Flap reconstruction and interstitial brachytherapy in nonextremity soft tissue sarcoma

ABSTRACT
Radiotherapy is an integral component of management of high-grade soft tissue sarcomas. Interstitial brachytherapy is used to deliver a boost or radical dose with several advantages over external beam radiotherapy. There has always been a concern to use brachytherapy with flap reconstruction of skin defects after wide excision.

We present our initial experience with interstitial brachytherapy in two patients of recurrent high-grade non-extremity sarcomas treated with surgical excision and soft tissue reconstruction of surgical defect.

KEY WORDS: Brachytherapy, myocutaneous flap, soft tissue sarcoma

INTRODUCTION
Multimodality treatment using surgical excision with adjuvant radiotherapy (RT) with or without chemotherapy is currently the standard of care for high-grade soft tissue sarcomas (STS). Interstitial brachytherapy (BRT) is an important component of RT for nonextremity sarcomas and recurrent tumors where often-adequate doses of RT cannot be delivered with conventional methods due to underlying dose limiting structures.[1] Occasionally large surgical defects following wide local excision (WLE) require reconstruction with skin grafts or myocutaneous vascularized flaps.[2] There has always been a concern/fear regarding tolerance of RT especially BRT with flaps and skin grafts.

We present our initial experience of BRT with myocutaneous pedicled flaps in recurrent nonextremity sarcoma in two cases.

CASE REPORTS

Case I
A 45-year-old male presented with a recurrent high-grade fibrosarcoma over left scapular region. The tumor measured 15×10 cm with fungation of overlying skin. His metastatic workup was normal. He underwent WLE with excision of overlying skin and reconstruction by a Pectoralis major myocutaneous (PMMC) flap with intraoperative interstitial brachytherapy. After assessing initial wound healing, high dose rate (HDR) brachytherapy was started on the seventh postoperative day (POD) with 3 Gy per fraction, twice daily with inter-fraction interval of six hours to a total dose of 18 Gy in 6 fractions over three days. External beam RT (EBRT) was started three weeks after surgery to a total dose 45 Gy in 25 fractions with CT-based planning. The flap tolerated RT well with out any major wound complications.

Case II
A 38-year-old male presented with a postop, post EBRT large recurrent high-grade fibrosarcoma over the interscapular region [Figure 1]. He had a history of surgical excision followed by EBRT two and a half years back with infield recurrence. Exact details of prior radiation doses were not available, but the skin changes in the form of pigmentation were visible and reflected prior RT portal. His metastatic workup was normal. He underwent WLE with excision of overlying skin and scar and reconstruction by Latissimus dorsi (LD) myocutaneous flap with intraoperative interstitial brachytherapy [Figure 2]. HDR BRT was started on POD 7 to a total dose of 34 Gy in 10 fractions @ 3.4 Gy /fr/ twice daily for five days with interfraction interval of six hours. Radical doses were delivered with BRT as patient had already received EBRT earlier. The flap survived with minor wound dehiscence at the margins, which was unrelated to catheter placement [Figure 3].

Technique
Surgical procedure in both cases consisted of wide local excision of all palpable and visible tumor with...
muscles, using absorbable sutures to avoid any distortion in implant geometry. In both cases, the tubes were secured to the skin using buttons. Gelfom sponge was placed between the implant catheters and flap to decrease the dose to the flap. The implant catheters were kept away from the flap pedicle. Orthogonal X-ray films were obtained for reconstruction; and planning was done using Plato bps v 1.3 (Nucletron) treatment planning system.

**DISCUSSION**

Impaired wound healing is a major complication after conservative surgery for STS. Peat et al. reported a 16% major wound complication rate after surgery for STS in 180 patients. In a univariate analysis cross sectional area of tumor resection, use of preop RT, width of skin excision, history of smoking, diabetes mellitus and or vascular disease were associated with wound failure. Sadegh et al reported similar results in 98 patients. In their series, complication rates were significantly higher in lower extremity than upper extremity (45% vs. 17%). Various factors affecting wound healing have been listed in Table 1.

RT is commonly used after surgical resection to decrease the local recurrence rate. Brachytherapy is an important component of RT in STS because of several advantages including early institution of RT in immediate postop period, shorter treatment time, high dose to tumor bed with sparing of normal structures (important more so for nonextremity sarcoma) and feasibility even in recurrent setting. Alektier et al. reported in a series of 164 patients similar wound complication rates after WLE for STS with or without adjuvant brachytherapy.

Some studies suggest that for large surgical defects rather than primary closure with complicated wounds; reconstruction with skin graft or myocutaneous flap may allow better wound healing with adjuvant treatment.

Tolerance of RT especially BRT by these myocutaneous flaps

| Table 1: Factors affecting wound healing |
|----------------------------------------|
| Host factors                           |
| Age                                    |
| Obesity                                |
| Tobacco abuse                          |
| Hypertension                           |
| Vascular disease                       |
| Diabetes mellitus                      |
| Anemia                                 |
| Tumor-related factors                  |
| Cross sectional area of surgical defect|
| Site of tumor                          |
| Treatment-related factors              |
| Interval between surgery and RT        |
| Preop RT                               |
| Brachytherapy                          |
| Recurrent sarcomas with prior RT       |

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**Figure 1:** Recurrent STS in interscapular region

**Figure 2:** Postresection surgical defect with LD flap and implant tubes in situ

**Figure 3:** Postoperative wound after completion of BRT
and skin grafts has been evaluated by some of the studies. Spierer et al. treated 43 patients with primary high grade STS of extremity with WLE with reconstruction (flap, skin graft or combination) with adjuvant RT. The five-year overall wound reoperation rate was 6%. In their series, most tissue transfer tolerated RT well. Aflatoon et al. reported major wound complication rate of 8% in 36 patients with free tissue transfer combined with surgical excision and BRT. Lee et al. have reported similar results and suggested that microvascular anastomosis should be placed well away from the radiation target area and closed suction drainage tubes be kept in place until completion of BRT.

In both our patients reported above there was a large surgical defect, which could not have been closed without flap reconstruction. Considering the site, size and recurrent nature of these tumors BRT was the best treatment option for them. Moreover both patients tolerated BRT with acceptable wound morbidity.

Reconstructive surgery with adjuvant radiation therapy allows better wound healing than primary wound closure alone large defects. BRT is a viable, safe and efficacious option and can be done even at the site of reconstruction in immediate postoperative period with minimal wound complications.

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