Utility and Safety of Pneumatic Tourniquet for Surgical Procedures of Hemodialysis Access Under Conscious Sedation

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No conflict of interest to disclose.
Background and Objectives

* Pneumatic tourniquet are commonly used for surgical procedures on the extremities.

* However, its use for surgical procedures of hemodialysis access is not widespread and mostly confined to the hospital settings under general anesthesia or regional nerve block in the United States.

* This study is to demonstrate the utility and safety of pneumatic tourniquet for a variety of surgical procedures of hemodialysis access under conscious sedation plus local anesthesia in an outpatient setting.
A Portable Pneumatic Tourniquet System
## Surgical Procedures of HD Access Assisted by Pneumatic Tourniquet

<table>
<thead>
<tr>
<th>Surgical Procedures of Hemodialysis Access</th>
<th># of Cases (%)</th>
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<tbody>
<tr>
<td><strong>Procedures of autogenous hemodialysis access</strong></td>
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<tr>
<td>* Arteriovenous fistula creation</td>
<td>377 (68.5%)</td>
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<tr>
<td>* Fistula aneurysm repair</td>
<td>105 (19.0%)</td>
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<tr>
<td>* Fistula reduction plus Dilator-assisted Banding</td>
<td>4 (&lt;1%)</td>
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<tr>
<td>* Fistula vein transposition</td>
<td>2 (&lt;1%)</td>
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<tr>
<td>* Lipectomy or elevation for deep fistula vein</td>
<td>10 (1.8%)</td>
</tr>
<tr>
<td>* Arteriovenous fistula anastomosis revision</td>
<td>3 (&lt;1%)</td>
</tr>
<tr>
<td>* Fistula surgical thrombectomy</td>
<td>4 (&lt;1%)</td>
</tr>
<tr>
<td>* Fistula ligation or vein removal</td>
<td>5 (&lt;1%)</td>
</tr>
<tr>
<td><strong>Procedures of prosthetic hemodialysis access</strong></td>
<td></td>
</tr>
<tr>
<td>* Placement of forearm arteriovenous graft</td>
<td>24 (4.4%)</td>
</tr>
<tr>
<td>* Graft pseudoaneurysm repair</td>
<td>8 (1.5%)</td>
</tr>
<tr>
<td>* Graft revision (i.e. bridge graft)</td>
<td>4 (&lt;1%)</td>
</tr>
<tr>
<td>* Graft surgical thrombectomy</td>
<td>2 (&lt;1%)</td>
</tr>
<tr>
<td>* Graft ligation or removal</td>
<td>2 (&lt;1%)</td>
</tr>
<tr>
<td><strong>Total number of cases</strong></td>
<td>550 (100%)</td>
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</table>
Safety of Pneumatic Tourniquet under Conscious Sedation

- 550 procedures by a single operator.
- Continuous tourniquet inflation time is limited to <30 minutes (to avoid ischemic pain and other issues).
- Well tolerated under conscious sedation.
- No significant tourniquet associated adverse event.
AV Fistula Creations Assisted by Pneumatic Tourniquet
AV Fistula Aneurysm Repair Assisted by Pneumatic Tourniquet
AV Graft Placements Assisted by Pneumatic Tourniquet
AV Fistula Creations ± Tourniquet: Sedation Medications and Procedure Duration (377 with tourniquet vs. 336 without tourniquet)

- Midazolam (mg):
  - With Tourniquet: 2.54±1.29
  - Without Tourniquet: 2.97±1.31
  - p<0.001

- Fentanyl (mcg):
  - With Tourniquet: 73.14±46.33
  - Without Tourniquet: 91.85±45.33
  - p<0.001

- Procedure Duration (minutes):
  - With Tourniquet: 37.2±8.6
  - Without Tourniquet: 55.8±16.5
  - p<0.001
Potential advantages of tourniquet use for surgical procedures of HD access

- Safe to use in outpatient settings
- Significantly reduced operating time
- Reduced bleeding risk and blood loss
- Improved visualization of anatomical details and reduced injury
- Reduced skin incision and scar formation
- Reduced vascular dissection and spasm
- No vascular clamps, hence less vascular injury and future lesions
- Making microsurgical fistula creation possible on children with small vessels
- May obviate the need to discontinue oral anticoagulant therapy
- Potentially improved outcome of access creation/revision procedures
Conclusions

* Pneumatic tourniquet can be safely employed under conscious sedation in an outpatient setting.
* It offers many advantages: less dissection, shortened procedure duration, reduced vascular trauma and potentially improved clinical outcomes.
* Given these advantages, the author recommends the routine use of pneumatic tourniquet during surgical procedures of hemodialysis access in suitable patients.
A Focused Review


Seminars in Dialysis (Epub ahead of print).