

Use of Intraoperative Radiation Therapy in Skull Base Oncology



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Opinion

Management of advanced and recurrent head and neck cancers constitutes multimodality treatment therapy; surgery, chemotherapy and radiation. Loco-regional relapse comprises a major hurdle for disease free survival patient, the role of intraoperative radiation therapy (IORT) has added in improving overall survival (OS) and local control of the disease. IORT allows delivery of a single tumoricidal dose of radiation to areas of potential residual microscopic disease while minimizing doses to normal tissues. Head and neck cancers (HNC) constitute 8th leading cause of cancer deaths globally. In developing countries its incidence is high due to tobacco use (smoke and smokeless form) and drinking habits in combination with poor socioeconomic status. HNC's encompasses diverse tumor types but around 90% of these tumors are squamous cell carcinomas (SCC) with further diversification in respect to etiological factors, pathogenesis, and clinical behaviour. The overall impact of management of HNC's on functional activities like swallowing, speech and cosmesis affects the patient both psychological and socially. In spite of several recent advances in surgery, chemotherapy and radiation therapy, the overall 5- year survival rate is still not improved and mainly influenced by disease staging, tumor margins, nodal diseases, extracapsular spread, perineural/ lymphovascular invasion and invasion of vital structures. Failure or recurrence rate for T4 lesions may vary between 19% to 35%. They may be either primary tumor site failure or distant site metastasis such as lungs, liver, bone and spine.

The recommended management of locally advanced tumors of head and neck are surgery and chemo radiation with/ without targeted therapy. Recurrences after irradiation may be addressed by salvage surgery if resection is possible, plus additional chemo radiation. There can be severe complications for surgery after radiation to the tissues. Recently, new radiation techniques such as intensity modulated radiation therapy (IMRT) and stereotactic body radiation therapy (SBRT) have

improved oncological results with reduced toxicities but specific indications have not been defined yet. Reirradiation still poses a major challenge for the radiation oncologist.

In this cases either advanced lesions extending to infratemporal fossa, pterygoids and skull base where 1cm-1.5cm oncologic free margins cannot be obtained, Intraoperative radiation therapy (IORT) is a very good alternative to be considered. It not only achieves local control of advanced tumors or residual disease, but also as an adjuvant therapy in salvage surgery. IORT was pioneered by the Japanese in 1960's for treatment of gastrointestinal tumors and introduced in the United States and Europe in the 1970s, initially for abdominal and gynaecologic malignancies. IORT can be used as a boost to external beam radiation (EBRT) or as the sole irradiation modality in a previously irradiated field. IORT allows rapid delivery of large single doses of radiation to a visible tumor bed margins with exclusion/ shielding of critical anatomic structures from the treatment field. IORT is generally delivered from a linear accelerator using mainly an electron beam field or in some cases a photon beam field. The field is well visualized, which allows for relatively easy placement of the electron beam or the photon beam cone on the tumor bed. This allows a steep dose fall off while sparing normal anatomic tissues. Occasionally, IORT is combined with external radiation therapy (EBRT) to provide the best combination of local and loco regional treatment. With this IORT radiation energy to the surrounding structures including neurovascular and bony structures, except for the suture line, anastomosis is also kept in minimum levels.

Advantages of IORT are the decreased possibility of geographical and anatomical miss when radiation is delivered during the surgery. . There is also increased biological efficacy per unit dose because of the administration of radiation as a single fraction with no time elapsing between multiple fractions and no time elapsing between surgical excision and RT. IORT

decreases the overall treatment time by reducing tumor cell re-population during overall treatment. It also allows to increase the dose because it is estimated that the single high dose given by IORT is biologically equivalent to 3- to 4-fold that of conventional EBRT. IORT toxicity does not overlap with that of EBRT and when properly combined with EBRT, it can be used for increasing the dose while potentially decreasing toxicity.

Delivered IORT dose ranged from 7.5 to 30Gy, and median was 20Gy. However, in most contemporary studies done so far, a trend to lower the delivered doses trying to reduce toxicity and complications was noticed. Reported local control rates with the addition of IORT modality appear as high as 90% in a 2-year follow-up in selected cases where no residual disease is noticed after surgical excision. The combination of EBRT postoperatively seems to further improve local control. Furthermore, the length of hospital stay is not appreciably prolonged when IORT is used

as a treatment adjunct to surgery. A benefit of the 2-year DFS has been reported as well. However, long-term survival rates do not seem to conform in all series. Some studies shows patients with advanced disease with carotid involvement, have the most dismal median OS of 1 year accompanied by high complication rates of 50%. This group of patients is at high risk for post-treatment cerebrovascular events and neurologic sequelae. These patients receive greatest benefit of IORT with some short term pain relief despite high rates of loco-regional failure. A good palliative effect has been obtained in these patients treated for extensive recurrence in previously irradiated fields. IORT is generally well tolerated without significantly increasing the rate of complications and in addition for symptomatic patients who have undergone a near total/subtotal resection, IORT as a boost seems to be a reasonable palliative approach if it is available. Hence IORT can be one of a good multimodality treatment for management of advanced/unrespectable tumors.



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