‘Flow Forward’ technology: A Continuous Flow Pump System Rapidly Dilates Ovine Cephalic Veins Prior to AVF Surgery and Improves AVF Maturation 45th Veith Symposium, November 17, 2018

Presenter: Surendra Shenoy M.D., Ph.D.

Disclosure

Work as a scientific and medical advisor with Flow Forward medical

Clinical Needs in Vascular Access

- Increase forearm AVF prevalence
- Increase AVF maturation rates
- Decrease time from AVF creation to maturation & use
- Prolong AVF primary & secondary patency
- Decreased need for interventions during and after maturation
- Reduce catheter use

Routine availability of 6 – 8 mm diameter veins tend to provide an easier surgical target
A faster and more reliable maturation

Hypothesis

Controlled increase in wall shear stress to around 4 Pa using graduated, non-pulsatile blood flow delivered to superficial veins can induce rapid, stenosis-free vein dilation

Ovine Study Methods

- 5 sheep between 54 – 68 kg
- Heparin coated centrifugal pump and catheters, rack-mounted controller
- Inflow from SVC via external jugular access
- Outflow to cephalic vein
- 7 – 11 days of treatment
- Forearm AVF created using treated cephalic vein to combined trunk of radial and median arteries
- Followed 6 weeks with weekly US and angiography
- 2 control sheep with bilateral forearm AVF created using same vessels but with untreated veins
Ovine Study Results: Treatment Effect on Vein Diameter

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<thead>
<tr>
<th>Start</th>
<th>Outflow Ven</th>
<th>Day 9</th>
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87% increase in cephalic vein diameter over 6 - 11 days

Ovine Study Results: Treatment Effect on AVF Maturation

<table>
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<tr>
<th>AVF Vessel</th>
<th>Brachial Artery</th>
<th>Outflow Vein</th>
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<tbody>
<tr>
<td>Initial AVF outflow vein &gt; 2X larger in treated animals</td>
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<tr>
<td>Brachial artery diameter 28% larger at 6 wks</td>
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<td>Cephalic vein diameter 50% larger at 6 wks</td>
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<td>Greater AVF blood flow</td>
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AVF Angiography After 6 Weeks of Maturation

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<tr>
<th>AVF Outflow Vein</th>
<th>AVF Inflow Artery</th>
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<td>Control AVF</td>
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<td>AFE Pre-Treated AVF</td>
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Ovine Study Conclusions

- Controlled increase in wall shear stress using graduated increase in non-pulsatile blood flow produces rapid, stenosis-free dilation of ovine cephalic veins
- Making AVFs with AFE System-treated ovine cephalic veins results in improved AVF maturation (larger artery and vein diameters and increased blood flow) compared to AVFs made with untreated veins
- This study suggests AFE System treatment is a viable method to obtain larger veins in the forearm and upper arm suitable for AVF creation in ESRD patients and could potentially improve AVF maturation and use rates, reduce time to AVF maturation, reduce AVF procedure, prolong AVF primary and secondary patency, and reduce the use of catheters

First in Human Clinical Trial

- Trial scheduled to start in Q3 2019
- Planning to carry out the trial at Sanatorio Italiano Hospital in Asunción, Paraguay
- The government of Paraguay generally pays for routine hemodialysis for citizens but does not pay for vascular access surgery
First in Human Clinical Trial

- 10 subjects
- Cephalic vein diameter > 2.5 mm and < 4 mm
- Radial artery diameter ≥ 2 mm
- AFE System treatment of forearm cephalic vein for 10 days
- Serial ultrasound of AFE System outflow vein diameter and flow during treatment
- Venography of cephalic vein before and after AFE System treatment
- AVF created after 10 day treatment
- Serial ultrasound of AVF outflow vein diameter and blood flow after AVF creation

Primary clinical endpoints
- Safety and absolute change in AFE System outflow cephalic vein diameter from baseline to end of treatment period

Selected secondary clinical endpoints
- AVF outflow cephalic vein diameter and blood flow prior to treatment and 2, 4, 6, 8, and 28 weeks after study enrollment

Rotary Pump System Rapidly Dilates Ovine Cephalic Veins Prior to AVF Surgery and Improves AVF Maturation

November 17, 2018

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