High pulse wave velocity is associated with poor shrinkage of abdominal aortic aneurysm in endovascular aneurysm repair patients

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Background: Endovascular aneurysm repair (EVAR) has widely spread for treatment of abdominal aortic aneurysm (AAA). However, the effects of EVAR on vascular function remain to be clarified. According to several reports, changes in aortic stiffness after EVAR reflect badly on future cardiovascular events. Recently, brachial-ankle pulse wave velocity (baPWV) is accepted as the most simple and reproducible method to determine the aortic stiffness.

Purpose: We aimed to evaluate the change of baPWV following EVAR and investigate the relationship between the aortic stiffness and the long-term outcomes following EVAR.

Methods: We enrolled 172 patients who underwent primary EVAR between January 2009 and December 2017 in our University hospital. Patients with saccular aneurysm, iliac aneurysm and pseudo aneurysm were excluded from the analysis. PWV data were collected before and 1 week after EVAR. PWV was measured as the mean baPWV values of both lower limbs. The long-term outcomes were evaluated with the cardiovascular event and AAA changing rate (mm/year) which was calculated by computed tomographic scanning at the preoperative and latest imaging studies. The cardiovascular event was defined as the expansion of thoracic or abdominal aortic aneurysm (> 10 mm or > 5 mm/year), central nervous system disorder, acute heart failure, new arrhythmia, peripheral arterial disease. Receiver operating characteristic (ROC) curve analysis was used to evaluate the cut off values of preoperative baPWV (pre-PWV) and postoperative baPWV (post-PWV) for the risk factor of cardiovascular event.

Results: The mean age was 76.6 ± 7.5 years and 149 patients (86.7 %) were male. The mean follow-up period was 41.6 ± 27.0 months. The mean AAA changing rate was -1.84 ± 4.72 mm/year. Post-PWV was significantly increased compared to pre-PWV (pre-PWV v.s. post-PWV; 1885 ± 382 cm/s v.s. 2060 ± 528 cm/s, p < 0.0001). The optimal cut-off values of the pre and post PWV for predicting cardiovascular events were 1900 cm/s and 2100 cm/s, respectively. The Kaplan-Meier curves indicate that 5 year-cardiovascular event free rates were 45.9% in the patients with pre PWV = 1900 cm/s and 73.2 % in the patients with pre PWV < 1900 cm/s (p=0.0185). Similarly, 5 year-cardiovascular event free rates were 46.6% in the patients with post-PWV = 2100cm/s and 73.4 % in the patients with post PWV < 2100 cm/s (p=0.0162).

Furthermore, the linear regression analysis indicated that post-PWV values correlated positively with the AAA changing rate (r=0.1811, p=0.0195) while pre-PWV was not associated with AAA changing rate (r=0.1211, p=0.1201).

Conclusions: Our results show that EVAR increase aortic stiffness in the acute phases and high post-baPWV is associated with poor shrinkage of abdominal aortic aneurysm in EVAR patients. This is the first study to demonstrate the association between high PWV and poor long-term outcome in endovascular aneurysm repair patients.