Arterial Access for Diagnosis and Intervention

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Disclosures

None
Objective

- Choice of site
- Access technique
- Closure technique
- Complications
Choice of site

• Principle:
  – Bone or bony prominence beneath the artery
  – Avoid diseased areas of artery/ calcification
  – Access on top of the artery
  – Away from side branches, bifurcation or crossing vein

• Decision influence by:
  – Site of artery and size of desired sheath
  – Anticipated area of intervention
  – Length of interventional device
Common femoral Artery

• Most common method of vascular access
• Most arterial access complications are preventable

• History
  – Symptom of PAD, prior intervention, open surgery, closure device, groin complication

• Physical Exam
  – Palpation of pulse and auscultation of the femoral pulse
  – Palpable and Doppler of distal arterial pulses (baseline)
Common femoral Artery: anatomy

- Continuation of external iliac artery
- Crosses the pelvic brim at the level of inguinal ligament
- Femoral sheath (artery, vein and nerve)
Common femoral Artery

- Ideal site for arterial access
- Relatively large in size, less involved with atherosclerosis
- Readily compressible against head of femur
- Caudal puncture to SFA/profunda
  - Bleeding/ hematoma/ PSA
  - Occlusion
- External iliac artery puncture
  - Retroperitoneal hematoma
Common femoral Artery

• Localization
  – Arterial pulse
  – Anatomical landmark and fluoroscopy
  – Ultrasound guidance
Anatomical Landmark: CFA

• Inguinal ligament marks the beginning of common femoral artery
• Between pubic tubercle and anterior superior iliac spine (ASIS)
• Medial 1/3 of femoral head
Anatomical Landmark: CFA

- Least reliable
- Should be avoided except in thin patient
- Obese patient inguinal skin fold is usually lower and overlies the superficial femoral artery
- Area of maximal pulse
Fluroscopy: CFA
Ultrasound: CFA

- Ability to identify intended vessel and to confirm patency
- Avoid branch point and bifurcation
- Area of calcification or stenosis

- Use of external skin markings in obese patient is misleading
Ultrasound: CFA

Figure 1. Ultrasound Guidance Technique

(A) The attached needle guide fixes the needle’s angle of entry to intersect the vessel at the imaging plane 1.5 cm, 2.5 cm, or 3.5 cm below the skin, depending upon the guide chosen. The vessel bifurcation is kept inferior to the probe at the time of insertion. (B) The right femoral artery bifurcation is imaged in the axial plane, identifying the separation of the profunda femoral artery (PFA) and superficial femoral artery (SFA). Compression is used to differentiate arteries from the femoral vein (FV). (C) The probe is moved superiorly until the common femoral artery (CFA) is visualized. During needle advancement, the anterior wall of the vessel is kept under the central target line (green circles), which indicates the path of the needle.
Ultrasound: CFA
Brachial Artery

- Usually with arm supinated over the olecranon process
- Entry should be over the olecranon process
- Ultrasound can be very helpful
  - High take off of radial artery
- Most can tolerate up to 6Fr sheath

- Complication: median nerve compression or injury (0.2% to 1.4%)
The brachial artery: A critical access for endovascular procedures

Javier A. Alvarez-Tostado, MD, a Mireille A. Moise, MD, a James F. Bena, MS, b Mircea L. Pavkov, MD, a Roy K. Greenberg, MD, a Daniel G. Clair, MD, a and Vikram S. Kashyap, MD, a Cleveland, Ohio

Table II. Complications related to brachial artery access

<table>
<thead>
<tr>
<th>Complication</th>
<th>Patients (n = 21), No. (%)</th>
<th>Need for surgical repair, No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pseudoaneurysm</td>
<td>11 (52)</td>
<td>5</td>
</tr>
<tr>
<td>Brachial artery thrombosis</td>
<td>7 (33)</td>
<td>7</td>
</tr>
<tr>
<td>Hematoma</td>
<td>3 (14)</td>
<td>1</td>
</tr>
</tbody>
</table>
Other access

- Axillary artery
- Radial artery
- Popliteal artery
- Tibial/pedal artery access
Access needle

• Single wall or double wall puncture needle technique

Fig. 4  Single-wall or double-wall puncture technique.  (A) The single-wall puncture needle has a beveled tip that is placed into the anterior wall of the artery.  (B) The double-wall puncture needle has a trochar with a sharp beveled tip that is inserted through the artery.  (C) The needle is removed.  (D) The blunt tip outer casing is then gradually withdrawn until its tip is in the arterial lumen and pulsatile backbleeding is evident.
Access needle

• Micropuncture (21 G) versus standard (18 G)
  – Can access smaller vessel
  – Allow confirmation of appropriate access to anterior wall of vessel
  – Potential to lower risk of access related vessel injury
Closure Techniques

- Manual compression

- Closure device
  - Extravascular plug
  - Suture mediated
  - Mechanical closure
  - Compressive assistance
  - Others
Manual Compression

• Most practical method
• Reverse anticoagulation (ACT <150, INR <2)
• Arterial puncture 5 minutes/Fr sheath size
• Moderate pressure is usually sufficient to obtain hemostasis

• Venous puncture 5-10 minutes
Closure Techniques

• Extravascular Plugs
  – Angioseal
  – mynxGrip
  – FISH

• Suture mediated
  – Proglide, Prostar

• Mechanical closure
  – Star close SE

Contraindication
• Low puncture
• Moderate plaque
• Small femoral artery (<5 mm)
Closure Techniques

- Extravascular Plugs
  - Angioseal
  - mynxGrip
  - FISH
Closure Techniques

• Extravascular Plugs
  – Angioseal
  – mynxGrip
  – FISH
Closure Techniques

- Suture mediated
  - Proglide, Prostar
- Mechanical closure
  - Star close SE
Closure Techniques

- Compressive assistance
  - Femostop
  - Catalyst III
Complication

• Systemic (<1%)
• Catheter-induced
• Access site
  – Hematoma (3%), major <0.5%
  – Bleeding (0.9%)
  – Arteriovenous fistula (0.9%)
  – Thrombosis (2%)
  – Pseudoaneurysm (0.6%)
  – Infection (rare)

Real-Time Ultrasound Guidance Facilitates Femoral Arterial Access and Reduces Vascular Complications

FAUST (Femoral Arterial Access With Ultrasound Trial)

Arnold H. Seto, MD, MPA,* Mazen S. Abu-Fadel, MD,† Jeffrey M. Sparling, MD,† Soni J. Zacharias, MD,† Timothy S. Daly, MD,† Alexander T. Harrison, MD,* William M. Suh, MD,* Jesus A. Vera, MD,* Christopher E. Aston, PhD,‡ Rex J. Winters, MD,§ Pranav M. Patel, MD,* Thomas A. Hennebry, MB, BCH, BAO,† Morton J. Kern, MD*
### Table 3. Intraprocedural Outcomes

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Fluoroscopy (n = 500)</th>
<th>Ultrasound (n = 502)</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of attempts</td>
<td>3.0 ± 3.2</td>
<td>1.3 ± 0.9</td>
<td>&lt;0.000001</td>
</tr>
<tr>
<td>First pass success</td>
<td>232 (46.4%)</td>
<td>415 (82.7%)</td>
<td>&lt;0.000001</td>
</tr>
<tr>
<td>Venipuncture</td>
<td>79 (15.8%)</td>
<td>12 (2.4%)</td>
<td>&lt;0.000001</td>
</tr>
<tr>
<td>Number of arterial punctures</td>
<td>1.14 ± 0.43</td>
<td>1.09 ± 0.36</td>
<td>0.076</td>
</tr>
<tr>
<td>Mean time to insertion, s</td>
<td>213 ± 194</td>
<td>185 ± 175</td>
<td>0.016</td>
</tr>
<tr>
<td>Median time to insertion, s</td>
<td>148 (102–242)</td>
<td>136 (90–212)</td>
<td>0.003</td>
</tr>
</tbody>
</table>

Values are mean ± SD, n (%), or median (interquartile range).

### Table 4. Vascular Access Complications

<table>
<thead>
<tr>
<th>Complication</th>
<th>Fluoroscopy (n = 501)</th>
<th>Ultrasound (n = 503)</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hematoma ≥5 cm</td>
<td>11 (2.2%)</td>
<td>3 (0.6%)</td>
<td>0.034</td>
</tr>
<tr>
<td>Pseudoaneurysm</td>
<td>0</td>
<td>1</td>
<td>NS</td>
</tr>
<tr>
<td>Dissection</td>
<td>3</td>
<td>2</td>
<td>NS</td>
</tr>
<tr>
<td>Access bleeding, transfusion</td>
<td>2</td>
<td>1</td>
<td>NS</td>
</tr>
<tr>
<td>Hematoma with DVT</td>
<td>1</td>
<td>0</td>
<td>NS</td>
</tr>
<tr>
<td>Any complication</td>
<td>17 (3.4%)</td>
<td>7 (1.4%)</td>
<td>0.041</td>
</tr>
</tbody>
</table>

Values are n (%) or n.

DVT = deep venous thrombosis.
Marginal evidence that APCD are effective
increase risk of hematoma (RR 1.89, 95% CI 1.13-3.15)
Pseudoaneurysm (RR 5.40, 95% CI 1.21-24.5)
Time to hemostasis was shorter (mean difference 17 minutes (range 14-19)
Conclusion

• Access site complications are the most common potentially preventable complication during angiogram

• Ultrasound can be very helpful especially in difficult access

• Compression device has been shown to considerably reduce time to hemostasis, however the complication rate still relatively high
Questions?

Thank you

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