Received: 20 June 2022 | Accepted: 31 August 2022

DOI: 10.1002/jso.27092

RESEARCH ARTICLE

Journal of SURGICAL ONCOLOGY WILEY

Impact of etiology leading to abdominoperineal resection with anterolateral thigh flap reconstruction: A retrospective cohort study

Joachim N. Meuli MD[1] | Martin Hubner MD[2] | Jérôme Martineau MSc[1] | Carlo M. Oranges MD, PhD[3] | David Guillier MD[4] | Wassim Raffoul MD[1] | Pietro G. di Summa MD, PhD[1]

[1]Department of Plastic and Hand Surgery, Lausanne University Hospital, Lausanne, Switzerland

[2]Department of Visceral Surgery, Lausanne University Hospital, Lausanne, Switzerland

[3]Department of Plastic, Reconstructive and Aesthetic Surgery, Geneva University Hospitals, Geneve, Switzerland

[4]Unit of Facial, Plastic, Reconstructive, Aesthetic and Hand Surgery, CHU Dijon, Dijon, France

Correspondence

Pietro G. di Summa, MD, PhD, Department of Plastic and Hand Surgery Lausanne University Hospital Rue du Bugnon 46, Lausanne 1011, Switzerland.

Email: Pietro.Di-Summa@chuv.ch

Abstract

Background: Large and deep perineal defects following abdominal perineal resection (APR) are a challenge for reconstructive surgeons. Even if generally performed for oncological reasons, APR can be indicated as well in extended infection-related debridement for Hidradenitis suppurativa, Fournier's gangrene, or Crohn's disease. We aimed to compare the outcomes of two groups of patients with different indications for APR (infectious vs. oncological) after pedicled anterolateral thigh (ALT) flap coverage

Results: Forty-four consecutive pedicled ALT flap used for coverage after APR in 40 patients were analyzed. 26 patients (65%) underwent APR for oncological reasons and 14 patients (35%) for infectious reasons. The overall postoperative complications rate was significantly higher for infectious cases (76.5% vs. 40.7%, $p = 0.0304$). Major complications occurred in 52.9% of infectious cases versus 11.1% of oncological cases ($p = 0.0045$). Obesity and infectious etiology were independent risk factors for overall and major complications, respectively.

Conclusion: Patients undergoing APR for acute or chronic infections had significantly more overall and major complications than patients having oncological APR. Modified care might be considered, especially in obese patients, in terms of surgical debridement, antibiotic treatment modalities, and postoperative management.

KEYWORDS

abdominoperineal resection, cancer, oncology, perineal reconstruction, surgery

1 | INTRODUCTION

1.1 | Background

Large and deep perineal defects following abdominal perineal resection (APR) are a challenge for reconstructive surgeons.

These are generally due to oncological resection but can follow extensive debridement for infectious reasons as well, such as in patients with extensive perineal Hidradenitis suppurativa, fulminant Fournier's gangrene, or complex perianal Crohn's disease.

Most of the published literature advocates the use of flaps over direct closure in an attempt to decrease the risk of wound failure, particularly after radiation therapy.[1–8] Regardless of the underlying etiology, reconstruction is generally indicated for large and deep defects. Vertical rectus abdominis muscle (VRAM) or gluteal flaps have been generally used in the past for larger defects, while lotus petal flaps and/or gracilis flaps have been more commonly adopted for less extensive defects.[9] Interestingly, the anterolateral thigh (ALT) flap, despite being a workhorse of plastic surgery for head and neck region[10–12] and extremities[13,14] was less utilized for perineal reconstruction.

This merits to be revisited as the pedicled version of this flap has largely proven to be a reliable option for coverage of the perineal area.[15–18] Furthermore, this flap offers multiple possible combinations to design the most appropriate coverage for the defect while avoiding the relevant abdominal donor site morbidity of VRAM or oblique rectus abdomini musculocutaneous flaps.[19]

Wong et al. published good results in 2009 already[20] and more recent literature confirmed that pedicled ALT flaps were good alternative to abdominal-based reconstruction techniques also in cases of deep defects with pelvic exenteration.[18,21,22] Earlier studies focused on APR performed in oncological settings only[20,22] but Perrault et al. study,[21] published in 2020, included patients in which APR was performed because of Crohn's disease. A total of 75% of these patients developed postoperative complications compared to only 32% of the patients who underwent the same surgical procedure because of a neoplasia. Definitive conclusions could, however, not be drawn at the time because of a limited number of patients. This study was, therefore, designed to compare surgical details and postoperative outcomes between larger sets of patients who underwent APR, and later coverage with ALT flaps, for oncological and infectious indications.

2 | MATERIALS AND METHODS

2.1 | Study design

This retrospective cohort study included consecutive all adult patients who underwent perineal reconstruction after APR with a unilateral or bilateral pedicled ALT flap between December 1998 and June 2021 with a minimal follow-up of 1 month.

Patients who benefited from another type of reconstruction (e.g., split-thickness skin grafts, local advancement flaps, gracilis myocutaneous flap, vertical rectus abdominis myocutaneous flap) were excluded. No minimal or maximal defect size was set. The study was approved by the institutional review board (ID 2021-02060). Written consent was obtained from all patients, agreeing to retrospective analysis of data, photographic documentation, and publishing of results. The study was conducted according to the guidelines of the 1975 Helsinki Declaration. Reporting adhered to the STROBE guidelines.

2.2 | Data sources/measurement

Population's characteristics, intervention details, and occurrence of complications were collected from the hospital electronic medical records (Soarian®, Cerner) and checked for accuracy by the lead authors.

2.3 | Investigated variables and outcomes

The following cohort characteristics were retrieved: patients' age and gender, comorbidities (alcohol abuse, tobacco use, diabetes, obesity, high blood pressure, active neoplasia other than the one requiring APR, cardiovascular disease, corticoid therapy, or malnutrition), radiotherapy or chemotherapy before or after APR, diagnosis leading to APR, defect size, time between APR and coverage, length of intervention and type of ALT flap performed (myocutaneous vs. fasciocutaneous).

Diagnosis leading to APR was classified in two categories, creating the two arms of this study: oncological or infectious, the latest including Fournier's gangrene, Hidradenitis suppurativa (Verneuil's disease) as well as complex perinanal Crohn's disease. In case of incidental neoplasia diagnosed in known infectious situations, the etiology was selected as infectious as this was the indication for APR.

Outcomes of interest were the following: time to complete wound healing, time to discharge (number of days between coverage and discharge), total hospital stay, major or minor operating site complications, and donor site complications. Major complications were defined according to previously published literature[17]: partial or total flap loss, flap congestion, or hypoxia requiring emergency retake to operating theater, wound dehiscence involving >1/3rd of incision length or persistent dead space requiring a supplementary reconstructive procedure. Minor complications included wound dehiscence involving <1/3rd of incision length, which healed after split-thickness skin grafting, direct suture or advancement of the ALT flap, wound dehiscence left to secondary healing but persisting >4 weeks, or surgical site infection. Per department policy, all clinically relevant surgical site infections were treated with surgical washout and IV antibiotics.

The primary outcome of the study was the complication rate (major or minor complications). The secondary outcomes were the length of postoperative hospital stay, defined as the number of days between the first reconstructive coverage and discharge of the patient, as well as the time to complete wound healing.

2.4 | Statistical analysis

Continuous variables are presented as medians (range), while discrete data are presented as full numbers or percentage. Normality was tested using Shapiro–Wilk's test given the limited number of observations.

Differences in characteristics and outcomes were assessed using two-sided exact Fisher's test for categorical variables and Mann–Whitney test for continuous variables.

A multivariable logistic or linear regression analysis was conducted in case of statistically significant differences in outcomes to assess the impact of predicting variables. Variables were included in this analysis if they showed a univariate association ($p < 0.25$) with the chosen outcome. There was no missing data. All analyses were performed using GraphPad Prism (version 9.2.0 for Windows, GraphPad Software). A p value < 0.05 was considered significant.

3 | RESULTS

3.1 | Patients

Forty-four consecutive pedicled ALT flap were used as coverage after APR in 40 patients. Three patients had immediate bilateral pedicled ALT flaps because of very large defect size and one patient required a second ALT after failure of the first one (Figure 1: flow diagram).

3.2 | Descriptive data

Patients' and flaps' characteristics are presented in Table 1. The median age was 63.5 years (interquartile range [IQR] 17.0) with a predominance of males (24 males vs. 16 females). Twenty-six patients (65.0%) underwent APR for oncological reasons and 14 patients (35.0%) for infectious reasons. Among these 14 patients were 7 patients with Fournier's gangrene, 3 patients with Hidradenitis suppurativa and 4 major fistulas in the setting of severe Crohn disease. Among the 26 oncological patients, 16 had epidermoid carcinomas, 6 had adenocarcinomas, 2 had melanomas, 1 had a chrondrosarcoma and 1 had a chordoma. Overall, 16 patients (40%) were smokers and 33 patients (82.5%) had at least one major comorbidity. The oncological etiology group was significantly older ($p = 0.0190$), had more female patients ($p = 0.0001$) and used corticoid therapy less ($p = 0.0368$) than the infectious etiology group. Tobacco use showed a trend toward a significantly higher frequency in the infectious group ($p = 0.0894$). Alcohol addiction, high blood pressure, obesity, diabetes, cardiovascular disease, malnutrition, and concomitant secondary active neoplasia were equally frequent in both groups.

There was no difference in defect size (median 186.0, IQR 131.0), in delay between debridement and coverage (median 14.0, IQR 21.0) nor in operative time (median 240.0, IQR 116.0) between the oncological group and the infectious group.

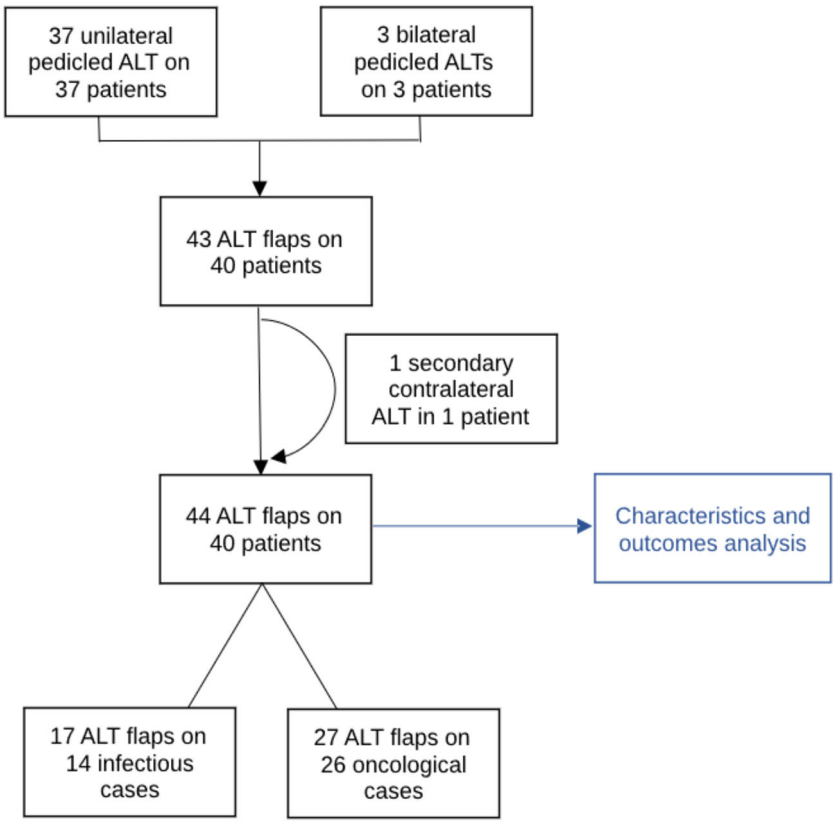

FIGURE 1 Flow

TABLE 1 Patients' and flaps' characteristics, medians [IQR] or *n* (%)

Patients characteristics	Total population *n* = 40	Infectious cases *n* = 14	Oncological cases *n* = 26	*p* Value
Age (years)	63.5 [17.0]	57.5 [17.0]	65.0 [±15.75]	**0.0190***
Female, *n* (%)	16 (40.0)	0 (0.0)	16 (61.5)	**0.0001*****
Smokers, *n* (%)	16 (40)	8 (57.1)	7 (26.9)	0.0894
Presence of at least one major comorbidity, *n* (%)	33 (82.5)	13 (92.9)	19 (73.1)	0.2216
Alcohol abuse, *n* (%)	8 (20.0)	3 (21.4)	5 (19.2)	>0.9999
Diabetes, *n* (%)	6 (15.0)	2 (14.3)	4 (15.4)	>0.9999
Obesity, *n* (%)	6 (15.0)	2 (14.3)	4 (15.4)	>0.9999
Hypertension, *n* (%)	13 (32.5)	4 (28.6)	9 (34.6)	>0.9999
Other active neoplasia, *n* (%)	4 (10.0)	1 (7.1)	3 (11.5)	>0.9999
Cardiovascular disease, *n* (%)	7 (17.5)	1 (7.1)	6 (23.1)	0.3870
Corticoid therapy, *n* (%)	3 (7.5)	3 (21.4)	0 (0.0)	**0.0368***
Malnutrition, *n* (%)	9 (22.0)	5 (35.7)	4 (15.4)	0.2338
Associated radiotherapy, *n* (%)	26 (65.0)	2 (14.3)	24 (92.3)	**<0.0001**
Associated chemotherapy, *n* (%)	19 (47.5)	1 (7.1)	18 (69.2)	**0.0002****
Length of follow up (months)	12.0 [18.75]	17.0 [31.5]	10.0 [12.5]	0.0722
Flaps characteristics	**Total population *n* = 44**	**Infectious cases *n* = 17**	**Oncological cases *n* = 27**	***p* Value**
Defect size (cm^2)	186.0 [131.0]	198.0 [120.0]	180.0 [150.0]	0.5869
Delay between debridement and coverage (days)	14.0 [21.0]	14.0 [16.0]	15.0 [28.0]	0.5692
Operative time (min)	240.0 [116.0]	260.0 [98.0]	230.0 [140.0]	0.8254

Abbreviation: IQR, interquartile range.

*$p < 0.05$.

**$p < 0.01$.

***$p < 0.001$.

3.3 | Outcome data

Twelve flaps out of 44 (27.3%) developed major complications. Eight presented a major dehiscence, 2 flaps presented a major necrosis, 1 presented a venous congestion cause by an hematoma, and 1 was complicated by a persistent dead space that required secondary filling with gracilis flaps. It is worth noting that all these flaps eventually healed despite the need for revision surgery. We observed 12 minor complications (27.3%), among which 10 were minor dehiscences, 1 was a fistula, and 1 was a surgical site infection. The overall complications rate (any major or minor complication) was 76.5% for infectious cases and 40.7% for oncological cases ($p = 0.0304$). Major complications occurred in 52.9% of infectious cases versus only 11.1% of oncological cases ($p = 0.0045$, Figure 2). Minor complications were as frequent in both groups (23.5% of infectious cases and 29.6% of oncological cases). There was no difference between groups in donor site complications (Table 2).

The median time to wound healing for the entire cohort was 21.0 (IQR 23.25) days. The difference between the infectious group (median 25.0 days, IQR 76.0) and the oncological group (median 20.0 days, IQR 16.0) was not significant ($p = 0.1892$) and had no impact on time to discharge and total hospital stay, which were similar across both groups.

Multivariable logistic regression was used to analyze the relationship between potential predicting variables and the occurrence of overall complications. The diagnosis leading to APR, the presence of obesity, the age, the smoking status, ongoing corticosteroid therapy, the occurrence of radiotherapy, the defect size, and the delay were selected upon univariate analysis. The odds ratio for

each of these variables is presented in Table 3. In this multivariate analysis, obesity was retained as an independent predicting factor ($p = 0.0244$).

The same approach was used for major complications. For this outcome, gender, the diagnosis leading to APR, the presence of major comorbidities, ongoing corticosteroid therapy, the occurrence of chemotherapy, the occurrence of radiotherapy, and defect size were selected upon univariate analysis. The odds ratio for each of these variables is presented in Table 4. For this outcome, the diagnosis leading to APR was retained as an independent predicting factor ($p = 0.0462$).

4 | DISCUSSION

In this study, short-term outcomes after APR and ALT flap reconstruction were significantly worse in patients with underlying infectious indications. Obesity was the only other independent risk factor for overall postoperative complications.

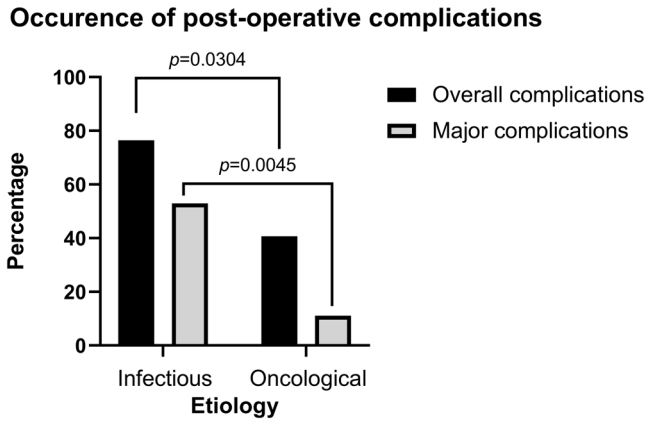

FIGURE 2 Comparison of postoperative complications

One possible explanation lies in the associated pathologies of these patients. They are more likely to be smokers and are significantly more frequently on corticosteroids therapy, both of which are demonstrated risk factors for postoperative complications.[23,24] The difference in tobacco use is only trending toward

TABLE 3 Multivariate regression analysis for overall complications

	OR	95% CI	*p* Value
Age (per 1 year increase)	0.99	0.92–1.07	0.9265
Infectious etiology	5.68	0.48–118.00	0.1964
Smoker	2.61	0.41–18.66	0.3150
Obesity	26.20	2.21–843.90	**0.0244***
Corticoid therapy	0.36	0.01–13.43	0.5424
Radiotherapy	0.44	0.04–4.95	0.4912
Delay (per 1 day increase)	0.96	0.89–0.99	0.1109
Defect size (per 1 cm^2 increase)	0.99	0.99–1.00	0.4521

Abbreviations: CI, confidence interval; OR, odds ratio.

TABLE 4 Multivariate regression analysis for major complications

	OR	95% CI	*p* Value
Female gender	3.18	0.1722–172.9	0.4798
Infectious etiology	82.46	2.156–15 951	**0.0462***
Presence of major comorbities	0.99	0.08316–23.99	0.9966
Corticosteroid therapy	2.26	0.1086–75.57	0.6009
Chemotherapy	1.25	0.1014–33.04	0.8685
Radiotherapy	5.90	0.5203–153.1	0.1892
Defect size (per cm^2 increase)	1.00	0.9998–1.017	0.1219

Abbreviations: CI, confidence interval; OR, odds ratio.

TABLE 2 Outcomes, medians [IQR] or *n* (%)

Patients outcomes	Total population *n* = 40	Infectious cases *n* = 14	Oncological cases *n* = 26	*p* Value
Time from operation to discharge (days)	28.5 [21.5]	28.0 [5.5]	29.5 [27.0]	0.8941
Total hospital stay (days)	43.0 [39.0]	44.0 [37.5]	42.5 [42.75]	0.5218
Flaps outcomes	**Total population *n* = 44**	**Infectious cases *n* = 17**	**Oncological cases *n* = 27**	***p* Value**
Overall operative site complications (*n*)	24 (54.5)	13 (76.5)	11 (40.7)	**0.0304** *
Major operative site complications (*n*)	12 (27.3)	9 (52.9)	3 (11.1)	**0.0045** **
Minor operative site complications (*n*)	12 (27.3)	4 (23.5)	8 (29.6)	0.7395
Donor site complications (*n*)	5 (11.3)	3 (17.6)	2 (7.4)	0.3590
Time to complete wound healing (days)	21.0 [23.25]	25.0 [76.0]	20.0 [16.0]	0.1892

Abbreviation: IQR, interquartile range.

significance but this is likely the result of the limited number of patients included in this study. Another potential reason is wound bed contamination, which is more frequent in infectious patients than in oncological ones, and might have contributed to wound dehiscence (Figures 3 and 4). It, however, fails to explain the higher flap loss rate. The difference in gender between the two arms of our cohort is likely explained by the much higher incidence of Fournier's gangrene in male than in female patients.

The higher rate of overall and major complications in patients with infectious etiologies did not translate into a longer postoperative hospital stay or total hospital stay. Indeed, once stable reconstruction was achieved after the initial postoperative weeks, patients were generally transferred to peripheral hospitals or discharged with intense ambulatory nursing support, making differences in hospital stay between groups somewhat less relevant.

The median time to wound healing for the entire cohort, at 21 days, is similar to previously published studies reporting on direct closure,[25] on coverage with other flaps, and on coverage with pedicled ALT including some from our own institution[17,18] and complete wound healing was eventually achieved in 100% of the patients. We, however, observed a nonsignificant trend toward a longer time to complete wound healing in the infectious etiology group. The range for the oncological etiology group was reasonably narrow (11–42 days), whereas the range for the infectious etiology group was considerably larger (12–195 days). Albeit not relevant statistically, these outliers create a considerable challenge in clinical management as achieving wound closure in these settings might be extremely complicated. Altogether, the occurrence of more complications and the potential risk of very long time to complete wound healing should lead us to reflect on possible changes in the management of future patients who undergo APR for infectious indications. Preconditioning the wound by surgical drainage combined with long-term antibiotics before performing APR could reduce the infectious charge and possibly improve flap healing. Such an approach is sometimes not realistic, such as in emergency debridement of Fournier's gangrene, but is advocated in the literature regarding Hidradenitis suppurativa.[26,27] Similarly, more generous and prolonged surgical site drainage before coverage, combined with negative pressure wound therapy such as performed in the coverage of infected sternotomy wounds,[28] could possibly reduce complications. All patients in this series received selective IV antibiotic therapy treatment based on perioperative microbiological samples. Detailed antibiotic management was unfortunately not recorded but offers an interesting option for further refinement, especially in patients with

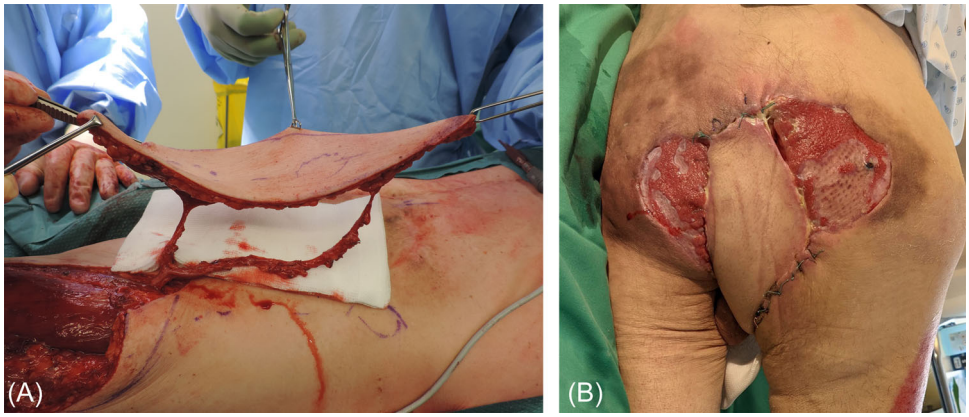

FIGURE 3 Pedicled anterolateral thigh coverage in infectious case. (A) Flap raise. (B) Flap inset

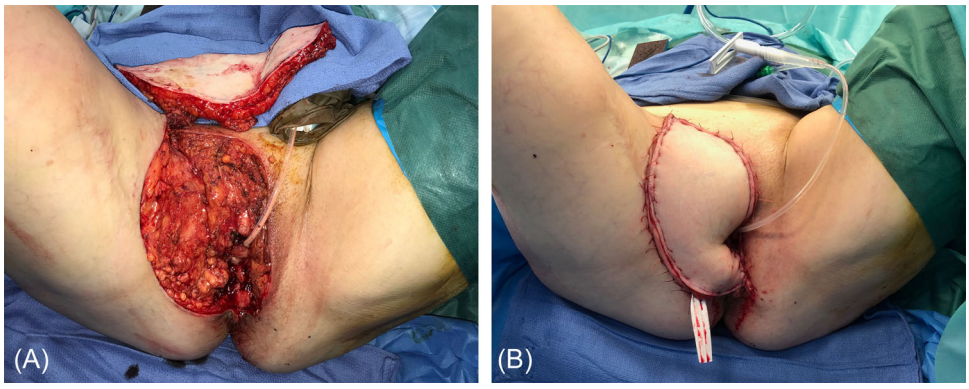

FIGURE 4 Pedicled anterolateral thigh coverage in oncological case. (A) Flap raise. (B) Flap inset

infectious diseases that may host multiple bacteria and may have undergone previous long-term antibiotic therapies creating potential resistance to treatment. Local administration of gentamicin, for example, has been showed to reduce perineal wound infection in APR performed for oncological indications.[29,30] Similarly, good evidence exists that antibiotic therapy helps to achieve a remission phase in Hidradenitis suppurativa, allowing major surgeries to be performed with higher success rates.[31,32] Last but not least, concomitant immunomodulatory therapies, such as anti-TNF, seem to offer better outcomes after endorectal advancement flaps for Crohn's perianal fistulas.[33] There is, however, no evidence of the effects on pedicled flaps reconstruction.

4.1 | Limitations

The external validity of this study's results is limited by its retrospective design. The association between obesity and overall postoperative complications is possibly overestimated because of the limited size of our sample, but might as well underscores the challenges in postoperative management such as maceration, difficult mobilization, and stronger shearing forces that put this population at high risk of overall complications. Results might have been impacted by local protocols, customs, and constraints. Association and not causality can be tested with this study's design. The chosen outcomes are objective measures but the evaluation of wound dehiscence and wound healing could carry a nonnegligible inter-rater variability. Personal bias has been rendered less likely by the fact that several contributors performed data collection and data analysis but it cannot be fully excluded.

5 | CONCLUSION

Patients undergoing a pedicled ALT flap reconstruction for APR in the setting of an infectious disease had more postoperative complications, particularly major ones requiring secondary interventions, than patients undergoing the same procedures in the setting of an oncological disease. These differences were independent of age and prior chemotherapy/radiotherapy. Reconstructive surgeons should, therefore, consider wounds preconditioning, optimization of the medical management of the underlying pathology, smoking cessation, different and prolonged antibiotic regimens as well as other surgical strategies in these patients and in presence of obesity in particular.

ACKNOWLEDGMENT

Open access funding provided by Universite de Lausanne.

AUTHOR CONTRIBUTIONS

Pietro G. di Summa, David Guillier, and Joachim N. Meuli designed the study. Joachim N. Meuli and Jérôme Martineau collected the data. Joachim N. Meuli analyzed the data. Joachim N. Meuli, Martin Hubner, and Pietro G. di Summa wrote the manuscript. All authors contributed and approved the final version of the manuscript. The data that support the findings of this study are available from the corresponding author upon reasonable request.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

ORCID

Joachim N. Meuli http://orcid.org/0000-0002-8433-3288

REFERENCES

1. Bullard KM, Trudel JL, Baxter NN, Rothenberger DA. Primary perineal wound closure after preoperative radiotherapy and abdominoperineal resection has a high incidence of wound failure. *Dis Colon Rectum*. 2005;48(3):438-443.
2. Spasojevic M, Mariathasan AB, Goscinski M, et al. Vertical rectus abdominis musculocutaneous flap repair improves perineal wound healing after abdominoperineal resection for irradiated locally advanced rectal cancer. *Ann Surg Oncol*. 2018;25(5):1357-1365.
3. Myers PL, Krasniak PJ, Day SJ, Bossert RP. Gluteal flaps revisited: technical modifications for perineal wound reconstruction. *Ann Plast Surg*. 2019;82(6):667-670.
4. Walma MS, Burbach JPM, Verheijen PM, Pronk A, van Grevenstein WMU. Vacuum-assisted closure therapy for infected perineal wounds after abdominoperineal resection. A retrospective cohort study. *Int J Surg*. 2016;26:18-24.
5. Chessin DB, Hartley J, Cohen AM, et al. Rectus flap reconstruction decreases perineal wound complications after pelvic chemoradiation and surgery: a cohort study. *Ann Surg Oncol*. 2005;12(2):104-110.
6. Chan S, Miller M, Ng R, et al. Use of myocutaneous flaps for perineal closure following abdominoperineal excision of the rectum for adenocarcinoma. *Colorectal Dis*. 2010;12(6):555-560.
7. Shibata D, Hyland W, Busse P, et al. Immediate reconstruction of the perineal wound with gracilis muscle flaps following abdominoperineal resection and intraoperative radiation therapy for recurrent carcinoma of the rectum. *Ann Surg Oncol*. 1999;6(1):33-37.
8. Lefevre JH, Parc Y, Kernéis S, et al. Abdomino-perineal resection for anal cancer: impact of a vertical rectus abdominis myocutaneus flap on survival, recurrence, morbidity, and wound healing. *Ann Surg*. 2009;250(5):707-711.
9. Wong DSY. Reconstruction of the perineum. *Ann Plast Surg*. 2014;73:S74-S81.
10. Koshima I, Fukuda H, Utunomiya R, Soeda S. The anterolateral thigh flap; variations in its vascular pedicle. *Br J Plast Surg*. 1989;42(3):260-262.
11. Zhou G, Qiao Q, Chen GY, Ling YC, Swift R. Clinical experience and surgical anatomy of 32 free anterolateral thigh flap transplantations. *Br J Plast Surg*. 1991;44(2):91-96.
12. Jin X, Teng L, Xu J, et al. Anterolateral thigh adipofascial flap for the restoration of facial contour deformities. *Microsurgery*. 2010;30(5):368-375.
13. di Summa PG, Sapino G, Cherubino M, et al. Reconstruction of complex soft tissue defects including tendons with anterolateral thigh flap extended to fascia lata: long term recovery and functional outcomes. *Microsurgery*. 39(5), 2019:405-415.
14. Sapino G, Zaugg P, Cherix S, et al. ALT flap with vascularized fascia lata for one-stage functional patellar tendon reconstruction. *J Plast Reconstr Aesthet Surg*. 2019;72(3):467-476.

15. Lin CT, Chang SC, Chen SG, Tzeng YS. Reconstruction of perineoscrotal defects in Fournier's gangrene with pedicle anterolateral thigh perforator flap. *ANZ J Surg*. 2016;86(12):1052-1055.
16. Zelken JA, AlDeek NF, Hsu CC, Chang NJ, Lin CH, Lin CH. Algorithmic approach to lower abdominal, perineal, and groin reconstruction using anterolateral thigh flaps. *Microsurgery*. 2016;36(2):104-114.
17. di Summa PG, Tremp M. Meyer zu schwabedissen M, schaefer DJ, kalbermatten DF, raffoul W. the combined pedicled anterolateral thigh and vastus lateralis flap as filler for complex perineal defects. *Ann Plast Surg*. 2015;75(1):66-73.
18. Rossi SA, Martineau J, Guillier D, et al. Outcomes of the composite anterolateral thigh flap for perineal reconstruction after postoncological abdominoperineal resection. *Dis Colon Rectum*. 2022;65:373-381.
19. Rossi SA, Guillier D, Maruccia M, di Summa PG. RE: perineal reconstruction following abdominoperineal resection: comprehensive review of the literature ALT versus VRAM for perineal reconstruction after abdominoperineal resection—still a debate or a no-brainer? *J Plast Reconstr Aesthet Surg*. 74(10), 2021:2776-2820.
20. Wong S, Garvey P, Skibber J, Yu P. Reconstruction of pelvic exenteration defects with anterolateral thigh–vastus lateralis muscle flaps. *Plast Reconstr Surg*. 2009;124(4):1177-1185.
21. Perrault D, Kin C, Wan DC, Kirilcuk N, Shelton A, Momeni A. Pelvic/perineal reconstruction: time to consider the anterolateral thigh flap as a first-line option? *Plast Reconstr Surg Glob Open*. 2020;8(4):e2733.
22. di Summa PG, Matter M, Kalbermatten DF, Bauquis O, Raffoul W. Transabdominal-pelvic-perineal (TAPP) anterolateral thigh flap: a new reconstructive technique for complex defects following extended abdominoperineal resection. *J Plast Reconstr Aesthetic Surg JPRAS*. 2016;69(3):359-367.
23. Grønkjær M, Eliasen M, Skov-Ettrup LS, et al. Preoperative smoking status and postoperative complications: a systematic review and meta-analysis. *Ann Surg*. 2014;259(1):52-71.
24. Wang AS, Armstrong EJ, Armstrong AW. Corticosteroids and wound healing: clinical considerations in the perioperative period. *Am J Surg*. 2013;206(3):410-417.
25. Chang CC, Lan YT, Jiang JK, et al. Risk factors for delayed perineal wound healing and its impact on prolonged hospital stay after abdominoperineal resection. *World J Surg Oncol*. 2019;17(1):226.
26. Scuderi N, Monfrecola A, Dessy LA, Fabbrocini G, Megna M, Monfrecola G. Medical and surgical treatment of hidradenitis suppurativa: a review. *Skin Appendage Disord*. 2017;3(2):95-110.
27. Alharbi Z, Kauczok J, Pallua N. A review of wide surgical excision of hidradenitis suppurativa. *BMC Dermatol*. 2012;12(1):9.
28. Papadakis M, Rahmanian-Schwarz A. Pedicle flap reconstruction for treatment of infected median sternotomy wounds after cardiac surgery in overweight and obese patients: proposal of a management algorithm based on a case series analysis. *BMC Surg*. 2022;22:7.
29. de Bruin AFJ, Gosselink MP, Wijffels NAT, Coene PPLL, van der Harst E. Local gentamicin reduces perineal wound infection after radiotherapy and abdominoperineal resection. *Tech Coloproctology*. 2008;12(4):303-307.
30. Gruessner U, Clemens M, Pahlplatz PV, Sperling P, Witte J, Rosen HR. Improvement of perineal wound healing by local administration of gentamicin-impregnated collagen fleeces after abdominoperineal excision of rectal cancer. *Am J Surg*. 2001;182(5):502-509.
31. van der Zee HH, Boer J, Prens EP, Jemec GBE. The effect of combined treatment with oral clindamycin and oral rifampicin in patients with hidradenitis suppurativa. *Dermatol Basel Switz*. 2009;219(2):143-147.
32. Gener G, Canoui-Poitrine F, Revuz JE, et al. Combination therapy with clindamycin and rifampicin for hidradenitis suppurativa: a series of 116 consecutive patients. *Dermatol Basel Switz*. 2009;219(2):148-154.
33. Bemelman WA, Warusavitarne J, Sampietro GM, et al. ECCO-ESCP consensus on surgery for Crohn's disease. *J Crohns Colitis*. 2018;12(1):1-16.

How to cite this article: Meuli JN, Hubner M, Martineau J, et al. Impact of etiology leading to abdominoperineal resection with anterolateral thigh flap reconstruction: a retrospective cohort study. *J Surg Oncol*. 2022;1-8. doi:10.1002/jso.27092