

Surgical management of surgery and radiation induced peristomal neck ulcerations

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Abstract. *Surgical management of surgery and radiation induced peristomal neck ulcerations. Problems/objective:* Non-healing cervical skin ulcerations with concomitant necrosis of the subcutaneous tissue and muscle is a rare but feared complication of radiotherapy that can arise in cervical regions. Constant erosion of the surrounding tissue by the expansion of the necrotic front can threaten important structures. Very few reports in the literature deal with the surgical management of these injuries.

Methodology: This paper reports on two cases of non-healing, slow-growing cervical ulcerations that occurred as a result of radiotherapy and surgery.

Results: After unsuccessful conservative treatment, definitive surgical repair was performed to achieve reparation of the defect and protect deep structures. The onset and characteristics of the ulcerations as well as the reconstructive options are discussed.

Conclusions: In the treatment of surgery and radiotherapy induced chronic cervical wounds, non surgical medical treatment should be always attempted for at least 6 months, and should always include hyperbaric oxygen therapy. If conservative methods fail, surgical repair by means of transposition of well vascularized tissue is mandatory to prevent serious complications such as major vessel rupture or fistulas.

Introduction

Chronic cervical ulcerations after definitive (chemo-) radiation are a rare complication and very few reports in the literature deal with the surgical management of these injuries. The aim of this paper is to describe how to reconstruct such defects in a particularly difficult environment.

In general, exposure of normal tissues to the radiation therapy or chemo-radiation used to treat cancer is inevitable. As a result, patients may experience adverse effects in the irradiated region during or after therapy.¹ Radiation side effects can be divided into acute, consequential, and late according to the time that symptoms appear. Acute side effects manifest during treatment or during the first weeks thereafter,

consequential effects appear late and present as persistent acute damage,^{2,3} and late effects appear months or even years after radiation treatments.^{4,5} Acute effects are largely time dependent with the most acutely damaged target cells being those in tissues with high cell turnover. The probability and severity of acute side effects increases with total dose, dose per fraction, and a reduction of the overall treatment time of radiation (accelerated radiation). Late radiotherapy side effects are mainly dependent on the total dose and dose per fraction, but not on the overall treatment time of radiation. The target cell population is comprised of tissue-specific parenchymal cells as well as vascular endothelial cells and mesenchymal cells (fibroblasts). The reduction in capillary density

results in parenchymal hypoplasia and atrophy, with decreased tissue vascularity, hypoxia, and increased vascular permeability.¹ In connective tissue, fibrosis is the leading symptom of radiation exposure. The pathogenesis of the fibrosis might arise from the increased vascular permeability of irradiated mucocutaneous tissues leading to fibrin deposition, subsequent collagen formation, and eventual fibrosis.⁵ Furthermore, radiation effects on fibroblasts leads to induced differentiation and a significant increase in collagen deposition. As a final result, the increased fibrosis and decreased vascularity can predispose for tissue necrosis, infection, and ulceration.

If surgery is needed in a head and neck area previously treated with surgery and radiotherapy, the

cervical skin must deal with late radiation side effects and with the unavoidable scar tissue from the previous surgery. Both factors play a role in the development of non healing cervical wounds. Additionally, the proximity of a tracheotomy can facilitate a chronic infection of the ulceration bed through constant contamination with tracheobronchial secretions. Tissue necrosis in chronic ulceration prevents spontaneous healing and leads to a three dimensional enlargement of the ulceration with consistent risk of major vessel exposure and formation of fistulas. The ever present possibility of recurrence or persistence of the primary malignant neoplasm within ulceration must be always suspected and adequately ruled out with multiple biopsies before planning any surgical repair.

This paper reports on two head and neck cancer patients who developed a non-healing, slow-growing cervical ulceration as a result of radiotherapy and surgical treatment in proximity to a permanent tracheostomy. The onset and characteristics of the ulcerations as well as the surgical management are discussed.

Case reports

Patient 1

The first patient was a 72-year-old male, heavy smoker with no comorbidities, who underwent a fronto-lateral laryngectomy because of a pT1bN0 glottic laryngeal carcinoma of the right true vocal cord. He didn't quit smoking at that time. Six years later, he underwent a total laryngectomy with radical neck dissection on the right-hand side and

received adjuvant radiotherapy (65 Gy) at the primary site and on both sides of the neck because of a second primary pT3N2b laryngeal carcinoma. After total laryngectomy, he stopped smoking.

Eighteen years after radiotherapy treatment, the patient found a 1 cm ulceration of the skin of the supraclavicular fossa on the right hand side, 1 cm lateral to the tracheostomy. The biopsy showed skin necrosis with extensive subcutaneous fibrosis related to the previous radiotherapy, with no evidence of tumour recurrence.

The patient was treated with local toilette, dressing, and oral and local antibiotics for several weeks, but the dimensions of the loss of skin progressed to 2.5 cm. He was then administered 21 sessions of hyperbaric oxygen therapy, obtaining an almost complete regression of the ulceration that then measured 0.5 cm. Two years later, the ulceration had slowly and progressively worsened and within the next year, despite 20 further sessions of hyperbaric oxygen therapy and constant wound medical care he developed an oval-shaped ulceration with a skin loss of 7 cm by 4 cm and a maximal depth of 3 cm.

The medial edge of the chronic wound eroded the lateral edge of the skin near the tracheostomy and the lateral wall of 2 tracheal rings. The ulceration remained confined to the supraclavicular region without extension to the thorax (Figure 1).

A preoperative contrast enhanced computed tomography (CT) scan was performed to evaluate the relationship with the great vessels. The common carotid artery ran 6 mm from the ulceration and the brachio-cephalic trunk 10 mm away (Figure 1).

Surgery was planned after new biopsies ruled out cancer recurrence. Microbiology research at the specimen was negative.

Under general anaesthesia, a surgical curettage of the ulceration's skin and deep surfaces was carried out until bleeding tissue was found (Figure 2), paying particular attention not to expose the carotid and brachio-cephalic arteries. The material was sent for pathological examination and microbiology.

A thoracic incision for a pectoralis major flap with a skin paddle of 9 cm by 7 cm was outlined on the right hand side. The skin paddle was transposed to the neck under a supraclavicular tunnel to reconstruct the cervical defect and the lateral tracheostomy wall eroded by the ulceration. The donor site was primarily closed. Perfect healing was achieved within 4 weeks (Figure 2).

Patient 2

The second patient was a 49-year-old male, a heavy smoker who chronically abused alcohol and had no other co-morbidities, who underwent a total laryngectomy with radical neck dissection on the left-hand side followed by postoperative radiotherapy (60 Gy) because of a T4N2b laryngeal squamous cell carcinoma. Thirteen years later, he underwent a total pharyngo-oesophagectomy with gastric pull-up and selective neck dissection at levels II-III-IV on the right-hand side because of a second primary cancer of the pharyngo-oesophageal junction. Six months later, the patient developed a 1 cm ulcer in his left paratracheostomal region, which was treated with local antibiotic dressing and a course of systemic

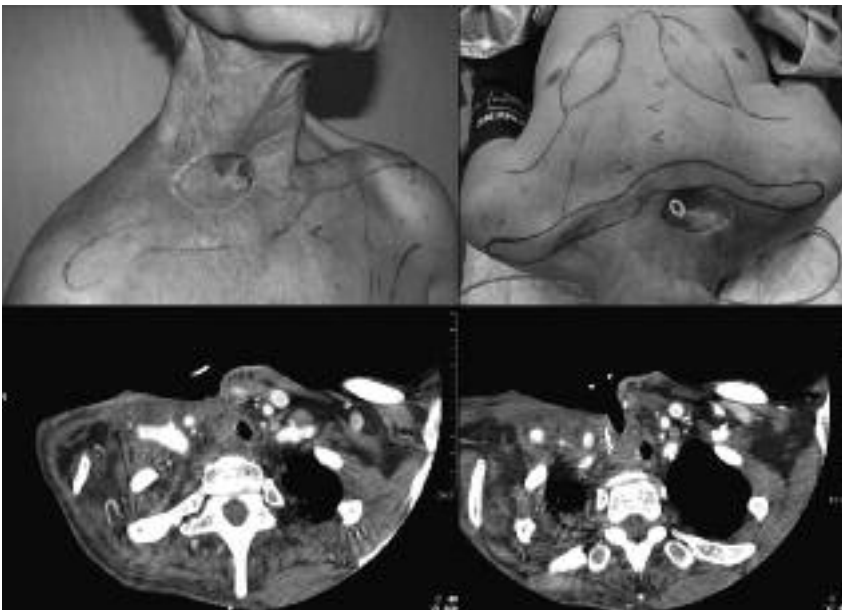


Figure 1

The parastomal ulceration and the preoperative preparation for patient 1 are shown. The CT scans shows the anonym trunk and carotid artery lying close to the bottom of the ulcer (at 10 mm and 6 mm, respectively). The erosion of the tracheal lateral wall is also easily recognizable.

antibiotics after a biopsy ruled out cancer recurrence.

Despite the indication for hyperbaric oxygen therapy which was firmly suggested, the patient did not comply with it and received only 5 sessions. Seven months after the first appearance of the lesion, the dimensions of the ulceration had increased to 5 cm by 5 cm (Figure 3).

Contrast enhanced CT scan showed that the ulcer extended deeply, up to 1 cm from the carotid artery (Figure 3).

Surgical curettage and reparation of the ulceration was planned and carried out 9 months after its first appearance. Under general anaesthesia, a curettage of the ulcerative wound was performed until bleeding tissue was exposed, paying particular attention not to expose the carotid artery wall. Tissue biopsies were sent for histopathological examination that ruled out cancer recurrence.

A delto-pectoral flap, based on the 2nd, 3rd, and 4th intercostal perforating arteries, was harvested on the left-hand side. This flap was transposed to cover the area of the defect; the donor site was primarily closed. Perfect healing was achieved within 4 weeks (Figure 4).

Discussion

The onset of non-healing chronic cervical ulcerations can complicate combined surgical and radiotherapy treatments for head and neck cancer. Most published reports are of a single or a few case reports, and mainly discuss non-surgical management. Non-surgical therapy can achieve complete healing with conservative local wound medical care associated with hyperbaric oxygen



Figure 2

The surgical curettage of the ulcer, reparation of the defect by a pectoralis major flap, and final result are shown.



Figure 3

The ulcer and the preoperative preparation for patient 2 are shown. The arrow points to the common carotid artery lying 10 mm from the bottom of the ulcer.

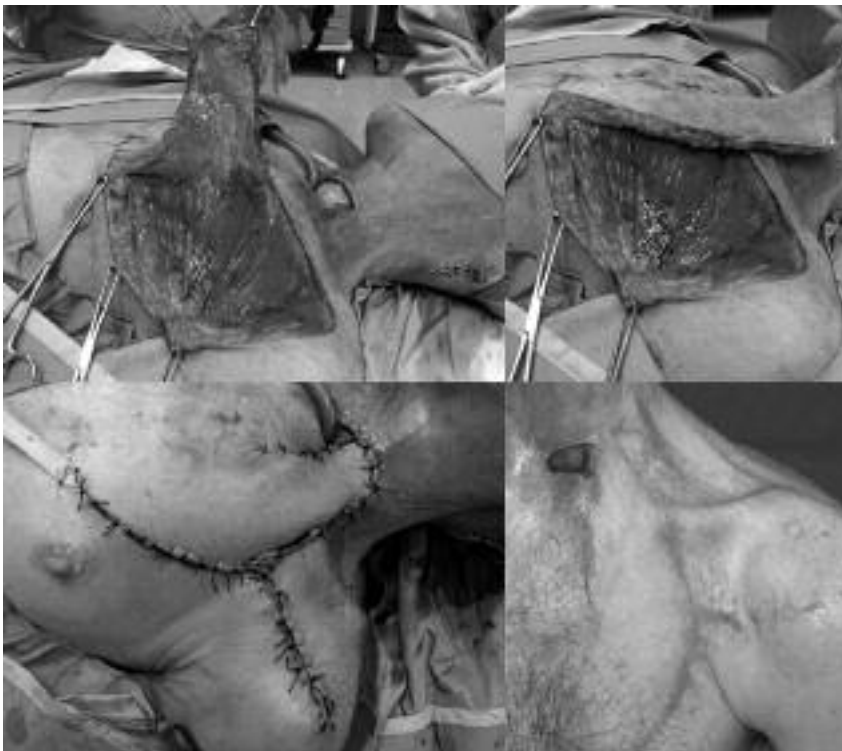


Figure 4

The harvest of the delto-pectoral flap, the reconstruction, and the final result is shown

therapy,⁶ and in some cases with the adjunction of intravenous pentoxifillin,⁷ overcoming the need for surgical repair. Other reports focus on intra-lesional local injections of granulocyte-macrophage colony-stimulating factor, a cytokine that induces differentiation and proliferation of a variety

of stem cells, improving spontaneous healing of chronic wounds. However, the experience in mucosal and chronic skin ulcerations that develop as late radiotherapy side effects is limited.⁸

Surgical repair with transposition of well vascularised, non-irradiated tissue appears to be manda-

tory if the ulceration does not heal with conservative attempts.⁹ The main goal of surgical repair is to cover the defect to prevent the exposition and the erosion of important underlying structures under the deep surface of the ulcer.

The tendency for a three-dimensional enlargement in chronic wounds is related to constant erosion of the surrounding tissue by the progression of the necrotic front. This enlargement can threaten important structures that could be injured with catastrophic consequences. Erosion of the great vessels, such as the carotid artery and the anonym trunk, can lead to unstoppable bleeding, while erosion of the pharynx or the gastric wall (in case of gastric pull up as in *patient 2*) results in the development of salivary fistulas that further complicate the scenario.

Microvascular free flaps are the most popular method currently employed to reconstruct defects in the head and neck area after cancer ablation. However, in some situations like those of chronic cervical ulcerations, the use of regional transposition flaps could be the first choice.

In surgically treated and irradiated patients who develop such complication, donor vessels suitable for the microvascular anastomosis are more difficult to identify and to dissect than under the usual conditions following immediate neck dissection and cancer ablation. Furthermore, the development of a chronic ulceration reflects deficient vascularization of the cervical area which can make microvascular free flap reconstruction difficult. Local cervical rotation flaps that lie within the irradiated field are not good

choices for the reconstruction of such defects.

Three different myocutaneous flaps can be harvested from the trapezius flap. Disadvantages include the sacrifice of the transverse cervical artery in the neck dissection, potential sacrifice of accessory nerves, special positioning during the lifting of the flap, and possible need for a skin graft for donor site closure. The superior trapezius myocutaneous flap is located on the upper two thirds of the trapezius muscle and the paraspinous perforators and occipital artery. It has a limited arc of rotation and a maximum extension of 10 cm. These characteristics make it suboptimal for reconstructing a parastomal defect. This flap is mainly used in posterolateral neck defects.

The lateral and lower trapezius flaps are located on the transverse cervical artery. In case of previous radical neck dissection, anatomical integrity of the cervical transverse artery is uncertain and should be verified by direct surgical exploration before lifting the flap, because this reduces the reliability of this flap after neck dissection.

We believe that split thickness skin grafts do not provide adequate wound healing under these circumstances because the nourishment of the transposed skin should be provided by the surface of the ulceration that per definition is rather hypovascularized.

In *patient 1*, the ulceration was rather large and relatively deep requiring reconstruction with a thick, well-vascularised flap with a large skin paddle. In our opinion, the pectoralis major flap provides these characteristics perfectly. The skin paddle was chosen in a rather proximal and juxta-areolar position in a zone with the

highest density of perforant vessels.^{10,11} Being that the recipient area was rather proximal, the flap was harvested with attention to carefully preserving not only the main pedicle (thoraco-acromial artery and vein), but also the lateral thoracic artery and vein with the aim of ensuring its maximum viability. Furthermore, the thoraco-acromial nerve was proximally transected to avoid possible tourniquet pressure on the pedicle caused by the rotation of the nerve in the transposition. In effect, the flap was rotated upwards of 180° and further rotated inside-out another 180°. The second rotation makes the nerve cross the thoraco-acromial vein and artery in correspondence to the clavicle so causing a possible interference with the blood flow; therefore we do recommend transecting at least 2 cm of nerve at this point. Denervation is also useful to prevent traction and contractions of the flap while elevating the arm, and helps to decrease the thickness of the flap (which is often excessive) by denervation-induced muscular atrophy.

In *patient 2*, the cervical ulceration was less extended than that of *patient 1*, and more superficial so that reconstruction with a deltopectoral fasciocutaneous flap seemed to be more appropriate in this case.¹² The de-epithelialization of the skin lying between the inferior border of the ulcer and the superior border of the deltopectoral skin flap (as outlined in Figure 3) allowed a single step reconstruction. In this patient, the reconstruction with the pectoralis major flap would have been inconvenient because of the disparity between the thickness of the flap and the relative shallowness of the defect.

Conclusions

In conclusion, we point out that in the treatment of surgery and radiotherapy induced chronic cervical wounds, non-surgical medical treatment should be always attempted for at least 6 months, and should always include hyperbaric oxygen therapy. If conservative methods fail, surgical repair by means of transposition of well vascularized tissue is mandatory to prevent serious complications such as major vessel rupture or fistulas. In our opinion, the use of regional pedicled flaps rather than microvascular free flaps appears to be a wise solution. This report also shows how late radiotherapy complications can develop many years after treatment (18 years in patient 1), and how further surgery after previous radiotherapy can predispose the patient for the onset of such a complication even after a long time (13 years later). Under these circumstances, an adequately long follow-up is advisable for the possibility of prompt conservative non-surgical treatment, before excessive enlargement of the ulcers.

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