Can peritumoral radiomics increase the efficiency of the prediction for meningioma's brain invasion on MRI?

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Background

- Brain invasion serves as an independent diagnostic criterion for the diagnosis of WHO grade 2 meningiomas.
- This study aimed to evaluate the efficacy of radiomics models based on features extracted from different regions for predicting brain invasion in meningiomas.

Conclusions

Our study indicated that radiomic signatures of the BTOI region demonstrated the most robust performance in predicting meningioma brain invasion. These findings have the potential to assist in preoperatively predicting meningioma brain invasion and aid in surgical decision-making.

Methods

- This retrospective study included 729 consecutive patients with pathologically confirmed meningiomas between 2013 and 2022. Nine radiomics models were constructed by using radiomics features extracted from nine different regions of interest (ROIs): brain-to-tumor interface (BTI) 3-5mm regions, brain-to-tumor inner interface (BTII) region 3-5mm regions, and brain-to-tumor outer interface (BTOI) 3-5mm regions.
- The features were extracted from T1W, T2-FLAIR, and CE-T1W images . We employed Logistic Regression (LR) as the classifier.
- Receiver operating characteristic (ROC) analysis was used to evaluate model performance.
- The decision curve analysis (DCA) and integrated discrimination improvement (IDI) index were used to compare the benefits of different models.

Results

- The BTOI radiomics models exhibited superior predictive ability for meningioma brain invasion compared to the models derived from the BTII and BTI region both in 3-5mm region.
- Specifically, the AUC values for the BTOI 3-5mm model were 0.845, 0.845, and 0.905 in the test cohort, respectively.
- Furthermore, The DCA curves showed that the BTOI models had the best net return.
- IDI showed that compared with BTII and BTI models, the BTOI models had a significant improvement in predicting the brain invasion of meningiomas ($p < 0.05$).

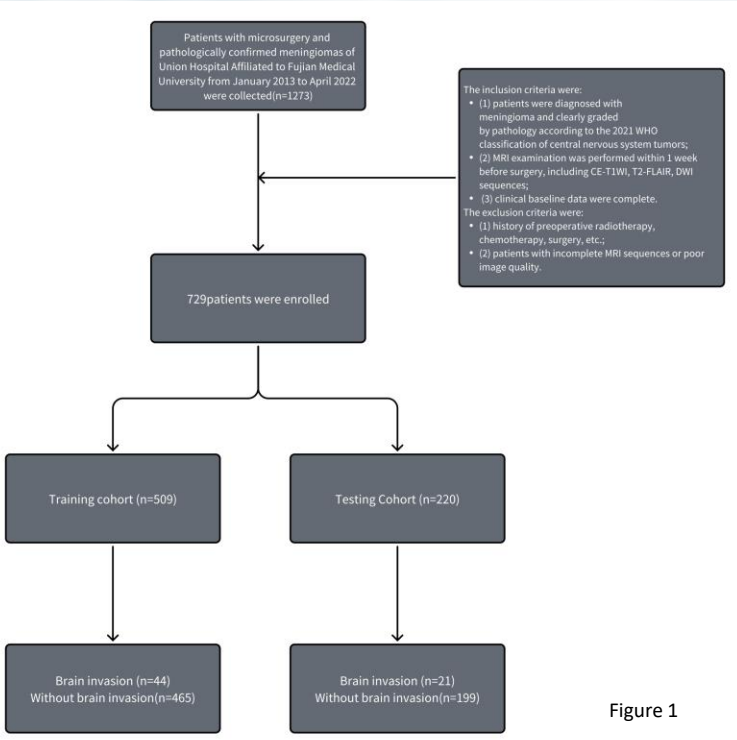


Figure 1

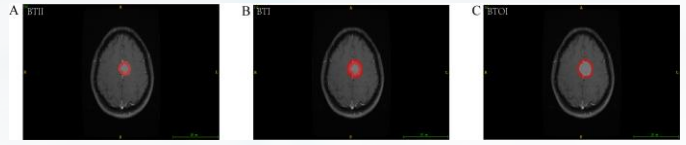


Figure 2

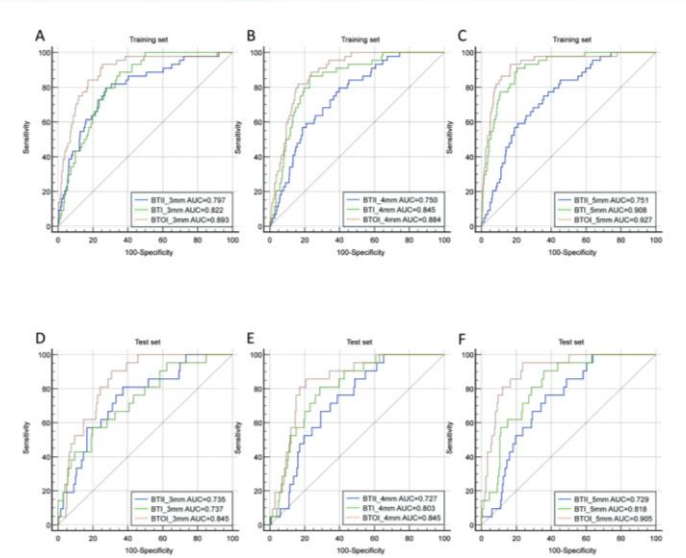


Figure 3

Figure 1 Inclusion and exclusion criteria.
Figure 2 The corresponding ROIs of each region. Figure A, Schematic Diagram of the Region of Interest of BTII. Figure B, Schematic Diagram of the Region of Interest of BTI. Figure C, Schematic Diagram of the Region of Interest of BTOI.
Figure 3 Comparison of the receiver operating characteristic (ROC) curves of different models. A-C. the performance of each model on the training set. D-F. the performance of each model on the test set.