

# Abruption and severe coagulopathy

# Disclaimer / Pre-amble

- These cases have been de-identified to protect the identity of the patient and the treating teams.
- These are all real cases and real ROTEMs. The individuals involved in these difficult cases have agreed to anonymously share these with us – thank you for your generosity.
- Successful management of the bleeding patient involves much more than just administration of blood products.
- The primary aim of these cases is to teach the use ROTEM guided blood product therapy. We have deliberately not included a lot of detail about some of the other aspects of management which might detract from this focus.

# Case Two – 2016

- 33 yr old woman, 34 weeks pregnant, 1 previous vaginal delivery
- Presents to hospital with antepartum haemorrhage and premature labour
- Urgent USS confirms abruption and fetal death in utero
- Request for an epidural for pain relief via phone – anaesthetist asks for COAG first.
- Standard laboratory blood tests taken by O&G team at 0930 show:  
(No ROTEM is done at this time)

## 0930 – Standard COAG profile

Prothrombin time 48.6s (12.4-16.4)

INR 5.0 (0.9 – 1.3)

APTT 75.4 (25 – 38.0)

APTT 50:50 32.9 (normal)

Thrombin clotting time 70.1 (14-18)

Fibrinogen < 0.4g/L (not available initially sent to SCGH)

## 0930 – FBC

Hb 110

Platelet count 46

- **Based on these results what do you think are the underlying coagulation problems and what treatments would you give?**

# Case Two – 2016

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Fibrinogen (not available so sample sent to SCGH)

## 0930 – FBC

Hb 110

Platelet count 46

Platelet count of 46 – She will probably need platelets

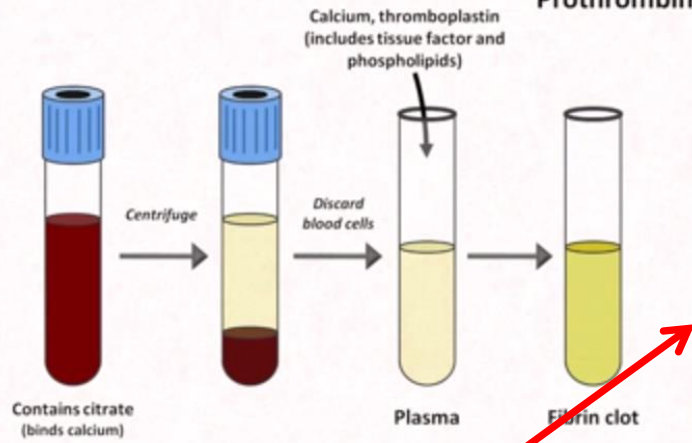
## Comments:

- The first thing that jumps out is the markedly prolonged INR of 5.0
- As we all know the INR is a test designed to measure the level of vitamin K dependent clotting factors (2,7,9,10)
- The most common clinical setting in which we see a prolonged INR is a deficiency of these clotting factors - usually because of warfarin use or liver disease.
- So I think it is reasonable to state that most of us assume when we see a markedly prolonged INR that “clotting factors” are needed or more specifically we want to give FFP (or prothrombinex in the case of warfarin).

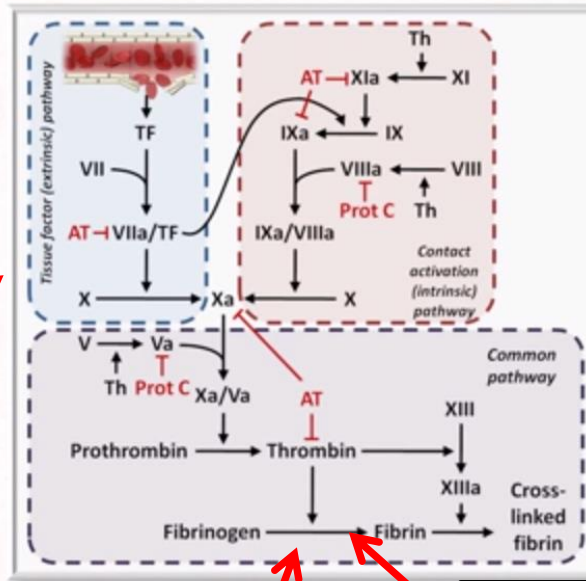
## But why is the INR prolonged in an obstetric patient having an abruption?

- She is not on warfarin and we have no reason to believe she has liver disease (although this can occur acutely in pregnancy).
- Let’s remind ourselves what an INR measures and what can actually cause it to be prolonged.

## PT Prothrombin Time



- PT is the time in seconds for the fibrin clot to form.
- Measures function of the tissue factor (extrinsic) and common pathways.



### Fibrinolysis

- The final step is formation of fibrin; in the setting of severe fibrinolysis this will prolong the INR / PT.

- The PT / INR measurement is prolonged if there is a deficiency in the “Extrinsic Pathway” (Tissue factor pathway)
- Factors 7 & 10

- It is also prolonged if there is a deficiency in the **“Common Pathway”**
- Factor 5, 2 prothrombin, fibrinogen and 13

# Case Two – 2016

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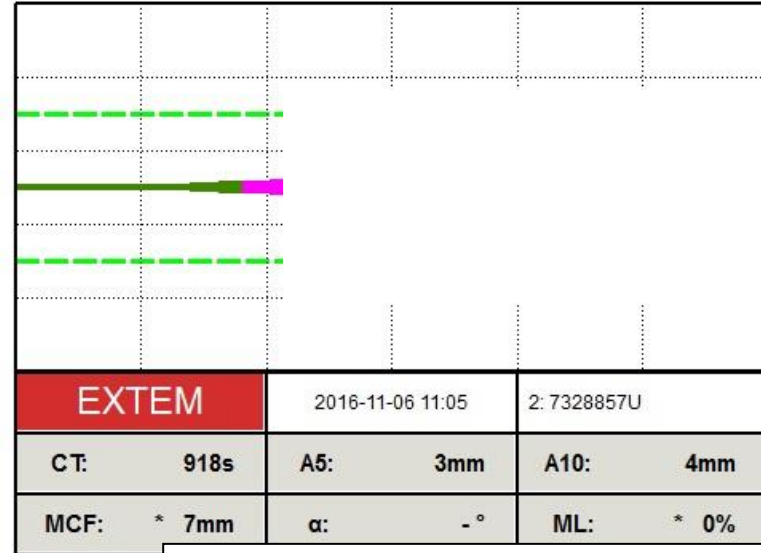
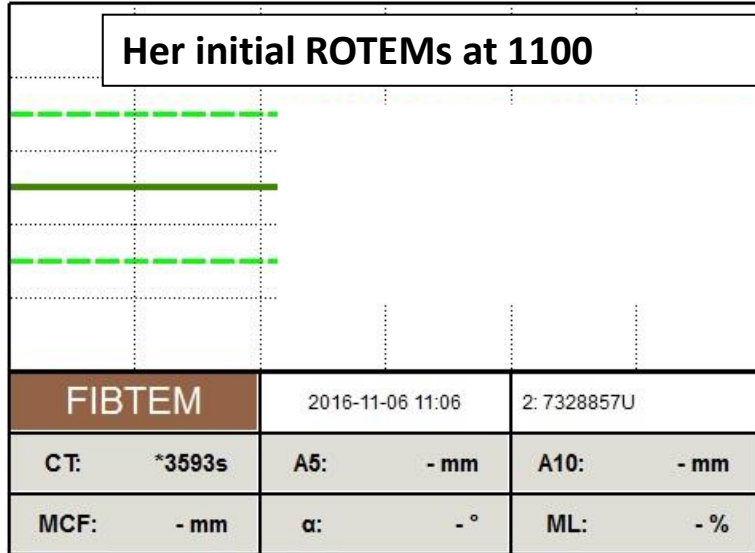
### So in light of this knowledge what should these results make us think?

- Coagulopathy can occur rapidly in abruption and these results indicate she is at very high risk of major haemorrhage.
- INR / APTT are severely prolonged – this could be due to hyperfibrinolysis, fibrinogen deficiency, low clotting factors (thrombin generation) or any combination of these.
- I would personally get an urgent ROTEM to help in the decision making (another blue tube will be needed as the original COAG sample has been centrifuged), ideally a Fibtem / Extem and Aptem.
- We can tell she will probably need platelets (only 46) and these should be requested early as they are not kept on site and probably fibrinogen - what dose is unclear however.
- I would definitely consider giving tranexamic acid 1g empirically without waiting for the ROTEM.

# Case Two – 2016

- A decision to deliver her vaginally is made as she was stable.
- Because of the coagulopathy the anaesthetist declines to perform an epidural
- She is given a PCA (patient controlled analgesia) of fentanyl for pain relief and whilst sitting a second IV for this – repeat bloods and ROTEM are sent off. (Aptem not requested unfortunately in retrospect)

## Her initial ROTEMs at 1100



At about 20min this is what you see.

- What is going here!!
- What treatment would you give if you use the ROTEM algorithm?

## 1100 – Standard COAG profile

INR 4.7 (0.9 – 1.3)

APTT 96.5 (25 – 38.0)

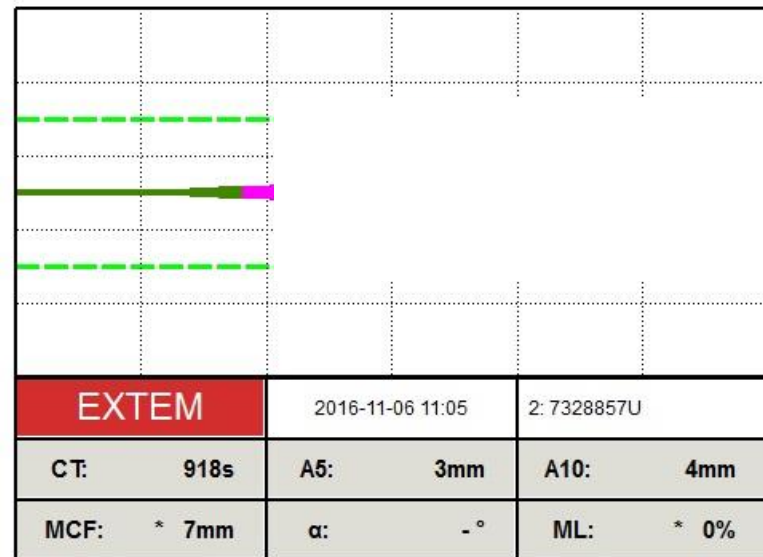
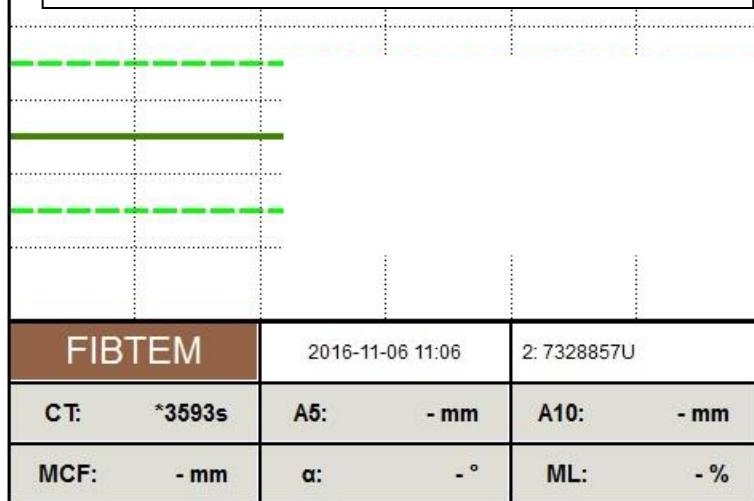
Fibrinogen 0.2g/L

Hb 110

Platelets 46

# Case Two – 2016

## Her initial ROTEMs at 1100



### Using the new draft KEMH ROTEM algorithm:

- Fibrinolysis:** Fibtetm CT > 600s – severe hyperfibrinolysis is high on the differential diagnosis here and it is very likely give TXA 1g.
- Fibrinogen:** Fibtetm A5 = 0 mm, Probably < 4mm Give Fibrinogen concentrate 4-5g (or cryo 20 - 25 units)
- Platelets:** Extem A5 =3mm but unreliable in presence of hyperfibrinolysis – use APTEM or treat with TXA and urgently repeat the ROTEM. However based on the known platelet count of 46 earlier it is very sensible to give platelets
- Factors:** Extem CT = 918s, can't interpret in the presence of hyperfibrinolysis / low fibrinogen. Use APTEM or give TXA / Fib Conc and get repeat ROTEM ideally. Not unreasonable to give PTX (or FFP) to improve thrombin generation if the clinical situation is dire (she is actually relatively stable and in labour)

This demonstrates almost complete haemostatic failure and is an absolutely critical situation in a woman about to give birth.....



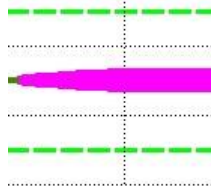
# Case Two – 2016

- **Over the next 1-2 hours during her labour she is given 2 units of FFP and 1 adult dose of platelets.**
- **She delivers at around 1230 and despite the above treatments she has very severe rapid bleeding and a code blue is called.**
- **She is given oxytocin / ergometrine and 2 litres of Hartmanns.**
- **She is rushed to theatre and arrives after an estimated blood loss of 3 litres over 30minutes.**

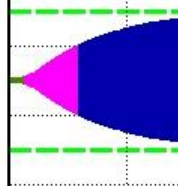
# Case Two – 2016

- The anaesthesia team at this stage are unaware of the first ROTEM result.
- She is given a GA and arterial line placed
- Tranexamic acid 1g is given immediately and cryoprecipitate apheresis 5 units (= 10units std cryo) which were already being thawed based on earlier results arrive and are rapidly given.
- A repeat ROTEM is then sent off.

## ROTEMs at 1342



FIBTEM				2016-11-06 13:42		2: 7328883W	
CT:	69s	A5:	5mm	A10:	6mm		
MCF:	7mm	α:	-°	ML:	* 0%		



EXTEM				2016-11-06 13:41		2: 7328883W	
CT:	86s	A5:	21mm	A10:	32mm		
MCF:	46mm	α:	44°	ML:	* 0%		

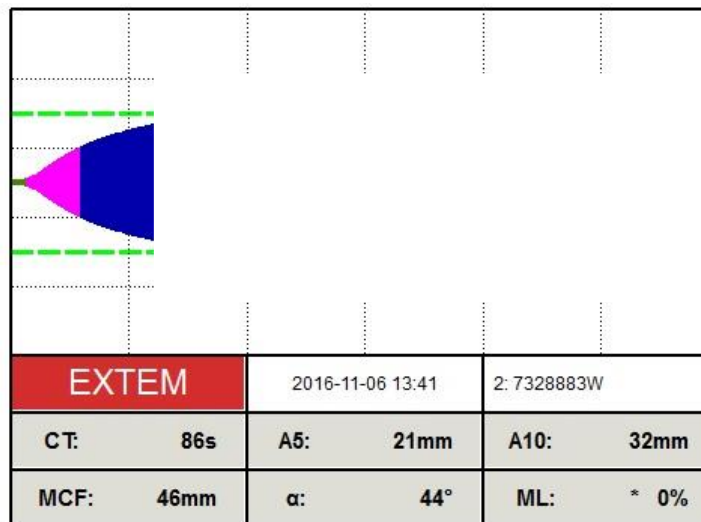
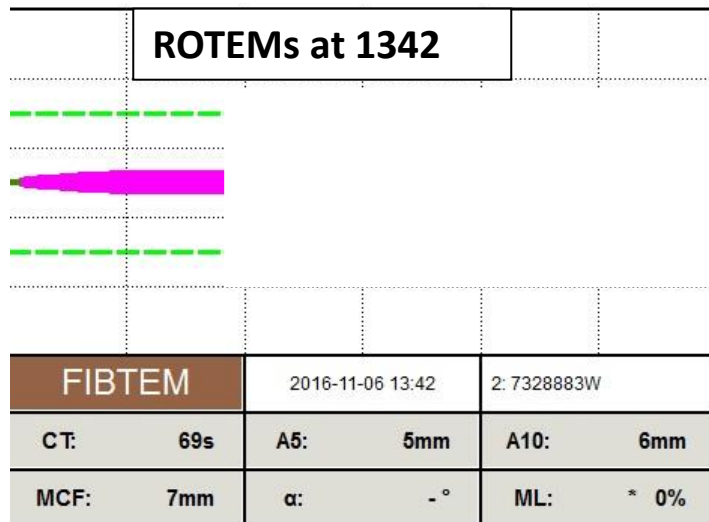
You see this trace (runtime of about 12min)

- What treatment would you give if you use the ROTEM algorithm?

### 1342 – Standard COAG profile

INR 1.5 (0.9 – 1.3)  
 APTT 41.4 (25 – 38.0)  
 Fibrinogen 1.1g/L  
 Hb 52  
 Platelet count 53

# Case Two – 2016



## Using the new draft KEMH ROTEM algorithm:

The probable fibrinolysis has now been treated and all the other underlying abnormalities can be readily diagnosed and treated. Despite all the previous treatments (TXA / FFP / Cryo / Platelets) she is still severely coagulopathic.

- Fibrinolysis:** Tranexamic acid has been given already and ML = 0% so no further TXA needed
- Fibrinogen:** Fibtet A5 = 5 mm, Using the dosing table Give Fibrinogen concentrate 4g (or cryo 20 units)
- Platelets:** Extem A5=21mm (if Fibtet low and Extem A5 < 25mm) Give Platelets 1 adult dose – Despite the platelet count being > 50, Clot strength (Ext A5) is poor and more platelets are indicated.
- Factors:** Extem CT = 86s. If the fibtet is low and it is between 80-140s correct fibrinogen first then recheck – No FFP or Prothrombinex needed.

## 1342 – Standard COAG profile

**INR 1.5 (0.9 – 1.3)**

**APTT 41.4 (25 – 38.0)**

**Fibrinogen 1.1g/L**

**Hb 52**

**Platelet count 56**

# Case Two – 2016

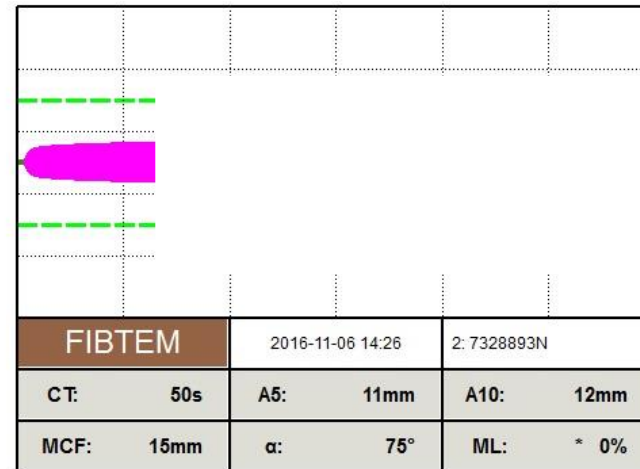
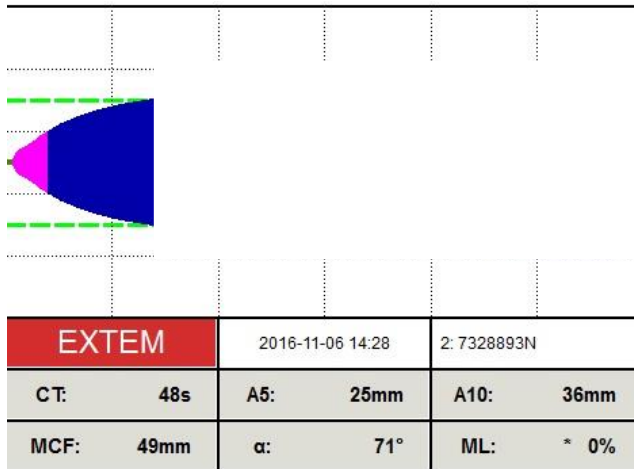
## Further Treatment:

- **4g of fibrinogen concentrate is given rapidly**  
(it is prepared using warm sterile water and each ampoule of 1g given over 3min.)
- **Red cells 4 units**
- **Surgical management consists of an intra-uterine Bakri balloon, vaginal packing and suturing of a tear.**
- **Uterine tone is relatively good throughout and clinically the impression is that the bleeding is mainly due to coagulopathy.**
- **Following this further tests / ROTEM are performed.**

# Case Two – 2016

## ROTEMs at 1428

- The patient is now in recovery and not bleeding, but there is concern that there is a high risk bleeding could recur and be concealed (behind the Bakri).



Once again I have shown you what the trace would look like after 10-15min – when you actually make a decision.

- What treatment would you give if you use the KEMH ROTEM algorithm?

### 1420 – Standard COAG profile

INR 1.4 (0.9 – 1.3)

APTT 38.2 (25 – 38.0)

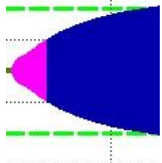
Fibrinogen 2.9g/L

Hb 105

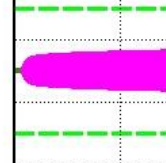
Platelet count 46

# Case Two – 2016

## ROTEMs at 1428



<b>EXTEM</b>		2016-11-06 14:28		2: 7328893N	
CT:	48s	A5:	25mm	A10:	36mm
MCF:	49mm	α:	71°	ML:	* 0%



<b>FIBTEM</b>		2016-11-06 14:26		2: 7328893N	
CT:	50s	A5:	11mm	A10:	12mm
MCF:	15mm	α:	75°	ML:	* 0%

### Using the new draft KEMH ROTEM algorithm:

The coagulopathy is now much better but still not normal.

- Fibrinolysis:** Tranexamic acid has been given already and ML = 0% so no further TXA needed
- Fibrinogen:** Fibtrem A5 = 11 mm, No further treatment needed. If platelets were unavailable (eg you are in a regional WA hospital) consider more fibrinogen to increase the Extem amplitude to above 35mm.
- Platelets:** Extem A5=25mm (<35mm and fibtem normal) Give Platelets 1 adult dose
- Factors:** Extem CT = 48s. This has completely normalised with fibrinogen alone.

### 1420 – Standard COAG profile

**INR 1.4 (0.9 – 1.3)**

**APTT 38.2 (25 – 38.0)**

**Fibrinogen 2.9g/L**

**Hb 105**

**Platelet count 46**

# Case Two – 2016

- She is given another adult dose of platelets another ROTEM is not performed however.
- She is transferred to the high dependency unit and there is no further bleeding.

## SUMMARY of blood products

- Fibrinogen concentrate 4g
- FFP 2 units
- Cryoprecipitate 10 units (5 apheresis units)
- Platelets 2 adult doses
- Red cells 4 units
- Tranexamic Acid 1g

Overall estimated blood loss 4 litres

# Discussion Points

One:

Coagulopathy can occur very rapidly in abruption – for further reading see ref below:

[Int J Obstet Anesth. 2015 May;24\(2\):100-2. doi: 10.1016/j.ijoa.2015.03.001. Epub 2015 Mar 6.](#)

**Coagulopathy and placental abruption: changing management with ROTEM-guided fibrinogen concentrate therapy.**

[Jones R<sup>1</sup>](#), [Collis RE<sup>2</sup>](#).

Two:

A prolonged INR / APTT does not always mean “low clotting factors – give FFP”. Other causes include hyperfibrinolysis / low fibrinogen or decreased thrombin generation or a combination of these. In this patient the main causes were probably hyperfibrinolysis and fibrinogen deficiency.

In major haemorrhage or acute bleeding is there any role for standard laboratory coagulation tests such as INR/APTT?? These tests take longer to perform, can't differentiate the cause or help determine the appropriate treatment.

For those interested in this topic in more detail I recommend the presentation at [perioperativebleeding.org](http://perioperativebleeding.org) -

Standard coagulation tests versus viscoelastic POC monitoring

Paer I Jahonsson

Rigshospitalet, Copenhagen, Denmark



Please login or register to watch this talk!



# Discussion Points

Three:

When fibrinogen is very low (e.g. fibtem A5 < 4mm or fibrinogen concentration <0.5g/L) a very large amount of fibrinogen is needed very rapidly (in this case the equivalent of approx 30units of cryoprecipitate were given). **Fibrinogen concentrate** definitely achieves this goal much faster than cryoprecipitate.

Four:

A flat fibtem (or a Fibtem CT > 600s) is highly likely to represent **severe hyperfibrinolysis**. If you ever see this give tranexamic acid. Fibrinogen is consumed rapidly in this condition also and will almost always need replacement too.

(For boffins: the confusingly titled paper below explains where this value / trigger comes from ).

3)

## **Assessment of Early Thromboelastometric Variables from Extrinsicly Activated Assays With and Without Aprotinin for Rapid Detection of Fibrinolysis**

Daniel Dirkmann, Dr. med., Klaus Görlinger, Dr. med., and Jürgen Peters, Prof. Dr. med.