ELSEVIER

Journal of Medical Imaging and Radiation Sciences xx (2014) 1-7

Journal of Medical Imaging and Radiation Sciences

Journal de l'imagerie médicale et des sciences de la radiation

www.elsevier.com/locate/jmir

Sensorineural Hearing Loss after Treatment for Head and Neck Cancer: A Review of the Literature

Phoebe Shorter, BSc[ab*], Fiona Harden, PhD[b], Rebecca Owen, PhD[c], Bryan Burmeister, MD, FRANZCR[ad] and Matthew Foote, MBBS[ad]

[a] *Department of Radiation Oncology, Princess Alexandra Hospital, Brisbane, Queensland, Australia*
[b] *Queensland University of Technology, Brisbane, Queensland, Australia*
[c] *Department of Radiation Oncology, Radiation Oncology Mater Centre, Brisbane, Queensland, Australia*
[d] *School of Medicine, University of Queensland, Brisbane, Queensland, Australia*

ABSTRACT

Background: Definitive cisplatin-based chemoradiation is increasingly delivered as the treatment of choice for patients with head and neck cancer. Sensorineural hearing loss is a significant long-term side effect of cisplatin-based chemoradiation and is associated with potential major quality of life issues for patients. The purpose of this article was to review the mechanism behind sensorineural hearing loss in patients treated with cisplatin-based chemoradiation, including incidence, the contributions of radiotherapy and cisplatin to sensorineural hearing loss, and the impact of the toxicity on patient quality of life.

Methods: Database searches were conducted through PubMed (National Centre for Biotechnology Information) and OvidSP Medline via the Queensland University of Technology Library website. General article searches were conducted through the online search engine Google Scholar. Articles were excluded if the full text was unavailable, they were not in English, or if they were published before 1990. Key words included hearing loss, ototoxicity, cancer, quality of life, cisplatin, and radiotherapy.

Results/Discussion: The total number of journal articles accessed was 290. Because of exclusion criteria, 129 articles were deemed appropriate for review. Findings indicated that sensorineural hearing loss is a significant, long-term complication for patients treated with cisplatin-based chemoradiation. Current literature recognizes the ototoxic effects of cisplatin and cranial irradiation as separate entities; however, the impact of combined modality therapy on sensorineural hearing loss is seldom reported. Multiple risk factors for hearing loss are described; however, there are contradictory opinions on incidence and severity and the exact radiation dose threshold responsible for inducing hearing loss in patients receiving combined modality therapy. Sensorineural hearing loss creates a subset of complexities for patients with head and neck cancer and these patients face significant quality of life impairment.

Conclusions: The literature review identified that sensorineural hearing loss is a major quality of life issue for patients treated with cisplatin-based chemoradiation for head and neck cancer. Further investigation evaluating the contribution of cisplatin-based chemoradiation to sensorineural hearing loss and the subsequent effect on patient quality of life is warranted.

RÉSUMÉ

Contexte: La chimiothérapie à base de cisplatine est de plus en plus le traitement retenu pour les patients atteints du cancer de la tête ou du cancer du cou. La surdité neurosensorielle, important effet secondaire à long terme de la chimioradiothérapie à base de cisplatine, pourrait entraîner une grande détérioration de la qualité de vie des patients traités.

Objet: Ce manuscrit avait pour objet d'examiner le mécanisme qui sous-tend la surdité neurosensorielle chez les patients qui subissent des traitements de chimioradiothérapie à base de cisplatine, dont l'incidence de cette affection, l'influence de la radiothérapie et du cisplatine sur celle-ci et l'impact de la toxicité sur la qualité de vie des patients.

Méthodes: Des recherches ont été effectuées dans des bases de données par l'intermédiaire de PubMed (National Centre for Biotechnolgy Information) et d'OvidSP Medline via le site Web de la bibliothèque de la Queensland University of Technology. En outre, des recherches générales d'articles ont été réalisées à l'aide du moteur de recherche en ligne Google Scholar. Les articles dont le contenu intégral n'était pas accessible et ceux qui n'étaient pas en anglais

Supported by the Princess Alexandra Hospital Private Practice Trust Fund Radiation Oncology Research Position.

* Corresponding author: Phoebe Shorter, BSc, Department of Radiation Oncology, Princess Alexandra Hospital, Ipswich Road, Woolloongabba, Queensland, 4102, Australia.

E-mail address: p.truswell@student.qut.edu.au (P. Shorter).

http://dx.doi.org/10.1016/j.jmir.2013.11.003

ou qui avaient été publiés avant 1990 ont été rejetés. Les mots-clés utilisés pour les recherches étaient *hearing loss*, *ototoxicity*, *cancer*, *quality of life*, *cisplatin* et *radiotherapy*.

Résultats/Analyse: Au total, les recherches ont donné accès à 290 articles. Après un tri basé sur les critères d'exclusion mentionnés ci-dessus, 129 de ces articles ont été jugés appropriés aux fins de l'examen. Il ressort de l'examen que la surdité neurosensorielle est un important effet secondaire à long terme chez les patients qui subissent des traitements de chimioradiothérapie à base de cisplatine. La littérature scientifique courante indique que les effets ototoxiques du cisplatine et l'irradiation crânienne sont considérés comme des entités distinctes; toutefois, il est rare qu'on aborde l'impact des traitements combinés de radiothérapie et de chimiothérapie sur la surdité neurosensorielle. Les facteurs de risque multiples liés à la surdité sont décrits, mais les opinions divergent quant à l'incidence et à la gravité de cet effet ainsi qu'au seuil de dose de rayonnement exact au-delà duquel les traitements combinés de radiothérapie et de chimiothérapie causent la surdité neurosensorielle chez les patients. Cette surdité induit un sous-ensemble de complexités chez les patients atteints du cancer de la tête ou du cancer du cou, qui subissent une importante diminution de leur qualité de vie.

Conclusion: La revue de la littérature réalisée révèle que la surdité neurosensorielle est un important effet secondaire chez les patients atteints du cancer de la tête ou du cancer du cou qui subissent des traitements de chimioradiothérapie à base de cisplatine. Il y a lieu de pousser la recherche afin d'évaluer la contribution de la chimioradiothérapie à base de cisplatine à la surdité neurosensorielle et l'effet ultérieur sur la qualité de vie des patients traités.

Keywords: Sensorineural hearing loss; quality of life; head and neck neoplasm; combined modality therapy

Introduction

Sensorineural hearing loss (SNHL) is a major complication of treatment for patients with head and neck cancer (HNC) treated with cisplatin-based chemoradiation (CbCRT). CbCRT is increasingly used in the management of HNC, with positive impact on overall survival [1]. However, both cisplatin and radiation are known to be ototoxic, and as such, the rate of treatment-induced SNHL is significantly higher with combined modality therapy.

SNHL is a type of hearing loss incurred by damage to the cochlea or retrocochlear region or from damage to the cranial nerve VIII and central auditory pathways. The mechanism underlying SNHL after CbCRT remains undefined. There is evidence to suggest it is related to a radiation-induced, pathophysiologic change in the auditory system, beginning at the Eustachian tube and extending to the brainstem [2]. Etiologies of SNHL may include vascular insufficiency, reduced number of capillaries, degeneration of endotheliocytes in vessels, loss of cells in the organ of Corti and degeneration of the stria vascularis, and atrophy of the spiral ganglion cells and the cochlea nerve [3–5].

Advances in treatment techniques over the past decade have substantially improved the prognosis for patients with HNC, with 5-year locoregional control greater than 80% in patients with locally advanced disease [5]. As such, it is important to consider the impact of treatment on quality of life because these patients are living longer with the side effects of their treatment. The aim of this article was to review the mechanism behind SNHL in patients treated with CbCRT, including incidence, the contributions of radiotherapy and cisplatin to SNHL, and the impact of toxicity on patient quality of life.

Methods

The literature was reviewed for relevant studies exploring HNC treatment modalities, particularly CbCRT and specific health outcomes including SNHL. The electronic databases OvidSP MEDLINE and PubMed (National Centre for Biotechnology Information) were searched via the Queensland University of Technology Library website. A combination of the following key words were used: hearing loss, ototoxicity, quality of life, cancer, cisplatin, and radiotherapy. The Google Scholar database was also searched using identical key word combinations. In addition, citation and related searches were completed using author names, reference checks, and the PubMed "related citations" function. All relevant retrospective and prospective cohort, cross-sectional, and case-control studies published in peer-reviewed journals between 1990 and 2013 were reviewed by one author. Only articles that were published in English with full text available were included.

The searches identified 290 articles, of which 129 met the inclusion criteria. A further 53 articles were excluded because they reported on a combination of chemotherapeutic drugs, alternate chemotherapy infusion methods, diagnoses other than head and neck, or pediatric cohorts, leaving 76 articles suitable for review.

Results and Discussion

Clinical Context

Over the past few decades, the incidence of patients presenting with HNC has been on a steady incline [6–9]. This rising incidence does not correlate with the conventional HNC risk factors of excessive tobacco and alcohol exposure, but, rather, it aligns with emerging epidemiologic data that confirm the increasing presence of virally mediated HNC [10, 11]. The recognition of virally mediated tumours has impacted the demographic of patients diagnosed with HNC, with the disease predominantly affecting middle-aged, white men with higher socioeconomic status and with no, or relatively low, smoking history [7–9].

Current treatment paradigms have also evolved. The need to optimize tumour control while preserving organ function is