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The study of hemodynamic and morphological characteristics of abdominal aortic remodeling after TEVAR in complex DeBakey type 3 aortic dissection

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Objective: To investigate the hemodynamic and morphological characteristics of abdominal aortic remodeling after Thoracic Endovascular Aortic Repair (TEVAR) in complex DeBakey type 3 Aortic Dissection (AD), using Contrast Enhanced Ultrasound (CEUS)/color doppler ultrasound in combination with CT Angiography (CTA).

Methods: CEUS/color doppler ultrasound was performed on 28 patients with DeBakey type 3 AD after TEVAR. Eight cases were type 3a (simple, confined to the descending thoracic aorta) and 20 cases type were 3b (complex, extended into the abdominal aorta). CTA of aorta was performed on all patients as well. Hemodynamic and morphological changes of the abdominal aorta were observed by CEUS/color doppler ultrasound at 3 different level: Upper border of the celiac artery truck, inferior border of the renal artery and 1 cm above the common iliac artery bifurcation. These characteristics were observed pre-TEVAR, 1 day post-TEVAR and 1 month post-TEVAR.

Results: (1) CEUS/color doppler ultrasound detected the hemodynamic aortic remodeling process. The true lumen showed high-resistance spectrum with high peak velocity, while the false lumen showed an irregular spectrum with low peak velocity. (2) The maximal blood flow velocity increased in the true lumen and decreased in the false lumen ($p < 0.05$). The blood flow pattern changed after TEVAR covered the proximal tears and showed the remote tears from the exit into the entrance. The shear stress at the rupture site decreased gradually and the pulsatory intimal movement was still observed. (3) Morphologically, no new tears of the abdominal aorta were noted in type 3a AD cases. Gradual thrombosis formation was noted in the false lumen of all type 3b AD cases at 1 month. (4) True and false lumen diameter measurements were similar whether using CEUS/color doppler ultrasound or CTA ($p > 0.05$). However, CEUS/color doppler ultrasound was less sensitive than CTA at detecting the number of tears ($p < 0.05$).

Conclusions: CEUS/color doppler ultrasound can play a complementary role in identifying the hemodynamic and morphological characteristics of abdominal aortic remodeling in complex DeBakey type 3 AD post-TEVAR. CEUS/color doppler ultrasound is easy to use, radiation free, and can overcome shortages of using only CTA in hemodynamic and morphology assessment. It is worth promoting for long-term patient follow-up.

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