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Paranasal sinus cancer

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ABSTRACT

Paranasal sinus cancers are rare diseases, accounting for about 5% of all head and neck malignancies. The variety of histological types and the overlapping pathological features with other entities constitute difficulties in pathologic interpretation, often requiring a skilled interpretation or a second opinion. Treatment of locally advanced disease relies on surgery and radiation therapy for operable disease, with a possible role for systemic treatment in selected histologies within a multimodal approach; unresectable paranasal sinus cancers are generally treated with a combination of radiotherapy and chemotherapy. The employment of high conformal radiation techniques, such as Intensity Modulated Radiation Therapy orcharged particle therapy, proton or carbon ion therapy may improve outcome and reduce late effects. Surgical treatment has evolved due to the progressive application of transnasal endoscopic techniques for naso-ethmoidal malignancies and due to innovative reconstructive techniques after resection of cancers of the maxillary sinus. Because of the rarity and complexity of this disease, multicenter trials represent an urgent need to improve prognosis and to reduce treatment-related effects.

1. General information

1.1. Epidemiology

1.1.1. Incidence

Nasal cavity and paranasal sinus cancers comprise a small proportion of head and neck (H&N) cancers, representing about 5% of all H&N cancer patients. They are very rare cancers, with an incidence of about 1 case every 100,000, with an average age at comparison between 50 and 60 years (Youlden et al., 2013). There are geographical differences in the occurrence of the disease, with the highest incidence in Eastern Europe and the lowest in the UK and Ireland. During the period 1999–2007, the incidence rate remained stable, being twice as high in males than in females (RARECAREnet).

1.1.2. Survival

Survival from nasal cavity and paranasal sinuses cancers in European adults diagnosed during 2000–2007 was 76% at one year after diagnosis and 47% at 5 years (RARECAREnet). Survival slightly reduces with age at diagnosis: 5-year survival was 51% in people who were under 65 years old at the moment of diagnosis and 42% in people aged +65 at diagnosis (RARECAREnet; AIRTUM Working Group, 2007).

1.1.3. Prevalence

In Europe, about 14,500 people are living with a diagnosis of an epithelial tumour of the nasal cavities and paranasal sinuses (Van Dijk et al., 2012). This includes people who are considered cured, under treatment, or in clinical follow-up (15 years or more after diagnosis). Cured patients are estimated to comprise about 22% of the total, while patients in treatment or in clinical follow represent 21% (Van Dijk et al., 2012).

1.2. Environmental factors

According to the International Agency for Research on Cancer (IARC), occupational exposure to several agents contributes to carcino genesis in the nasal cavities and paranasal sinuses, for some there is strong evidence (isopropyl alcohol production, leather dust, nickel compounds, radium, wood dust) and others are supported by only limited evidence carpentry and joinery, chromium(VI) compounds, formaldehyde,textile manufacture (Charbotel et al., 2014).

Epidemiological studies have consistently associated cancer of the nasal cavity and paranasal sinuses with wood dust, leather dust, nickel and radium (Demers et al., 1995; d'Errico et al., 2009; Grimsrud and Peto, 2006; Carnes et al., 1997; IARC, 2013). Adenocarcinomas have been associated with wood dust, leather dust, and formaldehyde (Demers et al., 1995; Luce et al., 2002), whereas squamous cell carcinomas have been linked to arsenic and welding fumes (d'Errico et al., 2009). The risk (odds ratio) of wood-related occupations of developing an adenocarcinoma was about 14 and increased to 46 in proportion to the quantity and duration of exposure (Gordon et al., 1998).

Studies published in IARC Monographs starting in 1986 provide sufficient evidence to establish a causal association between cigarette smoking and cancer of the nasal cavities and paranasal sinuses, among the other cancer sites (IARC, 1986; IARC, 2004). The association was based primarily on epidemiological studies, conducted in different countries throughout the world.

The meta-analysis by Gandini et al. reported a relative risk of 2.77 (95% CI: 2.17–3.54) for cancer of the nasal cavity in current smokers (Gandini et al., 2008).

1.3. Pathogenesis

Several studies have established a causal role of exposure to hard wood dust and leather in the development of sinonasal cancer, with particular association with intestinal-type adenocarcinoma (Luce et al., 2002; Hayes et al., 1986).

In 2001–2003 it was estimated that about 3.6 million workers were occupationally exposed to inhalable wood dust in the European Union alone (Dulguerov and Allal, 2006).

Wood dust is a complex mixture of organic and inorganic components, including genotoxic and carcinogenic factors (Hawkins et al., 1988; Bhattacharyya, 2002). Its capacity to induce DNA damage has been attributed in part to its particulate nature,which induces the generation of reactive oxygen species in the cells (Chen et al., 2007; Guntinas-Lichius et al., 2007).

However there are few experimental data on cellular mechanisms of wood dust related sinonasal carcinogenesis (Hawkins et al., 1988; Bhattacharyya, 2002).

In a retrospective review of 125 cases of patients with ethmoid adenocarcinoma, more than 90% had a history of wood- or leather-dust exposure, in contrast to 1.6% of patients with other types of sinonasal malignancies (Khademi et al., 2009).

Other proposed aetiological factors include industrial fumes, exposure to nickel refining processes, mineral oils, chromium and chromium compounds, isopropyl oils, exposure to soldering materials or paint.

Although occupational agents are the most important aetiological factors for sinonasal carcinomas, some studies have observed an

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