Complex Ulcers due to Radionecrosis – Pathophysiology, Diagnosis and Treatment

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Keywords: Complex ulcers; radionecrosis.

ABSTRACT

The authors present a study on the pathophysiology of complex wounds induced by radiotherapy, describing their clinical aspects and histopathological findings.

They go on to present six cases in which the lesion developed, and the clinical and surgical treatment established.

INTRODUCTION

Radiotherapy (rxt) has become increasingly important in the treatment of malignant tumors. The gold standard method is to reach neoplastic tissues, inhibiting the cancer without affecting neighboring areas[1].

Whenever present, complications may occur with various degrees of severity to the skin, subcutaneous tissues, muscles, vessels and bones, and may translate clinically from a skin erythema to deep and extensive necrosis that demands adequate repair.

PATHOPHYSIOLOGY OF THE RADIOLESION

Lesions caused by rxt in tissues have been classified in acute and late morbidity by the RTOG (Radiation Therapy Oncology Group)[2] .

Acute morbidity to the skin may be classified in grades 0 to IV, and the major changes found are: follicular erythema, humid and dry desquamation, edema, and even hemorrhage and necrosis, found in more severe lesions (level IV). The response varies according to the

amount of rays, time and program of exposure, and patients' clinical conditions.

Histologically, lesions begin with a reduction in mitoses in the basal layer and cell edema that in a late phase lead to atrophy, telangiectasia and ulceration[3].

Fig. 1 – Area of radio necrosis on the front side of the thigh. Debridement area marked with an adequate margin.

Fig. 2 – Reconstruction performed successfully. Note secretion from borders of wound.

Fig. 3 – Detail of the defect showing extensive tissue lesion and depth.

Changes are interdependent, especially vascular lesions that generate indirect lesions in all other tissues and are marked in a late phase, with thickening and calcification of vessel walls.

In other tissues, fibrosis of the subcutaneous fat, steatonecrosis, delayed bone growth, bone pain, osteoradionecrosis, pathological fractures and osteogenic sarcoma may be observed. Striated muscles undergo reversible metabolic changes a few days after radiation and the late lesion is due to angiomesenchymal damage, leading to vascular failure, proliferation of collagen and nerve strangulation.

PATIENTS AND METHODS

Six cases of radionecrosis treated in Units I and II of the Instituto Nacional de Cancer, from July 1999 to July 2001, were studied by a multidisciplinary staff comprised by oncology and plastic surgeons, clinical oncologists, radiotherapists and nurses. Tumor recurrence was excluded in all cases by means of a histological exam before reconstruction.

CASE 1

- Identification: male, 17 years old.
- Diagnosis: synovial sarcoma of the left thigh.
- Treatment: resection, pre-operative radiotherapy and brachytherapy totaling 5000 cGray (cG).
- Development: extensive necrosis of the soft tissue of the front portion of the thigh 3 months after surgery, resulting in a complex wound with exposure of the bone after debridement (Fig. 1).
- Reconstruction of a myocutaneous flap of the abdominal rectum muscle based on the lower deep epigastric artery.
- Development: secretion in wound border (Fig. 2) and pathological fracture of the femur 8 months after reconstruction. Disarticulation of the member was performed. Histological evaluation revealed osteoradionecrosis.

CASE 2

- Identification: female, 65 years old.
- Diagnosis: recurrent fibrosarcoma of the right suprascapular region.

- Treatment: resection and post-operative radiotherapy (total 50 cG).
- Development: late necrosis of the plastron, requiring debridement with partial resection of the 2nd and 3rd rib arches and spinal apophyses of the 6th and 7th vertebrae, with exposure of the parietal pleura (Fig. 3).
- Treatment: dressings to improve local conditions and reconstruction 7 months after the first debridement with a myocutaneous flap of the trapezium (Fig. 4).
- Development: local recurrence 1 year after reconstruction.
- Treatment: resection and reconstruction of the myocutaneous flap of the greater dorsal (Figs. 5 and 6).

CASE 3

- Identification: female, 64 years old.
- Diagnosis: left breast carcinoma.
- Treatment: Halsted mastectomy, radiotherapy and late reconstruction of the breast with unilateral TRAM.
- Development: total loss of flap, attributed to polyarteritis nodosa along with Raynauld phenomena.
- Treatment: debridement including rib fragments and immediate reconstruction with greater dorsal muscular flap (Fig. 7) and posterior skin graft.

CASE 4

- Identification: female, 57 years old.
- Diagnosis: right breast infiltrating ductal carcinoma.
- Treatment: Patey mastectomy, chemotherapy and radiotherapy with 5000 cG.
- Development: at the end of radiotherapy, presented humid skin desquamation and seven years after, radionecrosis of the plastron.
- Treatment: submitted to debridement, including rib fragments and immediate reconstruction with a greater omentum flap and posterior skin graft (Fig. 8).

Fig. 4 – Satisfactory reconstruction performed.

Fig. 5 – Defect after resection of recurrence and flap delimitation.

Fig. 6 – Reconstruction performed with adequate coverage of the defect.

CASE 5

- Identification: male, 56 years old.
- Diagnosis: right inguinal rhabdoid sarcoma.
- Treatment: resection, lymph node emptying and post-operative radiotherapy with 66 cG.
- Development: necrosis of the plastron 3 months after surgery.
- Treatment: debridement and immediate reconstruction with myocutaneous flap of the fascia lata tensor muscle and stabilization of the abdominal wall with polypropylene mesh (Fig. 9).

Fig. 7 – 1st post-operative day, reconstruction with flap of greater dorsal muscle.

Fig. 8 – Late result of reconstruction with flap of greater omentum and skin graft.

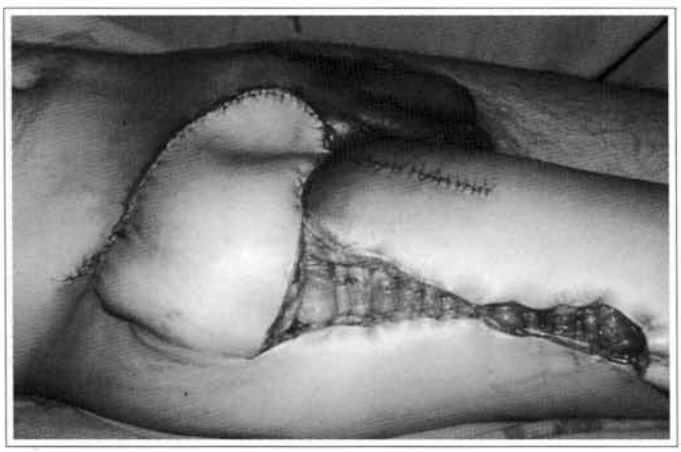

Fig. 9 – Immediate result – reconstruction with myocutaneous flap of the fascia lata tensor.

CASE 6

- Identification: female, 63 years old.
- Diagnosis: right breast infiltrating ductal carcinoma.
- Treatment: Halsted mastectomy and radiotherapy.
- Development: necrosis of the plastron 10 years after the end of radiotherapy.
- Treatment: reconstruction with omentum flap after stabilization of the thoracic wall with a polypropylene mesh and posterior skin graft.

SURGICAL TREATMENT OF LESIONS RESULTING FROM RADIOTHERAPY

The plastic surgeon is required when there are Grade IV lesions (RTOG) along with complex wounds[4].

Treatment begins with debridement, biopsy and programming reconstruction. The ideal moment for reconstruction should be decided on an individual basis. When noble structures are exposed or when local conditions are extremely favorable (clean, non-infected wounds), reconstruction should be immediate.

If the choice is late reconstruction, resources such as a hyperbaric oxygen chamber may be used with the objective of improving local conditions of lesions, by promoting angiogenesis and fibroplasia, according to the experience of some authors[5].

Debridement should include the bone and necrotic tissue involved with a 3 to 5 cm margin[4]. The procedure should be limited to the areas clinically suspected of devitalization. The margins may be expanded in cases of suspected clinical infection.

It is advisable to collect routine samples for culture and antibiogram.

Histological examination of the wound is required to assure eradication of the primary tumor and to exclude

the possibility of a tumor secondary to radiation.

The histological lesions described lead to vascular failure in tissues, evident in a period of up to 4 to 6 months after radiation. Based on this fact, reconstruction should use well irrigated tissue, such as muscle, myocutaneous or microsurgical flaps. When noble structures are not involved and if there is no bone exposure, one can choose local care and skin autografting, always bearing in mind how difficult skin graft integration is in poorly irrigated areas.

The flap should be chosen from tissue far from the field of radiation. An arteriography may be very valuable for studying the quality of the vascular pedicles of the flaps.

DISCUSSION

According to our literature review, due to the progressive aspect of the condition, which is characteristic of radio-lesions, clinical manifestations may occur right after treatment or years after its interruption, as we were able to observe in cases 3, 4 and 6.

The tumor relapsed in Case 2, showing the importance of the histological exam before beginning reconstruction.

The adequate moment for reconstruction may be difficult to decide, given that the lesion is a progressive and irreversible phenomenon that depends on the level of vascular lesion. As soon as local and systemic conditions are established, the reconstruction is the treatment of choice; there is no reason for waiting for "the development of the necrosis" or "definition of the process". Cases such as 1 and 2, with a large amount of wound secretion and a positive culture, were treated with local care after debridement, while waiting for better conditions for reconstruction, and because no noble structures were exposed. To that end, special dressings with hydro-coloids (case 2) and a hyperbaric oxygen chamber (case 1) were used.

In other cases, however, immediate reconstruction was chosen, due to satisfactory local conditions (cases 3 and 4) or due to the exposure of noble structures, such as the pleural and mediastinum cavities, in case 4, or femoral vessels and abdominal cavity, in case 6.

In order to promote an increase in oxygen and blood irrigation and perform a safe reconstruction, the option was muscle flaps (myocutaneous) for most cases, except for cases 4 and 6, in which a greater omenutum flap was chosen, a procedure that is easy to perform and that equally promotes improvement in the quality of the beds treated by incorporation of fully irrigated tissue.

To ratify the progressive development of the radiolesion, case 1 had a dramatic and fast outcome: 7 months after reconstruction, secretion suggestive of tissue necrosis continued from the borders of the wound, with eventual local abscess. After histological confirmation of the absence of neoplasm, the patient was again submitted to the hyperbaric oxygen chamber, but had a pathological fracture of the member due to osteoradionecrosis and had to be disarticulated.

All the patients are being followed at the Hospital by a multidisciplinary staff.

CONCLUSION

The complications caused by radiotherapy in tissues surrounding the programmed areas relate to the possibility of affecting noble structures, leading to complex and progressive wounds.

The reconstruction with well irrigated tissue is essential to stabilize these complex lesions with the objective of optimizing healing conditions.

From the oncological point of view, the primary tumor must be controlled, as a *sine qua non* condition for planning reconstructions.

Early reconstruction is a basic principle because when necrosis is established, it tends to progress.

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