Treating Venous Thromboembolism Without Lytics

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Types of Percutaneous Thrombectomy Techniques
- Catheter-Directed Thrombolysis (CDT)
- Conventional vs. ultrasound-assisted
- Mechanical Techniques
  - Fragmentation (pigtail, balloons, rotating devices)
  - Rheolytic Thrombectomy
  - Vacuum Assisted Thrombectomy
  - Suction Devices
  - Extraction Devices

Why do we need Mechanical Techniques?
- Venous Thromboembolic (VTE) in patients with a contraindication/failure of thrombolysis
- Patients who do not have a contraindication but are high risk for thrombolysis
- Require a rapid response
- Combination therapy

Ideal Mechanical Device VTE
- Simple to use; easy set up
- Able to use with multiple passes without losing access
- Low Profile -- No puncture site complications
- Removes large amount of thrombus
- Minimize blood loss
- Does not traumatize vessel
- Easy to navigate through vessels/ through heart safely
- Inexpensive
- Can be done with moderate sedation (no need for general anesthesia)
- Does not require long Fluoroscopy times (low radiation)
- Obtains consistent & reproducible results
- Does not require a large team

Mechanical Thrombectomy
- Over 25 devices available
- Highly competitive market space
- Market is expanding in arterial, DVT and PE
- To date no ideal devices
- Many practices are converting to single session therapy for cost and ease
Mechanical Fragmentation: Limited Data

- Schmitz-Rode T (J Am Coll Cardiol. 2000;36(2):375)
  - Rapid and safe improvement of the hemodynamic compromise
  - Average recanalization of about 1/3
  - Useful especially in high-risk patients
  - Mortality was high at 20%

- Nakazawa (2008 B J Radiol)
  - Rapid and low cost
  - Widely available
  - May result in distal embolization and PAP
  - Then requiring additional technique in conjunction

Rheolytic Thrombectomy: Self Rotating Devices

Trerotola Device: Arrow Medical
Cleaner Device: Argon Medical

Off Label use of these devices. Must be aware of potential damage to the pulmonary artery

Rheolytic Thrombectomy (Angiojet system- Boston Scientific)

- Rheolytic Thrombectomy (Angiojet system- Boston Scientific)
- Rheolytic Thrombectomy Mechanism of Action
  - The Bernoulli Effect explains the relationship between velocity and pressure.
  - Pressurized saline jets travel backwards to create a low pressure zone causing a vacuum effect.
  - Cross-Stream windows optimize the drawing action for more effective thrombus removal.
  - Thrombus is drawn into the catheter where it is fragmented by the jets and evacuated from the body.
JVIR Meta-Analysis: Catheter Directed Therapy for Massive PE

- AngioJet Rheolytic Thrombectomy (ART)
- 68 patients (11%)
- Major Complications = 19 (28%)
- Minor Complications = 27 (40%)
- 5 procedure-related deaths
- 19/25 (76%) of all major complications attributed to ART
- "...we believe the AngioJet device should not be used as the initial mechanical treatment in future CDT protocols for patients with acute massive PE."
- FDA has issued a black box warning for use of Angiojet in acute massive PE

Kuo WT et al., JVIR 2009; 20:1431–1440

Suction Devices

- Vacuum Assisted Thrombectomy
- Suction Cannula and Circuit
- Manual Aspiration and canister techniques
- Combinations

- Sheaths, catheters, hand suction, vacuum aided images

Manual Suction Devices

- Sheaths and catheters
- Limited by size of catheter/ sheath lumen
- Limited by manual suction
- Likely only helpful for small amount of thrombus

Suction Catheter with Circuit: AngioVac/AngioDynamics VORTEX

- 22F device
- FDA approved for the removal of Undesirable Intravascular Material (UIM)
- Extracorporeal bypass circuit
- Can be inserted via 26F dry-seal sheath
- Suction to engage and remove clot
- Drainage, filtration and reinfusion of blood

- AngioVac device advanced through 26 Fr DrySeal sheath placed via right IJV
- Pt is on extracorporeal bypass with reinfusion cannula in the left IJV
Findings:
• Caval thrombosis to the level of the IVC filter
• Bilateral iliofemoral DVT

Vacuum Assisted Thrombectomy
• Potential for single-setting management
• Small enough to make it an everyday procedure
• Large enough to handle clot burden
• Still have all other options open (Lysis, fragmentation), however, potential to reduce dosage
• Potential to reduce ICU and infusion costs

Indigo® System
Indication intended for the removal of fresh, soft emboli and thrombi from vessels of the peripheral arterial and venous systems.

Reinforced flexible catheters
Aspiration Catheters in 4 sizes - CAT- 3, 5, 6 & 8
Continuous - 25mmHg vacuum
Aspiration Efficiency

History

- 80 yo F with history colorectal CA with right lower extremity swelling diagnosed with RLE DVT on US
- Patient has persistent pain after 10 days of systemic anticoagulation.

Mass at right common iliac vein with obstruction.

Biopsy demonstrated squamous cell carcinoma (unknown primary)

Right popliteal access
New technologies to capture and remove thrombus

Example: FlowTriever from Inari

Thrombus Extraction Devices

- New technologies to capture and remove thrombus
- Example: FlowTriever from Inari
ClotTriever System: Clot and Device Removal

As clot is captured the collection bag, it is retrieved into sheath. The funnel on the sheath forces clot into the collection bag and into the sheath. Clot is then removed from the sheath.

Aspiration

- Rapid retrieval of clot
- No additional equipment
- No exposure to clot
- No need for embolization filters
-May perform thrombolysis in situ

JETi Catheter

- 6 & 8 F OD catheters

Jet macerates clot inside catheter tip then aspirated

Slides from Dr. Razavi
Truly Single Session Treatment of Iliofem DVT

- 51 YO female with 3-day hx of LLE swelling and pain
- PMH sig for:
  - hx of AML, s/p BMTx complicated by GVH disease
  - s/p L TKR
  - DVT/PE X 2; five and one year ago
- US positive for iliofem DVT

Single Center Experience

- May 2017-current: 19 patients
- DVT (non consecutive): 17
  - Acute: 14
  - Acute on chronic: 3
  - Arterial: 2
- % of acute clot retrieval (on the table) >90%
- 30-day patency: 15/16
- No device-related adverse events
  - No hemolysis/hematuria

Conclusion

- Mechanical thrombectomy provides an alternative treatment strategy for the management of acute and subacute VTE
- Catheter Directed Mechanical Therapy offers a more rapid therapeutic option when compared to pharmacologic options. Also when compared to thrombectomy.
- Data suggests procedures can be done safely
- Many unknowns
  - No good prospective trials to date
  - All referenced studies consider short term outcomes
- Ideal device does not exist
- Extremely exciting frontier!