



Minimaal invasieve capillaire bloedafname

Methoden en toepassingen

Introductie

- Bloedanalyse is een essentieel middel voor diagnose en behandeling van ziekte
- Meeste labtesten worden uitgevoerd met bloed uit een (slag)ader
- Kennis, kunde, tijd en geld
- Covid-19 pandemie: beperkte capaciteit en toegang tot zorg
- Technologische ontwikkeling > kleiner monstervolume
- Centralisatie vs decentralisatie (POCT)

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Voordelen capillaire bloedafname t.o.v. veneuze/arteriële bloedafname

- Minder invasief
- Minder pijnlijk
- Minder volume
- Minder afval
- Beter toegankelijk (@home)
- Makkelijke verwerking en opslag
- Meerdere aanprikplaatsen (oor, teen, onderarm, hiel, handpalm)
- Vermindering van naaldangst en verbetering van therapietrouw

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Proces capillaire afname

- De huid/capillair-bed punctie
- Bevorderen van de bloedstroom
- Collectie van het capillaire bloed

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Methoden voor aanprikken van huid en capillairbed

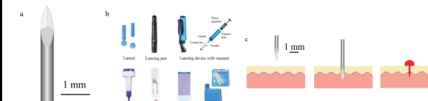
- Lancet
- Microneedles
- Laser lancet
- Liquid jet

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Lancet

- Naalden of mesjes die de huid punteren waardoor capillair bloed vrijkomt



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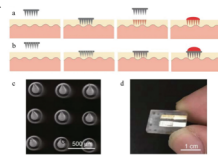
Microneedles

- Massieve naalden of holle naalden.
 - Bloedafname
 - Real-time monitoring (diabetes)
 - Medicatie toediening



HALO™ technology

- Bladeless microneedle array
- Microneedles thinner than an eyelash
- Virtually painless compared to fingersticks, venipunctures, and competitive products

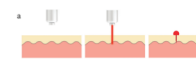


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Laser lancing

- Korte hoog-vermogen laser
 - Er:YAG laser
 - Effect op RBC (hemolyse)?

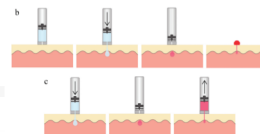
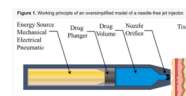


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Liquid jet

- Vloeistof onder hoge druk
 - Medicatie toediening
 - Interferentie?
 - Verdunning?



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Concluderend

- Voor poliklinisch gebruik zijn er potentieel veel alternatieven.
- Lancet afname eenvoudigst maar er zijn ontwikkelingen voor andere methoden.
- Voor self-sampling zijn mogelijkheden beperkter.
- Lancet afname nu nog meest gebruikt (microneedles in opmars maar relatief kostbaar)

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Aandachtspunten bij gebruik lancetten

Condition	Best practice	Expected result
Age	Birth to about 6 months	Over 6 months
Height	Shorter than 45 cm	Greater than 45 cm
Preparation of skin	On the inside of the hand	On the side of the hand
Preparation of skin	On the side of the hand	On the side of the hand
Preparation of skin	On the side of the hand	On the side of the hand

The recommended depth for a lancet is 1.5 mm.

• for a child over 6 months and below 8 years – 1.5 mm;

• for a child over 8 years – 2.4 mm.

Too much compression should be avoided, because this may cause a deeper puncture than is needed to get good flow.

• Type lancet hangt af van benodigd volume

• POCT

• Single marker monitoring (TM)

• Bepalingspakket (chronische ziekten)

Width and Depth (mm)	Blood Volume	Color
20 G x 1.5	Low Flow	Purple
21 G x 1.8	Medium Flow	Pink
1.5 mm x 2.0	High Flow	Blue

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Bevorderen van de bloedstroom

1. Take a hot shower or bath
2. Hydrate
3. Stand upright
4. Try a little light exercise
5. Try a different finger
6. Try a different finger
9. Try using the sides of your finger rather than the pad

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Bevorderen van de bloedstroom

Bloedstroom door de capillairen wordt gereguleerd door upstream myogene regulatie van arteriolen die vernauwen en verwijden als reactie op neuronale stimuli.

Fysieke manipulatie: melken
Herverdeling van bloed naar de vingertop en afsluiten van venen die het bloed afvoeren

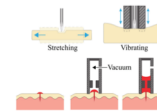


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Bevorderen van de bloedstroom

- Tactiel (melken, wrijven, rekken, trillen)
- Vacuum
- Vasodilatatie (menthol, warmte)
- Locatie (oorlel)
- Zwaartekracht

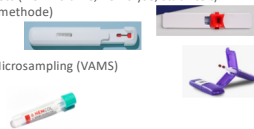


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Collectiemethoden

- Microtainer/minicollect/etc (klein volume, hemolyse, stabiliteit)
- DBS (opwerking, analysemethode)
- Plasma microsampling
- Serum microsampling
- Volumetric Absorption Microsampling (VAMS)
- Stabilisatie buffer



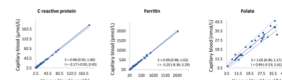
Toepassingen in de praktijk – biochemie & hematologie

- Groeiend aantal publicaties
- Vingerprik met lancet (BD, 2mm)
- Microtainer EDTA/serum (250ul)
- Hemolyse/monster afwijzing
- 37 parameters (hematologie (17)/
- Stabiliteit (24u rt)
- Patiënt ervaring

Analysis of common biomarkers in capillary blood in routine clinical laboratory. Preanalytical and analytical comparison with venous blood



Toepassingen in de praktijk – biochemie & hematologie



For all the studied parameters except for MCV, venous and capillary blood, are comparable and could be interchangeable using the same reference values established for venous blood. However, Ansari et al. [37] found differences

Although results are comparable between capillary and venous blood, ferritin, vitamin D, HTC, MCV, MCHC, platelets, PDW, MPV and basophils were not stable at 24 h.



Toepassingen in de praktijk – patiënt assessment

Table 5: Patients response to the questionnaire of assessment

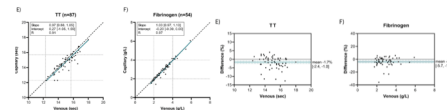
Patients	n	Capillary sample collection site painful than venipuncture		Capillary sample self-collection easier than venipuncture		Capillary blood sample consistent for remote health control		
		Yes (%)	No (%)	Yes (%)	No (%)	Yes (%)	No (%)	p-value
Group 1	131	64.7% (88)	24.1% (33)	11.3% (15)	0.005	68.4% (91)	3.8% (5)	0.56
Group 2	149	44.9% (70)	28.9% (45)	16.4% (25)	0.005	79% (124)	6.0% (9)	0.15
Male	131	58.8% (73)	29% (36)	12.2% (15)	0.005	85% (107)	1.3% (2)	0.89
Female	151	55.6% (84)	33.8% (51)	16.6% (25)	0.005	82.1% (124)	4.6% (7)	0.16
Age <50	107	58.8% (65)	33.2% (38)	15.9% (18)	0.294	83.6% (96)	5.6% (6)	0.21
Age ≥50	148	51.1% (84)	33% (52)	16% (26)	0.005	78.7% (114)	5.4% (8)	0.01



Toepassingen in de praktijk - hemostase

- INR, PT, APTT, TT, fibrinogeen, D-dimeer
- Vingerprik met lancet (BD, 2mm)
- Minicollect citraat

Comparison of capillary and venous blood sampling for routine investigation assays
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Toepassingen in de praktijk - hemostase

In conclusion, a method comparison between capillary and venous blood sampling for routine coagulation assays was performed in this study. Strong correlations and acceptable variations were found for INR, PT, TT, fibrinogen, and D-dimer between capillary and venous sampling. However, capillary sampling resulted in significantly shorter APTT values when using the standard APTT-SP Liquid reagent. Based on these results, capillary blood sampling proved to be an alternative blood withdrawal method for routine coagulation assays, with the exception of APTT, if a venipuncture is unavailable.

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Toepassingen in de praktijk - hemocytometrie

Stability and comparison of complete blood count parameters between capillary and venous blood samples

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Parameter	Mean relative difference % (95% CI)	TES (%)	Within TES?
Erythrocytes	2.0 (1.5 to 2.5)	3.9	Yes
Hematocrit	1.5 (0.9 to 2.0)	3.9	Yes
Hemoglobin	0.3 (-0.2 to 0.7)	3.8	Yes
Leukocytes	0.7 (-2.2 to 0.7)	13.8	Yes
Lymphocytes	0 (-2.2 to 2.3)	13.2	Yes
MCH	-1.6 (-2.0 to -1.2)	1.8	No
MCV	-0.7 (-0.9 to -0.5)	1.4	Yes
Neutrophils	0.9 (-0.3 to 0.3)	18.4	Yes
Basophils	8.4 (0.3 to 16.6)	13.2	Yes
Platelets	8.1 (-1.0 to 16.1)	13.2	Yes

In conclusion, overall comparability between capillary and venous CBC measurements was excellent, as demonstrated by Deming regression and bias analysis. The feasibility and clinical validity of delayed blood sample analysis depends on the clinical situation and required precision of the result. Although statistical significant changes of CBC measurements were observed within 24 h after sample collection, the majority of CBC parameters remained within desirable TES up to 72 h at 4°C or room temperature (21-22°C). Clinical laboratory specialists and clinicians should be aware of possible differences in venous and capillary measurements, and increased probability of invalid measurements with delayed analysis or storage temperatures exceeding room temperature. Our research

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Toepassingen in de praktijk

- Als het te mooi is om waar te zijn.....Theranos
- POCT testen
- Naaldangst, kinderen, ouderen, obesitas
- Monitoring van chronisch zieken (@home)
- Follow-up na ziekte (@home)



- Punctiemethoden
- Collectiemethoden
- Monstervolume/test

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Toepassingen in de praktijk

BD Receives FDA 510(k) Clearance for Potentially Transformative Fingertip Blood Collection Device

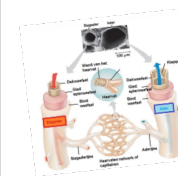
The 510(k) clearances include low-volume blood collection for a lipid panel, selected chemistry tests, and hemoglobin and hematocrit (Hb/Ht) testing. These tests are among the most commonly ordered lab tests and can be used to diagnose and monitor a variety of chronic conditions from hypertension to high cholesterol. BD plans to expand blood tests enabled by BD MiniDraw™ Collection System in the future.



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Vragen



<https://biologieles.nl/index.php/dna-18/489-capillaren-en-gaswisseling>

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Referenties

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