Update on massive transfusion NHO Meeting, Limerick 08

Joan O'Riordan

***A guideline for the use of blood and blood components in the management of massive haemorrhage.**
National Blood Users Group 2002

Massive Transfusion Definitions

- Replacement of entire blood vol in 24 hrs

  Total transfusion >8- 10 packed RBC units
- Replacement > 50% blood vol in 3 hrs
- Blood loss at 150 ml or > min
- Transfusion of 4 or more RBCs in I hr with ongoing haemorrhage
- Patient predicted to need 8 or > RBCs within 2 hours

Massive Transfusions
Blood Utilisation Study 2001

- 383 massive transfusion episodes
- 377 patients (1.25% tx population)
- 29 obstetric patients

  – 18 hospitals – 47,791 deliveries (86%) all deliveries

  Risk 0.06% (6/10,000); 1: 1600

Massive Maternal Haemorrhage

Developing countries

- PPH > 125 000 deaths/yr 28% maternal deaths
- risk of death 1 in 1000

Developed countries

- life- threatening haemorrhage 4-5 in 1000
- risk of death – 0.66 in 100 000

j10
j12
j13

Why Mothers Die UK 1985-2002
Saving Mothers' Lives 2003-2005

Triennium	placental abruption	placenta praevia	PPH	Total	rate/10^5
1985-87	4	0	6	10	.44
1988-90	6	5	11	22	.93
1991-93	3	4	8	15	.65
1994-96	4	3	5	12	.55
1997-99	3	3	1	7	.33
2000-02	3	4	10	17	.85
2003-05	2	3	9	14	.66

Report on confidential enquires into maternal deaths in UK

Slide 5

j10 60% of those who died received sub-optimal care
6 BMI > 30, and 2 morbidly obese ie, 8 or one half obese
11 had C/S
Half ethnic mororites & several spoke no English
2 Jeh Wit
oriordanj; 2008/10/11

j12 Despite their care being of a high standard
general priciples;
at first booking willingness to be ascertained should be obtained
consultant obst/anaest necessary ante-natally
informed consent for salvage should be sought & documented
at onset of labour must see Cons Obstet & Anaest for final care plan
oriordanj; 2008/10/11

j13 maternal deathys are exremely rare in Uk at 14,per 100,000 pregnancie3s for this triennium. If as in the case of \other countries, restricted to cause of death of death given by death certificate alonen the Uk maternal death rate was 7/100.000 maternities.
oriordanj; 2008/10/12

j9

Saving Mothers' Lives 2003-2005

- UK Obstetric Surveillance System
- Feb 2005-Feb 2006
- Peripartum hysterectomy –'near miss' event for maternal mortality from haemorrhage
- 315 women hysterectomy
- 41 per 100 000 maternities
- > 60 women hysterectomy for each woman who dies from haemorrhage

Slide 6

j9 During the 13 mos of the study .women who had undrgone a previous C/S wewre at higher risk of requiring a peripartum hysterectomy OR of 3.52.women who had 2 or more previous C/S deliveries had more than 18 times higher odds of requiring hysterectomy

oriordanj; 2008/10/11

j11

Preventable Death in Obstetrics ‘ Too Little Too Late”

- Failure to recognise signs of sustained intra-[j8] abdominal bleeding
- Delayed correction of hypovolaemia
- Delay in provision of blood
- Failure to take appropriate action when predisposing factors were recognised
- Absence of senior staff input
- Delay in recognizing coagulation failure

Slide 7

j8 sustained intraabdominal bleeding esp after C/S
oriordanj; 2008/10/11

j11 An early warning scoring system may help with the more timely recognition of cases of hidden bleeding
In 5 cases sustained intra-abdominal bleeding usually followinf C/S not recognised until too late.
oriordanj; 2008/10/11

Obstetric Haemorrhage

- At term, blood flow to placenta 700 ml/min
- Bleeding - unpredictable & massive
- may result in clear signs of hypovolaemic shock

but

- may be few signs of hypovolaemia despite considerable loss due to blood volume expansion in pregnancy

Why Mothers die:

Report on Confidential Enquires into Maternal Deaths in the UK 1994-96

- Third trimester A & E-unwell, no pain, pale & clammy
- Pulse & BP normal
- 2 hours later dead
- Haemorrhagic shock-Hb 3.0g/dl
- Uterus contained 2 l blood

Hemorrhage Health Alert : Prevention of Maternal Deaths through Improved Management of Hemorrhage*
DOH, State of New York, Aug 13, 2004

- Maternal deaths in 2000 NYS residents 15.9/100,000 livebirths vs 9.8/100,000 US
- African American mothers > 3 x than white women
- Review of deaths in NY City (NYC DOH) : haemorrhage leading cause of death (I/3 cases)
- 97% of haemorrhage-related deaths occurred in patients hospitalised at the time of death
- 'Hemorrhage is a highly preventable cause of maternal mortality'

the American College of Obstetricians and Gynecologists

Trauma

- Traumatic injury leading cause of death worldwide aged 4-44 yrs
- 2002: 800,000 injury related deaths in Europe – 8.3% of all deaths
- Uncontrolled bleeding contributes to 30-40% of trauma deaths
  - Leading cause of preventable deaths

Probability of Life-Threatening Coagulopathy Increases with Shock and Hypothermia

Clinical Status	Coagulopathy
ISS > 25	10%
ISS > 25 + SBP < 70 mmHg	39%
ISS > 25 + pH < 7.1	58%
ISS > 25 + temp < 34^{O}C	49%
ISS > 25 + SBP < 70 mmHg + temp < 34^{0}C	85%
ISS > 25 + SBP < 70 mmHg +temp < 34^{0}C +pH <7.1	98%

Cosgriff N et al. J Trauma 1997

Hypothermia

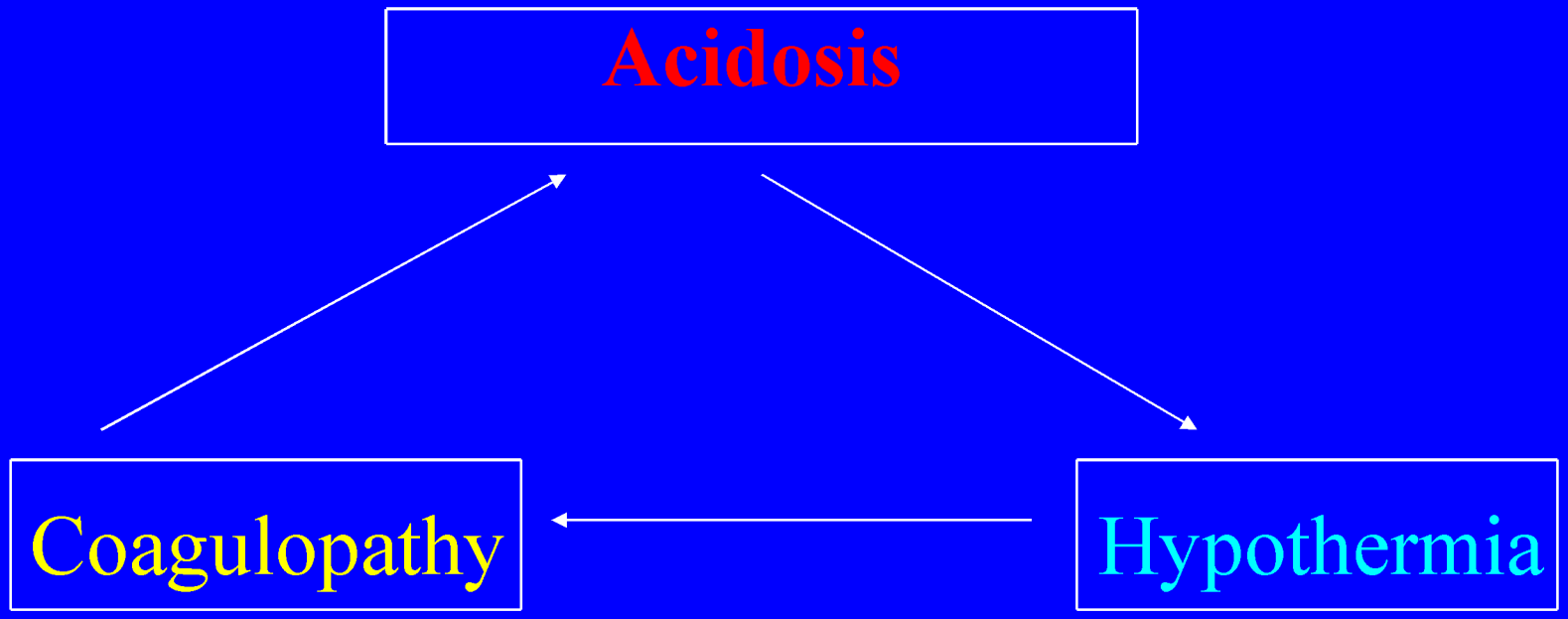
Hypothermia constitutes an extremely important reversible haemostatic defect*.

- Temperature below 35^0C
- Important contributor to coagulopathy
- Reversible platelet dysfunction
- Alters coagulation & enhances fibrinolysis
- patient warming, use of rapid infusion and an in-line counter current warming system for fluids and blood components

***May be overlooked as coag testing performed at 37^0C**

j7
j19
j23
j33

‘The Lethal Triangle’



Slide 14

j7 Acidosis, hypothermia and coagulopathy were identified more than 20 yrs `ago as a deadly triad for patients presenting with exsanguinating haemorrhage. this led to fundamental changes in initial management of severely injured pts. despite major advances, haemorrhage remains a leading cause of early death in trauma patients. Acidosis and hypothermia well managed but not coagulopathy
oriordanj; 2008/10/11

j19 Coagulopathy develops in 44% of all seriously injured pts & accounts for most deathsthat occur inthe first 24 hrs of admission . the mechanism of coagulopathy is multifactorial. Post injury the predominant factor is core hypothermiaother well described factors metabolic acidosis from inadequate tissue oxygenation & dilutional effects of massive transfusiion, hyperfibrinolysis and consumptive coagulopathy
oriordanj; 2008/10/12

j23 led to fundamental change in initial management of severel;y injured patients who present with exsan haem. Regional trauma now triage these criticall y injured pts to level 1 trauma centre where prevention of hypotherma damage control surgery , Massive transfusion protocols and earlt intensive care unit care for optimal resuscitation are standards opf care.Despite these major changes haem remains the leading cause of early death in civilian and military combat casualities
oriordanj; 2008/10/12

j33 There is a golden hour-its a metaphor for urgency, not a specific time
oriordanj; 2008/10/13

Massive Transfusion-Haemostatic Defects

- Type & vol blood & other fluids transfused
- Preexisting haemostatic abnormalities
- Effect of hypothermia
- Extent of tissue injury
- Hypovolaemic shock
- Consumption
- Hyperfibrinolysis

j21

RBC components have changed over time

- Fresh whole blood
- Stored whole blood
- Packed RBCs
- Concentrated RBCs
- RBCs in additive solution (SAG-M)
- In young soldiers receiving large vols of stored whole blood , PT, APTT & fibrinogen levels minimally effected
- Thrombocytopenia main factor in coagulopathy

(Simmons et al, Ann Surg 1969, Miller et al, 1971)

Slide 16

j21 Critically low levels of coag factors were seldom reported when whole blood was in common use

oriordanj; 2008/10/12

j22

Haemostatic Factors and Replacement of Major Blood Loss with Plasma-Poor RBCs

Haemostatic factor	Critical level	Critical blood loss % blood vol
Fibrinogen	$1.0 g.L^{-1}$	142 (117-169)
F 11, V, VII	20%	201-230
Platelets	$50.10^{9}.L^{-1}$	230 (169-294)

Hippala et al Anesth Analg 1995

Slide 17

j22 Hypofibrinogenaemia develops first and the majority of aptients reach the critical level of 1 by 150% blood loss replaced with plasma poor red cells.Plain dilution explains 90% of thefibrinogen change

oriordanj; 2008/10/12

j25

Massive Haemorrhage

Prompt action & good communication essential

General

Planned protocol & in parallel as appropriate

- **Send for senior help early**
- **Lab-must be aware that a massive haemorrhage is in progress-**
- **Massive transfusion (protocol) alert system should be initiated**

j25 successful outcome requires prompt action and good communication between clinical specialities, blood bank, diagnostic lab and local blood centre.
oriordanj; 2008/10/12

Massive Haemorrhage

Insert wide-bore peripheral cannulae

Send samples to lab:

Group & cross match

*FBC, PT, APTT, Fibrinogen, D-dimers

Biochemistry profile

Record pulse & BP

Urine output

CVP

Blood gases and lactate levels

*Repeat at least every 4 hours or after 1/3 blood volume replacement

*Repeat after blood component infusion

j17

Massive Haemorrhage

- Provide adequate ventilation & oxygenation
- Control the source of haemorrhage
- Restore the circulating volume-
- Start blood component therapy-warmed

  Anticipate coagulopathy (aim to prevent dilutional coagulopathy)
- Restore or maintain normothermia (aim prevent hypothemia)
- Evaluate therapeutic response
- Every unit must have a protocol for massive haemorrhage based on the specific local conditions for obtaining blood in an emergency & dealing with the logistic demands of massive transfusion
- Regular ‘fire drills’
- Audit each episode - HTC

Slide 20

j17 The mainstay therapy in haemorrhagic shock is the `arrest of bleeding and relement of circulating volume and oxygen carring capacity.
oriordanj; 2008/10/12

j18
j29

RBC Transfusion:Massive Transfusion

O_2 carrying capacity critically low-

- O uncrossmatched RBC:

  Females childbearing potential - O Neg

  Males & postmenopausal females – O Pos
- Group specific ASAP
- 1 blood vol replaced quickly(>8-10 units in<30 mins) crossmatching not needed
- Cell salvage

Slide 21

j18 During active haemorrhage, RBC transfusions should primarily be guided by the rate of bleeding & by signs symptoms of inadequate tissue perfusion. traditional clinical signs of shock include heart rate > 120 beats/min; a systolic BP <90 mmHG, or urine output\ < 15 ml/hr. biochemical evidence of inadequate tissue perfusion eg persistent metabolic acidosis;base deficit, bicarbonate and > lactate to detect compensated shock state after heamodynamic parametrs are normalised & bleeding is controlled.The basis for these tests is that the body compenstaes for inadequate tissue perfusion with anaerobic glycolysis; therefore the lab evidence of additional extracellular acidity can help quantify the magnitude of shock. At our institution after bleeding is controlled & haemodynamics are normalised, we sample arterial blood for base deficit & venous blood for lactate
oriordanj; 2008/10/12

j29 The pts clinical condition, response to initial fluid resuscitation and initial Hb level should be considered in the decision to transfuse.Normal Hb in an acutely bleeding pt does not mean that there is a normal red cell mass, but may indicate haemoconcentration from loss of volume
oriordanj; 2008/10/12

Start Blood Component Therapy

Responsibility of a senior, experienced member of staff:

- Delivery time
- Size of local inventory
- Distance to nearest blood bank
- In the emergency situation, protocols for checking & administration of blood must be adhered to
- Timelines determine choice

j26

How urgent is the blood?

Estimated blood loss (ml) (% blood volume)	Degree of urgency	Request
500-1000 (10-20%)	Standby	Standard crossmatch of 2 units
1000-1500 (20-30%) blood loss controlled	Urgent) (blood within 1hr) (?30 mins)	Urgent crossmatch of 6 units
1000-1500 (20-30%) actively bleeding and 1500-2500 (30-40%)	Very urgent (blood within 30 min) (? 10 mins)	6 units type-specific/ un-crossmatched blood
>2500 (>40%) or above with no response to fluid resuscitation	Emergency (immediate) (?15 min)	2 to 4 units group O RhD negative blood from satellite fridge or blood bank followed by type specific

Macphail et al Current Obs & Gyne 2001

j27

Slide 23

j26 the use of electronic selection & issue of units without serological testing between patient & donor red cells, electronic crosss-matching, is now routine in many hospitals facilitating rapir delivery of fully crossmatched blood. If a blood group & ab screen has been performed in the preceeding 7 days and women has not been transfused since then , fully xmatched blood can be issued within 10 mins.
oriordanj; 2008/10/12

j27 Although electronically xmatched blood or type specific blood can be made available within 10 mins of sample receipt, the total time to provide blood will be in the region of 30 mins
oriordanj; 2008/10/12

Safety of uncrossmatched type-O red cells for resuscitation from hemorrhagic shock.

Dutton et al 2005, J Trauma 2005

Uncrossmatched type O RBCs (UORBC)-

- 480 trauma patients received 5,203 units RBCs
- 581 units of UORBC were given to 161 patients
- Overall mortality 45%
- No acute haemolytic transfusion reactions

(10 Rh neg men received O+ blood, only one developed anti-D)

Massive Transfusion-recommendations (NBUG)

- FFP –15mls/kg (4-6 units) after 1 blood vol & definitely before 1.5 blood volumes (7 L approx)

  (too late ?, this needs updating)
- Further FFP –aim to maintain PT <1.5
- Early use of FFP may avoid the need for cryo
- Aim for fibrinogen >1.0g/L
- Fibrinogen < 1 g/l – give cryo (10 packs/2 pools)*
- Allow for delivery time +30 mins thawing time

*IBTS supplies pooled cryo (5 units/pool, vol 175)

j5

Massive Transfusion
Platelets

- **Platelets* < 50 x 10^9/l after 2x blood vol replacement (> 15 units RBCs)-dilutional-individual variation great**
- **But consumption in DIC**
- **Acutely bleeding patient aim > 50x10^9/l or > 100 x 10^9/l in multiple or CNS trauma**

  (BCSH Trigger 75 x 10^9/l to maintain count > 50x10^9/l)
- **Anticipation of platelet requirements needed to allow for delivery time. Delivery time assessed by HTC**

***Frequent measurements are needed**

Slide 26

j5 Platelets are central for haemostasis by adhering at site of vascular injury and by supporting thrombin generation necessary for clot formation

oriordanj; 2008/10/11

Massive Transfusion –Haemostatic Defects-DIC

Microvascular bleeding in operative field

Oozing from venepuncture sites

At risk patients:

- Prolonged hypovolaemia or tissue hypoxia
- Extensive tissue damage
- Hypothermia
- Penetrating head injury
- Obstetric - eg abruptio, uterine rupture, amniotic fluid embolism, pre-eclampsia, sepsis

j24

j24 a hypercoagulable state already exists during the latter months of pregnancy with increased activity of some coag factors, reduced natural anticoagulant activity (antithrombin, protein S and C) and decreased overall fibrinolytic activity.
oriordanj; 2008/10/12

j28
j30

Massive Transfusion-Haemostatic Defects-DIC

Lab evidence should be sought before microvascular bleeding

Suspected when >PT, >APTT & < fibrinogen beyond that expected by haemodilution

PT & APPT >1.8, Fibrinogen <0.6-0.8g/l, Platelets <50x10^9/l

Treat underlying disease

- Expert haematological advice
- If coagulation tests not readily available to guide component therapy - give
- 4-6 units FFP)
- *10 units cryo)
- Adult dose platelets

*Obstetric DIC -15 units cryo

Slide 28

j28 Obstet haemorrhage is strongly asssociated with DIC
oriordanj; 2008/10/12

j30 trend in serial lab results. in the third trimester, the APTT is at the lower end of the normal range, reflecting increased FV111 and VWillebrand protein levels & fibrinogen levels are raised; thus, a significant change in their respective levels may have occurred & the result could be in the normal range.Clinically significant DIC is unlikely if there is no biochemical evidence of accelerated fibrinolysis through the measurement of either D-dimers or FDPS
Rx is aimed at identifying & removing/Rx the underlying problem, providing mujlti-organ support and blood product support if there is active bleeding
oriordanj; 2008/10/12

j31

Massive Obstetric Haemorrhage

Primigravida

26 weeks advanced abdominal pregnancy

- 1.15 pm call for O neg blood
- Hb 3.6 g/dl, platelets 38 x 10^9/l, no coag screen*
- O Neg blood + fibrinogen concentrate
- 2.30 pm
- Almost instant haemostasis following infusion of fibrinogen

*(APTT >256, fibrinogen <0.4)

Estimated blood loss 24 litres; 30 units RBC, 20 FFP, 10 platelets

j31 Since a case report from Isreal of the successful use of rVIIa to arrest severe haemorrhage in an individual following an abdominal gunshot injury in 1999
oriordanj; 2008/10/12

j1

Lessons from the military ?

Borgman et al. J Trauma 63 :805-813, 2007

- Ratio of blood products transfused affects mortality in massively transfused patients at a combat support hospital.
  - Retrospective study of trauma patients(n=246)
  - Mortality rate of 65%, median time to death of 2 hrs Tx with median no of 16 RBCs and 2 FFP
  - Mortality rate of 19% , median time to death of 38 hrs transfused median no of 17 RBCs and 12 FFP

Slide 30

j1 This is an oustanding example of survivorship bias,what this report shows is that if you survive the first 24 hrs after trauma you live long enough to get FFP.their 3 group were imbalanced in terms of numbers 31 pts low, 162 pts high, higher rate thoracic low 26 v 7%,low group transfused faster 4 units/hr v 0.8/hr high low ratio group had trend towards .>hr,<Bp>inr acidotic

oriordanj; 2008/10/11

j6

Proactive administration of platelets & plasma for patients with a ruptured abdominal aortic aneurysm: evaluating a change in transfusion practice

- 2 units pooled platelets, 5 thawed FFP, 5 RBCs

	Intervention group	control group*	*p*
• PLT count	166 x10^9/l	69 x10^9/l	<.0001
• APTT	39 sec	44 sec	<.001
• Survival	66%	44%	0.02
• Blood units	34	28	0.07
• Platelet units	4.6	0.8	<.0001

- Fewer post up transfusions

* Platelets Tx after 2 blood volumes;FFP if PT>1.5 normal

Johansson et al, Transfusion 2007

j6 a proactive administration of platelets maintaining a platelet count >100 improved haemostasis and survival in patients undergoing surgery for a ruptured abdominal a a

oriordanj; 2008/10/11

j2

Massive postpartum haemorrhage

Goodnough: Transfusion 2007

Stanford University Medical Centre

- Clinician activates massive transfusion protocol (MTP)
- Anticipates total RBC >10
- Emergency release of MTP package:

  6 RBCs, 4 thawed FFP(liquid plasma), 1 dose apheresis Platelets -

  delivery time < 15 mins

Same for trauma patients

Slide 32

j2 the 6:4:1 ratio of blood products approximates the composition of whole blood with a HCT of 40%
oriordanj; 2008/10/11

Saving Mothers' Lives 2003-2005

- PPH-hysterectomy, EBL 3,000 mls j3
- Hartmann's 1 L,NS 1L, Gelatin 1L
- 6 RBC, 2 FFP
- Tachycardia next 4 hrs –BP 110/60
- Few more hours HR > 160, BP 90/28 j32
- 7 RBC, 2 FFP,NS 1 L, platelets 1, cryo 5
- DIC arrested

Slide 33

j3 Lessons to be learnt, 3000 mls is a major blood loss during hysterectomy & junior staff should have sought help. Although her circulating volume was reasonably well replaced during surgery this was almost entirely with a mixture of red cells and saline with no appreciation that this would inevitably lead to a serious dilutional coagulopathy.the development of a dilutional coagulopathy should be avoided if at all possible by the early use of FFP & blood products as required.
oriordanj; 2008/10/11

j32 lessons to be learned: 3,000 mls is a major loss of blood during a hysterectomy and junior staff involved should have asked for senior help earlier. although her circulating volume was erasonably well replaced during surgery this was almost entirely with a mixture of RBCs and saline with little or no appreciation that this would inevitabl.y lead to a serious dilutional coagulapthy.The development of a dilutional coagulopathyshould be avoided if at all possible by the eary use of FFP and other blod products if required.
oriordanj; 2008/10/12

Problems with 1:1 approach

- Use of 1:1 RBCs/FFP has not been subjected to a randomised clinical trial.
  - Could it increase deaths from Acute Lung Injury?
  - Allergic reactions
  - Donor exposure- Risk of transfusion transmitted infection

The coagulopathy of massive transfusion- *Hardy et al, Vox Sang, 2005*

	Elective surgery	**Trauma**
Tissue trauma	Controlled	Massive & uncontrolled
Initiation of Tx	No delay	Can vary widely
Vol status/shock	Normovolaemia maintained	Hypovolaemia & shock are frequent
Temperature	Normothermia	Hypothermia frequent
Monitoring of haemostasis	Ongoing-anticipation	Late-Lab tests obtained when coagulopathy estab.
Coagulopthy	Dilutional	DIC
Rx coagulopathy	FFP, Platelets	Correction of : tissue hypoperfusion acidosis hypothermia anaemia FFP, platelets & cryo

Guidelines on the Management of Massive Blood Loss

bcsh@b-s-h.org.uk

rV11a:

- Relatively safe :1-2% thrombotic complications
- Consider use in:
- >300 mls/hr blood loss
- No evidence heparin or warfarin effect
- Surgical control bleeding not possible
- Adequate replacement coag factors with FFP, cryoppt, platelets
- Local protocol in place

Guidelines for off-licence use of Recombinant Factor VIIa in acquired coagulopathy

NI Advisory Comm on blood safety-Aug 2007

1 Ongoing clinically significant haemorrhage despite appropriate attempts to achieve surgical control of bleeding and after correction of other clotting factor/platelet deficiences and adherence to regional guidance

2 Severe obstetric haemorrhage requiring consideration of internal iliac artery ligation, uterine artery embolisation,or hysterectomy in the setting of optimal blood product support

Guidelines for off-licence use of Recombinant Factor VIIa in acquired coagulopathy

NI Advisory Comm on blood safety-Aug 2007

- 3.Severe haemorrhage, refractory to local control, in patient who refuses/would refuse blood products but would accept recombinant blood factors. Administration in these patients may need to be earlier in the course of events, because transfusion is prohibited

j20

Update NBUG Guideline for Massive Transfusion

- Early use of FFP (acute massive transfusion package) ?
  (in an alert code red setting)
- When to stop!
- Fibrinogen
- rVIIa
- Patients who refuse blood
- Interventional radiology
- Near patient testing

Slide 39

j20 The current recommended resuscitation regimen encompassing early administration of crystalloids and colloids % adminisistration of FFP & platelets only when a whole blood volume has been substituted may further compromise haemostatic ability

oriordanj; 2008/10/12

The use of rFVIIa in life-threatening PPH- *Franchini, TATM 2007*

Systematic review literature:

- 97 patients with PPH receiving rFV11a
- Positive result 94.8%
- Mean dose 53.1ug/kg
- 44/93 patients hysterectomy
- rFV11a should not be considered as a substitute for, nor should it delay the performance of life-saving procedure such as embolisation or surgery
- Use as adjunctive therapy
- ‘in cases of intractable PPH with no other obvious indications for hysterectomy, administration of rFV11a should be considered before hysterectomy’ ?

j4

Recombinant Factor V11a

Recommendations on the use of recombinant a F VII as an adjuvant treatment for masssive bleeding- a European perspective Crit Care 2006; 10: R120:

- **Blunt trauma - (grade B)**

  PPH - (E)
- **Uncontrolled bleeding in surgical patients (grade E)**
  - **Uncontrolled bleeding after cardiac surgery (grade D)**
- **Not Recommended:**
  - **Penetrating trauma (grade B)**
  - **Prophylactically in elective surgery (grade A) or liver surgery (grade B)**

Slide 41

j4 E recommendation ie case series,expert opinion ,uncontrolled studies

oriordanj; 2008/10/11

Use of rVIIa in primary PPH: Northern European registry 2000-2004

Alfirevic Obstet Gynecol 2007

- 97 cases –primary treatment
- 16 –secondary prophylaxis
- Caesarean delivery 49%
- Uterine atony 56%
- Improvement single dose 80%
- Laparotomy 53% (hysterectomy 33)
- 4 cases thromboembolism; 1 MI
- 5 maternal deaths

Evolving Coagulopathy in the Severely Injured

- **Loss**
- **Dilution**
- **Hypothermia**
- **Acidosis**

Coagulopathy of Trauma

- **Consumption**
- **Fibrinolysis**

DIC

A guideline for the use of blood and blood components in the management of massive haemorrhage.

National Blood Users Group 2002

- BCSH: Guidelines on the management of massive blood loss 2006
- Management of bleeding following major trauma: a European guideline - Crit Care 2007;11:R17
- Recommendations on the use of rFVIIa as an adjuvant treatment for masssive bleeding- a European perspective – Crit Care 2006; 10: R120
- Early v late factor rV11a in combat trauma pts requiring massive transfusion. Perkins et al, J Trauma. May 07
- The effect of rFV11a on mortality in combat-related casualities with severe trauma and massive transfusion –Spinella et al, J Trauma , Feb 2008

Immediate versus delayed fluid resuscitation for hypotensive patients with penetrating torso injuries. *Bickell et al N Eng J Med 1994;*

- Improved outcome was shown in those who did not have aggressive fluid resuscitation until operative intervention for bleeding control was undertaken
- 203 of 289 (70%) v 193/309 (62%) p=.04
- ? Pressure disruption of an effective thrombus
- ?Dilution of coagulation factors
- ?Lowering blood viscosity, thereby decreasing resistance to flow around an incomplete thrombus

NB Immediate management of arterial bleeding should focus on control of bleeding

Massive Transfusion Summary

- Alert system
- Secure haemostasis
- Restore circulating volume
- Effective blood component replacement

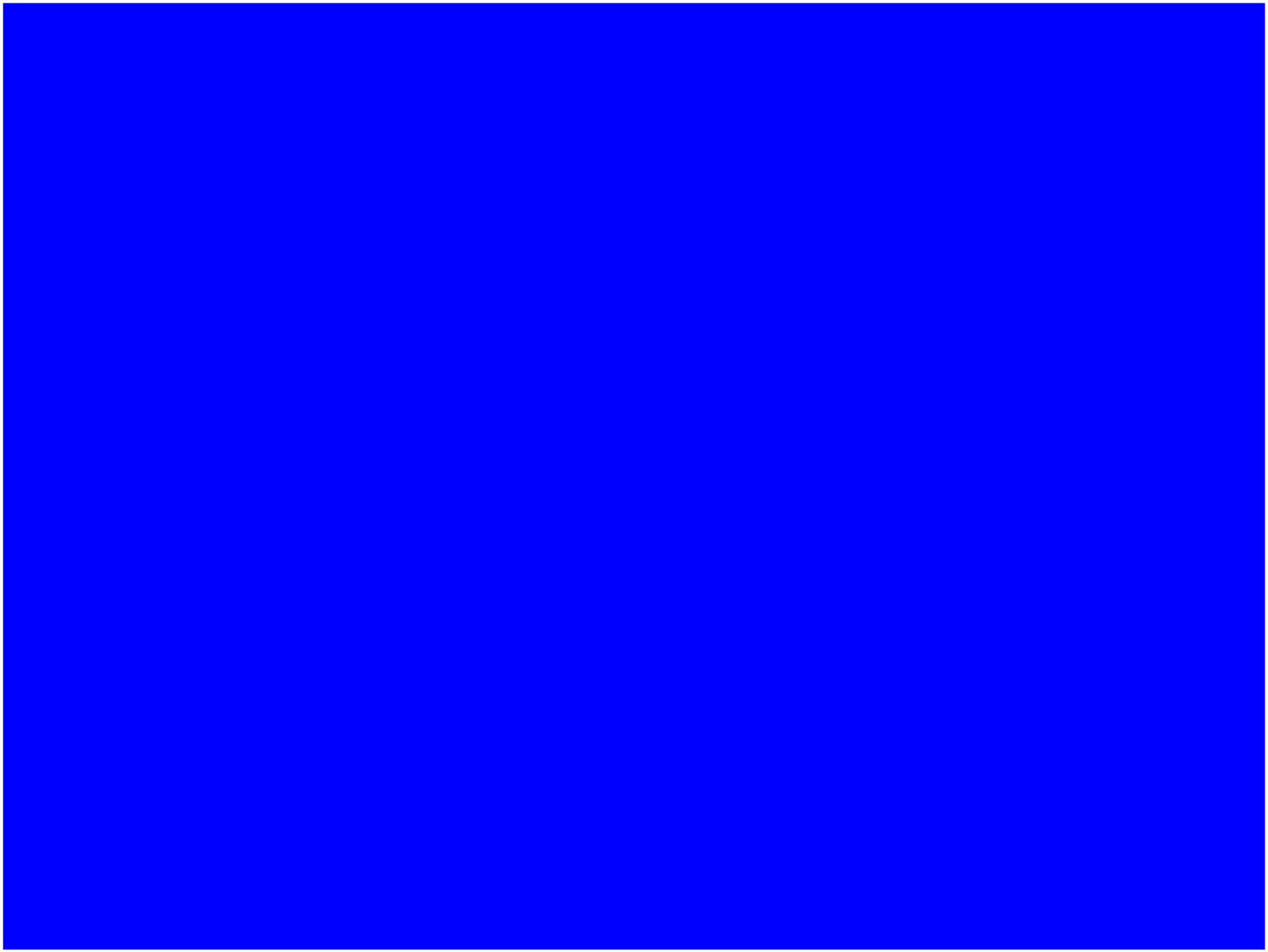
  Consider emergency release of a ‘package’:
- Every unit must have a protocol for massive haemorrhage based on the specific local conditions for obtaining blood in an emergency & dealing with the logistic demands of massive transfusion
- Regular ‘fire drills’
- Audit each episode - HTC

Incidence & predictors of severe obstetric morbidity

Waterstone et al BMJ 2001

- Estimated blood loss > 1500 ml
- Peripartum ↓ Hb ≥4g/dl
- Acute transfusion of ≥ 4 units blood
- 48 865 women SE Thames 1997-1999
- 6.7/1000 deliveries

jjj



vCJD : blood donors

UK - 18 blood donors *

66 recipients - 40 deceased

> 5 year survival 4 of 13 transmitted

France - 3 donors - 25 recipients

Ireland - 1 donor - 2 recipients

Spain (6 recipients) & Saudi Arabia

* 9 vCJD donations to 23 plasma pools

Predicting life-threatening coagulopathy in the massively transfused trauma patient.

Cosgriff et al, J Trauma 1997

Tissue trauma

Life-threatening coagulopathy

- pH of < 7.10
- Temperature of < 34^0C
- Injury severity score of > 25
- Systolic BP < 70 mmHg
- All risk factors present risk coagulopathy 98%

A Guideline for the Use of Blood And Blood Components in the Management of Massive Haemorrhage- *Blood Users Group 2002*

- 'The establishment of a massive transfusion alert system, similar to the cardiac arrest call, that would notify the relevant staff of the emergency situation should be considered.
- When the estimated blood loss has reached 1-1.5 litres and the bleeding is ongoing, the massive haemorrhage protocol should be initiated'-
- Any patient who requires 4 or more units of RBCs in one hour and in whom haemorrhage is on-going
- Patient predicted to need 8 or > RBCs within 2 hours

Major Haemorrhage Protocol

- Make 2 phone calls

1. Tell switch board:

There is a major haemorrhage

Name & location of patient

Contact name & telephone no for doctor in charge

Switchboard to inform:

Blood Bank (extension no……/ or on-call lab scientist)

Haematology lab (extension no …./ or on-call lab scientist)

On-call Haematologist

Porter

Consultant in charge: Obstetrician/ Anaesthetist / Surgeon/ intervention radiologist (extension no…/mobile no…)

Major Haemorrhage Protocol

2. **Phone the Blood Bank**

- How urgent is the need for blood ?
- Patient information
  - Name
  - Hospital no/Major incident no
  - Sex & DOB
  - ABO & Rh Group if known
- What blood component/s & how much is requested & how soon
- Where the blood is to be sent
- Name & contact no