

Predanalitički zahtjevi u laboratorijskoj hematologiji



DOC. DR. SC. NORA NIKOLAC GABAJ

KLINIČKI ZAVOD ZA KEMIJU

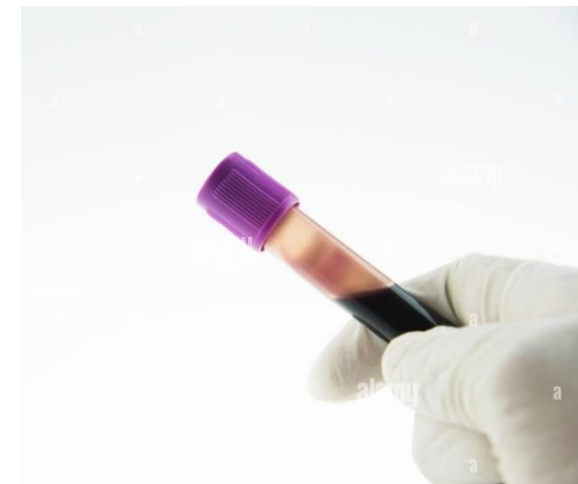
TEČAJ TRAJNOG USAVRŠAVANJA MEDICINSKIH BIOKEMIČARA POD NASLOVOM: "OSNOVE
LABORATORIJSKE HEMATOLOGIJE"

Predanalitički čimbenici

Nepromjenjivi



Promjenjivi



Nepromjenjivi predanalitički čimbenici



↑ ujutro: Erc,
Hb, Htc, Rtc,
Trc



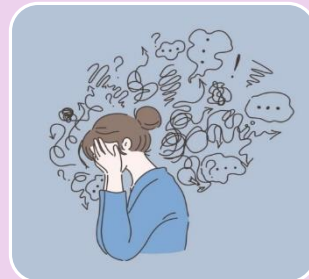
nakon obroka:
↑ Neu, ↓ Ly,
Htc, Erc
veg. prehrana:
↓ Hb, Trc, Lkc
gladovanje: ↓
Lkc



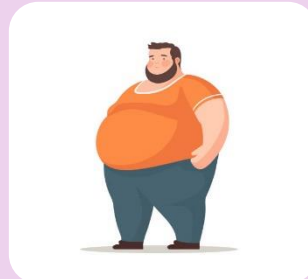
↑ Lkc, Neu, Ly,
Mo, Erc, Hb,
Htc



↑ Lkc, Neu,
Trc, SE
↓ Erc, Hb, Htc



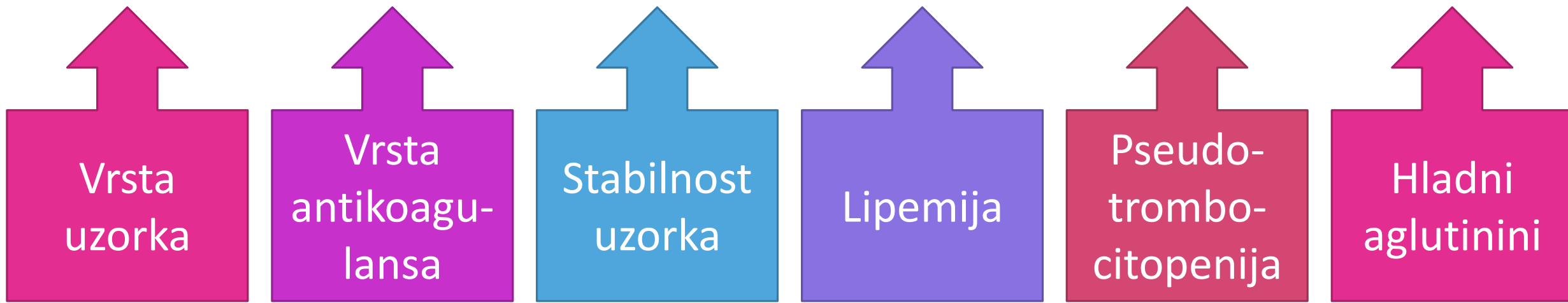
↑ Leu, Neu,
Trc
↓ Ly



↑ Erc, Trc, Lkc,
Neu, Ly
↓ MCV

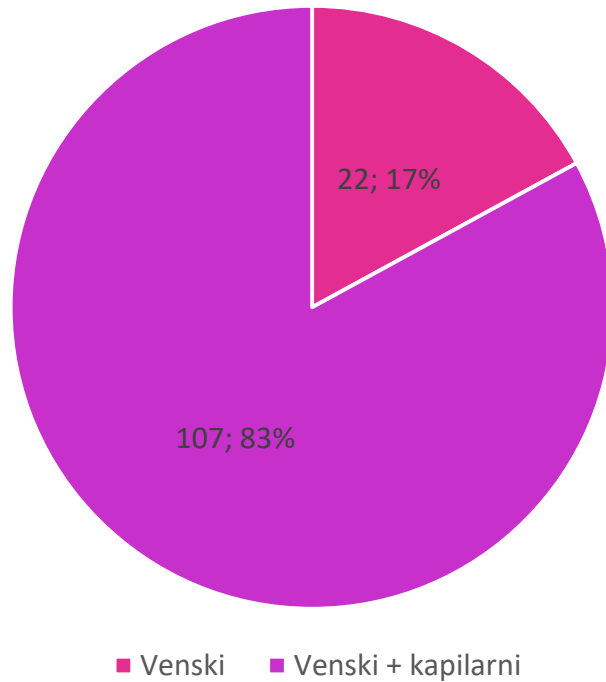
Vanja Radišić Biljak, Ivana Lapić*, Valentina Vidranski, Ivona Herceg, Franciska Tomić, Brankica Šimac, Martina Horvat, Helena Čičak, Dora Vuljanić, Adrijana Dorotić and Ana Nikler

Policies and practices in the field of laboratory hematology in Croatia – a current overview and call for improvement

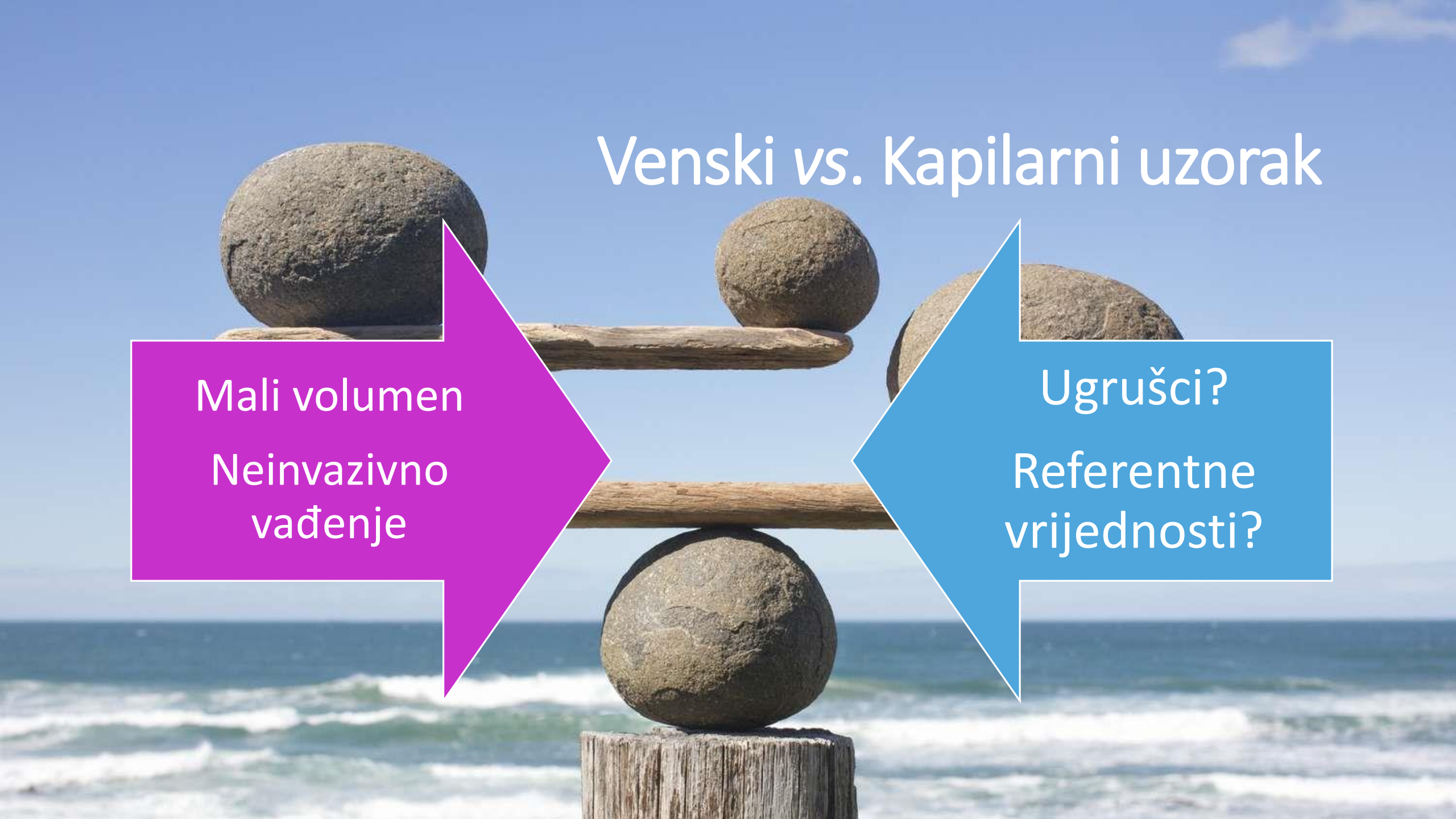


1. Vrsta uzorka

Koji se uzorak koristi za KKS?



Venski vs. Kapilarni uzorak



Mali volumen
Neinvazivno
vađenje

Ugrušci?
Referentne
vrijednosti?



Udio zgrušenih uzoraka

Tablica 2. Udio zgrušenih venskih i kapilarnih uzoraka za određivanje kompletne krvne slike.

Razdoblje	Ukupno	Broj zgrušenih uzoraka	% zgrušenih uzoraka	Sigma vrijednost
Venski uzorci				
1/2022	14696	89	0,60	4,1
2/2022	14117	73	0,52	4,1
3/2022	16558	93	0,56	4,1
4/2022	14622	72	0,49	4,1
5/2022	15598	91	0,58	4,1
6/2022	13899	64	0,46	4,2
Kapilarni uzorci				
1/2022	440	15	3,40	3,4
2/2022	337	13	3,85	3,3
3/2022	393	16	4,07	3,3
4/2022	370	10	2,70	3,5
5/2022	421	15	3,56	3,4
6/2022	321	6	1,87	3,6



Clin Chem Lab Med 2023; 61(4): 688–695

DE GRUYTER

Opinion Paper

Laura Sciacovelli*, Andrea Padoan, Ada Aita, Daniela Basso and Mario Plebani

Quality indicators in laboratory medicine: state-of-the-art, quality specifications and future strategies

	Pre-Clot (σ)
Minimalni	4,06
Optimalni	4,32
Poželjni	4,52

Referentne vrijednosti

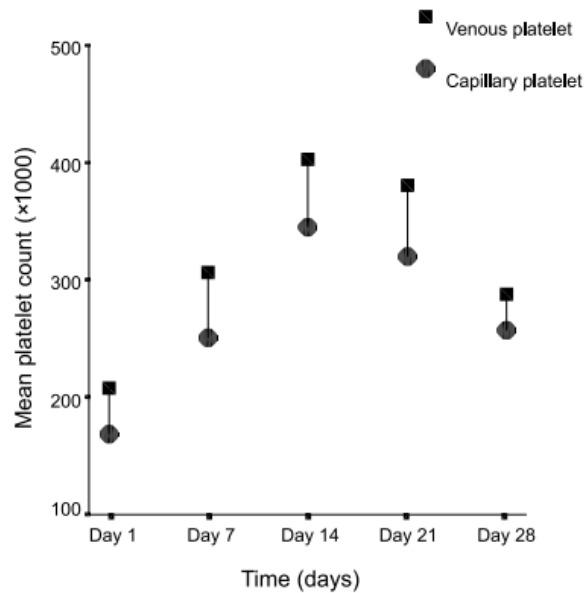


Figure 1. Mean values and venous–capillary differences of platelets during the neonatal period.

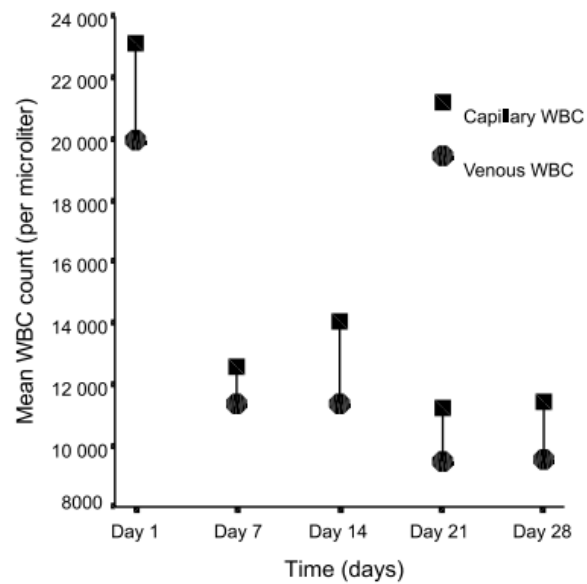


Figure 2. Mean values and venous–capillary differences of WBC during the neonatal period.

Kayiran SM, Ozbek N, Turan M, Gürakan B. Significant differences between capillary and venous complete blood counts in the neonatal period. *Clin Lab Haematol.* 2003 Feb;25(1):9-16.

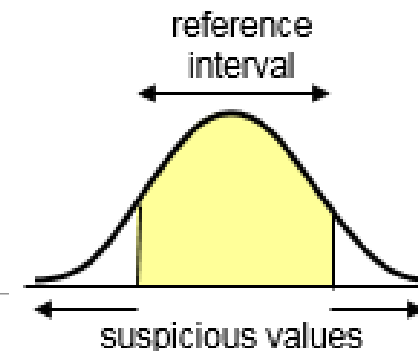
Table 1: Statistical results for the comparison of venous and capillary blood

Parameter	Correlation coefficient= r	Slope	Mean difference
Total WBC count	0.991	1.031	-0.432
Percentage of neutrophil count	0.819	1.021	1.357
Absolute neutrophil count	0.811	0.6582	14.94
Percentage of lymphocyte count	0.971	0.9872	0.543
Percentage of monocyte count	0.694	1.028	-0.246
Percentage of eosinophil count	0.932	0.9729	0.367
Percentage of basophil count	0.002	-	-0.324
RBC count	0.961	0.9908	-0.031
Hemoglobin	0.938	1.00	-0.148
Hematocrit	0.937	1.00	-0.305
MCV	0.996	1.004	-0.115
MCH	0.98	1.00	-0.147
Platelet count	0.957	0.9483	15.562
MPV	0.874	1.038	-0.725
PCT	0.999	1.05	-0.005
Platelet count ($0-150 \times 10^3/\mu\text{L}$)	0.540	1.023	5.676
Platelet count ($>150 \times 10^3/\mu\text{L}$)	0.968	1.025	20.304

MPV: Mean platelet volume, PCT: Plateletcrit, MCH: Mean corpuscular hemoglobin, MCV: Mean corpuscular volume, RBC: Red blood cell, WBC: White blood cell

Chavan P, Bhat V, Tiwari M, Gavhane U, Pal SK. Comparison of Complete Blood Count Parameters between Venous and Capillary Blood in Oncology Patients. *J Lab Physicians.* 2016;8(1):65-6.

Referentne vrijednosti



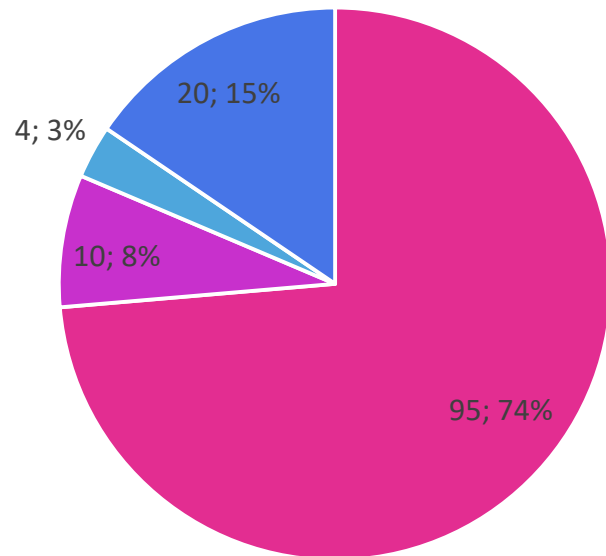
Kod zdravih ispitanika vrijednosti venske i kapilarne krvi su usporedive.

Poseban oprez kod djece (novorođenčadi), onkoloških bolesnika, trombocitopenije.

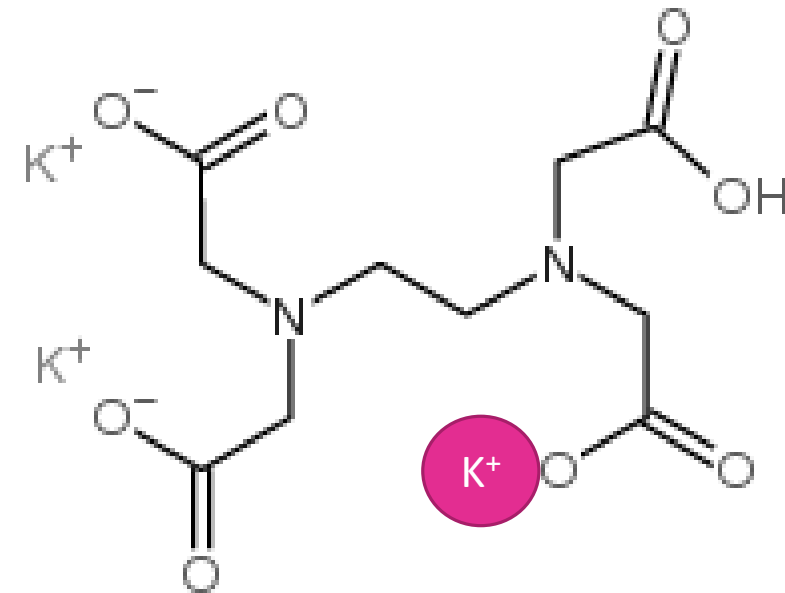
Potreba izrade prilagođenih referentnih vrijednosti?

2. Vrsta antikoagulansa

Koji se antikoagulans koristi?



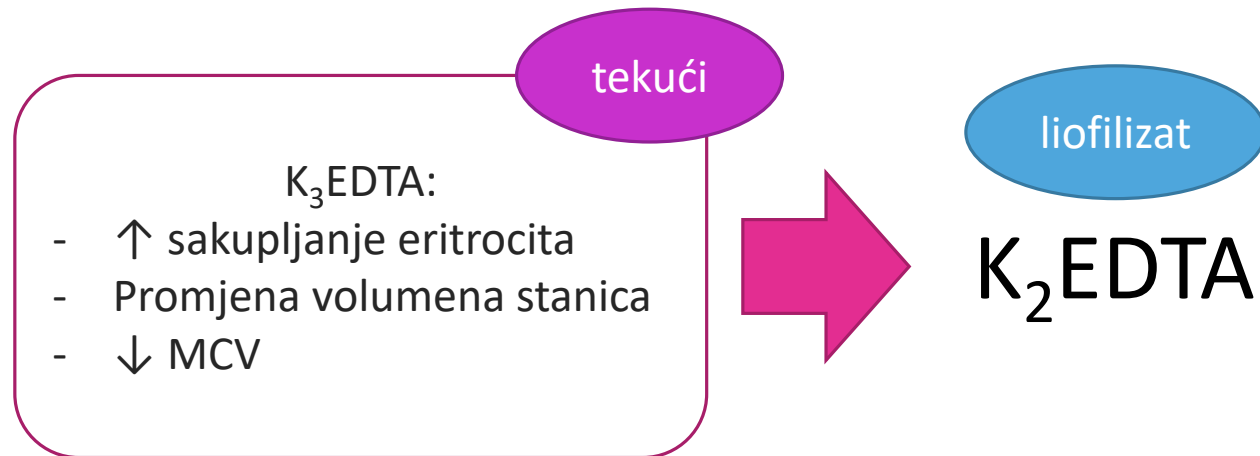
■ K3EDTA ■ K2EDTA ■ K3EDTA+K2EDTA ■ Nije propisano



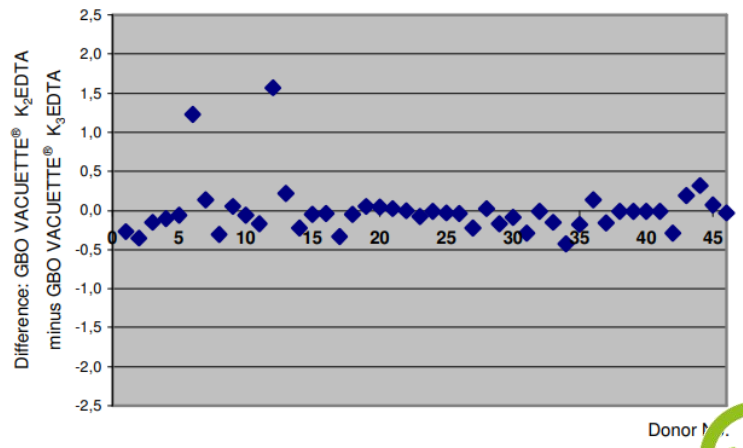
Recommendations of the International Council for Standardization in Haematology for Ethylenediaminetetraacetic Acid Anticoagulation of Blood for Blood Cell Counting and Sizing. International Council for Standardization in Haematology: Expert Panel on Cytometry

No authors listed

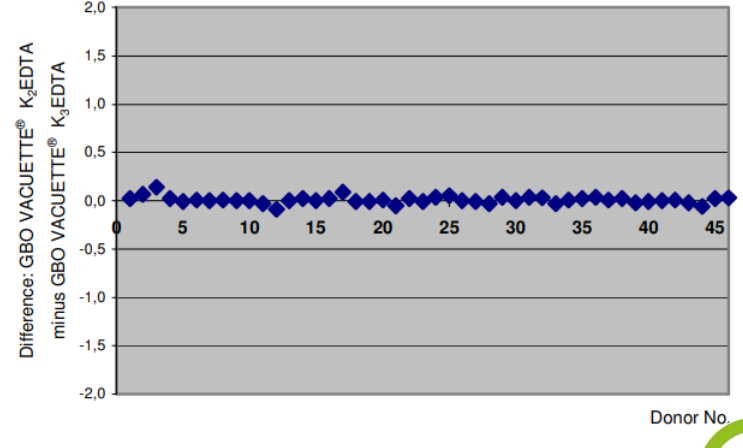
PMID: 8213631 DOI: 10.1093/ajcp/100.4.371



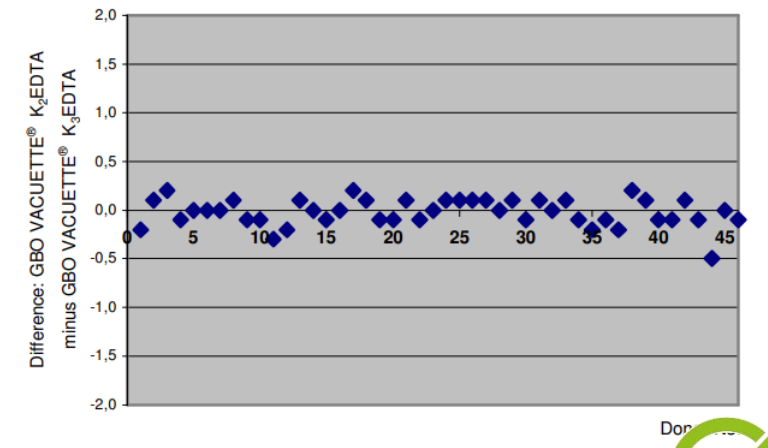
Deviation plot, y-axis WBC [$10^3/\mu\text{L}$]:



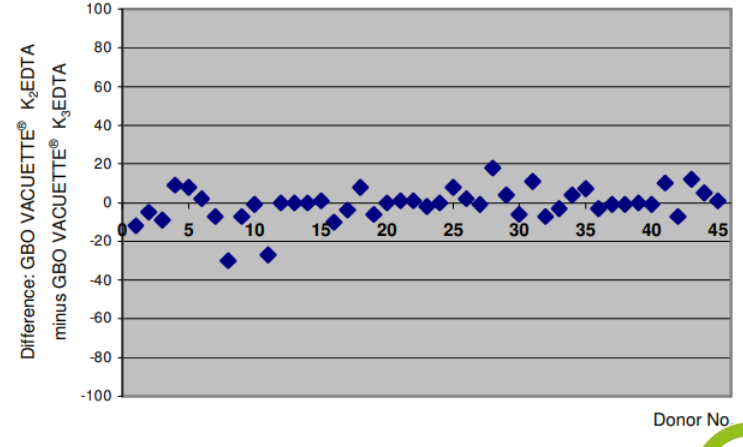
Deviation plot y-axis RBC [$10^6/\mu\text{L}$]:



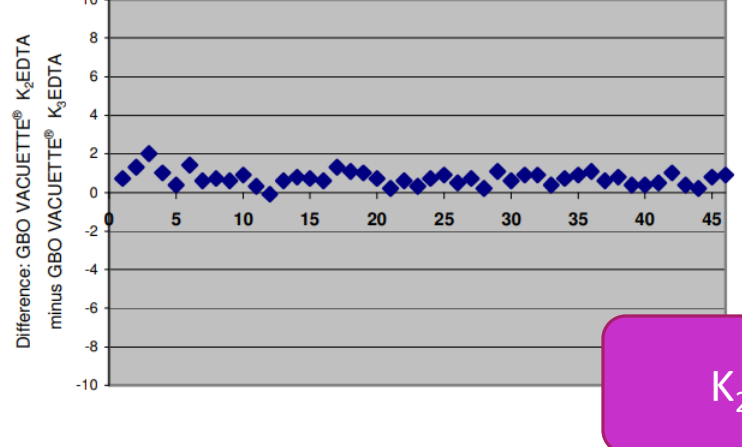
Deviation plot, y-axis HGB [g/L]:



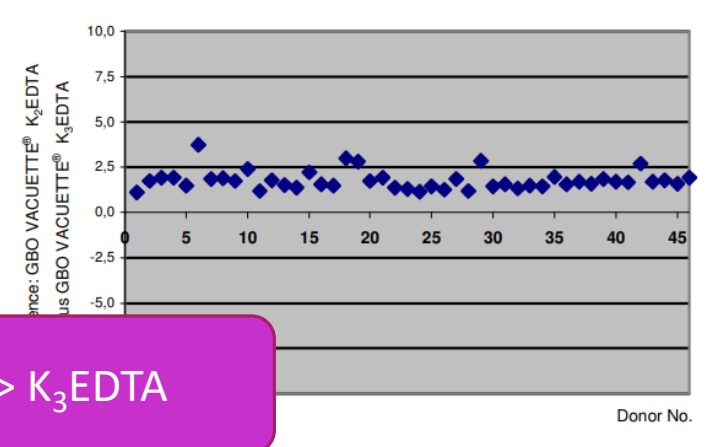
Deviation plot y-axis PLT [$10^6/\mu\text{L}$]:



Deviation plot y-axis HCT [%]:



Deviation plot y-axis MCV [fL]:

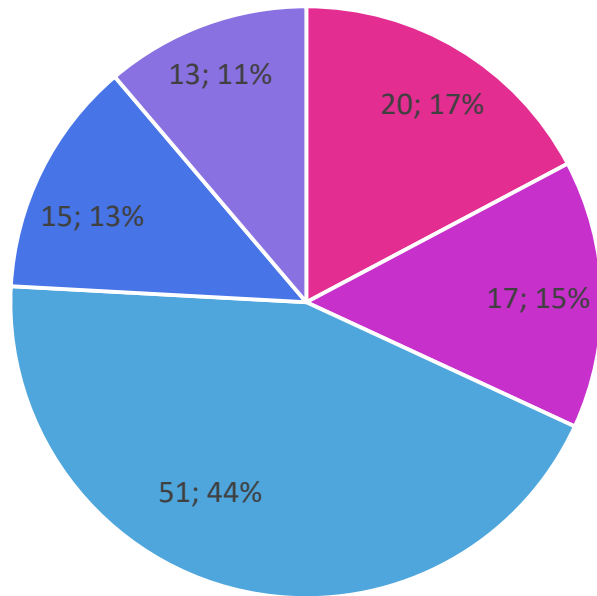


$K_2\text{EDTA} > K_3\text{EDTA}$

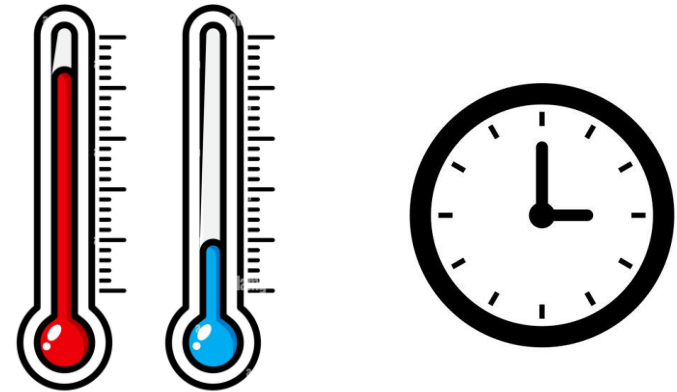
Unutar kriterija prihvatljivosti!

3. Stabilnost uzorka

Izvor kriterija za stabilnost uzorka?



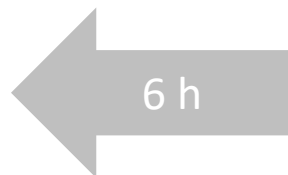
■ Rezultati verifikacije ■ Nepoznato ■ HKMB ■ Upute proizvođača ■ Literatura (ostalo)





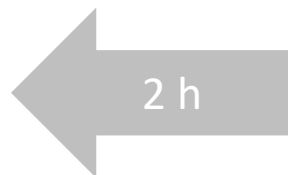
Hrvatska komora medicinskih biokemičara

KKS, DKS



20–22 °C

SE





ELSEVIER

Contents lists available at ScienceDirect

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journal homepage: www.ebiomedicine.com



How Long can we Store Blood Samples: A Systematic Review and Meta-Analysis



Dong-wen Wu *, Yu-meng Li, Fen Wang

Third Xiangya Hospital, Central South University, Changsha, China

89 studija

Sobna temp

Hlađenje:
+4 °C, -20 °C

Leu	Trc	Erc	MCHC
<ul style="list-style-type: none"> • RT: 3 d • 4 °C: 3 d 	<ul style="list-style-type: none"> • RT: 2 d • 4 °C: 3 d (8 h*) 	<ul style="list-style-type: none"> • RT: 24 h • 4 °C: 24 h 	<ul style="list-style-type: none"> • RT: 24 h • 4 °C: 12 h

?

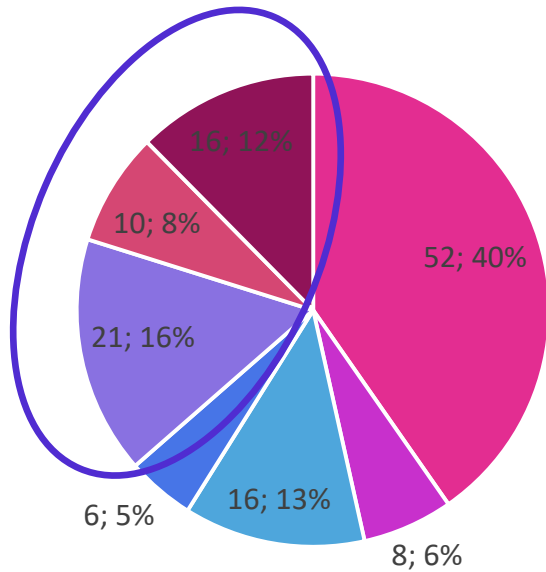
Uzorak stabilan 24 sata na sobnoj temperaturi!

~~Za du...~~

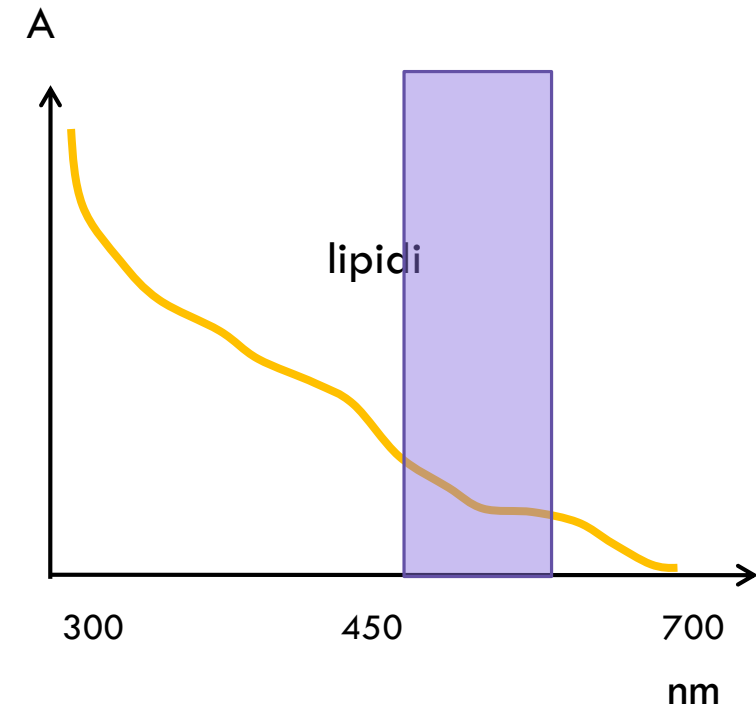
Na 4 °C: ↑ Trc, Mo, MCV, Htc; ↓ Ly, Eo

4. Lipemija

Postupak obrade lipemičnog uzorka



- Korekcija Hb
- Zamjena plazme
- CHCM
- Odbijanje uzorka
- Obrada bez korekcije
- Izdavanje broja stanica
- Nema procedure



Problemi obrade lipemičnog uzorka

Način detekcije

- \uparrow MCHC

Korekcija Hb

- Ručni izračun MCH, MCHC

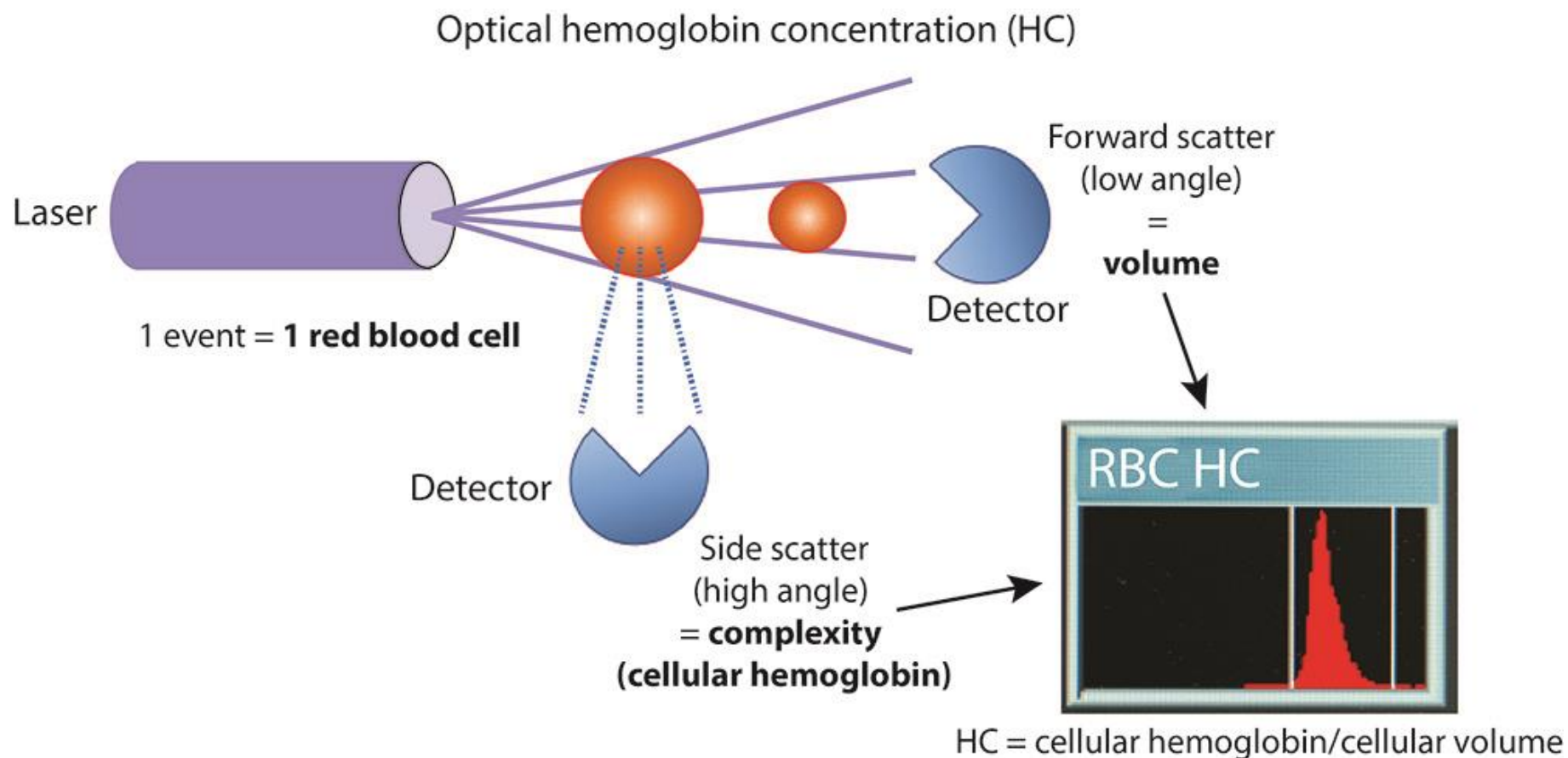
Zamjena plazme

- Mogućnost pogreške pri pipetiranju

CHCM

- Dostupnost analizatora

CHCM (engl. *cellular hemoglobin concentration mean*; srednja koncentracija staničnog hemoglobina)





Primjer nalaza

Parametar	Vrijednost	Flag
Erc (x 10 ¹² /L)	4,31	L
Hb (g/L)	119	L
Htc (L/L)	0,381	L
MCV (fL)	88,4	
MCH (pg)	27,6	
MCHC (g/L)	312	L

Hb u plazmi = 34 g/L

Odjel za laboratorijsku hematologiju i koagulaciju

Uzorak	Kompletna krvna slika	Rezultat	Jedinica	Referentni interval
vKe	Eritrociti	4,31 L	x10 ¹² /L	4,34 do 5,72
vKe	Hemoglobin	119 L	g/L	138 do 175
vKe	Hematokrit	0,381 L	L/L	0,415 do 0,53
vKe	MCV (prosječan volumen eritrocita)	88,4	fL	83 do 97,2
vKe	MCH (prosječan sadržaj hemoglobina u eritrocitu)	27,6	pg	27,4 do 33,9
vKe	MCHC (prosječna koncentracija hemoglobina u eritrocitu)	312 L	g/L	320 do 345
vKe	RDW (raspodjela eritrocita po volumenu)	13,9	%	9 do 15
vKe	Leukociti	7,5	x10 ⁹ /L	3,4 do 9,7
vKe	Neutrofilni granulociti (%)	63,2	%	44 do 72
vKe	Neutrofilni granulociti (x10 ⁹ /L)	4,71	x10 ⁹ /L	2,06 do 6,49
vKe	Limfociti (%)	30,2	%	20 do 46
vKe	Limfociti (x10 ⁹ /L)	2,25	x10 ⁹ /L	1,19 do 3,35
vKe	Monociti (%)	5,4	%	2 do 12
vKe	Monociti (x10 ⁹ /L)	0,40	x10 ⁹ /L	0,12 do 0,84
vKe	Eozinofilni granulociti (%)	0,5	%	do 7
vKe	Eozinofilni granulociti (x10 ⁹ /L)	0,04	x10 ⁹ /L	do 0,43
vKe	Bazofilni granulociti (%)	0,7	%	do 1
vKe	Bazofilni granulociti (x10 ⁹ /L)	0,05	x10 ⁹ /L	do 0,06
vKe	Trombociti	122 L	x10 ⁹ /L	158 do 424
vKe	MPV (prosječni volumen trombocita)	11,3 H	fL	6,8 do 10,4

Napomena: Zbog izrazite lipemije u uzorku, vrijednosti Hgb, MCH i MCHC korigirane

Nalaz izradio: Dora Kudic, bacc. med. lab. diagn.
Franciska Tomić, spec. med. biokemije i lab. medicine 7846444
Tamara Nađ, zdrav. lab. teh. 1230654

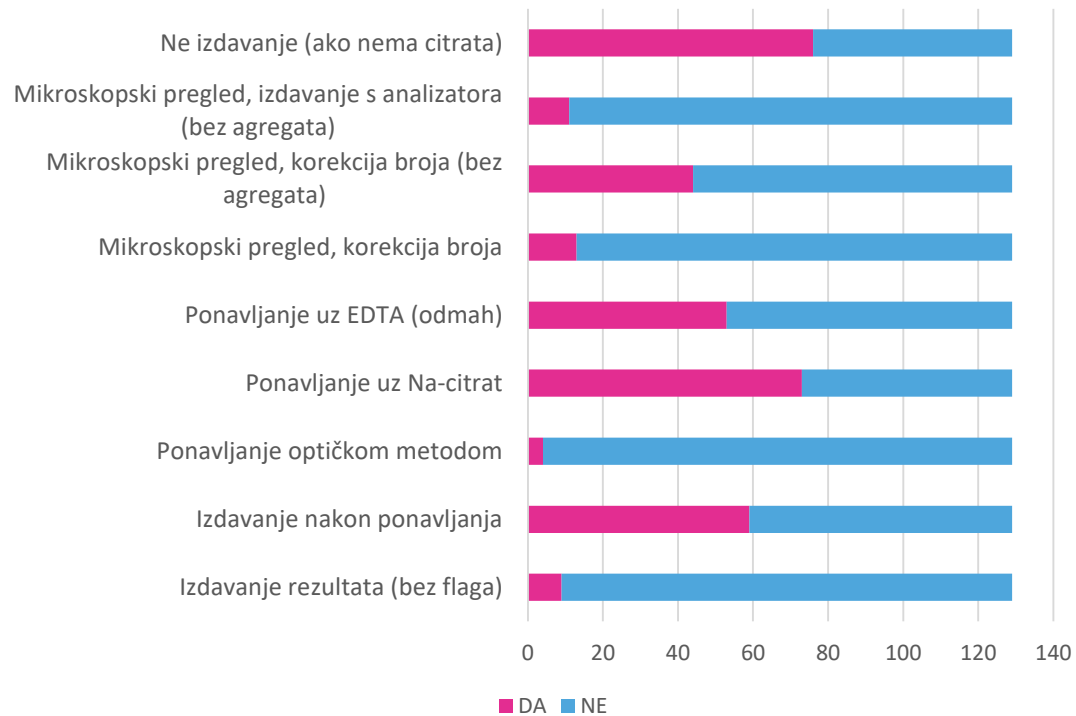
Voditelj odjela:

doc. dr. sc. Sandra Margetić
spec. med. biokemije i lab. medicine
0420255

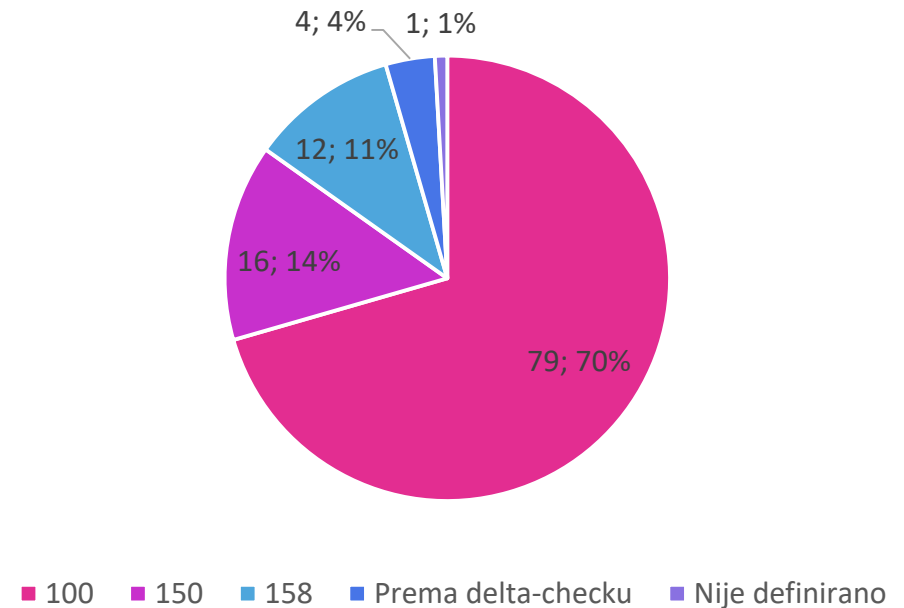
Rezultati dobiveni različitim imunokemijskim metodama nisu usporedivi.
Usporedba rezultata s referentnim intervalom: L - sniženo; H - povišeno; E - kritično.
Uzorcji: vKe - Ven, puna krv (EDTA-ljubičasta)

5. Pseudotrombocitopenija

Postupanje s trombocitopeničnim uzorcima



Broj trombocita u trombocitopeničnom uzorku ($\times 10^9 / L$)



Ostalo: 20, 30, 50, 80, 90, 120, 130, 140

Uzroci pseudotrombocitopenije

Ugrušci, PA
pogreške

Lijekovi

Veliki
trombociti

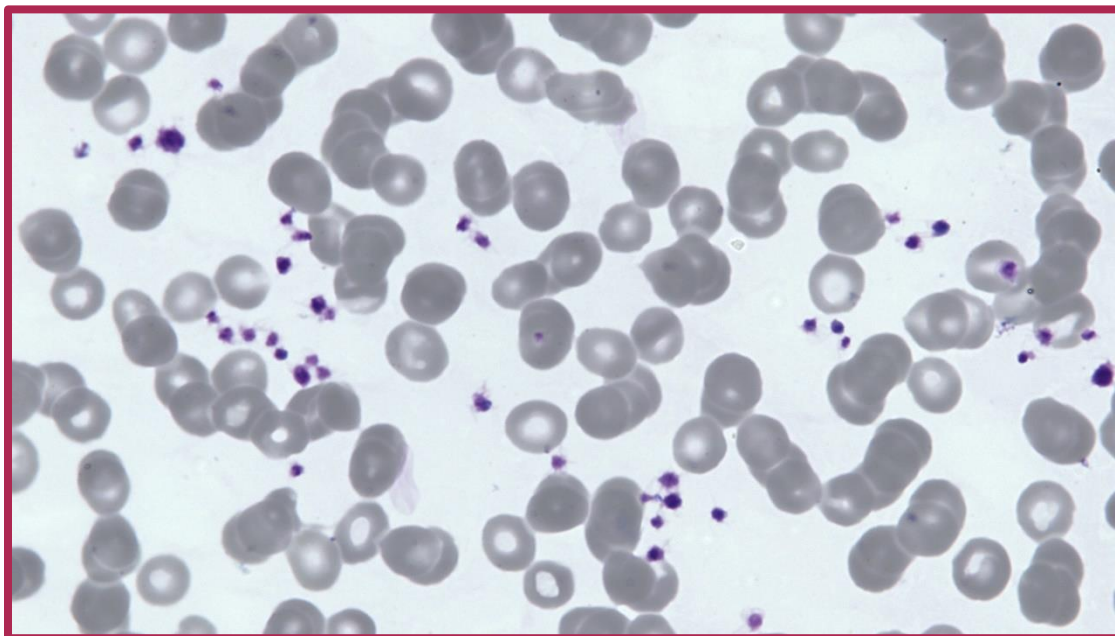
Hladni
aglutinini

Antikoagulansi
(EDTA)

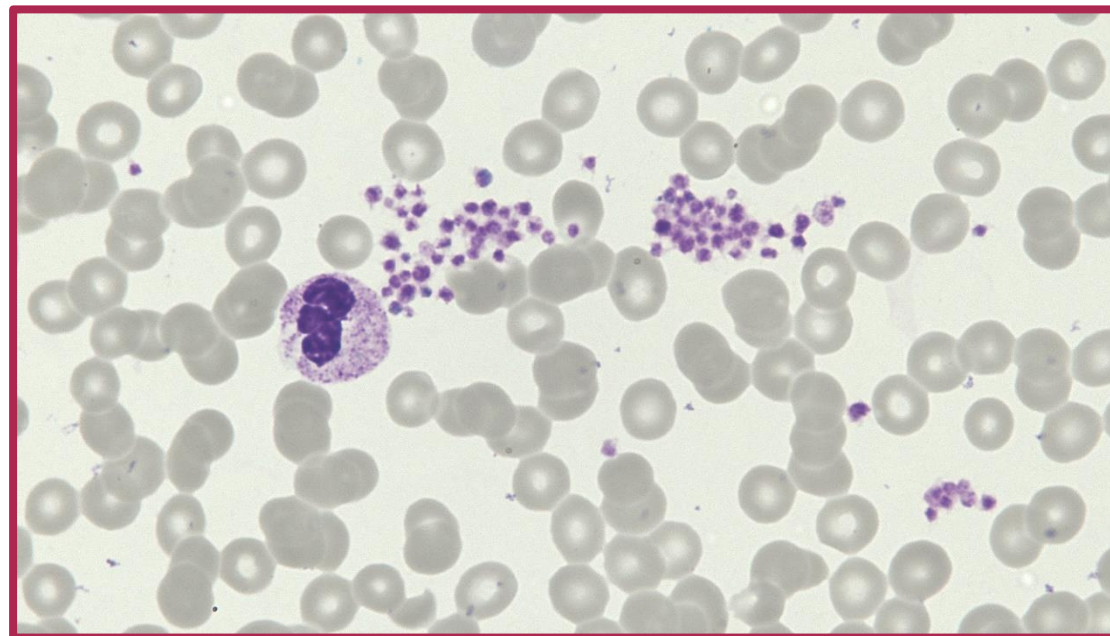
 Hrvatska komora
medicinskih biokemičara

 HD MBLM

Mikroskopski pregled



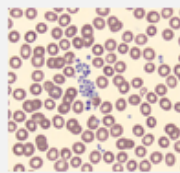
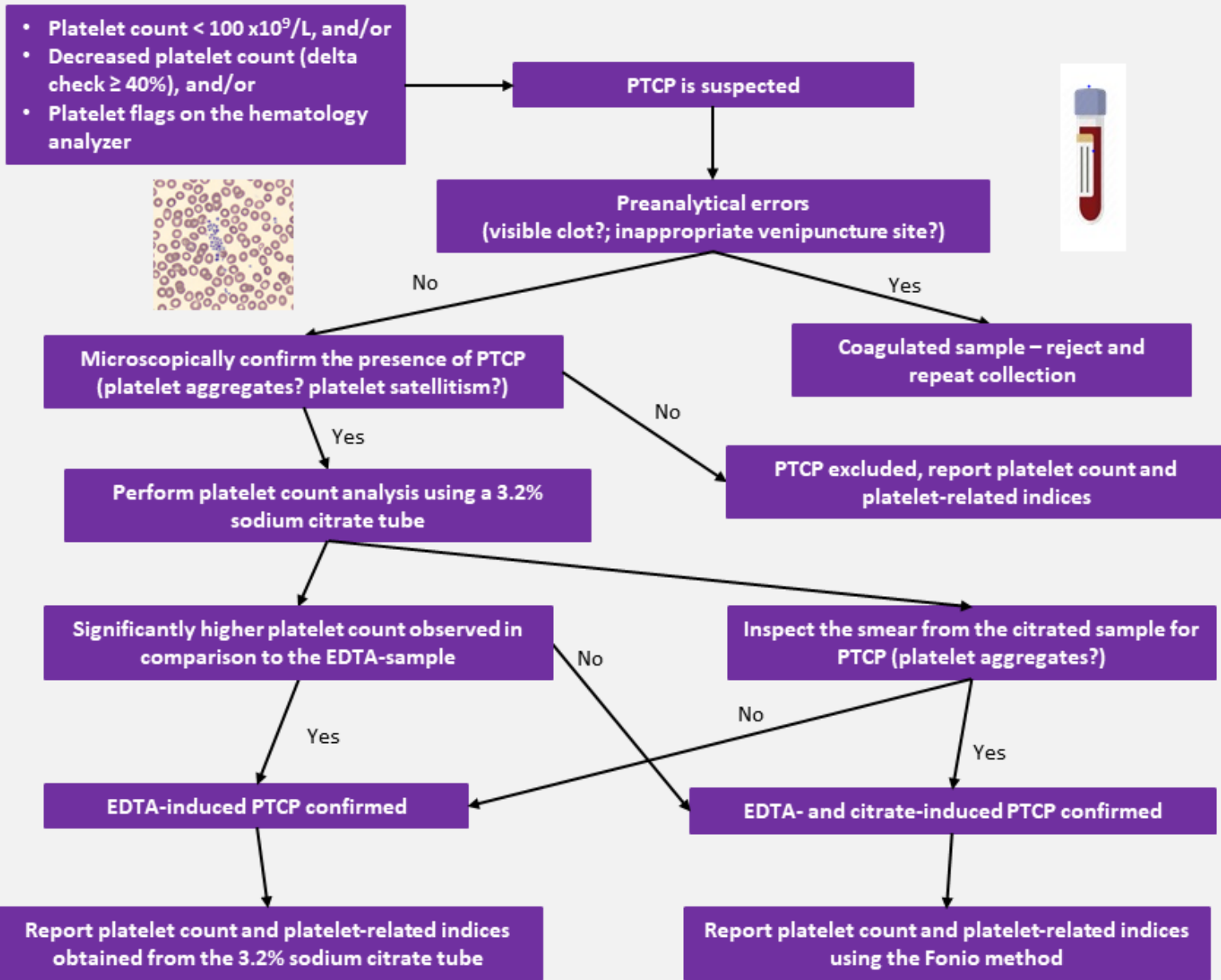
Agregati Trc



Agregati Trc uzrokovani EDTA

National recommendations of the Croatian Chamber of Medical Biochemists and Working group for Laboratory hematology of the Croatian Society of Medical Biochemistry and Laboratory Medicine: Management of samples with suspected EDTA-induced pseudothrombocytopenia

AIM: To assist in achieving national harmonization in laboratory management of samples with EDTA-induced PTCP





Primjer nalaza

vKe	Trombociti	150	L	$\times 10^9/L$	158 do 424
vKe	MPV (prosječni volumen trombocita)	12,2	H	fL	6,8 do 10,4
vKe	Interpretacija uz trombocite u citratu (*)	Rezultat isključuje pseudotrombocitopeniju uzrokovanu s EDTA.		opisni nalaz	

Nalaz izradio: Dijana Mlinarić, zdrav. lab. teh.
 Franciska Tomić, spec. med. biokemije i lab. medicine 7846444
 Nives Benček, mag. med. biochem. 9095616
 Silvija Haramustek, bacc. med. lab. diagn. 3005305
 Roman Mihić, spec. med. biokemije i lab. medicine 7995849

Voditelj odjela:

doc. dr. sc. Sandra Margetić
 spec. med. biokemije i lab. medicine
 0420255

Trc (EDTA) 134

vKc	Trombociti u citratu	225		$\times 10^9/L$	158 do 424
vKe	Interpretacija uz trombocite u citratu (*)	Rezultat potvrđuje pseudotrombocitopeniju uzrokovanu s EDTA zbog čega je potrebno uvijek istodobno uzorkovati dva uzorka venske krvi za KKS: jedan uzorak uz EDTA antikoagulans (ljubičasta epruveta) i jedan uzorak uz citratni antikoagulans (plava epruveta).		opisni nalaz	

Nalaz izradio: Martina Cvetić, zdrav. lab. teh.
 Roman Mihić, spec. med. biokemije i lab. medicine 7995849
 doc. dr. sc. Ivana Čelap, spec. med. biokemije i lab. medicine 0438081
 Ivana Vuga, spec. med. biokemije i lab. medicine 0436526

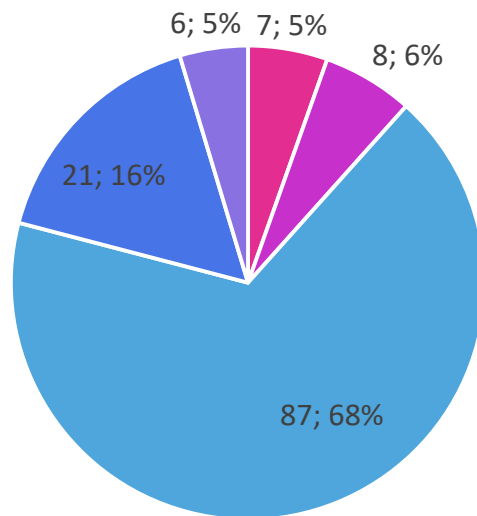
Voditelj odjela:

doc. dr. sc. Sandra Margetić
 spec. med. biokemije i lab. medicine
 0420255

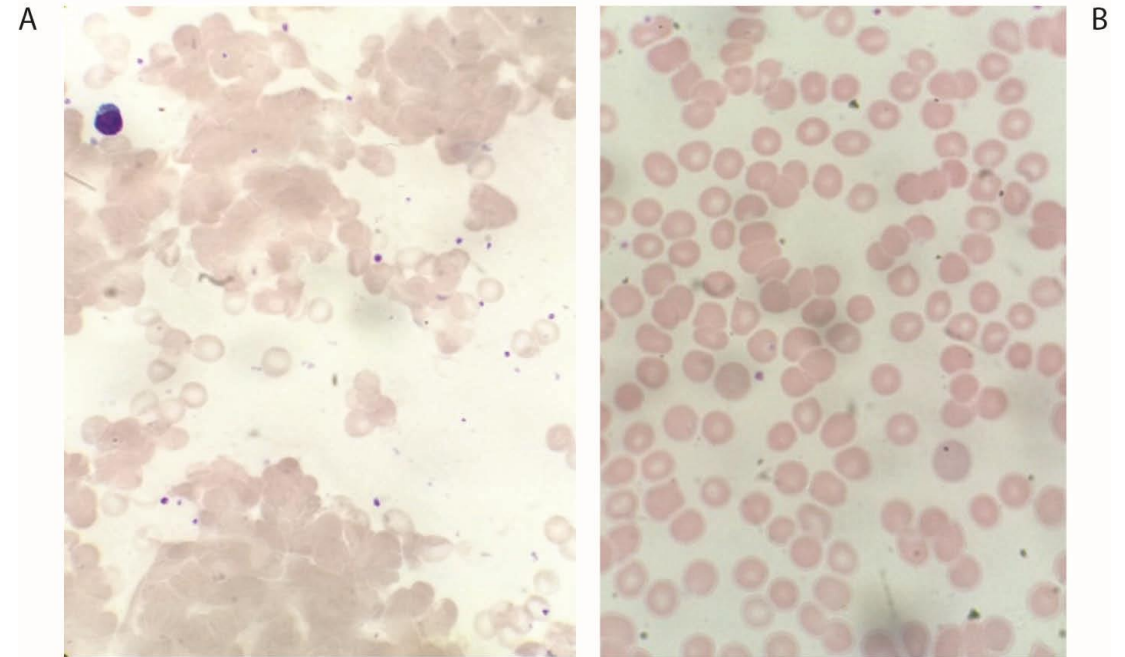
Trc (EDTA) 120
 MPV (EDTA) 11,7

6. Hladni aglutinini

Postupak kod sumnje na hladne aglutinine



- Izdavanje bez korekcije
- Izdavanje uz komentar
- Zagrijavanje uzorka na 37 °C
- Ponavljanje u zagrijanu epruvetu
- Ponavljanje i brza analiza



Topic A, Milevoj Kopcinovic L, Bronic A, Pavic M. Effect of cold agglutinins on red blood cell parameters in a trauma patient: a case report. *Biochem Med (Zagreb)*. 2018;28:031001

Hladni aglutinini

Aglutinacija eritrocita najčešće uzrokovana IgM antitijelima s maksimalnim afinitetom pri 0-4 °C.

Erc ↓

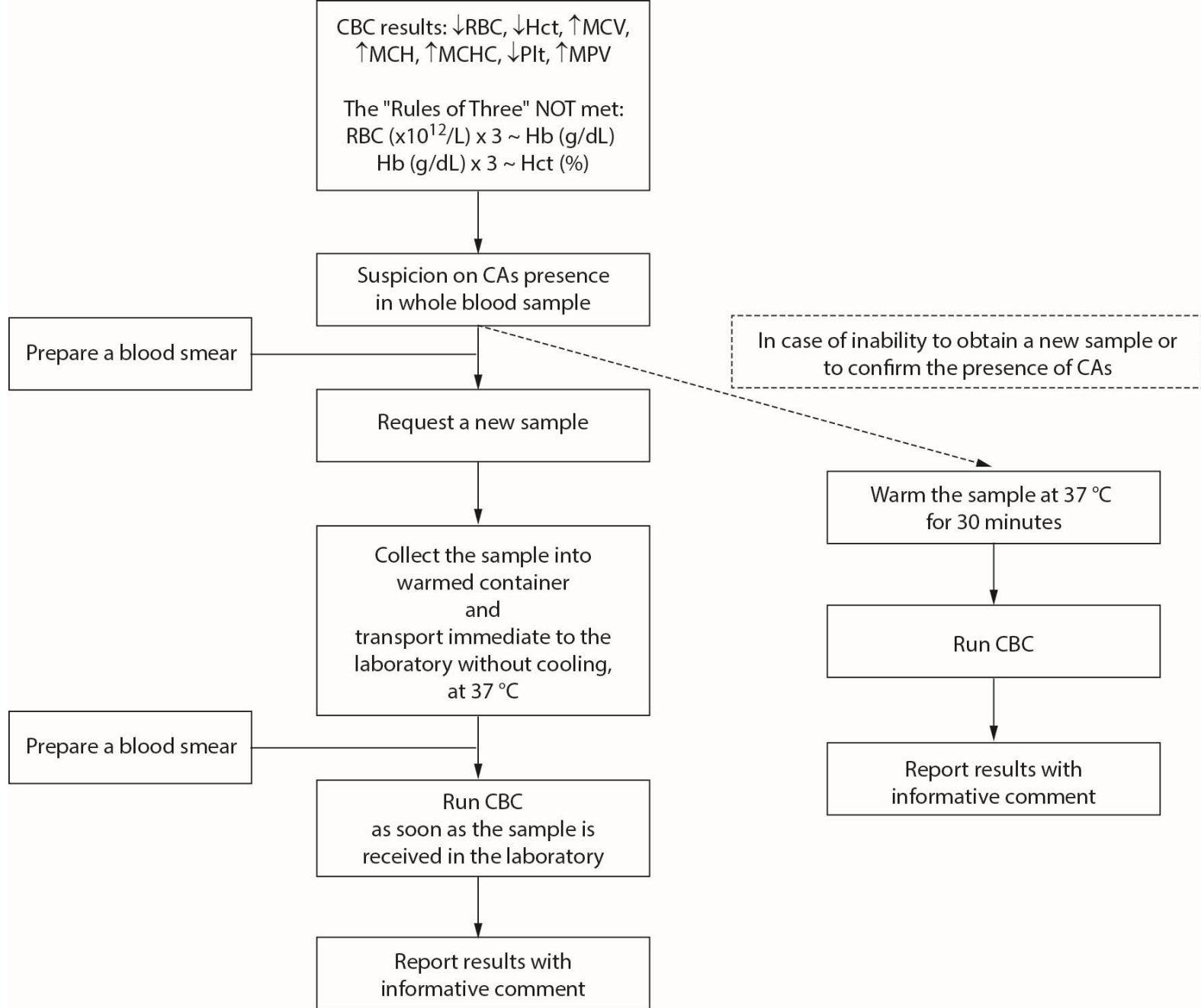
Hb N

Htc ↓

MCH ↑

MCHC ↑

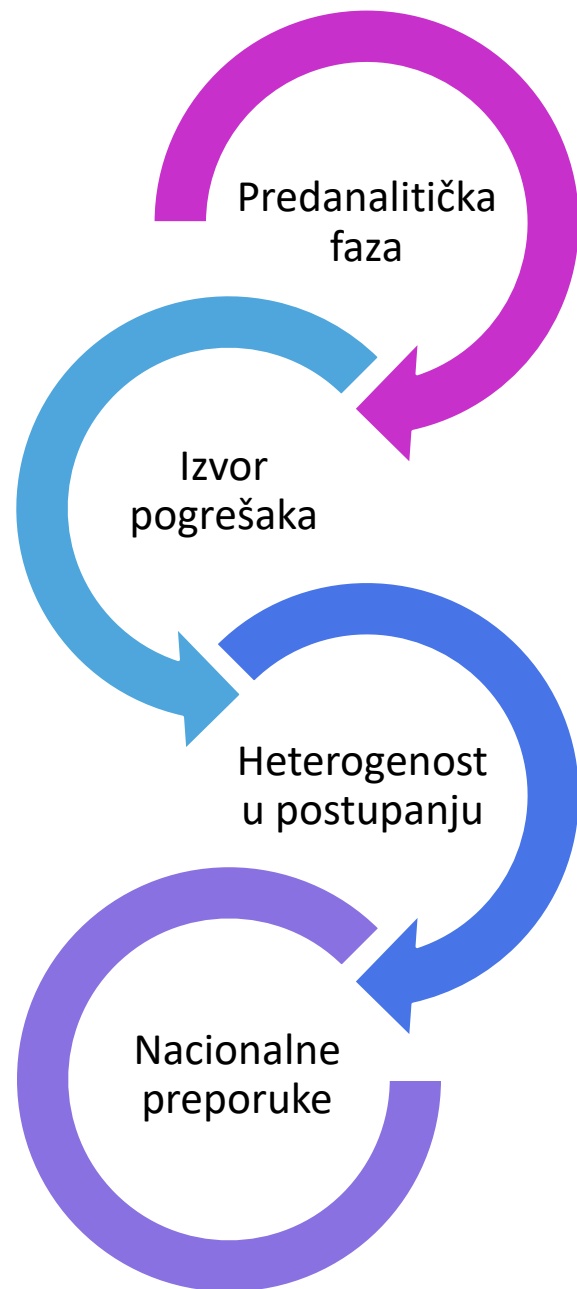
Reverzibilno ili ireverzibilno





 Hrvatska komora
medicinskih biokemičara

HD MBLM





Hvala na pažnji!