DIFFICULTIES IN TRANSSEPTAL PUNCTURE

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Indications for Transseptal Puncture

• Left atrial and ventricular catheterization in EP procedures

• Percutaneous mitral valve repair

• LAA closure
Interatrial septum and foramen ovale
A patent foramen oval (PFO) is present by echocardiographic evaluation or by probe in approximately one-quarter of the population.

It is located in the anterosuperior border of the FO and may be either direct or a long tunnel.

In approximately two-thirds of patients, the fossa is paper thin, and the catheter can be passed into the LA with gentle pressure and rotation of the dilator.

Relative to the normal site of transseptal puncture, it is both superiorly and anteriorly directed and can lead to difficulty in accessing the more posteroinferior pulmonary veins.

Dilatation of the left atrium will tend to direct the FO more posteriorly.

It has also been shown that a more posterior location is common with increasing age, possibly through the same mechanism.

Dilatation of the aortic root will tend to direct the FO in a more posterior direction.
How to perform a safe Transseptal Puncture?
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Tips and tricks for a safe puncture

- Characteristic **jump** felt when the needle crosses over the FO
- **Anatomical markers** (pigtail in the aorta, His and CS catheters)
- Recording of **left atrial pressure** waveform
- **Staining of the FO**
- Advancement of a guidewire in a left pulmonary vein
- Withdrawal of oxygenated blood from the transseptal needle
- **Tented FO** (TEE or ICE guidance)
- Appearance of bubbles in the left atrium after saline injection through the needle (ICE guidance)
Pigtail in the ascending aorta
Left atrial pressure monitoring
Sharp tenting of dye around the tip of the transseptal puncture system
Difficulties with transseptal puncture

- Dilated atria
- Dilated aorta
- Aneurysmal anomaly
- Fibrosed septum from previous transseptal punctures
- Artificial and pericardial patch

Difficulties to engage FO
Significant septal tenting or an aneurysmal anomaly
# Troubleshooting the difficult case: Use TEE or ICE...

<table>
<thead>
<tr>
<th>Problem</th>
<th>Cause</th>
<th>Possible Solutions</th>
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<tr>
<td>Fossa ovalis anatomically displaced</td>
<td>Anatomic variation, atrial dilation, cardiac rotation, congenital heart disease</td>
<td>Direct visualization of atrial septum with ICE or right atrial angiography</td>
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<tr>
<td>Aneurysmal fossa ovalis</td>
<td>Congenital</td>
<td>Hydrate patient to expand atrial volume ICE “Extra sharp” transseptal needle</td>
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<td>Direct needle toward far lateral atrial wall</td>
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<td>Radiofrequency-powered transseptal needle</td>
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<tr>
<td>Thick, scarred fossa ovalis</td>
<td>Congenital or previous transseptal puncture(s)</td>
<td>ICE “Extra sharp” transseptal needle</td>
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<tr>
<td></td>
<td></td>
<td>Radiofrequency-powered transseptal needle</td>
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<tr>
<td>Repaired ASD/PFO</td>
<td>Congenital</td>
<td>ICE</td>
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<td></td>
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<td>Cross pericardial or Dacron patches directly or at periphery</td>
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<td>Cross septum at periphery mechanical closure devices</td>
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Complications of the transseptal puncture

• The most usual complications are:
  • pericardial effusion
  • aortic puncture
  • perforation of the right or left atrial wall
  • thrombus formation
  • iatrogenic ASD
  • ST-segment elevation
Case presentation
Case presentation
Pericardial sinuses: the oblique and the transverse
Transseptal Access for Left Atrial Ablation: The Catheter-Probing Techniques Are Not Without Risk

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Risk of Catheter-Probing During Transseptal Access. Background: Transseptal puncture (TP) is a prerequisite for LA ablations. LA access can be gained by catheter probing in case of PFO (trans-PFO method) or puncture of the interatrial septum (IAS) using a transseptal needle. A 2nd access can again be gained via PFO, a 2nd TP or catheter probing of the previous puncture site (probe-TS method). This study investigates the risk factors and complications related to the mode of transseptal access.

Methods and Results: From August 2010 to August 2012, a total of 544 LA ablations were performed. The mode of LA access was either a double TP or a single TP followed by the probe-TS or the trans-PFO method, respectively. TP was always guided by TEE and was successfully performed without complications in all cases. In contrast, 6/410 patients (1.5%) in whom catheter probing was performed (probe-TS, n = 4, trans-PFO, n = 2) had a dissection of the superior IAS originating from inside the oval fossa (n = 5) or perforation above the oval fossa (n = 1). Perforation into the pericardial space occurred in 4/6 patients, leading to one cardiac tamponade. In 5/6 patients, LA ablation was successfully completed, after repeated TP, despite effective anticoagulation. Patients with complications had the following characteristics: LA size 46 ± 4 mm, persistent AF (5/6), a repeat transseptal procedure (3/6) and a right-sided pouch (RSP, 5/6).

Conclusions: Interatrial septum dissection/perforation, occasionally with perforation into the pericardial space, is an unreported complication of TP, especially with the catheter-probing techniques. An RSP is an unrecognized risk factor in this context and can be visualized by TEE. (J Cardiovasc Electrophysiol, Vol. 25, pp. 479-484, May 2014)
Septal anatomy with typical variations

- A complete fusion between the septum primum and secundum occurred along the entire zone of overlap in 29%, whereas lack of fusion between the septum primum and secundum resulted in a PFO in 28%.
- Fusion between the septum primum and secundum was limited to the inferior portion of the zone of overlap in 39%, leaving a left-sided pouch (LSP) accessible from the LA.
- In 4% fusion was limited to the cranial portion of the zone of overlap and resulted in a RSP, thus accessible from the RA.
Dissection of the interatrial septum (1.2%)
Perforation of the interatrial septum above the fossa ovalis (0.2%)
Interatrial septum dissection/perforation is an unreported complication of transseptal puncture.
The ablation catheter is trapped in a septal resistance, originating from inside the upper fossa

TAMPOONADE? NO!!!
“EVANGELISMOS” EXPERIENCE

• Initially, we used pigtail in the aorta and LA pressure MONITORING for safe punctures
• The last 5 years, we use His and CS catheters as anatomic markers for safe punctures
• TEE is used in all difficult cases
• NO DEATH
• NO SIGNIFICANT PERICARDIAL EFFUSIONS ATTRIBUTED TO TRANSSEPTAL PUNCTURE
“EVANGELISMOS” EXPERIENCE

• >1500 left atrial catheterizations

• 3 CASES WITH DISSECTION OF THE INTERATRIAL SEP'TUM AND 2 CASE WITH PERFORATION WITHOUT PERICARDIAL EFFUSION

• THE SEATH-DILATOR-NEEDLE APPARATUS MOVED VERY EASILY TO THE LEFT SIDE, GIVING THE IMPRESSION OF A PFO !!!

• THE ANGIOPLASTY GUIDEWIRE COULD NOT BE ADVANCED IN THE LEFT ATRIUM AND WAS DAMAGED WITHIN THE SEPTUM (ACCORDION SHAPE)
Take home messages

• The transseptal puncture is safe, but not 100%

• Overall, serious complications from transseptal catheterization are <1%

• Pericardiocentesis is an important part of transseptal puncture training

• TEE or ICE are very helpful in difficult cases

• A safe puncture requires "numbers" and "experience"

• An experienced electrophysiologist develops his own technique
Thank you very much for your attention

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This is a similar complication
• A His bundle catheter that is recording a His bundle always identifies the most inferior aspect of the non-coronary cusp of the aorta.

• As the needle/sheath assembly is withdrawn, an initial slight leftward jolt of the assembly is noted as it enters the RA, and then a second movement leftward occurs as the catheter tip approaches the level of the His bundle catheter, which is below the superior limbus of the fossa ovalis. At this level the RAO view confirms that the catheter tip is posterior to the site of the His bundle recording and angled posterior and parallel to the projection of the coronary sinus.

• Adjustments of angulation between 3 o'clock and 6 o'clock may be necessary, with enlarged left atria often requiring a more posterior (or 5 to 6 o'clock) angulation and vertically oriented hearts requiring a more anterior (3 to 4 o'clock) angulation of the needle.
Standard Equipment for Transseptal Puncture

- Two 63-cm standard 8.5F long sheaths
- J-tipped 0.032 inch guidewires
- A 71-cm Brockenbrough needle:
  - BRK
  - BRK-1
  - NRG Transseptal needle, Baylis Medical
- An angioplasty guidewire 0.014 or 0.016 inch
- Contrast media (optional)
- TEE (optional)