

Role of CT-MRI co-registration in tumor delineation for preoperative radiotherapy of rectal cancer.

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PURPOSE

Intensification of preoperative radio-chemotherapy in locally advanced rectal cancer (LARC) is gaining progressive interest with a view to increasing response rates and to developing new organ preservation approaches. Dose escalation programs are providing promising results but they require optimization of boost volume definition. T2 weighted (T2w) magnetic resonance (MRI) imaging is the gold standard for rectal cancer staging and the diffusion-weighted sequence (DWI) allows for the best definition of the tumor. We compared the rectal gross tumor volume (GTV) delineated on computed-tomography (CT), T2w MRI and DWI MRI images to evaluate inter- and intra-observer agreement.

METHODS

LARC patients (pts) underwent CT without contrast medium for radiotherapy treatment planning and subsequently T2w and DWI (b = 1500 s / mmq) MRI axial sequences. CT and MRI were acquired in the prone position and pts had the same bladder preparation for both procedures. Rigid CT-MRI co-registration of image series was obtained. Four independent observers (ob) with different skill levels and experience delineated the GTV on CT, T2w and DWI MRI images. Conformity index (CI) was calculated between each ob-pair per patient per technique and between each technique-pair per patient per ob. Reliability between techniques and between ob was assessed using the intraclass correlation coefficient (ICC). Comparisons within and between groups were analyzed by mixed repeated-measures ANOVA, with Geisser-Greenhouse adjustments for non-sphericity with Bonferroni's post hoc correction.

RESULTS

Twenty consecutive pts were included. CT, T2w MRI and DWI MRI mean GTV in cm3 were 43.01, 34.98 and 36.10 respectively for ob one; 42.88, 34.39 and 41.89 for ob two; 47.20, 36.39 and 36.70 for ob three; 40.41, 33.67 and 34.15 for ob four. ICC among ob for CT, T2W MRI and DWI MRI volumes were 0.76, 0.81 and 0.94 respectively and this reliability were confirmed by the comparison between ob-pairs. Volumes are significantly related to imaging technique (p=0.0003) with CT volumes larger than T2w and DWI and they do not depend on the observer. Median CIs among all ob are 0.45, 0.54 and 0.74 for CT, T2w and DWI, respectively. The average of the median values for pairs of ob are 0.62, 0.53 and 0.73 respectively for the three modalities. There is a statistically significant difference between the CIs (p=0.007) and also the relationship between CIs and the modalities tends to significance (p=0.062). Mean difference of urinary bladder volume between CT and MRI was 25 cm3 but this did not affect CIs.

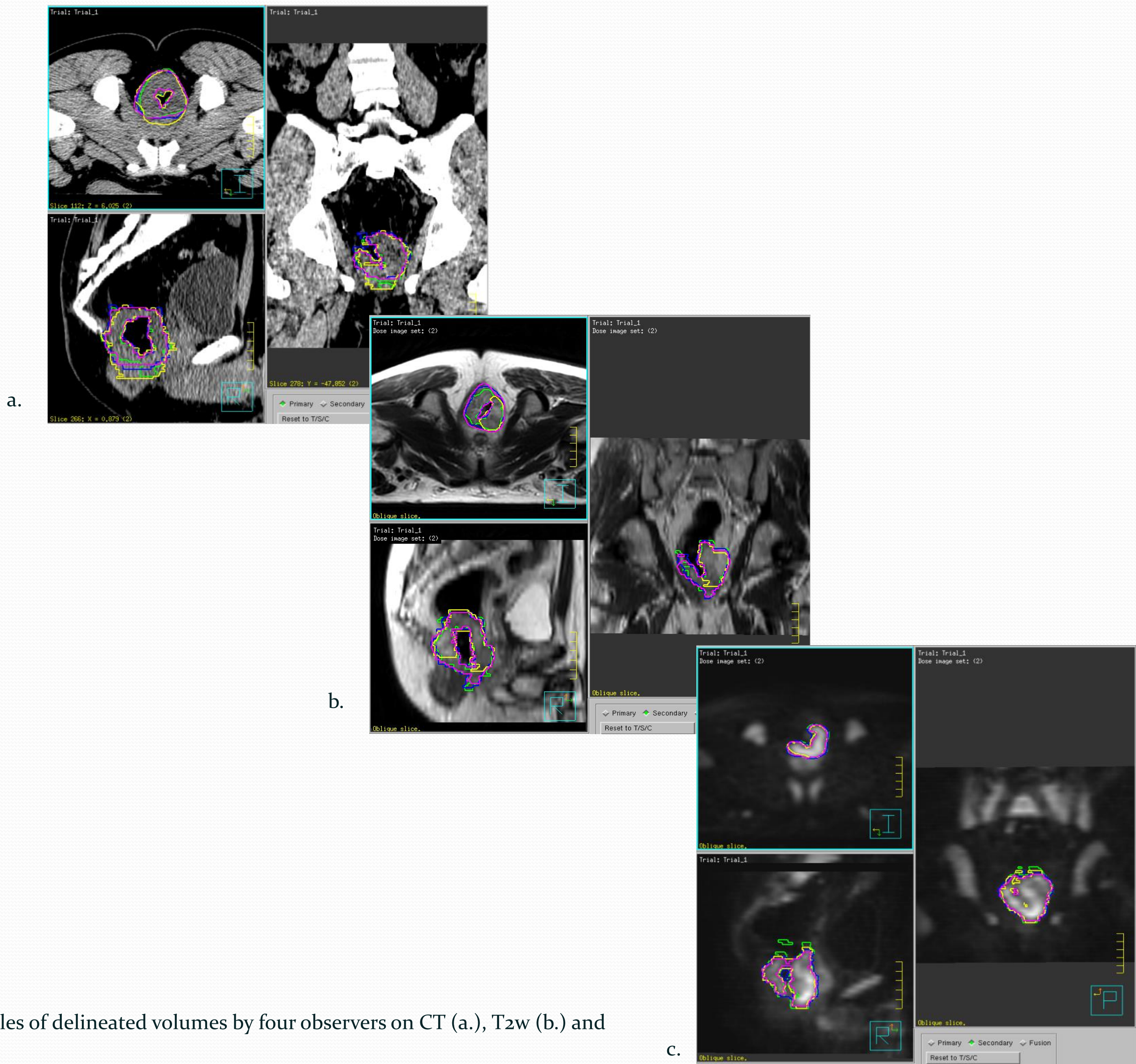


Fig. Examples of delineated volumes by four observers on CT (a.), T2w (b.) and DWI (c.).

CONCLUSION

MRI, mostly DWI series, showed high agreement among different ob and therefore it could be useful for the definition of GTV in LARC. Studies with a larger number of pts are needed to confirm whether such agreement is significant. The best imaging technique for the definition of the true tumor volume is still to be determined.

References
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