Mechanical Thrombectomy Devices

Thomas M. Vesely, MD
Vascular Access Services, LLC
Saint Louis, Missouri
No conflicts of interest relevant to thrombolysis / mechanical thrombectomy
Number and Type of Hemodialysis Thrombectomy Procedures by Year

- Thrombolysis
- Mechanical
Use of a 7 Fr. guiding catheter to aspirate thrombus

guiding catheters have non-tapered tips for better aspiration of thrombus
7 Fr. introducer sheath

thrombus

tip of guiding catheter
Post-aspiration thrombectomy
Thrombus aspirated from hemodialysis graft
# Thrombectomy Methods

<table>
<thead>
<tr>
<th>Method</th>
<th>Popularity</th>
<th>Cost</th>
<th>Speed</th>
<th>Effectiveness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aspiration</td>
<td>++++</td>
<td>+</td>
<td>++</td>
<td>++</td>
</tr>
<tr>
<td>Balloon Maceration</td>
<td>+++</td>
<td>++</td>
<td>+++</td>
<td>+++</td>
</tr>
<tr>
<td>Mechanical Devices</td>
<td>+</td>
<td>++++</td>
<td>++++</td>
<td>++++</td>
</tr>
<tr>
<td>Thrombolytics</td>
<td>+</td>
<td>++++</td>
<td>+</td>
<td>++</td>
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</tbody>
</table>
“Vascular access patency is determined by the identification and successful treatment of all significant stenoses, and not the method of thrombus removal.”

Thomas Vesely, MD
Are mechanical thrombectomy devices cost effective?

Nope

No clinical studies to answer this question
Mechanical Thrombectomy Devices

“Spinning Wires”
Percutaneous Thrombolytic Device (PTD)
Cleaner XT (Prolumen)
Solera
XTD

“Spinning Brushes”
Castenada Brush
Cragg Brush

“Acoustic Energy”
EkoSonic (Omnisonics)

“Supersonic Spinners”
Helix (ATD)
Thrombex
Aspirex S
Exciser
ThrombCat

“Hydrodynamic”
AngioJet
Hydrolyser
Oasis

“Suction”
EndoVac
PTD Thrombectomy Device inserted through 6 Fr sheath

wire basket fragments and macerates thrombus
Mechanical Injury to Vein
Comparison of the PTD to Embolectomy Balloon


Percentage of Endothelial Denudation

[Bar chart showing comparison between PTD and Fogarty for percentage of endothelial denudation across acute, 1 week, and 6 weeks time points.]
Solera

- Similar to PTD but only the inner basket spins (at 3000rpm)
- Outer basket can be manually rotated
**XTD** ("Extract Device")

Battery powered motor spins a **curved guidewire tip** at 10,000-15,000 rpm

Aspiration using attached syringe
After maceration of the thrombus, use a 20cc syringe to aspirate the thrombus via the sidearm of the vascular sheath.
Needle damage to stent graft
Stent graft wrapped around on PTD basket
PTD entangled in fractured metal stent
Unraveled fractures stent from PTD thrombectomy device
Mechanical Thrombectomy Devices

“Supersonic Spinners”
Helix
Thrombex
Aspirex S
ThrombCat
Exciser

“Hydrodynamic”
AngioJet
Hydrolyser
Oasis
Super high speed (>100,000 rpm) pressurized (30 psi) air-driven impeller within catheter tip housing
After maceration of the thrombus, use a 20cc syringe to aspirate the thrombus via the sidearm of the vascular sheath.
AngioJet

Solent Omni

Solent Proxi

AVX

Multiple high pressure saline jets create vacuum at catheter tip
To aspirate and remove thrombus
Hydrodynamic Thrombectomy Devices

Fluid turbulence shears thrombus into fragments

<table>
<thead>
<tr>
<th>Device</th>
<th>Particulate Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>AngioJet</td>
<td>≤ 10 μm</td>
</tr>
<tr>
<td>Helix</td>
<td>≤ 20 μm</td>
</tr>
<tr>
<td>PTD</td>
<td>1-3 mm</td>
</tr>
</tbody>
</table>

Some devices will aspirate thrombus fragments
Oasis and Hydrolyzer devices had similar systems
Intraprocedural Blood Loss

- Hemodialysis patients have low hematocrits (25 - 35%)
- Aspiration devices can remove large volumes of blood quickly

Hemolysis

- Destruction of red cells liberates plasma-free hemoglobin (PFH)
- $\uparrow$ PFH $\rightarrow$ renal tubular damage
- Intraprocedural blood loss
Maintain awareness of the procedure:

- Is progress being made?
- Patient fatigue
- Radiation exposure
- Blood loss
Complications related to percutaneous thrombectomy of hemodialysis grafts

T.M. VESELY

Mallinckrodt Institute of Radiology, St. Louis, Missouri - USA

ABSTRACT: Purpose: To retrospectively review the complications reported during percutaneous thrombectomy procedures performed on polytetrafluoroethylene hemodialysis grafts.

Materials and Methods: A retrospective review revealed that 985 percutaneous thrombectomy procedures were performed at our institution between January 1993 and June 2001. The type and number of procedures include: Arrow PTD (527), pulse-spray with urokinase (240), Amplatz Thrombectomy Device (96), AngioJet (17), Oasis (15), Hydrolyser (10), Endovac (7), Lyse and Wait (7), Thrombex (6), Cragg brush (6), Castaneda brush (4). Complications were reported to have occurred in 31 patients. The radiology reports and medical records of these patients were reviewed.

Results: The overall complication rate was 3.3%. The type and number of complications included: rupture of a vein during angioplasty (13), severe cardiopulmonary distress (4), arterial emboli (4), rigors related to urokinase (3), minor bleeding (2), hypoxia with chest pain (2), other assorted complications (3). There was one death resulting from a fall from the angiography table immediately following the procedure. There were 12 minor complications, requiring minimal treatment, and 19 major complications that altered the course of the procedure or treatment of the patient.

Conclusion: The most common complication was angioplasty-induced rupture of the vein or graft. The most severe complications occurred immediately following dislodgement of the arterial plug and were likely due to acute pulmonary embolization. (The Journal of Vascular Access 2002; 3: 49-57)

KEY WORDS: Uremia, Arteriovenous fistulas, Aneurysm, Endografting repair

803 percutaneous thrombectomy procedures were performed on PTFE hemodialysis grafts between 1/1/93 and 9/1/00.

This included the following types and numbers of procedures:

- Pulse-spray UK (240)
- Arrow-PTD (412)
- ATD (79)
- AngioJet (17)
- Oasis (15)
- Hydrolyser (10)
- Endovac (7)
- Lyse & Wait (7)
- Thrombex (6)
- Cragg brush (6)
- Castaneda brush (4)
12 minor complications requiring minimal treatment

18 major complications that altered the course of the procedure or treatment of the patient

Ten (10) of these major complications were due to angioplasty-induced rupture of a vein

One death resulting from a fall from the angiography table immediately following the procedure
Complications were reported to have occurred in 30 patients.

The complication rate was 3.7%.

The type and number of complications included:
- Rupture of a vein during angioplasty (13)
- Severe respiratory distress (4)
- Arterial emboli (3)
- Rigors related to urokinase (3)
- Access site bleeding (2)
- Moderate hypoxia (2)
- Other complications (3)
## Complication Rates

<table>
<thead>
<tr>
<th>Complication</th>
<th>Other Reports</th>
<th>Vesely</th>
</tr>
</thead>
<tbody>
<tr>
<td>Major bleeding</td>
<td>0.7 – 1.7 %</td>
<td>0</td>
</tr>
<tr>
<td>Minor bleeding</td>
<td>2.8 – 11.1 %</td>
<td>0.25 %</td>
</tr>
<tr>
<td>Venous rupture/dissection</td>
<td>1.2 – 7.0 %</td>
<td>1.6 %</td>
</tr>
<tr>
<td>Arterial emboli</td>
<td>1.2 – 9.3 %</td>
<td>0.37 %</td>
</tr>
<tr>
<td>Acute respiratory arrest</td>
<td>1.6 – 2.3 %</td>
<td>0.50 %</td>
</tr>
<tr>
<td>Contrast reaction</td>
<td>0.7 – 1.4 %</td>
<td>0</td>
</tr>
<tr>
<td>Sepsis; infection</td>
<td>1.2 – 2.0 %</td>
<td>0</td>
</tr>
</tbody>
</table>
Conclusions

Long-term patency of access in not related to thrombectomy method

Many different types of mechanical thrombectomy device
- READ instructions for use document

Mechanical thrombectomy devices are not cost effective but improve speed to thrombus removal

Mechanical thrombectomy procedures have complication rates similar to other percutaneous thrombectomy methods

Be mindful of blood loss and hemolysis