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NON-INVASIVE SERIAL MONITORING OF ATHEROSCLEROTIC PLAQUE PROGRESSION AND THROMBOSIS WITH PET-CT IN A RABBIT MODEL

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Objectives to investigate the characteristics of atherosclerotic plaque progression at different stages with PET-CT imaging as well as the feasibility and accuracy of detecting vulnerable plague using this fused imaging techniques.

Methods Eighteen male New Zealand White rabbits were divided into two groups as follows: atherosclerosis group (n=9, group A), statins group (n=9, group B). Two groups were fed with high cholesterol diet for 2 weeks and balloon injury of abdominal aorta was performed. After that, group A were fed with interrupting high-cholesterol diet for 16 weeks, group B were given high- cholesterol diet for 6 weeks and atorvastatin with normal diet for 10 weeks. By week 18, the rabbits underwent 2 pharmacological triggerings to induce thrombosis within 24 h. During the whole experiment, a total of 4 PET/CT scans were performed on rabbits. The mean standardised uptaking values (SUVmean) and maximal standardised uptaking values (SUVmax) were measured over the aorta. The rabbits were then euthanised after the last scan; PET-CT data of arterial segments and pathological information of arteries were measured.

Results The result of different stages of atherosclerosis showed that the average SUVmean and SUVmax for baseline scan was 0.607±0.149 & 0.823±0.239; 0.876±0.285 & 0.950±0.335; 0.927 ±0.234 & 0.999±0.289; 1.287±0.537 & 1.429±0.618. The difference was statistically significant (p=0.000). The result of before triggering for thrombosis scan show the mean SUVmean and SUVmax of group A was 0.873±0.240 & 0.953±0.288; group B, 0.806±0.235 & 0.902±0.276. The difference was statistically significant (p=0.006 & 0.003). The result of before triggering for thrombosis scan show the mean SUVmean and SUVmax of group B with thrombosis was 0.906±0.201 & 1.010±0.216; group B without thrombosis was 0.745±0.234 & 0.837±0.288. The difference was statistically significant (p=0.000). The artery segments with thrombosis and without thrombosis in group A: SUVmean (1.105±0.177 vs 0.762±0.109, p=0.000), SUVmax (1.236±0.280 vs 0.798±0.118, p=0.000), cap core ratio (0.147±0.092 vs 0.304 ±0.113, p=0.000), the number of macrophage (58.09±16.55 vs 47.30±16.17, p=0.023), all have statistically significant differences. The number of smooth muscle cell (45.14±17.11 vs 50.07±19.25, p=0.344) was not statistically significant. The number of macrophage was positive correlated significantly with SUVmean (r=0.413, p=0.002); the number of macrophage was positive correlated significantly with SUVmax (r=0.386, p=0.005); it has negative correlation between cap core ratio and SUVmean (r=−0.531, p=0.000), cap core ratio and SUVmax (r=−0.552, p=0.000); The number of smooth muscle cell was not related to SUVmean (r= −0.065, p=0.645), the number of smooth muscle cell was not related to SUVmax (r=−0.039, p=0.784).

Conclusions ^{18}F-FDP PET-CT fused imaging technology can achieve the combination of anatomy and function. It can comprehensively reflect the features of vulnerable plaque at different stages of progression from minute lesion to plaque rupture.