

THE PERIPARTURIENT MARE

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Periparturient mare

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www.foalinmare.com



Periparturient mare

- Essential monitoring ?
- Specific precautions to take
- Main problems and how to handle ?

Introduction



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Diagnostic challenge

- Mare-foal bound
- Stage III : expulsion of the membranes
- Nervous, exhausted
- Pathological ?

Plajn and Strömbeck, 1990

Adams, 1992

Berly, 1988
Witt, Pascoe, Strick, 1993
Lacey & Carter 1996
Pascoe & Pascoe 1998
Frascaferri, 1999

Periparturient mare

Diagnostic and therapeutic challenge

- unique set of differential diagnoses (GI >> Genital)
- large gravid uterus
- priorities ?

Dolente, 2004

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Periparturient mare

Physical examination

- metabolism ↗ → tachycardia (40-60bpm)
- abdominal size → changes ?

Dolente, 2004

Rectal palpation

- Informative or frustrating -> GI normal findings ≠ no abno
-> lig uteri: swelling/position/sens.

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Periparturient mare

Diagnostic and therapeutic challenge

- *Prepartum* vaginal palpation ?
= minimal diagnostic value
- vestibulum = variety of germs – normal physiological flora
= pushed forward when inserting (speculum) arm
- *Post partum* : intra-vaginal / uterine US

Ducroire 2004

Hewitt et al. 1988
Paccaroni Figliotti 2011

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Periparturient mare

Diagnostic and therapeutic challenge

- priorities
- foal ? -> **assessment of foetal viability** →
 1. endocrinology
 2. mamm.secretions
 3. ultrasonography
- dead foal in late gestation → dystocia
- dead or induced (sacrificed) foal → supervision (nightwork)

Ducroire 2004

Savich and Vaise 2011

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Periparturient mare

- Prepartum changes (hormones) too acute
 - P4 ? ≠ **progestagens** P5, 5αDHP
 - ? measurements ~ cross reactivity
- “P” ↓ → acute fetal distress / death/abortion
- “P” ↑ → enhanced fetal adrenocortical activity (placentitis)

Kruze 2012

Dukever et al. 1984

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Periparturient mare

- Prepartum changes (hormones) too acute
 - **Oestrogens ?**
 - = phenolic oestrogens : estrone and oestradiol 17 β and unsaturated oestrogens (equilinn, equilenin)
 - foetal gonads produce the precursors → utero placental unit → conversion to oestrogens

Maternal oestrogens only changes after severe foetal stress or abortion

Periparturient mare

Prefoaling **mammary secretions**

- ~ foetal readiness for birth
- Ca > 10mmol/L (Na < 70 mg/dl, K > 135 mg/dl)
- ! side mare test = Ca and Mg

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Periparturient mare

Transrectal US

- placental integrity (CTUP)
- Cx score
- foetal fluids (vernix-echoic appearance-volume)

Periparturient mare

- Transrectal US
 - placental integrity (CTUP)
 - foetal fluids (vernix-echoic appearance)
- Transabdominal US
 - presentation
 - (foetal gender)
 - foetal heart rate (brady- <50bpm or tachycardia >120bpm)
 - volume and clarity of foetal fluids
 - CTUP (>15mm)
 - aortic diameter, biparietal diameter

Nisue 2011

Ruff et al 2006
Gavril-Brokanovlev & Pappas 1997

Leblanc et al 2004

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Periparturient mare

Abdominocentesis

- sonographic guidance (≠allantocentesis)
 - haemoperitoneum
 - septic peritonitis
 - creatinine (urine bladder trauma >< → < 2x bloodvalues)
- normal parturition = no abno
 - ≠↑ protn or Lφ
 - (↗Nφ)

Dasserra 2004

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Periparturient mare

Decision for surgery ?

- pain and response to analgesics
- presence of reflux
- lack of fecal passage
- Surgery → minimal impact on foal unless
 - ↓ placental oxygenation
 - = late term

Savochi et al 2002

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Periparturient mare

- Sick mare
 - => difficulties during parturition
 - => compromised foal
- = client communication -> **priorities** ?

Docente 2008

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Treatment options

Progesterone

- => pregnancy loss due to 'progesterone insufficiency' = "NOT common"
- Endotoxaemia <55 days of pregnancy → pregnancy loss
- P-conc = wide variation in high risk pregnancies = 'as a result' rather than cause
- P4 → uterine quiescence , inhibits PGL mediated abortion
- P4 → supplementation when already ↑ conc ?


Swets and Vanisq 2012

D'haeyer et al. 2005
Kleider et al. 1991
Goffel et al. 1991
Savitski et al. 1991
Morris et al. 2007

LeBlanc et al. 2004
Holtzer 1988

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Treatment options

Progesterone

- crisis: 0.88 mg/kg SID
- stabilisation : 0.44mg/kg SID
- minimum 1 wk
- check **fetal viability** periodically
- decrease dose gradually → 0 when anticipated foaling date

Swets and Vanisq 2012

LeBlanc et al. 2004
Holtzer 1988

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Treatment options

NSAID

- phenylbutazone, flunixin (non selective COX inhib)
 - firocoxib (COX 2)
- reduce inflammation, inhib PGL prod ? >< abortion

Severts and Wynn, 2011

Card 2022

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Treatment options

Steroids

- Premature delivery imminent ?
- 100mg dexa IM/4days → induction of mature foals ??
- Dexa group → earlier, mature
→ poor colostrum quality

Severts and Wynn, 2011

Witt et al. 1975
Jefferson and Neustadt 1977

Douay et al. 2008

~ time of gestation

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Treatment options

Tocolytics

- clenbuterol (β_2 adrenergic agonist- spasmolyticum)
- ineffective in delaying onset of normal parturition in healthy mares
- not effective in preventing abortion
- induce flacid Cx

Severts and Wynn, 2011

Card 2022

Potman et al. 2002
Boeing and Leutenstorfer 1993

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Treatment options

Anti dopamine

- Dopamine during pregnancy → ↑ readiness for birth
- ↑ adrenal cortical axis maturation
- ↑ secretion of PRL → ↓ mammary gl

blocks DOPA-rec

domperidone → maturation of pregnancy

Search and Voisin 2012
Petersen et al. 1992
Redwood et al. 1994

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Treatment options

Vitamine E

- antioxidant
- >> inflammation
- neuroprotective (foetus)

- 1000-8000 IU
- empiric

Search and Voisin 2012
Vot et al. 1988
Dobson et al. 1999

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Treatment options

Supplementation of oxygen

- exchange (maternal – foetal) = very effective
- high diffusing capacity (countercurrent)

- nasal insufflation → ↑ P_aO₂
- ↻ 10-20 l/min → ↑ P_aO₂ x 2-3
- keep maternal P_aO₂ > 80mmHg

Stor and Corliss 1975, Corliss and Silver 1975
Search and Voisin 2012
Wooding and Poulos 2006
Wilson et al. 2009; Dolezal et al. 2010; Wilkes 2010, 2009
Sartori et al. 1991; Calzone 2004

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Treatment options

Nutritional support

- placenta very efficient nutrient transfer

Speckl and Vavra 2011
Wooling and Fowler 2005
Viv et al 1999

- fasting late term mare (12-30h) → ↑ increased production of PGL F
 5/8 → premature delivery within 1 wk

Silver and Fossum 1982

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Treatment options

Nutritional support

- => hypoglycemia → ≠ placental metabolism & glucose delivery to foetus

Speckl and Vavra 2011

- later term mares – deprivation of food



infusion of glucose (dextrose 1-2mg/kg/min)



prevent hypoglycemia, hyperlipaemia, optimize glu delivery to the foal
reduce risk of PGL-mediated preterm labor

Silver and Fowler 1982

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Periparturient mare

- nutrition
 - requirements – late gestation **+50%** → lactation **+80%**
 - metabolic demands of illness = x1,5
 - >> abdom disease -> withholding feed ??
- water
 - Lactation : 3% BW/day -> 10-15L **extra** water (per os or IV)

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Treatment options

Induction of parturition ?

→ (to) ensure skilled surveillance

- ≠ methods of induction

→ ↑ incidence of dystocia, PPS, hypoxia, dysmaturity
→ selection !

- criteria

gestational length
mammary development / colostrum
cervical softening

Adrenocortical maturation very late in gestation i.e. 24-28 h before birth

320 -362d ~ day length, age,
10 mmol/l, K>Na, >> parity, placentitis, ...
cervical softening , PGE?

Jeffcott and Rossdale 1977
Kawabata and Jeffcott 1978
MacPherson et al. 1997

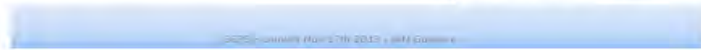
Sawyer and Kohn 2012
Paschen 1980
Ley and Nispank 2007
Wynne et al. 2008

Parks et al. 1977

Hovew and Kohn 1971
Gang and Green 1975

Chapoy et al. 1984
Foster et al. 1970
Lendon et al. 1984

Jeffcott and Rossdale 1977
Meyer and Hovew 1991
MacPherson et al. 1997
27. Apply et al. 1998



Treatment options

Induction of parturition ?

→ (to) ensure skilled surveillance

- ≠ methods of induction

- Glucocorticoids – limited efficacy (maturation cfr slide)
- Prostaglandines – myometrial contractions

- Oxytocin - rapid action (delivery in 15-90min) - different protocols
 - succes ~ adherence to selection criteria
 - => low doses = safer means for induction
 - > too low -> RFM
 - => 3-5 IU

MacPherson and Pascoe 2012
Paschen 1980
Ley and Nispank 2007
Wynne et al. 2008

Parks et al. 1977

Jeffcott and Rossdale 1977
Meyer and Hovew 1991
MacPherson et al. 1997
28. Wynne et al. 2008, Hovew 1975
Paschen 1980



Treatment options

Induction of abortion ?

→ Pregnancy loss between 50-300d

- ≠ methods of induction

- Late term abortion

! animal welfare

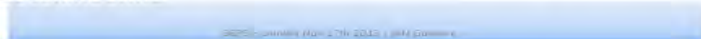
- iatrogenic disruption of fetal membranes
- infusion of hypertone saline, ...

- Complications: RFM, reproductive tract trauma, dystocia, endometritis, endotoxaemia

Hovew et al. 1975

Cand. 2012

Gossard and Kohn 1982



Periparturient mare

- Essential monitoring ?
- Specific precautions to take
- Main problems and how to handle ?

Periparturient mare

Prepartum

- Placentitis
- Varicose
- Torsion
- Hydrops
- Ventral oedema
- Hernia / tendon rupture
- abortion
- Haemorrhage
- Uterine rupture
- LCV
- GI ≠

Intrapartum

- PSS
- Dystocia
- Stage 1
- Prolaps (bladder/rectum)
- Haemorrhage
- Uterine rupture
- LCV
- GI ≠

Postpartum

- Haemorrhage
- RFM
- Metritis
- Uterine rupture
- Inversion
- Prolaps
- LCV
- GI ≠

haemorrhage



- 55% of perip death
- a ut med
- utero ovarian aa
- a iliaca ext
- a vag
- >12y, multiparous (Cu deficiency)

Orskov, 2012

Dwyer and Harrison, 1993
Dolan et al., 2002

Parson, 1979
Parson and Frayer, 1994
Lund et al., 2010

Fisher, 1994
Parson, 1979
Brunner et al., 1998
Stow, 1968
Innesgard, 1997

haemorrhage

- Post >> **pre** partum
- Diagnose ~ sn
- Palpation ? US (uterine, peritoneal fluid, ligaments)

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haemorrhage



Diagnosis

- acute abdominal pain
- Flehmen, trembling, sweating
- thready pulse, shock
- tachycardia (60-140bpm)
- peracute death
- i/ broad lig: pressure by serosa stops haemorrh
- ! palpation
- ! exsanguination

Perkins and Froyd, 2004

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haemorrhage



- PCV =, \nearrow , \downarrow
- Hypoprote
- peritoneal fluid : TP \uparrow , normal WBC
- haemo-abdomen

Finzer et al. 1996
Frazier 2002

Van Loon G

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haemorrhage

Therapy

- avoid extra stress
- keep blood prss ↓
- aminocaproic acid (40mg/kg i/1L fvs)
- naloxone (30mg/Ei/0,5L fvs)
- formalin (150ml, 10% i/ 1L fvs)
- blood transfusion ?
- ~~surgery~~
- oxygen

Alvarez et al. 1998
 Skopple and McCue. 2007
 Joffe et al. 1999
 Roberts. 1948
 Orsborne 2012
 Looze et al. 2009



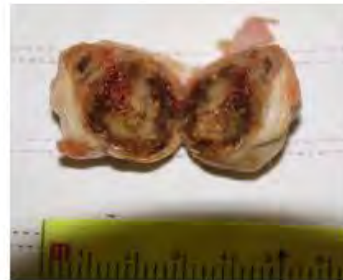
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haemorrhage

Survival rate

- up to 80% ~ location
- Fertility
 - no reason to end breeding career
 - 49% produced a foal post recovery



Alvarez et al. 2008



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Periparturient mare

Prepartum

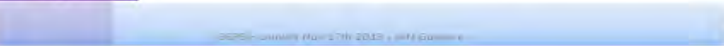
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Uterine laceration - rupture

uterine torsion

- = high risk pregnancy
 - <320d : survival mare 97% vs foal 72%
 - >320d: 65% vs 32%

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Uterine laceration - rupture



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Uterine laceration - rupture

- prepartum in ass with uterine torsion
- post partum in ass with dystocia and normal (swift) delivery
- rectal ex ? -> 24% of ruptures diagnosed
- 75% horn vs. 25% corpus location
- ! transuterine wall bruising -> translocation of bacteria/inflamm

Oliver 1998
Cradock 2012

Van den Broek et al. 2010

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Uterine laceration - rupture

- Perinatal death
 - 1st Ut a rupt
 - 2nd GI tract rupt
 - 3th Uterine tear
- Diagnose ?
 - depression, tachycardia, tachypnea, ileus, anorexia, colic, fever
 - leucopenia
 - hypovolemic shock
 - peritonitis (>10-15 000cls/ μ L; TP>2,5-3g/dL, degen N \emptyset >80%, bact)
 - ↔ peritonitis post partum without cytologic evidence of GI rupture → assume uterine tear

Duizer 1999
Castro 2012
Gonzalez 2004

Jennings et al 2010

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Uterine laceration - rupture

- Mare survival rate 65-97%
 - no differences
 - surg T vs medic T
 - tear location
 - abdom lavage or not
 - presence of (poly)bact cult of peritoneal fluid
 - use of OT or not
 - Differences
 - GI reflux, heartrate \uparrow , \downarrow BE, \downarrow leucocytes
 - outcome ~ interval partus – diagnosis/therapy

Dobson 2004
Cribbet 2012

Jennings et al 2010

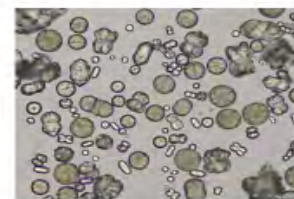
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Urine bladder laceration - rupture

Urine bladder rupture

- anechogenic effusion in peritoneal cavity
- peritoneal fluid
 - Calcium carbonate crystals
 - Creatinine = 2x peripheral blood
- rectal ex ?
 - thickened abno tissue / rupture
- cytoscopie
- surgery (ventral midline/vaginal)
- conservative

Jennings et al 2010



<http://www.abnypeth.com/>

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Periparturient mare

Prepartum

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Gastro intestinal colic

mild colic → no danger for mare and pregnancy
(difficulties in diagnostics)

surgery → pregnancies after surgery → consider as "at-risk"
→ <20%> pregnancy loss
→ regular foetal assessment

intra-operative ↓ oxygenation → "high risk"

colic + endotoxaemia → "high risk"

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Gastro intestinal colic

colic with endotoxaemia → ↓ prognosis
(fever, tachycardia, dehydration, leukopenia, hypotension, cyanosis)

endotoxins → detrimental to pregnancy and foal outcome
first trimester > midgestation < last trimester gestation

Knauth et al. 1991

Gram neg bact → systematic inflammation → Δ perfusion and coagulation
(iso)hypert fluid, COX, polymyxin B

Werner and Pohl-Chrommel 2005
Berton et al. 2004

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Gastro intestinal colic

Colitis

- maintenance of pregnancy ↓
- when + diarrhea → ↑ septic foal

dehydratation → utero placental perfusion → ↑ risk on foetal hypoxia
 diarrhea = fecal contamination perineum → ↑ risk ascending placentitis
 → infection during expulsion
 = episodes of bacteremia → hematogenous infection

Wright et al. 1991

Winters and Fox-Grenning 2005
 Borjesson et al. 2004

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Gastro intestinal colic

Colitis

- maintenance of pregnancy ↓
- when + diarrhea → ↑ septic foal

= > assume foal to be septic until proven

Wright et al. 1991

Winters and Fox-Grenning 2005
 Borjesson et al. 2004

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Large colon volvulus

LCV (large colon volvulus)

- Throughbreds
- ~ age , (2mnts) post partum period (50-91% of cases)
- survival rate 35-88%
- in general colic surgery
 - foaling rates ↓
 - abortion rates ↗
 - LCV-> 74-81% live foals after surgery

Wright et al. 1991; Borjesson et al. 1981; Jackson et al. 1981; Harrison 1988

Moore et al. 1982; May & Swift 2005; Hackett et al. 2015; Borjesson & Leachman 1999

Zacharia 2009; Dalziel et al. 2003a; Adams & Allen, 2002; Henberg et al. 2004; Scadding 2015; Allen et al. 2007

Lesly et al. 2017

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Large colon volvulus

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Weyler et al. 1990; Santoyo et al. 1981; Jackson et al. 1989; Morrison 1988

Moore et al. 2002; Mori & Smith 2005; Mikstett et al. 2015; Böhling & Leondorfer 1993

Downes et al. 2009; DeWitt et al. 2003a; Adams & Allen, 2002; Hennig et al. 2004; Scoggins 2015; Allen et al. 2007

Leahy et al. 2017

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Large colon volvulus

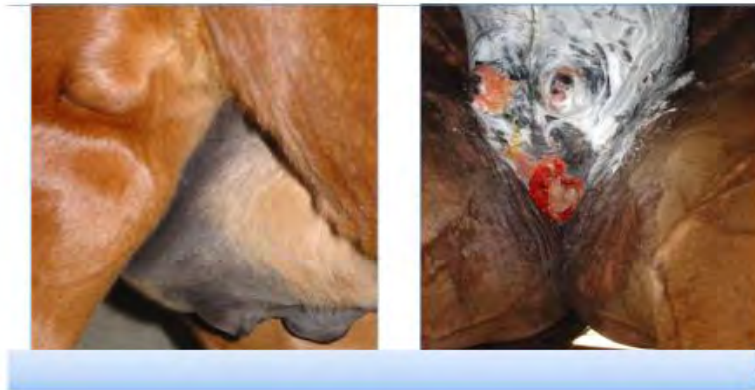


Periparturient mare



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conclusion

- priorities and expectations client >< achievable possibilities
 - progn / € constrains

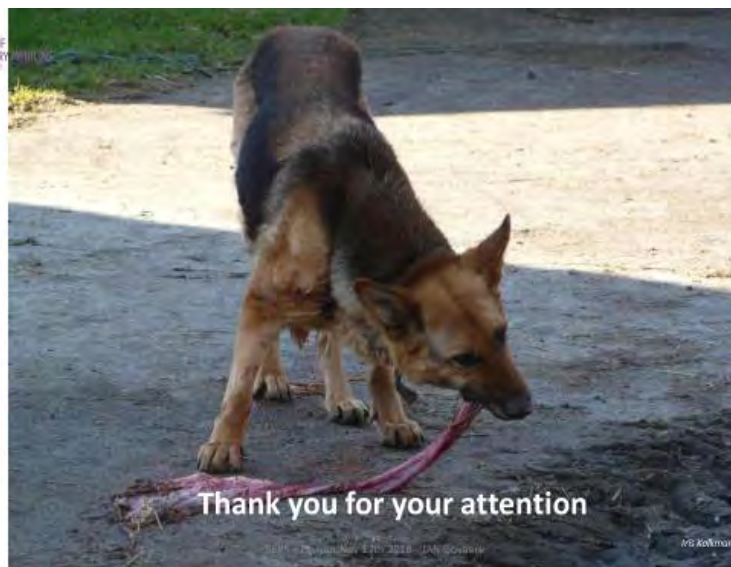
- nutritional requirements
- hydratation / perfusion

- $GI \neq > Ut \neq$ → temper your enthusiasm

- ? → referring
 - close monitoring (hernia/haemorrh/vague complaints...)
 - avoid straining
 - haemorrhage ? !

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Dr Kalkman

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