EMBOLIZATIONS of ANEURYMS AND FALSE ANEURYMS of DIGESTIVE ORIGINS
(a 15 years experience: 220 patients)

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THREE VERSUS FALSE ANEURYSMS?

**True aneurysm**

**Aetiology:**
- Atheroma
- Fibro dysplasia
- Elastic tissue disease
- Pregnancy alteration of the media and hyper blood flow

**History:**
- Fortuitous discovery
- Rupture rate 3-10%

To take charge:
- Survey
- Surgical treatment
- Endovascular treatment

**Loss of arterial wall parallelism > 1.5 of ∅**

**Respect of the three tunic of the wall**

**Sacciform**

**Fusiform**

Depends on:
- Clinical symptomatology
- Size
- Localisation, background....
THRUÉ VERSUS FALSE ANEURYSMS?

False aneurysm

Aetiology:
- Post-traumatic,
- Iatrogenic
- Inflammatory (pancreatitis)
- Infectious.

History:
- Symptomatic ++
- Haemorrhagic rupture > 95%

To take charge:
- All +++ (emergency conditions)
- Endovascular treatment with exclusion of the aneurysm and the pathological artery bearing.

Douane et al. JFR 2012
PREVALENCE?

- Incidence: 0.1 – 10 %
- But real prevalence not known.
- Fortuitous discovery frequent.
- Most of the aneurysms and false aneurysms are asymptomatic.
- Emergency situations: 22 %?
  - Hemorrhage
  - Rupture

*Splanchnic artery aneurysms.*

Pasha SF1, Głowiczki P, Stanson AW, Kamath PS.

1Division of General Internal Medicine, College of Medicine, Mayo Clinic, Rochester, MN 55905 USA.
MORTALITY

- Variable
- Depends:
  - Clinical presentation.
  - Localization
  - Status.

- No rupture: 1.2 %
- Rupture: 15.5 %
  - endovascular: 2.7 %
  - surgery: 23.7 %

- Rupture during pregnancy:
  - maternal: 75 %
  - fetal: 90 %

- Celiac trunk: 100 % mortality

*Cochennec et al. Eur J Vasc Endovasc Surg 2011
Popham et al. J Obst Anesth 2003*
Splanchnic artery aneurysms.

Pasha SF, Gloviczki P, Stanson AW, Kamath PS.

Division of General Internal Medicine, College of Medicine, Mayo Clinic, Rochester, MN 55905 USA.
CLINICAL DATA

- Sudden rupture (spontaneous hemorrhage) (70%).
- Post-traumatic - post operative causes (surgery, biopsies).
- Fortuitous discovery (US, CT, MRI).
WHEN TO TREAT: SIZE CRITERIAE?

Size ≥ 2 cm?

- ACC/AHA recommendations
- MAYOCLINIC Experience:
  - 168 SAA followed during 6 years (34% ≥ 2 cm): no rupture.
- Most of series:
  - No correlations between size and rupture.
  - No high level of proof.
  - Threshold value debatable.

Hirsch et al. JACC 2006
Cochennec et al. Eur J Vasc Endovasc Surg 2011
WHEN TO TREAT: OTHERS PARAMETERS?

- Age
- Sex: young woman ++
- Co-morbidity
- Localization: Pancreatic duodenal artery ++
- Caliber of the feeding artery.
- Etiology.
- Technical feasibility.
- Calcifications could protect:
  - 90% of the ruptures aneurysm were calcified!
WHEN TO TREAT THE ANEURYSMS: FINALLY?

False aneurysms:
- All!
- Consensus (authors)

True aneurysms:
- Size > 2 cm.
- Rupture.
- Symptomatic.
- Strong, rapid evaluation future pregnancy.
- Pancreatic-duodenal arcades.
- Portal hypertension.

Cochennec et al. Eur J Vasc Endovasc Surg 2011
MATERIALS and METHODS

• Etiologies: False aneurysms, aneurysms.
  – Abdominal traumatisms.
  – Pancreas surgery – retroperitoneal (kidney),
  – Cholecystectomy (cœlioscopy),
  – Aorta surgery (by-pass, aneurysm),
  – Acute-chronic pancreatitis,
  – Mycotic infection,
  – Complex vascular malformations.
TECHNICAL ASPECTS

• Sheath (6F) in the groin; approach catheter (5F)

• Micro-catheter is necessary 2.7F!

• "Packing technique": coils for supra-selective embolization.

• Stents and/or coils in selective cases (association).

• Occlusion of the concerned (afferent) artery.

• Others possibilities: glue, combined techniques (+++).
PACKING TECHNIQUES

• Preferable:
  – Sacciform
  – With or no:
    • non covered stent
    • remodelling balloon

• Advantages:
  – Respect of the feeding artery.

• Disadvantages:
  – Risk of recanalization (5 %)

_Loffroy et al. Eur J Vasc Endovasc Surg 2010_
SANDWICH TECHNIQUES

• Preferable:
  – Fusiform
  – Large neck
  – Proximal

• Advantages:
  – Often more easy.

• Disadvantages:
  – Ischemia risk of the downstream parenchyma
COVERED STENTING

• Preferable
  – Troncular ++

• Advantage
  – Respect of the feeding artery.

• Disadvantage:
  – Feasibility ?
    • Caliber, tortuosity's, buckles
    • Stent : Atrium V12 0.014 (5 - 7 millimeters ☺)
  – Restenosis ?
  – Pancreatic duodenal artery.
2004:
48 years old Female
Acute Abdominal pain with a preexisting well known chronic pancreatitis
CT Scan: localized enhancement within the pancreatic gland (corpus)

2004:

Arteriogram: cracking of the false aneurysm
Treatment: complete occlusion of the aneurysm, with micro-coils (Packing technique)
2004:

A 14 months later, MRA and MRI control

Normal aspect of the splenic artery

The false aneurysm is excluded
2014:
Left side pain (young woman)
CT: 3 calcified aneurysms (splenic artery).
2014: 
Angiography: multiple aneurysms on a displastic splenic artery. 
Treatment: “coiling-packing” for 2 localizations. 
Control angiogram: splenic ischemia !!
2014:
Distant MRA-MRI control.
Very localized splenic ischemia.
ANEURYSM-FALSE ANEURYSM
EMERGENCY SITUATIONS!
Case 2(a) 60 years woman.
Abdominal pain, hypovolemic shock.
CT: ruptured aneurism, Spleen hilum (hemo peritoneum)
2(b) Procedure: embolisation of a small branch coming from the splenic artery: aneurism exclusion. Ischemia of the upper part of the spleen.
2(c) Procedure: embolisation of a small branch coming from the splenic artery: aneurism exclusion. Ischemia of the upper part of the spleen.
2(d) CT control: aneurism is not visible, thrombosed. Spleen is normal.
Case 4

48 years old woman, abdominal hematoma 5 days after coelioscopy for umbilical herniation. Dissection of the ileocaeco-colo appendicular branch and false aneurism.
ARTERIAL HEMORRHAGIC
POST DPC
IATROGENIC COMPLICATIONS
(EARLY AND LATE)
CLINICAL DATA

- Old Technic (Whipple, 1935)
- Since the 80 years, development and standardization of the technic.
- Now post operative mortality < 5%.
- Morbidity higher with complications rate between 20-50%.
POST PANCREATECTOMY HEMORRHAGE

- Frequency: 1 - 8% of cases with a mortality (11 - 38%)

- Definition, due to the delay:
  - Early in the first 24h:
    - Technical problem (per-operative hemostasis)
    - post operative coagulopathy
  - Late after 24h:
    - vascular erosion (pancreatic fistula)
    - False aneurysm rupture
    - Anastomotic ulceration
Case 6(a)
75 years old patient de, DPC for degenerative TIPMP
Loss of red cells at J17
Case 6(b)
Case 6(c)
Case 11(a): 80 years old woman
Digestive hemorrhage 7 weeks after DPC
Case 11(b):
ANEURYMS-FALSE ANEURYMS
NOT IN THE
EMERGENCY SITUATIONS!
PANCREATICO DUODENAL ARCADES

• Hyper flow aneurysm (retrograde).
• Rare: 2 %
• Coeliac trunk stenosis (association): 50-80 %.
• Rupture risk: 50-75 %, independent of the size.
• In case of mortality rupture: high 25-50 %.
• Clinical presentation: hemophilia.

– Systematic treatment
– Sandwich +++ (numerous, large, anastomosis circles).
– To lift the obstacle (stenosis), not absolutely necessary.

Murata et al. AJR 2006
Weber et al. CardioVasc Interv Radiol 2005
Ikeda et al. CardioVasc Interv Radiol 2007
Case 13(a)
73 years old woman
CT: pancreatico-duodenal aneurysm, fortuitously discovered.
13(b)
CT control 2 days later.
Endovascular Treatment Results

Fig 4. Distribution of visceral artery aneurysms (VAA) and visceral artery pseudoaneurysms (VAPA) amongst the various visceral arterial beds. (SMA, Superior mesenteric artery.)

Table II. Distribution of elective and urgent interventions for visceral artery aneurysms and pseudoaneurysms with associated perioperative results

<table>
<thead>
<tr>
<th>Arterial bed</th>
<th>Urgent vs elective</th>
<th>No.</th>
<th>Mean size (mm)</th>
<th>Technical success (%)</th>
<th>30-day mortality (%)</th>
<th>End-organ ischemia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Splenic</td>
<td>Urgent</td>
<td>3</td>
<td>63</td>
<td>100</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Elective</td>
<td>17</td>
<td>28</td>
<td>100</td>
<td>0</td>
<td>5 (29)</td>
</tr>
<tr>
<td>Celiac axis branches*</td>
<td>Urgent</td>
<td>9</td>
<td>22</td>
<td>100</td>
<td>2 (22)</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Elective</td>
<td>5</td>
<td>32</td>
<td>80</td>
<td>0</td>
<td>1 (20)</td>
</tr>
<tr>
<td>SMA</td>
<td>Urgent</td>
<td>1</td>
<td>20</td>
<td>100</td>
<td>1 (100)</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Elective</td>
<td>1</td>
<td>22</td>
<td>100</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Hepatic</td>
<td>Urgent</td>
<td>9</td>
<td>16</td>
<td>100</td>
<td>1 (11)</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Elective</td>
<td>3</td>
<td>53</td>
<td>100</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

*Except splenic/hepatic.
Endovascular treatment versus surgery?

Table III. Location and classification of aneurysms treated by either endovascular or open techniques

<table>
<thead>
<tr>
<th>Aneurysm*</th>
<th>Endovascular (n = 35)</th>
<th>Open (n = 24)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Splenic</td>
<td></td>
<td></td>
</tr>
<tr>
<td>True</td>
<td>14</td>
<td>11</td>
</tr>
<tr>
<td>Pseudo</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Hepatic*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>True</td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>Pseudo</td>
<td>10</td>
<td>4</td>
</tr>
<tr>
<td>Celiac trunk</td>
<td></td>
<td></td>
</tr>
<tr>
<td>True</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Pseudo</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Gastrointestinal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>True</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Pseudo</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Superior mesenteric artery</td>
<td></td>
<td></td>
</tr>
<tr>
<td>True</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Pseudo</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Pancreaticoduodenal artery</td>
<td></td>
<td></td>
</tr>
<tr>
<td>True</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Pseudo</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

*The P values for these aneurysms were not significant except for hepatic (P = .002).

Table V. Complications, reinterventions, and 30-day mortality after open or endovascular repair of aneurysms involving branches of the celiac and superior mesenteric arteries*

<table>
<thead>
<tr>
<th></th>
<th>Endovascular (n = 35)</th>
<th>Open (n = 24)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complications</td>
<td>9</td>
<td>8</td>
</tr>
<tr>
<td>Reinterventions</td>
<td>7</td>
<td>4</td>
</tr>
<tr>
<td>Deaths ≤30 days</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

*The P values for these data are not significant.

Endovascular 2.4 days ≠ Surgery 6.6 days

Case 14(a)
57 years old man.
Acute pancreatitis.
Duodenal bleeding, false aneurysm in the gastro-duodenal artery.
Case 14(b)
Failure of GD catheterism
Case 14(c) other modality: Onyx Glue®
Digestive Arteries
Aneurysms and False Aneurysms

Complex forms and Modalities

The Difficulties

- Endovascular approach, due to a tortuous artery (splenic).
- Exact localization of the aneurysm (bi-tri-furcation).
- Supra-selective catheterism.
- Complementary modalities of treatment:
  - Coïls
  - stent (open and covered)
  - belonging, leaving (departure) arteries embolization
  - glue utilization
Case 15(a)
60 years old woman. Aneurysm trifurcation. Splenic artery embolization and covered stent in the coeliac trunk and the common hepatic-artery
15(b)
Aneurysm trifurcation.
Splenic artery embolization and covered stent in the coeliac trunk and the common hepatic-artery

Before

After
Case 18(a)

Fortuitous coeliac-trunk discovery
18(b): combined treatment, open stent and coiling through the meshes
18(c)
CT control
Case 19(a)
69 years old woman.
Previous aorta operated aneurysm.
Distant complications: coeliac trunk false aneurysm and 2nd localization on the splenic artery.
Surgery before embolization: hepatic artery is “re-implanted” (on the abdominal aorta).
19(b)
Interventional procedure
19(c) Coeliac trunk embolization (coïls and plugs). Control angiogram
19(d)
Early CT control
19(e)
3 months MRA-MRI control
Cas 21(a)
33 years old women. Recklinghausen.
2 aneurisms in a tortuous splenic artery
21(b): supra selective embolization (2 sites)
21(c)
MRI control
CONCLUSIONS

- The percutaneous aneurysms embolization's (false aneurysms) represent an interesting alternative to the surgical conventional treatment (size < 3 cms).
- The pre-procedure explorations must be specially precise and accurate.
- The endovascular treatment is to realize by an expert radiological team.
- In almost all cases the permeability of the afferent artery is preserved and the rate of complications is inferior to those of the surgical conventional procedures.
- The "packing technique" allows a complete definitive treatment in almost cases.
- It is necessary to have an access of the neck's aneurysm
- For the following, MR-MRA explorations would be preferred.
- This technique can be used, naturally in others anatomic regions.
Case 22(b)
Case 22(c)