IMOET National Meeting
Tuesday 30th September 2014
Dublin Castle

Standardisation of multidisciplinary obstetric emergency training nationally.

Feidhmeannacht na Seirbhíse Sláinte
Health Service Executive

IMOET
Irish Multidisciplinary
Obstetric Emergency Training

The Management of Pulmonary Embolism

John R. Higgins
UCC Professor of Obstetrics & Gynaecology,
Head College of Medicine & Health

Feidhmeannacht na Seirbhíse Sláinte
Health Service Executive

IMOET
Irish Multidisciplinary
Obstetric Emergency Training

Purpose and scope

1. Diagnosis

2. Treatment

3. Challenges
   - Massive PE
   - PE before delivery
   - Reversal of anticoagulation

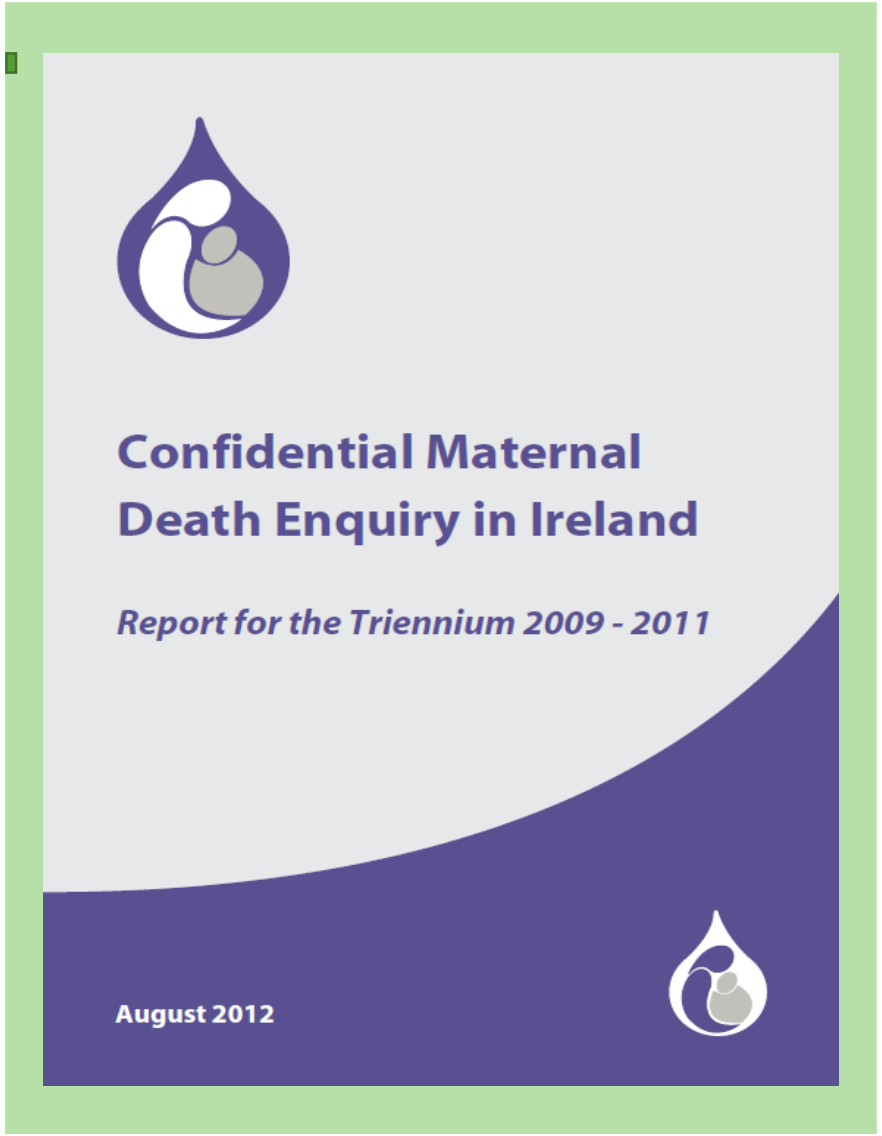
New National Guideline

- Haematology
  - Susan O'Shea, Niamh O'Connell, Fionnuala Ni Ainle
- Obstretrics
  - Carmen Regan, Brigette Bryne, John Higgins
- Radiology
  - Kevin O'Regan
- Respiratory Medicine
  - Des Murphy

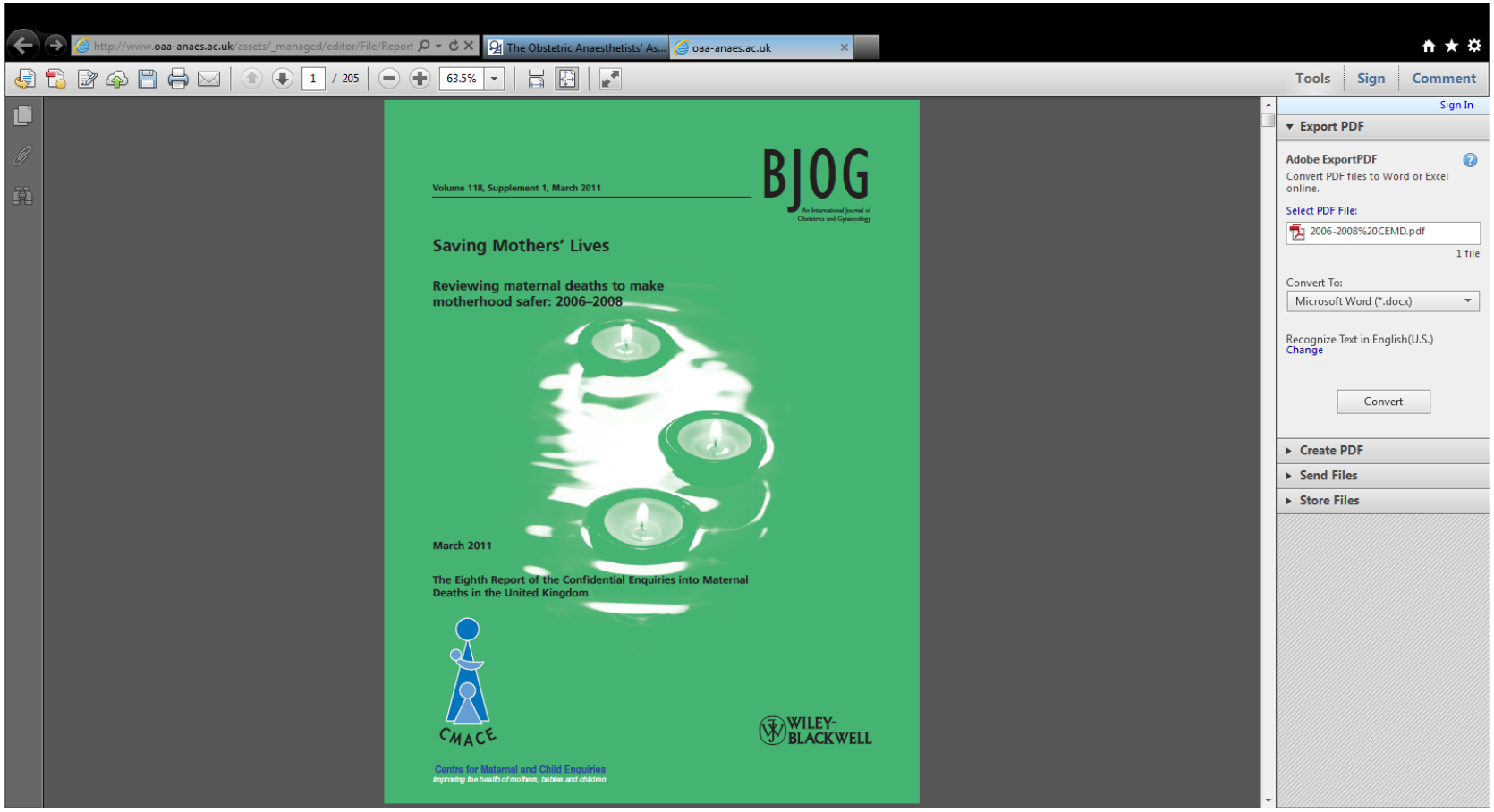
- 25 maternal deaths
- Rate 8 per 100,000 maternities

- 6 Direct Deaths

- 3 Deaths due to pulmonary embolism
- Rate 1 per 100,000 maternities



CMACE – March 2011



CMACE – March 2011

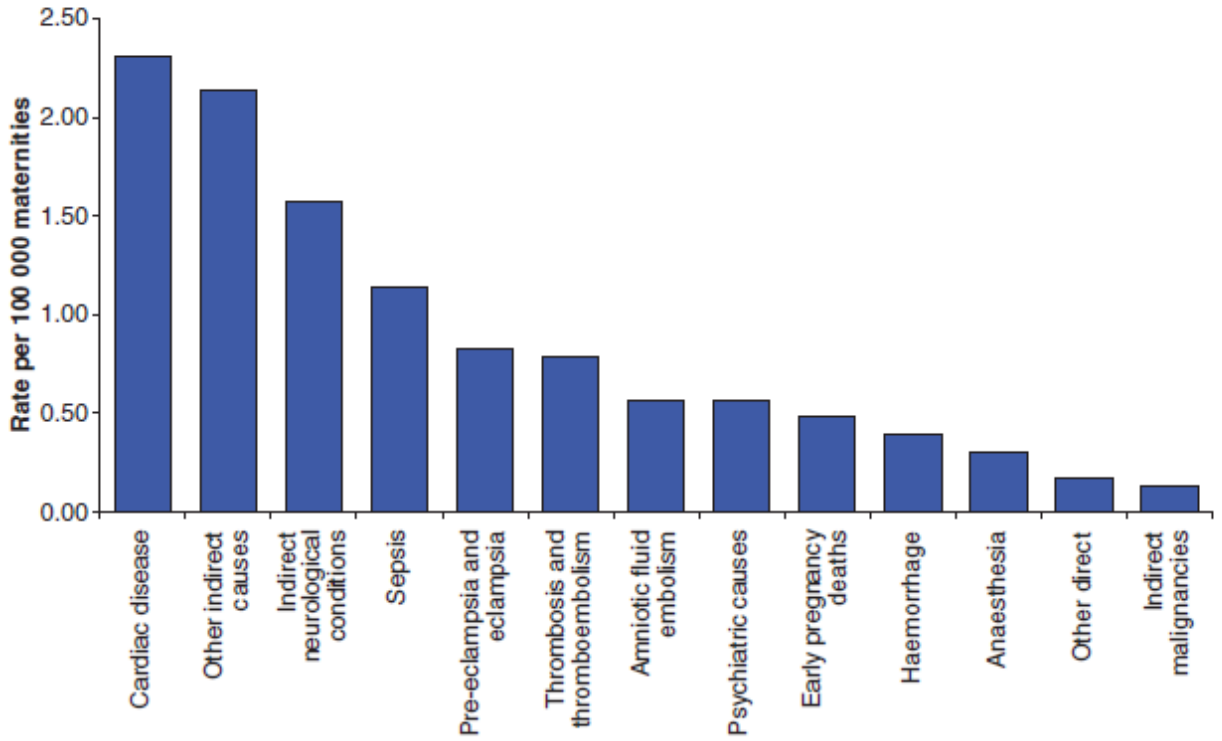


Figure 1.4. Leading causes of maternal death per 100 000 maternities; UK: 2006–08. Other *Indirect* causes of death are separated into neurological and others, and Other *Direct* includes fatty liver and a direct cancer.

CMACE – March 2011

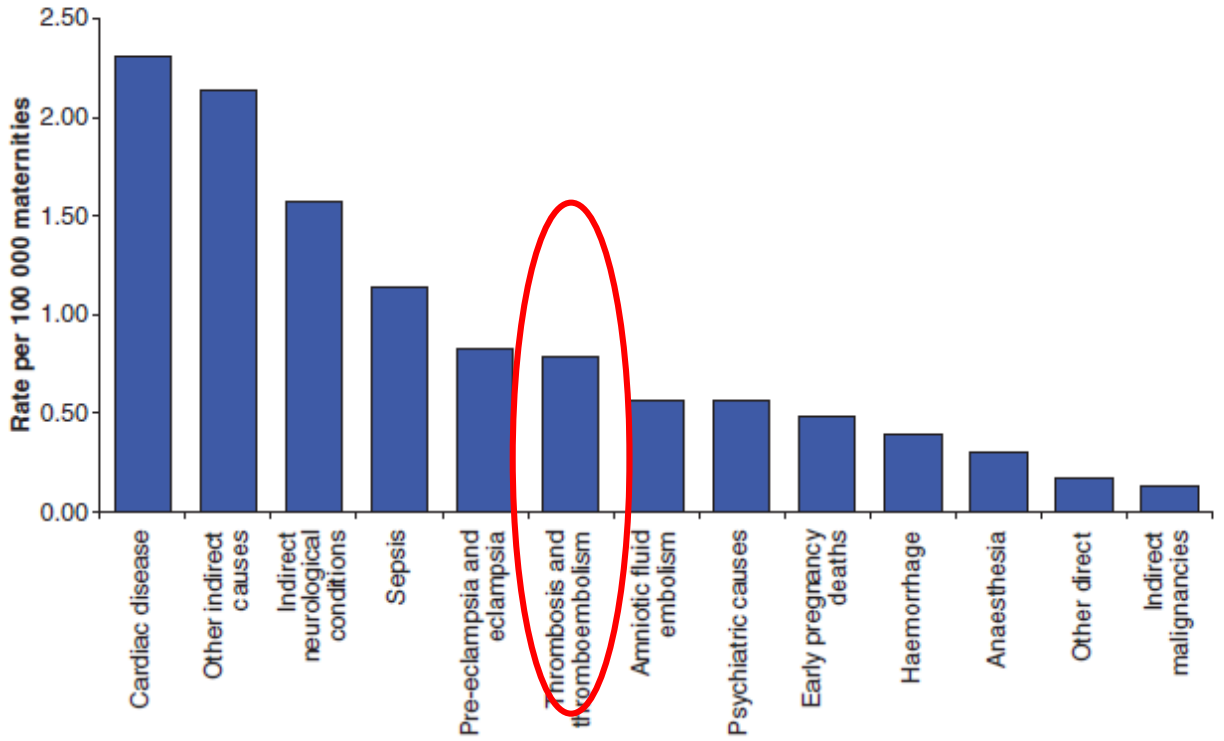


Figure 1.4. Leading causes of maternal death per 100 000 maternities; UK: 2006–08. Other *Indirect* causes of death are separated into neurological and others, and Other *Direct* includes fatty liver and a direct cancer.

CMACE – March 2011

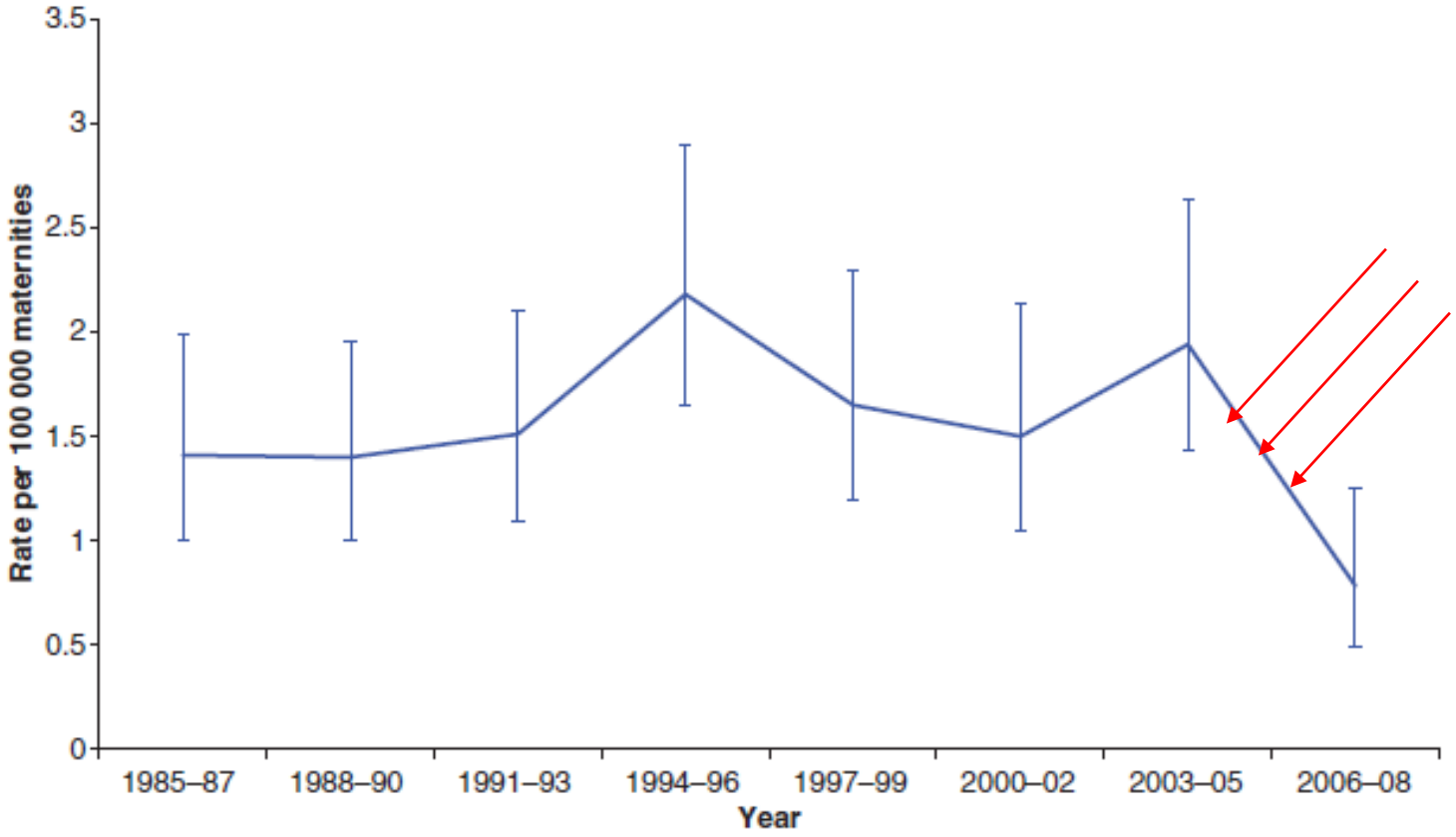


Figure 2.1. Rates per 100 000 maternities of *Direct* deaths from thrombosis and thromboembolism; UK: 1985–2008.

The Pyramid of Disease

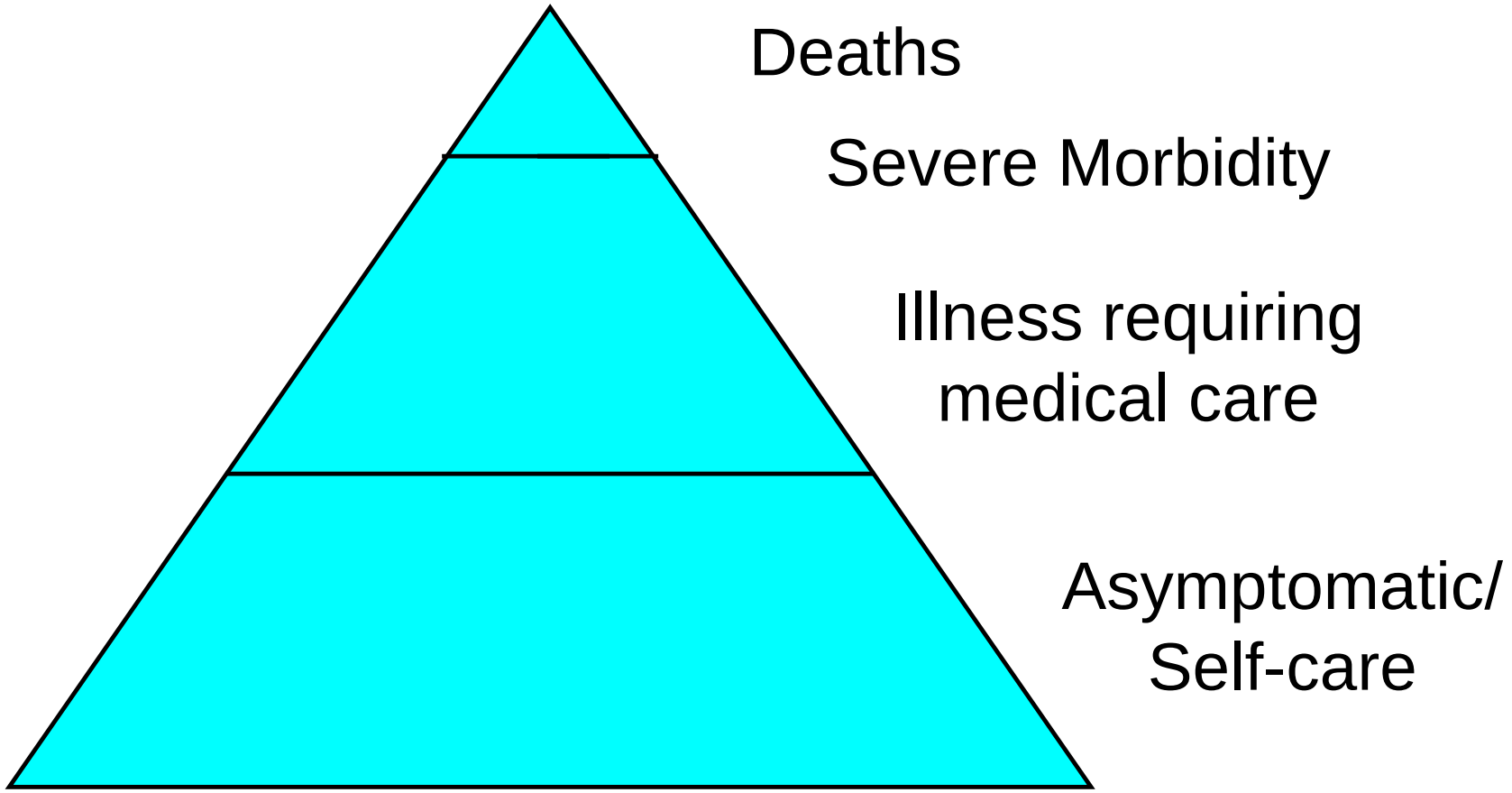
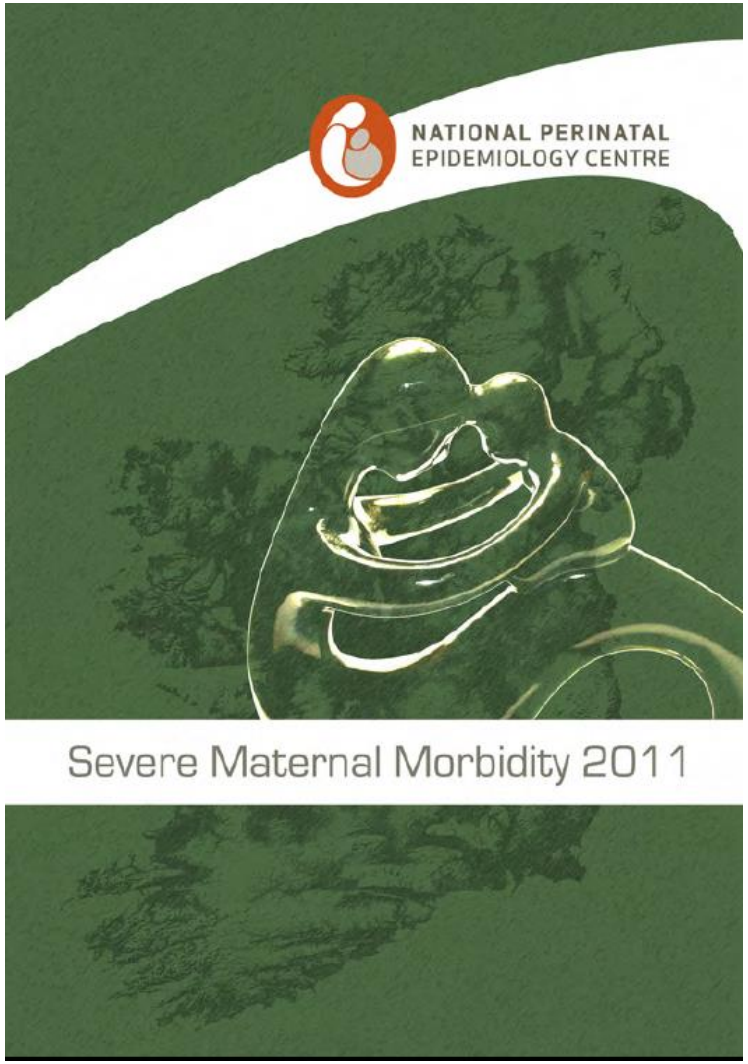


Table 1: Frequency and corresponding rates, 2011, 19 maternity units

Event	Frequency	Rate per 1,000 (95% CI)
Major obstetric haemorrhage	159	2.3 (1.9-2.7)
ICU/coronary care unit admission	111	1.6 (1.3-1.9)
Renal or liver dysfunction	26	0.4 (0.2-0.5)
Peripartum hysterectomy	23	0.3 (0.1-0.3)
Pulmonary embolism	12	0.2 (1.0-3.1)
Eclampsia	12	0.2 (1.0-3.1)
Pulmonary oedema	8	0.1 (0.04-0.20)
Cardiac arrest	7	0.1 (0.04-0.20)
Anaesthetic problem	7	0.1 (0.04-20)
Cerebrovascular event	6	0.09 (0.02-0.16)
Acute respiratory dysfunction	5	0.07 (0.01-1.10)
Septicaemic shock	4	0.06 (0.00-0.10)
Status epilepticus	3	0.04 (0.00-0.09)
Coma	–	–
Interventional radiology		
Planned	8	0.1 (0.04-0.20)
Unplanned	8	0.1 (0.04-0.20)
Total events reported	**399**	**3.8 (3.36-4.30) ***

*Total rate is based on the number of women diagnosed with a severe morbidity, not on the number of events.

0.3)



Antenatal pulmonary embolism:risk factors, management and outcomes

- One of first UKOSS studies
- Feb 2005 – Aug 2006
- All Obstetric units in UK

- 143 antenatal Pulmonary Emboli
- Incidence – 1.3 per 10,000 maternities

- Risk factors identified
  - BMI≥30kg/m aOR 2.65 (95%CI 1.09-6.45)
  - Multiparity aOR 4.03 (95%CI 1.6-9.84)

Knight et al for UKOSS BJOG 2008;115:453-461

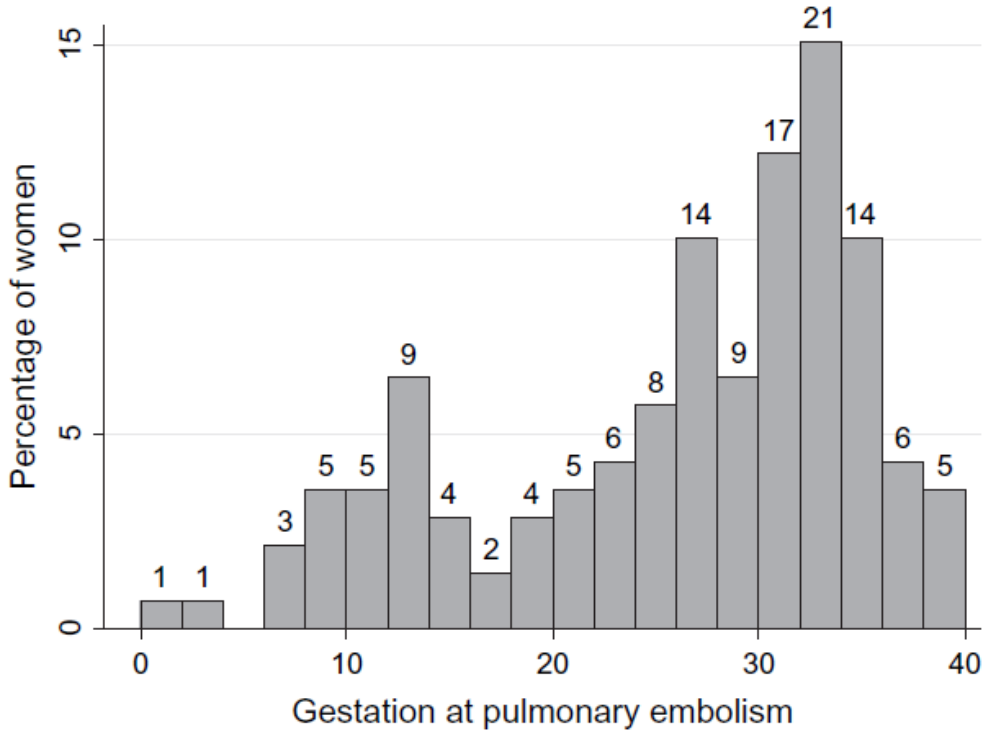


Figure 2. Gestational age at pulmonary embolism (completed weeks). Figures above bars show numbers of women.

Venous thromboembolism in pregnant and puerperal women in Denmark 1995-2005

- A national cohort study
- Women 15-49years
- 1995- 2005 incl.

- 727 VTE from 819,751 pregnant women

Thromb Haemost June 2011; 106:304-309

Venous thromboembolism in pregnant and puerperal women in Denmark 1995-2005

- Absolute risk antenatally 10.7 per 10,000 pregnancy-years
- Absolute risk in puerperium 17.5 per 10,000 puerperal years

Thromb Haemost June 2011; 106:304-309

Venous thromboembolism in pregnant and puerperal women in Denmark 1995-2005

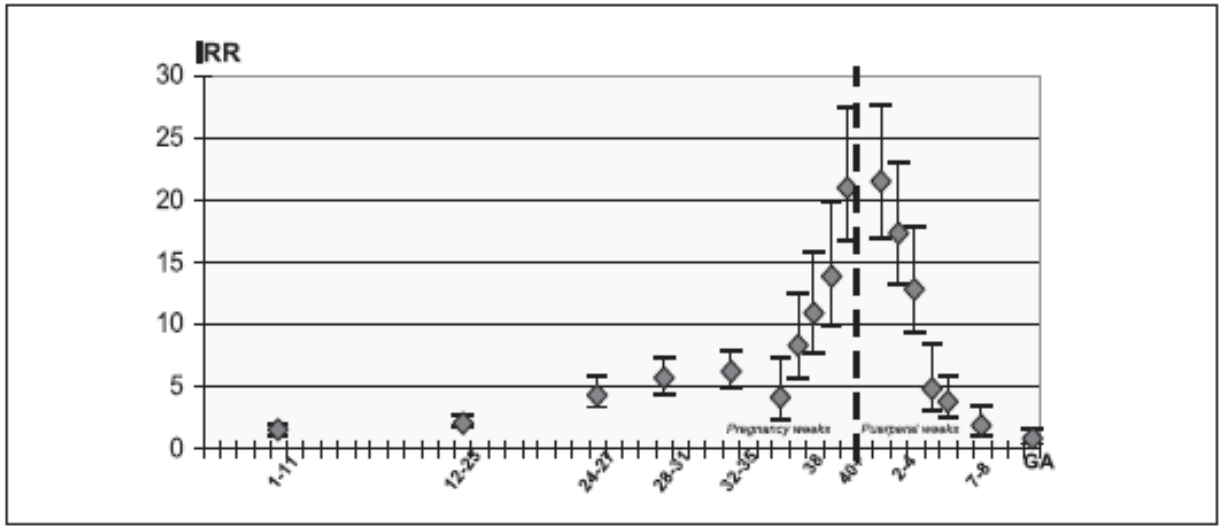


Figure 1: Adjusted* incidence rate ratios (IRR) of thromboembolism in pregnant and puerperal women versus non pregnant women not using oral contraceptives.
*Adjusted for age, calendar year and education.

Thromb Haemost June 2011; 106:304-309

Risk of first venous thromboembolism in and around pregnancy:a population-based cohort study

- UK primary care database
- Women 15-44 years
- 1987-2004

- 207, 327 live birth pregnancies
- Overall rate 10.7 per 10,000 person years

Aylshah Abdul Sultan *et al* BJH Dec 2011

Risk of first venous thromboembolism in and around pregnancy:a population-based cohort study

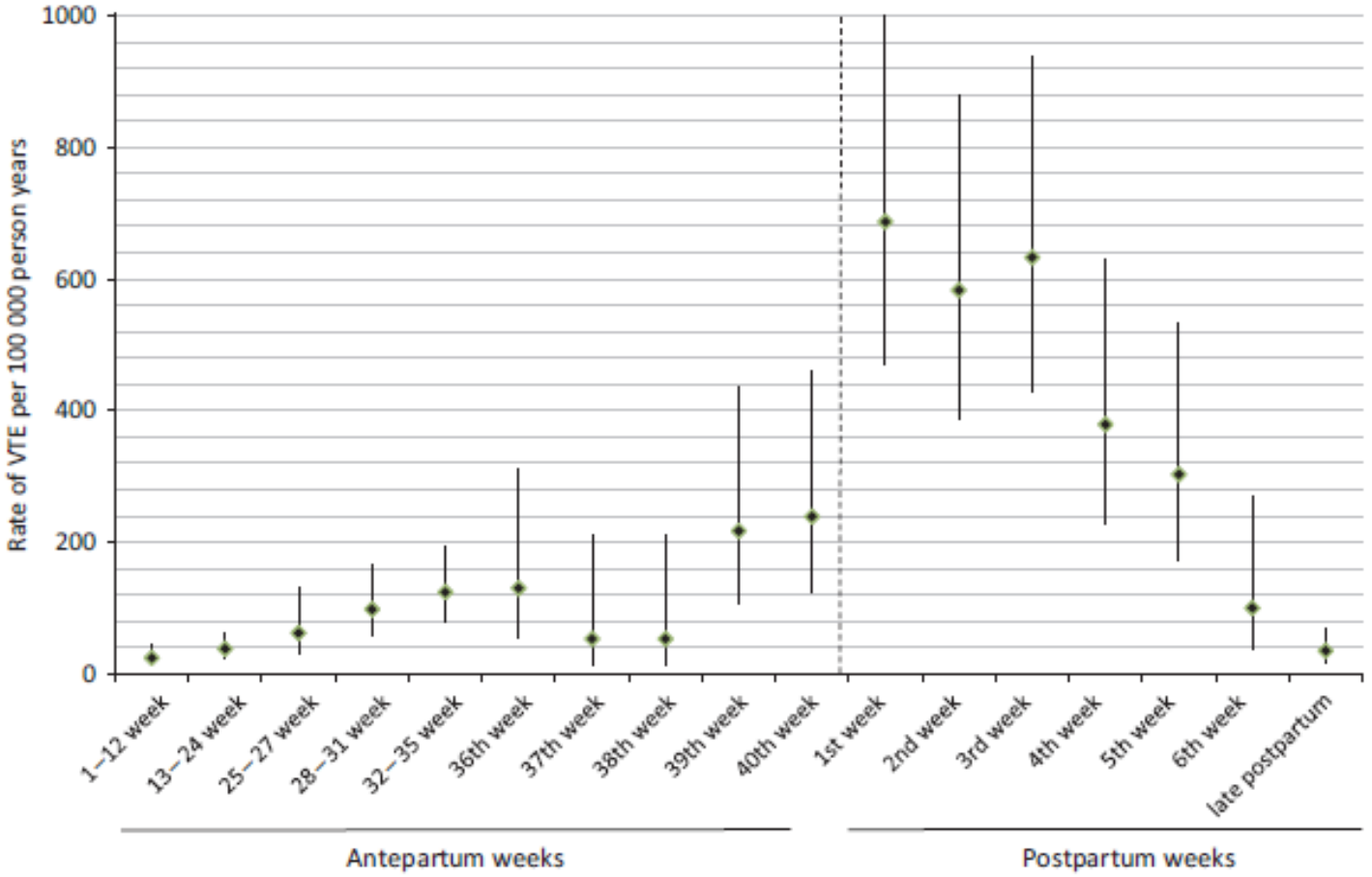


Fig 3. Rate of venous thromboembolism (VTE) per 100 000 person-years in weeks of antepartum and postpartum period.

Aylshah Abdul Sultan *et al* BJH Dec 2011

Conclusion

- Increased risk is in late pregnancy
- Very high relative risk out to three weeks post partum
- Observational data continues to be essential

Clinical practice guidelines

- Venous Thromboprophylaxis in pregnancy HSE Clinical Care Programme in Obstetrics and Gynaecology, 2013
- The Acute Management of Thrombosis and Embolism during Pregnancy and the Puerperium RCOG, Greentop guideline No. 37b, 2007
- Pulmonary Embolism in Pregnancy – Diagnosis and Treatment ACOG 2013

Early detection of PE in pregnancy

- *Clinical diagnosis is difficult – high index of suspicion required*

Tachypnoea	89
Dyspnoea	81
Pleuritic pain	72
Apprehension	59
Cough	54
Tachycardia	43
Haemoptysis	34
Temp > 37 C	34

Initial Management

1. *Clinical diagnosis is difficult – high index of suspicion required*
2. *Consider PE in all women presenting with shortness of breath, chest pain, tachycardia, cardiovascular collapse*
3. *If unstable immediately*
    - *involve senior obstetrician, anaesthetist and medical team*
    - *Assess Airway, Breathing, Circulation – CPR if woman is in cardiac arrest*
    - *Transfer to HDU for monitoring*
4. *Initial investigations – FBC, baseline clotting, arterial blood gas, ECG*
5. *Diagnostic imaging by protocol – Chest X-ray, Lower limb Doppler, Ventilation/perfusion, CTPA*
6. *Anticoagulate while awaiting outcome*

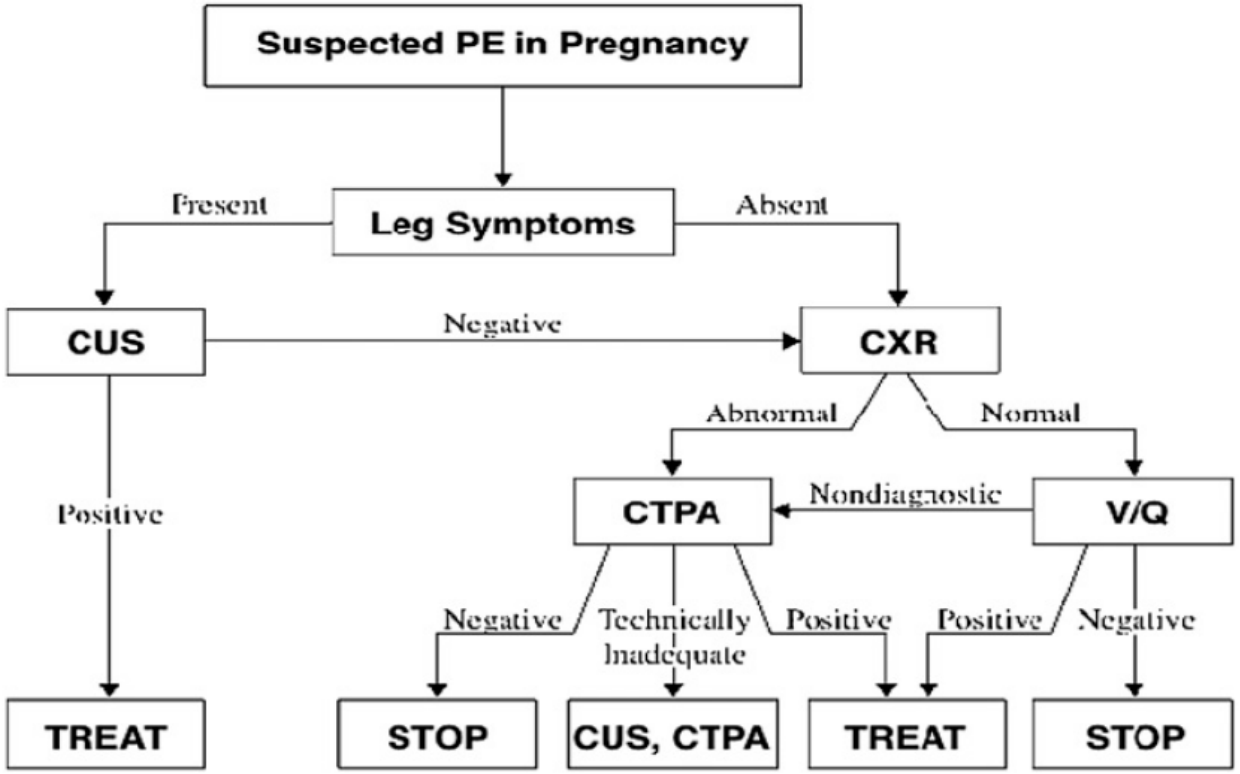
Differential for SOB/respiratory distress in suspected PE in pregnancy

1. *Pneumonia*
2. *Asthma exacerbation*
3. *Cardiovascular causes*
   - *Pre-eclasmpsia*
   - *Valvular heart disease*
   - *Cardiomyopathy*
4. *Amniotic-fluid embolism*

Bui *et al* N Engl J Med September 2014

Management response

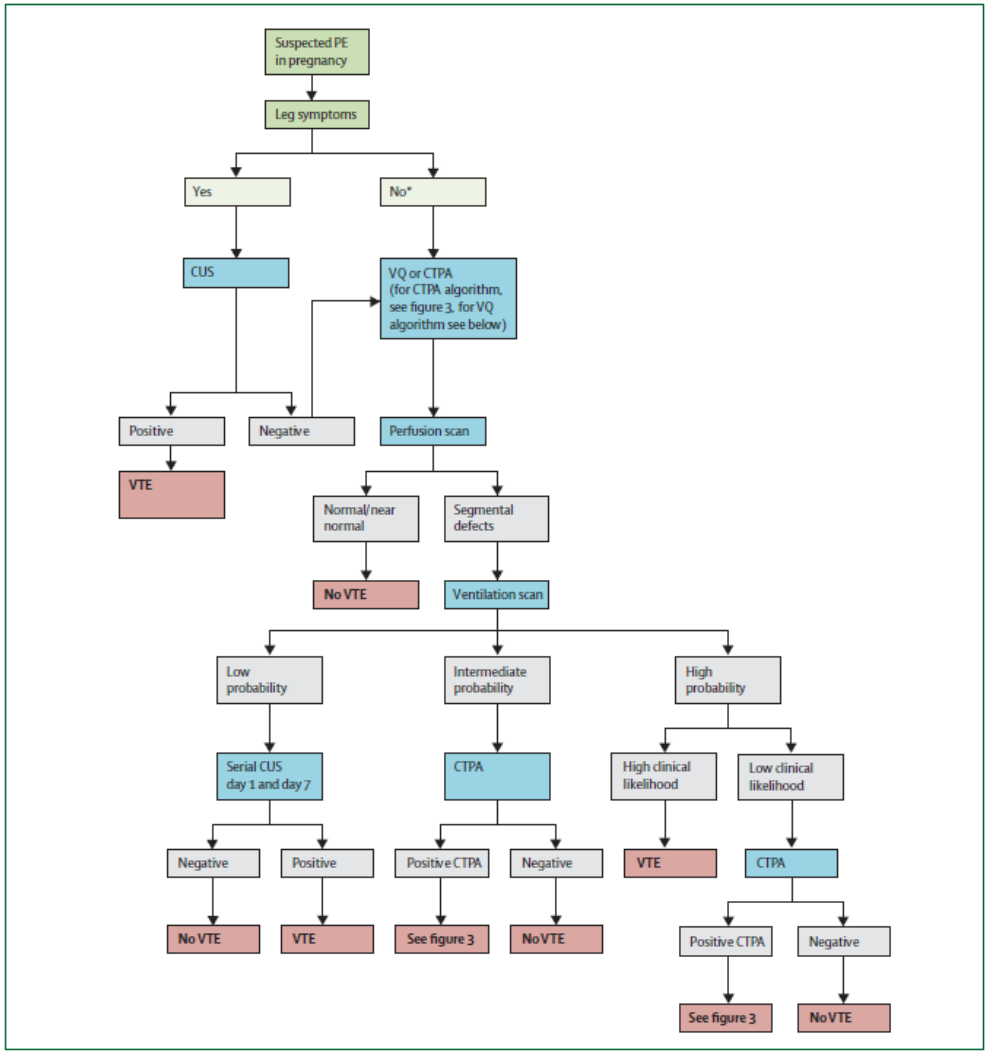
Diagnostic algorithm for suspected PE in pregnancy*



**If PE is suspected and CUS and V/Q scanning services are not readily available, proceed immediately to CTPA to avoid a potentially lethal delay in treatment.*

Approved by ATS, STR & ACOG

Management Response



Bourjeily et al, Lancet 2010

Investigation dilemma

- *CTPA vs V/Q*
  - *Radiation exposure*
  - *Test characteristics*
  - *Availability*

Treatment – Low Molecular Weight Heparin

Table 1. Calculation of initial doses of drugs by early pregnancy weight

Initial dose	Early pregnancy weight (kg)			
	< 50	50–69	70–89	> 90
Enoxaparin	40 mg bd	60 mg bd	80 mg bd	100 mg bd
Dalteparin	5000 iu bd	6000 iu bd	8000 iu bd	10,000 iu bd
Tinzaparin	175 units/kg once daily (all weights)			

bd = twice daily

RCOG Greentop guideline 37b 2010

Challenges – Massive PE

Individualised decision making – senior Obstetrics, Haematology, Respiratory, Radiology, Cardio-thoracic, Midwifery

1. IV unfractionated heparin

2. Thrombolysis (rare)

3. Thoracotomy/surgical embolectomy (V. Rare)

Challenges – Massive PE

IV unfractionated Heparin

1. Loading dose 80units/kg

2. Maintenance 18units/kg/hr

3. Adjust to APTT – target 1.5 to 2.5

Challenges – Massive PE

IV unfractionated Heparin

1.Loading dose 80units/kg

2.Maintenance 18units/kg/hr

3.Adjust to APTT – target 1.5 to 2.5

Table 2. Infusion rates according to activated partial thromboplastin time (APTT)

APTT ratio	Dose change (units/kg/hour)	Additional action	Next APTT (hours)
< 1.2	+ 4	Re-bolus 80 units/kg	6
1.2–1.5	+ 2	Re-bolus 40 units/kg	6
1.5–2.5	No change		24
2.5–3.0	– 2		6
> 3.0	– 3	Stop infusion 1 hour	6

RCOG greentop guideline 37b , 2010

Challenges – PE before delivery

Individualised decision making – Obstetrics, Haematology, Radiology

1. Peripartum anticoagulation – Unfractionated heparin?

2. Retrieval inferior vena cava filter

Challenges – Reversal of anticoagulation

Individualised decision making – Obstetrics, Haematology,

***Panel 2*: Suggested protamine dose for reversal of UFH and LMWH*[94]**

Intravenous heparin

- Immediately after dose: 1·0–1·5 mg per 100 U heparin
- 30–60 min after infusion stopped: 0·5–0·75 mg per 100 U heparin
- More than 2 h after infusion stopped: 0·25–0·375 mg per 100 U heparin

Subcutaneous heparin

- Dose needed for reversal: 1·0–1·5 mg per 100 U heparin
- 25–50 mg given slowly intravenously, followed by the remaining portion of the dose given as a continuous infusion over 8–16 h

Enoxaparin

- 1 mg for each 1 mg of enoxaparin
- Additional 0·5 mg per 1 mg enoxaparin if antifactor-Xa concentration more than 0·2 IU/mL 2–4 h after first dose

Dalteparin or tinzaparin

- 1 mg per 100 IU antifactor-Xa
- Additional 0·5 mg per 100 IU antifactor Xa if antifactor-Xa concentration is more than 0·2 IU/mL 2–4 h after first dose

*Excessive protamine doses might exacerbate the risk of bleeding.

Bourjeily et al Lancet 2010

Practical skills & drills elements

- Non-massive PE
  - Desktop scenario training
- Massive PE – haemodynamically unstable
  - Clinical drill
- Massive PE – cardiac arrest
  - CPR drill

Clinical Drill

- Patient- late pregnancy, new onset SOB, pleuritic chest pain, hypotensive
- Setting – Emergency room maternity hospital
- Response 1 – Call for senior help – obstetrics, anaesthetics, haematology midwifery
- Response 2 – ABC, IV access,
- Response 3 – FBC, Coag studies, ABG, ECG

Clinical Drill

- Response 4 – consider treatment – LMWH or UFH or Thrombolysis
- If good patient recovery
- Response 5 – Complete investigations – CTPA, V/Q , Doppler
- If Cardiac arrest
- Response 6 – CPR and Delivery,

Summary

1. Diagnosis of PE in pregnancy requires high index of suspicion

Summary

2. Once suspected PE must be treated while awaiting investigations

Summary

3. If investigations negative and still clinically suspicious *continue* to treat

Summary

4. Massive PE – haemodynamically unstable- requires immediate complex individualised care with input from senior Obstetric, Haematology, Anaesthetic, Radiology, Surgical and Midwifery

Summary

5. PE at term poses particular risk of delivery when therapeutically anticoagulated and requires individualised care with input from senior Obstetrics, Haematology, Anaesthetics and Midwifery

Quality standards and improvement

1. Risk assessment of all pregnant women performed

2. Appropriate treatment for all suspected and confirmed PE

3. Delivery management plan documented for all women on treatment for PE

Looking forward

- Complete new Irish Guideline on Management of VTE in pregnancy

- If you do only one thing when you return to your unit……

  - ***Highlight the importance of shortness of breath in pregnancy***