US-guided central venipuncture techniques currently used: an overview

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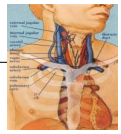
GAVeCeLT

WINFOCUS

INSERTION PROTOCOL



Standardized technique of venipuncture

VEIN	APPROACH	VEIN SCAN	NEEDLE/US BEAM
First choice: Internal jugular	Low lateral	Short axis	In plane
Other choices:			
Brachiocephalic	Supraclavicular	Long axis	In plane
Subclavian	Supraclavicular	Long axis	In plane
Axillary	Infraclavicular	Short axis	Out of plane
Axillary	Infraclavicular	Long axis	In plane
Internal jugular	Axial approach	Short axis	Out of plane

US-guided venipuncture

- Which vein?
- Which approach?
- Which technique of US venipuncture?

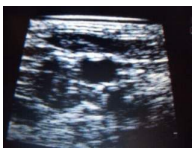
Which vein? Which route?

- Internal jugular vein
  - Jernigan
  - Axial
- Brachiocephalic vein
- Subclavian vein
  - Supra-clavicular
  - Infra-clavicular
- Axillary vein (thoracic)
- Cephalic vein (thoracic)
- External jugular vein (deep neck)

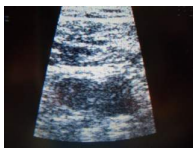
Which US technique?

- 'out of plane' venipuncture
  - Needle is visualized only when enters the vein
- 'in plane' venipuncture
  - Complete control of the needle trajectory
  - Requires more skill

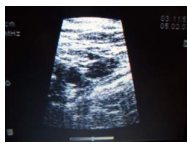
'out of plane'



IJV axial approach

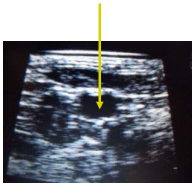


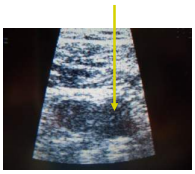
Femoral vein

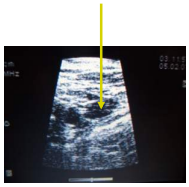


Axillary vein, infraclavicular

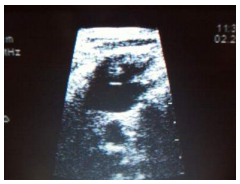
‘out of plane’

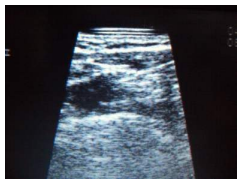

IJV axial approach


Femoral vein

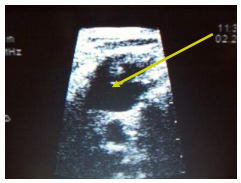

Axillary vein, infraclavicular

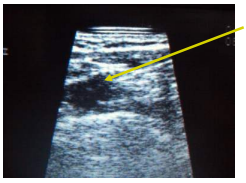
‘in plane’ - transversal


IJV Jernigan approach

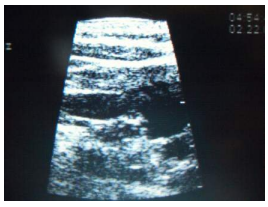

Brachiocephalic vein

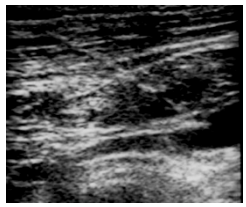
‘in plane’ - transversal


IJV Jernigan approach

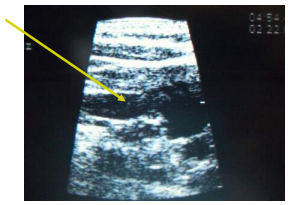

Brachiocephalic vein

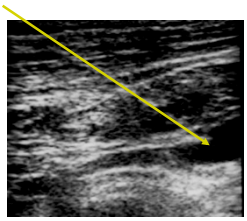
‘in plane’ - longitudinal


Subclavian vein, supraclavicular


Axillary vein, infraclavicular

‘in plane’ - longitudinal

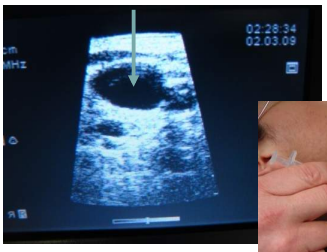

Subclavian vein, supraclavicular

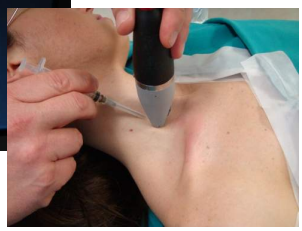

Axillary vein, infraclavicular

Which are the most common ‘central’ approaches?

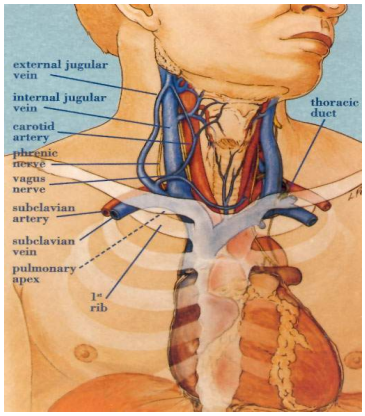
- Internal jugular vein
  - Jernigan (in plane)
  - Axial (out of plane)
- Brachio-cephalic (innominate) vein
- Subclavian vein
- Axillary vein
  - Out of plane
  - In plane

Internal jugular vein, axial approach, 'out of plane'

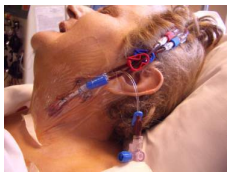


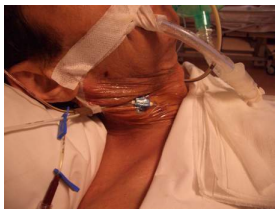


- IJV, axial approach: not as a first choice!
  - Risk of arterial puncture and/or haemothorax
  - For non-tunnelled CVC: high risk of infection (difficult dressing of the exit site)
  - For tunnelled CVC: high risk of malfunction due to neck movements and or kinking of the catheter (if the needle has passed through the muscle)

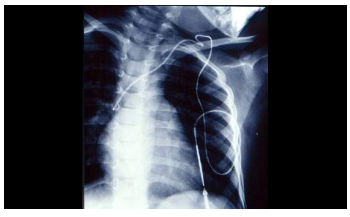


- high risk of infection (difficult dressing of the exit site)

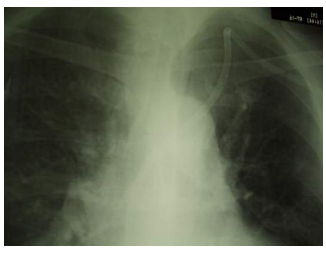




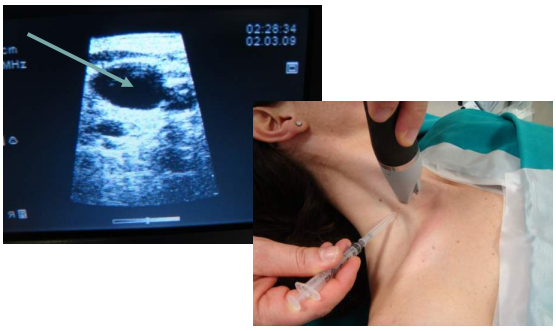
- Kinking of the catheter (tunnelled Groshong)

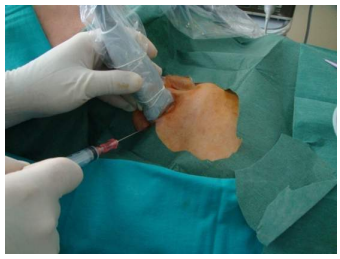


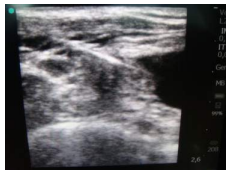
- Kinking of the catheter (long term access for dialysis)



Internal jugular vein, Jernigan approach, 'in plane'

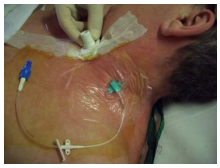


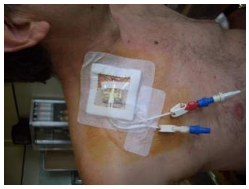




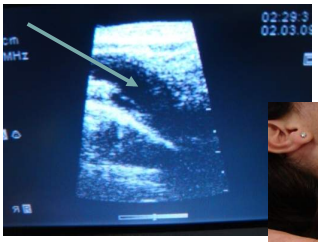
- IJV, Jernigan approach:
  - No risk of subclavian or carotid artery puncture
  - For non tunnelled CVC, easier management of the exit site
  - For tunnelled CVC, no risk of kinking

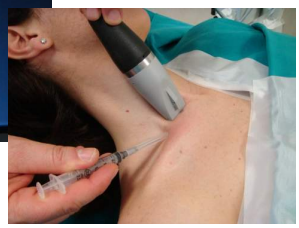
- Jernigan: easier management of the exit site





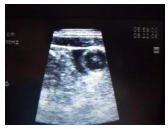
Innominate vein, lateral approach, 'in plane'

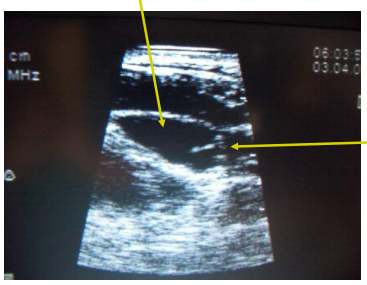


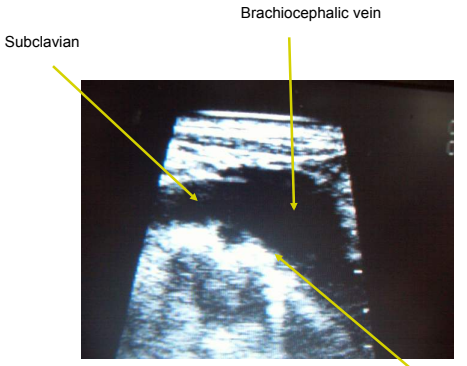


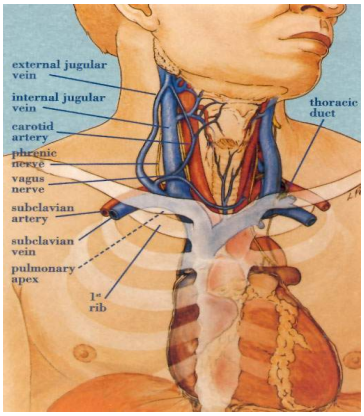
'in plane' technique: IJV or BCV ?

- IJV = smaller
- IJV = diameter variable during breathing
- IJV = passage of the guidewire sometimes may be difficult
  - Angle of the needle
  - Valve
  - Physiological stenosis at the IJV-BCV junction
  - IJV compressed by carotid

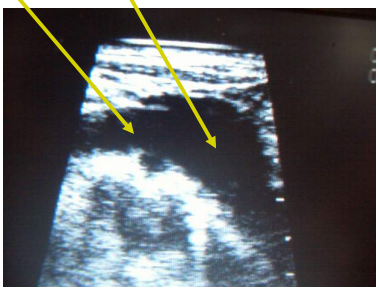




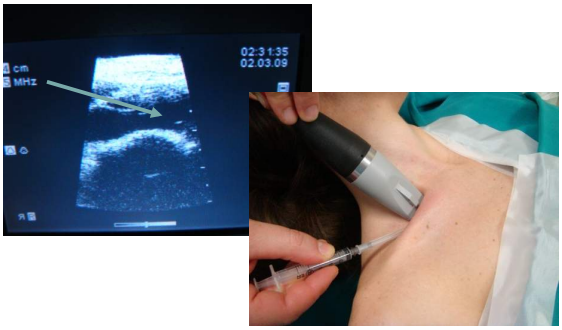




Direction of the needle when puncturing 'in plane'



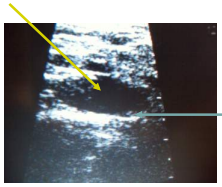
Subclavian vein, supraclavicular approach,'in plane'



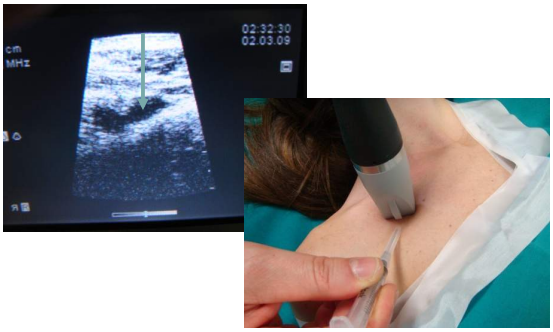
Subclavian venipuncture

- Exclusively supraclavicular
- There is still a minimal risk of pnx
  - Non-expert operators

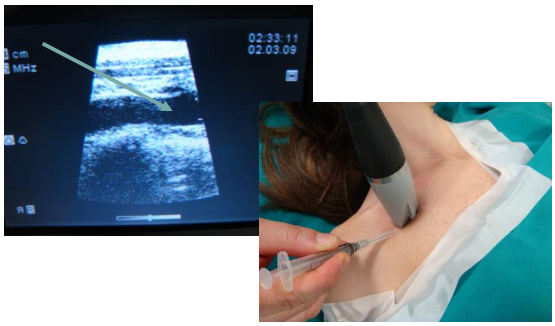
needle



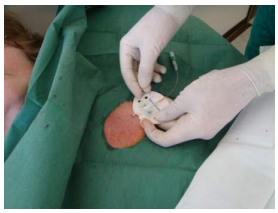
Axillary vein, infraclavicular approach, 'out of plane'

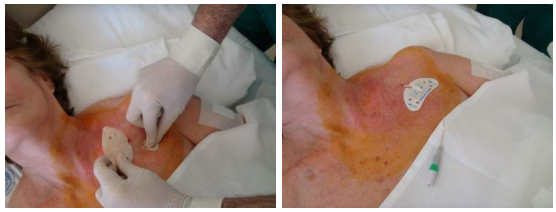


Axillary vein, infraclavicular approach, 'in plane'

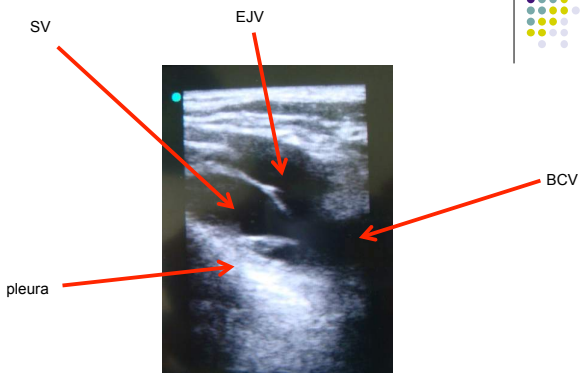


- Axillary vein (infraclavicular approach).
  - Anatomical limit between SV/AV: edge of the first rib)
  - Both 'in plane' and 'out of plane'
  - microintroducer with soft straight tip is recommended
  - Easier management of the exit site
  - no risk of pnx
  - No risk of 'pinch-off' (typical of long term CVC inserted by 'blind' subclavicular approach)





- Cephalic vein (thoracic)
  - Technique described by LeDonne
  - Evident below and parallel to the clavicle
  - 'in plane' puncture
  - May be difficult (small vein)
  - microintroducer with soft straight tip is recommended
  - Sometimes, difficult passage of the guidewire into the axillary vein



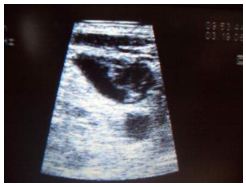
- External jugular vein
  - 'deep neck' approach (close to the IJV/SV junction, parallel to the SV)
  - 'in plane' puncture
  - Not always evident
  - Sometimes, difficult passage of the guidewire into the subclavian vein

- Femoral vein
  - 'out of plane' puncture
  - Sometimes difficult
    - May be very deep
    - May be completely behind the artery
  - May be punctured 'high' or 'low'
  - High risk of infection if exit site is in the groin
  - High risk of catheter related venous thrombosis (large bore CVC)

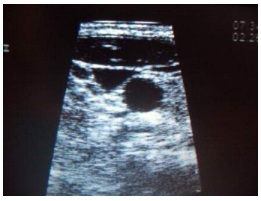
Final considerations

- We suggest to evaluate each case and choose the approach most likely to be easy and safe in that patient, in that anatomical and/or pathological situation

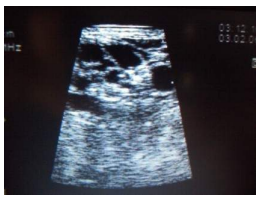
- COMMON SENSE BASED MEDICINE: avoid veins with evidence of thrombosis !

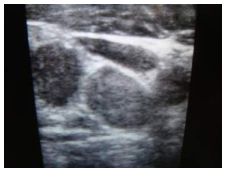


- COMMON SENSE BASED MEDICINE: avoid very small veins!

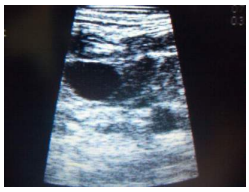


- COMMON SENSE BASED MEDICINE: avoid veins surrounded by lymphonodes!





- COMMON SENSE BASED MEDICINE: avoid veins partially compressed by hematomas!



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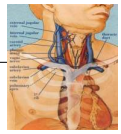

Standardized technique of venipuncture

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First choice:			
Internal jugular	Low lateral	Short axis	In plane
Other choices:			
Brachiocephalic	Supraclavicular	Long axis	In plane
Subclavian	Supraclavicular	Long axis	In plane
Axillary	Infraclavicular	Short axis	Out of plane
Axillary	Infraclavicular	Long axis	In plane
Internal jugular	Axial approach	Short axis	Out of plane

Final considerations (2)

- Before the procedure, perform a rapid exam of the four main central veins (IJV, BCV, SV, AV) and choose the approach most likely to be easy and safe in that specific situations, taking into account:
  - Characteristic of the vein
  - VAD to be inserted
  - Risk of infection
  - Pathological findings
  - ……

Thank you for your attention

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