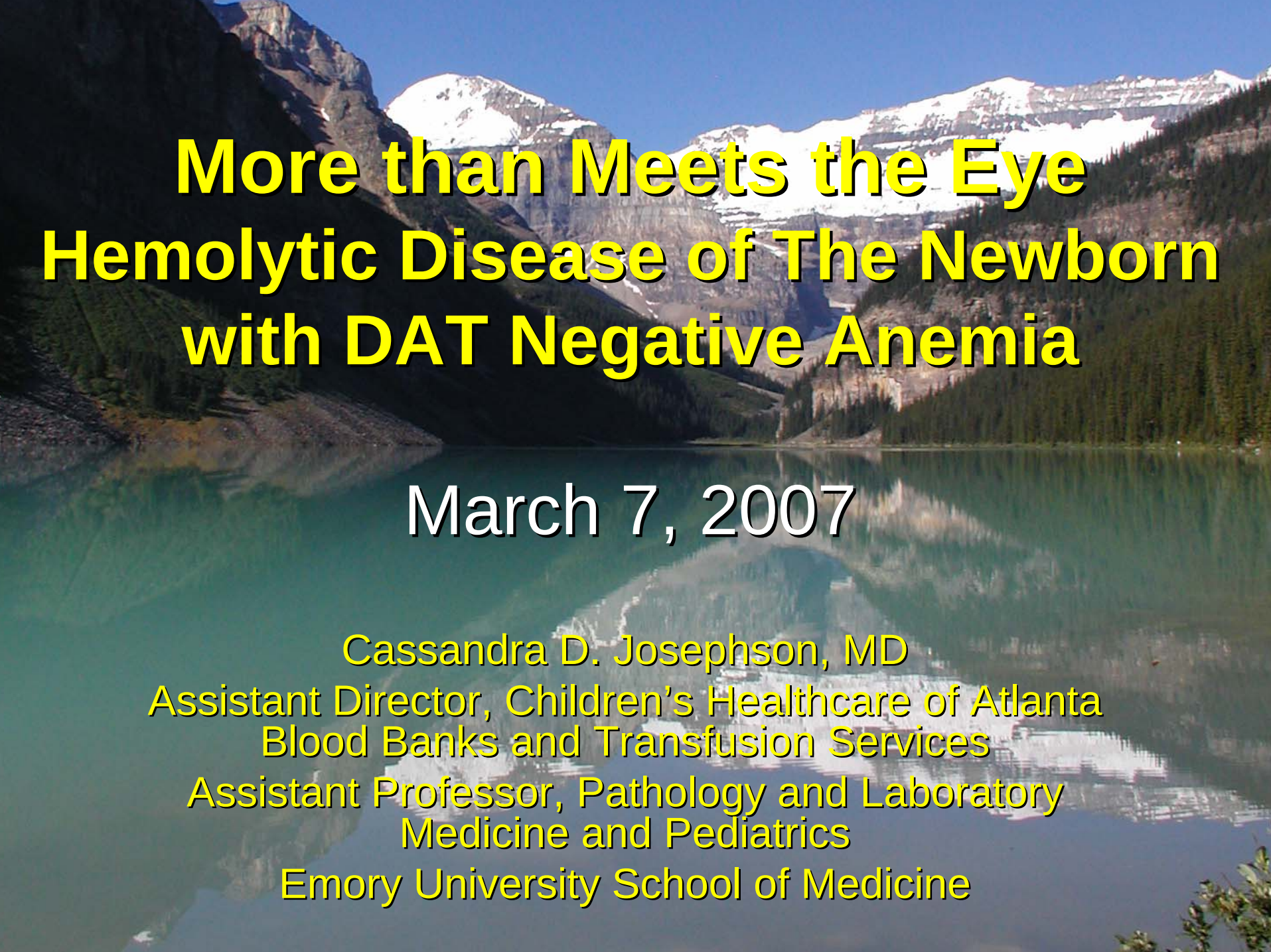

More than Meets the Eye Hemolytic Disease of The Newborn with DAT Negative Anemia

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Case Presentation

- 17 day old male born to a G_2P_1 female who presents to the Children's Hospital with pallor, respiratory distress, and jaundice.
- PMHx: Born at 37 weeks NSVD
- Transfusion History: 3 intrauterine red cell transfusions

Laboratory and Blood Bank Studies

- Hemoglobin: 5.4 gm/dl
- Total bilirubin: 15 mg/dl
- Indirect bilirubin: 14.6 mg/dl
- Reticulocyte count: < 0.5%

- Patient typing as 0 negative
- Patient's antibody screen positive
- Anti-C identified in patient

Questions to Consider

- What historical information would we want from mother of child?
- What is the differential diagnosis for DAT negative anemia in a 2 week old?
- What role does the blood bank have in this case and how can they help?

Questions to Consider

- What type of red cells should the patient receive for transfusion now?
- Should the transfusion be a simple one or an exchange transfusion?
- When are intrauterine red cell transfusions indicated and what type of red cell products should be transfused?

What is Hemolytic Disease of the Fetus/Newborn?

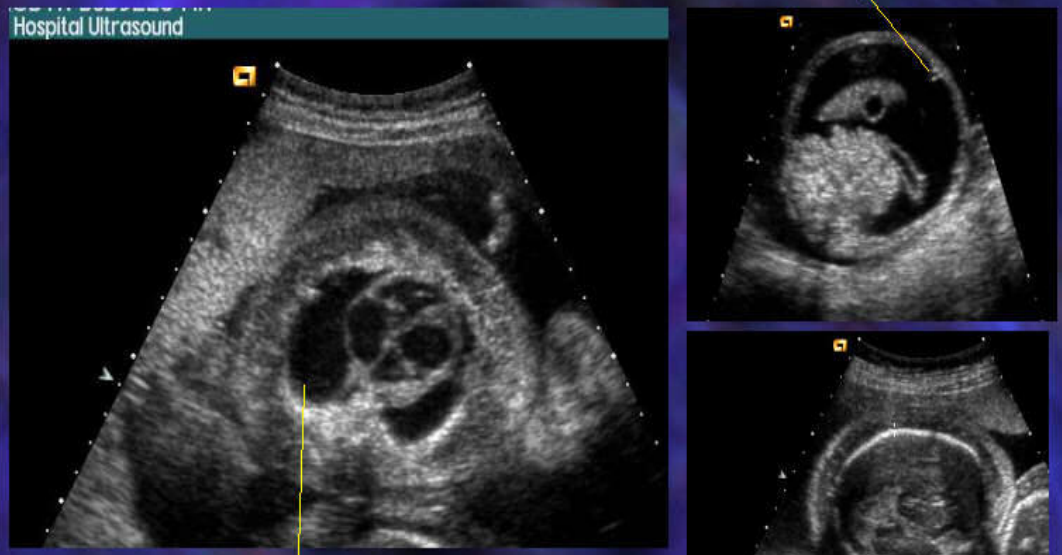
- Fetal RBCs become coated with maternal IgG (alloantibodies) directed against paternal antigens

NATURAL HISTORY

- RBCs ↑ production in liver
- ↑ nucleated RBC in circulation
- ↓ albumin synthesis
- Anemia – Cardiovascular failure---Tissue Hypoxia---(+) ↓ oncotic pressure –edema, ascites, effusions =

HYDROPS

Fetal hydrops



Ascites

Pleural Effusion

Scalp Edema

Hemolytic Disease of the Fetus and Newborn

- Usually positive DAT
- Post-natal hyperbilirubinemia
- In utero hemolysis
- In utero death (hydrops fetalis)

Comparison of Rh and ABO HDN

Clinical	Rh	ABO
First born	5%	40 – 50%
Predictable severity subsequent preg	Yes	No
Stillbirth/hydrops	Frequent	Rare
Jaundice	+++ to ++++	+
HSM	+++	+
Response to bililights	Limited	Excellent
Infant DAT	+	+ or 0
Maternal antibody ID	Usually	Not clear
Spherocytes	0	+
Late Anemia	Common	Rare

Algorithm for the management of RhD sensitized pregnancy

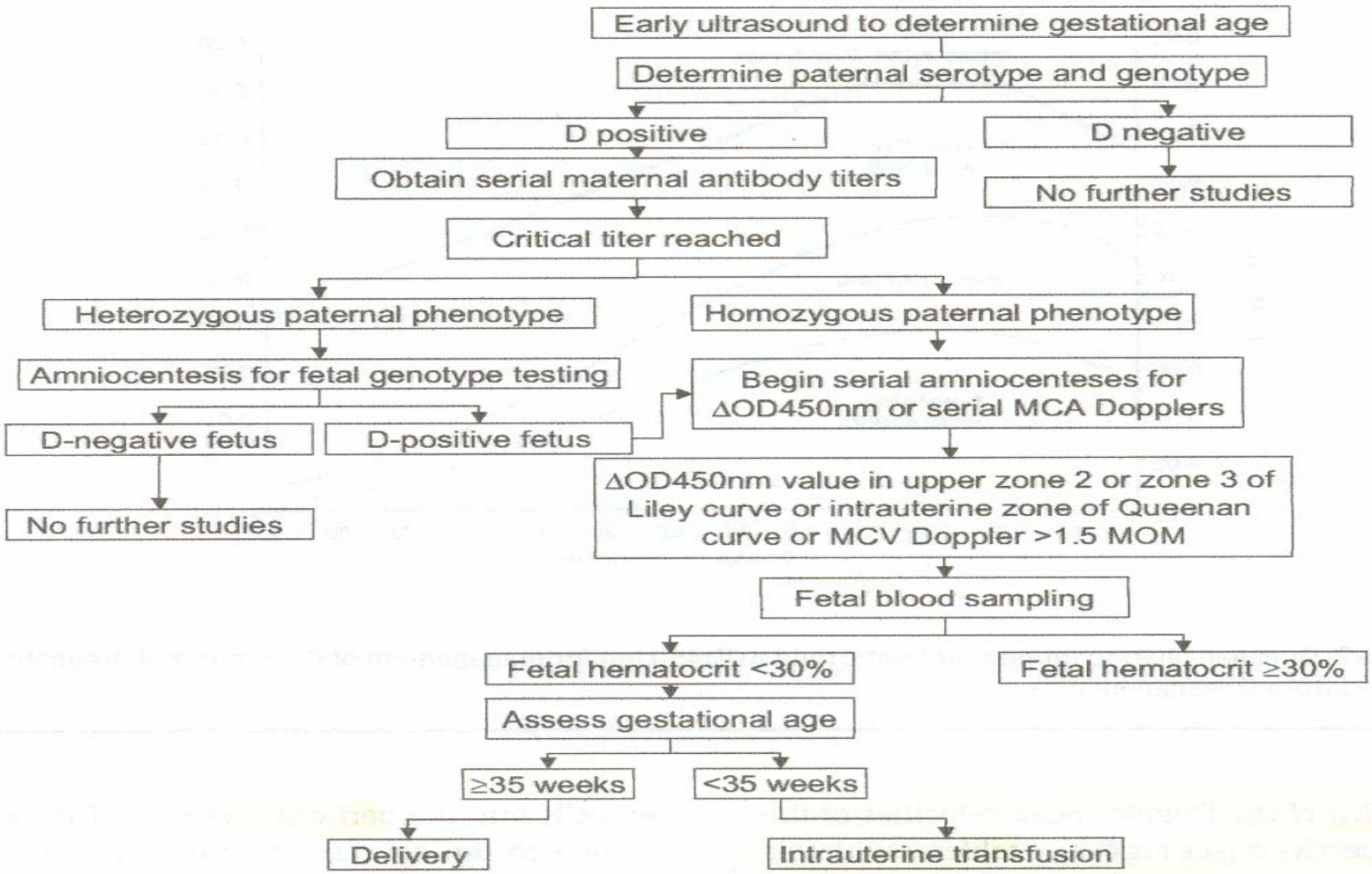
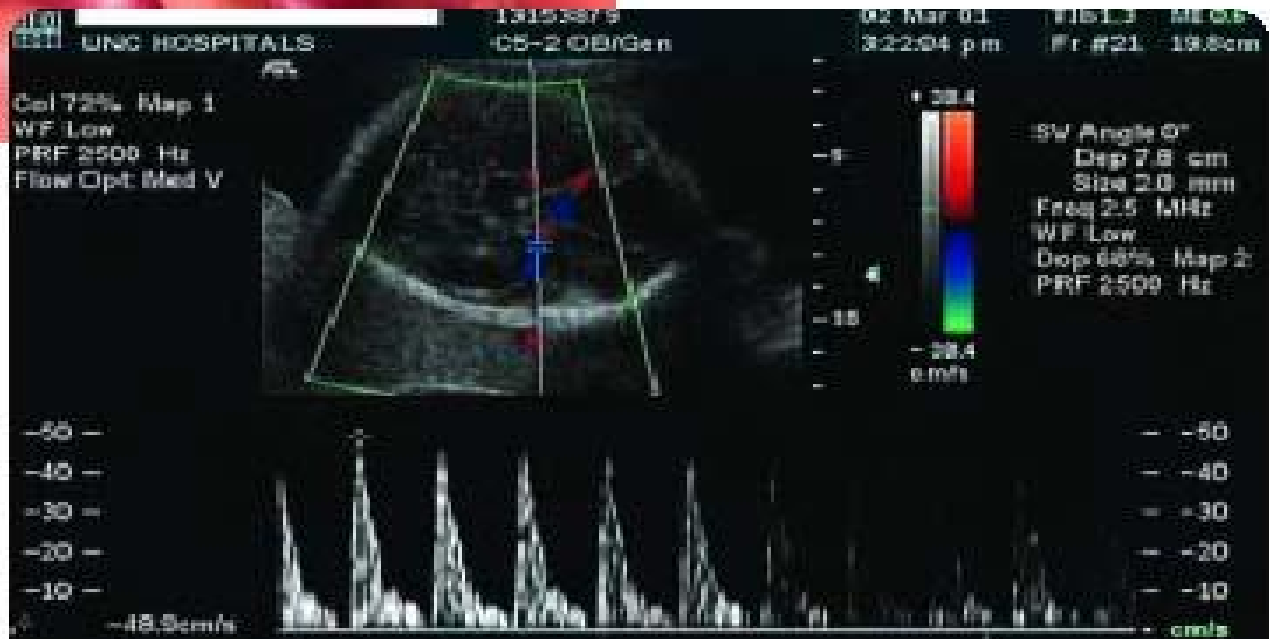


Figure 6-1. A suggested algorithm for the management of RhD sensitized pregnancy. (Used with permission from Moise.[11]) **Intrauterine, Neonatal, and Pediatric Transfusion: Wong, Luban In:Transfusion Therapy: Clinical Principles and Practice**

FIGURE 1. Middle cerebral artery peak systolic Doppler velocity



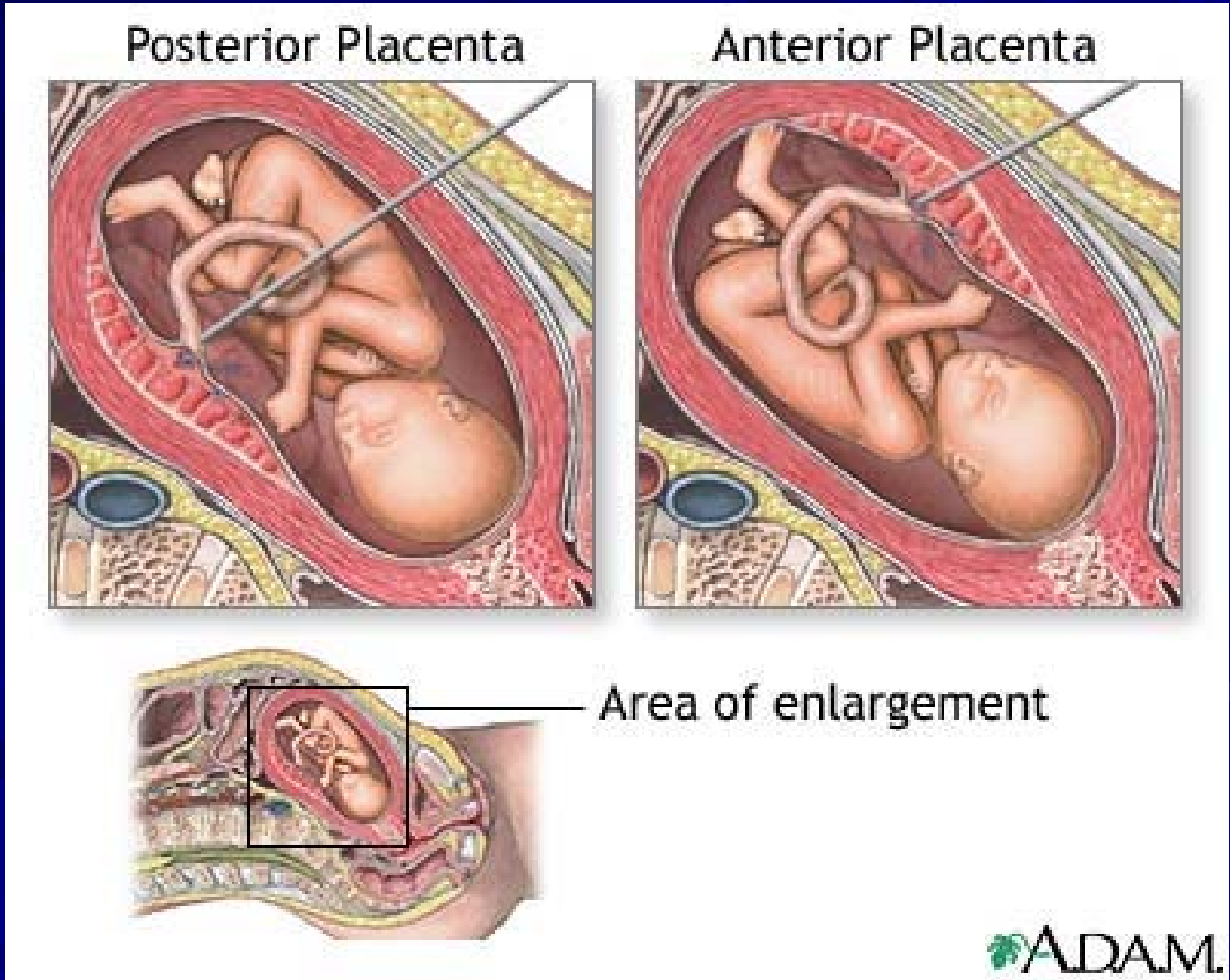
Moise KJ. *Obstet Gynecol* 2002;100:600-11.

Middle Cerebral Artery (MCA) Doppler

- > 1.50 multiples of the mean (MoM) MCA peak velocity for the detection of moderate/severe anemia
- Sensitivity 100%
- False positive 12%
- Positive predictive value rate 65%
- Perform prior to 35 weeks
- Measure must be > 1.5 MoM before fetal blood sampling is performed
- Percutaneous umbilical blood sampling (PUBS) has a 1-2% risk of fetal loss

Mari *et al. N Eng J Med* 2000; 342;9-14

Percutaneous umbilical blood sampling (PUBS)



Queenan and MCA Charts

Invasive
Amniotic fluid monitoring

Non-invasive
MCA velocity monitoring

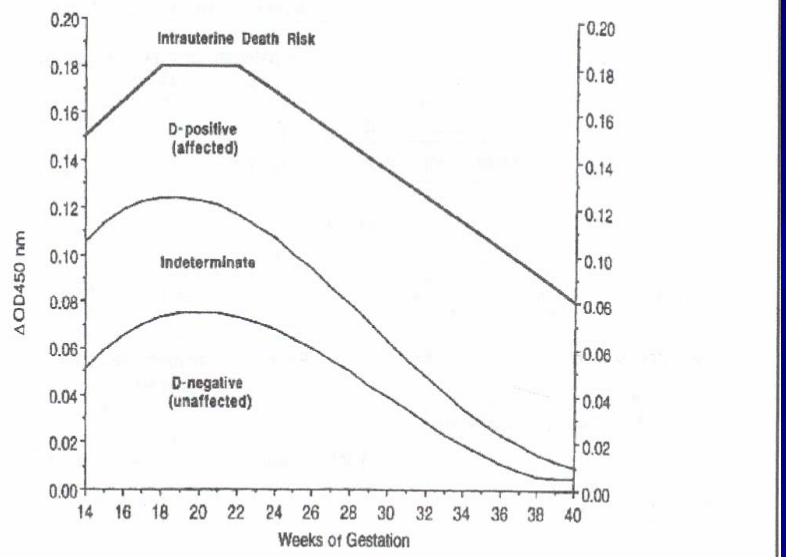


Figure 6-2. Queenan chart to monitor amniotic fluid ΔOD450 nm for management of D-immunized pregnancies. (Modified from Queenan et al.[18])

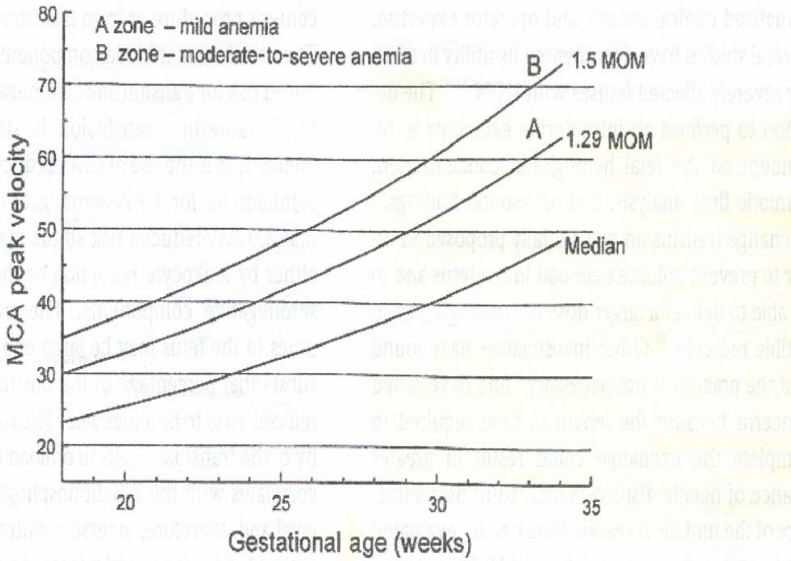


Figure 6-3. Comparison of middle cerebral artery peak velocity and gestational age in relation to fetal anemia. (Used with permission from Moise.[11]) MCA = middle cerebral artery; MOM = multiples of the median.

Intrauterine, Neonatal, and Pediatric Transfusion: Wong, Luban In:Transfusion Therapy: Clinical Principles and Practice

Red Cell Alloimmunization Antibodies Necessitating Intrauterine Transfusion

- Anti-D
- Anti-Kell (K1)
- Anti- c, C

Intrauterine Transfusion

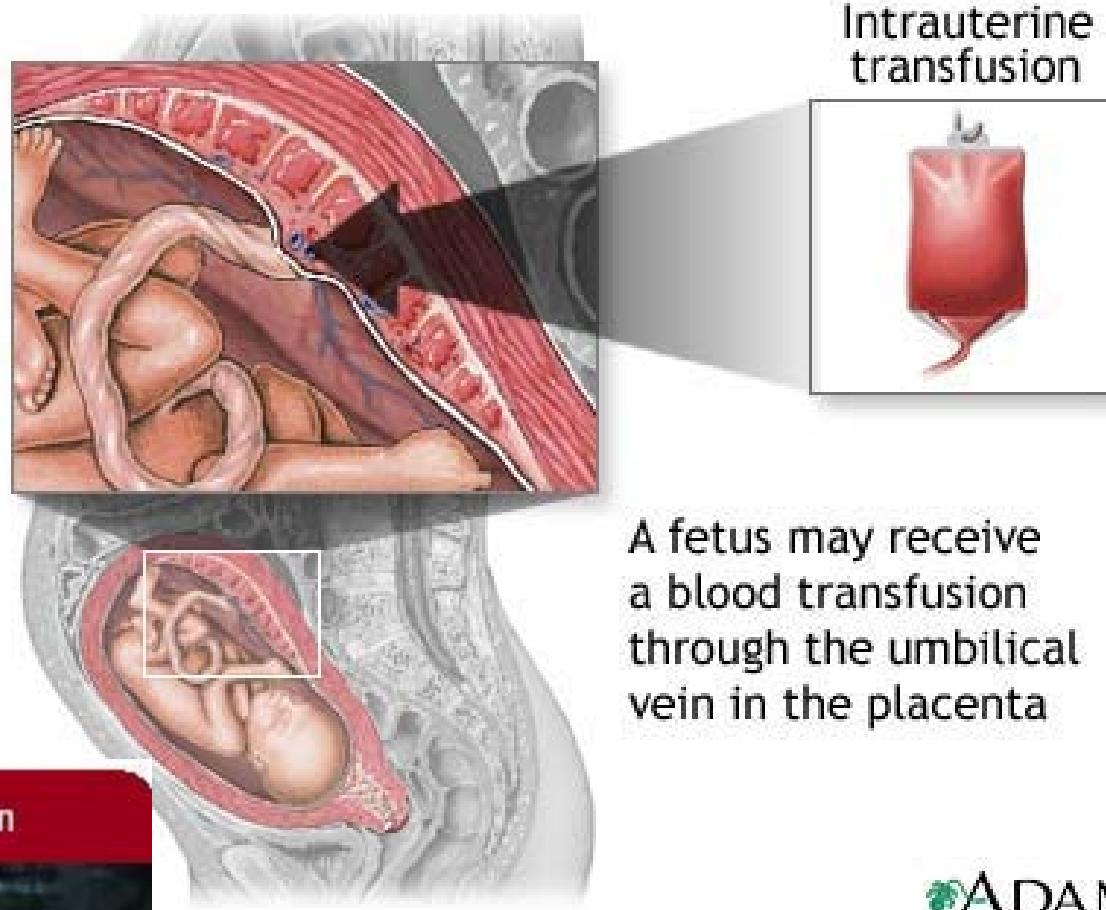



FIGURE 5. Setup for intravascular intrauterine transfusion

Thresholds and Transfusion Rates in Intrauterine Transfusions

- Hemoglobin < 10 g/dL or two standard deviations below the mean for gestational age
- Transfusion volumes between 20 – 50% of fetoplacental blood volume
- Non-hydrops fetus infusion rates 5 – 7 mL/minute
- Hydropic fetus 1 – 2 ml/minute (can be 3 transfusion of red cells 1 -2 weeks apart

Clin Perinatol 1994;21:573-589
Am J Obstet Gynecol 1990;162:1053-9
Am J Obstet Gynecol 1987;157:4-9

Intrauterine Transfusion RBC Selection and Processing

- Compatability with maternal sample
- “CMV safe” - leukoreduced or CMV negative
- Fresh as possible RBCs
- Reconstituted with FFP to prevent dilutional coagulopathy (Hct 50 – 80%)
- Washing: fluid status patient, if mother’s blood used for transfusion, if AS units used
- Blood negative for Hemoglobin S
- Irradiated

Intrauterine Transfusion Perinatal Survival

- Overall perinatal survival: 84%
- Survival with fetal hydrops: 74%
- Survival without hydrops: 94%

Am J Obstet Gynecol 1998;179:858-63.

Intrauterine Transfusion Neonatal Follow-up

- 36 infants
- 50% required top-up transfusions
- Mean: 38 days (20-68 days)
- Most required 1 top-up transfusion
- Follow-up with weekly hcts and retics
- Adverse neurologic outcomes in 9.1% w/hydrops vs 6.4% w/o hydrops

Janssens *et al. J Pediatr* 1997;131:373-80.
Hudon *et al*. *Am J Obstet Gynecol* 1998;179:858-63

Questions to Consider

- What historical information would we want from mother of child? Did she receive Rh IgG and when? Does she have a known antibody?

- What is the differential diagnosis for DAT negative anemia in a 2 week old? Usually implies non-immune mediated process so: G-6 PD, Pyruvate kinase deficiency, Diamond-Blackfan anemia, leukemia, blood loss, or potentially immune mediated with total destruction of targeted red cells explaining DAT negative result

Questions to Consider

- What role does the blood bank have in this case and how can they help?
- What type of red cells should the patient receive for transfusion now?
- Should the transfusion be a simple one or an exchange transfusion?
- When are intrauterine red cell transfusions indicated and what type of red cell products should be transfused?

Follow-up: Case presentation patient

- He was placed on rEPO due to hypoproliferative suppression of bone marrow.

- He is still requiring transfusion every 4 - 5 weeks and now approximately 80 days later his IAT is negative, retic count is close to normal and he is growing well.