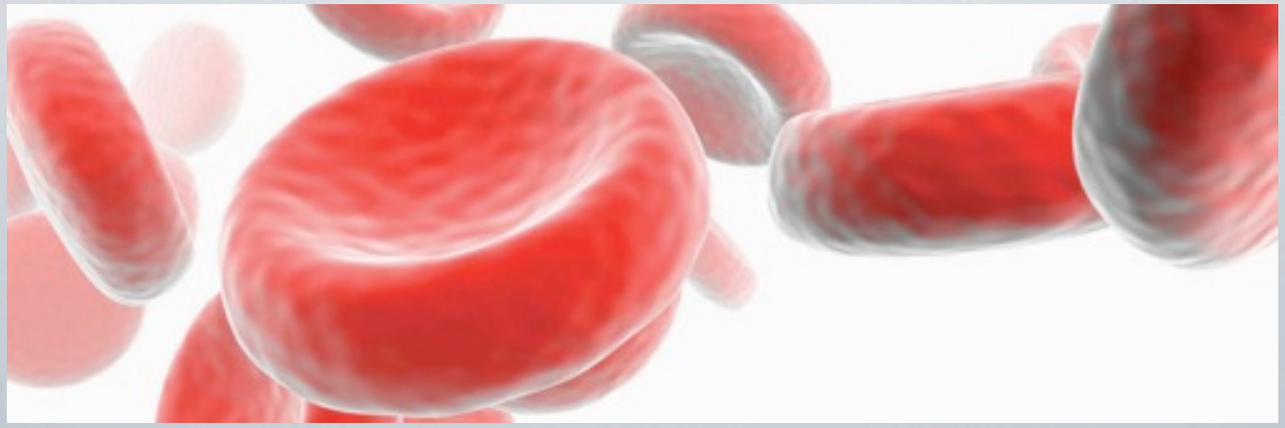


A FRESH LOOK AT CELL SALVAGE

what we should know

SICCH - ROMA 27 . XI . 2014

E. Testa TFPC

Unità operativa di CCH
Direttore dott. E. Polesel

INTRODUZIONE

DIVERSI STUDI HANNO DIMOSTRATO COME L'ENTITA' - ANCHE MINIMA - DI TRASFUSIONE SIA UN FATTORE DI RISCHIO INDIPENDENTE DI COMPLICANZE POSTOPERATORIE

Circulation
JOURNAL OF THE AMERICAN HEART ASSOCIATION

American Heart Association®

Risk Associated With Preoperative Anemia in Cardiac Surgery : A Multicenter Cohort Study

Keyvan Karkouti, Duminda N. Wijeysundera and W. Scott Beattie

Circulation. 2008;117:478-484; originally published online January 2, 2008;
doi: 10.1161/CIRCULATIONAHA.107.718353

Surgical Outcomes and Transfusion of Minimal Amounts of Blood in the Operating Room

Victor A. Ferraris, MD, PhD; Daniel L. Davenport, PhD; Sibu P. Saha, MD, MBA; Peter C. Austin, PhD; Joseph B. Zwischenberger, MD

Efficacy of red blood cell transfusion in the critically ill: A systematic review of the literature*

Paul E. Marik, MD, FACP, FCCM, FCCP; Howard L. Corwin, MD, FACP, FCCM, FCCP

Morbidity and mortality risk associated with red blood cell and blood-component transfusion in isolated coronary artery bypass grafting*

Colleen Gorman Koch, MD, MS; Liang Li, PhD; Andra I. Duncan, MD; Tomislav Mihaljevic, MD; Delos M. Cosgrove, MD; Floyd D. Loop, MD; Norman J. Starr, MD; Eugene H. Blackstone, MD

Transfusion of fresh frozen plasma in critically ill surgical patients is associated with an increased risk of infection

Babak Sarani, MD, FACS; W. Jonathan Dunkman, BA; Laura Dean; Seema Sonnad, PhD; Jeffrey I. Rohrbach, RN, MSN; Vicente H. Gracias, MD, FACS

Allogeneic Blood Transfusion Increases the Risk of Postoperative Bacterial Infection: A Meta-analysis

Gary E. Hill, MD, William H. Frawley, PhD, Karl E. Griffith, MD, John E. Forestner, MD, and Joseph P. Minei, MD

New Study Reveals Wide Variation in Blood Transfusion Practices During Surgery

Blood transfusions carry risks. In a previous meta-analysis of 45 studies evaluating the risks of blood transfusion, 42 studies showed a significant link to mortality, infection, or adult respiratory distress syndrome.[3]

3 Marik, P. E. and H. L. Corwin (2008). "Efficacy of red blood cell transfusion in the critically ill: a systematic review of the literature." *Crit Care Med* 36(9): 2667-74.

Blood tra…us meta-analysis …f blood transfusi… link to mortality, l… distress syndrome.[3]

COMPLICANZE

3. Marik, P. E. and H. L. Corwin (2008). "Efficacy of red blood cell transfusion in the critically ill: a systematic review of the literature." *Crit Care Med* 36(9): 2667-74.

Blood transfusions are also one of the largest cost centers in hospitals. While the material cost of blood ranges from $200 to $300 per unit, the additional costs from storage, labor, and waste result in an actual cost per unit between $522 and $1,183.[10] In addition to the cost of blood itself, each unit of blood transfused increases the cost of care, with even higher costs incurred when patients are transfused at higher hemoglobin levels.[11]

10 Shander, A.,A. Hofmann, et al. "Activity-based costs of blood transfusions in surgical patients at four hospitals." *Transfusion* 50(4): 753-65.

11 Murphy, G. J., B. C. Reeves, et al. (2007). "Increased mortality, postoperative morbidity, and cost after red blood cell transfusion in patients having cardiac surgery." Circulation 116(22): 2544-52.

Blood transfusions are also one of the largest cost centers in hospitals. While the material cost of [illegible] $200 per [illegible], [illegible] and [illegible] between [illegible] to the cost of blood itself, each unit of blood transfused increases the cost of care, with even higher costs incurred when patients are transfused at higher hemoglobin levels.[11]

COSTO REALE

10 Shander, A.,A. Hofmann, et al. "Activity-based costs of blood transfusions in surgical patients at four hospitals." *Transfusion* 50(4): 753-65.

11 Murphy, G. J., B. C. Reeves, et al. (2007). "Increased mortality, postoperative morbidity, and cost after red blood cell transfusion in patients having cardiac surgery." Circulation 116(22): 2544-52.

A recent systematic evaluation of 494 studies concluded that 59% of transfusions were "inappropriate" based on their impact on patient outcomes.[12]

12 Shander, A., A. Fink, et al. (2011). "Appropriateness of allogeneic red blood cell transfusion: the international consensus conference on transfusion outcomes." *Transfus Med Rev* 25(3): 232-246 e53.

A recent systematic evaluation of 494 studies concluded that 59% of transfusions were "inappropriate" based on their impact on patient

APPROPRIATEZZA

12 Shander, A., A. Fink, et al. (2011). "Appropriateness of allogeneic red blood cell transfusion: the international consensus conference on transfusion outcomes." *Transfus Med Rev* 25(3): 232-246 e53.

Proceedings from the National Summit on Overuse

September 24, 2012

Organized by The Joint Commission and the American Medical Association-Convened Physician Consortium for Performance Improvement® (PCPI®)

Five subject areas that have triggered concerns about overuse and quality

2. **Appropriate Blood Management**

   Chair, Aryeh Shander, M.D., Society for the Advancement of Blood Management

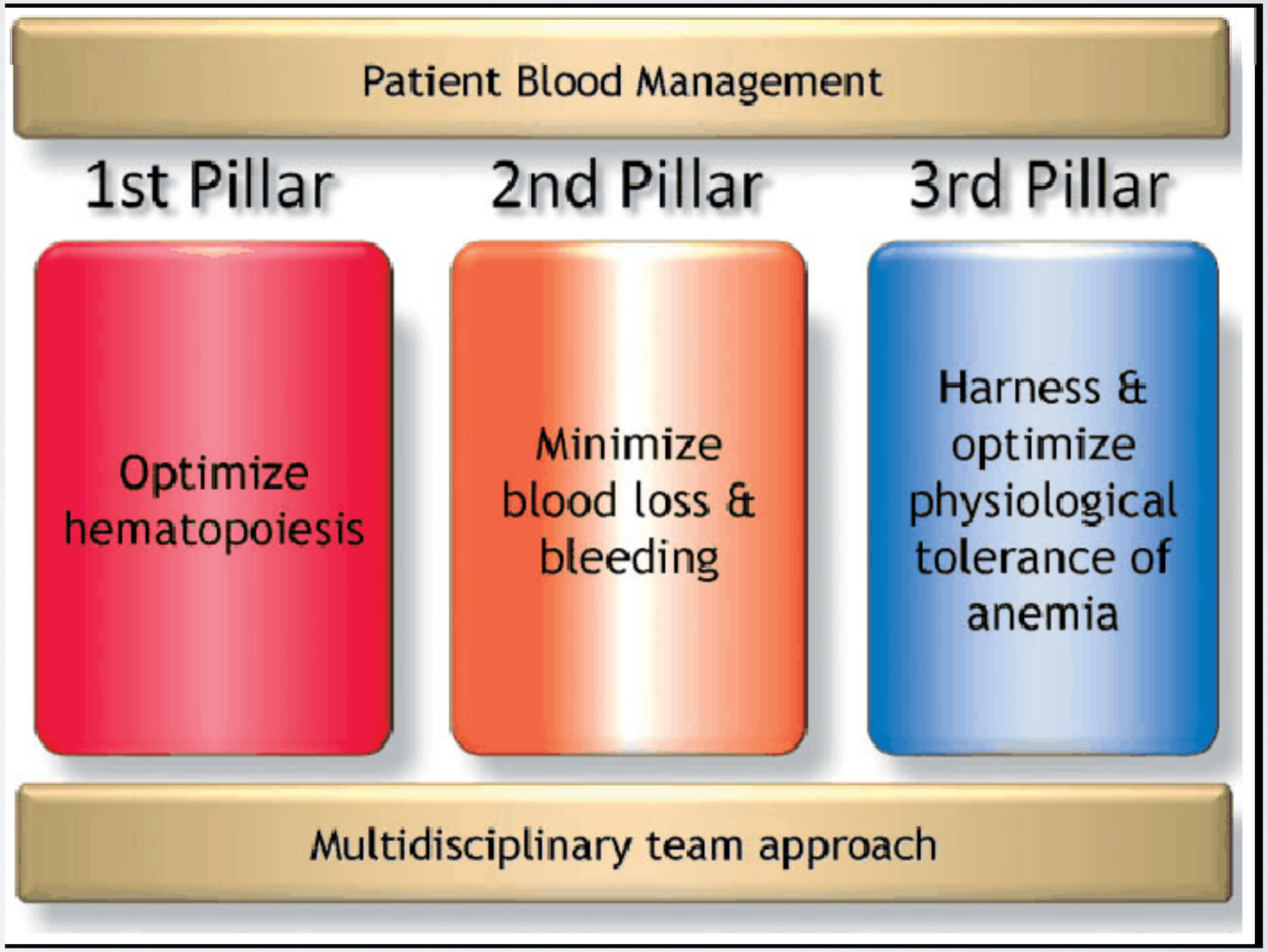
SABM's definition of Patient Blood Management (PBM)

The timely application of evidence-based medical and surgical concepts designed to maintain hemoglobin concentration, optimize hemostasis and minimize blood loss in an effort to improve patient outcome._

ATTENZIONE AL PAZIENTE,
NON
AL PRODOTTO EMATICO

3 PILASTRI DEL PBM

- PREOPERATORIO
- INTRAOPERATORIO
- POSTOPERATORIO



PREOPERATORIO

2nd Pillar

Minimise blood loss and bleeding

- Identify and manage bleeding risk (past/family history, current medications, etc)
- Minimise iatrogenic blood loss
- Procedure planning and rehearsal
- Preoperative autologous blood donation (in selected cases or when patient choice)

Intraoperative

- Timing surgery with haematological optimisation

- Meticulous haemostasis and surgical techniques
- Blood-sparing surgical techniques
- Anaesthetic blood-conserving strategies
- Autologous blood options
- Pharmacological/haemostatic agents

- Optimise cardiac output
- Optimise ventilation and oxygenation
- Restrictive evidence-based transfusion strategies

Postoperative

- Treat anaemia/iron deficiency
- Stimulate erythropoiesis
- Be aware of drug interactions that can cause/increase anaemia

- Optimise tolerance of anaemia
- Treat anaemia
- Maximise oxygen delivery
- Minimise oxygen consumption
- Avoid/treat infections promptly
- Restrictive, evidence-based transfusion strategies

- Vigilant monitoring and management of post-operative bleeding
- Avoid secondary haemorrhage
- Rapid warming – maintain normothermia (unless hypothermia specifically indicated)
- Autologous blood salvage
- Minimising iatrogenic blood loss
- Haemostasis/anticoagulation management
- Prophylaxis of upper gastrointestinal haemorrhage
- Avoid/treat infections promptly
- Be aware of adverse effects of medication

2ND PILLAR

MINIMIZZARE LE PERDITE DI SANGUE DURANTE O DOPO L'INTERVENTO CHIRURGICO

PREOPERATORIO:

PIANIFICAZIONE DELLA PROCEDURA

INTRAOPERATORIO:

OPZIONI PER IL SANGUE AUTOLOGO

POSTOPERATORIO:

RECUPERO SANGUE AUTOLOGO

AGENDA

A FRESH LOOK AT CELL SALVAGE

- TECNICA
- INDICAZIONI / CONTROINDICAZIONI
- RISCHI /BENEFICI
- NELLA PRATICA....

FORMAZIONE USA

- PBMT : Perioperative Blood Management Technologist

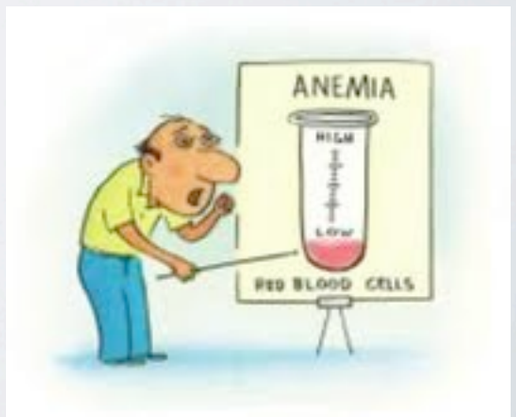
ESAME

K = conoscenza
S = abilità
A = pratica

K/S/A	Label	Count	Percent
K	Knowledge	45	0.41
S	Skills	31	0.28
A	Application	34	0.31
	Total	110	1.00

FORMAZIONE ITALIA

- NON E' RICHIESTA UNA FORMAZIONE SPECIFICA!
- IL CORSO DI LAUREA DEL TECNICO DI FISIOPATOLOGIA CARDIOCIRCOLATORIA E PERFUSIONE CARDIOVASCOLARE HA TRA GLI OBIETTIVI FORMATIVI: " LA GESTIONE DELLE METODICHE DI EMORECUPERO, PLASMAFERESI INTRAOPERATORIA, GEL PIASTRINICO E COLLA DI FIBRINA"



TECNICA

IL PARCO MACCHINE

Haemonetics Elite

Fresenius Cats

Sorin Xtra

LA TECNICA

- TIPOLOGIE DI DEVICES
- A COSA PUO' SERVIRE (non solo a recuperare GR!!)
- SOLUZIONI ANTICOAGULANTI
- LA TECNICA OPERATIVA (particolarità)
- LA TECNICA NEI CASI PARTICOLARI

TECNICA

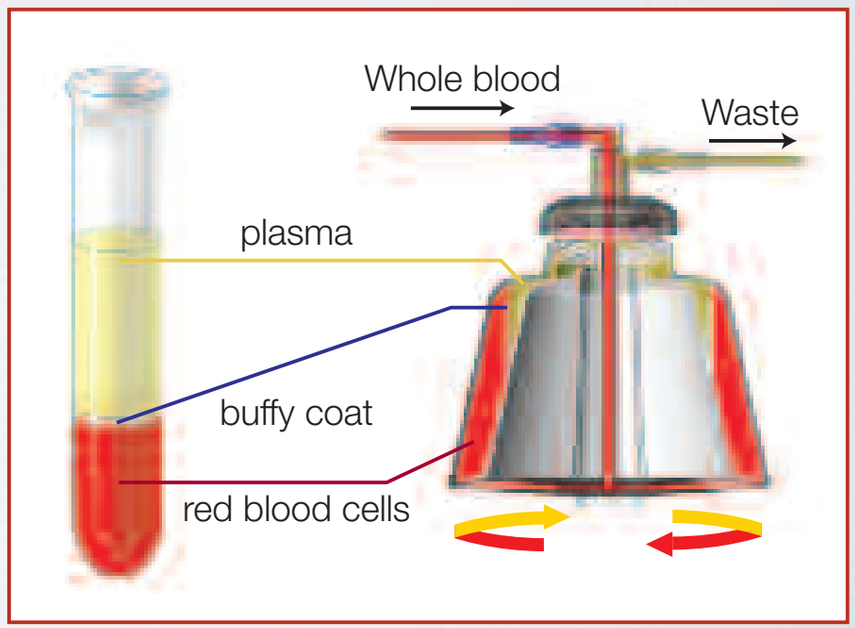
CAMPANE A VOLUME FISSO

(Haemonetics)

(Sorin)

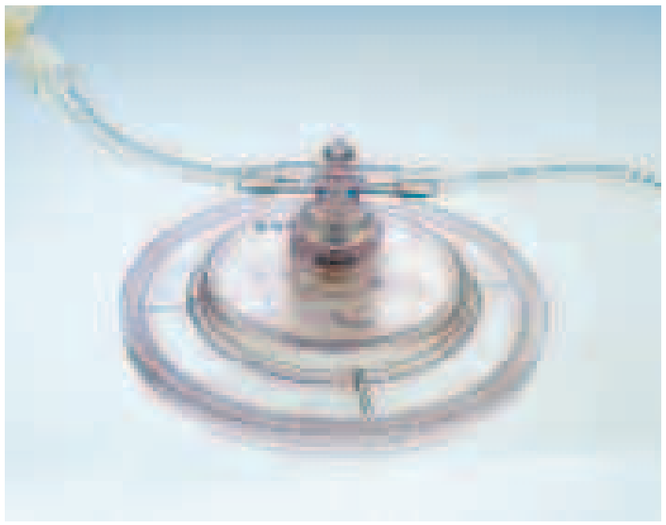
(Medtronic)

- disponibili in diverse “taglie” in base alla quantità prevista di sangue perso.
- è necessario un volume minimo per riempire la campana ed avere un prodotto finale consistente e di buona qualità



TECNICA

DISCO A VOLUME VARIABILE



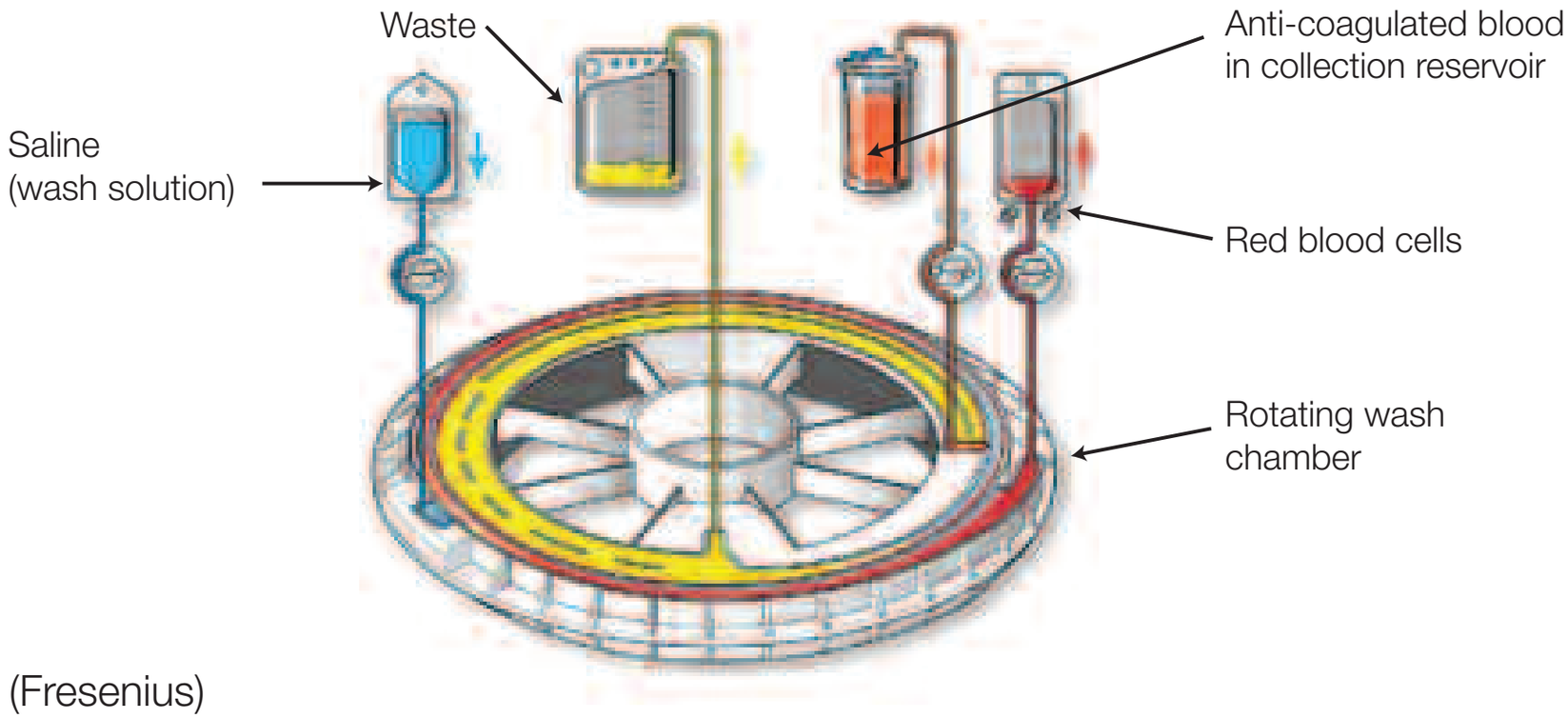
(Haemonetics)

- diaframma elastico in silicone
- non richiede volume prefissato di sangue
- prodotto finale di volume variabile con Ht fisso

USATO PER IL RECUPERO POSTOPERATORIO

TECNICA

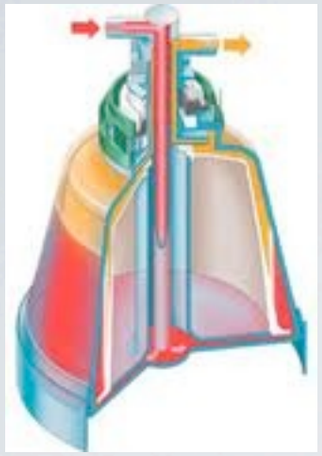
SISTEMA ROTATORIO CONTINUO



(Fresenius)

- richiede volumi molto piccoli di sangue perso.
- separazione, lavaggio e reinfusione avvengono contemporaneamente.

TECNICA



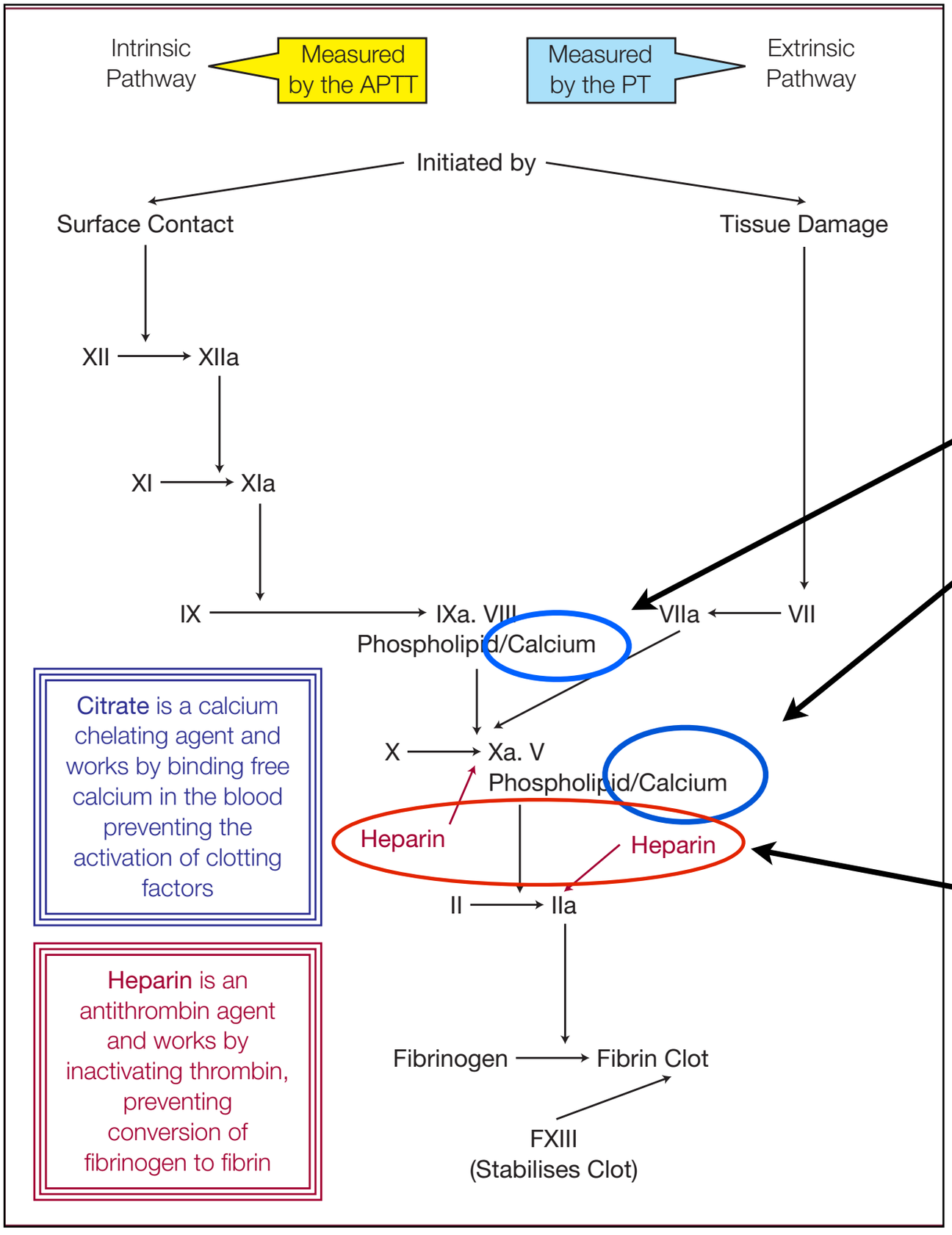
SEPARATORE CELLULARE

- RECUPERARE I **GLOBULI ROSSI**

- **PLASMAFERESI PRE-OP.**
  - DA SANGUE INTERO SEPARA GR (da reinfondere subito)
  DA **PLASMA E PIASTRINE**

- DA SACCA DI SANGUE INTERO
  PPP, PRP, GRC → **GEL PIASTRINICO (da PRP)**

CASCATA COAGULATIVA

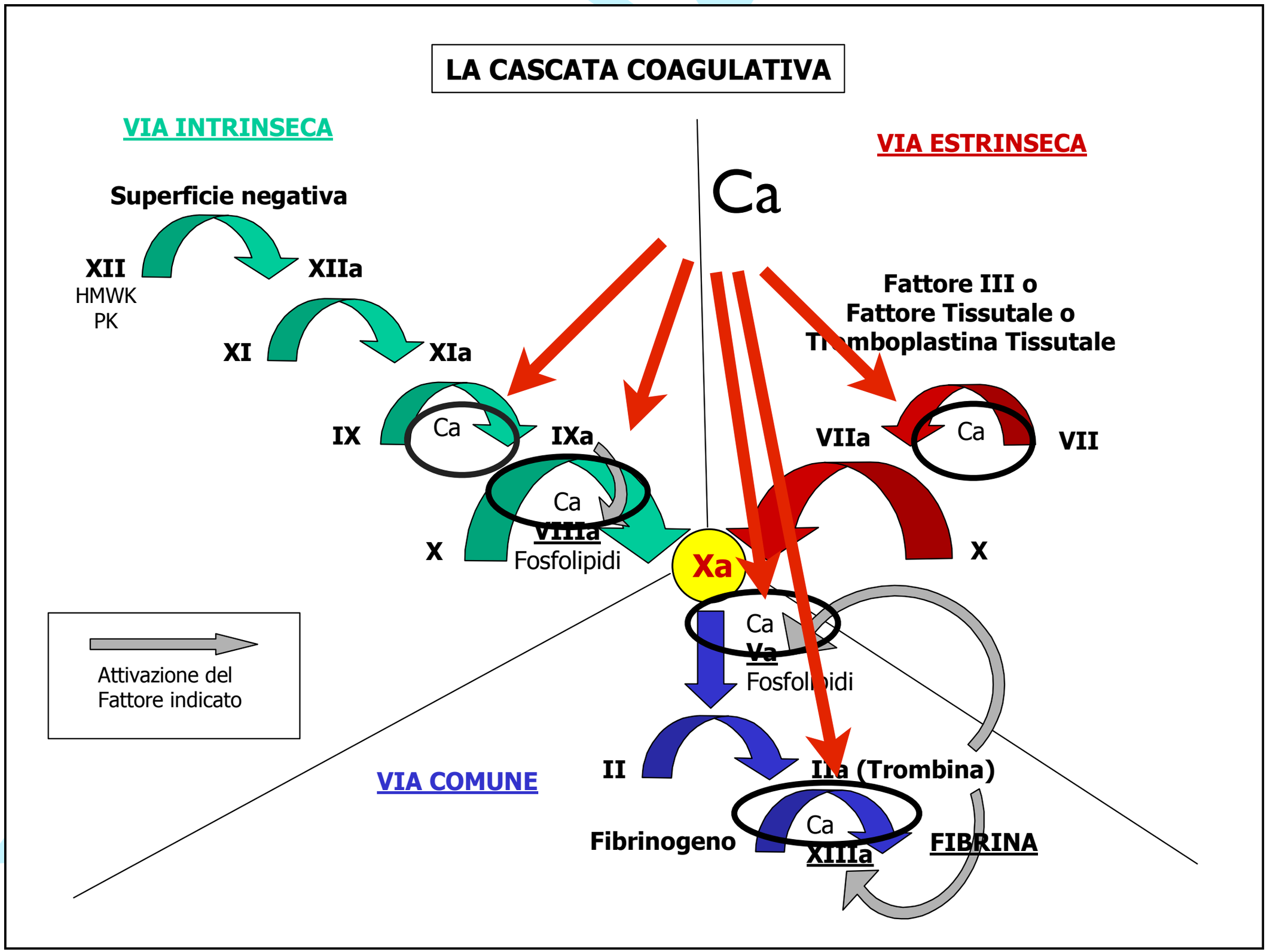


SOLUZIONI ANTICOAGULANTI

CITRATO:
è un agente chelante del calcio

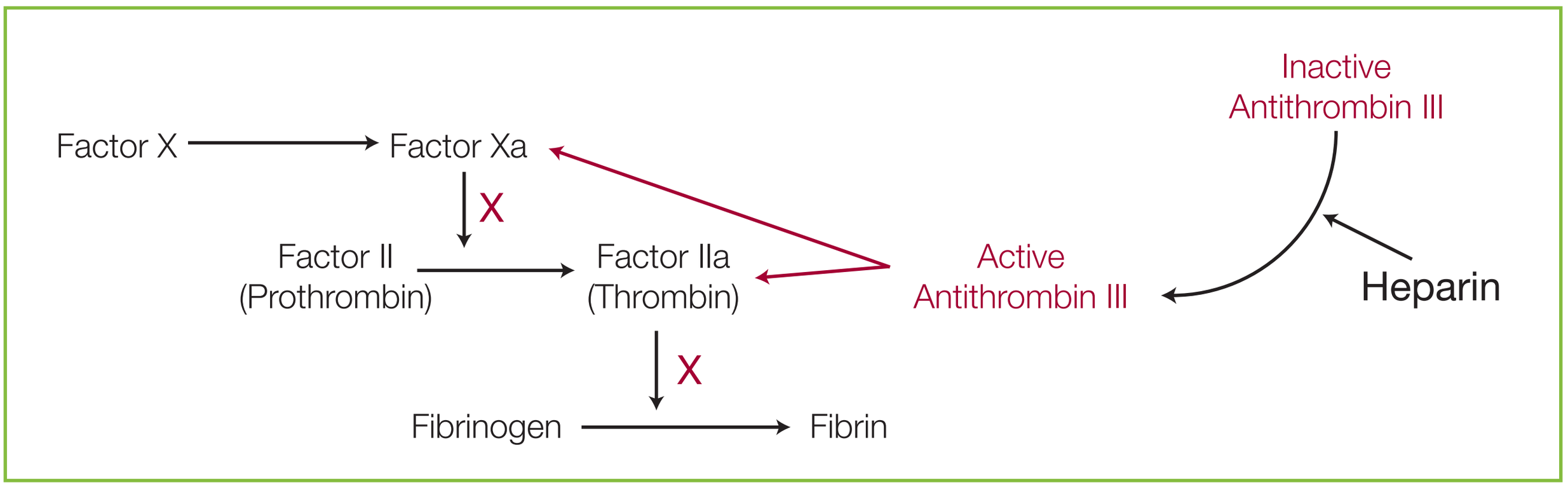
EPARINA:
è un agente antitrombinico

IMPORTANZA DEL CALCIO



ANTICOAGULANTE

- EPARINA
  - 30.000 UI/L soluzione fisiologica.
  - 60/80 gocce /min.
  - Agisce attivando ANTITROMBINA III



ANTICOAGULANTE

- ACD-A (CITRATO)
  - soluzione pronta
  - rapporto raccomandato 1:7 =

  15ml. / 100 ml sangue (45-60 gocce / min.)
  - agisce legando il calcio nel sangue (importante cofattore nella cascata coagulativa)

attenzione all'uso di soluzioni contenenti calcio
(Hartmann's - Ringer),
può inibire l'effetto del citrato.

RACCOMANDATO IN PAZ. CON HIT

- Prima di aspirare sangue nel cardiotomo, far scorrere la soluzione eparinata o l' ACD-A per bagnare il filtro (150 cc. circa)

LA TECNICA - INDICAZIONI

punta dell'aspiratore: dovrebbe avere un diametro grande (4mm.) per minimizzare il danno da suzione

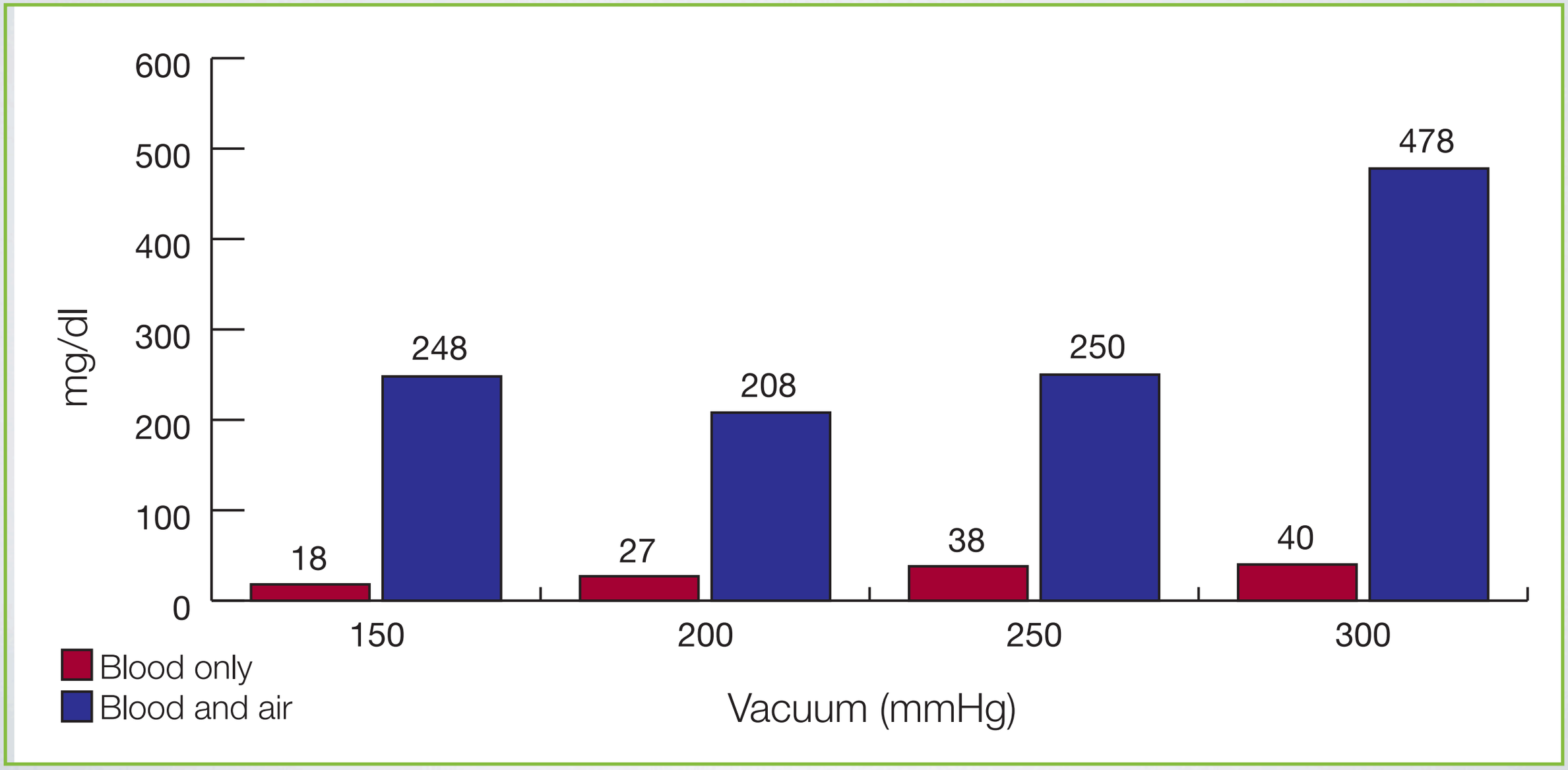
vacuum : causa emolisi!
dovrebbe essere mantenuto a livelli più bassi possibile. (< -150 mm.Hg)

testimoni di Jehovah: la preparazione del set è particolare e dovrebbe essere discussa prima

TECNICA DI ASPIRAZIONE

- EVITARE di aspirare aria insieme al sangue.

Hb plasmatica



Modification of Suction-Induced Hemolysis During Cell Salvage

Jonathan H. Waters, MD*

Brandon Williams, BS†

Mark H. Yazer, MD, FRCPC‡§

Marina V. Kameneva, PhD†‖

NO ARIA CON IL SANGUE!

CONCLUSIONS: Significant reduction of blood damage can be obtained by diluting blood with normal saline while suctioning it from the surgical field. Although immediate hemolysis due to suctioning was not very high, the red blood cell damage from suctioning produced by a dynamic blood–air interface might adversely affect the efficiency of cell salvage.

(Anesth Analg 2007;104:684–7)

SIGNIFICATIVA RIDUZIONE DEL DANNO SE SI AGGIUNGE SOL. FISIOLOGICA AL SANGUE DA ASPIRARE DAL CAMPO OPERATORIO

PER MASSIMIZZARE IL RECUPERO

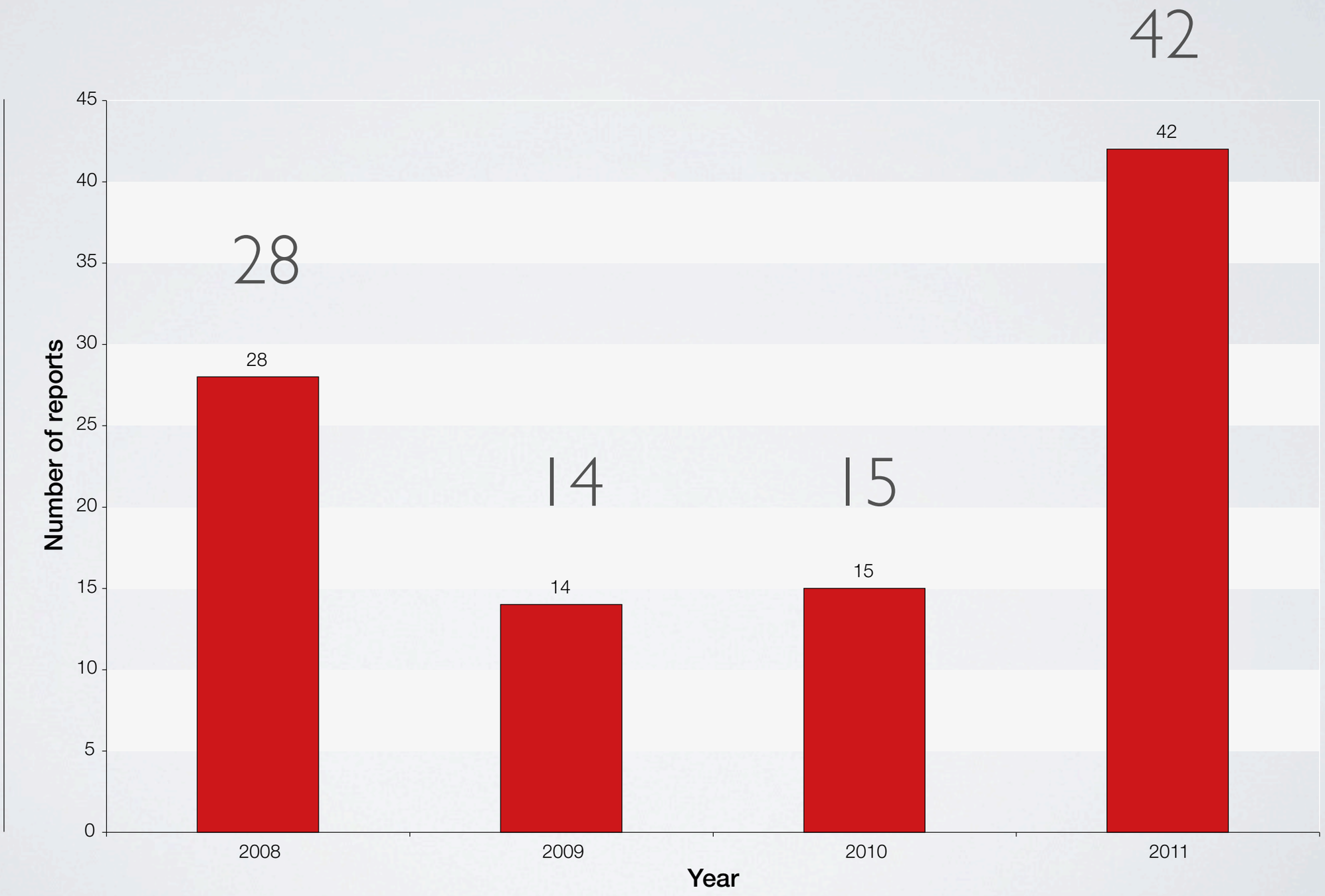
UK CELL SALVAGE ACTION GROUP
TECHNICAL FACTSHEET

SWAB WASHING

- "LAVAGGIO" DELLE GARZE
- "LAVAGGIO" DELL' OSSIGENATORE / CARDIOTOMO (se viene recuperato il sangue della CEC).
- BASSI LIVELLI DI VACUUM (per evitare l'emolisi)
- TECNICA DI ASPIRAZIONE (evitare aria)

EVENTI AVVERSI CS INTRA E POST-OP

Figure 21.1
Autologous adverse events

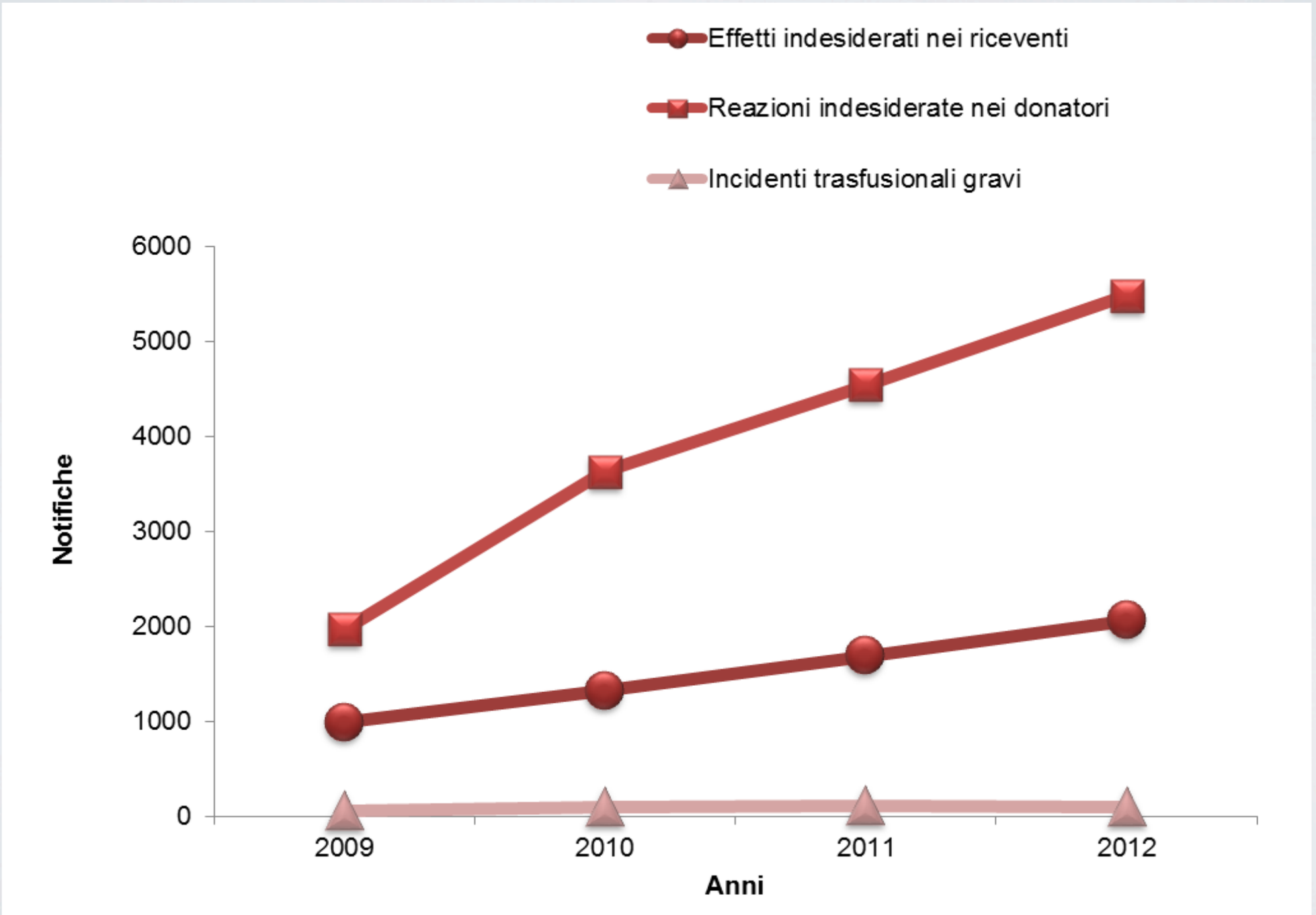


Learning points

- The use of leucodepletion filters (LDF) with cell salvaged blood can, rarely, cause significant hypotension
- Stopping the infusion and resuscitation with fluids and vasopressors may be necessary although all reports describe only transient hypotension
- In cases where there is brisk haemorrhage and the blood is needed, try infusing without the LDF

EMOVIGILANZA ITALIA

RAPPORTO 2012



INDICAZIONI /CONTROINDICAZIONI

British Journal of Anaesthesia **105** (4): 401–16 (2010)
Advance Access publication 28 August 2010 · doi:10.1093/bja/aeq244

BJA

REVIEW ARTICLES

Cell salvage as part of a blood conservation strategy in anaesthesia

A. Ashworth and A. A. Klein*

Department of Anaesthesia and Critical Care, Papworth Hospital, Papworth Everard, Cambridge CB23 3RE, UK

* Corresponding author. E-mail: andrew.klein@papworth.nhs.uk

ASAIO Journal 2013

Intraoperative Blood Recovery

JONATHAN H. WATERS

INDICAZIONI /CONTROINDICAZIONI

British Journal of Anaesthesia **105** (4): 401–16 (2010)
Advance Access publication 28 August 2010 · doi:10.1093/bja/aeq244

BJA

REVIEW ARTICLES

Cell salvage as part of a blood conservation strategy in anaesthesia

Indications and contraindications of cell salvage

Jonathan H. Waters

TRANSFUSION Volume 44, December 2004 Supplement

JONATHAN H. WATERS

Perioperative cell salvage

Revalidation
FOR ANAESTHETISTS
RCA Revalidation matrix
Matrix reference 1A06

Continuing Education in Anaesthesia, Critical Care & Pain | Volume 10 Number 4 2010
© The Author [2010]. Published by Oxford University Press on behalf of the British Journal of Anaesthesia.

General indications for cell salvage

(i) Anticipated intraoperative blood loss >1 litre or >20% of blood volume.

(ii) Preoperative anaemia or increased risk factors for bleeding.

(iii) Patients with rare blood group or antibodies.

(iv) Patient refusal to receive allogeneic blood transfusion.

(v) The American Association of Blood Banks suggest cell salvage is indicated in surgery where blood would ordinarily be cross-matched or where more than 10% of patients undergoing the procedure require transfusion.

INDICAZIONI
E SELEZIONE DEL PAZIENTE

- PAZIENTI ADULTI E PEDIATRICI SOTTOPOSTI A CHIRURGIA ELETTIVA O D'EMERGENZA DOVE LE PERDITE EMATICHE SONO STIMATE ESSERE >20% VOLEMIA O > di 1 L.

- PAZIENTI CON GRUPPI RARI O ANTICORPI MULTIPLI, PER CUI SIA DIFFICILE AVERE SANGUE ALLOGENICO

- PAZIENTI CON ANEMIA PREOPERATORIA O AUMENTATO RISCHIO DI SANGUINAMENTO

- PAZIENTI CHE RIFIUTANO SANGUE ALLOGENICO

- AABB suggerisce che il CS è indicato nelle chirurgie dove più del 10% dei pazienti sottoposti a quel tipo di chirurgia richiede una trasfusione o più di una unità di sangue.

Complications of and Contraindications to Perioperative Autotransfusion

AABB Guidelines for Blood Recovery and Reinfusion in Surgery and Trauma

Many contraindications are relative and the risk/benefit factor must be determined for each patient. **The decision to use peri operative autotransfusion is the responsibility of the surgeon in charge.**

Molte controindicazioni sono relative e il fattore rischio/beneficio deve essere determinato per ciascun paziente. **La decisione di usare l'autotrasfusione peri operatoria è responsabilità del chirurgo che ha in cura il paziente.**

CONTROINDICAZIONI

RELATIVE PIUTTOSTO CHE ASSOLUTE

pochi dati supportano il danno delle controindicazioni proposte

Table 4. Proposed Contraindications to Blood Salvage

Pharmacologic agents
Clotting agents (avitene, surgicel, gelfoam, etc.)
Irrigating solutions (betadine, antibiotics meant for topical use)
Methylmethacrylate
Contaminants
Urine
Bone chips
Fat
Bowel contents
Infection
Amniotic fluid
Methylmethacrylate
Hematologic disorders
Sickle cell disease
Thallassemia
Miscellaneous
Carbon monoxide (electrocautery smoke)
Catecholamines (pheochromocytoma)
Oxymetazoline (afrin)

Quando si decide di non usare CS bisogna farlo alla luce dei rischi conosciuti dati dall'alternativa: il sangue allogenico

AZIONI CORRETTIVE

- EVITARE L'ASPIRAZIONE DIRETTA (sito infetto, liquido amniotico, disinfettante, colla, grasso.....)
- IRRIGARE IL SITO CHIRURGICO CON FISIOLOGICA
- LAVAGGIO EMAZIE MIGLIORATO
- FILTRO DELEUCOCIZZANTE (chir. tumorale e ostetricia)

INDICAZIONI CONTROVERSE

- OSTETRICIA
- CHIRURGIA TUMORALE
- CONTAMINAZIONE BATTERICA

Dzik and Sherburne,[25] in a review of the controversies surrounding blood salvage, pointed out that allogeneic transfusion leads to an increase in infection rate and that when faced with bacterial contamination of salvaged blood, a clinical decision needs to be made as to which therapy offers the least risk to the patient. Known risk exists with allogeneic blood, yet only theoretical risk is associated with salvaged blood. Until data is generated supporting the theoretical risk of salvaged in these circumstances, it seems reasonable to avoid the known risk of allogeneic blood through the use of blood salvage.

RISCHI **CONOSCIUTI** SANGUE ALLOGENICO VS RISCHI **TEORICI** CS !!

CONTROINDICAZIONI RELATIVE

- QUALSIASI COSA CHE PROVOCHI LA LISI CELLULARE
- SITO INFETTO
- OSTETRICIA
- CHIRURGIA TUMORALE

USO CS IN OSTETRICIA APPROVATO DA:

- CMACE (Center for Maternal and Child Enquiries)

- OAA (Obstetrics Anesthetists' Association)

- AAGBI (The Association of Anesthetists of G.B. & Ireland)

- NICE (National Institute of Clinical Excellence)

Issue date: November 2005

Information about NICE Interventional Procedure Guidance 144

NHS
National Institute for Health and Clinical Excellence

Intraoperative blood cell salvage in obstetrics

USO CS IN UROLOGIA

Issue date: April 2008

NHS
National Institute for
Health and Clinical Excellence

Interventional procedure guidance 258

Intraoperative red blood cell salvage during radical prostatectomy or radical cystectomy

The use of cell salvage during radical retropubic prostatectomy: does it influence cancer recurrence?

M. DAVIS, M. SOFER, O. GOMEZ-MARIN*, D. BRUCK and M.S. SOLOWAY
*Departments of Urology and *Epidemiology, University of Miami, School of Medicine, Miami, Florida, USA*

Accepted for publication 28 November 2002

CONCLUSION

Cell salvage during RRP does not influence the recurrence of prostate cancer. Cell salvage is a safe method of transfusion during RRP.

INTRAOPERATIVE CELL SALVAGE DURING RADICAL PROSTATECTOMY IS NOT ASSOCIATED WITH GREATER BIOCHEMICAL RECURRENCE RATE

ALAN M. NIEDER, ADRIENNE J. K. CARMACK, PAUL D. SVED, SANDY S. KIM, MURUGESAN MANOHARAN, AND MARK S. SOLOWAY

INTRAOPERATIVE CELL SALVAGE IN RADICAL RETROPUBIC PROSTATECTOMY

CHRISTINE L. GRAY, CHRISTOPHER L. AMLING, GREGORY R. POLSTON, CURTIS R. POWELL, AND CHRISTOPHER J. KANE

CONCLUSIONS

ICS is an effective and safe technique for blood management in patients undergoing radical prostatectomy. Compared with patients using autologous blood predonation, it results in higher preoperative and postoperative Hct levels and a lower homologous transfusion rate. Additionally, ICS does not appear to increase early biochemical recurrence rates in radical prostatectomy patients.

ASIAN SPINE JOURNAL
Clinical Study
Asian Spine J 2013;7(3):167-172 • http://dx.doi.org/10.4184/asj.2013.7.3.167

Role of Intraoperative Red Cell Salvage and Autologus Transfusion in Metastatic Spine Surgery: A Pilot Study and Review of Literature

Harinder Gakhar, Munzer Bagouri, Rajendranath Bommireddy, Zdenek Klezl

Department of Trauma and Orthopaedics, Royal Derby Hospital, Derby, UK

Blood salvage use in gynecologic oncology

Nimesh P. Nagarsheth, Tarun Sharma, Aryeh Shander, and Ahsan Awan

TRANSFUSION 2009;49:2048-2053.

Use of the Cell Saver in Oncologic Surgery

DOMINIQUE ÉLIAS[1], VALÉRIE BILLARD[2], VALÉRIE LAPIERRE[3]

TATM 2001;3(6):25-28

OSTETRICIA
CHIRURGIA TUMORALE

- FILTRO DELEUCOCIZZANTE
  (J. H. Waters - Pittsburgh, PA)

- IRRADIAZIONE DELLE EMAZIE 50 Gy - 12 Log reduction
  probabilità di cellule tumorali residue minore del 99,97%
  (E. Hansen - Regensburgh)

Intraoperative blood salvage in cancer surgery: safe and effective?

Ernil Hansen *, Volker Bechmann, Juergen Altmeppen

Department of Anesthesiologie, University of Regensburg, D-93042 Regensburg, Germany

Transfusion and Apheresis Science 27 (2002) 153–157

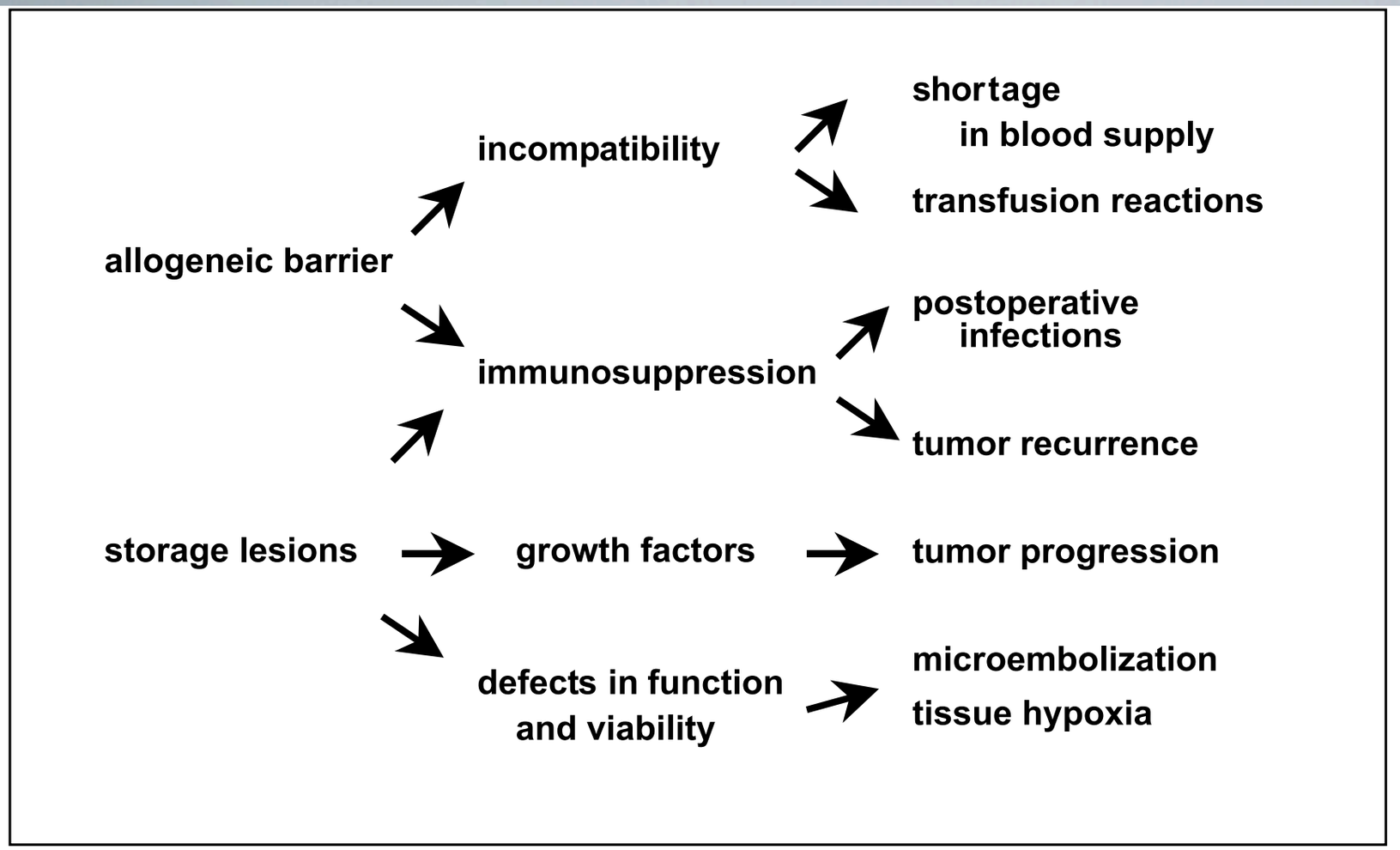


Fig. 1. Transfusion risks most relevant to cancer patients.

più di 700 casi
irradiazione GRC
50Gy

diminuzione cellule
tumorali Log 12
ottima qualità,
sopravvivenza,
funzione

2011 Update to The Society of Thoracic Surgeons and the Society of Cardiovascular Anesthesiologists Blood Conservation Clinical Practice Guidelines*

d) Blood Salvage Interventions

EXPANDED USE OF RED CELL SALVAGE USING CENTRIFUGATION

Class IIb.

1. In high-risk patients with known malignancy who require CPB, blood salvage using centrifugation of blood salvaged from the operative field may be considered since substantial data support benefit in patients without malignancy, and new evidence suggests worsened outcome when allogeneic transfusion is required in patients with malignancy. (Level of evidence B)

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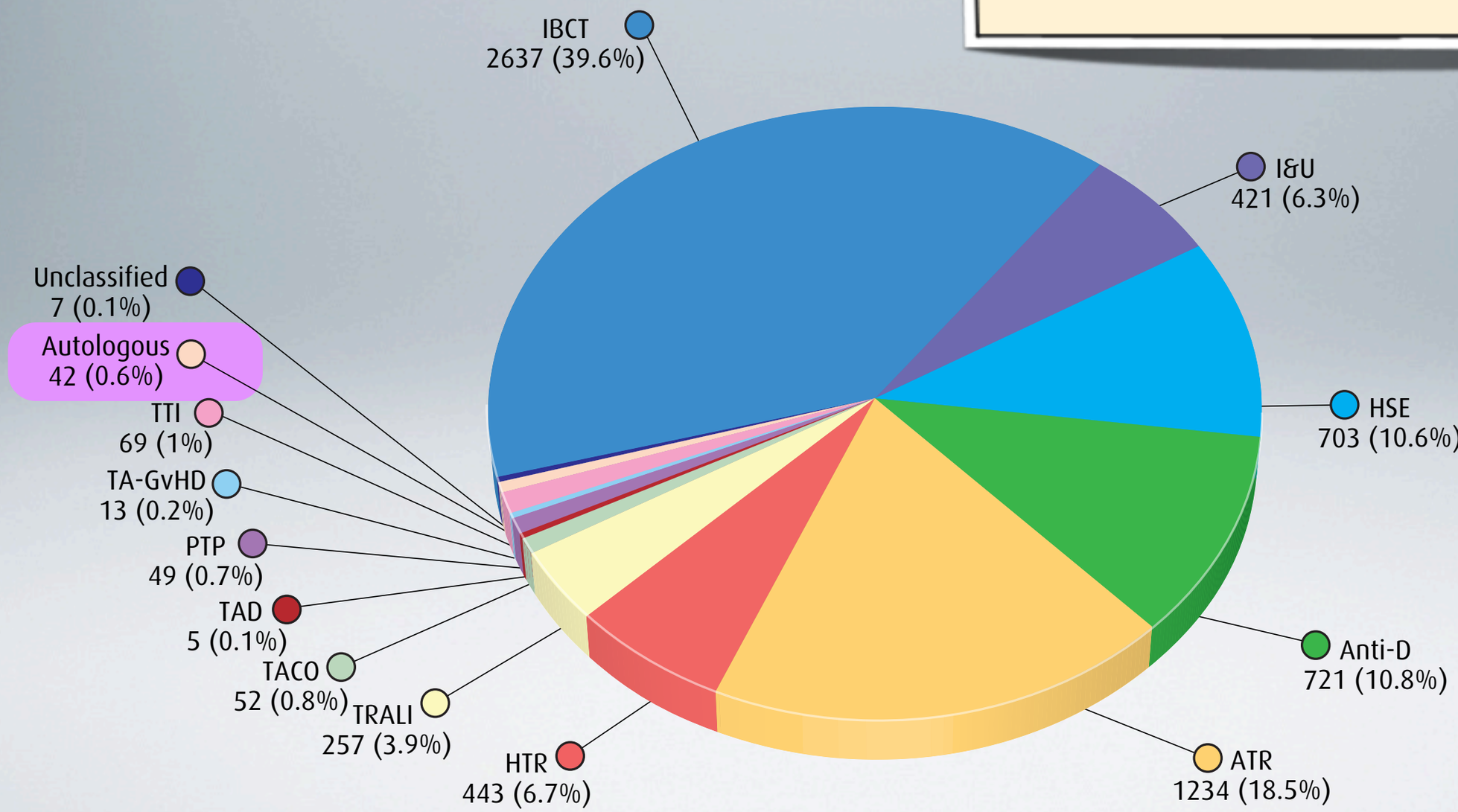
RISCHI

http://www.asiageographic.com/primum/view_film.htm

SHOT report 2009

IBCT = incorrect blood component transfusion
ATR = acute transfusion reaction
Anti D= omiss. or late anti D
HSE = handling and storage errors
I&U = inappropriate and unnecessary
HTR = haemolytic transfus. reactions

Cumulative numbers of cases reviewed 1996–2009 ***n*** = 6653



SHOT REPORT 2013

(SERIOUS HAZARDS OF TRANSFUSION)

20 Cell Salvage and Autologous Transfusion (CS)

Definition:

Any adverse event or reaction associated with autologous transfusion including intraoperative and postoperative cell salvage (washed or unwashed), acute normovolaemic haemodilution or preoperative autologous donation.

In addition specific definitions for cell salvage events are as follows:

- Adverse events due to operator error, machine failure and availability of trained staff where the event impacts on the care of the patient
- Adverse clinical events during the cell salvage process
- Pathological reactions to ***reinfused*** blood

12 CASI SEGNALATI NEL 2012

Specialty involved in the event

The following specialties were involved in the 12 cases reviewed:

- 5 were orthopaedic
- 5 were obstetric
- 1 was neurosurgery
- 1 was vascular

Type of cell salvage

- In 8 cases intraoperative cell salvage was involved
- In 3 cases postoperative cell salvage was involved
- In 1 case a combined system was used

Adverse reactions n=8

N. 4 = IPOTENSIONE DOVUTA AL FILTRO DELEUCOCIZZANTE (ACD)

N. 3 = IPOTENSIONE E BRIVIDO (rec. post-op)

N. 1 = IPOTENSIONE, no LDF (eparina)

TUTTI CLASSIFICATI COME "MINOR MORBIDITY"

Adverse events n=4

N. 2 = ROTTURA DELLA MACCHINA

N. 1 = PARTICELLE NERE nei GRC

N.1 = INFUSIONE CONTINUATA OLTRE IL TEMPO LIMITE

CLEVELAND CLINIC

Transfusion 1998; **38**: 296–300

- REVIEW RETROSPETTIVA di 5 aa. SU EVENTI AVVERSI ASSOCIATI A TRASFUSIONE DI SANGUE ALLOGENICO VS. AUTO-TRASFUSIONE DI EMORECUPERO:

0.14% 0,027%

S. ALLOGENICO - EMORECUPERO

RISCHI

POTENZIALI COMPLICANZE ASSOCIATE AL CS

- EMBOLIA GASSOSA/SOLIDA
- COAGULOPATIA (se le perdite sono > 3L.)
- CONTAMINAZIONE DA FARMACI
- SOLUZIONI DI LAVAGGIO SBAGLIATE
- AGENTI INFETTIVI
- CAMPANE INCOMPLETE (contaminazione con leucociti attivati, citochine ed altri microaggregati)

Errors During Intraoperative Cell Salvage Because of Inappropriate Wash Solutions

Jonathan H. Waters, MD, and Juraj Sprung, MD, PhD*

Department of General Anesthesiology, Cleveland Clinic Foundation, Cleveland, Ohio; and *Mayo Clinic, Mayo Medical School, Rochester, Minnesota

SOL. FISIOLOGICA 0,9 %

ACQUA STERILE

GLICINA 1,5%

ITALIA - SISTRA

Sistema Informativo dei Servizi Trasfusionali

CENTRO NAZIONALE SANGUE

- NON RACCOGLIE E FORNISCE DATI SU EMORECUPERO

COSTI

An Economic Analysis of Costs Associated with Development of a Cell Salvage Program

Janet Robinson Waters, MD, MBA*

Heidi Hylton Meier, DBA, CPA*

Jonathan H. Waters, MD†

(Anesth Analg 2007;104:869–75)

CONCLUSION: This analysis suggests that cell salvage can be significantly less expensive than allogeneic blood. The cost of cell salvage in other institutions will vary depending upon case volume, expected levels of blood loss per case, and initial investment costs. A step-by-step formula is provided to assist in the evaluation of a cell salvage service in hospitals of various sizes.

Health Technology Assessment 2006; Vol. 10: No. 44

Cost-effectiveness of cell salvage and alternative methods of minimising perioperative allogeneic blood transfusion: a systematic review and economic model

229 pag.

Conclusions: The available evidence indicates that cell salvage may be a cost-effective method to reduce exposure to allogeneic blood transfusion. However, ANH may be more cost-effective than cell salvage.

Estimating the cost of blood: past, present, and future directions

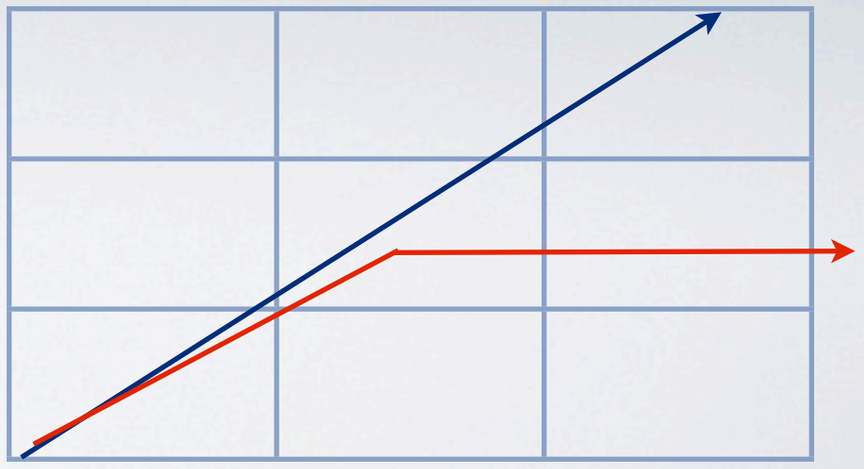
COSTO REALE TRASFUSIONE

$$c_{txn} = \frac{c_1x_1+c_2x_2+c_3x_3+c_4x_4+c_5x_5+c_6x_6+c_7x_7+c_8x_8+c_9x_9}{x_4} = \frac{\sum_{n=1}^{9} c_n x_n}{x_4}$$

- STAND-BY PROCEDURE = COSTO DEI REAGENTI X TIPIZZARE 2 UNITA' DI SANGUE (S.A. Esper, J. H. Waters)

EMORECUPERO

SANGUE BANCA



NELLA PRATICA

- E‘ DI QUALITA‘ MIGLIORE

Hansen E. - Anaesthesist 2011 Apr; 60 (4): 381 -9

	sangue di banca	**CS**
pH	6.73	7.52
K	47.2	1.2
2,3 dpg	0.7	13.8
ATP	2.3	4.3
sopravv. 24h. (%)	79.7	94.7
citrato	15.2	0
Hb libera	1.2	0.3

EMOGASANALISI

	EMAZIE BANCA		CS
	5 gg.	23 gg.	
Hct	58.8	59.9	51,5
Hb	19,3	19.6	16,8
pH	6,691	6,59	7,71
pCO_2	84,2	113	0,6
pO_2	34,6	43,3	217
Na	137	118	151
K^+	7,1	28,7	1,4
Ca^{++}	0,15	0,14	0,42
Glu	494	412	13
Lac	9,3	16	0,7
SBE	-23,4	-24,3	
HCO_3	5,0		
SO_2	42,7	57,5	100

EMOGASANALISI

	GRC BANCA 5gg.	GRC BANCA 2[illegible] gg.	CS
Hct	58.8	[illegible].9	51,5
Hb	19,3	[illegible].6	16,8
pH	6,691	[illegible]	7,71
pCO_2			
pO_2			
N[illegible]			
K			
Ca^{++}			
Glu			[illegible]5
Lac	9,3	16	0,7
SBE	-23,4	-24,3	
HCO_3	5,0		
SO_2	42,7	57,5	100

FATELO VOI !

ETICHETTATURA

AUTOLOGOUS TRANSFUSION

Untested Blood

For AUTOLOGOUS use only

Hospital / NHS No……..……..

Last name……..…

First name……..…….

DOB……..……

Operator Name (Print)……..……

Collection
Date…… Time……..……

Expiry
Date…… Time……..……

Type of autologous blood:

Intra-op Cell Salvage ☐
Post-op Cell Salvage (Washed) ☐
Post-op Cell Salvage (Unwashed) ☐

Total Volume……mls

AFFIX IN TRANSFUSION RECORD

(This section <u>should</u> be completed and affixed in patient's transfusion record)

Autologous Transfusion

Full Name ……..……

Hospital / NHS No. ……..……

Type:
Intra-op Cell Salvage ☐
Post-op Cell Salvage (Washed) ☐
Post-op Cell Salvage (Unwashed) ☐

Administered by……

Transfusion Started at: Date……..
Time……..

Total Volume……..mls

STOP!

DO NOT use addressograph labels

Handwrite the label from the information on the patient's identification band

DO NOT separate autologous blood from the patient

DO NOT Refrigerate

Reinfuse in accordance with the hospitals transfusion policies

Before transfusion, carry out the following checks:

1. Confirm the patient's identification.
2. Check the information on the label matches the information on the patient's identification band (where possible, ask the patient to state their NAME and D.O.B.).

   <u>No identification band</u>
   <u>No transfusion</u>

3. Check expiry date <u>and</u> time of blood.
4. If any details do not match - **Do not transfuse**
5. If a transfusion reaction is suspected, STOP the transfusion and seek medical advice.

QUALITA'

✓OPERATORE: deve essere adeguatamente istruito e regolamente aggiornato nell'addestramento.

✓ MACCHINE:

- ordinaria (pulizia, sistema di controllo minore, registrazione malfunzionamenti)
- controlli di manutenzione preventiva

✓PRODOTTO

QUALITA' : PRODOTTO

SAREBBE OPPORTUNO MISURARE
DALLA SACCA DI EMAZIE LAVATE
nell' 1% casi / ogni mese /ogni 2 mesi ???

- Ht (> 50%)
- K^+ (< 2)
- Hb libera
- FATTORE ANTI Xa (< 0,05U/ml)

- Esame Colturale

Cell Saver device efficiently removes cell-derived microparticles during cardiac surgery

Jeanette M. van den Goor, MSc,[a] Rienk Nieuwland, PhD,[b] Willem van Oeveren, PhD,[d] Peter M. Rutten,[a] Jan G. Tijssen, MSc, PhD,[c] Chi M. Hau, BSc,[b] Augueste Sturk, PhD,[b] León Eijsman, MD, PhD,[a] and Bas A. de Mol, MD, PhD,[a] Amsterdam and Groningen, The Netherlands

TABLE 1. Cell Saver device data

	Cell Saver device			
	Before	**After**	**Removal (%)**	***P* value**
Volume (mL)	850 (796-934)	440 (323-481)	53 (46-63)	<.001
Hematocrit (L/L)	0.26 (0.24-0.26)	0.55 (48-0.60)	NA	<.001
Erythrocytes (mL)	217 (199-246)	199 (178-253)	3 (−5-17)	.161
Thrombocytes (10^9)	140 (85-179)	16 (10-21)	89 (79-91)	<.001
Leukocytes (10^9)	4.7 (3.1-6.0)	3.8 (1.5-4.0)	31 (18-45)	<.001
Heparin (10^3 IU)	1765 (1666-2053)	9 (4-11)	100 (99-100)	<.001
F_{1+2} (nmol)	2.47 (0.50-7.39)	0.04 (0.03-0.05)	98 (92-99)	.003
EryMP (10^7)	128 (37-292)	5 (2-5)	97 (86-99)	.002
PMP (10^7)	147 (93-191)	1 (1-2)	99 (98-99)	<.001

Data are presented as medians (interquartile ranges). *NA,* Not applicable; F_{1+2}, prothrombin fragment; *EryMP,* erythrocyte-derived microparticles; *PMP,* platelet-derived microparticles.

EPARINA RESIDUA

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Thrombocytes (10^9)	140 (85-179)	1… (10-21)	89 (79-91)	<.001
Leukocytes (10^9)	4.7 (3.1-6.…)	3.8 (1.5-4.0)	31 (18-45)	<.001
Heparin (10^3 IU)	765 (…66-2053)	9 (4-11)	100 (99-100)	<.001
F_{1+2} (nmol)	2…7 (0.…-1.39)	0.04 (0.03-0.05)	98 (92-99)	.003
EryMP (10^7)	1…2 (37-292)	5 (2-5)	97 (86-99)	.002
PMP (10^7)	147 (93-191)	1 (1-2)	99 (98-99)	<.001

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FALSO MITO !!

TEMPO LIMITE
AABB GUIDELINES

REINFUSIONE DELLE EMAZIE:

- **EMORECUPERO INTRAOPERATORIO:**
  - 4 ore dalla PROCESSAZIONE

- EMORECUPERO POST-OP:
  - 6 ore dall' INIZIO DELLA RACCOLTA (applicabile quando la macchina x emorecupero intraop. è usata per il post-op.)

- IL TEMPO DI SCADENZA DEVE ESSERE SCRITTO CHIARAMENTE SULL' ETICHETTA

RIASSUMENDO...

- L’emorecupero è una procedura sicura in mano di personale istruito.

- E’ indicato nella maggior parte delle procedure chirurgiche dove le perdite ematiche si presumono > 20% volemia.

- E’ approvato dal NICE anche in ostetricia e chirurgia oncologica - prostatectomia e cistectomia (con le dovute precauzioni) . ....

- Per ottimizzare e massimizzare il recupero:
  - Lavaggio garze
  - Lavaggio circuito extracorporeo
  - Tecnica di aspirazione (evitare aria)
  - Vacuum < -150 mmHg.
  - Rallentare il lavaggio e aumentarne il volume

- La sacca di emazie deve essere etichettata e mantenuta al letto del paziente. (non in frigorifero)

- La procedura va registrata

- L'unica controindicazione importante è la contaminazione batterica del sito chirurgico. - nessun filtro rimuove i batteri.

- Tuttavia in caso di perdite importanti e in emergenza può essere valutato il rapporto rischio/beneficio.

CONCLUSIONE

The work group pointed out that more guidelines are not the answer, since there are many excellent trials and guidelines available that are not being followed. To make sustainable progress in the use of blood and blood components, changing behaviors when supporting data are available is the best solution.

RIUSCIRE A CONDIVIDERE LA CONOSCENZA
E
METTERLA IN PRATICA
ATTRAVERSO UN PROCESSO DI CAMBIAMENTO...

GRAZIE PER L'ATTENZIONE!