"Brain surface motion imaging" to detect adhesion between meningioma and brain.

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Purpose: The purpose of this study is to evaluate the feasibility of the imaging method we developed to observe pulsatile motion of brain surface ("brain surface motion imaging") for providing pre-surgical information about adhesion between meningioma and brain surface. "Brain surface motion imaging" is a method in which subtractions of images in systolic and diastolic phases of CSF/brain pulsatile motion are made.

Materials and Methods: Subject of the current study was 12 cases (34 y.o. to 75 y.o, 11 female and one male) with surgically resected meningioma, in which "brain surface motion imaging" was obtained presurgically.

We hypothesized that location with adhesion has no discrepancy in pulsatile motion between tumor and brain. In order to obtain information of discrepancy in pulsatile motion, we made subtraction between systolic and diastolic phases of heavily T2 weighted image using pulse gated 3D fast spin echo sequence. Imaging consisted of a pulse-gated cine phase contrast pre-scan and two sets of pulse-gated 3D fast spin echo scan by *syngo SPACE* technique (Siemens AG, Erlangen, Germany). Images of systolic phase and diastolic phase were obtained, and subtraction was made with offset of 100 signal unit. Thus, white areas on the subtracted image mean the region in which brain is replaced by CSF with pulsatile movement, and black areas are the reverse. We analyzed the presence of high and/or low signal band like texture surrounding meningioma (Figure, b) which we hypothesized as an indicator of "no adhesion", and judged degree of adhesion as "total", "partial" and "no". We studied surgical record and obtained the degree and location of adhesion. For the cases with "partial" adhesion, agreements in location of adhesion were also evaluated.

Results: On presurgical "brain surface motion imaging", 6 cases were judged as total adhesion, 4 cases were judged as partial adhesion, and 2 cases ware judged as no adhesion. These presurgical predictions about adhesion and surgical finding agreed in 10 cases (83%). Location of the adhesion agreed in all three cases with partial adhesion. Disagreements were seen in 2 cases, and both of them were judged as total adhesion on "brain surface motion image", while, no adhesion was found at the surgery.

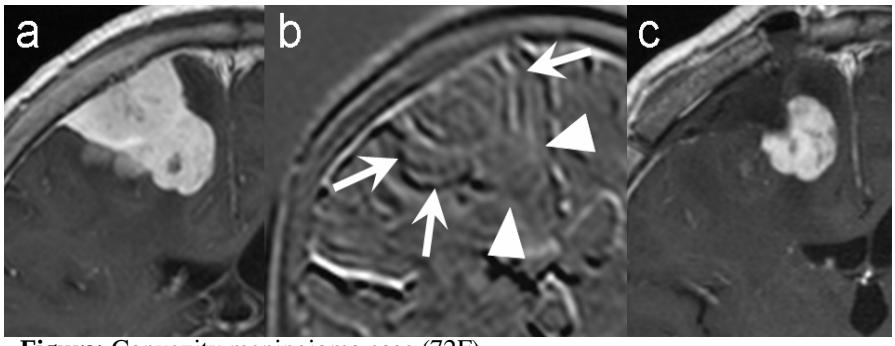

Figure: Convexity meningioma case (72F)
a: Coronal contrast enhanced MRI; Irregular shaped convexity meningioma.
b: "Brain surface motion image" shows band like texture on the interface of cranial portion of tumor and brain (arrow) which indicate that there is discrepancy in pulsatile motion at the interface, and there will be no adhesion. On the other hand, band like texture cannot be seen at the caudal portion of tumor (arrowheads) indicating that there will be adhesion. We judged this case as "partial adhesion", and the site of adhesion will be caudal portion of the tumor.
c: Post surgical contrast enhanced MRI; On the surgery, the neurosurgeon found adhesion at the caudal portion of the tumor, which agreed with the prediction by "brain surface motion image" above. Caudal portion of the tumor was not removed at the surgery because of adhesion.

Conclusion: Adhesion between brain and extraaxial tumor such as meningioma is one of major cause for difficulty in surgical resection. Pre-surgical prediction of adhesion between brain and meningioma will bring great advantage for surgical planning. In the current study, prediction for brain/meningioma adhesion by "brain surface motion imaging" agreed with surgical findings in 83% of the cases. This imaging method seems to be feasible as providing presurgical information about brain/meningioma adhesion.