Title: Measuring the Palpable Pulsatility Length as a Physical Examination Test in Defining the Severity of Inflow Stenosis for Hemodialysis Fistulas

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Reviewer: Anatole Besarab

Reviewer's report:

Measuring the Palpable Pulsatility Length as a Physical Examination Test in Defining the Severity of Inflow Stenosis for Hemodialysis Fistulas

This paper examines the utility of pulsatility in assessing the severity of inflow stenosis in arteriovenous native fistulas (AVF). This concept is an extension of test for pulsatility and collapse described by others. The palpable pulsatility length (PPL) defined as the distance between anastomosis and the most distal arterial cannulation site (aPUMP) was determined before and after any corrective intervention. The ratio of aPUMP/PPL was defined as the aPump Index (API).

Measurements were conducted in 76 patients, all of whom were referred for dysfunctional fistula function. The AVF were predominantly radiocephalic (59), the remaining 17 being brachiocephalic (11) or brachiobasilic (6). Many had clear evidence of inadequate inflow such as blood pump flow rate < 250ml/min and/or AVF suction or tubing shaking during hemodialysis indicative of very negative pre-pump pressure (4 cases). Difficulty in cannulation occurred in 8 cases. Others had obvious evidence of outflow manifested by high dynamic venous pressure and pronged post needle withdrawal bleeding (24), and limb selling (sign of inadequate collateralization with more central stenosis (4)

ROC analysis showed AUC of 0.895 for API marginally better than that for of 0878 for PPL. With cutoff values of < 1.29 for API and < 11 cm for PPI, sensitivity was 96% for API and 80% for PPL with specificities of 84% for both. Measurements were conducted by 2 observers to reduce observer bias. Kappa was high at 0.89 for IP A and 0.92 for PPL.

An important observation is the finding that when there is both outflow and inflow lesions, the outflow dominated the pulsatility length and API. Interestingly, all 20 AVF with pure outflow lesions had not a single case of an arterial inflow problem. This gives credence that wall strain and shear rate due to high access flows are important in the genesis of venous stenosis. It is reassuring that in this study a stenosis of 50% by diameter (75% cross section) lead to aPump inadequacy. In the presence of venous outflow lesions, the tourniquet effect prevented this manifestation, and inadequate inflow was missed in 2/3 of cases.
The major issue is how can the findings of this study be implemented into clinical practice. Depending on country, physical exams of the AVF are only done by those with a passion for detecting access dysfunction before underdialysis occurs or the access thrombosed. In the USA, technicians are not rained to do so, and nephrologists do not take the time. Flow surveillance is done in very few places and is not very cheap.

I laud the authors for trying to quantitate the PE and encourage them to develop an ever larger data base. At some point the value of such examinations should be done in a RCT where PE is done routinely with timely referrals versus SOC which typically waits until the access is more severely affected by stenosis and PTA may not produce an optimal result.

Major

1. AVF may have arterial inflow, outflow stenosis (particularly if upper arm), or a mixture of the two. The test is looking for inflow lesions whether the patient has clinical signs or not. The authors do perform a comparison of AVF with pure inflow and compare these to situations where there is pure outflow as well as the effect of PTA. Due to spasm 4 cases could not have pre-post comparisons but it is not clear whether the 4 cases were included in Hypothesis 1.

2. I am not convinced that a residual stenosis of > 30% at the completion of treatment is exclusionary. These could have been analyzed as a subgroup.

3. The paper is too long for the average reader. The discussions on rheologic blood flow and kinetic energy can be shortened

4. Reason for referral is not stipulated in 32 cases. Are these the asymptomatic cases and if so what was the reason for referral.

Minor

1. The authors stipulated that only AVF that has matured and were in use for at least 6 months were studied. Also any AVF with more than one main early trunk, or which was deep was excluded. This limit generalizability.

2. I am not sure that one needs to define 3 types of inadequate inflow.
3. The absence of a significant difference in the API between subjects with hypotension and those with "normal BP" is limited by sample size (n=8). It is an observation which should be followed up!

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Yes: Physical examinations of autologous fistulas can be quantitated and used to detect asymptomatic stenosis

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