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ORIGINAL CONTRIBUTION

Outcomes of the Composite Anterolateral Thigh Flap for Perineal Reconstruction After Postoncological Abdominoperineal Resection

Running title: Composite ALT flap in APR

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ABSTRACT

BACKGROUND: The vertical rectus abdominis flap is considered the gold standard in perineal reconstruction after oncological abdominoperineal resection, however has a non-negligible donor site morbidity. The anterolateral thigh flap offers reliable soft tissue coverage.

OBJECTIVE: The aim was to analyze long term outcomes of composite anterolateral thigh-vastus lateralis flaps in oncological abdominoperineal resections.

DESIGN: We conducted a retrospective cohort analysis of a prospectively maintained database.

SETTINGS: This study was conducted in the Lausanne university hospital. Annually, approximately 10 oncological abdomioperineal resections are performed. Literature reports 7-20% of patients undergoing abdominoperineal resection requiring flap reconstruction; in our institution, approximately 2 patients with large defects after abdominoperineal resections required reconstruction.

PATIENTS: Twenty-nine pedicled anterolateral thigh-vastus lateralis flaps in 27 consecutive patients (mean age 63 years +/-11.2, 23 with radio-chemotherapy) after abdominoperineal resection to cover large defects (median 190 cm^2, 48–600 cm^2) were analyzed.

INTERVENTION: Pedicled composite anterolateral thigh-vastus lateralis flaps were performed after oncological abdominoperineal resection.

MAIN OUTCOME MEASURES: Descriptive statistical analysis was conducted. Short and long-term outcomes were analyzed, uni- and multivariate analysis were performed. Median follow-up was 16 months (12-48 months).

RESULTS: Flap-related postoperative complications occurred in 16 flaps, flap-survival was 100%. Multivariate logistic analysis identified initial defect size as predictive for complications. Patients with larger defects (≥ 190 cm^2) had higher complication rates (**p=0.006). Long-term analysis revealed three chronic fistulae, two tumor recurrences, one flap dysesthesia and one perineal acne inversa.

LIMITATIONS: Limitations include retrospective analysis, selection bias and lacking a control group. Sample size limits statistical power.

CONCLUSIONS: The pedicled anterolateral thigh-vastus lateralis flap offers reliable, stable tissue with low morbidity and good long-term outcomes. Complications compared favorably with current literature describing perineal reconstructions with rectus abdominis flaps. The composite anterolateral thigh flap is a valid alternative without the setback of abdominal donor site morbidity. See **Video Abstract** at http://links.lww.com/DCR/B757.

RESULTADOS DEL COLGAJO COMPUESTO ANTEROLATERAL DE MUSLO PARA LA RECONSTRUCCIÓN PERINEAL DESPUÉS DE LA RESECCIÓN ABDOMINOPERINEAL POST ONCOLÓGICA

ANTECEDENTES: El colgajo vertical de recto abdominal se considera el estándar de oro en la reconstrucción perineal después de la resección abdominoperineal oncológica, sin embargo, tiene una morbilidad no despreciable en el sitio donante. El colgajo anterolateral del muslo ofrece una cobertura confiable de los tejidos blandos.

OBJETIVO: El objetivo fue analizar los resultados a largo plazo de los colgajos compuestos anterolaterales del muslo - vasto lateral - en resecciones abdominoperineales oncológicas.

DISEÑO: Realizamos un análisis, retrospectivo, de tipo cohorte, de una base de datos mantenida prospectivamente.

AJUSTES: Este estudio fue realizado en el hospital universitario de Lausanne. Anualmente se realizan aproximadamente 10 resecciones abdominoperineales oncológicas. La literatura reporta que entre el 7 y el 20% de los pacientes que se someten a una resección abdominoperineal requieren de reconstrucción con colgajo; en nuestra institución, aproximadamente 2 pacientes con grandes defectos tras la resección abdominoperineal requirieron reconstrucción.

PACIENTES: Fueron analizados veintinueve colgajos pediculados anterolaterales de muslo - vasto lateral - en 27 pacientes consecutivos (edad media 63 años +/- 11,2, 23 con radio quimioterapia)

después de la resección abdominoperineal para cubrir defectos grandes (mediana 190 cm2, 48-600 cm2).

INTERVENCIÓN: Tras la resección abdominoperineal oncológica se realizaron colgajos pediculados compuestos anterolaterales de muslo - vasto lateral.

PRINCIPALES MEDIDAS DE RESULTADO: Fue realizado un análisis estadístico descriptivo. Fueron analizados los resultados a corto y largo plazo – fueron realizados así mismo análisis uni y multivariados. La mediana de seguimiento fue de 16 meses (12-48 meses).

RESULTADOS: Complicaciones postoperatorias relacionadas con el colgajo ocurrieron en 16 colgajos, la supervivencia del colgajo fue del 100%. El análisis logístico multivariado identificó al tamaño del defecto inicial como predictor de complicaciones. Aquellos pacientes con defectos más grandes (≥ 190 cm2) tuvieron mayores tasas de complicaciones (** p = 0,006). El análisis a largo plazo reveló tres fístulas crónicas, dos recidivas tumorales, una disestesia de colgajo y un acné perineal inverso.

LIMITACIONES: Las limitaciones incluyen análisis retrospectivo, sesgo de selección y falta de grupo de control. El tamaño de la muestra limita el poder estadístico.

CONCLUSIONES: El colgajo pediculado anterolateral de muslo - vasto lateral - ofrece tejido confiable y estable con baja morbilidad y buenos resultados a largo plazo. Los resultados de las complicaciones se mostraron favorables con respecto a la literatura actual que describe reconstrucciones perineales con colgajos de recto abdominal. El colgajo compuesto anterolateral de muslo es una alternativa válida sin el revés de la morbilidad del sitio donante abdominal. Consulte **Video Resumen** en http://links.lww.com/DCR/B757. *(Traducción—Dr. Osvaldo Gauto)*

KEY WORDS: Abdominoperineal resection; Anterolateral thigh flap; Peri neal reconstruction.

INTRODUCTION

Postoncological perineal reconstruction remains challenging for plastic surgeons: extensive resections leave large dead spaces, with remnant local tissues often damaged by radiotherapy. Literature reports complication rates ranging 14 to 80%.[1–4] Fistulae, chronic abscesses, irradiated skin and constant pressure during seating are some of many challenges to overcome.[5–7] For these reasons, perineal reconstruction requires voluminous, stable and reliable tissue. Literature reports flap reconstruction in APR ranging 7 to 20%,[8,9] with primary closure showing a significant increase of perineal complications compared to flap closure.[10] The reconstructive armamentarium includes local,[5,11–13] abdominal (vertical rectus abdominis myocutaneous VRAM or vertical deep inferior epigastric perforator v-DIEP),[9,14–16] and thigh-based flaps (gracillis myocutaneous, anterolateral thigh ALT, posteromedial thigh PMT).[5,6,17–20] Pedicled VRAM are considered the gold standard after APR. This technique is however limited by the number and position of ostomies needed and prior abdominal surgery.[4] Moreover, the use of abdominal flaps (VRAM, v-DIEP) suffers from potentially severe donor site morbidity, abdominal bulging with symptomatic herniation occurring in up to 67% of cases.[10,14,21] Although literature widely adopted the pedicled VRAM, recent data suggests that composite ALT flaps (associated to the vastus lateralis (VL) muscle) show similar advantages without the setback of potential abdominal donor site morbidity.[21,22]

The ALT flap described by Song in 1984 represents an ideal solution, due to its long pedicle, wide rotation arc, big skin paddle, and possibility to tailor bulk by harvesting various portions of vastus lateralis as a composite ALT-VL myocutaneous flap. The algorithm proposed by Zelken et al. shows the versatility of composite ALT flaps in perineal wounds.[5] However, data on long-term outcomes remain scarce, especially in an oncological setting.

The aims of this study were to critically analyze outcomes and complications in ALT-VL flap reconstructions after oncological APR, both at short (e.g. wound healing) and long term (>12

months, and at the end of follow up). Reporting of our results was conducted according to STROBE guidelines.[23]

PATIENTS AND METHODS

Twenty-seven consecutive patients undergoing perineal reconstruction at the Lausanne university hospital (CHUV) by pedicled composite ALT-VL after oncological APR performed between January 1, 1999 to December 31, 2019 were included in a prospectively maintained database. Reviewed data in this retrospective cohort study was retrieved from patients' electronic medical records, included demographic metrics, comorbidities, tobacco use, defect size, operation duration, radiotherapy, chemotherapy, postoperative short- and long-term complications as well as follow-up duration.

Outcome definitions were specifically defined for perineal reconstruction as previously reported: major flap-related complications included total or partial flap loss, major wound dehiscence at donor or recipient site involving more than a third of the incision length and persistent dead space requiring additional reconstructive surgical procedures during follow-up. Minor complications included local infections resolving by antibiotic therapy alone, recipient or donor site seromas or hematomas not requiring drainage, dehiscence at donor or recipient site involving less than a third of the incision length that healed with conservative treatment, debridement, split-thickness skin graft (STSG) or flap advancement. Complete wound healing was defined by the absence of signs of infection and intact skin and considered the total healing time if the patient underwent a secondary surgical procedure. Donor site outcomes were defined as favorable in the absence of deambulation problems, pain and color-mismatch.[20]

Written consent was obtained from all patients, agreeing to retrospective analysis of data, photographic documentation and publishing of results. The study was designed according to the guidelines of the 1975 Helsinki Declarations.

Oncological resection and debridement were performed by visceral surgeons; 23 cases of reconstructions were secondary, with 7 to 10 days of delay allowing wound conditioning and decontamination by negative wound pressure therapy (VAC®, KCI, Acelity Inc., San Antonio, Texas, USA). Four cases were primary reconstructions in planned large resections due to local advanced cancer.

Preoperative markings identifying ALT-perforators by pencil Doppler were performed the day before the reconstruction; patients were placed in lithotomy position in order to access both the thigh and the perineum. Dissection of the ALT flap with VL muscle as a composite flap was performed as described in previous series.[20]

Before committing to the flap harvest, the defect size was carefully assessed, particularly the volume needed to fill the perineal dead space: this allowed a tailored harvest of vastus lateralis muscle. In larger defects, the flap included vascularized fascia lata to reconstruct a stable, solid pelvic floor (Fig. 1)

The elevated flap was passed through a tunnel between the sartorius and rectus femoris muscles until reaching the perineum: this leads to a gain of 5 to 8 centimeters and avoids tension on the pedicle.[22,24] Flap inset was performed in layers. Hereafter are two illustrations of representative cases (Figs 2 and 3).

Postoperative course included clinical and Doppler flap monitoring, alternate lateral decubitus and mobilization by postoperative day 5. Seating was allowed after full healing and suture removal, usually 3 weeks postoperatively.

Subject selection bias was mitigated by the retrospective nature of this study: patient selection was dictated by the clinical situation and the defect size determined the need for flap reconstruction. Confounding bias was limited by using multivariate analysis in the statistical method.

Continuous variables are presented as mean (+/- standard deviation) or as median (range) depending on the normality of their distribution, verified using the Shapiro-Wilk test. They were compared

using two-sided independent t-test or Mann-Whitney U test. Complications were compared using two-sided Fisher's exact test. We used logistic regression and linear regression to assess associations between independent variables (age, defect size, neoadjuvant radiotherapy, tobacco use) and dependent outcomes (complications, time to healing, hospital stay).

Statistical significance was set at a p-value < 0.05. Statistical analysis was performed using GraphPad Prism (version 8.0, GraphPad® software, La Jolla, CA) and SPSS for Mac (version 25, IBM Corp., Armonk, N.Y., USA).

RESULTS

In the aforementioned timeframe, 27 patients (13 female) with extensive perineal defects following APR underwent reconstructive surgery with 29 pedicled composite ALT-VL flaps (2 patients with bilateral reconstructions). Seven patients underwent APR after tumor recurrence. Twenty-three patients underwent a staged procedure.

Mean age at the time of the procedure was 63 years (+/- 11.2 years). Table 1 summarizes the APR indication, defect size, operation duration and adjuvant treatment. Table 2 displays postoperative outcomes.

Resulting perineal defect surfaces ranged from 48 to 600 cm^2, with a median defect size of 190 cm^2. Median operation duration was 230 min (90-510 min). Median time to complete wound healing was 20 days (13-76 days), median length of hospital stay (total duration of hospitalization, including the APR procedure) totaled 31 days (14-95 days). The median follow-up was 16 months (12-48 months).

Three flaps developed major complications; two secondary reconstructive procedures due to partial flap necrosis were performed; one flap developed venous congestion requiring revision surgery. Thirteen flaps presented a limited peripheral dehiscence, which were treated either by debridement, flap re-advancement or conservative treatment. The remaining 13 flaps did not present any complication. There was no flap loss in this series (Table 3).

Using a median-split separation for defect size we observed that flaps covering larger defects (≥ 190 cm^2) presented 3 major complications (3 out of 16, 19%) and 9 minor complications (56%), accounting for a global 75% complication rate, significantly (*p= 0.03) higher when compared the flaps used for smaller defect sizes (<190 cm^2), which did not develop any major complication and only minor complications (Figure 4).

Multivariate logistic analysis including age, defect size, history of neoadjuvant radiotherapy (RT and RT/CT) and tobacco use revealed only the defect size as independent risk factor for complications (Table 4).

We performed linear regression analysis on time to complete wound healing and length of hospital stay in relation to defect size, tobacco use, age, and neoadjuvant therapy. Again, the surface of perineal defect following oncologic surgery was an independent predictor of both length of hospital stay (*p=0.04) and time to complete healing (*p=0.03). Tobacco use interestingly failed to reach statistical significance (p= 0.18). Age (p= 0.90) and history of neoadjuvant treatment (p= 0.48) did not reach statistical significance on length of hospitalization. Again the same factors were not independent predictors of total time to healing (tobacco use p= 0.12; age p=0.88; history of neoadjuvant treatment p= 0.71).

We recorded following local and regional long-term complications during the mean follow-up time of 16 months (12-48 months): 3 fistulae, 2 local tumor recurrences, one flap dysesthesia with muscle animation, one perineal occurrence of acne inversa in a patient with extensive acne inversa overlapping the oncological disease. We did not encounter any perineal hernia or pelvic instability.

DISCUSSION

This study reports outcomes and complication profiles of 29 consecutive postoncological perineal reconstructions by pedicled composite ALT-VL flaps. Final defect coverage was achieved in all patients, noteworthy considering the expected high complication rates in perineal reconstruction.[1,8,21]

Out of 29 flaps, we observed three major complications requiring revision surgery (10%). We identified solely the defect size as independent risk factor for complications. Overall complications were high in this series, although no reconstructive failure occurred. The ALT-VL composite flap shows favorable reconstructive success rates, similar to the VRAM, the current gold standard, without the potential donor site morbidity.

This study suffers several limitations, starting from its retrospective analysis of a however prospectively maintained database. We acknowledge a selection bias as patients addressed to our unit were the most complex cases with either extensive defects or previous recurrent complications after their initial ablative intervention. We also acknowledge the lack of a control group in this study.

Our outcomes compare similarly to a recent meta-analysis comparing flap closure by gracillis myocutaneous or VRAM flaps, reporting major complications ranging from 0 to 17%.[10] In another series by Spasojevic et al comparing pedicled VRAM reconstruction versus primary closure, the VRAM group had a 30-day unplanned reoperation rate of 20%.[9]

The only clear variable identified as strongly linked to complication rates was the defect size: this confirms findings of a previous series published in our institution.[20] Data showed a significant correlation between defect size and complications – using a median-split, patients with an initial defect equal or larger than 190 cm^2 had a significantly higher complication rate (86% vs. 31% for patients with a smaller initial defect).

The relatively high incidence of minor complication rate (13 out of 29 flaps) is in line with current literature.[2,8,9] The mean time to complete healing (29 days) appears to be significantly shorter when compared to recent literature on VRAM outcomes showing delayed healing.[9]

Both radio-chemotherapy and smoking did not show a higher rate of perineal complications: this is again representative of current available data published in other series.[15,21] However, smoking clinically showed a positive trend towards complications, suggesting how this condition should be

still considered with attention before embarking in complex perineal flap surgery. Interestingly, smoking did not show statistical significance towards flap related complications rates. We interpret this being related to lack of statistical power especially when we examined impact of independent variables on final outcomes, such as smoking, despite being the largest single-center study on ALT composite flap for reconstruction after APR. For instance, larger series on ablative surgeries describe smoking as an independent risk factor towards complications.[25] Analysis of more cases in the future might clarify the impact of smoking on healing time and incidence of complications.

The choice of the ideal flap for perineal reconstruction is a complex task, and even the necessity of flap reconstruction has been debated in literature.

In a systematic review by Devulapalli et al., no significant differences were noticed between the different myocutaneous flaps used (i.e. VRAM, gracillis). Moreover, primary closure showed a significant increase of the likelihood of perineal complications as compared to myocutaneous flap closure.[10]

Distant pedicled flaps show fewer complications than local flap closure, as local tissues may have been jeopardized by radiotherapy or infection. Moreover, adjacent local flaps may be limited in volume, without the possibility of carrying tissue bulk often needed in the perineal defect: Sheckter et al. did not find any difference between primary closure and flap reconstruction groups in complications, but admitted differences in comorbidities, radiotherapy, size and complexity of the defect between groups,[4] hinting towards selection bias.

Indeed, a direct comparison of outcomes between primary closure and flaps coverage after APR risks to be not pertinent as patient selection bias can be relevant. This was clearly shown in a systematic review and meta-analysis by Yang et al., examining eighteen studies totaling 17913 patients. The authors identified 1567 cases where either VRAM or gracilis myocutaneous flaps were used. The flap reconstruction group showed a more advanced cancer stage as opposed to the primary closure groups, as well as a larger proportion of comorbidities (diabetes, smoking) and

preoperative radiotherapy. The meta-analysis showed a reduced risk towards overall wound complications, perineal wound complications and perineal wound infection in myocutaneous flap reconstruction.[21]

Our long term follow-up data is in line with current literature for both local tumor recurrences and fistulae,[10,13,21,26] and compares favorably with series describing primary closure of perineal wounds when examining pelvic floor instability.[21]

The favorable outcomes we measured in this series confirms previous smaller series on the ductility of ALT in regions spanning from lower abdomen, groin and perineal wound reconstruction.[5,20,22,24]

In our experience, in the particular setting of tumor ablation by APR, a myocutaneous ALT-VL flap is an ideal solution for regional flap reconstruction. Not only does it provide abundant volume in form of bulk (VL, reliable subcutaneous fat), it can also provide vascularized fascia (fascia lata) to reconstruct a missing or fragile perineal floor.[20,22]

Postoncological perineal wounds present an extensive and deep tissue defect, myocutaneous ALT-VL flaps are an ideal solution for regional flap reconstruction.[5,20]

When we compare to the widely adopted VRAM flap, several advantages favor the composite ALT, making it the primary tool for extensive perineal reconstruction in our unit. Firstly, the absence of abdominal donor site morbidity, whereas potential abdominal bulging after VRAM can arise in up to 25% of cases as described in a recent meta-analysis,[21] even up to 67% of cases in other recent reports.[10,14] Indeed, the thigh does not show any major functional or esthetic impairment after ALT raise, even when the majority of the VL is harvested.[26] In our series, three patients required a skin graft to the donor site, all showing uneventful healing, no functional impairment and no aesthetic complains.

Second, the thigh represents a virgin donor site for flap harvest, whereas prior abdominal surgery or previous ostomies can seriously jeopardize perfusion and compromise VRAM harvest.[5]

Finally, the ALT flap is localized far from often radiated perineal field, and the position of the reconstructive surgeon lateral to the thigh also clears the abdomen for the ablative team, allowing for simultaneous two team approach.

Although VRAM has been widely adopted in literature, recent data suggests that the composite ALT+VL may show better outcomes without the setback of abdominal donor site morbidity, however comparative studies are needed. This series reinforces previous reports with a solid experience over two decades. Moreover, our data give critical insights on predicting potential complications, which clearly appear with the increase of the soft tissue defect size resulting after APR.

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FIGURE LEGEND

Fig. 1: Raised composite ALT flap, including bulk (vastus lateralis, arrows) and fascia lata (*).

Fig. 2: Large defect (≥190 cm^2). A, intraoperative; B, postoperative; C 12 months follow-up views in lithotomy position.

Fig. 3: Small defect (<190 cm^2). A, intraoperative; B postoperative; C 12 months follow-up views in lithotomy position.

Fig. 4: Minor and major complications in small (<190cm^2) and large (≥190cm^2) defect patients groups. Note the highly significant difference in the overall complication rate (**p=0.006)

TABLE LEGENDS

Table 1. Patient demographics, diagnosis, reconstructive procedure, defect size and operating time. CT: chemotherapy, RT: radiotherapy, ALT: anterolateral thigh flap, VL: vastus lateralis, FL: fascia lata.

Table 2. Patient outcomes, related to defect size, STSG: split thickness skin graft.

Table 3. Flap complications in both small (<190 cm^2) and large (≥190 cm^2) defect groups. A significant statistical difference between total number of complications (*p=0.03) was seen between groups.

Table 4. Multivariate logistic analysis, note only the defect size as significantly increasing complications.

Table 1 Patient demographic data, operative procedure

n	Sex/Age [years]	Diagnosis	Neoadjuvant treatment	Defect Size [cm^2]	Reconstructive procedure	Operative time [min]
1	F/68	recurrent vulvar melanoma + ovarian cystadenocarcinoma	RT + CT	128 (16 x 8)	ALT myocutaneous + VL	190
2	F/41	anal epidermoid carcinoma	RT + CT	192 (12 x 16)	ALT myocutaneous + VL	240
3	F/71	anal epidermoid carcinoma	RT + CT	160 (16 x10)	ALT myocutaneous + VL	330
4	F/56	recurrent vulvar melanoma	CT	120 (12 x 10)	ALT fasciocutaneous + VL	200
5	F/64	recurrent anal epidermoid carcinoma	RT + CT	240 (16 x 15)	ALT myocutaneous + VL	180
6	F/70	vulvar epidermoid carcinoma	RT	177 (15 cm diameter)	ALT myocutaneous + VL	150
7	M/77	rectum adenocarcinoma	RT	112 (14 x 8)	ALT myocutaneous + VL	192
8	F/81	rectum adenocarcinoma	RT	154 (14 cm diameter)	ALT myocutaneous + VL	150
9	F/68	recurrent rectum adenocarcinoma with rectovaginal fistula	RT + CT	162 (18 x 9)	ALT myocutaneous + VL	210
10	M/50	anal epidermoid carcinoma	RT + CT	396 (22 x 18)	Double ALT myocutaneous + VL	230
11	F/64	recurrent anal epidermoid carcinoma	RT + CT	136 (17 x 8)	ALT myocutaneous + VL	180
12	M/65	rectum adenocarcinoma + perineal fistula	RT + CT	180 (18x 10)	ALT myocutaneous + VL	158
13	M/40	recurrent sacral chordoma	RT	120 (15 x 8)	ALT myocutaneous + VL	294
14	F/77	rectum adenocarcinoma	RT	190 (19 x 10)	ALT myocutaneous + VL + FL	96
15	F/72	anal epidermoid carcinoma	RT	270 (18 x 15)	ALT myocutaneous + VL	240
16	F/60	anorectal junction epidermoid carcinoma	RT + CT	160 (20 x 8)	ALT myocutaneous + VL	270
17	M/50	recurrent anal epidermoid carcinoma	RT + CT	48 (8 x 6)	ALT fasciocutaneous + VL	395
18	M/64	anal epidermoid carcinoma	RT + CT	225 (15 x 15)	ALT fasciocutaneous + VL + FL	510
19	F/65	vulvar epidermoid carcinoma	RT + CT	300 (25 x 12)	ALT myocutaneous + VL	475
20	M/57	mucinous anal adenocarcinoma	-	400 (20 x 20)	ALT myocutaneous + VL + FL	286
21	M/59	mucinous perineal adenocarcinoma	-	200 (20 x 10)	ALT myocutaneous + VL	283
22	M/66	mucinous anal carcinoma and right colon adenocarcinoma	-	198 (22 x 9)	ALT myocutaneous + VL	90
23	M/74	anal epidermoid carcinoma	RT	120 (8 x 15)	ALT myocutaneous + VL	467
24	M/63	perineal basal cell carcinoma	RT	450 (25 x 18)	Double ALT myocutaneous + VL	313
25	M/74	rectum adenocarcinoma	RT + CT	600 (30 x 20)	ALT myocutaneous + VL + FL	241
26	M/67	rectum adenocarcinoma with para-anal fistula	RT + CT	300 (15 x 20)	ALT myocutaneous + VL	225
27	F/39	anal epidermoid carcinoma	RT + CT	285 (19 x 15)	ALT myocutaneous + VL + FL	190

Table 1: Patient demographics, diagnosis, reconstructive procedure, defect size and operating time. CT: chemotherapy, RT: radiotherapy, ALT: anterolateral thigh flap, VL: vastus lateralis, FL: fascia lata.

Table 2 Patient outcomes

n	Defect Size [cm^2]	Outcome	Donor site closure	Time to Healing [days]	Hospital Stay [days]
1	128 (16 x 8)	peripheral dehiscence, direct closure after debridement	primary closure	30	42
2	192 (12 x 16)	remaining defect covered by double gracilis muscular flap	primary closure	21	24
3	160 (16 x10)	peripheral dehiscence, direct closure after debridement	primary closure	30	50
4	120 (12 x 10)	peripheral dehiscence covered by local pudendal flaps and flap debulking	primary closure	30	38
5	240 (16 x 15)	favorable	primary closure	14	18
6	177 (15 cm diameter)	favorable	primary closure	14	29
7	112 (14 x 8)	favorable	primary closure	14	21
8	154 (14 cm diameter)	favorable	primary closure	13	15
9	162 (18 x 9)	favorable	primary closure	14	48
10	396 (22 x 18)	venous suffering of one of the flaps, revision and STSG for partial necrosis	partial closure, STSG	42	80
11	136 (17 x 8)	favorable	primary closure	20	29
12	180 (18x 10)	favorable	primary closure	14	19
13	120 (15 x 8)	favorable	primary closure	14	14
14	190 (19 x 10)	peripheral dehiscence covered by local pudendal flap	primary closure	40	43
15	270 (18 x 15)	major dehiscence requiring second reconstructive procedure by gracilis myocutaneous flap	primary closure	26	67
16	160 (20 x 8)	peripheral dehiscence, conservative treatment	primary closure	20	55
17	48 (8 x 6)	favorable	primary closure	14	30
18	225 (15 x 15)	peripheral dehiscence, direct closure after debridement	primary closure	37	53
19	300 (25 x 12)	peripheral dehiscence, conservative treatment	primary closure	40	34
20	400 (20 x 20)	peripheral dehiscence, conservative treatment	primary closure	21	30
21	200 (20 x 10)	peripheral dehiscence, direct closure after debridement	primary closure	14	29
22	198 (22 x 9)	peripheral dehiscence, direct closure after debridement	primary closure	30	31
23	120 (8 x 15)	favorable	primary closure	14	76
24	450 (25 x 18)	peripheral dehiscence, direct closure after debridement	partial closure, STSG	76	95
25	600 (30 x 20)	peripheral dehiscence, conservative treatment	primary closure	14	30
26	300 (15 x 20)	favorable	primary closure	14	22
27	285 (19 x 15)	peripheral dehiscence, direct closure after debridement	partial closure, STSG	30	65

Table 2: Patient outcomes and complications, STSG: split thickness skin graft.

Table 3 Complications related to defect size

Complications	Flaps used (n=29)	
	defect <190cm^2, n=13	defect ≥190cm^2, n=16
minor	4 (31%)	9 (56%)
major	none	3 (19%)
total complications	4 (31 %)	12 (75%)

Table 3: Summary of flap complications in both small (<190cm^2) and large (≥190cm^2) defect groups. A significant statistical difference between in total number of complications (* p=0.03) was seen between groups.

Table 4

Variable	OR	95CI	P value
Age, per one year increase	*0.99*	*0.9 – 1.08*	*0.67*
Tobacco use	*4.36*	*0.48 – 52.44*	*0.22*
Defect size, per 50cm^2 increase	*2.11*	*1.05 – 4.38*	**** 0.04***
Neoadjuvant radiotherapy	*0.39*	*0.26 – 5.86*	*0.50*

Table 4 : Multivariate logistic analysis, note only the defect size as significantly increasing complications

Figure 1

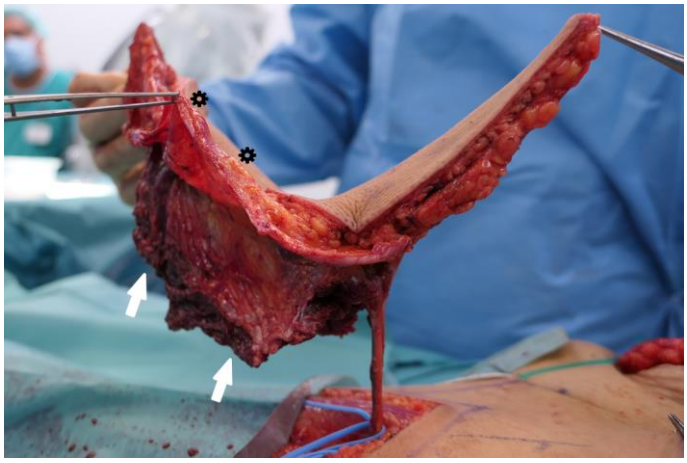

Figure 2

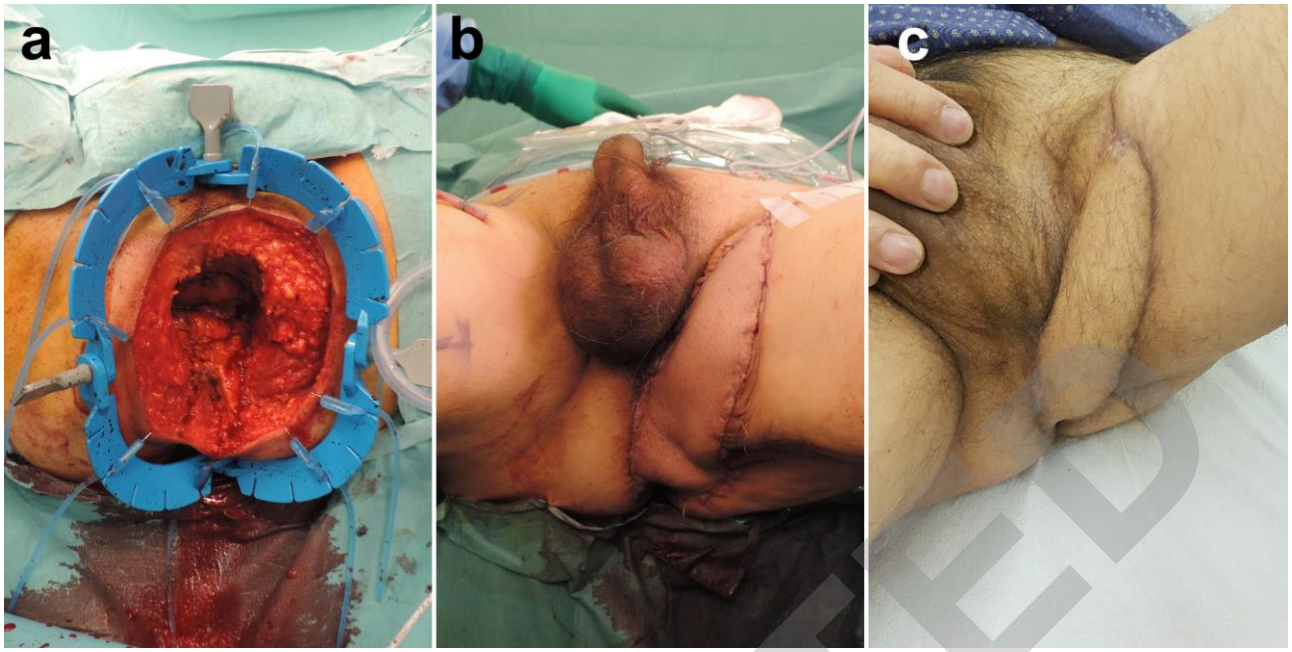

Figure 3

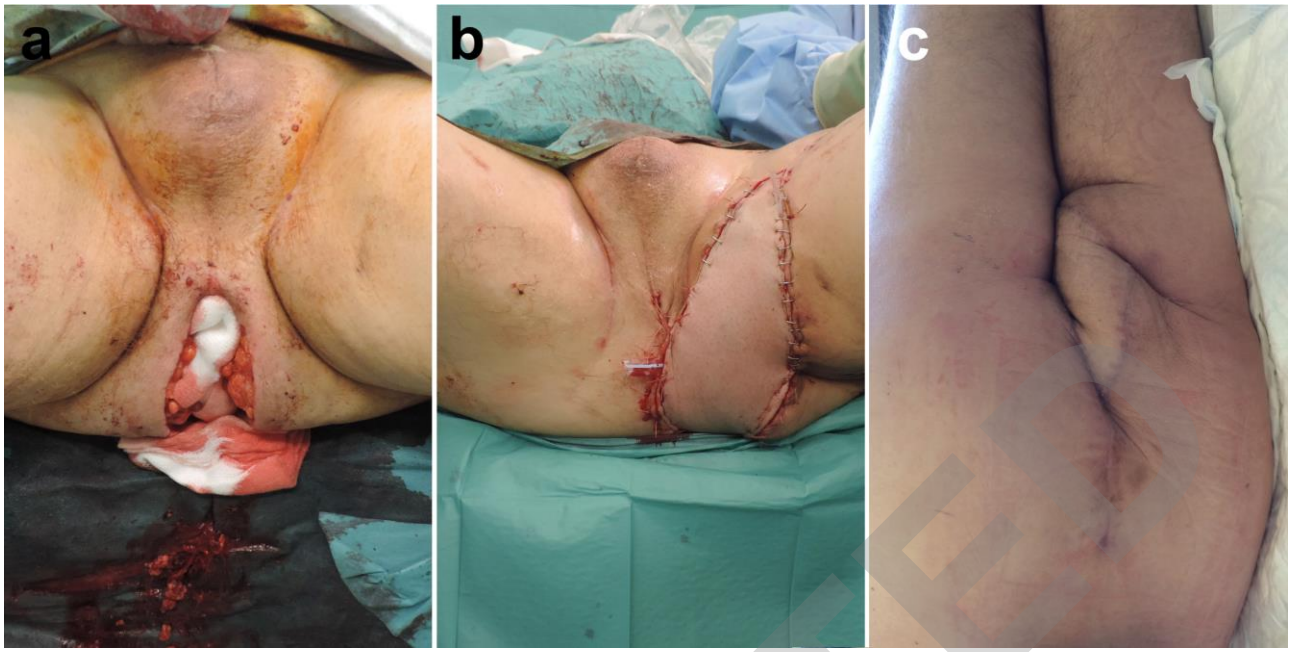

Figure 4