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Artificial stroke clots: How good is the applicability to the real world?

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PURPOSE

Especially since the establishment of mechanical thrombectomy as part of the standard stroke therapy, artificial thrombi have become important in the training of interventionalists as well as for the development and testing of devices. So far, these in vitro clots lack direct comparisons with ex vivo thrombi. We therefore compared the histological appearance of dynamically produced clots with that of stroke thrombi acquired during mechanical recanalization.

METHODS

Thrombi of 145 consecutive stroke patients with large-vessel occlusions were histologically compared with 10 artificial clots, dynamically created from human blood and pig's blood using a Chandler loop system. Quantified FP/RBC ratios (fibrin/platelets divided by red blood cell fraction) and WBC (white blood cell) fractions were identified and compared between artificial (human and pig) and ex vivo thrombi obtained from patients with various stroke etiologies.

RESULTS

There were no significant differences in the analysis of FP/RBC ratios between artificial thrombi and ex vivo thrombi (p=0.42) or in the more precise analyses considering etiological subgroups. Distinct differences were observed for the WBC fraction, with lower values in artificial thrombi (median 1.34%) than ex vivo thrombi (median 5%) (p<0.001).

DISCUSSION

The main clot components, FP and RBC, are presumably the most influential factors for clot stability and mechanical resistance. Similarities between artificially generated and ex vivo stroke clots (and when considering different stroke subgroups) support the utility of these artificial thrombi in the pre-evaluation of thrombus extraction devices and as appropriate training material.

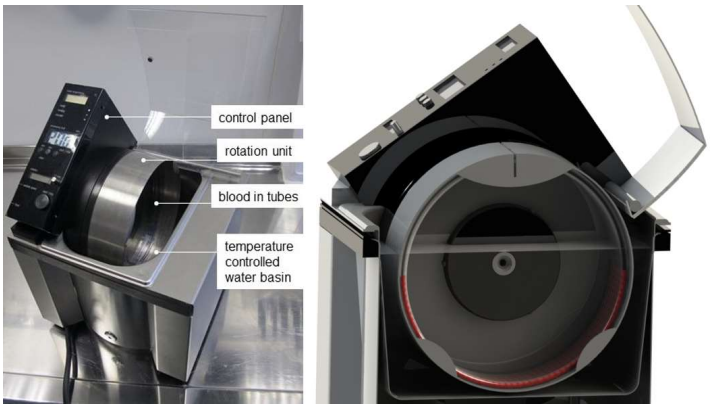

Figure 1: Chandler Loop System ® (left) and side view of the rotating loop (right)

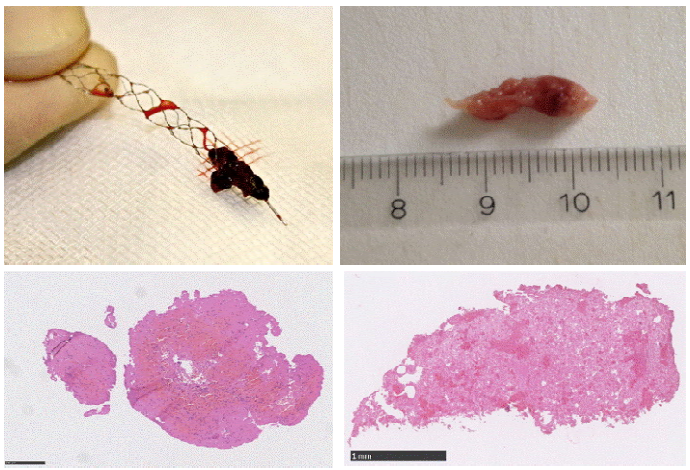

Figure 2: Macroscopic (top row) and histological (bottom row) pictures of an ex vivo thrombus (on the left) and an artificial thrombus (on the right)

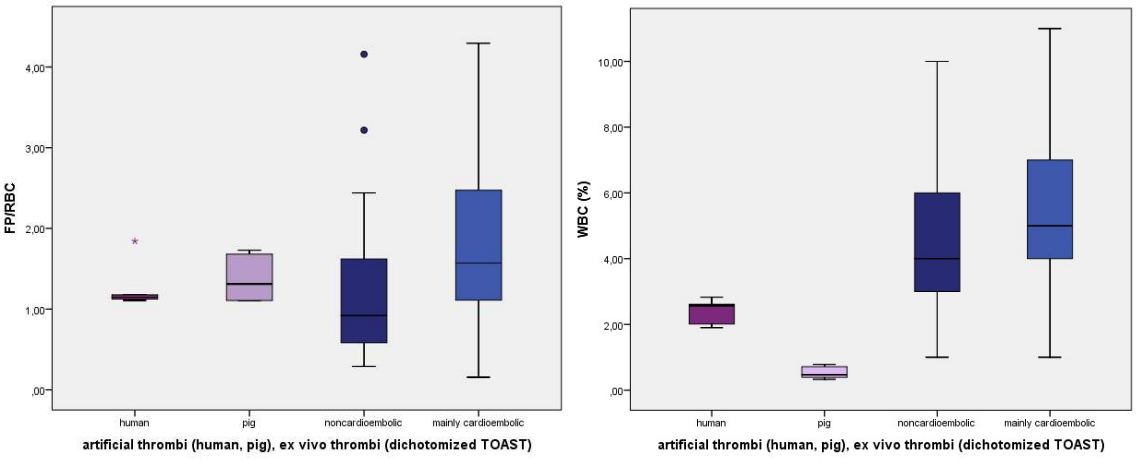

Figure 4: Boxplots of FP/RBC ratio (on the left) and of relative fractions of WBC (%) (on the right) for artificial thrombi (human, pig) and ex vivo thrombi (dichotomized TOAST: noncardioembolic vs. cardioembolic and cryptogenic)

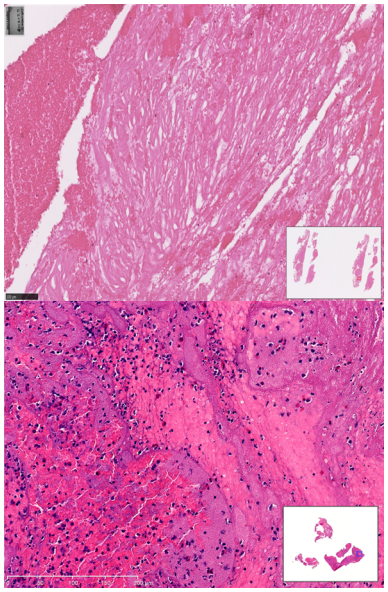

Figure 3: Enlarged histological sections of an artificial (top) and ex vivo thrombus (bottom)