

Lecture Title:

Peri-operative Fluid Therapy and Blood Transfusion Practice

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Lecture Date: 026/11/2014

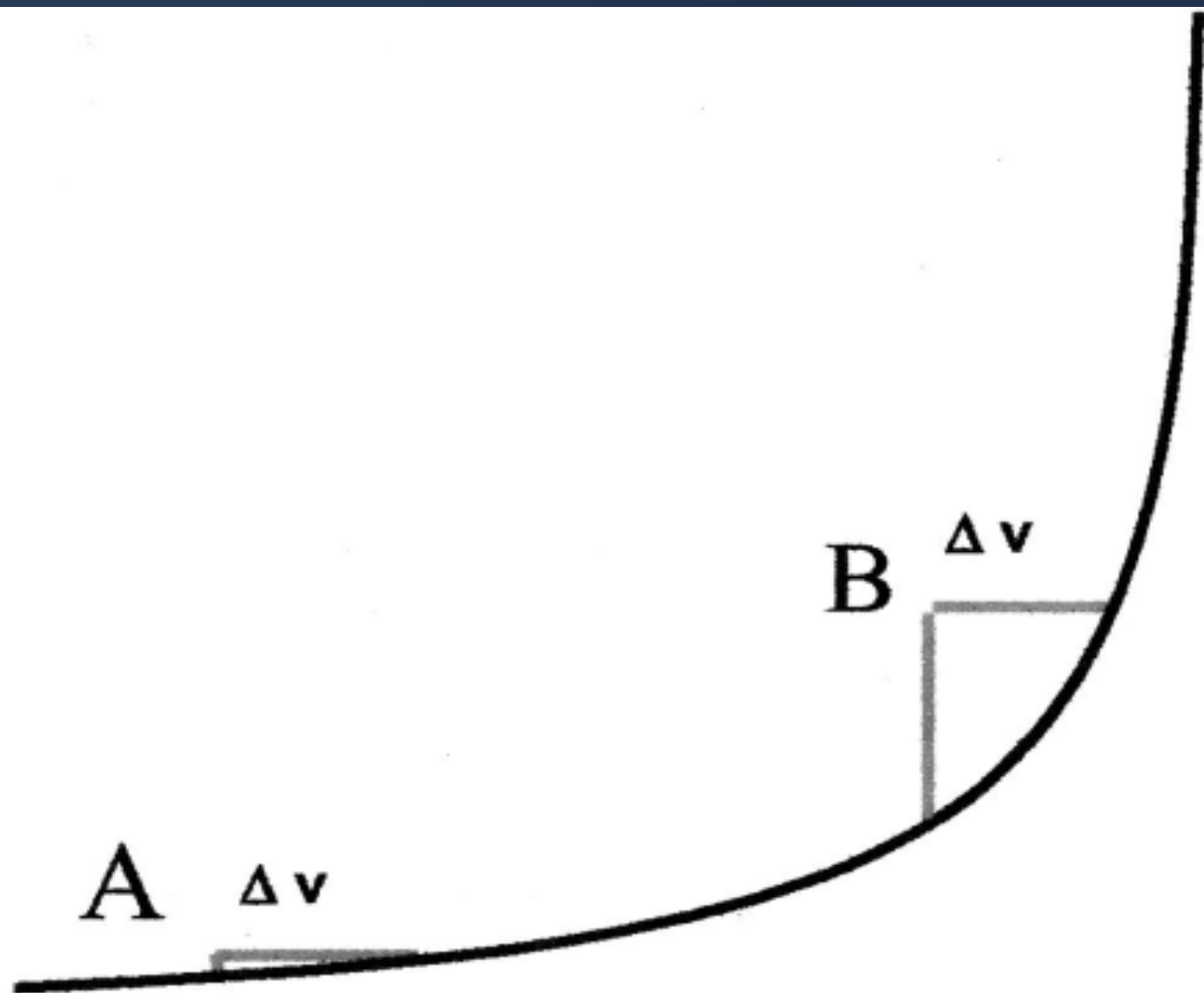


Response of CVP/PAOP to increase in intra-vascular volume



CVP
PAOP

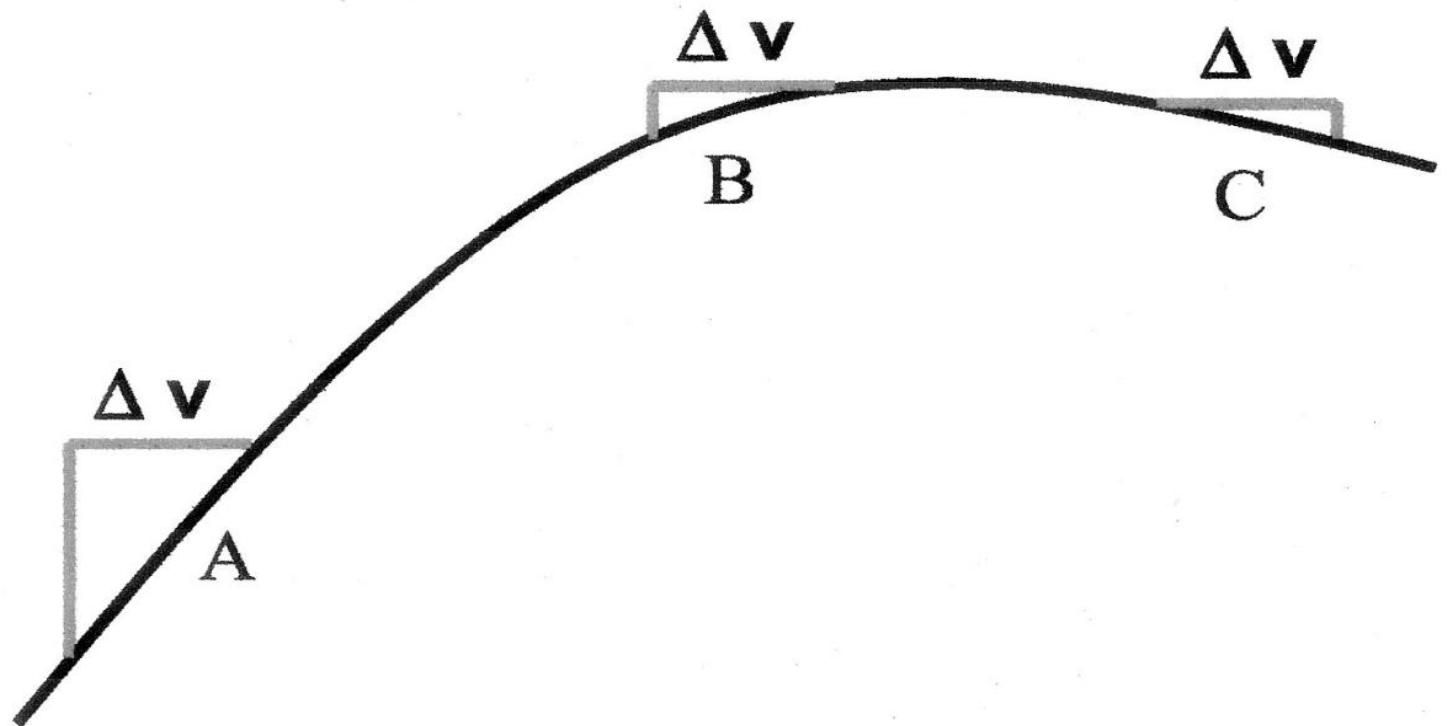
Intra-vascular volume



Stroke volume response to an increased intravascular volume (Frank-Starling curve)



Stroke
Volume



Lecture Objectives

Students at the end of the lecture will be able to:

- Describe different fluids components
- Describe the challenges of Fluid therapy
- Blood transfusion
- Answer FAQ



FAQs

- Crystalloids vs Colloids
- Role of plasma volume expander in septic shock
- Why dose limit for colloids
- For how long HES
- Does HES reduce capillary leak
- Renal and liver functions



FLUID LOSSES

-TRAUMA

-BURNS

-PERITONITIS

-BLEEDING



Final Goals of Fluid resuscitation

- Achievement of normovolemia& hemodynamic stability
- Correction of major acid-base disturbances
- Compensation of internal fluid fluxes
- Maintain an adequate gradient between COP&PCWP
- Improvement of microvascular blood flow
- Prevention of cascade system activation
- Normalization of O₂ delivery
- Prevention of reperfusion cellular injury
- Achievement of adequate urine output

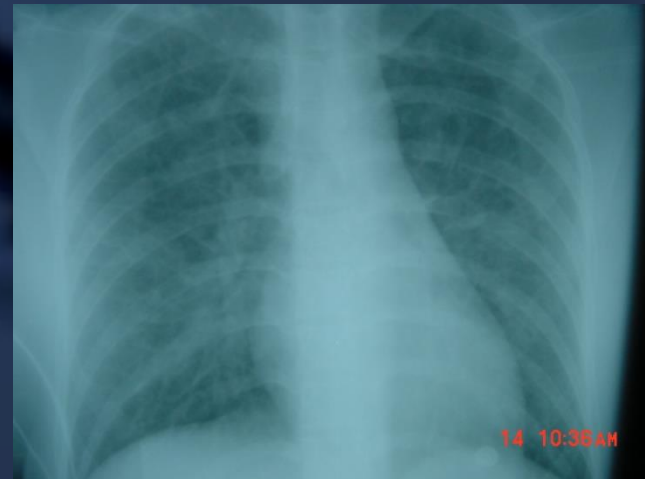


Desirable outcome of fluid resuscitation

- No peripheral edema



- No ARDS



Characteristics of different volume substitutes

-IVVP Cryst<Gel<Dex<HSS

-Coag Cryst<Alb<Gel=HES<Dex

-Anaphyl Cryst<HES=Alb<Dex<Gel

-Cost Cryst=Gel<HES<Dex<Alb



Crystalloids in trauma

Advantages:

- Balanced electrolyte solutions
- Buffering capacity (Lactate)
- Easy to administer
- No risk of adverse reactions
- No disturbance of hemostasis
- Promote diuresis
- Inexpensive



Crystalloids contin...

Disadvantages:

- Poor plasma volume support
- Large quantities needed
- Risk of Hypothermia
- Reduced plasma COP
- Risk of edema



Crystalloid solutions

NaCl

Isotonic 0.9%: 9g/l , Na 154, Cl 154,
Osmolarity: 304mosmol/l

Disadvantages: Hyper-chloremic acidosis



Hypertonic saline

Advantages:

- Small volume for resuscitation.
- Osmotic effect
- Inotropic effect
- Direct vasodilator effect
- Increase MAP, CO
- Increase renal, mesenteric, splanchnic, coronary blood flow.

Disadvantages:

increase hemorrhage from open vessels. Hyponatremia
Hyperchloremia. Metabolic acidosis.



Crystalloids

Lactated Ringer's

Composition: Na 130, cl 109, K 4, ca 3, Lactate 28,
Osmolarity 273mosmol/l

- Sydney Ringer 1880
- Hartmann added Lactate=LR
- Minor advantage over NaCl

Disadvantages:

- Not to be used as diluent for blood (Ca citrate)
- Low osmolarity, can lead to high ICP



Crystalloids

Dextrose 5%

Composition: 50g/l, provides 170kcal/l

Disadvantages:

- enhance CO₂ production
- enhance lactate production
- aggravate ischemic brain injury



Colloids

Advantages:

- Good IVVP
- Prolonged plasma volume support
- Moderate volume needed
- minimal risk of tissue edema
- enhances microvascular flow



Colloids

Disadvantages:

- Risk of volume overload
- Adverse effect on hemostasis
- Adverse effect on renal function
- Anaphylactic reaction
- Expensive



Dextran

Composition: 40/70

Inhibit platelet aggregation



bleeding



MRI sagittal view:
epid hematoma T12-
T9

MRI Transverse
view: epid
hematoma at T12

Medscape 16/09/03



Gelatins

- Derived from hydrolyzed bovine collagen
- Metabolized by serum collagenase
- 0.5-5hr
- Histamine release (H1 blockers recommended)
- Decreases Von W factor (VWF)
- Bovine Spongiform Encephalopathy

1:1,000,000



Albumin

- Heat treated preparation of human serum
- 5% (50g/l), 25% (250g/l)
- Half of infused volume will stay intravascular
- COP=20mmHg=plasma
- 25%, COP=70mmHg, it will expand the vascular space by 4-5 times the volume infused
- 25% used only in case of hypoalbuminemia



Starch

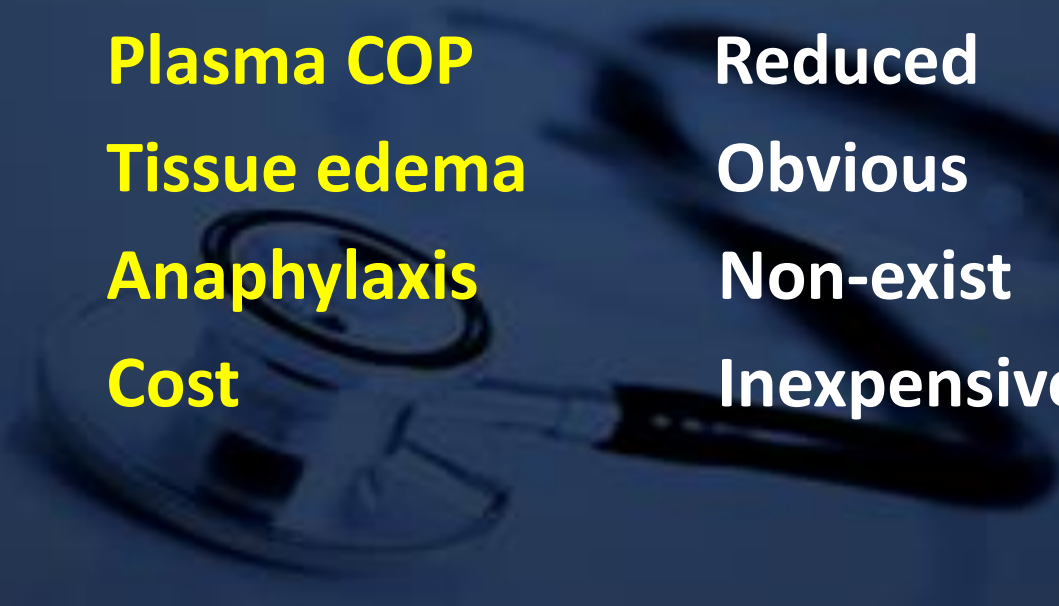
	MW	DS	Max dose
Hetastarch	240,000	0.7	1,500/day
Pentastarch	200,000	0.5	2,500/day
Tetrastarch (Voluven)	130,000	0.4	3,500/day



Summary of the new recommendations

- HES products should only be used for the treatment of hypovolaemia due to acute blood loss when crystalloids alone are not considered sufficient
- HES products should be used at the lowest effective dose for the shortest period of time. Treatment should be guided by continuous haemodynamic monitoring so that the infusion is stopped as soon as appropriate haemodynamic goals have been achieved.
- HES products are now contraindicated in
 - o Sepsis
 - o Burns
 - o Renal impairment or renal replacement therapy
 - o Intracranial or cerebral haemorrhage
 - o Critically ill patients (typically admitted to the ICU)
 - o Hyperhydrated patients, including patients with pulmonary oedema
 - o Dehydrated patients
 - o Severe coagulopathy
 - o Severely impaired hepatic function
- There is a lack of robust long term safety data in patients undergoing surgical procedures and in patients with trauma. The expected benefit of treatment should be carefully weighed against the uncertainties with regard to long term safety and other available treatment options should be considered.
- Large randomised clinical trials have reported an increased risk of renal dysfunction in the critically ill, including patients with sepsis. Therefore HES should no longer be used in these patients.
- Monitoring of renal function in patients receiving HES is recommended **and** HES must be discontinued at the first sign of renal injury.

This letter is being sent in agreement with the EMA (European Medicines Agency) and the Medicines and Healthcare Products Regulatory Agency.



	Crystalloids	Colloids
IVVP	Poor	Good
Hemod Stability	Transient	Prolong
Infusate volume	Large	Moderate
Plasma COP	Reduced	Maintain
Tissue edema	Obvious	Insignific
Anaphylaxis	Non-exist	low-mod
Cost	Inexpensive	Expensive





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Crystalloids OR Colloids

ACS protocol for ATLS: replace each ml of blood loss with 3 ml of crystalloid fluid. 3 for 1 rule. Patient response:

- Rapid
- Transient
- Non-responsive



Blood Transfusion

(up to 30% of blood volume can be treated with crystalloids)

Why?

- Improvement of oxygen transport
- Restoration of red cell mass
- Correction of bleeding caused by platelet dysfunction
- Correction of bleeding caused by factor deficiencies



Massive Transfusion (MT)

Definition:

Transfusion of at least one blood volume or 10 units of blood in a 24 hr period



DIC

Type

Definition

Diagnosis

Lab

Biological

Hemostatic defect
without clinical SS

high D-Dimers and
major or minor criteria
of platelet consumption

DD \geq 500ug/l
Plat 50-100,000

Clinical

Hemostatic defect+He

same above+microvasc
bleeding

INR 1.2-1.5

Complicated

+ischemia

+organ failure

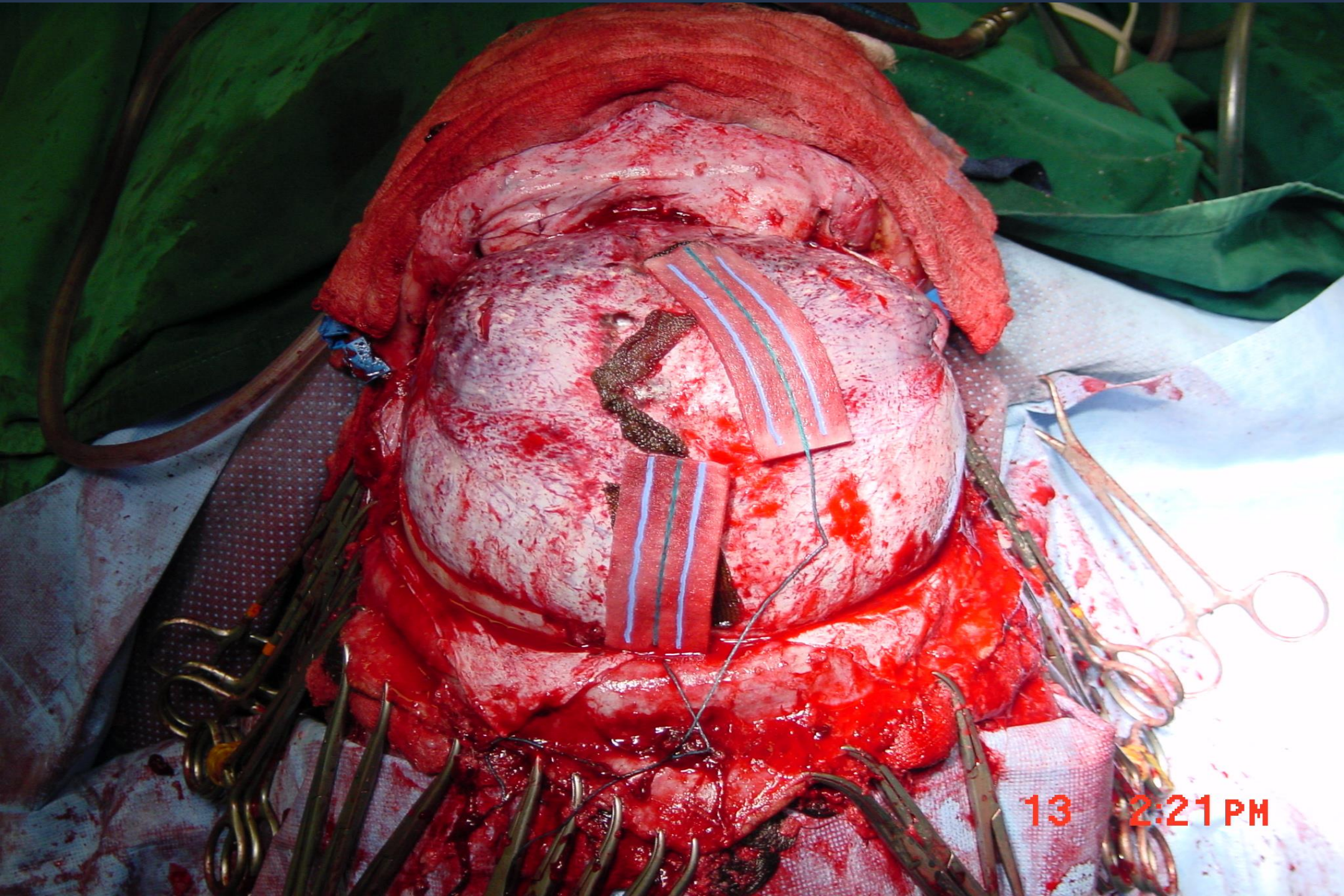


Auto-transfusion

Techniques:

- Pre-deposit transfusion
- Intra-operative acute normovolemic hemodilution
- Intra-operative cell salvage





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Pre-deposit transfusion

- blood collection begins 3-5 weeks preoperatively
- 2-4 units stored
- Eliminates risk of viral transmission
- Reduces risk of immunological reactions
- Collection is expensive and time consuming
- Only suitable for elective surgery



Intra-operative acute normovolemic hemodilution

- Whole blood removed at start of surgery
- 1-1.5L can be collected
- Blood stored in OR
- Re-infused during or after surgery
- Cheaper than pre-deposit
- Little risk of clerical error
- Suitable for elective surgery



Intra-operative cell salvage

- shed blood is collected from surgical field
- heparin added
- cells washed with saline and concentrated by centrifugation.
- concentrate transfused
- large volume could be used
- platelets and clotting factors are consumed
- suitable for cardiac surgery
- contraindicated in contaminated surgical field



FFP

- Is plasma removed from a unit of whole blood and frozen at or below -18°C within 8hr of collection
- It contains all coagulation factors in normal amounts and is free of red cells, leukocytes and platelets
- It is not a concentrate of clotting factors. One unit is 225ml and must be ABO compatible, Rh not considered
- 1ml/kg will raise most clotting factors by 1%.
- Should be used within 24hr after thawing



Cryoprecipitate

- Is low purity concentrate of 3 hemostatic proteins prepared from donated whole blood
- A single bag Cryo contains: 100units factor VIII and VWF+150-250mg fibrinogen with XIII and fibronectin
- No compatibility test required
- Indication:** hypo-fibrinogenemia <100mg/dl



Complications of Blood Transfusion

Immune complications:

- hemolytic (acute and delayed)
- non-hemolytic (febrile, urticaria, anaphylactic, purpura, immune suppression)

Non-Immune complications:

- Complications associated with massive blood transfusion:
 - coagulopathy, citrate toxicity, hypothermia, acid-base balance, serum K
- Infectious complications: hepatitis, AIDS, other viral agents (CMV,EBV,HTLV), parasites and bacteria..



Reference book and Journal reference

-American Society of Anesthesiologists Task Force on Perioperative Blood Transfusion and Adjuvant Therapies. Practice guidelines for perioperative blood transfusion and adjuvant therapies. Approved October 22, 1995, last amended October 25, 2005. Available at

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- Grocott M et al. Perioperative fluid management and clinical outcomes in adults. **Anesthesia Analgesia 2005;100:1093-106**



Thank You 😊

