5 Head and Neck Cancer

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5.1 Introduction

The possible role of IORT in the management of head and neck tumors has rarely been explored, an exception being the large series at the Methodist Hospital of Indiana (GARRETT et al. 1989). IORT can be introduced in the multidisciplinary management of head and neck cancer as a boosting modality in areas of residual disease or close surgical margins in patients with locally advanced tumor, in an effort to promote local tumor control. The potential advantages of IORT in these tumor locations do not derive from normal tissue sparing, but from better definition of high risk areas for recurrence and the simultaneous combination of high dose radiotherapy and surgical debulking.

The conventional management of head and neck cancer patients varies according to tumor stage and site of origin. In early tumor stages radical radiotherapy is regarded as a treatment option able to preserve the anatomy and adequate function of the different organs. In intermediate tumor stages the combination of surgery and radiotherapy is in most cases considered the best alternative to assure disease control. Finally, patients with locally advanced disease patients might be considered candidates for investigational treatment protocols due to their poor prognosis. Locoregional recurrences are the most common cause of failure, particularly in advanced nodal disease of the neck. The results of surgery and external beam radiotherapy in the treatment of head and neck cancer patients have generally reached a plateau, although certain technical advances in both modalities have allowed improved treatment in selected patients. These advances comprise the introduction of reconstructive surgical procedures and myocutaneous flaps, and the availability of electron beam and brachytherapy techniques for sophisticated radiation boost in the areas of large tumor burden (MILLION et al. 1989).

Recurrent disease following radical treatment is an important problem in head and neck cancer patients. In most cases it is a desperate situation in which no treatment alternative can be found. Nevertheless, occasionally patients can be selected for rescue therapy, and some cases of long-term survival are known. In selecting such patients it is necessary to evaluate carefully the clinical features and previous treatments, as well as the skills and the results obtained in each institution.

An interesting suggestion concerning the use of IORT in head and neck cancer patients was that myocutaneous flaps be used in patients undergoing radical dissection for locally advanced or recurrent neck disease. In these cases the area primarily at risk for residual tumor is the major vessels (carotid artery and internal jugular vein), but the skin might also be contaminated by neoplastic tissue. A myocutaneous flap might add some security margin to the surgical resection, avoid recontamination of the IORT-treated area, and allow some additional external beam irradiation even in patients previously treated.
5.2 Previous Experiences

5.2.1 Tissue Tolerance Studies

The normal tissues included in IORT for head and neck cancer patients are in general those left in situ after radical neck dissection: major vessels, subcutaneous tissues, peripheral nerves, muscle, vertebral bodies, and rarely the esophagus and pharyngeal wall mucosa and its sutures. Several studies in animal models have investigated the tolerance of these tissues to IORT alone or in combination with external beam radiotherapy. In general the results can be summarized by saying that the peripheral nerve is the dose-limiting structure both for IORT alone and for IORT in combination with external beam radiotherapy, and that the remaining structures tolerate reasonable doses in the range of 10–15 Gy plus full course conventional external beam irradiation (50 Gy) or a 20 Gy single IORT dose (Le Coteur et al. 1989; Powers et al. 1989a,b; Gillette et al. 1988).

One experimental study employing a canine model analyzed tissue changes after IORT in the cervical area (Mittal et al. 1989). The experiment was designed to deliver escalating doses of IORT (25, 35, 45, and 55 Gy) through an 8-cm cone to a treatment zone including a portion of the carotid artery, the internal jugular vein, and the vagus nerve. Animals were sacrificed 3 and 6 months after IORT. Carotid rupture was not observed in any of the animals. In both vessels an increased collagen content was seen in the tunica media. The vagus nerve showed severe demyelination and loss of fibers, these changes appearing to be dose dependent.

5.2.2 Clinical Results

The experience at the Methodist Hospital of Indiana is the most relevant clinical experience using IORT in head and neck cancer patients and has been updated several times (Garrett et al. 1987, 1989). In their last report (Freeman et al. 1990) a total of 104 patients treated in a period of 6 years were available for analysis. Tumor histologies included in the study were: squamous cell carcinoma (74), salivary gland carcinoma (24), sarcomas (3), melanoma (2), and recurrent basal cell carcinoma (1). Forty patients were treated with surgery and IORT as the initial treatment, and 64 in a bid to rescue previous treatment. IORT dose ranged from 15 to 20 Gy with the exception of one case treated with 100 Gy to the mandible. The cone sizes most frequently used were 4.5 and 6 cm in diameter. The neck was the predominant treatment zone in 38 patients. The analysis of patterns of tumor progression for squamous cell carcinoma showed an overall local control rate of 40% with minor differences between groups subclassified by postsurgical residual disease: microscopic residual disease had a local control rate of 44%, close surgical margins 30%, and gross residual disease 43%. Twenty-five autopsies were performed in patients who died with local disease. In 22 patients, the local recurrence was found to be marginal to the treatment field. Local tumor control in the group of salivary gland neoplasms was obtained in 88% of cases. Several complications were related to IORT, including six cases of osteoradionecrosis (all patients were treated with external beam radiotherapy, and in three cases the mandible was not included in the IORT field), six large fistulas reconstructed with flaps (three in previously irradiated patients), and three cases of carotid or innominate artery rupture (one at the time of tumor recurrence).

Adopting a systematic approach in both recurrent and primary disease, this large series has established the feasibility of IORT during head and neck cancer surgery. The pattern of disease progression does not appear to correlate with local tumor control rates and postsurgical residual disease, but this has to be analyzed further due to the heterogeneity of disease status (primary versus recurrent, differing tumor stage, etc.) and treatment protocol. An important aspect to emerge from the study is the need to consider as a protocol requirement the use of large treatment cones in all cases, trying to include not only the area of evident residual disease but also a margin of normal tissue. The identification of treatment complications, mainly grouped in recurrent patients, constitutes valuable information.

Schmitt et al. (1989) have reported preliminary results regarding the use of IORT in cases of T3–T4 squamous cell carcinoma of the base of the tongue. In all 15 patients treated (five recurrent cases) surgery was able to remove gross tumor completely. The IORT boost dose was 20 Gy in 13 cases and 17.5 Gy in two cases. Treatment cones were 4 and 5 cm in diameter. Ten patients received a full course of fractionated external