Internal Jugular Vein Location and Anatomy on Ultrasound

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Internal Jugular Vein Location and Anatomy on Ultrasound

- Introduction
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Introduction
Venous access

- Peripheral
- Central
  - Jugular
  - Subclavicular
  - Femoral
  - PICC
- Mixed (surgical)
Jugular catheterisation

- Landmark approach
  - (1) Anterior
  - (2) Central
  - (3) Posterior
  - (4) Supraclavicular

- Ultrasound-guided
  - Indirect
  - Direct (RTUS)
    - LAX (in-plane)
    - SAX (out-of-plane)

US SAX
Problem?
Goals

• To investigate the incidence of anatomical variants of the internal jugular vein

• To express a relationship between these variants and specific patient characteristics

• To assess whether certain variants yield an increased risk of complications
Methods
Methods

- Informed consent after ethical approval
- 50 patients to be included
- Patient positioning
  - Trendelenburg (10-15°)
  - Right-sided (unless contra-indicated)
  - Head rotated contralaterally (CAVE extreme rotation)
- RTUS
  - Linear transducer (BK Medical)
  - High frequency (10-12 mHz)
  - SAX
  - @ level of cricoid
- Timing
  - From start needling until aspiration of blood over catheter
Parameters

• Patient-related
  o Gender
  o Age
  o ...

• Ultrasonographic
  o Vein diameter
  o Vein position relative to the ICA

• Outcome
  o Success rate
  o Time until success
  o Number of attempts
  o Complications
Parameters

- Patient-related
  - Gender
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  - ...
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Results
Diameter

**Average:**
Diameter: 13.11 mm  
Cross-sectional area: 135.52 mm²

**Side:**
Left (12.85 mm) vs. right (13.17 mm)  
p = 0.85

**Gender:**
♂ (12.48 mm) vs. ♀ (13.73 mm)  
p = 0.42
Diameter
Diameter
Diameter

Age:
\[ \rho^* = -0.06 \]

Length:
\[ \rho = 0.05 \]

Weight:
\[ \rho = 0.11 \]

BMI:
\[ \rho = 0.09 \]

* Pearson’s correlation coefficient
Position

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<td>12 (100)</td>
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Position

Side:
Left (83%*) vs. right (29%)
RR 2.86; 1.39-5.86**
p = 0.03

Gender:
(right)
♂ (25%) vs. ♀ (33%)
RR 0.75; 0.21-2.66
(left)
♂ (100%) vs. ♀ (67%)
RR 1.5; 0.67-3.34

* Percentage of cases with significant overlap
** 95% confidence interval
Position

Age:
\[ \rho = 0.04 \]
Outcome measures

- **Success rate**
  - 28 / 30 (93.5%)

- **Number of attempts**
  - Difficult cannulations (more than 3 attempts): 3 / 30 (of which 2 failed)

- **Time until success**
  - Average: 03:54 (00:50 to 11:08)
  - Longer in...
    - Left-sided cannulation
    - Smaller veins
    - Significant overlap
    - Presence of co-assistants in a 10ft radius

- **Complications**
  - Unsuccessful cannulation: 2 / 30 (6.5%)
  - Accidental arterial puncture: 2 / 30 (6.5%)
Complications based on ...

- **Side**
  - Left 2 / 6 (33.33%) vs. right 2 / 24 (8.33%)
  - RR = 4 (not statistically significant)

- **Diameter**
  - Average diameter in complicated (12.04 mm) vs. non-complicated cannulations (13.27 mm)
    - p = 0.63
  - Complication rate in smallest quartile (25%) vs. larger veins (9.09%)
    - RR 2.75 (not statistically significant)

- **Position**
  - Complication rate with non-significant 0 / 18 (0%) vs. with significant overlap 4 / 12 (33.33%)
    - p = 0.02
Discussion
Landmarks versus ultrasound

**Literature**

- Higher success rate with US in a shorter time window, in general and at first attempt (98% vs. 87%)\(^1,2\)
- Lower general complication rate (13.5% vs. 3.9%)\(^1\)
- Higher failure rate in left-sided cannulation\(^5\)

**Study**

- Success rate of 93.5% (attempts performed by residents)
- General complication rate 13% (attempts performed by residents)
- Higher failure rate in left-sided cannulation (not statistically significant)
Vein diameter

**Literature**

- Higher failure rate in smaller vessels\(^3\)

- Left IJV is more often the smaller vein (and is less prone to dilation with Valsalva manoeuvre)\(^4\)

- Higher failure rate in left-sided cannulation\(^5\)

**Study**

- Higher failure rate and longer time until success in smaller vessels (not statistically significant)

- Difference in right- and left-sided vein not significant

- Higher failure rate in left-sided cannulation (not statistically significant)
Vein position

**Literature**

- The IJV often locates more anteriorly to the artery (41.9%) with a variable degree of overlap\(^6\)

- The vein tends to overlap more in the elderly and when the head is rotated contralaterally, and to a lesser extent on the left side and in men\(^6\)

**Study**

- Significant overlap in 40%

- Higher degree of significant overlap on the left side (83% vs. 29%)

- No strong correlation with gender and age

- Higher complication rate when significant overlap is present
Conclusion
What we already knew

• Real-time ultrasonographic guidance for central line placement increases success ratio and decreases the risk of complications

• Smaller vessels are more difficult to cannulate

• The left IJV is often smaller than the right one

• The IJV often does not lie lateral to the ICA but more anteriorly with a varying degree of overlap
What this study adds

- On average the left IJV tends to overlap with the ICA to a further extent than the right one does.

- The hypothesis that an anteriorly located IJV yields an increased risk of complications has been confirmed.
Limitations

• Relatively small sample size

• Central line placement performed by residents

• Different residents, not always same performer

• Study was not powered for VJI puncture complications
References
References


