Emergency Department Workflows
Data-driven approaches to common questions

Christine Snozek, PhD, D(ABCC)
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Disclosures

Relevant Financial Relationship(s):
Nothing to Disclose

Off Label Usage:
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Outline

• Different points of view: ED and lab
• The big questions:
  • Who draws the blood?
  • How much blood should we draw?
  • What do we do with the blood?
• Summary and questions

The ED is a unique environment

• More diverse patients than most clinical areas
  • Range of issues/diseases presenting
  • Arrivals unpredictable, vary throughout day
• Many EDs use nurse-driven ordering protocols
• Intense pressure on time from door-to-door (LOS), either admitted or sent home
• Emphasis can be less on getting the exact right answer, more on getting patient to the right area
Challenges for the Lab

- Phlebotomists & lab staff in ED
  - Staff full-time in ED vs float as needed
  - Additional duties, e.g., performing POCT
- Unique arrivals & protocols
  - Stroke, trauma, etc. met by swarm of staff
  - Triage orders (stat) plus numerous add-ons
- Balancing good practice with ED/patient needs
  - Reducing multiple sticks for add-ons
  - Optimizing turnaround time

ED and lab? Or ED vs. lab?

ED perspective
- TAT = pt arrival to result
- FAST, correct answer
- LOS is door-to-door
- Goal is patient care
- Data needed to make effective decisions

Lab perspective
- TAT = collect to result
- CORRECT answer, fast
- LOS is entire admission
- Goal is patient care
- Data needed to make effective decisions

“The practices used are largely dependent upon the personal preference of the ED medical staff” Heyer et al.
Some notes about our system

• Mayo Clinic Arizona
  • 24-bed ED, plus overflow areas
  • No trauma or peds, 85-120 arrivals/day
  • ED and hospital lab are across a hallway
  • Pneumatic tube used for most samples
  • 1 phlebotomist in ED 24/7, more as needed
  • All blood drawn by phlebotomy unless patient has central line (nurse collect)

Question 1: Who draws the blood?
Who draws the blood?

- ED perspective
  - ED techs or nurses are often already accessing patient’s veins (IV start)
  - Drawing at IV start saves the patient a stick and (in theory) saves time

- Lab perspective
  - Hemolysis, labeling, etc. are common issues
  - High-quality samples prevent re-draws
  - Challenging to staff phlebotomists in ED

What do the data show?

- Few (mostly small) studies, conclusions vary
- Studies from the nursing perspective:
  - Mohler et al., peripheral IV vs venipuncture
    - Up to 50% differences in K⁺, AST, LD
    - No discussion of hemolysis
  - Himberger & Himberger, PIV vs VP
    - <3% differences outside of CLIA limits
    - 28% data “lost” – not collected or reported
  - Both looked at IVs currently in use, i.e., not at time IV first started
Hemolysis in ED samples

- Reviewed by Heyer et al. 2012
  - Best practice guideline / literature review
  - Hemolysis in ED: 6.8-19.8%, up to >30%
  - Looked specifically at VP vs IV start, also practices to reduce hemolysis from ED

- Best practice: use new, straight-needle venipuncture rather than existing IV access
  - VP reduces hemolysis risk by 84%
How much hemolysis is too much?

• MCA internal study: 16 IV vs VP pairs
  • 6 (38%) IV had H >40, 3 (19%) H >100
  • 1 IV had H >1950 – no testing possible

• We collect blood on ~70 pts/day in our ED
  • Drawing from IV stick = 20% re-collections
  • Actual recollects for K+, AST = ~1.7%
  • Recollection/repeat (45-60 min delay)
    • 1 in 50 patients using venipuncture
    • 1 in 5 patients if we used IV start

Heyer et al., continued

• If IV starts must be used:
  • Antecubital IV consistently reduces hemolysis (55%) vs more distal sites
  • Larger bore (≤21 gauge) IV reduces hemolysis by 63%; data were “inconsistent”
  • Partial vacuum reduces hemolysis by 89% relative to full vacuum; data “suggestive”
  • No difference, syringes vs vacuum tubes

Note – placing IV in the antecubital fossa is not common practice at many institutions, for patient comfort & IV flow
Who draws the blood: How can you answer this at your institution?

- Consider (with data) the following:
  - Staff – How many phlebotomists needed? How much ED nurse/tech time spent if IV draw used?
  - Timing – Is overall efficiency gained from IV draws worth more re-collections?
  - Safety/quality – Do lab and ED staff have PPID for collections? What are typical error rates (mis-ID, missing info from label) for lab vs ED staff?
  - Other considerations – Special populations (peds), other quality issues (order of draw), additional processes (blood bank collections)

Question 2: How much blood should we draw?
How much blood should we draw?

- **ED perspective**
  - Add-on tests are common, want results asap
  - Extra blood drawn up front cuts down on second VPs, wait time for add-ons

- **Lab perspective**
  - Many tests require unique tubes (e.g., coags), not amenable to add-ons
  - Extra blood means extra supplies, time, processing, archiving, discarding
  - Rainbow considered poor practice, higher risk

The “rainbow draw”

- Common practice of drawing pre-defined array of tubes regardless of what orders placed
  - Rationale: can draw before initial or add-on orders; gives extra volume for add-ons

- Wide variability in practice across institutions
  - Number/type of tubes included in rainbow
  - Whether any orders placed before draw
  - Labels on extra tubes (lab, chart, other)
  - How extra tubes are handled in lab
What do the data show?

- Seaver & Gray looked at costs of rainbow
  - Tubes had no orders or barcoded labels
  - Moved from rainbow on all ED pts to rainbow only when specifically ordered
  - >$200K/year saved (FTE, supplies)
- Mullen et al. consolidated 7 tubes to 2-4
  - Saved $20K/yr (supplies? Not stated)
  - Reduced number of tubes by 60%
  - Unexpected: cut hemolysis rate by 75%

Limitations of the data

- Not much available regarding ED concerns:
  - Frequency of add-on orders
  - Turnaround time for add-ons
  - Additional venipunctures
- Or of lab concerns beyond supply/FTE costs
  - Amount of blood wasted
  - Mis-labels and other quality issues
MCA internal study

Objectives:
- Explore ED staff perceptions re rainbow
- Document utilization of tubes drawn
- Determine typical rates for:
  - Add-on orders accommodated by rainbow
  - Other tests not captured in rainbow
  - Second venipunctures in the ED
  - Blood volume wasted

Rainbow draws at MCA

- 5 tubes, ~24 mL blood
  - Serum: 5 mL RST, 8.5 mL SST
  - Whole blood: 4 mL EDTA
  - Plasma: 2.7 mL blue, 4 mL gray

- Perceived value was high
  - Most ED and lab staff shared opinion that workflow depended heavily on extra blood
    - “We do a ton of add-ons”
ED staff perceptions

- Provider and nursing staff polled re utilization of tubes, add-ons, and second venipunctures

Utilization of tubes in rainbow

- Most gray (lactate) and blue (coag) tubes had initial orders – only ~3 pts/day add-on only
ED staff perceptions

- Does extra blood save pt second stick?

So is the rainbow worth it?

- All 5 tubes used in <10% of patients
  - ~1/2 of blue tops, 2/3 of gray tops wasted
  - Estimated blood wasted: 238 L/yr

- Drop blue and (later) gray, use 3.5 mL SST
  - Estimated blood wasted: 106 L/yr
  - No change in 2nd sticks or add-on blue tops (will evaluate gray this winter)
How much blood: How can you answer this at your institution?

- Consider (with data) the following:
  - Staff – Who draws blood? How many repeat VPs? How disruptive is 2nd stick vs. delayed add-on?
  - Safety/quality – How are “extra” tubes labeled? Typical blood volume wasted?
  - Other considerations – Can common add-ons and unique samples (e.g., cultures) be added into initial orders to reduce re-work?

Question 3: What do we do with the blood?
What do we do with the blood?

• ED perspective
  • Want results in the fastest possible time
  • POCT, on-site “stat” labs common requests

• Lab perspective
  • POCT, stat lab mean more validations, ongoing competencies & expense
  • Accuracy often compromised or at least biased relative to standard lab tests

• Who should run the tests, ED or lab staff?

Faster is always better, right?

• Some examples from the literature:
  • Introduction of a stat laboratory reduces emergency department length of stay, Singer et al. 2008
    • Median LOS from 466 min to 402 min
  • Use of a comprehensive metabolic panel point-of-care test to reduce length of stay in the emergency department, Jang et al. 2013
    • Median LOS from 372 to 350
  • Use of point-of-care testing and early assessment model reduces length of stay for ambulatory patients in an emergency department, Kankaanpaa et al 2016
    • “Process expedited” by 46 min
But is that the whole story?

• Published studies:
  • Generally focus on LOS, might include cost
  • Likely publication bias – no one publishes “POC did nothing to help our ED LOS”

• Issues rarely discussed:
  • Pts returning after ED discharge
  • Effect on admissions/treatment
  • Repeat testing after initial POC/stat labs
  • Extra workup related to lab results
  • Impact on lab & ED staff workflow

POCT…not the magic wand we were promised

• Issues we’ve seen
  • Distrust – docs order duplicates (POC & lab) or don’t order POCT at all
  • Handoff – ED techs busy, lab not staffed adequately to run POC
  • Quality – can’t detect hemolysis (K⁺), bias relative to lab tests used in rest of hospital
  • Sensitivity – troponin POC to rule out MI
  • Non-lab delay – pt not available, samples sitting after collection (UA project)
POCT: yes or no?

• Don’t use POCT as bandage for broken process
  • Is the lab TAT is really the issue?
  • Is POC menu adequate for clinical need?

• Considerations
  • Who will run the test (is handoff needed)?
  • How will blood be collected, labeled, etc.?
  • How often will test be used (competence)?
  • How well do results correlate to lab version?
  • Expense – include QC, PT, etc.

Stat/satellite lab

• Issues we’ve seen
  • Distrust of blood gas & smaller instruments
  • Not clear who’s allowed to use the lab
  • How to handle orders with non-stat labs – Extra tubes? Aliquots? IT-driven vs manual?
  • What hours to operate? If not 24/7, how to get notification when lab is needed?
  • Backup plan during PM or downtime?
The ED stat/satellite lab: yes or no?

• Main lab far from ED or just overwhelmed

• Considerations
  • What tests are needed & are small/bedside instruments available for them?
  • Are space, personnel, facilities available?
  • What are anticipated volumes from ED?
  • How much time will actually be saved?
  • Additional costs of duplication – reagents, QC, calibrators, lineairties, PT, instrument cross-checks, competencies, maintenance

What to do with the blood: How can you answer this at your institution?

• Consider the following:
  • Feasibility – What aspects of ED practice can actually be addressed with POCT/stat lab?
  • Utilization – Do providers (ED and non-ED) trust POC/satellite results? Is 20 min decrease in ED LOS offset by repeating labs upon admission?
  • Safety/quality – How will errors (e.g., hemolysis) and issues (e.g., failed handoffs) be tracked? What number of errors/issues can be tolerated?
  • Other considerations – What is game plan if POCT/stat lab fail to solve the problem?
Summary: Keep it data-driven

- ED & lab have common goal, different paths
  - Keep optimal patient care as primary focus
  - Gather data to answer questions and steer objective discussion
  - Pilot studies can be good – just make sure everyone agrees it’s a pilot!

- Times change
  - Use literature whenever possible
  - Re-evaluate data with changes: pt volumes, materials used, tests available

References

Questions & Discussion