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Effect on Lens Radiation Exposure and Image Quality after Modification Scanning Plane in Temporal Bone CT

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Introduction

High-resolution CT is the method of choice for imaging of temporal bone. In usual protocol, axial scan of the temporal bone is conducted in a plane parallel to the orbitomeatal line. These causes direct irradiation of the lens of the eyes and increases the risk of cataract.

Objectives

We assess the radiation dose reduction to eye lenses during temporal bone CT by modification of scanning plane and determine the effect on image quality

Methodology

Radiation dose to eye lenses was assessed using head phantom and calibrated TLDs placed in the estimated positions of lenses. Three scanning protocols performed: head in neutral position and scan plane parallel to orbito-meatal line (plane 1); head in neutral position and gantry tilt parallel to orbital floor (plane 2); head in extension with scan plane parallel to orbital floor (plane 3). 40 normal temporal bones were included from 31 consecutive patients with temporal bone CT performed in our department during Jan-Aug 2013; 20 of the temporal bones using original plane parallel to orbito-meatal line (male:female=11:3,age=20-79) and another 20 using modified scanning plane parallel to orbital floor by gantry and/or head tilting (male:female=11:6,age=17-80). Contrast-to-noise ratio (CNR) of the images were measured. 19 temporal bone structures were then reviewed by two independent reviewers for image qualities, assigning a score from 1 (worse) to 4 (best). Image qualities between the two protocols were compared by Mann-Whitney U test.

Result

The estimated absorbed lens dose using plane 1- 3 were 35.63mGy, 19.20mGy and

24.43mGy respectively, giving dose reduction about 31.4%-46.1% by modified planes. The modified and original protocols result in comparable dose-length products (p=0.302). The mean CNR were 7.88 vs 8.44 (p=0.057). All except 3 assessed structures showed comparable image quality scores (p>0.05). Image qualities of cochlear nerve canal (mean scores 3.8vs4,p=0.011), round window (3.9vs4,p=0.022) and oval window (3.8vs4,p=0.026) showed significant difference between modified and original scanning planes. However, image qualities were still acceptable for diagnostic purpose with mean scores being on high side. In conclusion, modification of scanning plane of temporal bone CT results in reduced radiation dose to eye lenses without jeopardizing diagnostic image quality.