Middle Ear Morbidity after Head & Neck Radiation Therapy

Niranjan Bhandare,* William M. Mendenhall,* Christopher G. Morris,* & Patrick J. Antonelli§

University of Florida Departments of *Radiation Oncology & §Otolaryngology

ABSTRACT

Objective: Radiation therapy (RT) for head and neck cancers (HNCa), has been associated with middle ear morbidity (MeM), but is sparsely reported. The goal of this study was to evaluate the incidence of middle ear morbidity in HNCa patients receiving RT +/- chemotheraphy (Chemo) and associated patient and treatment related factors.

Methods: Pre-and post RT records of HNCa patients were retrospectively assessed to estimate the incidence of chronic otitis media with effusion (OME), chronic suppurrative otitis media (CSOM), tympanosclerosis, persistent membrane perforation (TMP), mastoiditis, dysgeusia, and radiation dose to the middle ear.

Results: 375 patients (750 ears) were evaluated. The rate of MeM included: OME (31.5%), CSOM (8.0%) TMP with (7%) and without (8.5%) tympanostomy tube, tympanosclerosis (20.5%) mastoiditis (5.5%), middle ear fibrosis (6.0%), dysgeusia (7.5). With a range of 0.25 to 6.5 years, the median times for detection of MeM varied from 0.95 to 2.3 years. Univariate and multivariate analyses indicated that dose to middle ear was significant for all MeM, but age > 60, gender, and race were not. Significance of dose fractionation (daily/twice daily) for OME was marginal (p=0.0498). Adjuvant chemo was significant for OME and TMP (p=0.03)

Conclusion: Post-RT Incidence of post-RT MEM is proportional to radiation dose received by middle ear. Adjuvant chemo associated with MEM but further investigation into this risk factor is needed.

INTRODUCTION

Radiation therapy (RT) is often delivered in very high doses to cancers arising from the nasopharynx, paranasal sinuses, and nasal cavity. The middle ear often receives high doses of RT, which may lead to the development middle ear morbidity (MEM). The incidence MEMs after RT is sparsely reported. The goal of this study was to evaluate the rate and severity of MEMs in head and neck cancers (HNCa) patients.

METHODS

Pre and post RT medical records of patients with malignancies of the nasopharynx, paranasal sinuses, and nasal cavity treated with curative intent, 1964 – 2000, were reviewed. Minimum follow up was 6 months. Patients with tumor involvement of the temporal bone or pre-RT middle ear conditions were excluded. Patients with pre-RT OME secondary to nasopharyngeal cancer were included. RT dose received by middle ear was determined by generating 3 dimensional reconstruction of the treatment plan using patient’s CT scan. For patients pre-dating CT-based treatment planning, CTs of Alderson-Rando anthropomorphic phantom, scaled to match patient dimensions, were used as proxy phantom. Mean dose received by middle ear was used for analysis.

RESULTS

- A total of 375 patients (750 ears) were included in analysis.
- Median follow up was 5.8 years (range 0.5-30.6 years).
- 301 patients were treated with RT alone.
- 74 patients were treated with adjuvant chemotherapy and RT.
- Doses received by middle ear varied between 25 Gy to 80 Gy.

Complication | % incidence | Minimum dose (Gy) (Dose range: Gy)
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Tympanic Membrane | | |
Tympanosclerosis | 8.0 | 45.0 (45.79-5)
TM perforation (w/o tympanostomy) | 8.5 | 47.0 (47.80-8)
TM perforation (post tympanostomy) | 7.0 | 47.0 (47.80-8)
Middle ear | | |
Otitis media with effusion | 31.5 | 40.5 (40.5-80.0)
Chronic suppurrative otitis media | 8.0 | 43.5 (43.5-80.0)
Mastoiditis | 5.5 | 55.0 (55.0-77.5)
Middle ear fibrosis | 6.0 | 53.5 (53.5-80.0)
Dysgeusia | 7.5 | 53.0 (53.0-78.0)

Univariate Analysis

| Age (<60 yrs, ≥ 60 yrs) | OME: 0.1677
| TMP: 0.2462
| Mastoiditis: 0.1685
| Dysgeusia: 0.1325
| Gender | OME: 0.3568
| TMP: 0.2563
| Mastoiditis: 0.3022
| Dysgeusia: 0.1245

Dose to middle ear (<50 Gy, ≥ 50 Gy)

| OME: <0.0001
| TMP: <0.01
| Mastoiditis: 0.026
| Dysgeusia: <0.01

Chemo. + RT

| OME: 0.0298
| TMP: 0.0302
| Mastoiditis: 0.0495
| Dysgeusia: 0.3123

Fractionation (once or twice daily)

| OME: 0.0449
| TMP: 0.0523
| Mastoiditis: 0.1723
| Dysgeusia: 0.0985

Dose per Fraction (<1.8 Gy, ≥ 1.8 Gy)

| OME: 0.0351
| TMP: 0.0738
| Mastoiditis: 0.1321
| Dysgeusia: 0.3248

Multivariate Analysis

| Age (<60 yrs, ≥ 60 yrs) | OME: 0.2337
| TMP: 0.2288
| Mastoiditis: 0.2314
| Dysgeusia: 0.3233
| Gender | OME: 0.4476
| TMP: 0.3526
| Mastoiditis: 0.4512
| Dysgeusia: 0.3241

Dose to middle ear (<50 Gy, ≥ 50 Gy)

| OME: <0.0001
| TMP: 0.0351
| Mastoiditis: 0.0458
| Dysgeusia: 0.0224

Chemo. + RT

| OME: 0.034
| TMP: 0.0326
| Mastoiditis: 0.0565
| Dysgeusia: 0.3654

Fractionation (once or twice daily)

| OME: 0.0498
| TMP: 0.06102
| Mastoiditis: 0.2115
| Dysgeusia: 0.1378

Dose per Fraction (<1.8 Gy, ≥ 1.8 Gy)

| OME: 0.1256
| TMP: 0.0978
| Mastoiditis: 0.3151
| Dysgeusia: 0.5123

CONCLUSIONS

Post-RT MEM is proportional to RT dose received by middle ear. Adjuvant chemo therapy may be associated with increased incidence of MEM. Future studies on RT-induced MEM account for middle ear dose and adjuvant therapy.