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POST IRRADIATION HEARING LOSS IN HEAD/NECK PATIENTS IN LAGOS, NIGERIA

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ABSTRACT
A prospective study was conducted at Lagos University Teaching Hospital on patients with malignancies of the head and neck region treated with external beam irradiation type and severity of hearing loss. Each patient had a pre-irradiation and post irradiation pure tone audiogram at 3 weeks, 8 weeks and 6 months. Following completion of radiotherapy serial post irradiation audiogram threshold was compared with pre-treatment threshold. An increase of 10 dB HL (decibel hearing level) or greater was considered significant. Radiation dose ranged from 45-55Gy in twenty to twenty-five fractions per weeks over four to five weeks treatment. Patients that received chemotherapy as adjunctive to therapy during the period of the study were excluded.

A total of 40 patients (80 ears) completed the audiological follow up out of ninety four patients seen during the study period .Age ranged between 4-79 years. The tumor site distribution showed 20% in the nasopharynx, 25% in the larynx, 15% in the nose and paranasal sinuses and 10% in the parotid. 7.5% in the oral cavity and mandible respectively and 5% in the ear. Majority 33 (82.5%) were sqaumous carcinoma, 10% were sarcoma and 5% were adenocarcinoma.Pre-radiation hearing assessment revealed 62 ears (77.5%) with normal hearing, 8ears (10%) with mild SNHL and 5 ears (6.25%) with mild and moderate CHL respectively. Final post radiation hearing assessment after 6 months revealed normal hearing in 64 ears (80%), 11 ears (13.8%) with mild SNHL and 2 ears (2.5%) with moderate SNHL. 1.25% with moderate conductive hearing loss and 2 ears (2.5%) with mixed loss. Negative effect of radiotherapy post radiation was seen in 5 ears (6.25%) mainly in mandibular, parotid and ear tumours.

The study shows that hearing loss after external beam irradiation could be a significant side effect after radiotherapy in head and neck cancer patients, hence patients should be informed during the pre-treatment counseling period and audiological assessments should be an integral part of pre-therapy evaluation for medicolegal reasons.

ABSTRAIT
Une étude éventuelle a été entreprise à l'hôpital d'enseignement d'université de Lagos sur des patients avec des malignités de la région de tête et de cou traitée avec le type d'irradiation de faisceau et la sévérité externes de perte d'audition. Chaque patient a eu un audiogramme pur de tonalité d'pré-irradiation et d'irradiation de poteau à 3 semaines, 8 semaines et 6 mois. L'accomplissement suivant du seuil périodique d'audiogramme d'irradiation de poteau de radiothérapie a été comparé au seuil de traitement préparatoire. Une augmentation de 10 HL de DB (niveau d'audition de décibel) ou un plus grand a été considérée significatif. La dose de

rayonnement s'est étendue de 45-55Gy dans vingt à vingt-cinq fractions par semaines plus de traitement de quatre à cinq semaines. Des patients qui ont reçu la chimiothérapie comme adjunctive à la thérapie pendant la période de l'étude ont été exclus.

Un total de 40 patients (80 oreilles) a accompli l'ultérieur audiologique sur quatre-vingt-dix quatre patients vus pendant la période d'étude.L'âge s'est étendu entre 4-79 ans. La distribution d'emplacement de tumeur a montré 20% dans le nasopharynx, 25% dans le larynx, 15% dans le nez et les sinus paranasal et 10% dans la parotide. 7.5% dans la cavité buccale et la mâchoire inférieure respectivement et 5% dans l'oreille. La majorité 33 (82.5%) étaient carcinome sqaumous, 10% étaient sarcome et 5% étaient adénocarcinome.l'évaluation d'audition de Pré-rayonnement a indiqué 62 oreilles (77.5%) avec l'audition normale, 8ears (10%) avec SNHL doux et 5 oreilles (6.25%) avec CHL doux et modéré respectivement. L'évaluation finale d'audition de rayonnement de poteau après 6 mois a indiqué l'audition normale dans des 64 oreilles (80%), 11 oreilles (13.8%) avec SNHL doux et 2 oreilles (2.5%) avec SNHL modéré. 1.25% avec la perte d'audition conductrice modérée et 2 oreilles (2.5%) avec la perte mélangée. L'effet négatif du rayonnement de poteau de radiothérapie a été vu dans des 5 oreilles (6.25%) principalement dans mandibulaire, tumeurs de parotide et d'oreille.

L'étude prouve que perte d'audition après que l'irradiation externe de faisceau pourrait être un effet secondaire significatif après la radiothérapie dans des patients de cancer de tête et de cou, par conséquent les patients devraient être au courant pendant le traitement préparatoire conseillant la période et les evaluations audiologiques devraient être une partie intégrale d'évaluation de pré-thérapie pour des raisons medicolegal.

INTRODUCTION

The effect of ionizing radiation on any organ depending on the dose varies from local tissue reactions, to genetic mutation and cancer induction [1]. Radiation causes excitation of molecules and release of ions and free radicals that are capable of affecting enzymatic activities.[1, 2] Radiation hearing loss could result from cumulative effects of therapeutic radiation or acute high level radiation exposure [3,4].

The documented effects of therapeutic ionizing radiation on the ear varies from relative resistance, to temporary conductive hearing loss(CHL) and permanent sensorineural (SNHL) and mixed hearing loss(MHL)[5-7]. The temporary hearing impairment can result from eustachain tubes dysfunction, radiation induced otitis media and transient vasculitis of inner ear vessels[6]. The delayed radiation induced hearing loss has been attributed to the effects of radiation on inner ear with cellular changes, inflammatory reaction and haemorrhage involving the vessels[7,8].

The conductive component is amenable to treatment while the sensorineural hearing loss(SNHL) is a source of concern. Varied factors have been mentioned as determinants of hearing loss in these patient, viz age, absorbed dose, number of fractions, methods of delivery, treatment days, irradiated site specific tolerance dose and appropriate shielding of surrounding structure [8,-10]. Cochlea of children is more vulnerable to damage because of high growth rate and immaturity[10].

The prevalence of head/neck tumor is on the increase in Lagos Nigeria and late

presentation is still a problem with our patients and many will end up having radiotherapy [11 - 13.] The aim of this study is to document type and severity of hearing loss in post irradiated head and neck cancer patients excluding those who had chemotherapy.

MATERIALS AND METHODS

Prospective study was conducted at Lagos University Teaching Hospital between January 1998 to June 2001.
Patients with malignancies of the head and neck region referred to the radiotherapy department of the hospital to be treated with external beam irradiation were recruited into the study. Informed consent was obtained. They all had otological examination done. Each patient had a pre-irradiation and post irradiation pure tone audiogram at 3 weeks, 8 weeks and 6 months. Following completion of therapy serial post irradiation audiogram threshold was compared with pre-treatment threshold. An increase of 10 dB HL or greater was considered significant. Radiation dose ranged from 45-55Gy in twenty to twenty-five fractions per weeks over four to five weeks treatment.
Patients who received chemotherapy as adjunctive to radiotherapy during the period of the study were excluded from this study because some of the chemotherapeutic drugs are ototoxic e.g. Cisplatinum.

Overall, null effect of radiation on hearing was seen in 66 ears (82.5%) while positive effect on hearing was seen in 6 (7.5%) and negative effect was recorded in 5 ears (6.25%).

RESULTS

Forty (40) patients (80 ears) completed the audiological follow up and received no chemotherapy as adjunctive to radiotherapy out of a total of ninety four patients with Head and Neck cancers referred for external beam irradiation during the study period. Age ranged between 4-79 years with mean age 44 years.
Twelve (12) (30%) were civil servants, 20% traders, 15% were technicians, 10% professionals, 12.5% were students and 12.5% were not gainfully employed.

Table 1 showed the tumor site distribution, 20% in the nasopharynx, 25% in the larynx, 15% in the nose and paranasal sinuses and 10% in the parotid. 7.5% in the oral cavity and mandible respectively and 5% in the ear. Majority 33(82.5%) were sqaumous carcinoma and 10% were sarcoma and 5% were adenocarcinoma.

Pre-radiation hearing assessment revealed 62 ears (77.5%) with normal hearing, 8ears (10%) with mild SNHL and 5 ears (6.25%) with mild and moderate CHL respectively. Final post radiation hearing assessment after 6 months revealed normal hearing in 64 ears (80%), 11 ears (13.8%) with mild SNHL and 2 ears (2.5%) with moderate SNHL. 1.25% with moderate conductive hearing loss and 2 ears (2.5%) with mixed loss. Table ii.

Further analysis of hearing loss by site of tumours distribution, Table III were as follows, 48 ears (60%) with bilateral normal hearing that remain normal post radiation mainly in some nasopharyngeal, 5% laryngeal 10%, nose/paranasal 7.25% oropharyngeal, palatal, tongue, eyelid, madibular and occult neck tumours1.25% respectively. 7 ears (8.75%) with unilateral normal hearing that remain same post radiation in the nasopharynx, larynx, occult neck disease 1.25% respectively and in the parotid and ears 2.5% respectively.

Normal hearing that deteriorated into mild sensorineural hearing loss post radiation was seen in 3 ears (3.75%)

mainly in mandibular and parotid tumours.

Abnormal hearing mainly conductive loss that became normal post radiation was seen in 6 ears (7.5%) (see figure III) mainly in nasopharyngeal mandibular and some parotid tumours. Abnormal hearing in 6 (7.5%)ears of which five were mild sensorineural loss and one moderate conductive loss that remain unchanged post radiation mainly in nasopharyngeal, alveolar and occult neck tumours. Abnormal hearing, moderate conductive loss in 2 ears (2.5%) that deteriorated post radiation into moderate mixed hearing loss mainly in patients with ears tumours.

DISCUSSION

Various aetiological factors have been documented as causes of hearing impairment in different age group and environments.[14] Mode of therapy of a disease either medical or surgical is target specific but in reality the patients sometimes experience some untoward effects.

Drugs and ear surgery can induce hearing loss in patients, so also is radiation used for therapy of head and neck cancer patients. The reported negative effect of radiation therapy on the ear is not universal; some patients are vulnerable while other are not.[15-17] Various vulnerability factors and mechanisms have been mentioned.[8-10 18 19]

Children cochlear are said to be more vulnerable to radiation effect. The proportion of children in this study is few and do not make reasons for any meaningful discussion.

It is worth noting that 10% of the patients were found with pre-radiation mild sensorineural hearing loss not related to age, head, neck cancers disease and occupation. Had it not been for the pre-evaluation, this will have been attributed to radiotherapy. The medicolegal implication of this must be borne in mind for patient with oncological diseases going for radiotherapy. They must have audiological assessment as part of the irradiation evaluation and they should be counseled about the untoward effects of radiotherapy including possible hearing loss.

The pre-irradiation mild and moderate conductive hearing loss were due to disease involvement of the eustachian tube in some of the patients with nasopharyngeal tumor craniopharyngioma, mandibular and parotid tumor. Post irradiation improvement in hearing was noted in 7.5% of patients, this improvement could obviously be attributed to tumor regression following radiotherapy.

The permanent negative effect of radiotherapy in form of sensorineural hearing loss was seen more in irradiated parotid tumor, and jaw tumor tumours. The hearing loss in these patients can be attributable to the wider field of radiation and, the use of multiple radiation fields and other intrinsic susceptible factors that is patient dependent. 82.5% of the patients experienced no change in hearing thresholds six months post radiotherapy.

CONCLUSION

The study has shown that hearing loss after external beam irradiation could be a significant side effects after cancer therapy, hence, patients should be informed during the pre-treatment counseling period and audiological assessments should be an integral part of pre-therapy evaluation for medicolegal reasons.

TABLE I: SITE DISTRIBUTION OF HEAD/NECK TUMOURS

Site	Histodiagnosis	No	%
Ext Aud Canal	Rhabdosarcoma	1	5
	Squamous Carcinoma	1	
Nose/PN	Squamous Carcinoma	4	15
	Adenocarcinoma	2	
Nasopharynx	Squamous Carcinoma	7	20
	Craniopharygioma	1	
Oropharynx	Embryo Rhabdo Sarcoma	1	2.5
Palate/Alveolus Tongue	Squamous Carcinoma	2	7.5
	Sarcoma	1	
Mandible	Squamous Carcinoma	2	7.5
	Sarcoma	1	
Larynx	Squamous Carcinoma	10	25
Upper Eyelid	Squamous Carcinoma	1	2.5
Parotid	Squamous Carcinoma	4	10
Occult Neck Disease	Squamous Carcinoma	2	5

TABLE II
RESULTS OF PURE TONE AUDIOMETRIC EVALUATION PRE AND POST RADIATION THERAPY

	PRE-RADIATION				POST RADIATION			
	L	R	TOTAL NO	%	L	R	TOTAL NO	%
Normal 0-25db	31	31	62	77.5	32	32	64	80
Mild 26-40db SNHL	5	3	8	10	6	5	11	13.5
Mild 26-40 COND	2	3	5	6.25				
Mod 40-55 db SNHL	-	-	-	-	1	1	2	2.5
Mod 40-55 db CHL	2	3	5	6.25	-	1	1	1.25
Mixed 40.55 db	-	-	-	-	1	1	2	2.5
	40	40	80	100	40	40	80	100

TABLE III
HEARING LOSS BY TUMOR SITE DISTRIBUTION

	No of Patients	PRE-RADIATION						POST RADIATION					
		Normal		Mild		Moderate		Normal		Mild		Moderate	
		L	R	L	R	L	R	L	R	L	R	L	R
Nasopharynx	7	5	4	1	1	1c	2c	6	5	1	1	-	1
Craniopharyngeal	1	-	1	1c				1	1				
Oropharyngeal	1	1	1					1	1				
Larynx	10	8	9	2	1			8	9	2	1		
Nose/PNS	6	6	6					6	6				
Ext. Aud Canal	2	1	1			1c	1c	1	1			1m	1m
Palate	1	1	1					1	1				
Mandible	3	2	2	1c	1c			3	2		1		
Alveolus	1			1	1					1	1		
Tongue	1	1	1					1	1				
Eye lid	1	1	1					1	1				
Occult Neck	2	1	2	1				1	2	1			
Parotid	4	4	2		2c			2	2	1	1	1	1

c-=Conductive hearing loss
m= Mixed hearing loss

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