

Detection of Pulsation in Unruptured Cerebral Aneurysms by ECG-Gated 3D-CT Angiography (4D-CTA) with 320-Row Area Detector CT (ADCT) and Follow-Up Evaluation Results: Assessment Based on Heart Rate at the Time of Scanning





Many epidemiological studies on unruptured cerebral aneurysms (UnRCA) have reported that the larger the aneurysm, the higher the risk of rupture. However, many ruptured cerebral aneurysms (RCA) are not large. ECG-gated 3D-CT angiography (4D-CTA with 320-row ADCT) was used to detect pulsation in UnRCA. The differences in the clinical course of patients in whom pulsation was or was not detected were then evaluated.

Methods

42 patients with 62 aneurysms who underwent follow-up 3D-CTA more than 4 months (120 days) later were randomly selected as the subjects of this study. ECG-gated reconstruction was performed and a single cardiac cycle was divided into 20 phases to detect aneurysmal pulsation. Patients with a heart rate higher than 80 bpm at the time of scanning were excluded, so analysis was performed for 37 patients with 56 aneurysms.

ECG-gated 3D-CTA, Helical CT or ADCT

Helical CT scan is necessary to stitch together the datasets acquired for the same phase of the ECG in different temporal phases in order to generate a single volume dataset. In ADCT, examination can be completed by performing conventional (nonhelical) scanning

during a single cardiac cycle. As a result, the volume data is generated in the same temporal phase and the same cardiac phase.

Results The average size of the aneurysms was 5.19 \pm 3.51 mm (mean± SD, range: 1.2 to 14.3 mm), with 3 large aneurysms measuring more than 10 mm. The mean follow-up period was 498.5 days (range: 137 to 1235 days). Pulsation was detected in 20 of the 56 UnRCA. Of the 20 aneurysms in which pulsation was detected, 6 showed a change in shape at the time of follow-up 3D-CTA. Of the 36 aneurysms in which pulsation was not detected, 2 showed a change in shape at follow-up. There was no significant difference in the follow-up interval between aneurysms in which pulsation was or was not detected. Therefore, a change in shape was observed in a significantly higher percentage of the aneurysms in which pulsation was detected (p=0.039). In addition, the aneurysms in which pulsation was detected showed a higher odds ratio of 7.286.

Representative clinical case

Figure 1 shows a right middle cerebral artery aneurysm (arrow).

Figure 2 shows the 20 frames of a 4D-CTA image obtained by dividing a single cardiac cycle into 20 phases. Details of the cerebral aneurysm site are shown. In the 15% to 45% frames, an elevation (pulsation) is observed in a part of the bleb of the aneurysm (arrow). The movie shows the pulsation of the aneurysmal bleb.

Figure 3 shows the follow up 3D-CTA images that the bleb of the aneurysm had expanded (arrow).



3D-CTA of Rt. middle cerebarl artery aneurysm

Figure 2



4D-CTA of cerebral aneurysm

Conclusions

4D-CTA with 320-row ADCT was performed in patients with UnRCA to detect aneurysmal pulsation. UnRCA in which pulsation was detected were more likely to show a change in shape at follow-up. The results of this study suggest that 4D-CTA may be useful for identifying UnRCA with a higher risk of rupture.



Follow up 3D-CTA of middle cerebral artery aneurysm

