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Collecting Blood from Patients with Vascular Lines

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Outline

- Vascular lines
- Sample contamination
- Options for collecting blood in patients with lines
- Investigating contamination

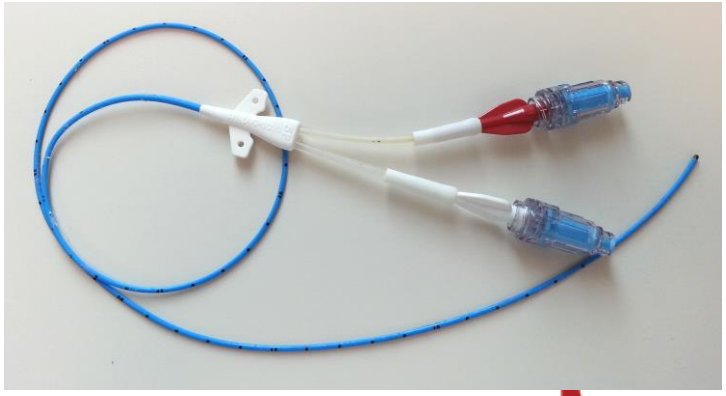
Vascular Lines

Commonly used in medical practice

- Infuse range of simple (0.9% NaCl) or complex (TPN) fluids
- Provide access for frequent blood collections

Infusions in, blood out

- Central venous catheter (CVC)
- Peripheral intravenous (IV) line
- Arterial line
- Venipuncture



Options for Blood Collection: What Does the Evidence Say?

Central and peripheral lines are generally acceptable

- Most studies included limited tests – basic chemistries, CBC
- Few report interference data, e.g., hemolysis

Common techniques for collection

- Most collections: Pause infusion for at least 2 min
- Line draw: Waste blood – at least 2x dead volume
- Venipuncture: Opposite arm or distal (below IV)

Most studies fairly old

- Reviews in Mohler et al., Himberger & Himberger

Risk of Sample Contamination

Infusate contamination presents the greatest risk when collecting blood from lines

- Non-equilibrated mixture of blood and other fluid/compound

Basic mechanisms

- Fluid in line dilutes blood collected
  - Fluid components → falsely high or normal
  - Other blood components are diluted → falsely low
- Infused materials, e.g. some drugs, adsorb to line
  - Release into blood during collection → falsely high
- Infusion is not fully equilibrated in bloodstream

Equilibration

Mixing

- Healthy heart circulates full blood volume roughly 1X/min
- 2 min wait = 2 body volumes, generally adequate circulation to equilibrate infused material throughout the bloodstream
- Pausing 2 min can greatly improve specimen collection

Some exceptions to the rule

- Some substances (Mg, Ca, PO_4, TPN) may take longer
- Likely delay from distribution into cellular compartment
- No conclusive study, mostly anecdotal
- No evidence-based standard for how long to wait

Options for Blood Collection: Line Draws

Preferred by patients and care team

Proper procedure is key to avoid contamination

- Turn off infusions for at least 2 min
- Flush the line with saline
- Waste blood: 2 times catheter dead-space volume (non-coagulation testing); 5 mL or 6 times dead-space volume for coagulation studies

Other considerations

- Order of draw, inverting to mix, etc.
- Minimize hemolysis

Options for Blood Collection: Peripheral IVs

Convenient but higher rates of hemolysis

- Collecting blood at IV start common in emergency rooms
- CDC LMBP strongly support venipuncture as a best practice

Evidence suggests technique can reduce hemolysis risk

- Large-bore needles, at least 21-gauge
- Place IV in antecubital fossa rather than distal
- Partial-vacuum tubes rather than full-vacuum or syringe

Peripheral IVs: Hemolysis at IV start

An example of hemolysis (H-index) at IV start:

	H-index			H-index	
ID #	IV	Venipuncture	ID #	IV	Venipuncture
1	1952	19	9	11	35
2	183	0	10	11	15
3	175	21	11	6	4
4	64	24	12	5	31
5	63	20	13	3	4
6	44	9	14	1	3
7	39	4	15	0	0
8	13	2	16	0	2

Options for Blood Collection: Venipuncture

Some advantages over line collections

- Less risk of hemolysis
- May be best for specific samples, e.g., TDM
- Less frequently contaminated

Avoiding contamination:

- Use the opposite arm if IV is running fluids
  - Caution with glucose, lipids
- Distal (below IV) after pausing a minimum of 2 minutes
- Proximal (above IV) only as last resort

Investigating Potential Specimen Contamination

Suspect specimen contamination if:

- Na & Cl normal, other basic tests (e.g., K, Hgb) very low
- Absurd/critical results that do not fit patient's status
- Unexpectedly high drug levels without dose change

Questions to think about when investigating:

- How was the specimen collected? Does the patient have a line?
- What (if anything) was being infused before collection?
- Was the infusion paused, and if so, for how long?
- Could wrong order of draw explain the results?

Conclusions

Vascular lines present opportunities and risks

- Possibility to collect blood without venipuncture
- Higher likelihood of hemolysis, peripheral > central
- Potential for contamination of line draws and venipunctures

Proper procedure is key

- Line draws: Pause, Flush, Waste
- Venipuncture: Pause(?), Opposite>Distal>>>Proximal

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