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Calcification of branches is superior to abdominal aortic calcification in predicting mortality of hemodialysis patients

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Objectives : Vascular calcification (VC) has a high incidence and has been reported to predict the mortality of MHD patients. Inspired by an extreme example of VC in dialysis patients, calciphylaxis (which involves extensive calcification of small- and medium- arteries with poor prognosis), we hypothesized that calcification of branches was a better predictor of mortality than abdominal aortic calcification (AAC).
Methods : A cohort study was established including 237 HD patients. The calcification volume of abdominal aorta and its branches in CT were quantitatively evaluated through software 3DSlicer4.11. Patients were followed-up until all-cause death, and were randomly divided into training set and validation set in a ratio of 7:3. Cox proportional hazards regression was performed to construct the nomogram model. ROC, calibration curve, and decision curve analysis were used to evaluate the comprehensive model.
Results : The prevalence of total VC is 95.36%. Among the abdominal arteries, AAC is the most prevalent (88.61%), followed by internal iliac artery calcification (85.65%). The 1-year, 3-year, and 5-year cumulative mortality rate was 28.69%, 49.99%, and 64.57%, respectively. Internal iliac artery calcification was screened out as the most representative predictor for all-cause death among the calcification of arterial calcification by lasso regression. Internal iliac artery calcification ($P<0.001$) and serum albumin level ($P<0.001$) were independently associated with mortality in MHD patients. The nomogram model constructed with age, comorbid cardiovascular disease, serum albumin level, and internal iliac artery calcification is shown in Figure 1. The model was well discriminative, calibrated, and clinically applicable for predicting 3-year survival in both the training dataset and validation dataset (Figure 2).
Conclusions : Calcification of abdominal aortic branches, especially internal iliac artery, is a better predictor for mortality of MHD patients than abdominal aortic calcification. Our concern with calcification of large arteries in MHD patients needs to be shifted to smaller branch arteries.

Figure 1.jpg

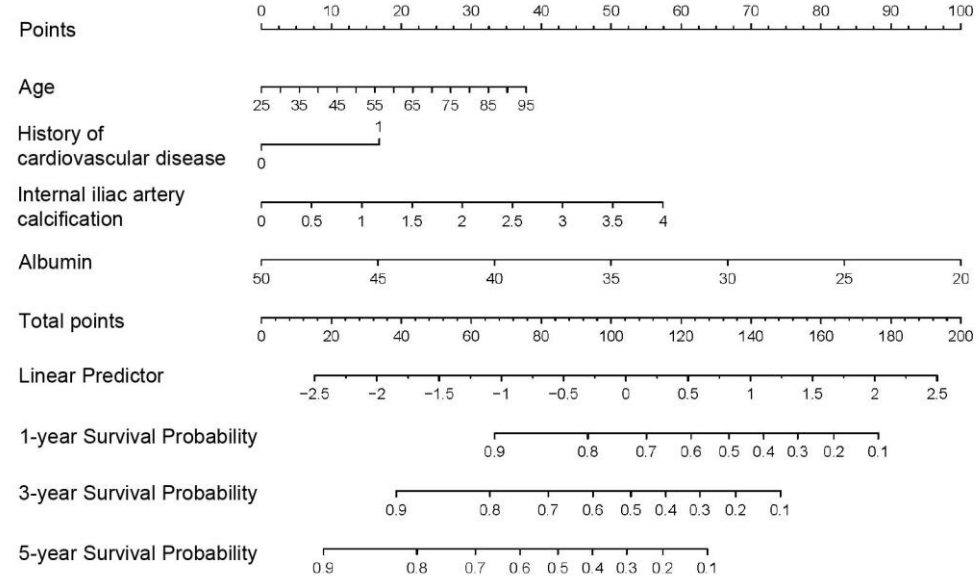
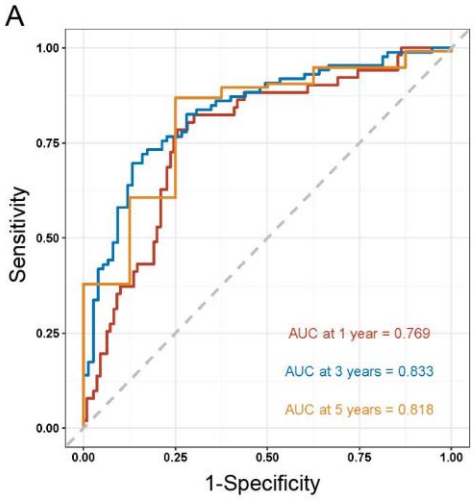
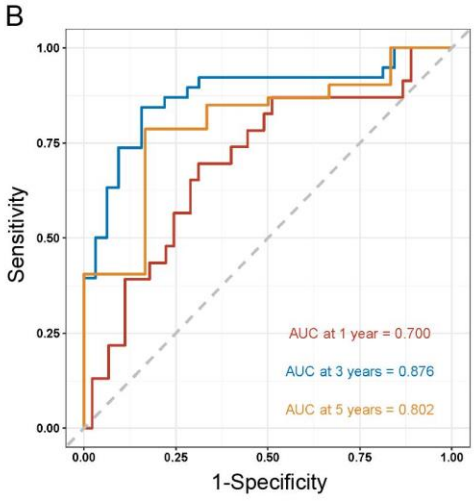
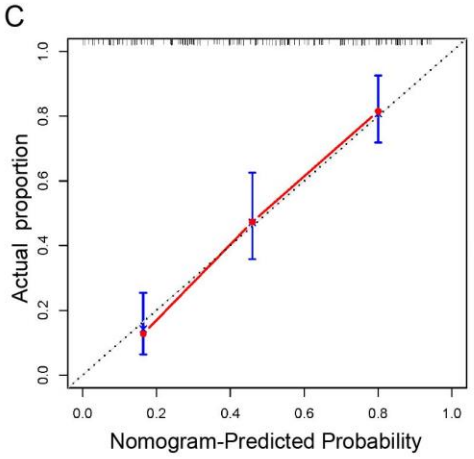
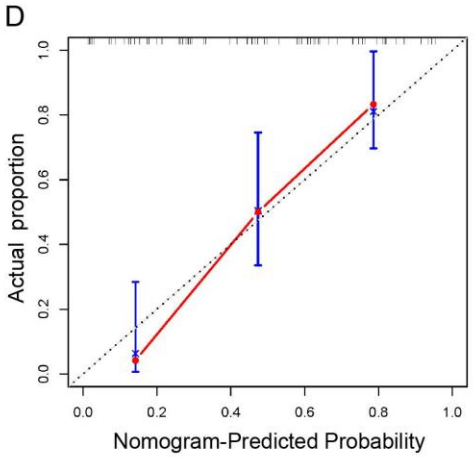

Points
0 10 20 30 40 50 60 70 80 90 100
Age
25 35 45 55 65 75 85 95
History of cardiovascular disease
0 1
Internal iliac artery calcification
0 0.5 1 1.5 2 2.5 3 3.5 4
Albumin
50 45 40 35 30 25 20
Total points
0 20 40 60 80 100 120 140 160 180 200
Linear Predictor
−2.5 −2 −1.5 −1 −0.5 0 0.5 1 1.5 2 2.5
1-year Survival Probability
0.9 0.8 0.7 0.6 0.5 0.4 0.3 0.2 0.1
3-year Survival Probability
0.9 0.8 0.7 0.6 0.5 0.4 0.3 0.2 0.1
5-year Survival Probability
0.9 0.8 0.7 0.6 0.5 0.4 0.3 0.2 0.1

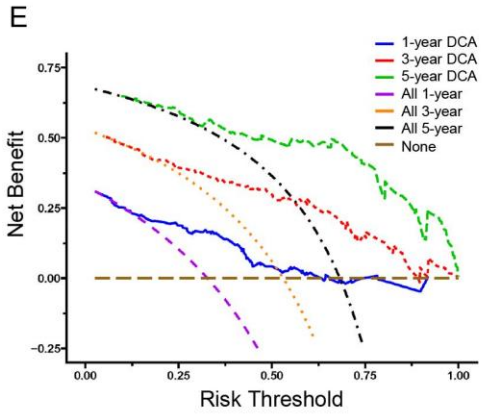
Figure 1.jpg

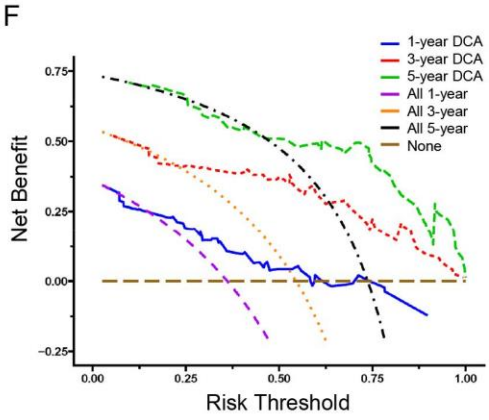

A
Sensitivity
1-Specificity
AUC at 1 year = 0.769
AUC at 3 years = 0.833
AUC at 5 years = 0.818


B
Sensitivity
1-Specificity
AUC at 1 year = 0.700
AUC at 3 years = 0.876
AUC at 5 years = 0.802


C
Actual proportion
Nomogram-Predicted Probability


D
Actual proportion
Nomogram-Predicted Probability


E
Net Benefit
Risk Threshold
1-year DCA
3-year DCA
5-year DCA
All 1-year
All 3-year
All 5-year
None


F
Net Benefit
Risk Threshold
1-year DCA
3-year DCA
5-year DCA
All 1-year
All 3-year
All 5-year
None