DUPLEX PRE OPERATIVE MAPPING

APPLICABILITY OF PERCUTANEOUS AVF CREATION BASED ON A PROSPECTIVE ULTRASOUND EVALUATION

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Disclosure

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| I have the following potential conflicts of interest to report: |
| Consulting |
| Employment in industry |
| Shareholder in a healthcare company |
| Owner of a healthcare company |
| Other(s) |

- I do not have any potential conflict of interest
STATEMENT OF THE PROBLEM

- AVF at wrist is the first option for vascular access creation (KDOQI, EBPG) despite:
  High early thrombosis and non-maturation rate ranging from 5 to 50%

- PERFORATING VEIN AT CUBITAL FOSSA
  Valuable resource for the creation of a vascular access
  Surprisingly it doesn’t take any place in the recommendations of AVF creation

WHEREAS

- Easy to perform surgically or now better PERCUTANEOUSLY
  Allows future construction of AVF using the predilated veins if necessary: CV-BV-BR VEINS
Percutaneous AVF creation with ELLIPSIS® vascular access system between deep communicating vein (DCV) and proximal radial artery (PRA) Needs to meet specific anatomic criteria
The specific study of the deep communicating vein (DCV) at the elbow is not part of the usual vascular mapping except when it is the only drainage of the veins of the forearm. But now, the advent of percutaneous AVF creation makes this study mandatory.
Knowledge of the venous arrangements of the cubital fossa may imply better outcomes and lower complications rates of the procedure
**SPECIFIC US INVESTIGATION**

The assessment before percutaneous AV fistula is focused on the antecubital fossa.

**SPECIFIC EXAMINATION INCLUDES**

- DCV wall quality & Ø
- Distribution of venous M
- Patency of CV/BV
- Relationship with the PRA
- Quality of PRA wall and Ø
- Patency of brachial veins

- Spontaneous drainage flow
- Tourniquet above the elbow and proximal
- Drainage test below the tourniquet
Proximal radial artery is about 30% bigger than distal radial artery. Even if the wall is thickened it remains most of the time free of calcification at the origin facilitating puncture.
LOCALISATION OF THE PERFORATING VEINS OF THE UPPER EXTREMITY

- DCV at ELBOW: CONSTANT
- Ø 2 to 5 mm Ø AVERAGE :3.6 mm

- 20 to 30 CONSTANTS PERFORATORS AT FOREARM WITH VARIABLE DISTRIBUTION
- Ø AVERAGE FOREARM PERFORATORS: 1 mm

DCV is the most voluminous perforator with a mean Ø of 3,6 mm among 20 or 30 tiny perforators at forearm

PATTERN TYPES OF SUPERFICIAL CUBITAL VEINS

Venous arrangement shows regional, side and gender differences among populations.

GENDER:
♂: higher frequencies Type 1-7
♀: higher frequencies Type 3

INDIAN/JAPANESE:
lesser frequencies of type 1
higher frequencies of type 2

MALAY:
higher frequencies Type 3

INDIAN:
higher frequencies of type 4

TYPE 1 M /Y/V
20-25%

TYPE 2 N or H
44-60%

TYPE 3 I or O
4-11%

Type 4
3-4%

Type 5
2.4%

Type 6
4.5%

Type 7
13%

Type 8
8%

CV = cephalic vein; BV = basilic vein; MAV = median antebrachial vein; MCuV = median antecubital vein; MBV = median basilic vein; MCV = median cephalic vein; ACV= accessory cephalic vein
The “M” of the elbow veins
- 3 parallel branches + V
  - medially: the basilic vein
  - laterally: the cephalic vein
  - middle: the median cubital vein

Capital “V”:
- medially: the median basilic vein
- laterally: the median cephalic
- Perforator vein at the point of the V

DOWNSTREAM?
CRANIO-CAUDAL OBLIQUE

Many anatomical variation exist that must be investigated and reported on the shema. Some are less favorable to the creation and development of the AVF such as these which are eccentric with incomplete or rudimentary venous disposition.
Duplex is easy to perform and provides all necessary information often on a single scan as on this longitudinal plane. It is of easier understanding contrary to invasive and expensive investigations.
DCV VALVELESS VEIN

BEFORE AVF CREATION
SPONTANEOUS FLOW DIRECTION: from deep to superficial vein
BIDIRECTIONAL FLOW OBTAINED BY COMPRESSION

Testut, Jacob. 1952
Testut, Latarjet. 1958
Gardner. 1978
Goss. 1977,
Latarjet, Liard. 1993,
Moore. 2014
US-ANATOMY of ANTECUBITAL FOSSA

Longitudinal duplex-scan of antecubital fossa: Relationship between (1) RA - PV (2) and vena comitans (3)

Radial artery and DCV are close to each other

Junction of the veins and distribution of different ascending blood streams are displayed thanks to rock and roll maneuver, slight lateral motion of the probe
High bifurcation of brachial artery can cause problems because the distance between the vein and the artery can be too important to safe percutaneous creation.

- Schwalbe, 1898; Breme, 1899; Muller, 1903; Adachi, 1928; Skopakoff, 1959; Wankoff, 1962; Fuss 1985

**BILATERAL HIGH BIFURCATION: DISTANCE > 3 mm**
A FIRST PROSPECTIVE STUDY OF 100 NAIVE CONSECUTIVE PATIENTS REFERRED TO THE VASCULAR LAB PRIOR TO FIRST AVF CREATION WAS CARRIED OUT TO ASSESS THE FEASIBILITY OF P.AVF CREATION

- 100 PATIENTS
- 67 men
- 33 women
- Mean age: 61 years (range 21-87 SD 20.8)

A total of 200 limbs were investigated
# ELIGIBILITY CRITERIA

<table>
<thead>
<tr>
<th>DEEP COMMUNICATING VEIN</th>
</tr>
</thead>
<tbody>
<tr>
<td>NORMAL VENOUS WALL</td>
</tr>
<tr>
<td>DIAMETER ≥ 2.0 mm</td>
</tr>
<tr>
<td>DIRECT AND COMPLETE DRAINAGE TOWARD AT LEAST ONE SUPERFICIAL VEIN AT THE ARM</td>
</tr>
<tr>
<td>DEPTH &lt; 1 cm</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ARTERY</th>
</tr>
</thead>
<tbody>
<tr>
<td>PROXIMAL RADIAL ARTERY WITH NORMAL WALL OR AT LEAST FREE OF CALCIFICATION</td>
</tr>
<tr>
<td>DIAMETER ≥ 2.0 mm</td>
</tr>
</tbody>
</table>

| ANATOMICAL VARIATION ARE MENTIONED      |

| ARTERIAL-VENOUS DISTANCE ≤ 1.5 mm      |
| BDP and DBI WERE RECORDED IF ANY CONCERN ABOUT ISCHEMIC RISK |
In 69 % of the limbs : proximal radial artery (PRA) has a diameter ≥ 2 mm suitable to P.AVF CREATION
In 31 % of the limbs : radial artery (PRA) has a diameter < 2 mm
In 84% of the limbs DCV diameter was ≥ 2 mm
DISTANCE between RA and DCV

In 88% of the limbs distance between PRA and DCV was ≤ 1.5 mm
RESULTS/LIMBS

ELIGIBILITY

100 limbs (50%)
- PRA ≥ 2mm
- DCV ≥ 2 mm
- A-V Distance ≤ 1,5 mm

37 patients (37%)
- 62 limbs (31%): PRA < 2mm
- 32 limbs (16%): DCV < 2mm
- 24 limbs (12%): distance > 1,5 mm

INEGIBILITY

26 (26%) UNILATERAL

74 (37%) BILATERAL

45% ♀
23% ♂
RESULTS/PATIENTS

ELIGIBILITY

63 patients (63%)
• PRA ≥ 2mm
• DCV ≥ 2 mm
• A-V Distance ≤ 1,5 mm
• MCV or MBV at least

INEGIBILITY

37 patients (37%)
• 15 patients (15%): no superficial veins
• 14 patients (14%): too small vessels
• 8 patients (8%): distance > 1,5 mm

26 (26%) UNILATERAL

37 (37%) BILATERAL
### ANATOMICAL VARIATIONS

<table>
<thead>
<tr>
<th>ANATOMICAL VARIATIONS</th>
<th>PATIENT</th>
<th>UNILATERAL</th>
<th>BILATERAL</th>
<th>LIMBS</th>
<th>HBRA</th>
<th>HBUA</th>
</tr>
</thead>
<tbody>
<tr>
<td>26</td>
<td>26%</td>
<td>19%</td>
<td>7%</td>
<td>33</td>
<td>31</td>
<td>2</td>
</tr>
<tr>
<td>26%</td>
<td>19%</td>
<td>7%</td>
<td>33 (16.5%)</td>
<td>31 (15.5%)</td>
<td>2 (1%)</td>
<td></td>
</tr>
</tbody>
</table>

**Frequency of anatomical variations by patient and limbs**
- HBRA: High birth of radial artery
- HBUA: High birth of ulnar artery

**PITFALLS RELATED TO ARTERIAL ANATOMICAL VARIATIONS**

DISTANCE DCV-PRA > 1.5 mm / 42%
or
PRA Diameter < 2 mm: 48%

**ONLY 6 P.AVF 23 %**
CONCERN ABOUT P.AVF CREATION?

Suitable vessels for a SUCCESSFULL distal AVF creation were found in 91 extremities (45%)

BUT

ONLY IN 17% in patients over 70 years old

Among the 100 limbs eligible for percutaneous arteriovenous fistula, only 30 (30%) were eligible for distal AVF

it is therefore more than ever necessary to set up multidisciplinary concertation meetings in order to avoid any detrimental effect
CONCLUSION I

- This is the first prospective study of naives consecutive patients

- Half of the limbs in two third of the patients are eligible

- Regardless of the lack of median basilic or cephalic vein:
  74% of patients would have been suitable for P.AVF creation
  underlying the need for preservation of venous capital at the elbow

- However these results are less optimistic than in the retrospective study:
  J E Hull:87.9% feasibility (29 patients /33 limbs)

THE STUDY OF:

- Deep communicating vein
- Proximal radial artery
- Relationship between them

Should now be part of the basic assessment
Prior AVF creation
To discuss the possibility of P.avf
THANKS FOR YOUR ATTENTION ANY QUESTIONS? NO? GREAT!