

Diagnostic accuracy of existing AVF function criteria in assessing functional dialysis use.

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Introduction

SONG HD patient and physician surveys on research in vascular access demonstrated strong preference for outcomes demonstrating fistula use for dialysis. We previously proposed a pragmatic definition of a functional fistula (Functional Dialysis Use; FDU) as six consecutive, successful cannulations of AVF with two needles to deliver prescribed dialysis. Assuming usual three dialysis sessions per week, this is an equivalent of two weeks of uninterrupted use of the AVF¹. Current clinical and ultrasound assessment criteria focus on patency rates and variably defined usability of AVF for dialysis. In this project we assessed diagnostic accuracy of four assessment methods (Clinical judgement (HDREADY), "Rule of 6s" (ROsx), University of Alabama (Birmingham) Ultrasound Criteria (UAB) and SONAR study criteria) in identifying fistulas that meet the criteria for FDU.

Methods

This audit was part of a quality improvement project within the renal access service. Consecutive patients with newly formed AVF between 01/10/2016 and 31/03/2019 were followed up in the renal access clinics 6 weeks from the time of surgery. Fistulas were assessed clinically (inspection and palpation). Where the ultrasound was part of the follow-up clinic, the diameter, depth and flow in the AV fistula were assessed. Diagnostic accuracy against FDU was assessed by calculating Sensitivity, Specificity, Positive (PPV) and Negative Predictive Values (NPV) and compared using McNemar's test. ROC curves were drawn, and AUC calculated and compared using bootstrap method. Method agreement was assessed using Fleiss kappa for multiple, and Cohen's kappa for binomial comparisons.

Results

Two hundred and eighty-three patients underwent AVF formation during study period. The median age was 65.0 [54.0,75.5] and 171 (60.4%) were male. Diabetic nephropathy was the primary renal diagnosis in 146 (51.6%) cases. One hundred and seventy-four (61.5%) AVFs were radio-cephalic, 94 (33.2%) were brachio-cephalic, and 15 were categorised as 'other' (brachio-basilic, ulno-cephalic, radio-basilic).

There was no difference in the distribution of patient characteristics and outcomes (FDU, assisted FDU, failure of FDU, non-use) between those patients who attended the ultrasound clinic (n=111) and those who did not (n=172).

The diagnostic accuracy was analysed in patients followed up in the ultrasound clinic. Patients with unknown FDU status (n=23) and primary failure (n=5) were excluded.

Ultrasound-based criteria had similar diagnostic accuracy as clinical judgement but greater than Rule of 6s. However, the differences were not statistically significant (Table 1). SONAR criteria performed best with the highest AUC (0.79). PPV and NPV were similar for US-based criteria and clinical judgement. There was fair-to-moderate agreement between all methods, with almost perfect agreement between ultrasound-based criteria.

Discussion

We demonstrated statistical equivalency between all assessment methods, however SONAR criteria seemed to perform better than other assessment methods. A relatively small sample size, and single ultrasound operator (reproducibility of measurements) limit generalisability of our findings precluding any recommendations. However, AVFs that did not achieve the threshold for FDU according to SONAR criteria may benefit from closer surveillance to support maturation and prevent fistula failure.

Fig 1. Comparison of ROC curves for four diagnostic methods.

Tab 1. Diagnostic accuracy of four methods of fistula assessment.