Diagnostic Value of Multiple CT Scans in Acute ICH

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Introduction

Following intracerebral hemorrhage (ICH), hematoma expansion leads to worse outcomes. Currently no guidelines exist specifying the quantity and timing of imaging to determine hematoma stabilization in the 24 hours following admission. We investigated the extent to which a third CT scan in this time window is necessary for detecting hematoma-volume fluctuations.

Methods

All patients presenting to the Columbia Neuro-ICU between 02/2009 and 03/2012 were selected. Fifty-two patients received three scans in the first 24 hours after the start of symptoms. Two patients were excluded due to missing scans. Hematoma volume was assessed by two blinded-reviewers using MIPAV software. Inter-observer error was assessed to predict approximate typical expected measurement error, which was defined as the threshold for minimal meaningful expansion. The volume of expansion between first and second CT scans was compared to the volume expansion between second a third CT scans. The calculated expansion was then compared to expected error to determine the probability of meaningful expansion. Patients with meaningful "early" expansion (between scan one and two) were compared to those without meanigful early expansion to assess if either predicted "late" expansion (between scan two and three).

Results

The mean Error was 4.33 cm3. For eight patients (16%), volume expansion between first and second scans was greater than the expected error. A significantly higher proportion of these patients had hematoma volume growth beyond the expected error between scans 2 and 3 than those with expansion from first to second scan less than the mean error (3/8=37.5% vs. 2/42=4.8%, p=0.024). A majority (40/50=80%) had no change beyond the expected error. Logistic regression analysis was used to assess for statistical differences.

Conclusions

Our results suggest that the majority of changes in hematoma volume are within the expected measurement error; furthermore, patients with a meaningful expansion on the second scan have a significantly higher chance of showing a meaningful expansion on the third. Further studies are needed to determine whether a third CT scan is of marginal benefit to patients without meaningful expansion on the second scan, and if patients with confirmed expansion of the second scan benefit from the additional data regarding expansion in the third.

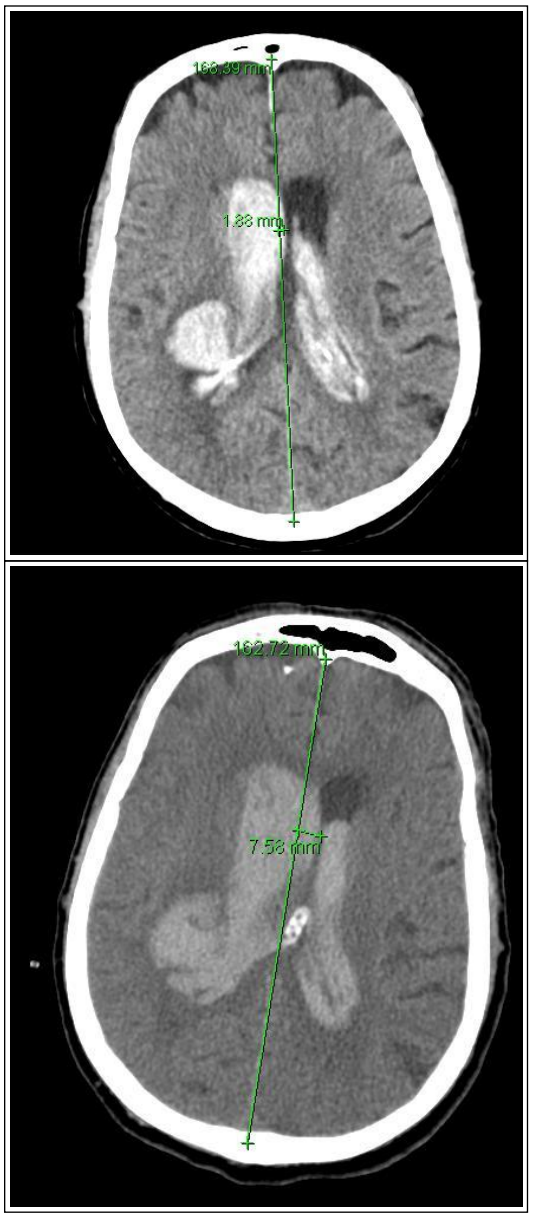

Figure 1: CT Scans at presentation, two hours, and five hours after presentation of a right thalamic intracerebral hemorrhage. The scans demonstrate sequential midline shift and progression of the hemorrhage into the ventricular system and adjacent tissues.

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