This work describes a flexible and body-conforming multi-channel sensor and associated signal processing methods for automated DOS characterization of vascular access” Panda et al (2019).

Abstract:

Point-of-care screening for hemodialysis vascular access dysfunction requires tools that are objective and efficient. Listening for bruits during physical exam is a subjective examination which can detect stenosis (vascular narrowing) when properly performed. Phonoangiograms (PAGs)-mathematical analysis of bruits-increases the objectivity and sensitivity and permits quantification of stenosis location and degree of stenosis (DOS). This work describes a flexible and body-conforming multi-channel sensor and associated signal processing methods for automated DOS characterization of vascular access. The sensor used an array of thin-film PVDF microphones integrated on polyimide to record vascular access bruits at multiple sites along a vascular access. Nonlinear signal processing was used to extract spectral features, and cardiac cycle segmentation was used to improve sensitivity. PAG Signal processing algorithms to detect stenosis location and severity are presented. Experimental results using microphone arrays on a vascular access phantom demonstrated that stenotic lesions were detected with 1 cm of the actual location and graded to three levels (mild, moderate, or severe). Additional PAG features were also used to define a simple binary classifier aimed at patients with failing vascular accesses. The classifier achieved 90% accuracy, 92% specificity, and 91% sensitivity at detecting stenosis greater than 50%. These results suggest that point-of-care screening using microphone arrays can identify at-risk patients using automated
Skin coupled microphone array for point of care dialysis vascular access monitoring | 2

signal analysis.

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