# Evaluation of prescription dose using follow-up images of head and neck IMRT

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## Background

Intensity-modulated radiation therapy (IMRT) is useful to reduce the dose to normal tissues in head and neck radiation therapy[1),2)].

Doses of radiation therapy are generally prescribed according to guidelines.

Persistent diseases, local and neighborhood or regional recurrences may occur after treatment. When radiation oncologists report treatment results, they are categorized based on stage, patient background, the presence or absence of chemotherapy, etc.

## Purpose

We investigated irradiated dose associated with persistent diseases, local and neighborhood or regional recurrences in the head and neck IMRT performed at our hospital.

## Materials

・Linac : Clinac iX (Varian)
・Treatment Plan System : Eclipse (Varian) Ver13.6.23
・Dose Calculation algorithm :
  Acuros External Beam (AXB) Ver13.6.23
・The subjects : 154 head and neck IMRT patients
・Treatment Periods : January 2013 ~ December 2019

## Methods

・The calculation algorithm for AXB is more accurate than Anisotropic Analytical Algorithm (AAA)[3),4),5)]. Therefore, the plan calculated by was recalculated using AXB, and the dose was evaluated by modifying the MU irradiated by AAA.
・The irradiation method was volumetric modulated arc therapy (VMAT), and mainly the simultaneous-integrated boost (SIB) method was used[6),7)].

・Using the evaluation images (mainly PET images) after the completion of radiation therapy, the doses at the persistent, local and neighborhood or regional recurrences sites were evaluated.
・The dose was divided by the prescription dose and evaluated as a percentage.

## Results

**Table1. Details of 154 cases**

Follow-up images were 30 (number of cases in parentheses) of 34 cases in Persistent diseases, local and neighborhood or regional recurrences.

| | Case | Persistent Diseases | Local Recurrences | Neighborhood or Regional Recurrences |
|---|---|---|---|---|
| **Nasopharynx** | 14 | 0 | 0 | 0 |
| **Oropharynx** | 46 | 4(3) | 5(3) | 1 |
| **Hypopharynx** | 49 | 7 | 7(6) | 2 |
| **Larynx** | 10 | 0 | 0 | 0 |
| **Others** | 35 | 3 | 2 | 3 |
| **All** | 154 | **14(13)** | **14(11)** | **6** |

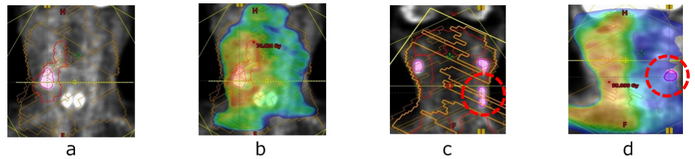


**Fig1. Dose distribution and follow up images**

a) PET images of local recurrence
b) Dose distribution of local recurrence on (a) image
c) PET images(In the red circle was neighborhood or regional recurrences)
d) Dose distribution (In the red circle was neighborhood or regional recurrences)

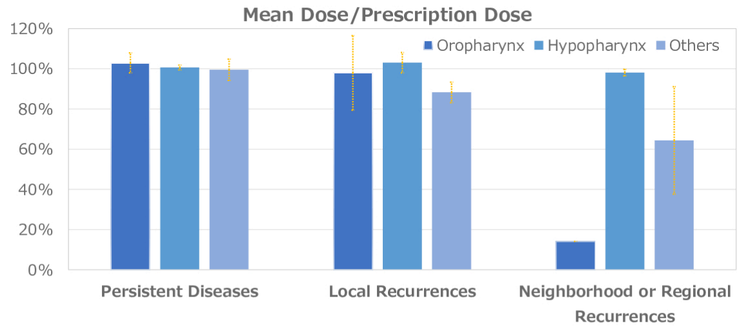


**Fig2. Ratio of mean dose/prescription dose at each site**

The mean doses were compared by site. There was little difference between the oropharynx and the hypopharynx. Details of each site were shown in Fig 3.

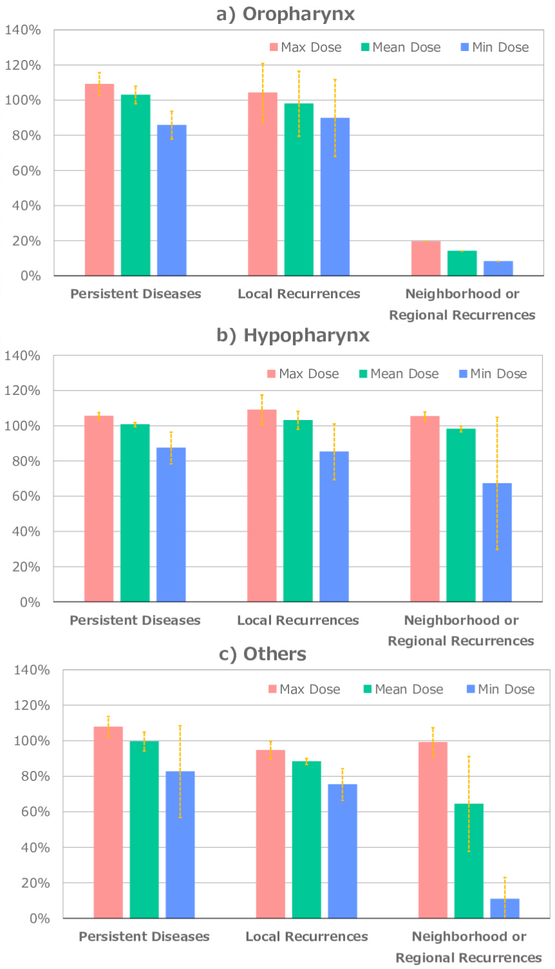


**Fig3. Ratio of max, mean or min dose/prescription dose a) Oropharynx, b) Hypopharynx, c) Others at each site**

The max and mean doses were almost the prescribed doses, but the min dose was around 80% in site of persistent diseases and local recurrences.

## Discussion

Persistent diseases are considered that the dose to the primary tumor was insufficient, so the dose may be increased when the dose to the normal tissues is within an acceptable.

Local recurrences may be associated with a recurrence of the primary lesion, which may reduce the dose to the prevention area. The prevention area is also possible that the prescription dose was not irradiated due to displacement by weight changes.

Neighborhood or regional recurrences were often found on the opposite side. Even if the lesions are biased, bilateral treatment may be needed in case by case.

## Conclusion

Regarding persistent diseases and local recurrence, the required dose was administered as planned, but the tumor was not controlled, suggesting that the prescribed dose needs to be reconsidered.
It should be more by concentrated with IMRT.

## References

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