Second cancers in children treated with modern radiotherapy techniques

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Introduction

The scattered radiation from the treatment volume might be more significant for children than for adults and, as a consequence, modern radiotherapy treatment techniques such as IMRT or passive proton therapy could potentially increase the number of secondary cancers. In this report secondary cancer risk resulting from new treatment technologies were estimated for an adult prostate patient and an a child.

Material and Methods

The organ equivalent dose (OED) concept with a linear-exponential, a plateau and a linear dose-response curve was applied to dose distributions of an adult prostate patient and a child with a Rabdomyosarcoma of the prostate. Conformal radiotherapy, IMRT with 6 MV photons and proton therapy was planned. OED (cancer risk) was estimated for the whole body, the rectum and the bladder. In addition relative cumulative risk was calculated.

Results

Secondary cancer risk in the adult is not more than 15% increased when IMRT or passive proton therapy is compared to conventional treatment planning. Figure 1 shows the OED relative to conventional 3D conformal planning as a function of treatment technique for the adult (a) and for the child (b). In the child risk remains practically constant or is for proton therapy even reduced. In the child the cumulative risk relative to the adult can be as large as 10 to 15.
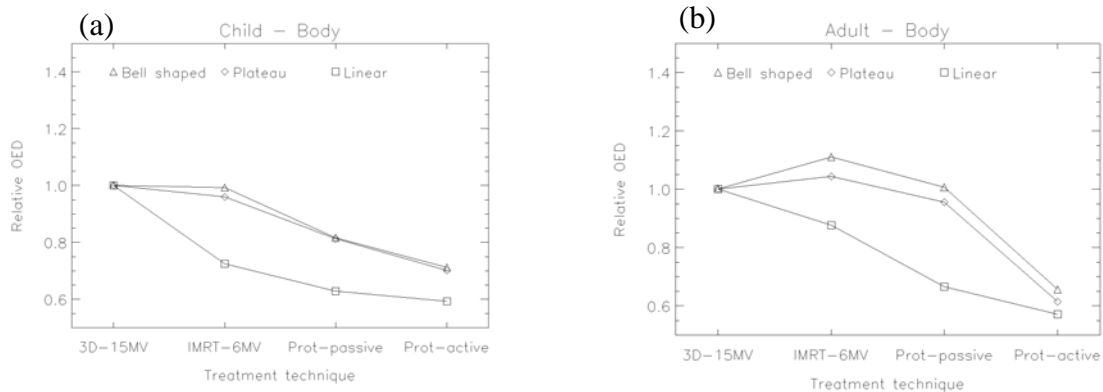

Fig. 1. Organ equivalent dose (OED) in the whole body normalized to a 3D conformal treatment with 4 fields as a function of radiotherapy treatment technique. Shown in (a) for the adult patient and in (b) for the pediatric patient. Triangles represent the results from the bell shaped model, diamonds of the plateau model and squares for the linear model.

Discussion

By a comparison between an adult patient and a child treated for a disease of the prostate it was shown that modern radiotherapy techniques such as IMRT or proton therapy (active and passive) do not increase the risk for secondary cancers.