Preanalytical cases for educational purposes

From the Nordic Scientific Working Group on Preanalytics

Case #1

- A 56-year-old man
- Admitted to the ED with alcohol-induced severe acute pancreatitis
- Blood tests were ordered
- Test results:
  - Blood glucose, 15.4 mmol/L
- Clinicians refuse to take action since there were no signs of hyperglycaemia
- Second blood sample drawn and transported to the laboratory
- Test results:
  - Blood glucose, 4.9 mmol/L

Anaesthesia 2013, 68, 1179–1187

Accidental hypoglycaemia caused by an arterial flush drug error: a case report and contributory causes analysis

K. J. Gupta and T. M. Cook

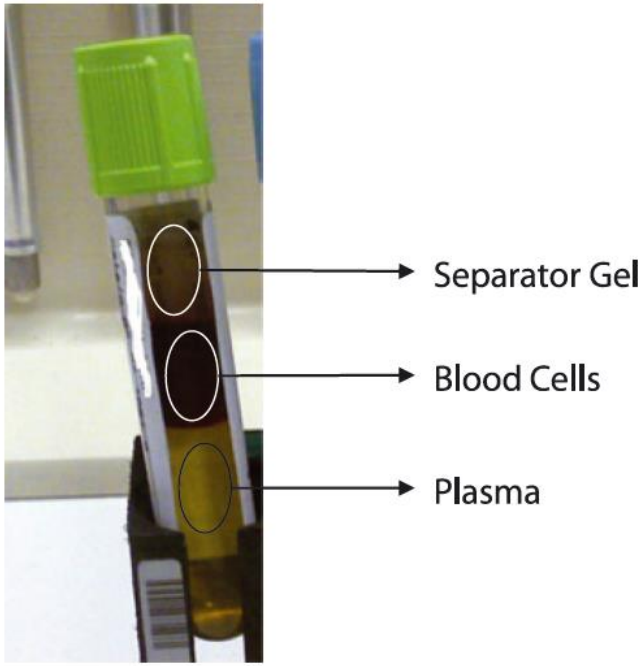
• First blood sample was drawn from **glucose-contaminated arterial blood line**, without appropriate flushing.

• **How do we avoid this??**

• **Education**
• **Education**
• **Education**

Case #2

- 50-year-old man
- Admitted to the ED for acute myocardial infarction
- Subjected to percutaneous coronary intervention (PCI)
- First blood sample drawn from femoral artery and transported to the laboratory
- Apperance of sample after standard centrifugation:



Biochemia Medica 2016;26(3):444–50

Abnormal gel flotation caused by contrast media during adrenal vein sampling

Gabriel Lima-Oliveira*[1], Giuseppe Lippi[2], Gian Luca Salvagno[1], Matteo Gelati[1], Antonella Bassi[1], Alberto Contro[3], Francesca Pizzolo[4], Gian Cesare Guidi[1]

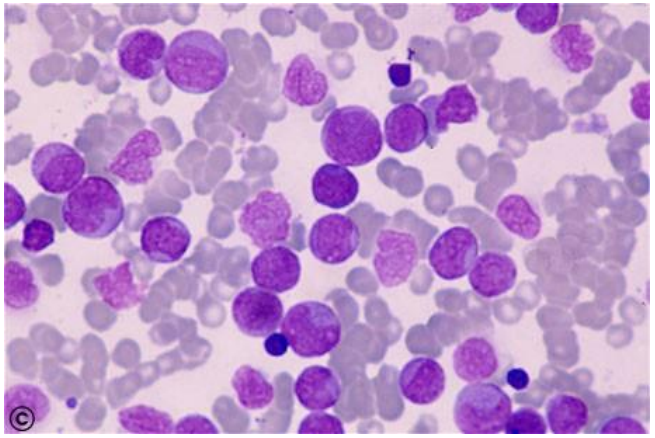
• Specific gravity of serum and plasma is 1.026-1.031 g/cm^3, and that of the clot is 1.092-1.095.
• Specific gravity of separator gels should be 1.03-1.09 g/cm^3 to permit its suitable positioning after centrifugation.
• The interfering substance was a **tri-iodinated nonionic water-soluble contrast dye**, 140 ml of which were administered to the patient before coronary revascularization

• **How do we avoid this??**

Case #3

- 72-year-old man
- Admitted to the ED for fatigue and dizziness lasting for days
- First blood sample drawn and transported to the laboratory by the PTS
- Test results:
  - WBC, 75 x 10^9/L
  - Hb, 5.0 mmol/L
  - Plasma potassium, 5.7 mmol/L
- No signs or symptoms of hyperkalemia
- Second blood sample drawn 45 after admission and manaully transported to the Lab
- Test results:
  - WBC, 78 x 10^9/L
  - Hb, 5.0 mmol/L
  - Plasma potassium, 3.9 mmol/L

• The patient is diagnosed with acute myeloid leukemia.
• Fragile **neoplastic leukocytes are injuried or destroyed** during PTS transportation, releasing potassium in the surrounding plasma.



Clinical Chemistry 64:5
782–790 (2018)

Mini-Review

Blood Sample Transportation by Pneumatic Transportation Systems: A Systematic Literature Review

Mads Nybo,[1*] Merete E. Lund,[2] Kjell Titlestad,[2] and Christian U. Maegaard[3]

Case #4

- 66-year-old man
- Hospitalized for colorectal cancer
- Routine (morning) blood sample drawn and transported to the laboratory
- Test results:
  - Creatinine, 82 μmol/L
  - Hb, 7.5 mmol/L
  - Plasma potassium, 17.2 mmol/L
  - Serum calcium, not measurable
- Second blood sample drawn after 1 h admission
- Test results:
  - Creatinine, 81 μmol/L
  - Hb, 7.6 mmol/L
  - Plasma potassium, 3.7 mmol/L
  - Serum calcium, 2.5 mmol/L

- Four blood samples were planned to be collected:
    - 1 EDTA blood tube
    - 1 Sodium citrate blood tube
    - 2 Serum blood tubes
- Blood stopped during collection of the fourth blood tube, leaving the tube almost empty.
- The nurse **pour some EDTA blood** into the serum blood tube.

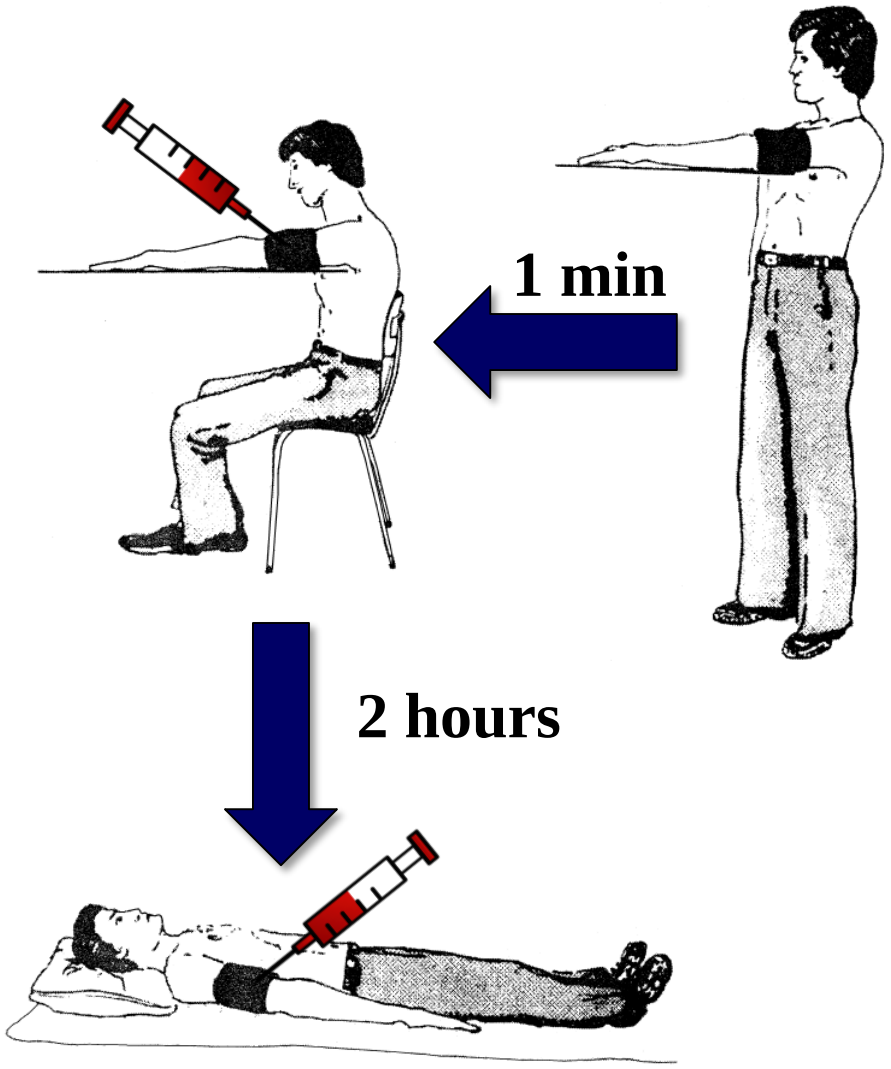
Case #5

- 55-year-old women
- Admitted to the ED at 1 AM for acute gastrointestinal pain lasting for 5 hours
- Blood sample immediately drawn upon arrival and transported to the laboratory
- Test results:
  - CRP, 1.2 mg/L
  - Hb, 7.3 mmol/L
  - WBC, 3.5 x 109/L
- Patient managed with “watch-and-wait” approach, waiting for ultrasound
- Second blood sample drawn after 2 h, in the ED observation unit
- Test results:
  - CRP, 1.0 mg/L
  - Hb, 6.6 mmol/L
  - WBC, 3.0 x 109/L
- Ultrasound negative, no clinical signs of bleeding, no other signs or symptoms

Scientific Event 2017

Tallinn 2017

- First blood sample drawn with only 1 min of stay in seated position
- Second blood samples drawn in supine position
- Plasma volume **changes up to 20% shifting from standing to supine position**



Case #6

- A 71-year-old man
- Admitted with left anterior cerebral artery hemorrhagic stroke
- Blood tests were never ordered
- Test results:
  - Procalcitonin, 4.4 ng/mL
  - CRP, 13.3 mg/L
  - WBC, 13.5 x 109/L
- Clinicians refuse to take action and order lab tests on this patient
- Blood sample drawn and transported to the laboratory
- Test results:
  - Procalcitonin, Not requested
  - CRP, 0.3 mg/L
  - WBC, 9.4 x 109/L

Bucurescu S, J Neurol Neurophysiol 2013, 4:5

Pre-analytical Laboratory Error in a Stroke Patient due to Blood Collection from another Stroke Patient: A Case Report

Septimiu Bucurescu*

Neurology at Klinikum Ansbach, Escherichstr. 1, 91522 Ansbach, Germany

• First blood sample drawn from **another 75-year-old same gender patient with right middle cerebral artery ischemic stroke, with a similar family name**, who was transferred the same day to the intensive care unit due to a nosocomial infection

Case #7

- A 5 months old infant hospitalized with lung dysfunction due to prematurity
- Routine zinc measurement reveals unexpected elevated zinc concentration: 20.2 µmol/L (ref. 10.0-19.0 µmol/L) compared to 11.6 µmol/L five days earlier
- When repeated some days later the zinc concentration are further increased to 42.4 µmol/L
- No clinical signs of increased zinc concentration
- Medication and nutrition supplements reveals no relevant zinc content

Pre-analytical mysteries

Elevated zinc concentrations in a 5 months old infant: A case report

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- The blood sample was obtained by capillary sampling
- The mother had applied vitamin E ointment containing zinc oxide at the infant's left heel
- A capillary sample obtained from the right heel revealed a totally normal zinc concentration
- Preanalytical contamination with ointments must be considered in unexpected measurements from capillary blood
- Ask the parents!
- Avoid unnecessary testing!!

Case #8

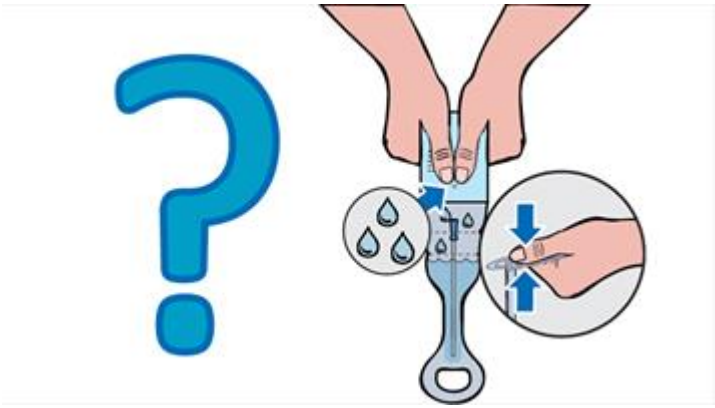
- 61-year old man with chronic kidney disease
- Undergoing maintenance haemodialysis
- Blood tests ordered:
- Test results:
  - Sodium, 182 mmol/L
  - Potassium, 4.8 mmol/L
  - Chloride, 87 mmol/L
- Second blood sample immediately drawn and transported to the laboratory
- Test results:
  - Sodium, 139 mmol/L
  - Potassium, 4.6 mmol/L
  - Chloride, 88 mmol/L

Biochemia Medica 2016;26(2):260–3

Pseudohypernatremia secondary to trisodium citrate (Citra-Lock™)

Janice Milliere[1], Daryl Corriveau[1], Malvinder S. Parmar*[1,2]

• First blood sample **contaminated during collection with trisodium citrate, a catheter-lock solution, commonly used in dialysis units** to maintain patency of dialysis catheters.



Case #9

10 months old boy admitted with hemoglobin 4.2 mmol/L and rectal bleeding

Coagulation parameters from Sysmex CS5100:

aPTT	> 300 seconds	(22 – 28 seconds)
INR	1.1	(normal)
Fibrinogen	5.5 µmol/L	(5.5 – 11.5 µmol/L)

Hemophilia A or B? Von Willebrand's disease? Heparinised sample?

KF VIII	1.81
KF IX	1.22
aPTT (STAR)	34 seconds

Interference in Coagulation Testing: Focus on Spurious Hemolysis, Icterus, and Lipemia

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Semin Thromb Hemost 2013;39:258–266.

- **The blood sample was highly lipemic, but no one saw this in the automated solution**
- The curve from the CS5100 indicated “No coagulation”, which was interpreted as endless clotting time and an aPTT > 300 sec.
- If the curve had been inspected properly, the cause would have been obvious
- **Be aware of the “automated” interpretation algorithms**
- **Always inspect samples with unexpected results!**