) who were treated with V-Y flap and 6 (30.0 %) of these were treated with fascio cutaneous flap. Mean age of the patients was 55.5 ± 14.4 years with the mean follow-up time of 12.3 ± 15.6 months. Mean BMI was 24.8 ± 4.9 kg/m². Of these patients 4 were paraplegic and 5 were tetraplegic. All of the patients had at least one comorbidity: diabetes (n = 2, 10.0 %), blood thinning medication (n = 6, 30.0 %) and smoking (n = 4, 20.0 %). The mean perioperative pre-albumin was 0.15 ± 0.05 and the mean of peri-operative albumin was 26.3 ± 4.7 .

In group A 8 of the patients had pressure sore of grade III and 12 had pressure sore of grade IV, the average size of the defect was 74.7 ± 79.7 cm². Total of 5 patients (14.7 %) had preoperative VAC treatment and the average duration of VAC was 62.3 ± 43.1 days.

In group B there was total of 27 patients (10 females and 17 males) who were treated with rotational flap and 7 (26.9 %) of these were treated with fasciocutaneous flap. Mean age of the patients was 56.4 ± 17.0 years with the mean follow-up time of 7.4 ± 1.5 months. Mean BMI was 26.5 ± 7.2 kg/m². Of these patients 9 were paraplegic and 1 was tetraplegic. All of the patients also in this group had at least one comorbidity: diabetes (n = 4, 14.8 %), blood thinning medication (n =

9, 33.3 %) and smoking (n = 7, 26.9 %). The mean perioperative pre-albumin was 0.13 ± 0.05 and the mean of peri-operative albumin was 27.0 ± 6.7 .

In group B 11 of the patients had pressure sore of grade III and 16 had pressure sore of grade IV, the average size of the defect was $46.5 \pm 53.4 \text{ cm}^2$. Total of 13 patients (37.7 %) had preoperative VAC treatment and the average duration of VAC was 47.5 ± 35.8 days.

Operative times were pretty similar in both groups (A: 130.3 ± 35.3 days and B: 140.8 ± 44.7 days, $p = 0.344$). Slightly lesser blood loss was estimated in group A (A mean: 362.7 ± 222.2 ml and B mean: 571.2 ± 881.6 ml), there was still no statistically significant difference with the p-value 0.431. Both groups had almost equal average hospital stay (A: 6.7 ± 6.3 days and B: 7.1 ± 6.7 days, but the mean wound healing time was also shorter in group A (A: 48.0 ± 65.7 days and B: 67.9 ± 84.4 , $p = 0.664$). There was almost no difference in mean drainage duration between groups (A: 6.1 ± 3.5 days and B: 6.6 ± 3.6 days, $p = 0.682$), average of total ward drainage however was smaller in group B (A: 262.8 ± 180.7 ml and B: 208.2 ± 184.5 ml), but not statistically significant $p = 0.438$). There was no big difference in pressure sore recurrence between the groups: in A 8 of the patients (23.5 %) and in B 11 of the patients (26.8 %), $p = 0.795$. Ulcer recurrence rate was slightly smaller in group A with 2 patients (10.5 %) than in group B with 6 patients (22.2 %) but the p-value was 0.440. Bigger difference was in recurrence time: group A 130.5 ± 139.2 days and group B 70.9 ± 69.6 days ($p = 0.074$).

There was no big difference between the groups in postoperative complications at follow-up (Table 3). In total, surgical site occurrence rate was 8 patients (40.0 %) in group A and 7 patients (25.9 %) in group B with the p-value 0.355.

Post-operative complications divided into groups according to Clavien-Dindo classification:

C-D I: superficial wound infection in A 5 patients (25.0 %) and in B 8 patients (30.8 %), $p = 0.749$.

C-D II: Seroma in A 2 patients (10.0 %) and in B 1 patient (3.7 %), $p = 0.567$. Blood transfusion in A 1 patient (5.3 %) and in B 2 patients (7.4 %), $p = 1.00$.

C-D III: Hematoma in A 1 patient (5.3 %) and in none in B (0.0 %), $p = 0.426$. Deep wound infection in A 1 patient (5.0 %) and in B 2 patients (7.4 %), $p = 1.00$. Wound dehiscence in A 5 patients (25.0 %) and in B 5 patients (18.5 %), $p = 0.723$.

There were no Clavien-Dindo IV or V graded complications in either group.

DISCUSSION

Although there were no statistically significant differences between surgical techniques, there were some differences in two groups that are interesting. In group A defect size was bigger than in group B (A $74.7 \pm 79.7 \text{ cm}^2$ and B $46.5 \pm 53.4 \text{ cm}^2$), there was no big differences in age, BMI, comorbidities or peri-operative laboratory results. Also, both groups had equal number of fasciocutaneous and myocutaneous flaps. Still patients with V-Y-flap needed shorter time for wound healing (A: 48.0 ± 65.7 days versus B: 67.9 ± 84.4 days), also ulcer recurrence was lower with V-Y-flaps (A 2 (10.5%) and B 6 (22.2%)). As stated above these were not statistically significant differences but it could be interesting to compare these in bigger dataset to identify possible meaningful differences. Number on post-operative complications was almost identical in both groups (Table 3). Total number of post-operative complications was small (A group 8 and B group 7), which is of course good thing for patients but makes it more difficult to compare different treatment options.

Comparative studies between different flap techniques have not conducted and almost all studies about ischial pressure ulcers are clinical case reviews with only few patients. Also studies with wider patient material usually included sacral, trochanter or other regions sores and not only ischial ulcers. Due to the lack of similar research comparing results is only approximate estimation. But if studies with other pressure ulcers and other flap techniques are taken into consideration our results are similar to those. In our study SSO was in group A 40.0 % and in group B 25.9% and ulcer recurrence rate was A 10.5% and B 22.2%. In other study by Wettstein et al. (2015) with 170 different pressure ulcers, 44 (26 %) complications appeared, 27 (16 %) required surgical treatment, specific complication rate in ischial ulcers was 32 % and overall recurrence rate was 11 % [11]. In Single-centre analysis of ischial defect coverage by Djedocic et al. (2017) 8 of 28 (28.6 %) patients showed complications [12]. Cohort study with 27 patients and 34 pedicled internal pudendal artery perforator (PIPAP) flaps by Legemate et al. (2018), had results where 27 % of flaps had complications which required surgical treatment and 9 % had recurrent ulcer [13].

There are also few limitations in this study: Patients commitment in follow-up treatment plays key role in wound healing and that was not measured in this study so it might be one big reason that causes differences in healing process. Also, follow-up of the patients' condition ended at last visit in the plastic surgery clinic. Thus, long-term effect on mortality or possible mortality-rate

differences between the groups were not included in this study. In most cases patients' nutritional state was defined by single pre-albumin and albumin value.

Further research is needed on this topic. Possibly, longer follow-up time and larger groups would reveal more differences. To get collect more patients, it would be also possible to include sacral, trochanter and coccygeal pressure ulcers into same dataset and then compare all V-Y flaps and rotational flaps together. Insufficient nutrition can cause so much variation in wound healing that it covers variation between different flaps. More accurate observation of nutritional laboratory values by taking them at regular intervals before and after operation would provide chance to eliminate this variable from flap groups.

CONCLUSIONS

Our results show that both flap designs appear to be similarly reliable for pressure sore defect coverage in the ischial area. No statistically significant differences between groups A and B were found in this study. V-Y flaps seem to be associated to a lower ulcer recurrence and a longer time to recurrence. However, complication rates are very comparable in both designs; thus, they can be used at surgeon's preference. Recommendations for using one flap rather than another cannot be given before further larger studies on this topic.

Table 1. Demographics of patients at time of study.

	<i>Group A (V-Y flap)</i> <i>n = 20</i>	<i>Group B (rotational flap) n =</i> <i>27</i>	<i>p-value</i>
Age (mean ± SD)	55.5 ± 14.4	56.4 ± 17.0	0.767
Sex ratio (F:M)	3:17	10:17	0.114
Follow-up time (months)	12.3 ± 15.6	7.4 ± 1.5	0.113
Mean BMI (kg/m ²)	24.8 ± 4.9	26.5 ± 7.2	0.668
Defect size (cm ²)	74.7 ± 79.7	46.5 ± 53.4	0.859
Paraplegic (n=)	4	9	0.348
Tetraplegic (n=)	5	1	0.070
Other (n=)	11	17	0.764
Grade III (n=)	8	11	1.000
Grade IV (n=)	12	16	0.959
Any comorbidity	20 (100.0 %)	27 (100.0 %)	0.359
Diabetes n= (%)	2 (10.0 %)	4 (14.8 %)	1.000
Blood-thinning medication n= (%)	6 (30.0 %)	9 (33.3 %)	0.808
Smokers n= (%)	4 (20.0 %)	7 (26.9 %)	0.732
Peri-Operative Pre-Albumin (mean ± SD)	0.15 ± 0.05	0.13 ± 0.05	0.551
Peri-Operative Albumin	26.3 ± 4.7	27.0 ± 6.7	0.804

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

	<i>Group A (V-Y flap)</i> <i>n = 20</i>	<i>Group B (rotational flap) n</i> <i>= 27</i>	<i>p-value</i>
Operative time (min, mean $\pm$ SD)	130.3 $\pm$ 35.3	140.8 $\pm$ 44.7	0.344
Preoperative VAC	5 (14.7 %)	13 (37.7 %)	0.108
VAC duration (days, mean $\pm$ SD)	62.3 $\pm$ 43.1	47.5 $\pm$ 35.8	0.639
Estimated blood loss (ml, mean $\pm$ SD)	362.7 $\pm$ 222.2	571.2 $\pm$ 881.6	0.431
Fascio cutaneous flap	6 (30.0 %)	7 (26.9 %)	0.818
Hospital stay (days, mean $\pm$ SD)	6.7 $\pm$ 6.3	7.1 $\pm$ 6.7	0.800
Total ward drainage (ml, mean $\pm$ SD)	262.8 $\pm$ 180.7	208.2 $\pm$ 184.5	0.438
Mean Drainage duration (days, mean $\pm$ SD)	6.1 $\pm$ 3.5	6.6 $\pm$ 3.6	0.682
Time of wound healing	48.0 $\pm$ 65.7	67.9 $\pm$ 84.4	0.664
Pressure sore recurrence	8 (23.5 %)	11 (26.8 %)	0.795
Ulcer recurrence	2 (10.5 %)	6 (22.2 %)	0.440
Time to recurrence	130.5 $\pm$ 139.2	70.9 $\pm$ 69.6	0.074

Table 3. Postoperative complications at follow-up.

	<i>Group A (V-Y flap)</i> <i>n = 20</i>	<i>Group B (rotational flap) n</i> <i>= 27</i>	<i>p-value</i>
SSO (n =, %)	8 (40.0 %)	7 (25.9 %)	0.355
Complications			
<i>Clavien-Dindo grade I</i>			
Superficial wound infection	5 (25.0 %)	8 (30.8 %)	0.749
<i>Clavien-Dindo grade II</i>			
Seroma	2 (10.0 %)	1 (3.7 %)	0.567
Blood Transfusion	1 (5.3 %)	2 (7.4 %)	1.000
<i>Clavien-Dindo grade III</i>			
Hematoma	1 (5.0 %)	0 (0.0 %)	0.426
Deep wound infection	1 (5.3 %)	2 (7.4 %)	1.000
Wound dehiscence	5 (25.0 %)	5 (18.5 %)	0.723
<i>Clavien-Dindo grade IV</i>			
None	0 (0.0 %)	0 (0.0 %)	
<i>Clavien-Dindo grade V</i>			
None	0 (0.0 %)	0 (0.0 %)	

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