Case Studies and Review: Pulmonary Embolism

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Columbia University College of Physicians & Surgeons

Society for Maternal-Fetal Medicine
Magnitude of Problem

- 1998-2005, Accounts for 478 maternal deaths
- Immediate
  - 10% fatal within first hour of symptoms
  - 5-10% will present in shock
- Delayed
  - An additional 5% have delayed mortality
  - 50% have right ventricular dysfunction
    - High short term mortality
  - 50% of perfusion defects resolve within 1 month of treatment
    - Complete resolution in 66% eventually
  - 5% develop chronic thromboembolic pulmonary HTN

CASE PRESENTATION
1
Case Presentation 1

40 yo G₃P₁ at 39 weeks for repeat CD (2006)

- Past ObHx:
  - Post dates CD for failure to progress

- PMH:
  - Chronic HTN: labetalol 100mg BID
    - Baseline EKG: NSR, possible LAE
  - Hypothyroidism: Synthroid 125mcg
  - Obesity (BMI 37)
  - Depression: Lexapro 10mg

- PSH:
  - Gastric bypass (2003)
    - Lost 112 lbs after surgery, gained 24 lbs this pregnancy
  - Laparoscopic cholecystectomy
Case Presentation 1

Admitted for scheduled repeat CD

- BP 140/90, Ht 64’, Wt 216lbs (BMI 37)
- Physical exam unremarkable

Procedure

- Repeat low transverse CD
- Male infant, Apgars 8/9
- Birth weight 3005g
- EBL 500cc
Case Presentation 1

POD #0

- Vital signs
  - BP 110s-140s/40s-60s
  - HR 60s-80s
  - RR 12-22
  - O2 sats 94-98%

- Activity orders
  - Up to the chair within 8 hours
  - Increase activity as tolerated

- No SCDs or anticoagulation
Case Presentation 1

POD #1

- 0900, Patient was noted to be “moving all extremities” and out of bed, into the chair
  - BP 144/84, HR 83, RR 20, T 98.0
- 1412, after voiding patient slumped to the ground
  - Pale with shallow respirations, weak pulse
  - Assisted back to bed with 4 nurses and husband
- 1413, patient unresponsive, CPR started
- 1414, code blue called
  - Anesthesia, cardiology at bedside
- 1425, patient intubated
Case Presentation 1

- Code duration 50-55 minutes, unable to resuscitate
  - Initial pulseless electrical activity (PEA), followed by asystole
- Bedside echocardiography
  - Reduced left ventricular systolic function (25-30%)
  - Right atrium and ventricle severely dilated
- 1450, ABG pH 6.59, PCO2 116, PO2 29, BE -25
- 1504, patient was declared dead

Was standard of care met?
ACOG Recommendations

- Despite increased risk of VTE during pregnancy...
  “routine anticoagulation therapy for all pregnant women is not warranted.”

- Placement of pneumatic compression devices before CD is recommended for all women not already receiving thromboprophylaxis

- Patients undergoing CD with additional risk factors for VTE, individual risk assessment may require thromboprophylaxis with both pneumatic compression devices and unfractionated heparin or LMWH

ACOG Practice Bulletin No. 123 (2011)
Recommend heparin if at least 1 of the factors below is present:

- Already receiving heparin as outpatient
- Pre-pregnancy class 3 obesity (BMI > 40)
- Any history of VTE
- Thrombophilia and family history of VTE

OR 2 or more risk factors below are present:

- Cesarean delivery
- Hemorrhage
- Hysterectomy
- General anesthesia
- Postpartum infection
- Age > 40 or < 15 years
- Pre-pregnancy obesity (BMI > 30)
- Bed rest
- Any Thrombophilia
- Medical or pregnancy complications

Prophylactic LMWH or UFH until discharge

RCOG, 2009 Green Top 37a
Direct Deaths per Million Maternities by Cause - UK 1994-2008

Underuse of Post-cesarean Thromboembolic Prophylaxis


<table>
<thead>
<tr>
<th>Characteristic</th>
<th>None</th>
<th>Mechanical</th>
<th>Pharmacologic</th>
<th>Combination</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>955,787 (75.7)</td>
<td>278,669 (22.1)</td>
<td>16,639 (1.3)</td>
<td>12,110 (1.0)</td>
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</table>

<table>
<thead>
<tr>
<th>Year of Surgery</th>
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<tbody>
<tr>
<td>2003</td>
<td>115,663 (91.6)</td>
<td>8,717 (6.9)</td>
<td>1,274 (1.0)</td>
<td>664 (0.5)</td>
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<td>2004</td>
<td>124,230 (87.4)</td>
<td>15,674 (11.0)</td>
<td>1,319 (0.9)</td>
<td>923 (0.7)</td>
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<td>2005</td>
<td>131,220 (84.6)</td>
<td>21,013 (13.5)</td>
<td>1,889 (1.2)</td>
<td>1,051 (0.7)</td>
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<td>2006</td>
<td>154,876 (81.0)</td>
<td>32,302 (16.9)</td>
<td>2,413 (1.3)</td>
<td>1,608 (0.8)</td>
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<tr>
<td>2007</td>
<td>145,589 (74.7)</td>
<td>44,842 (23.0)</td>
<td>2,451 (1.3)</td>
<td>2,053 (1.1)</td>
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<td>2008</td>
<td>131,250 (66.0)</td>
<td>62,545 (31.4)</td>
<td>2,852 (1.4)</td>
<td>2,294 (1.2)</td>
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<td>2009</td>
<td>125,096 (60.5)</td>
<td>75,315 (36.4)</td>
<td>3,609 (1.8)</td>
<td>2,753 (1.3)</td>
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<tr>
<td>2010</td>
<td>27,863 (58.4)</td>
<td>18,261 (38.3)</td>
<td>832 (1.7)</td>
<td>764 (1.6)</td>
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</tbody>
</table>
CASE PRESENTATION
2
Case Presentation 2

31 yo G3P0020 at 33 weeks with Preterm PROM (2012)

- No significant medical or surgical history
- BP 126/78, HR 87, SpO2 99%, BMI 22
- Benign physical exam
  - SSE visually 1cm dilated
- Betamethasone, latency antibiotics
- Hospital day 2, spontaneous preterm labor
- Arrest of dilation at 5cm
  - Face presentation
- Primary LTCD without complication
  - Intrapartum compression devices
  - Male infant, Apgars 8/9
  - EBL 800cc
Case Presentation 2

- Postoperative
  - BP 110s-120s/60s-80s
  - HR 70s-90s
  - RR 15-18
  - SpO2 97-99%

- Postoperative DVT prophylaxis
  - Sequential compression devices (SCDs)
  - Early ambulation
Case Presentation 2

POD #1

- 0800, Ambulating around the room
  - HR 118/88, HR 93, RR 19, SpO2 97%
- 0900, Acute chest pain, shortness of breath
- Patient unresponsive, without palpable pulse
- Medical response team called
  - MFM, Cardiology, anesthesia at bedside
- CPR was performed, sinus rhythm was restored
- Transferred intubated to CCU
- Right heart failure on echo
- Patient never regained consciousness
- Cerebral edema, pupils fixed
- On POD#9, support was removed
Clinical Pearls

Was standard of care met?

Current ACOG Guidelines:

- Placement of pneumatic compression devices before CD is recommended for all women not already receiving thromboprophylaxis

- Studies of routine thromboprophylaxis for CD have been
  - small
  - not adequately powered

Unable to assess decreased risk of DVT or PE with anticoagulation therapy

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- Hemorrhage
- Hysterectomy
- General anesthesia
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- Bed rest
- Any Thrombophilia
- Medical or pregnancy complications

Prophylactic LMWH or UFH until discharge

RCOG, 2009 Green Top 37a
New York Presbyterian/CUMC VTE Guidelines

- October 2012, NYP issued new guidelines
- Apply pneumatic compression devices prior to surgery
  - Maintain until ambulatory
- Anticoagulation
  - Unfractionated Heparin
    - 5000 Units, subcutaneously, every 12 hours
    - First dose given in PACU, at least 1 hour after epidural catheter removal
  - Low Weight Molecular Heparin
    - First dose 6 hours post op
    - Weight-based dosing
- Promote early ambulation
CASE PRESENTATION

3
Case Presentation 3

33 yo G_3_3 P_2_2 32 weeks gestation, presents to the ED with right upper quadrant pain (2011)

- Seen in ED 1 week prior for left hip pain, diagnosed with sciatica
- Past medical history significant for chronic hypertension
- Past OB history: one SVD, CD for twins
- BP 113/67  HR 110  RR 20  SpO2 94%, BMI 36
- Physical exam: RUQ and RLQ tender
- Plan: admit for evaluation ? degenerating fibroid pain
Abdominal pain improved however intermittent contractions noted

Patient complaining of leg pain, R>L

Chest clear, abdomen soft, RUQ and RLQ tenderness present but improved from day of admission

EXT no edema, no tenderness in L leg, slight tenderness in R leg, neg Homan sign

Labs normal

Assessment degenerating fibroid, no evidence of DVT

Plan: Continue observation, watch lower ext for evidence of DVT
0900
- Pain remains unchanged
- No leg pain
- Abdominal exam remains unchanged

2100
- Patient reports pounding heart, followed by shortness of breath
- Noted to be diaphoretic, tachypneic
- Pulse Ox 80s, BP 70/30, Pulse 130
- MFM note, “IVF fluids 10L/min O2→O2 sats to 100%, BP to 90/50, Pulse 110, FHT 160s no decels”
2130
- MFM note: “Patient feeling better, chest x-ray normal, EKG unremarkable, FHT reassuring, sono active fetus vertex presentation”

2200
- Increase shortness of breath, O2 Sat 91, BP 70, Pulse 120, FHT 100 then increased to 160s after IVF fluids
- Pulmonary consult requested
- Second IV line placed
- Assessment: Acute shortness of breath, hypotension, rule out PE, patient reports R calf tenderness 2 days ago, transfer to CCU
2300
- Cardiology attending, strong concern for MI, troponin 0.3 ng/mL (normal < 0.1 ng/mL)
- Awaiting V/Q scan to rule out PE
- MFM attending note “will continuously monitor fetus”

2345
- Patient had emesis
- FHR 80s
- Maternal pulse 130-150
- Stat CD called
CD performed
- Viable female infant 1900g, cord pH 6.90, po2 16, pco2 108
- Neonatal resuscitation, intubation followed by typical course of neonatal encephalopathy
- Minimal maternal bleeding
- Cardio pulmonary arrest following delivery of infant
- Resuscitative efforts unsuccessful
- Autopsy: saddle pulmonary embolus, DVT R Leg

Was standard of care met?
Suspected PE in Pregnancy

Leg symptoms

CUS

TREAT

+

CUS, CTPA

CXR

- Abnormal

Non-diagnostic

CTPA

Technically Inadequate

V/Q

- Normal

+ Normal

+ Abnormal

- Non-diagnostic

TREAT

STOP

STOP

Prevention Recommendations

- No recommendations for acute management of pregnant patient with high/moderate suspicion
- Guidelines focus on management and use of antithrombotic agents during pregnancy
- 2012 Chest Guidelines (not specific to pregnancy)
  - High/intermediate clinical suspicion suggests treatment with parenteral anticoagulants while awaiting diagnostic test results
  - Low clinical suspicion suggests not treating with parenteral anticoagulants while awaiting diagnostic test results (results should be received within 24 h)
Lessons from this Case

- If patient complains of leg pain perform compression ultrasound (CUS)
- The most common CXR finding in PE
  - Normal CXR
- The most common EKG finding in PE
  - Normal EKG
- If there is a high clinical suspicion for PE, start treatment with parenteral anticoagulants while awaiting diagnostic test results
Summary
“single cause of death most amenable to reduction by systematic change in practice”

Clark, SL. Semin Perinatol 2012;36(1):42-7

- Significant changes in clinical practice for prevention of VTE with CD over last decade
- Vaginal delivery hospitalization represents opportunities for improved care and research
- “Current recommendations based on observational studies or extrapolation from other populations”
- Urgent need for appropriately designed studies in pregnancy

CHEST 2012; 141(2)(Suppl):7S–47S
VTE Continues to be a major problem...

- 3,358 pregnancy-related deaths during 2006-2010
  - 9.6% Thrombotic Pulmonary Embolism (TPE)
  - 5.3% Amniotic Fluid Embolism (AFE)
  - No information about delivery mode for 529 (15.8%) cases
- In women with a known vaginal delivery (N=647) there were 79 embolism deaths: 53 TPE deaths & 26 AFE deaths
- In women with a known cesarean delivery (N=1,263) there were 215 embolism deaths: 107 TPE deaths & 108 AFE deaths

Personal communication from William Callaghan, MD and Andreea A. Creanga, MD, PhD
Centers for Disease Control, Atlanta, GA
### Prophylaxis in Vaginal Delivery Hospitalizations

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>No Prophylaxis</th>
<th>Any Prophylaxis</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
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<tr>
<td>All Patients</td>
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<td>97.4</td>
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<tr>
<td>Year of Delivery</td>
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<td>2006</td>
<td>366,317</td>
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<td>374,851</td>
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<td>352,438</td>
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<td>2009</td>
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<td>2012</td>
<td>390,881</td>
<td>97.2</td>
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Critical Care in Obstetrics

“Increase in simulation and case-based learning methodologies”

- Putting the "M" back in maternal-fetal medicine.

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