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Critical Reviews in Oncology/Hematology 84 (2012) e110–e114

CRITICAL REVIEWS IN
Oncology
Hematology
Incorporating Geriatric Oncology

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Nasopharyngeal cancer around the Mediterranean area: Role of newer radiation techniques☆

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Accepted 27 May 2010

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Abstract

Primary radiotherapy has been the mainstay of treatment of patients with nondisseminated nasopharyngeal cancer (NPC). Novel techniques, such as intensity modulated and image guided radiotherapy has the capability to generate steep dose gradients, leading to an improved therapeutic index, especially in NPC. Although it is widely accepted as the treatment of choice in NPC in the modern world, in developing countries the financing of these innovative delivery systems still continues to be a major problem. The purpose of this article is to discuss the difficulties one may experience during the transition from 2D way of thinking to the 3D conformal era and to review the clinical outcome and toxicity profile of these promising new radiation techniques.

Keywords: Nasopharyngeal cancer; IMRT; Treatment results

1. Introduction

Over the past decade the availability of commercial systems for the delivery of intensity modulated radiotherapy (IMRT) has increased dramatically. Improvement in tumor coverage to achieve a high control rate and better avoidance of normal tissues resulting in a reduction in toxicity are the potential advantages of this highly conformal technique. Due to its close proximity to critical neural structures such as brain, brain stem, and optic pathways the treatment of nasopharyngeal cancer (NPC) with IMRT has been the

☆ This work was presented at the AROME International Oncology Meeting in Monaco, 22–23 January 2010.

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[1] Association of Radiotherapy and Oncology of the Mediterranean arEa (www.aromecancer.org).

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doi:10.1016/j.critrevonc.2010.05.012

focus of research in implementing this innovative radiotherapy approach into the daily practice. IMRT has been shown to offer superior dose conformity to the tumor target and better sparing of critical organs in the treatment of NPC in several studies [1–4]. IMRT offers the potential for improved tumor control through dose escalating to the tumor targets and high risk subclinical disease regions, while sparing normal structures such as parotid glands with sharp dose gradients.

The aim of this article is to discuss the implementation of IMRT in NPC, going through all critical steps from definition of target volumes to the delivery under image guidance, as well as to review the clinical outcome reported in the literature.

2. Implementation of IMRT in nasopharyngeal cancer

2.1. Definition of gross target volume

An essential adaptation in the transition to IMRT is the translation from working with two-dimensional films to handling more complex computer tomographic (CT) images and 3D visualization (Fig. 1). Defining the gross target volume (GTV) is the critical step in the planning process of the conformal treatments. All the clinical data derived from physical and fiberoptic examination, as well as imaging studies should be used to define the target volumes during the simulation process. Simulation using CT became standard in most radiation oncology departments to acquire three-dimensional anatomic data of the treatment site. However, the information contained in the CT data is often inadequate due to the lack of contrast resolution for GTV delineation, and fusion with complementery imaging modalities like magnetic resonance imaging (MRI) are found helpful to better define the GTV in the treatment planning of tumors of head and neck, especially nasopharynx [5,6]. In recent years there is a growing interest in integrating the molecular imaging with PET/CT into the radiotherapy treatment planning for delineation of the primary tumor. In a recent study, adding whole-body FDG-PET to the pretherapeutic conventional staging of head and neck cancer significantly improved the TNM classification of the disease and altered the management of 13.7% of patients [7]. Nevertheless, the lack of a perfect delineation protocol limits the use of functional data in defining target volumes to clinical trials [8]. Our limited experience with PET/CT guided IMRT in NPC resulted in high locoregional disease control with acceptable toxicity [9]. All these findings make the use of functional data an interesting topic in the definition of target volumes.

2.2. Clinical target volumes

Clinical target volume (CTV) is a volume at risk of harboring subclinical disease that should be irradiated prophylactically. In the treatment of nasopharynx 3 CTV's

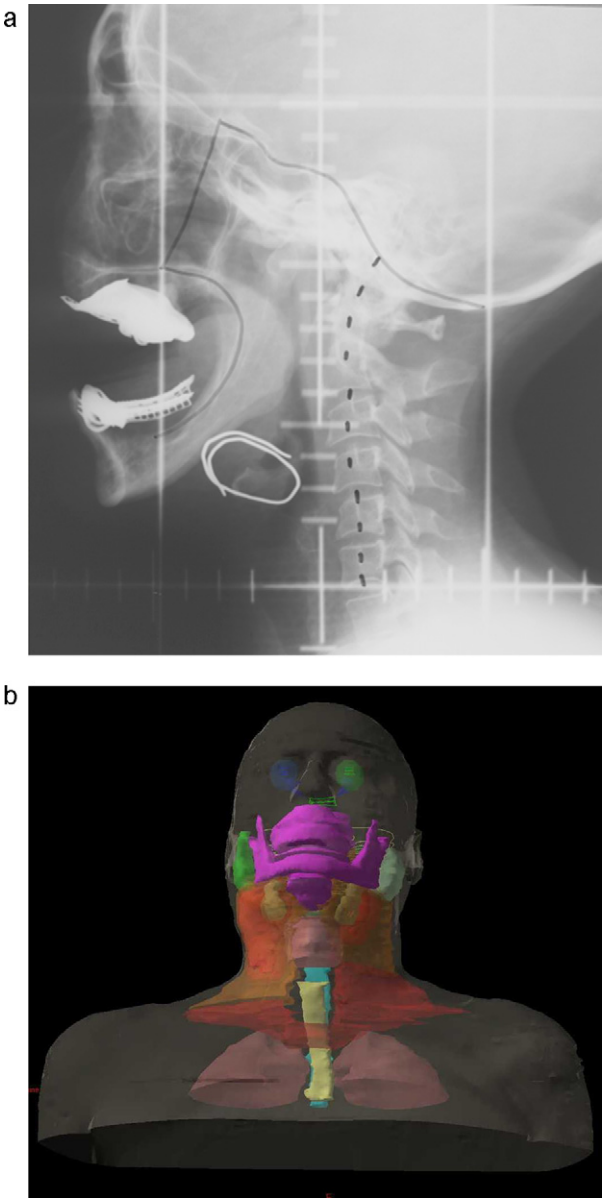

Fig. 1. Transition from 2D to 3D era. CT simulation enables the precise localization of the target volumes, as well as the organs at risk.

are defined. High dose CTV (CTV 70) usually covers all gross primary and nodal disease to eliminate the subclinical malignant disease adjacent to GTV. High risk CTV (CTV 60) includes the entire nasopharynx, retropharyngeal lymph nodal regions, anterior half of the clivus, skull base, pterygoid fossae, parapharyngeal space, inferior sphenoid sinus, and the posterior third of the nasal cavity and maxillary sinuses. High risk CTV also includes any high risk nodal regions, including the bilateral upper jugular (level II) and parapharyngeal nodes, jugulodigastric, mid jugular (level III), low jugular (level IV), and supraclavicular and the posterior cervical (level V) nodes. In case of cranial nerve or skull base involvement the cavernous sinus is covered. In patients with skull base involvement high risk CTV should include most of the bone structures of the skull base as well as the entire clivus