Central Line Use & Establishment (C.L.U.E.) – Part I

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NOTICE

- The following slides accompany Dr. David Ciceri’s Central Line Use and Evaluation lectures.
- If your residency program does not require attendance at Dr. Ciceri’s lectures, you may use this program as a joint conference.
Outline

1. Indications
2. Rule of 3
3. Site selection
4. Site preparation
Outline

4. Routes of cannulation
   A. Internal jugular
   B. Subclavian
   C. Femoral
5. Pulmonary artery catheterization
6. Insertion complications
Indications for Central Lines

- Inability to establish peripheral access
- Infusion of ‘irritant” medications
- Invasive hemodynamic monitoring
- Parenteral nutrition
- Hemodialysis / plasmapheresis
- Transvenous pacemaker
- Air embolism - therapeutic
Rule of 3

• Only attempt 3 passes in a non-emergent situation

• If unsuccessful:
  • Request the assistance of a more experienced colleague.
  • Utilize ultrasound guidance (IJ)
  • Select a New site
Site Selection
Subclavian vein

- Volume resuscitation*
- Traumatic brain injury
- Cannot tolerate Trendelenberg’s position
- TPN
- Anticipated prolonged duration
- Ongoing CPR
Site Selection
Internal Jugular Vein

- Preoperative catheterization
- Pulmonary compromise or mechanical ventilation
- Hemodialysis
- Pulmonary artery catheterization
- Transvenous pacemaker
Site Selection
Femoral veins

- Unable to lie supine
- Coagulopathy
- Volume resuscitation*
- During airway management
- During CPR*
Site Preparation

- 2% chlorhexidine solution
- 30 second scrub
- Generous area
Site Preparation

- Wash hands
- Cap & mask
- Sterile gown
- Sterile gloves
Site Preparation

- Large drape covering patient’s head and body
  - Raad et al. Infect Control Hosp Epidemiol 1994
- Any contamination – discard equipment
Introducer / Dilator Assembly
Internal Jugular Cannulation

- Indication
- Informed consent
- Appropriate monitors (ECG, other)
- Prep area
- Don cap, mask, gown, & gloves
- Drape patient (maximal sterile barriers)
Internal Jugular Cannulation

Patient Positioning

- Trendelenberg’s position
- Arrange finder needle, introducer needle, and guidewire in field of vision
Internal Jugular Cannulation
Patient Positioning

Slight rotation of head
Internal Jugular Cannulation

Anatomy
Internal Jugular Cannulation
Central Approach

- Apex of triangle
- Gently palpate carotid
- Insert needle lateral to carotid artery
- Local anesthesia
- 22 gauge finder needle
Internal Jugular Cannulation
Central Approach

- Local anesthesia
  - Skin wheal
  - SC tissue
- 22 gauge finder needle
Internal Jugular Cannulation

- 30 - 45° angle
- Aim at ipsilateral nipple
- Advance slowly
- 3 – 5 cm depth
- If no venous blood, slowly withdraw while aspirating gently
Internal Jugular Cannulation
Alternative Approach

- Identify cricoid cartilage
- Gently palpate carotid artery at level of cricoid
- Insert needle just lateral to carotid
- 30° - 45° angle
- Aim at ipsilateral nipple
Internal Jugular Cannulation
First Pass Negative

- Are you sure of landmarks?
- Change angle slightly medial or lateral
  - Do not violate plane of carotid artery

- **Rule of Three**
  - Remember anatomic variation

- Consider ultrasound guidance

- Request assistance from more experienced colleague

- Different site
Internal Jugular Cannulation
After Venipuncture with Finder Needle
Internal Jugular Cannulation
After Venipuncture with Finder Needle

• Insert introducer needle
  – Advance introducer needle over anterior aspect of finder needle while finder needle is still in place
  – Remove finder needle & insert introducer at same insertion site & angle*

• Venous blood aspirated

• Negative with introducer needle → Finder needle
Internal Jugular Cannulation
After Venipuncture with Introducer Needle

- Fix needle to patient with left hand (RIJ)
- Drop angle of needle slightly
- Reconfirm easy flow of blood
- Insert guidewire 15 – 20 cm
  - J tip first
  - Rotate guidewire gently
- Remove introducer needle while fixing guidewire in place
Confirming Venous Placement

- Visual inspection unreliable
  - Hypotensive patient
  - Compressed vessel
- Color of aspirated blood
  - Hypoxemic patient
  - Unreliable in routine use
- ABG – impractical
- Transducing needle – impractical
- Ultrasound confirmation – good
- Best = column of blood with angiocath & IV tubing
Internal Jugular Cannulation

Confirm Venous Placement

- Place 2 inch angiocath over guidewire & into vessel
- Remove guidewire & reload it onto carrier
Internal Jugular Cannulation
Confirm Venous Placement

- Occlude angiocath lumen with finger
- Attach short length of sterile IV tubing to angiocath
- Allow tubing to passively fill
Internal Jugular Cannulation
Confirm Venous Placement

- Elevate tubing
- Allow blood meniscus to fall with gravity
- Reinsert guidewire
- Remove angiocath
Internal Jugular Cannulation

- Make skin incision with scalpel
  - Generous at skin
  - Avoid incising IJ vein
  - Aim edge lateral and away from carotid artery
Internal Jugular Cannulation

- Insert dilator or assembled introducer/dilator over guidewire
- Rotate slightly
- Insert dilator to vessel depth but not entire length
Internal Jugular Cannulation

- Remove dilator while fixing guidewire in place*
- Gauze
- Insert central line over guidewire
- Depth of insertion
  - RIJ = 15 to 17 cm at skin
  - LIJ = 17 to 19 cm at skin
- Remove guidewire
Internal Jugular Cannulation

- Take the patient out of Trendelenberg’s position
- Aspirate and flush each lumen
- Suture central line in place
Catheter Site Care

- No antimicrobial ointment
- Sterile dressing
  - Semiocclusive, transparent
  - Gauze
  - Cover all stopcocks
OBTAIN AND REVIEW CXR
Internal Jugular Cannulation

Complications

• Carotid artery puncture
  – Management
• Dysrhythmias
• Pneumothorax - LIJ
• Vessel erosion
• Thrombosis
• Infection
• Chylothorax – LIJ
• Horner’s syndrome, phrenic nn injury, other
Internal Jugular Cannulation
Ultrasound Guidance

• Improves rate of successful cannulation
• Increases success on first attempt
• Decreases number of arterial punctures
• Techniques
  – Use of needle-guide
  – “Free-hand”
  – Ultrasound localization
Subclavian Vein Cannulation

- Indication
- Informed consent
- Appropriate monitors (ECG, other)
- Don cap, mask, gown, & gloves
Subclavian Vein Cannulation

Patient Positioning

- Supine or Trendelenberg’s position
- Turn head away from side of cannulation
- Do not place roll between shoulders
- Arms at patient sides
- Prep area
- Drape patient (maximal sterile barriers)
Subclavian Vein Cannulation
Preparation

- Arrange finder needle, introducer needle, and guidewire in field of vision
- Orient bevel of introducer needle with markings on syringe
Subclavian Vein Cannulation
Anatomy
Subclavian Vein Cannulation
Infraclavicular Approach

- Identify junction of medial and middle thirds of clavicle
- Identify suprasternal notch
- Identify superior aspect of ipsilateral clavicle
- Maintain needle orientation parallel to floor at all times
Subclavian Vein Cannulation

Infraclavicular Approach

- Insertion point 2 – 3 cm inferior & 2 – 3 cm lateral to genu of clavicle
- Delto-pectoral groove
- Local anesthesia
  - Skin wheal
  - Path towards superior aspect of ipsilateral clavicle at sterno-clavicular junction
  - Periosteum of clavicle
Subclavian Vein Cannulation
Infraclavicular Approach

• Introducer needle with syringe with small amount of saline
• Insertion point 2 – 3 cm inferior & 2 – 3 cm lateral to genu of clavicle
• Expel skin plug
• Advance towards superior aspect of ipsilateral clavicular head
Subclavian Vein Cannulation

Infraclavicular Approach

- “Walk” needle down clavicle
- Advance needle along inferior-posterior aspect of clavicle while gently aspirating
- If venipuncture doesn’t occur, slowly withdraw needle while gently aspirating
- Direct second attempt slightly more cephalad
Subclavian Vein Cannulation
Infraclavicular Approach

- When venous blood is aspirated, rotate bevel of needle in an inferior direction
- Advance guidewire 15 – 18 cm
- Remove needle
- Make skin incision with scalpel
Subclavian Vein Cannulation

Infraclavicular Approach

- Introduce dilator or assembled introducer/dilator for PAC
- Remove dilator while fixing guidewire in place
Subclavian Vein Cannulation
Infraclavicular Approach

• Gauze
• Insert central line over guidewire
• Depth of insertion
  – RSC = 14 to 16 cm at skin
  – LSC = 16 to 18 cm at skin
• Remove guidewire
• Aspirate and flush each lumen
• Suture central line in place
OBTAIN AND REVIEW CXR
Subclavian Vein Cannulation

Complications

- Pneumothorax
- Dysrrhythmias
- Arterial puncture
- Thromboembolism
- Infection
Pulmonary Artery Catheterization

Indications

- Area of great controversy
- Monitor not therapy
- “Expert” use only
- Careful risk – benefit assessment in each patient
Pulmonary Artery Catheterization

Pre-insertion Check
Pulmonary Artery Catheterization
Pre-insertion Check
Pulmonary Artery Catheterization
Pre-insertion Check
Pulmonary Artery Catheterization
Pre-insertion Check
Pulmonary Artery Catheterization
Pre-insertion Check
Pulmonary Artery Catheterization

Insertion

- Pass catheter through introducer into vein $\approx 15 - 20$ cm
- Inflate balloon fully
Pulmonary Artery Catheterization
Insertion
Pulmonary Artery Catheterization
Insertion
Pulmonary Artery Catheterization

Insertion
Pulmonary Artery Catheterization
Insertion
Pulmonary Artery Catheterization After Obtaining Initial PAOP

- Deflate balloon by disconnecting syringe
- Slowly reinflate balloon while monitoring pressure waveform
Pulmonary Artery Catheterization
After Obtaining Initial PAOP

- Note insertion distance
  - 45 cm from RIJ or RSC
- Volume to inflate balloon
  - < 1 cc = too distal
- Safest position = most proximal
- Catheter will migrate
Pulmonary Artery Catheterization
OBTAIN AND REVIEW CXR
Complications

- Dysrrhythmias
- RBBB
- Pneumothorax
- Arterial puncture
- Catheter knotting
- Infectious
- Thrombosis
- Pulmonary artery perforation
- Pulmonary infarction
- Intracardiac injury
- Air embolism
- Balloon rupture
- Heparin-induced thrombocytopenia
- Mesmerism
- Misinterpretation
- Therapeutic misadventure
C.L.U.E. - 2004

- 2 lectures – insertion, use & complications
- Assigned reading material
- Written examination
- Patients > 5 years of age
- 15 supervised & documented IJs
- 15 supervised & documented SCs
Summary

- Indications
- Rule of 3
- Site selection
- Site preparation
- Routes of cannulation
  - Internal jugular
  - Subclavian
  - Femoral
- Pulmonary artery catheterization
- Insertion complications
The End

- If you are taking this program as a joint conference, proceed to the post test
- Print off the post test
- Complete the post test
- Return the post test to Dr. S. Oliver
- Room 407i TAMUII
Post Test Question One

An indication for a Central Line is:

1. Inability to establish peripheral access
2. Infusion of ‘non-irritant” medications
3. Non-invasive hemodynamic monitoring
4. Maintenance IV fluids
Post test Question two

Rule of Three means
1. It usually requires 3 attempts to insert a CVP.
2. After 3 attempts to insert a CVP choose a different insertion technique.
3. Request the assistance of a more experienced colleague after 3 failed attempts.
Post Test Question 3

Your patient requires a CVP for hemodialysis. Which of the following is the most appropriate site?

A. Internal jugular
B. Subclavian
C. Femoral
Post test Question 5
Dr. Ciceri recommends which of the following to prepare the CVP site:

A. 70% alcohol and a 30 second scrub
B. Iodophors and a 60 second scrub
C. 2% chlorhexidine solution and a 30 second scrub
Post Test Question 5

You have just inserted a Internal Jugular Vein CVP. The best means to confirm venous placement is:

1. Visual inspection
2. Assess color of aspirated blood
3. Order an ABG
4. Passive filling of a column of blood with angiocath & IV tubing
Post Test Question 6

The last step in the insertion of a pulmonary artery catheter is:

Obtain and review _______