The size dependence of ion chambers in measuring a point dose for intensity modulation radiotherapy

Doo-Hyun Lee[1], Dongho Shin[1], Se-Byeong Lee[1], Kwan Ho Cho[1], Joo-Young Kim, Jung Keun Cho[2],

Research Institute and Hospital, NationalCancerCenter,Korea[1]
Department of Radiological Science College of Alternative Medicine, Jeonju University of Korea[2]
E-mail: dhlee64@ncc.re.kr

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Purpose

To investigate the size(volume) dependence of an ion chamber in measuring the absolute point dose using various sizes of ion chambers for intensity modulation radiotherapy (IMRT) of head and neck cancers and to quantify the changes in measurements depending on the various conditions.

Materials and methods

Absolute dosimetry using 3 different sizes of ion chambers was performed for 6 patients' IMRT plans with Linac 21EX (6MV,120MLC, Varian). The volumes of 3 ion chambers were 0.015cc (Pinpoint Chamber, type 31014, PTW, Germany), 0.125cc(Micro Chamber, type 31002, PTW, Germany) and 0.6cc (Famer type Chamber, type 31002, PTW, Germany) respectively. The experiments were done in the high dose gradient region as well as the low gradient region to check the sensitive area for ion chamber size. The measurement were performed at same location in solid-water phantom and then the measured point doses were compared to the calculated data from the treatment planning system.

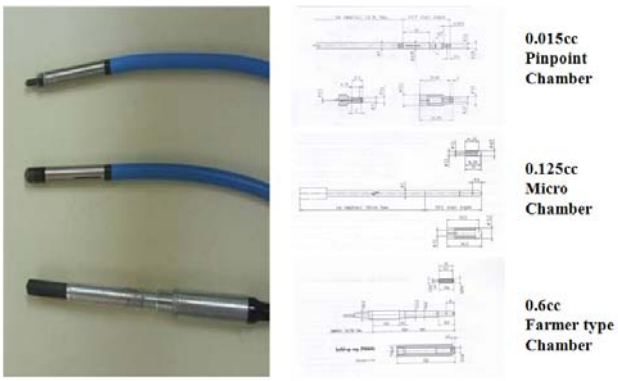

Fig 1. Information of 3 ion chambers in this study

Results

The comparison of the point doses between high and low dose gradient region suggests that the maximum difference in average doses between measured point dose and calculated dose was less then 1% in the lower dose gradient area irrespective of ion chamber size. Unlike the low gradient dose area, the maximum average dose difference was about 2~6% in the high dose gradient area but it shows no significant dependence of ion chamber size.

Conclusion

The results show that the ion chamber size dependence is critical when the point dose measurements were carried out in the high dose gradient region irrespective of ion chamber size suggesting that the lower gradient in dose, the better accordance of the measurement to the calculated value.