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Metastatic lesion contouring on brain MRI with the help of AI

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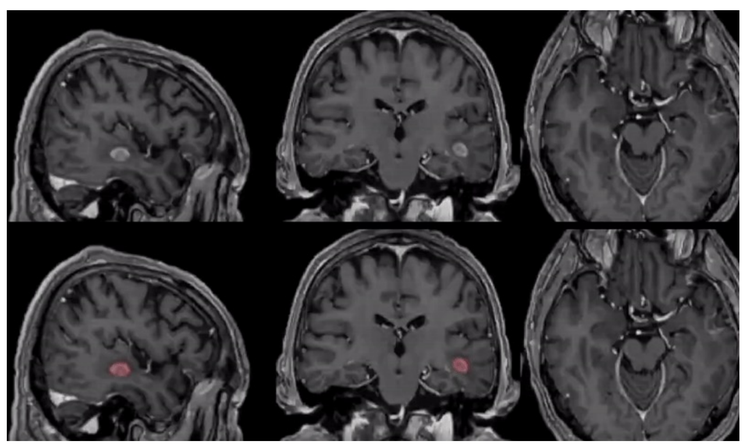
Purpose

In the last more then ten years we performed more than 1000 cranial stereotactic radiosurgical treatments with several indications on a Novalis TX linear accelerator. With the close follow up of the brain metastatic patients, which is done in every three month for each patient, we collected a significantly large MRI data. Our aim was to create a tool which is able to outline any metastatic lesion on a T1 contrast enhanced brain MRI, and later on we can provide automatic conturing aid to radiosurgical planning.

Materials and Methods

We collected previously, manually contoured contrast enahnced T1 MR images of brain matestatic cases from our Brainlab Iplannet database. Part of the data were implemented into nnU-Net, which is a deep learning-based segmentation method that automatically configures itself, including preprocessing, network architecture, training and post-processing for any new task. Our results were evaluated by the Dice's coefficient, which represents the percentage of the overlaping fields of manually and automatically contured lesions, the range is 0.0000 to 1.0000, inclusive.



Results

72 cases were collected from our Brainlab Iplannet contouring database whose data were suitable technically. Each subjects had 1 to 4 metastatic lesions, which was previously contoured manually for radiosurgical treatment on contrast enhanced T1 MR images. 75% of the data were implemented to nnU-NET for learning purposes. 25% of the images were used to evaluate the precision of the automated contouring tool. The final Dice's coefficient was 0,812. In 5 cases the lesion were not detected, these were 3-4mm in size, in 2 cases the tool found additional manually non-contoured extracranial lesion. The corrected Dice's coefficient without these 7 cases was 0.89.

Conclusion

Our results shows that predefined lesions can be contoured automatically with good results, especially if we take into account that interobserver Dice's coefficient is 0.91, according to the literature. With the use of deep learning-based segmentation method it is possible to develop a tool which is able to contour target volumes for stereotactic treatment of brain metastatic patients. Using additional MRI sequences, such as postcontrast FLAIR the results can be improved. On our series we can presuppose that in the future the identification of these lesion also can be done automatically.