Flushing and locking of venous access devices: guidelines, scientific evidence and clinical practice

Flushing I.V. catheters: guidelines, scientific evidence and reality

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Disclosures:

Baxter, Boehringer, B-Braun, Bard, Eumedica, Becton Dickinson, Cook Medical, ICU, Perouse Medical, Smith and Nephew, 3M, Vygon,Teleflex,, …

When is it necessary to flush a catheter ?

1/ What should you flush?

2/ Origin of pollution?

3/ Flushing guidelines?

4/ Anything new?

5/ And in practice?

6/ References

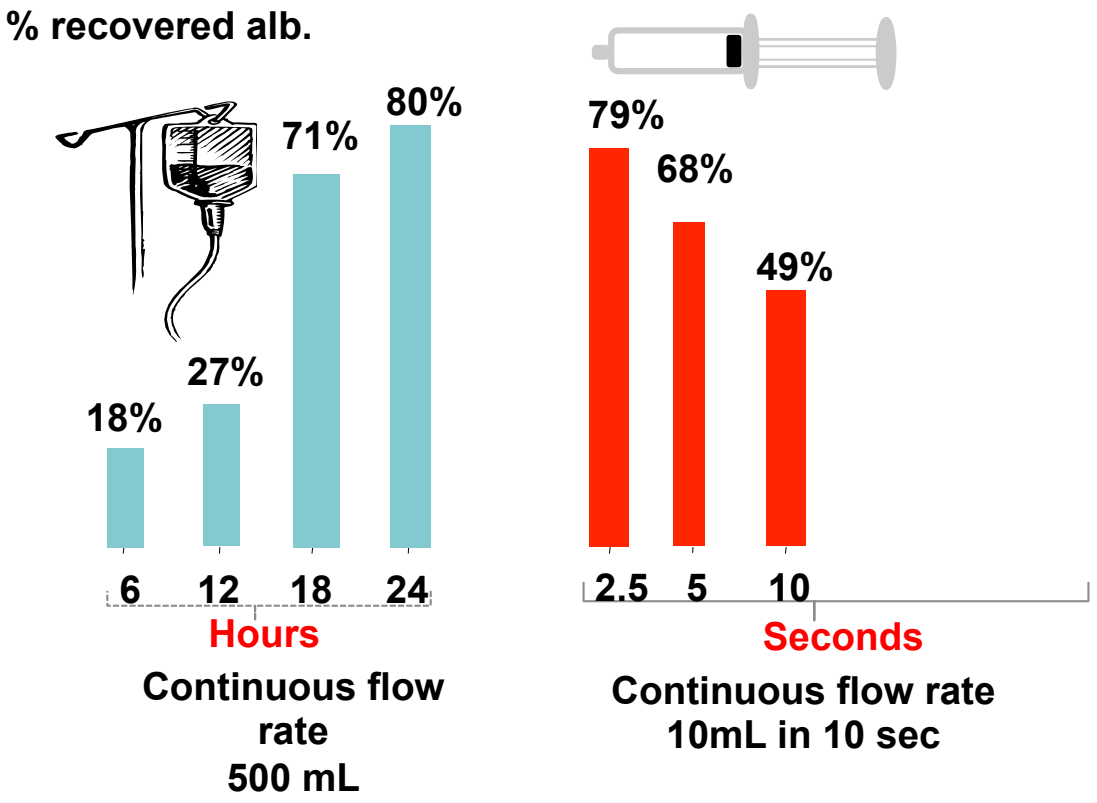
DEFINITIONS: FLUSHING / RINSING

RINSING:

Injecting a fluid to eliminate a drug product or biological content in a medical device (md)

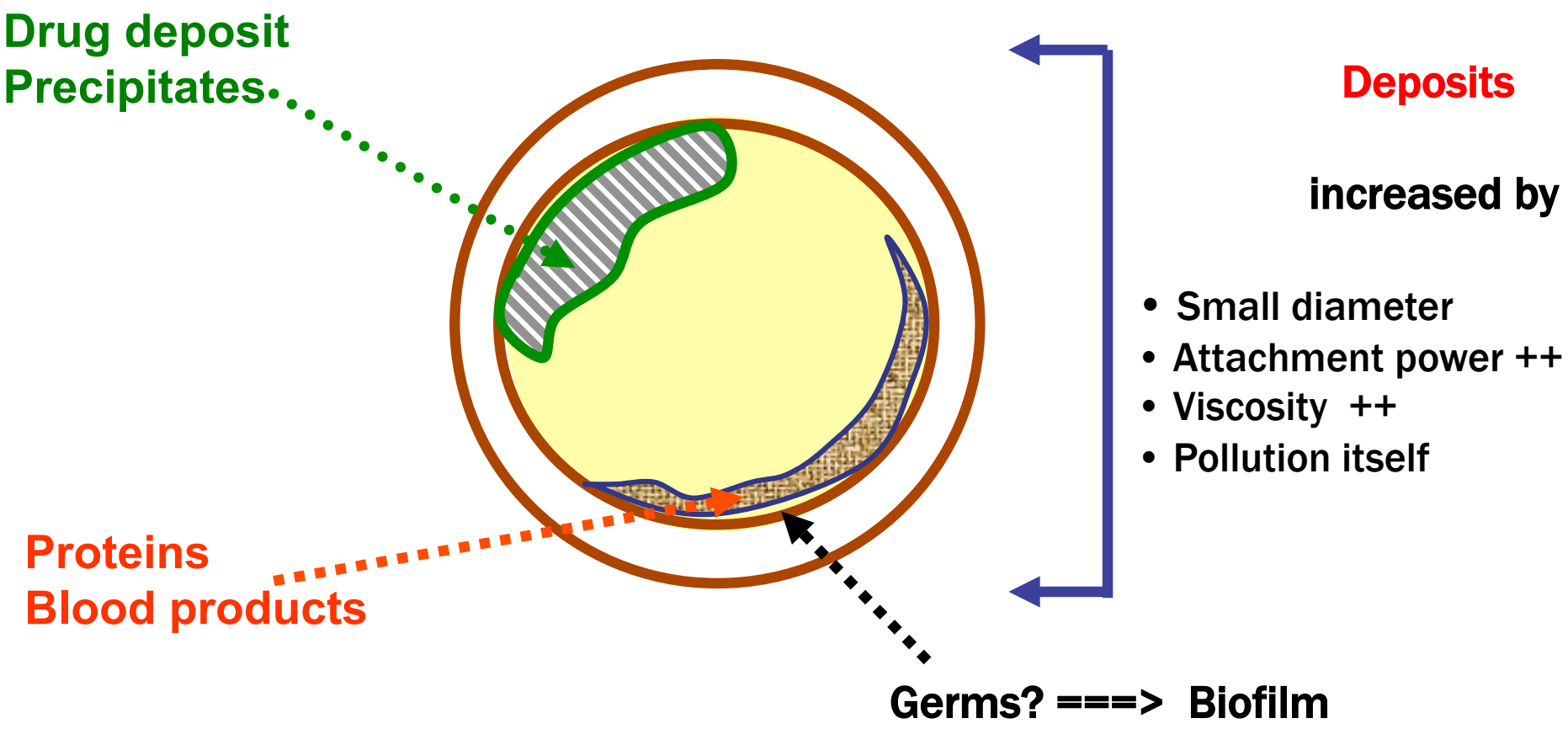
FLUSHING:

Injecting a fluid in order to remove fixed but removeable drugs and proteins on the wall of a md



1/ What should you flush?

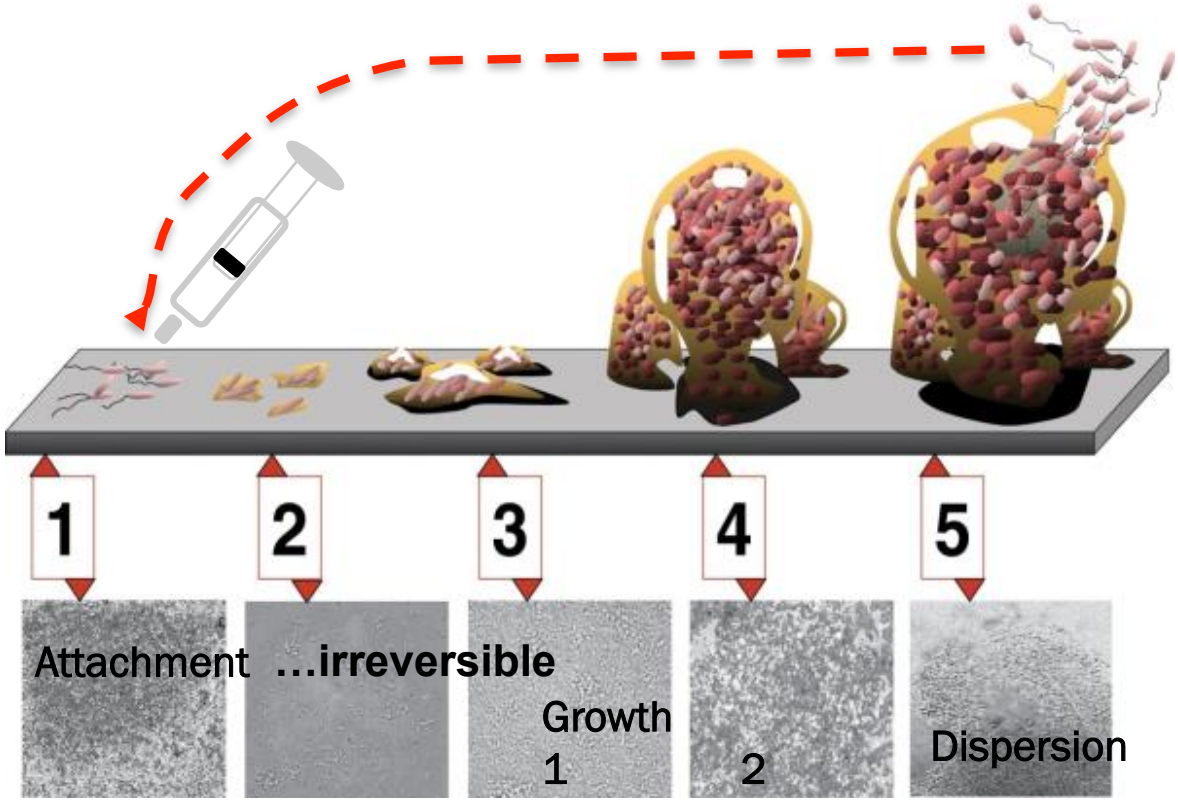
Spontaneous and following injections ... but repeated



Small pollutions lead to .....

....greater occlusions AND more infections

1/ What should you flush?



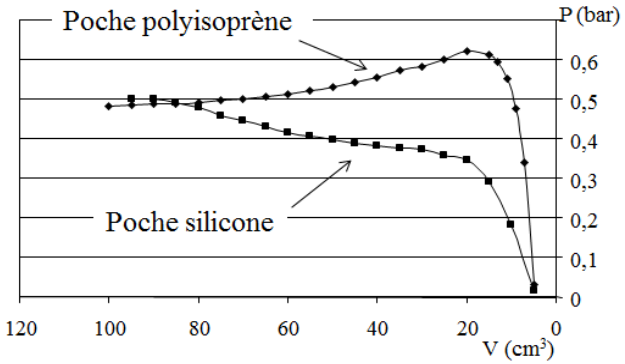
By D . PLoS Biology Vol 5 ;11 e 307 doi: 10.137/journal.pbio.0050307

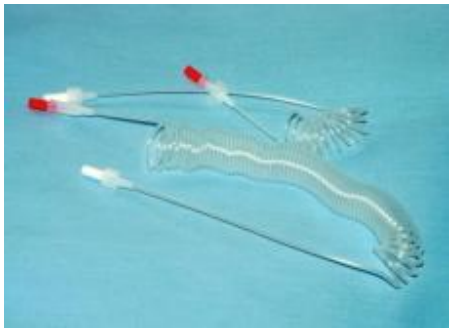
Ferroni A et al. Pulsative flushing as a strategy to prevent bacterial colonization of vascular access devices.

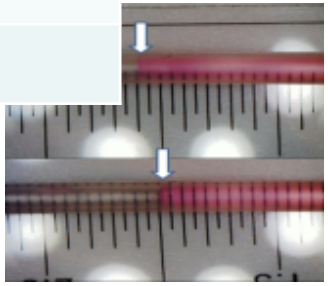

4cc/sec MAX

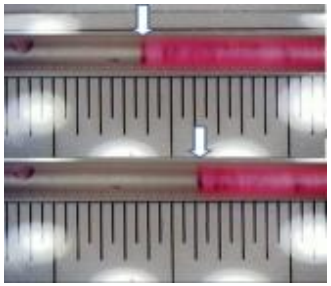
2/ Origins of pollution

External movement	Insertion I.V. line (flexibility, spiral line, unclamping)
Internal movement	Patient dependent (cough, movements in the daily life, …) Device dependent (infusor, gravity))
Practice	Inefficient flushing/ external and haematogenous contamination
Infused solution	Viscosity

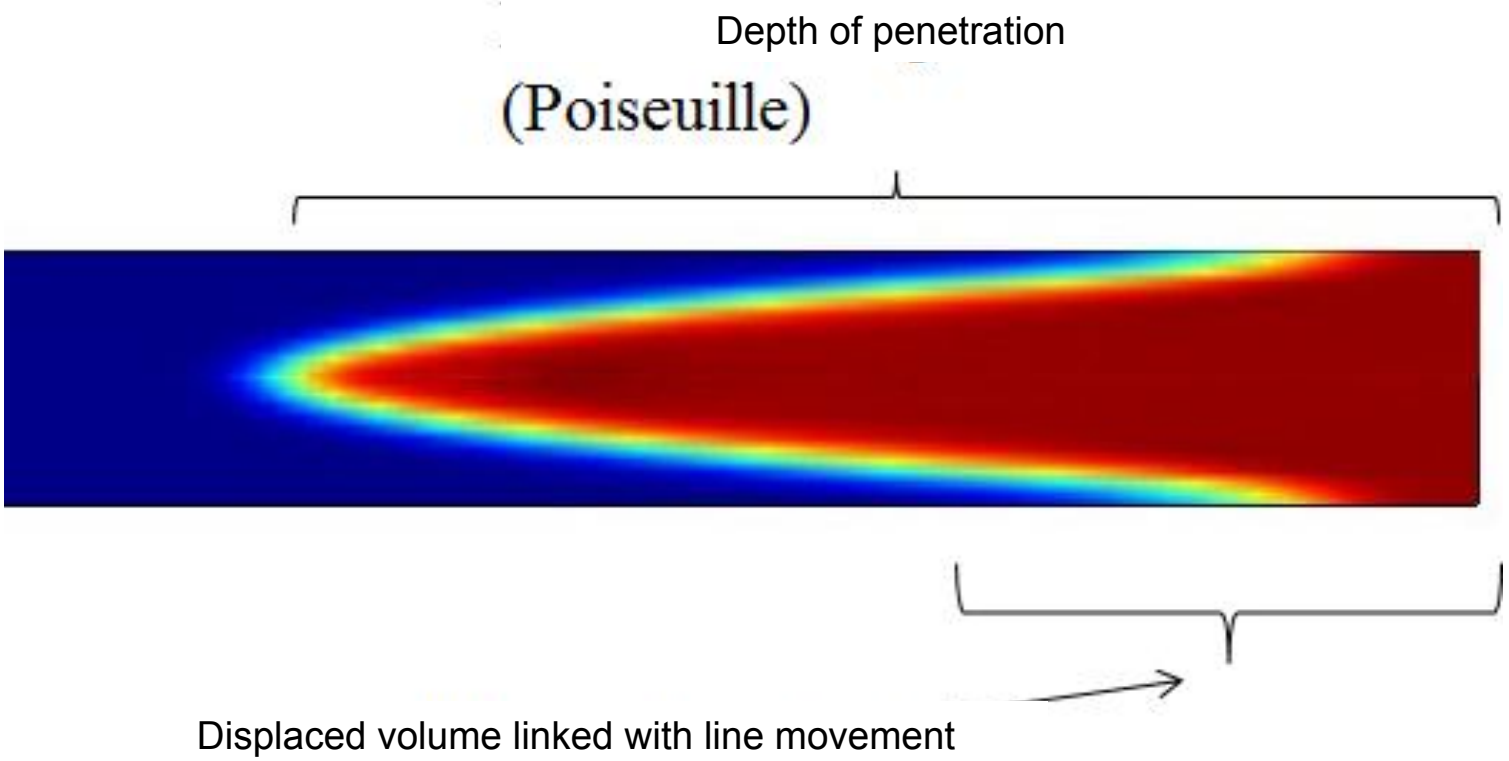








2/ Origins of pollution

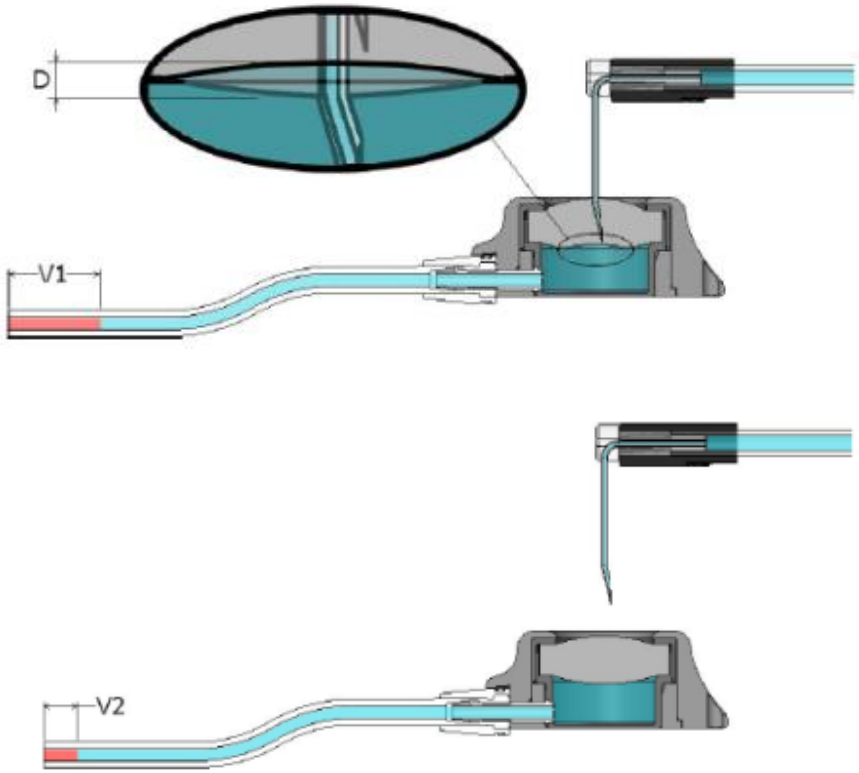


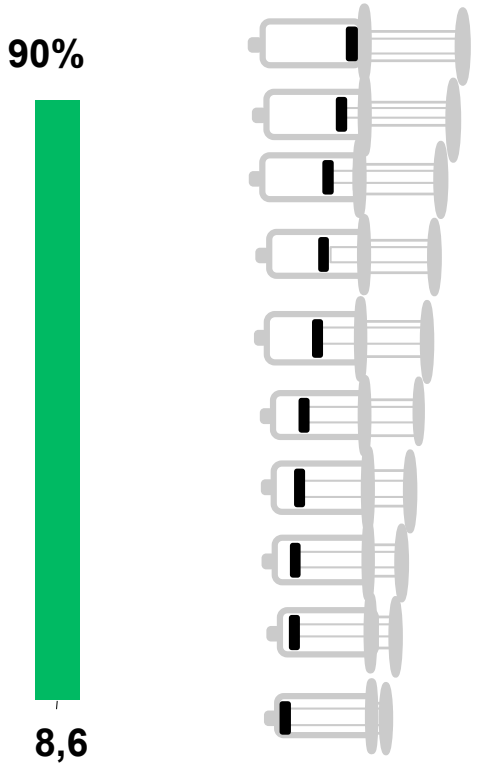
In fact, the pollution is twice as high

3/ Flushing Guidelines?

- Flushing solution (NS) preferred not because of viscosity but due to infection risk

- Pulsatile or Push/pause flushing technique





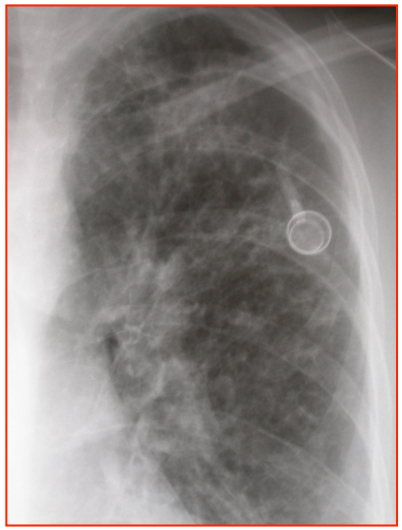
Pulsatile flush
1mL x 10 in 0,5 sec
0,4 sec steps x 9

Flushing and locking of venous catheters:available evidence and evident deficit
L. Goosens. 2015

3/ Flushing guidelines

- Syringe with a plunger diameter not less than 1.5 cm

Indicated for de-obstruction,



But …

Today, recommended for all injections by french guidelines

4/ Anything new?

1/ The effect of positive pressure when locking the PICC doesn’t last

2/ The orientation of the bevel of the non coring needle impacts the efficacy of flushing

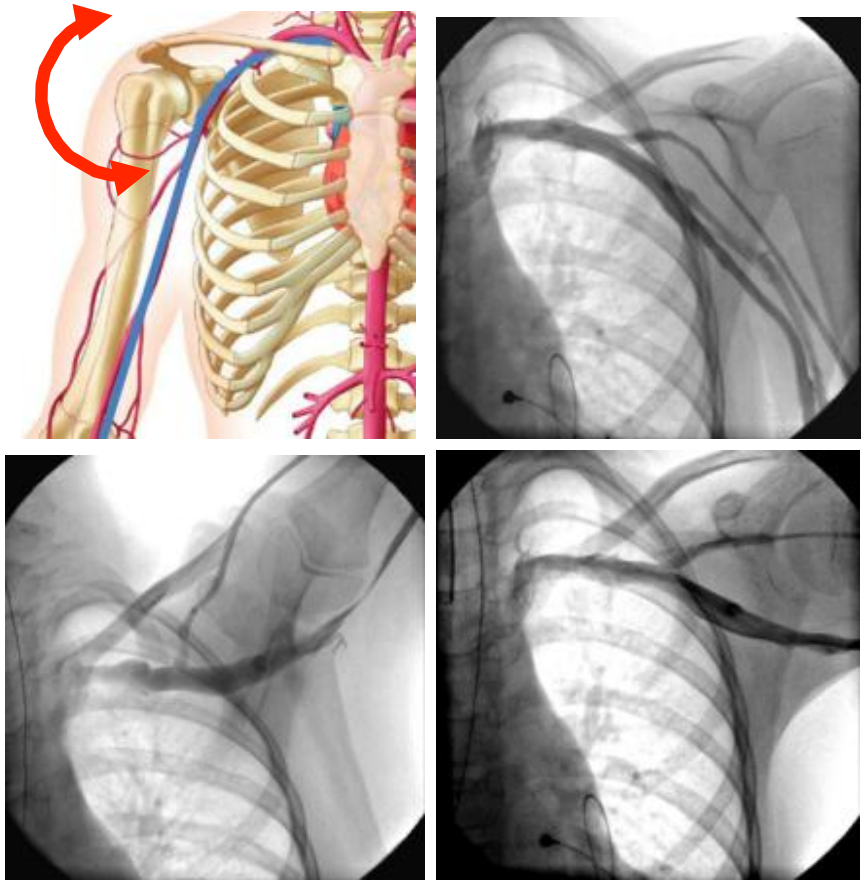
3/ It’s impossible to totally flush out X-ray contrast media

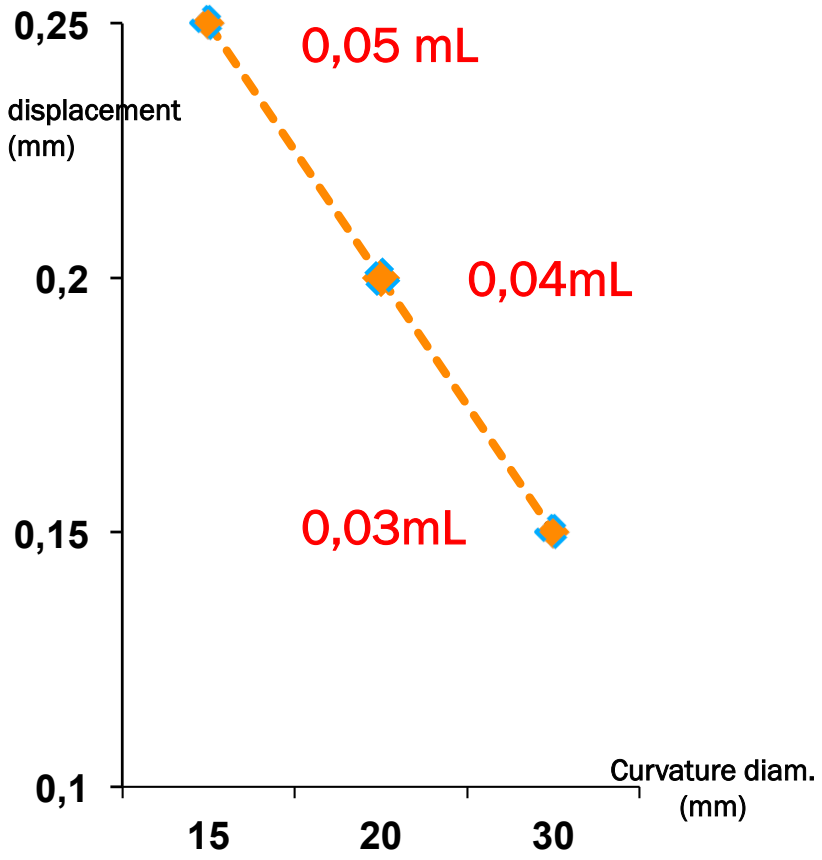
4/ Spherical Ports are easier to flush

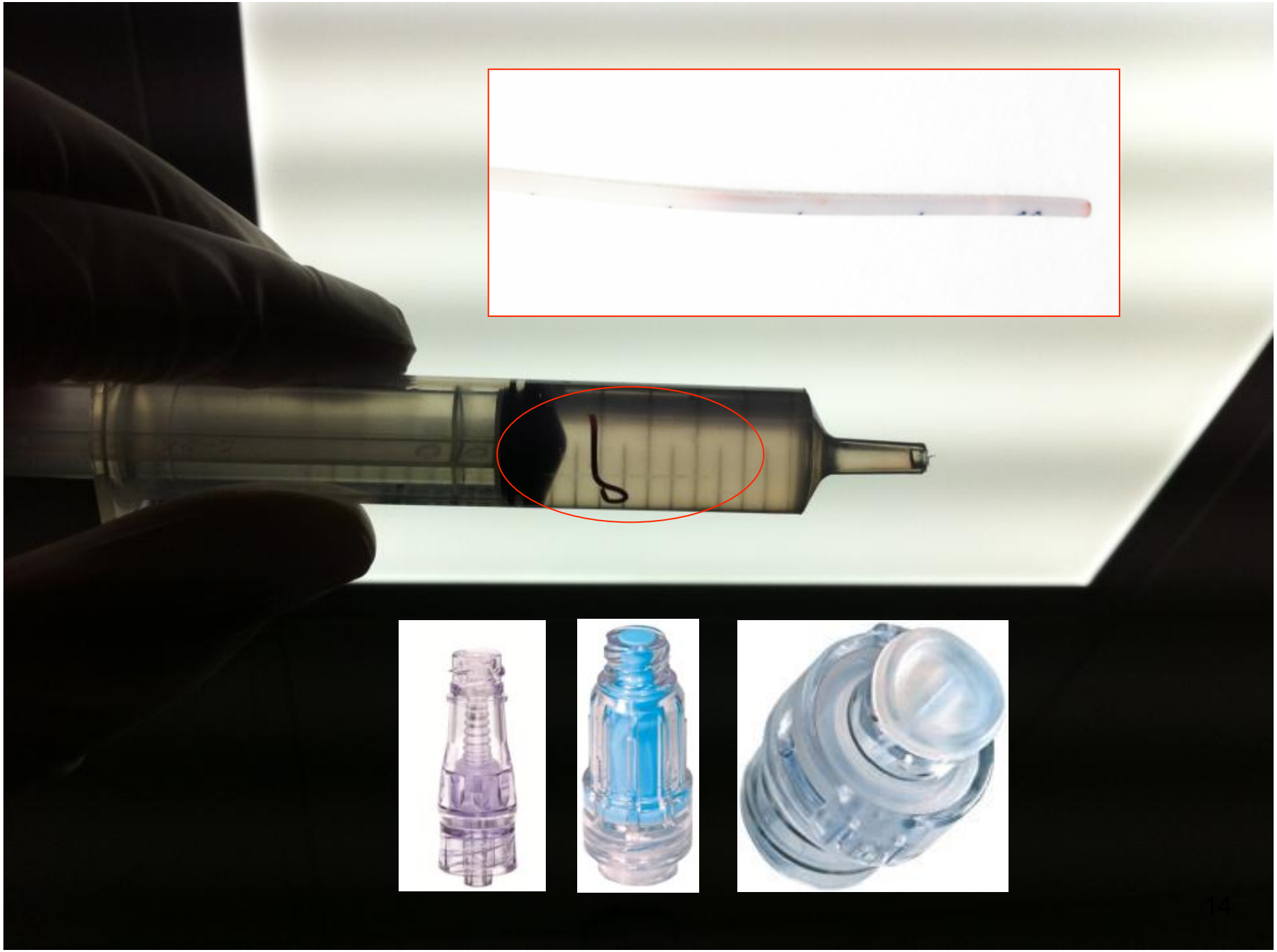
5/ The delay between the end of the infusion and the flushing impacts the efficacy of the flushing

6/ 5 mL is not enough to flush efficiently NFC polluted with TPN

4.1/ The effect of positive pressure when locking the PICC doesn't last



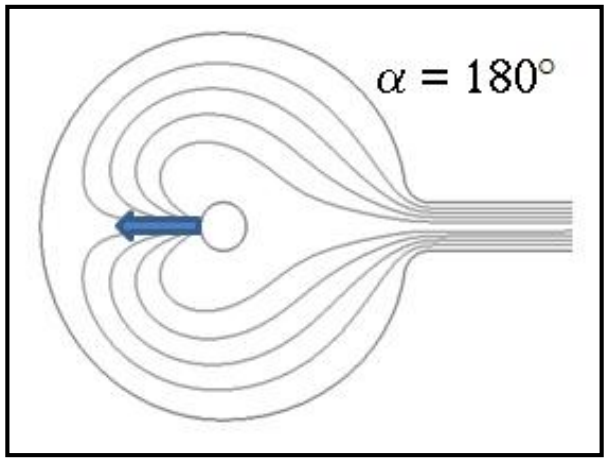


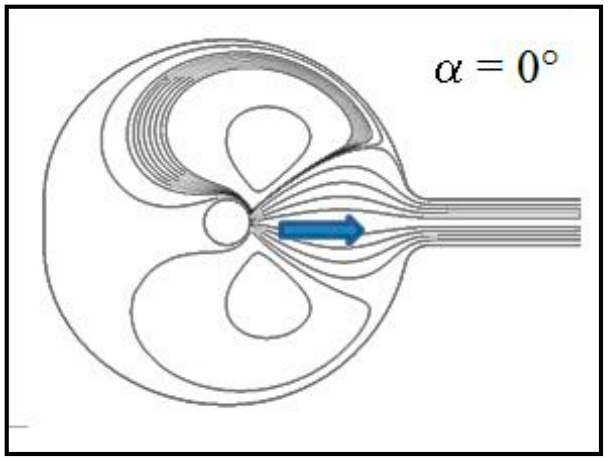


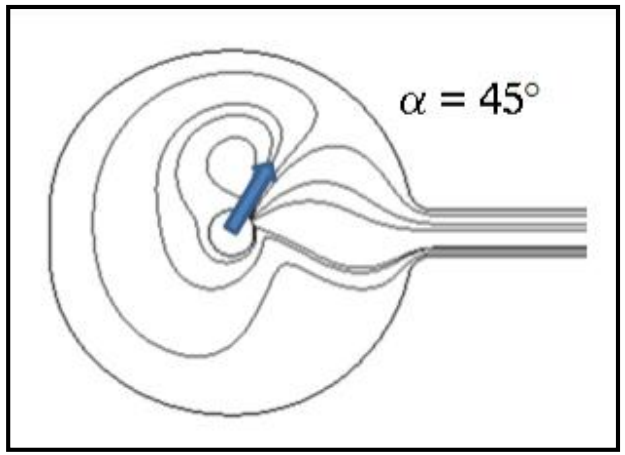
4. 2/ The orientation of the bevel of the non coring needle impacts the efficacy of flushing

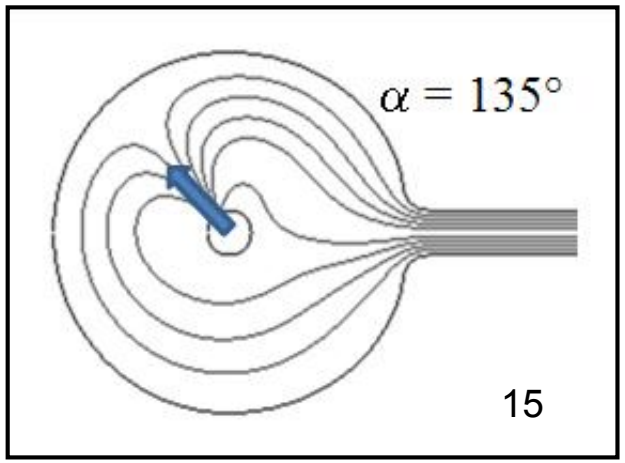
Flow lines

Recirculation ===> trap

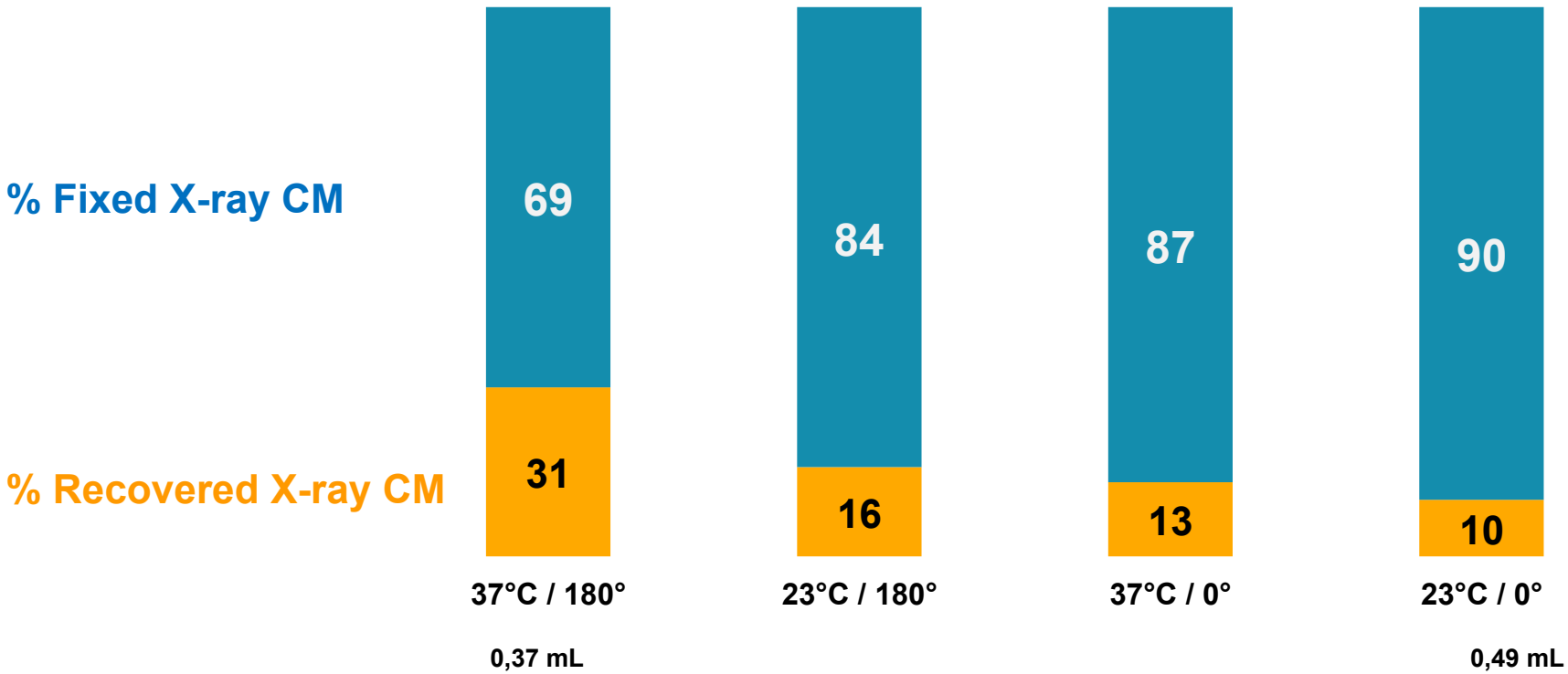


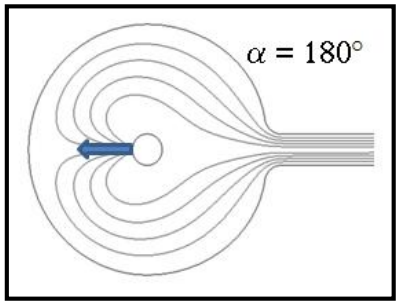






4.3/ It’s impossible to totally flush out X-ray contrast media



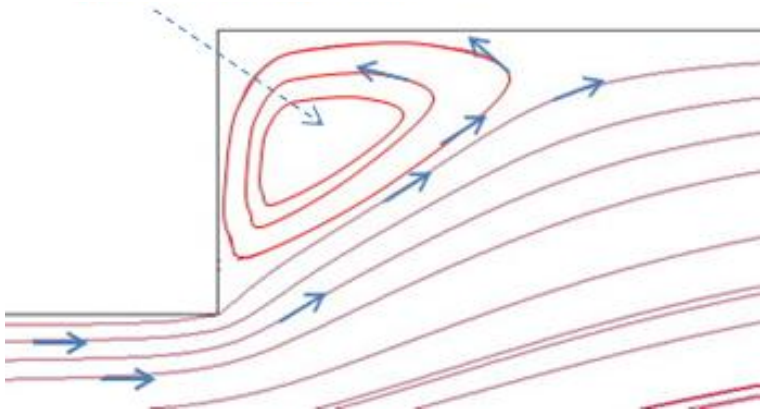


Cc : Whatever you do, the CM is not totally flushed
+ Tip displacement risk

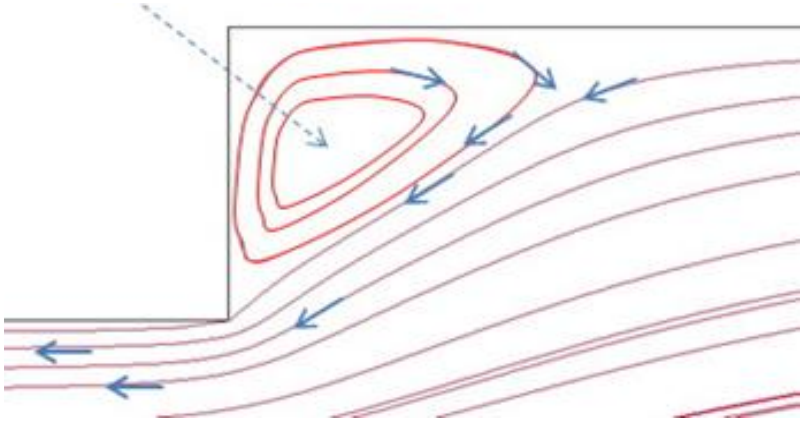
4.4/ Spherical Ports are easier to flush

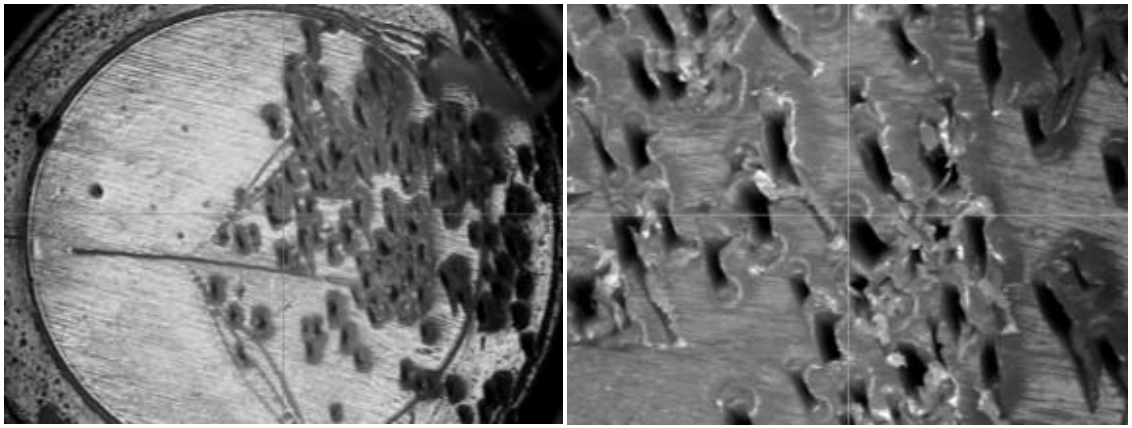
Importance of devices design when flushing

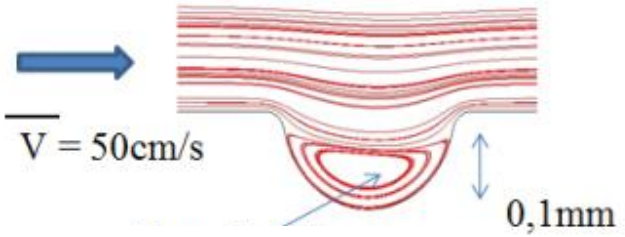
Recirculation zone



Recirculation zone





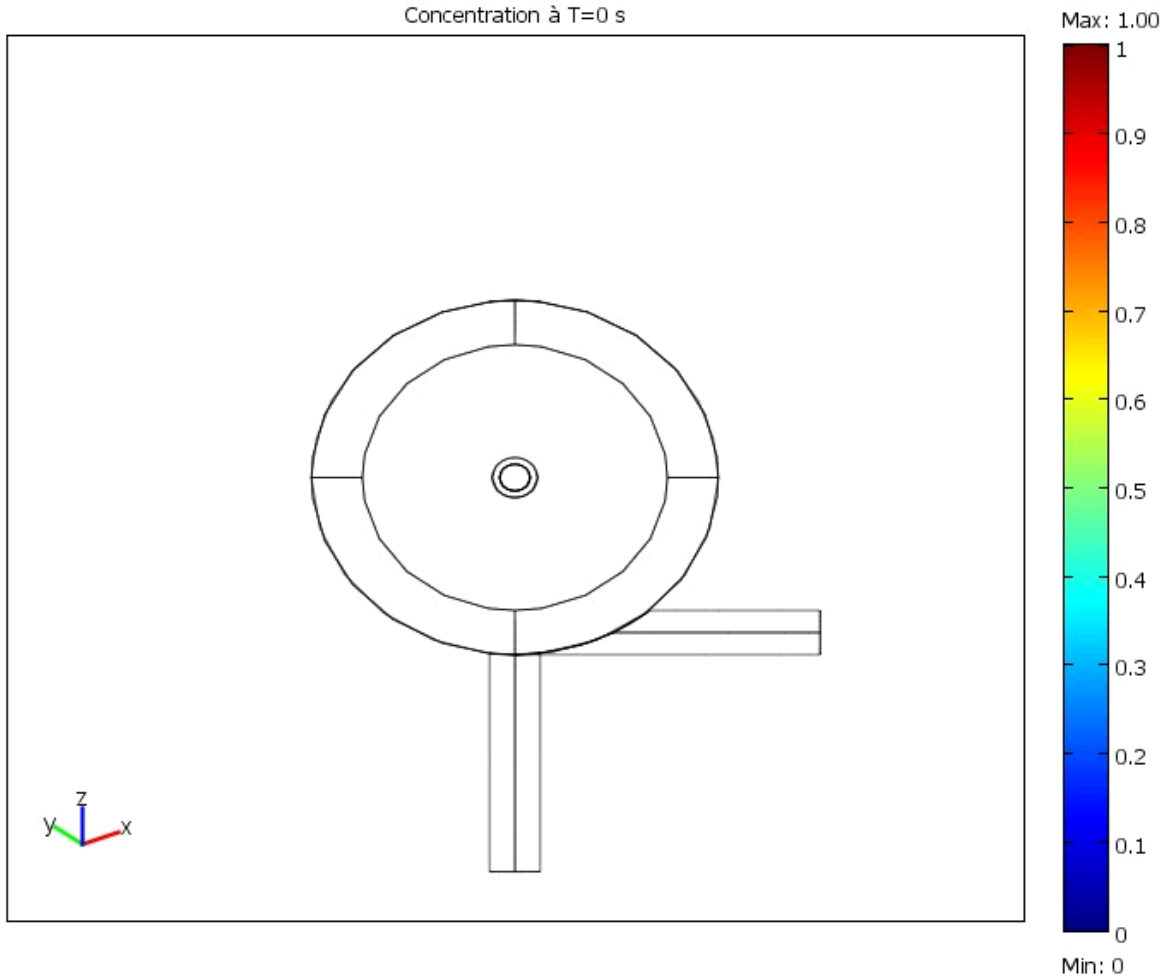


Trap zone

4.4/ Spherical Ports are easier to flush

Importance of device design when flushing

Comparison rinsing Rounded (Spherical Ports) / Straight Walls Ports backwards rinsing



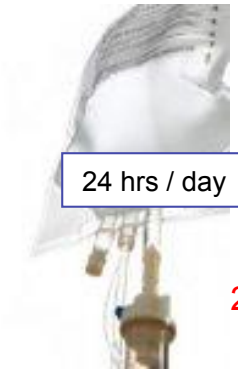
4.5/ The delay between the end of the infusion and the flushing impacts the efficacy of the flushing

4.6/ 5 mL is not enough to flush efficiently NFC polluted with TPN

- After infusion of radio labeled TPN (Smofkabiven®, Frésénius Kabi),
  a flush 24 hrs after the end of the infusion shows a more important residual pollution
  with mechanical NFC than with others.
  This difference isn't significant if the mechanical NFC is flushed just after the end of the TPN infusion
  or 1hr after.

- A 10 mL flush is more efficient than a 5 mL one with any valve.

5/ And in practice?



24 hrs / day Infusion

2nd Infusion 30 mn after the end of n°1 without flushing = HIGH RISK ?

1st Infusion

Catheter

STOPCOCK

Extension line
Length: 13,5 cm
Internal diameter: 2.5 mm

VOLUMETRIC PUMP

2 cm between 2 stopcocks

Extension line
Length: 150 cm
Internal diameter: 2.5 mm

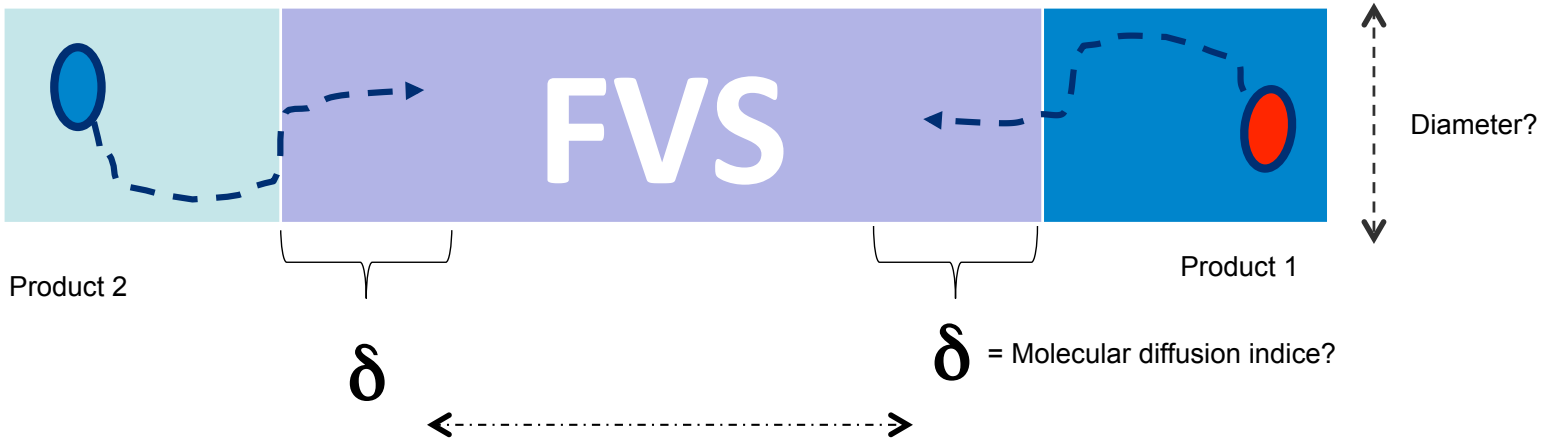
Extension line
Length:100 cm
Internal diameter: 2.5 mm

STOPCOCK

Haematology unit:

10 infusions / day
1 blood sampling / day
2 L continous infusion / day

Infusion rate?



FLUID VOLUME SEPARATOR

Infusion rate (mL/24Hrs)	duration in s for obtaining a 1cm plug in the line
500	9
1000	5
2000	3
3000	2
4000	1

APPROXIMATE TIME TO OBTAIN A 1 cm FLUID VOLUME SEPARATOR (FVS)

Infusion rate (mL/24Hrs)	Transit perfusion time t in the line of perfusion (mean diameter 3mm) for a length Lp		
	Lp = 2cm	Lp = 150cm	Lp = 263,5cm
500	17 s	21 mn	37 mn
1000	9 s	11 mn	19 mn
2000	4 s	5 mn	9 mn
3000	3 s	4 mn	6 mn
4000	2 s	3 mn	4 mn

APPROXIMATE TIME FOR FVS TO GO TO THE INJETION POINT

Internal diameter: 2.5 mm

5. And in practice?

Relative protection by FVS

1L over 24h

1st Infusion

VOLUMETRIC PUMP

FVS in 9 sec

2 cm between 2 stopcocks

150 cm Extension line

13,5 cm Extension line

Catheter

STOPCOCK

FVS in 19 mn

100 cm Extension line

FVS in 11 mn

STOPCOCK

Relative protection by FVC

- Don’t infuse 2 products together without considering precipitation risk

  Ex. Heparin, Furosemide, Vancomycin, ..

- The needle free connector is not flushed (infection risk)

5. And in practice?

With intermitently or continuously infused I.V. line:

- Systematic flushing after each injection
- Higher risk with blood products (transfusion or sampling), TPN, vesicant drugs

Inject contrast media in a central line only when SPC insertion is risky or impossible

With continuously infused I.V. line and
when the policy of systematic flushing after each injection is problematic:

- Use fluid volume separator effect
- Flush the Catheter once a day at the most proximal access point

In any case:

- Change I.V. line every 4 days
- Change the non coring needle 7 days (never more) and only with 20 and 22 G
- Make a list of incompatible medications available on the unit

To understand reality, beliefs and senses are not enough

By Caravaggio from Milan

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