Purpose

Following the recent Royal College of Radiologists (RCR) recommendations\[1, 2\], all prostate cancer patients at CancerPartnersUK centres are treated with inverse planned IMRT. This study compares the organ at risk (OAR) doses as well as the PTV dose distributions and irradiated volumes in IMRT and 3D conformal radiotherapy (3D CRT) treatment of prostate carcinoma.

Method

Twenty patients treated for prostate cancer to a prescribed dose of 74Gy were planned using 7-field step & shoot IMRT and 3-field 3DCRT techniques. The bladder, rectum and prostate CTV were outlined. The CTV was expanded to a PTV using a margin of 0.7cm in all directions. As per local protocol IMRT planning objectives were set to try to achieve ≥ 99% dose coverage to the PTV, 100% modal dose, an ICRU maximum (2cc) ≤ 105% and to satisfy OAR dose constraints. Figure 1 demonstrates a typical dose distribution. The dose constraints used in the treatment planning for the bladder were V50<50%, V60<25% and V74<5% whilst for the rectum the constraints were V50<60%, V60<45%, V65<30% and V70<15%. The resultant OAR doses and dose volume histograms (DVHs) were used for plan comparison. PTV coverage was evaluated in terms of the V95%, conformity index (CI) and the homogeneity index (HI).

Results

Table 1 examines the V95% dose coverage, conformity index and heterogeneity index between the two methods. The statistical significance of the differences observed has been assessed using a paired t-test. There is no significant difference between the two planning techniques in terms of V95% coverage and dose heterogeneity, but the IMRT technique demonstrates significantly improved Conformity. The values obtained have been compared to similar studies\[3, 4\], with good agreement found in all cases.

Conclusions & further work

For all patients the IMRT plan improved bladder and rectum sparing and PTV dose conformity whilst maintaining PTV dose coverage and homogeneity. Continued follow-up of these patients will provide organ toxicity and long-term survival data. As all patients in this planning study were treated using inverse planned IMRT, it is fair to assume the improvements observed in the treatment plans should lead to better treatment outcomes, particularly as all treatments were delivered with 3D IGRT and daily online correction.

The improvements achieved in the planned dose distributions also suggest the potential for dose escalation when using inverse planned IMRT for future patients.