Vascular Access and Complications of Endovascular Procedures

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Disclosures

• Consultant: Boston Scientific, VNUS Medical, WL Gore, Embrella, Maquet

• Equity position: Hatch Medical, Northpoint Domain

• Training Courses/Grants:
  • Abbot, Boston Scientific, Vnus Medical, WL Gore
CLASSIFICATION

I  Access site complications.
II  Complications related to passage of catheters and devices
III  Intervention specific complications or due to the intervention
General Angiographic Complications

- Access site complications
  - Hematoma
  - AV fistula
  - False aneurysm
  - Femoral artery thrombosis
  - Closure device complications
- Micropuncture technique helpful
General Angiographic Complications

- Access route complications
- Vessel dissection/perforation
  - Vasculopaths tend to have tortuous and stenotic vessels
  - Be conscious of the complete vascular system, not just the carotid arteries
  - Be as careful getting to the carotid lesion as you are treating it
Watching the wire
## Type of Complications Requiring Surgical Intervention

<table>
<thead>
<tr>
<th>Type</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pseudoaneurysm</td>
<td>61.2%</td>
</tr>
<tr>
<td>Hematoma</td>
<td>11.2%</td>
</tr>
<tr>
<td>AVF</td>
<td>10.2%</td>
</tr>
<tr>
<td>External Bleeding</td>
<td>6.1%</td>
</tr>
<tr>
<td>Retroperitoneal Hematoma</td>
<td>5.1%</td>
</tr>
<tr>
<td>Arterial thrombosis</td>
<td>3.1%</td>
</tr>
<tr>
<td>Groin Abscess</td>
<td>2.0%</td>
</tr>
<tr>
<td>Mycotic Aneurysm</td>
<td>1.0%</td>
</tr>
</tbody>
</table>
Location of Access Site Complications

- Accessory femoral artery: 3.6%
- Limb of aortobifemoral graft: 2.4%
- 14.4%
- 9.7%
- 61.4%
SIR threshold complication rate for quality assurance following groin puncture and angiography.

<table>
<thead>
<tr>
<th>Complication</th>
<th>Threshold</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hematoma</td>
<td>3 percent</td>
</tr>
<tr>
<td>Occlusion</td>
<td>0.5 percent</td>
</tr>
<tr>
<td>Pseudoaneurysm</td>
<td>0.5 percent</td>
</tr>
<tr>
<td>Arterial venous fistula</td>
<td>0.1 percent</td>
</tr>
<tr>
<td>Catheter-induced Complications</td>
<td></td>
</tr>
<tr>
<td>Arterial Dissection</td>
<td>2 percent</td>
</tr>
<tr>
<td>Subintimal injection</td>
<td>1 percent</td>
</tr>
<tr>
<td>Cerebral Arteriography</td>
<td></td>
</tr>
<tr>
<td>All neurologic complications</td>
<td>4 percent</td>
</tr>
<tr>
<td>Permanent neurologic complications</td>
<td>1 percent</td>
</tr>
<tr>
<td>Contrast Reactions</td>
<td></td>
</tr>
<tr>
<td>All reactions</td>
<td>3 percent</td>
</tr>
<tr>
<td>Major reactions</td>
<td>0.5 percent</td>
</tr>
<tr>
<td>Contrast-induced renal failure</td>
<td>10 percent</td>
</tr>
</tbody>
</table>
Groin Hematoma
Secondary Infection of Hematoma
External Compression Devices.

- Must be properly positioned
- Patient must be compliant
- Can make it worse

Closure Devices
- Work well
- Thrombotic and bleeding complications
- Infection
CT - Groin Hematoma
Traumatic Arteriovenous Fistula

- Puncture of crossing Vein
- Progressively enlarge
- Do not close spontaneously

- Arterialization of Vein
- To and Fro flow Pattern
Treatment of Arteriovenous Fistula

- Surgical Repair
- Very selective Role
  - Covered Stents
  - Embolization
  - Observation
Pseudoaneurysm.

- Symptoms: pain, swelling
- Signs: pulsatile mass, hematoma, bruit
Pseudoaneurysm Treatment

- Observation
  - Small PA < 2.0cms.
  - Anticoagulation decreases rate thrombosis
- Compression
  - Largely abandoned
- Surgical Repair
  - Wide necked
  - Thrombin injection
    - Main therapy
Easy to do

All about imaging, if you can see it....

But be careful
Post operative complications following open repair of the femoral artery following arterial puncture.

<table>
<thead>
<tr>
<th>Complication</th>
<th>Incidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aspiration pneumonia</td>
<td>1.05%</td>
</tr>
<tr>
<td>Neuralgia</td>
<td>5.25%</td>
</tr>
<tr>
<td>Wound bleeding</td>
<td>7.35%</td>
</tr>
<tr>
<td>Retroperitoneal bleeding</td>
<td>2.1%</td>
</tr>
<tr>
<td>Lymph leak</td>
<td>1.05%</td>
</tr>
<tr>
<td>Limb swelling</td>
<td>1.05%</td>
</tr>
<tr>
<td>Myocardial infarction</td>
<td>1.05%</td>
</tr>
<tr>
<td>Septicemia</td>
<td>2.1%</td>
</tr>
<tr>
<td>Death</td>
<td>3.1%</td>
</tr>
</tbody>
</table>
Anatomy of the Retroperitoneum

- Multiple Compartments
- Between fascia and peritoneum
- Intramuscular
  - Psoas
  - Iliacus

Hypotension, falling Hct
Flank Pain, groin pain
Femoral Nerve Palsy: hip flexion, knee extension
May be no Groin Hematoma
Retroperitoneal Hematoma.

Examine for Femoral Nerve Weakness
TREATMENT

• Cause Specific
  • Lysis/anticoagulation related
    • Correct coagulopathy
  • Procedure related
    • Repair bleeding site
• Femoral nerve palsy
  • Immediate exploration and decompression
Endovascular Complications.

II. Complications related to passage of catheters and devices.

- Perforation of the main artery
- Perforation of a side branch
- Intimal dissection
- Atheromatous embolization
- Thrombus embolization from
  - catheter or wire
- Air embolization
Ruptured Iliac Artery

- Risk Factors:
  - small vessels
  - heavy calcification
  - oversized balloon?
  - chronic steroid use

- Rupture:
  - small contained
  - continued hemorrhage

- Treatment
  - reinflate balloon

QuickTime™ and a Cinepak decompressor are needed to see this picture.
Delayed Ischemia

PTA 1 week prior
Acute Lower Extremity Ischemia

- Pain
- Pallor
- Pulseless
- Parasthesiae
- Poikilothermia
- Paralysis

- Embolization
- Common Femoral Occlusion
Trash Foot
Distal embolization following kissing iliac stents.
Mycotic Pseudoaneurysm

Catheter/wire Perforation

? Seeded Hematoma

Required Aortic Resection
Occluded Stent

- Symptom Recurrence
- Embolization
- Acute Ischemia
  unusual
Rupture of Iliac Artery

- Iliacs at Risk:
  - Calcified
  - Small
  - Interventions

- Recognition
  - Angiography
  - Balloon Control
  - Stent Graft
  - Surgical Repair
Puncturing Grafts

- Types of Grafts:
  - Aortoiliac
  - Aortobifemoral
  - Fem Pop
  - Fem - Fem

- Concerns:
  - Graft thrombosis
  - Graft Infection
    - pre - existing
    - Induced
  - Avoid Closure Devices

Antibiotic Prophylaxis
Complications of Brachial Puncture

- Median and ulnar nerves remain confined within the medial brachial fascial compartment until the elbow. This anatomic arrangement explains why the median and ulnar nerves are disproportionately affected in the syndrome.

Antecubital Brachial Puncture

- T1 weighed MRI of the forearm, black arrow indicating a small hematoma at the antecubital fossa.
- The white arrow indicates the radial artery as it crossed the antecubital fossa.

Angus M Kennedy, a Michael Grocott, a Martin S Schwartz, a Hamid Modarres, a Mark Scott, b Fred Schona. Medial nerve injury: an underrecognised complication of brachial artery cardiac catheterisation? J Neurol Neurosurg Psychiatry 1997;63:542-546

Methodist DeBakey Heart Center
Left Thigh

Note relationships

- Numbness anteromedial thigh
- Inability to extend knee
Conclusion

- Access related complications remain common
- Many can be avoided
- High suspicion of Retroperitoneal hematoma
- Psuedaneurysms
  - Thrombin injection
- Larger Fistulæ
  - Surgical closure