Effect of Radiation on Oropharyngeal Flora in Patients of Head and Neck Cancer

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In the present study 124 cases of head and neck cancers subjected to radiation therapy were studied and the change in oropharyngeal flora with the radiation therapy noted. 50 cases for comparison with no ENT complaints were taken control. The oropharyngeal flora in the control cases was established as the normal flora. Any other floral constituent was considered to be abnormal oropharyngeal flora. It was found that with radiation there was a statistically significant increase in several constituents of normal as well as abnormal oropharyngeal flora. This increase could be the predisposing factor for post radiation infections especially in post operative patients. Oropharyngeal swabs were sent before, during and after radiation therapy for detailed bacterial and mycotic flora smear and culture examinations.

INTRODUCTION

The normal or indigenous flora of the body is a collection of species routinely found in the normal healthy individual. Some of these species are positively beneficial to the host, their importance for health sometimes being revealed quite dramatically under stringent antibiotic therapy. Along with various complications the effect of radiation was seen on the oropharyngeal flora. This change in the flora could be held responsible for infections in the post radiation period.

MATERIAL AND METHODS

In all 192 cases were included for this study in the present series. 124 were cases of head and neck cancers were being treated with radiotherapy and 50 control cases who were free

from any signs and symptoms related to the ear nose and throat. Both the study group patients and the control group patients were subjected to oropharyngeal flora examination by swab culture and smear studies. The identification of the individual flora was based on their colonial characterization on culture as well as smear studies employing different staining procedures.

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OBSERVATIONS

In 50 control cases the commonest aerobic constituent was *Streptococcus viridans* (64%) followed by *Neisseria catarrhalis* in 40% cases. Commonest anaerobic constituent was *Peptococcus* seen in 36% cases followed by *Peptostreptococcus* in 28% cases. Mycotic flora were positive only in 2% cases comprising of *Candida albicans*.

23% cases of head and neck cancer had abnormal aerobic oropharyngeal flora as compared to none in controls. 15% cases of head and neck cancer had abnormal anaerobic oropharyngeal flora as compared to none in controls (Table No.1).

There was a significant increase in abnormal aerobic flora from 32 cases (23%) before radiation therapy to 35 cases (32%) during radiation therapy and to 68 cases (48%) after radiation therapy. Following radiation therapy

Table I : Comparison of Oropharyngeal Flora Between Head and Neck Cancer Cases and Control Cases

Oropharyngeal flora	Controls		Head and neck cancer		P value	Significance
	No. of cases	%	No of cases	%		
Aerobic						
Sterile	12	(24%)	24	(16%)	—	NS
Normal	38	(76%)	86	(61%)	<0.05	SS
Abnormal	0	(0%)	32	(23%)	<0.001	SS
Anaerobic						
Sterile	24	(48%)	28	(19%)	<0.001	SS
Normal	26	(52%)	92	(66%)	—	NS
Abnormal	0	(0%)	22	(15%)	<0.001	SS
Mycotic						
Negative	49	(98%)	122	(86%)	—	NS
Positive	1	(2%)	20	(14%)	<0.05	SS
Total No.	50		142			

there was a statistically significant increase in *Streptococcus viridans*, *Streptococcus hemolyticus*, *Streptococcus pneumoniae*, *Klebsiella*, *Pseudomonas* and *Staphylococcus aureus* (Table No.II).

Commonest organism in normal anaerobic flora

was *Peptococcus* while *Clostridia* and *Bifidobacterium* were the common constituents of abnormal anaerobic flora in the preradiation period. There was a significant increase following radiation therapy in *Peptococcus*, *Propionibacterium*, *Bifidobacterium* and *Clostridia*. (Table No. III).

Table II : Distribution of Aerobic Oropharyngeal Flora Before, During and After Radiation Therapy

Organism	Pre-radiation	Mid-radiation	Post-radiation	P value	Sig.
Sterile	24	14	4		
Normal flora					
<i>Streptococcus viridans</i>	66	84	83	<0.001	S
<i>Streptococcus pyogenes</i>	16	20	18	—	N
<i>Staphylococcus epidermidis</i>	18	12	14	—	N
<i>Neisseria</i>	28	30	32	—	N
<i>Haemophilus influenzae</i>	4	6	5	—	
Abnormal flora					
<i>Streptococcus hemolyticus</i>	22	38	55	<0.001	S
<i>Streptococcus pneumoniae</i>	2	6	12	<0.01	S
<i>Staphylococcus aureus</i>	18	34	32	<0.01	S
<i>Klebsiella</i>	16	19	28	<0.05	S
<i>Pseudomonas</i>	12	18	24	<0.01	S
<i>Proteus</i>	4	9	10	—	N
<i>Escherichia coli</i>	8	12	9	—	N
<i>Vibrio</i>	2	2	2	—	N
<i>Bacillus anthracis</i>	2	3	2	—	N

Table III : Distribution of Anaerobic Oropharyngeal Flora Before, During And after Radiation Therapy

Organism	Pre-radiation	Mid-radiation	Post-radiation	P value	Sig
Sterile	28	16	15	—	—
Normal					
Peptococcus	68	74	72	—	NS
Peptostreptococcus	24	26	23	—	NS
Vielonella	38	41	40	—	NS
Bacteroides	30	26	29	—	NS
Fusobacterium	15	12	14	—	NS
Lactobacillus	14	10	11	—	NS
Abnormal					
Propionibacterium	4	12	20	<0.001	SS
Bifido bacterium	8	15	22	<0.001	SS
Clostridia	8	19	18	<0.001	SS

14% cases were positive for mycotic flora in pre-radiation group as compared to 28% in mid-radiation and 38% in post-radiation group. Both these difference were found to be statistically significant. A significant increase of 24% cases positive for mycotic flora was seen after radiation therapy.

Commonest constituent of the mycotic flora was *Candida*. *Candida* was found to increase from 12.5% cases in the preradiation period to 36% in the post radiation period. All other constituents of the mycotic flora (*Aspergillus*, *Trichophyton* and *Mucor*) were found to increase significantly

in 48% of preoperative cases as compared to 67% in postoperative cases. Post-irradiation flora was abnormal in 52% preoperative cases as compared to 100% in postoperative cases.

DISCUSSION

The differences in the normal oropharyngeal flora between various studies are bound to occur as the flora is dependent on the environment of the individual concerned. So an exclusive set of normal oropharyngeal flora inherent specifically to the individuals in the environment of the present study was established by taking

Table IV : Distribution of Mycotic Flora

Organism	Pre-radiation	Mid-radiation	Post-radiation	P value	Significance
<i>Candida</i>	18	34	48	<0.001	SS
<i>Aspergillus</i>	2	6	10	<0.01	SS
<i>Trichophyton</i>	0	2	6	<0.05	SS
<i>Mucor</i>	0	2	8	<0.001	SS
No. of cases positive for mycotic flora	20 (14%)	39 (28%)	54 (38%)		

with radiation therapy (Table No. IV). Maximum increase in the mycotic flora following radiation therapy was seen in cases of carcinoma larynx followed by oropharynx and oral cavity.

Pre-irradiation oropharyngeal flora was abnormal

50 control cases who were normal healthy individuals not having any ENT problem.

On comparing these oropharyngeal flora with the oropharyngeal flora found in head and neck

cancer patients it was found in the present study that only 66% had the normal oropharyngeal flora, 23% were positive for abnormal aerobic flora, 15% for abnormal anaerobic flora and 14% were positive for abnormal mycotic flora which clearly showed that there is an increasing incidence of abnormal oropharyngeal flora in head and neck cancer patients. This statistically significant increase in abnormal oropharyngeal flora in head and neck cancer patients can be explained due to decreased immunological status of these patients. The present observations are similar to those of McCormick (1985) who also observed abnormal oropharyngeal flora and was of view that increased incidence of infection in head and neck cancer patients was due to decreased blood supply, immunocompetence and loss of anatomical barriers. Wanebo et al. (1975) stated that the immunological system is depressed in head and neck cancer patients even more so after radiotherapy. Kapoor et al. (1981) and Baskies et al. (1982) have also expressed similar opinion.

The effect of radiation therapy on the oropharyngeal flora was noted, preirradiation, mid irradiation and post irradiation oropharyngeal flora were established. It was seen that there was a definitive increase in abnormal oropharyngeal flora during and after radiation. This operation is in agreement with studies of Abu Shara (1993), Blozis et al. (1968), Gourie et al. (1971), Lalkes K et al. (1974) and Bera et al. (1979).

It was seen that the abnormal aerobic oropharyngeal flora which was 0% in controls increased to 23% in preirradiated head and neck cancer cases, to 32% in mid therapy and a further increase to 48% in the post irradiation period. Thus a statistically significant change of 25% in the abnormal aerobic oropharyngeal flora was seen after radiation therapy. Similarly the abnormal anaerobic oropharyngeal flora from 0% in controls increased to 15% in preradiation head and neck cancer patients. A further increased was

seen to 23% in the mid radiation period and to 28% in the post radiation period. A statistically significant change of 13% in the abnormal anaerobic oropharyngeal flora after the radiation therapy was seen. The mycotic flora was positive only in 2% in controls. It increased to 14% in pre-irradiated head and neck cancer cases. A further increase to 28% in midradiation period and to 38% in the postradiation period. A statistically significant increase in the mycotic flora of 24% was noted. These observations are similar to those made by Blozis et al. (1968) who stated that there is a definitive increase in mycotic oral flora secondary to radiation therapy especially seen in candida. Martin MV et al. (1981) also noted an increase in fungus after radiation therapy. He stated that the increase of opportunistic organisms was seen due to decreased immunological status. Pau HW et al. (1985) also stated that there was a significant increase in yeast fungus following radiation.

In the present study it was found that there was a statistically significant increase of many organism following radiation therapy. Among the aerobic organisms were *Streptococcus viridans*, *Streptococcus pneumoniae*, *Streptococcus hemolyticus*, *Staphylococcus aureus*, *Klebsiella* and *Pseudomonas* (Table No.II). Similar observations were made by Abu Shara (1993) except that they had found no change in the number of cases positive with *Streptococcus viridans*. Rice and Gill (1979) also found an increase in *Staphylococcus aureus*, *Proteus* and *Pseudomonas*.

Among the anaerobic organisms it was found that there was a statistically significant increase in *Propionibacterium*, *Bifidobacterium* and *Clostridia*. No statistically significant change was seen in the normal anaerobic flora (Table No.III).

Commonest organism seen in the mycotic flora was *Candida* which was seen to significantly increase other mycotic flora seen to increase were *Aspergillus* and *Trichophyton* and *Mucor* (Table No.IV). In all cases the increase was seen to be

statistically significant. *Candida* was seen to increase with radiation by Bodey et al. (1966), Rice and Gill et al. (1979), Martinez et al. (1981), Freeman et al. (1985), Epstein et al. (1993) and Abu Shara et al. (1993).

While studying the difference in change in oropharyngeal flora in preoperative and postoperative cases, it was found that in preoperative cases the increase in abnormal oropharyngeal flora was from 48 to 52% after radiation therapy, while in postoperative cases it was from 67% to 100%. These results led us to believe that irradiation has marked effects on oropharyngeal flora and this increase in pathogenic organisms appear to play a role in postoperative infections in these patients. Also probably because of this reason postoperative irradiation is preferred to preoperative to avoid the harmful effects of pathogenic flora which persists even in the post irradiation period.

In the present study strong statistically significant correlation between the change in oropharyngeal flora with radiation therapy and the oral mucosal changes was found. A high incidence of mycotic flora both before and after radiation therapy was seen in cases with white patch in the oral mucosa. While cases with oral ulceration and association oropharyngeal infections were seen to be strongly positive for abnormal aerobic oropharyngeal flora. So, it is suggested that during the course of

radiation therapy regular ENT examination should be done and accordingly to the oral mucosal changes and the oropharyngeal flora, drugs should be administered along with radiation therapy.

Thus the present study has established that following radiation therapy there is a definite increase in abnormal bacterial and mycotic oropharyngeal flora. In the light of findings of the present study it is suggested that regular ENT examination and oropharyngeal flora cultures for both bacterial and mycotic organisms should be done. If the findings before radiation are abnormal, appropriate drugs should be given along with the radiation therapy to prevent oropharyngeal complications in patients receiving irradiation.

In this study the use of prophylactic antibacterial or antifungal therapy was not found to be required if the examination and oropharyngeal flora is normal before irradiation. But it is suggested that oral hygiene has to be adequately maintained, along with good nutritional status and personal hygiene. The prophylactic use of antibacterial and antifungal drugs in postoperative cases can be considered even if the flora is normal as in this study 100% postoperative cases were found to have abnormal oropharyngeal flora following the radiation therapy.

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Congratulations !

- Dr. Mohan Bansal of Anand went to USA under sponsorship of Group Study Exchange Programme (GME) of Rotary International.
- Maj Gen. Dr. H. B. Singh (Retd.) of Delhi has been designated as President of Korean War Veterans Association of India.
- Dr. Vinod Shah of Surat delivered Dr. G. Narayan Memorial Oration at the Annual Conference of Rajasthan State Branch of AOI at Kota on 27-09-97.
- Dr. Girish Mishra Prof. & Head, ENT Dept., P. S. Medical College, Karamsad was awarded travel fellowship by "Charotar Aryoga Mandal" for visiting Sloan-Kettering Memorial Cancer Centre at New York for 3 months.