

Patrocini Richiesti

Sistema Socio Sanitario
Regione Lombardia
ASST Ovest Milanese



Patient Blood Management

Presidente del Convegno
Ivo Beverina

Comitato Scientifico
Bruno Brando
Erika Borotto
Chiara Novelli

dalla teoria alla pratica



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**IL RECUPERO PERIOPERATORIO
COME STRATEGIA DI "BLOOD CONSERVATION"**

Maria Beatrice Rondinelli

UOC SIMT A.O. San Camillo-Forlanini
Roma



The image is a flowchart illustrating the stages of perioperative management. It is divided into three main horizontal sections, each with a colored header bar and two sub-sections below it. The top section is blue, the middle is dark blue, and the bottom is purple. Large blue arrows point downwards between the sections. The text 'RECUPERO PERIOPERATORIO' is circled in red. The background features a stylized illustration of medical professionals and a large red blood cell on the left side.

PREPARAZIONE DEL PAZIENTE

Diagnostica ematologica

Diagnostica emorragica/coagulativa

METODICHE ANESTESIOLOGICHE-CHIRURGICHE

RECUPERO PERIOPERATORIO

Monitoraggio emostatico
coagulativo

MONITORAGGIO POSTOPERATORIO

TRIGGERS TRASFUSIONALI

Terapia di supporto

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

Key points

- Cell salvage reduces the requirement for allogenic blood transfusion.
- It should be considered for surgery with an anticipated blood loss of >1000 ml.
- It can be used in cancer surgery, but a leucocyte depletion filter is recommended.
- Evidence from cardiac and orthopaedic surgery is reasonable but is limited for other surgery.
- There is still a need for large prospective randomized controlled trials.

Summary. The use of intraoperative cell salvage and autologous blood transfusion has become an important method of blood conservation. The main aim of autologous transfusion is to reduce the need for allogeneic blood transfusion and its associated complications. Allogeneic blood transfusion has been associated with increased risk of tumour recurrence, postoperative infection, acute lung injury, perioperative myocardial infarction, postoperative low-output cardiac failure, and increased mortality. We have reviewed the current evidence for cell salvage in modern surgical practice and examined the controversial issues, such as the use of cell salvage in obstetrics, and in patients with malignancy, or intra-abdominal or systemic sepsis. Cell salvage has been demonstrated to be safe and effective at reducing allogeneic blood transfusion requirements in adult elective surgery, with stronger evidence in cardiac and orthopaedic surgery. Prolonged use of cell salvage with large-volume autotransfusion may be associated with dilution of clotting factors and thrombocytopenia, and regular laboratory or near-patient monitoring is required, along with appropriate blood product use. Cell salvage should be considered in all cases where significant blood loss (>1000 ml) is expected or possible, where patients refuse allogeneic blood products or they are anaemic. The use of cell salvage in combination with a leucocyte depletion filter appears to be safe in obstetrics and cases of malignancy; however, further trials are required before definitive guidance may be provided. The only absolute contraindication to the use of cell salvage and autologous blood transfusion is patient refusal.

Keywords: blood transfusion; care, intraoperative; surgery

75 Randomized controlled studies.

Studies published between 1978 and 2008.

**48 studies on post-op salvage,
16 studies on intra-op salvage,
11 studies on intra-op + post-op salvage.**

**36 trials in orthopaedic surgery
33 trials in cardiac surgery,
6 in vascular surgery.**



- Sono controindicazioni assolute la contaminazione batterica del campo operatorio e disordini ematologici
- Gli autori sottolineano i limiti degli studi esaminati ed auspicano l'esecuzione di ampi studi prospettici e trial randomizzati
- Concludono che la pratica del recupero post-operatorio appare giustificata in chirurgia ortopedica maggiore (anca, ginocchio, colonna) mentre sembra meno utile in cardiocirurgia (2C+)
- RPO va comunque riservato ad interventi con perdita di volume > 10% del volume circolante e se ne giovano pazienti con valori di Hb compresi tra 12gr/dl e 15gr/dl

Use of intraoperative cell-salvage for autologous blood transfusions in metastatic spine tumour surgery: a systematic review

Naresh Kumar, Yongsheng Chen, Aye S Zaw, Deepti Nayak, Qasim Ahmed, Richie Soong, Hee K Wong

4 gynaecological cancer surgery

7 hepatobiliary cancer surgery

1 gastrointestinal cancer surgery

15 urological cancer surgery

1 lung cancer surgery

2 in-vitro studies showing absence of tumour cells in cell salvaged blood

All studies showed either **equivalent or better results across all clinical outcome parameters studied in the IOCS group**, compared with those who did not receive IOCS. Of the five non-reinfusion studies, four showed that no tumour cells could be detected in the salvaged blood after LDF filtration. Only in one study involving 32 patients undergoing orthotopical liver transplantation for hepatocellular carcinoma, two of the 32 samples remained positive for tumour cells—both were cases in which the tumour had ruptured during surgery.



Description of the evidence

A Cochrane review showed that the use of cell salvage reduced the risk of PRBC transfusions (RR 0.78, 95% CI 0.68–0.91) during cardiac surgical procedures [117, 137]. In a meta-analysis com-

In the postoperative period, tube drainage and the washing of blood may be implemented to reduce postoperative blood transfusions. The British National Institute for Health and Clinical Excellence conducted an extensive review of the literature and several meta-analyses for postoperative cell salvage [146]. In cardiac surgery, the absolute risk of being exposed to allogeneic blood was approximately 15.6% (95% CI 7.4–21.4%) lower in patients receiving postoperative cell salvage and 1 unit less of allogeneic blood. Postoperative cell salvage resulted in lower rates of infection, lower mortality rates and shorter hospital stays. Unwashed salvaged blood from postoperative surgical drains contains higher concentrations of inflammatory mediators, fibrin split products, interleukins, fat emboli and complement factors and may increase the risk of inflammatory complications [147].

BLOOD MANAGEMENT

Reduction of allogeneic red blood cell usage during cardiac surgery by an integrated intra- and postoperative blood salvage strategy: results of a randomized comparison

Luca Weltert, Saverio Nardella, Maria Beatrice Rondinelli, Luca Pierelli, and Ruggero De Paulis**

BACKGROUND: The amount of allogeneic blood transfusion may relate to worse outcome in cardiac surgery. The reinfusion of red blood cells (RBCs) lost by patients, including those of chest drains, is a promising strategy to minimize allogeneic transfusions.

STUDY DESIGN AND METHODS: To verify this hypothesis, 1047 cardiac surgery patients were randomly assigned to either traditional intraoperative blood salvage followed by chest drain insertion or intra- and postoperative strategy with the Haemonetics cardioPAT system. Allogeneic RBC transfusion rate (primary end-

Continuous progress in the policies and technologies for blood collection and blood qualification have determined a great reduction in the rate of transfusion-transmitted infections in developed countries. On the other hand, despite a significant reduction of transfusion-transmitted infection originated by well-known microbic and viral agents, blood transfusions remain related to a wide series of adverse reactions due to clerical errors, immunologic reactions, and transmission of unrecognized blood-borne pathogens.^{1,2} Patients undergoing cardiac surgery account

Recupero Perioperatorio

- 1) Principi di funzionamento :Wash vs No Wash**
- 2) Indicazioni e controindicazioni**
- 3) Contesti chirurgici specifici multidisciplinari**
- 4) Percorso HTA apparecchiature / CQ**
- 5) Formazione del personale**
- 6) Indicatori di efficacia**
- 7) Take-home messages**

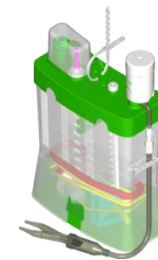
1943 : invenzione della prima macchina del recupero sangue



Recupero Perioperatorio

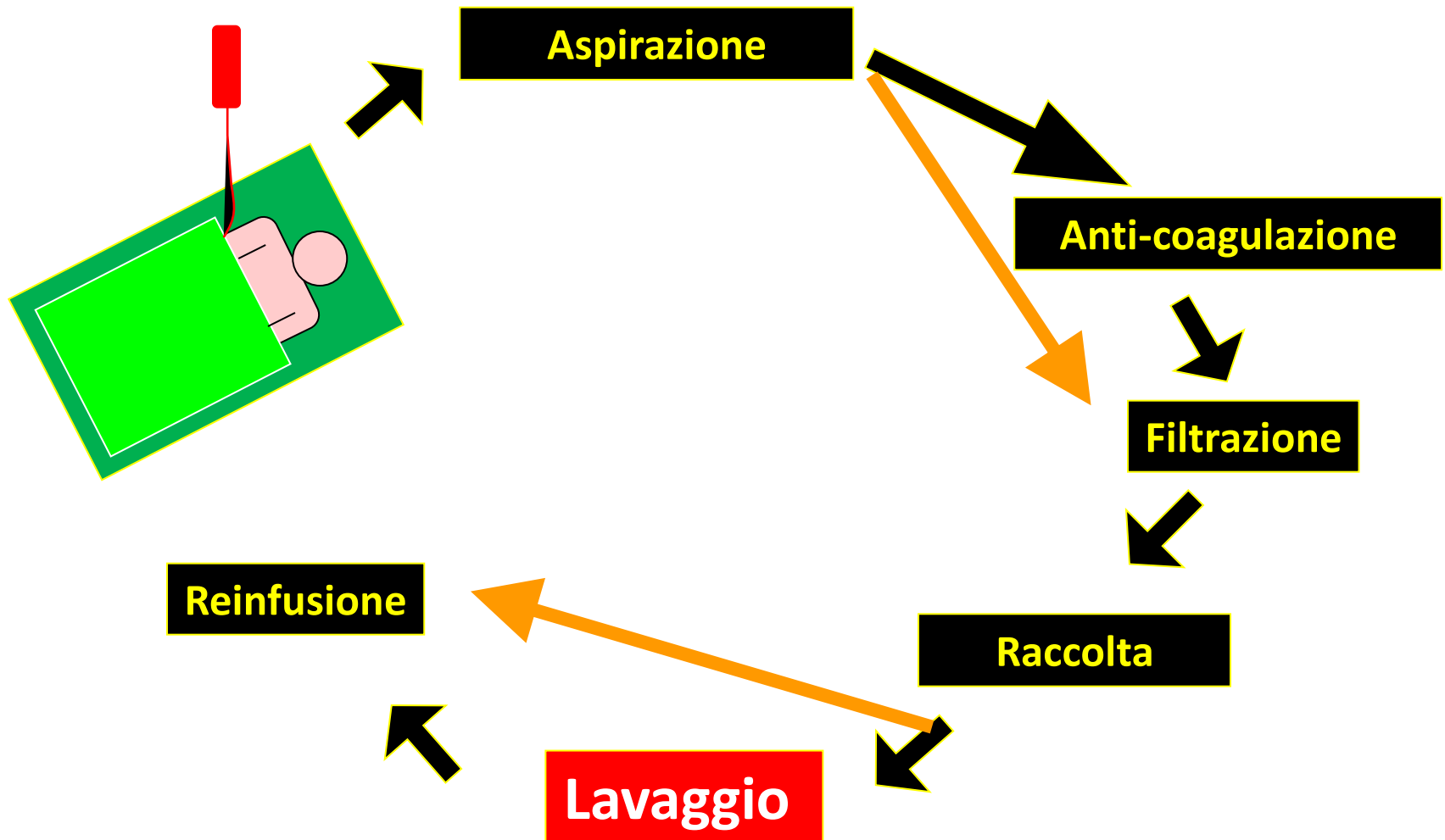
WASH

NO
WASH



Recupero Perioperatorio

Intraoperatorio e/o Postoperatorio



- **SISTEMI WASH**

Raccolta
Anticoagulazione



Filtrazione
sistematizzata



Lavaggio
In continuo
Centrifugazione per gradiente

- **SISTEMI NO WASH**

Raccolta
Senza
anticoagulazione



Filtrazione
con sistema
progressivo



**Reinfusione senza
lavaggio delle
emazie**

• SISTEMI WASH

Training
Maggiore impegno organizzativo



Complessità esecutiva
Minore incidenza effetti collaterali



Standardizzazione dei prodotti
Maggiori costi

• SISTEMI NO WASH

Training
Minore impegno organizzativo



Facilità esecutiva
Maggiore incidenza effetti collaterali per grandi volumi reinfusi



Variabilità nei prodotti
Minori costi

INDICAZIONI WASH

W

- Interventi chirurgici : Perdita ematica prevista almeno 800-1000 ml o maggiore al 20% della volemia del paziente

A

- Chirurgia elettiva maggiore
- Chirurgia d'urgenza

SH

- Ortopedia /Traumatologia
- Cardiochirurgia/ Chirurgia Vascolare
- Chirurgia dei Trapianti : fegato, cuore,

INDICAZIONE SISTEMI NON WASH

NO

- Tipologie chirurgiche con perdite minori e protratte nel tempo

WA

- PostOCare :Chirurgia ortopedica maggiore
- Chirurgia cardiovascolare :HT

SH

- Verifica efficacia e monitoraggio effetti collaterali

Controindicazioni : metodiche wash

Stato settico disseminato
Neoplasie disseminate

Inquinamento liquidi biologici / liquido amniotico
Inquinamento con liquidi d'irrigazione

Patologie emolitiche del globulo rosso:
(Anemia falciforme –Sferocitosi- Talassemie)
Coagulopatia diluizionale e trombocitopenie
Eparinizzazione non controllata associata alla CEC

SOSTANZE DA NON ASPIRARE

trombina topica

colle di fibrina

soluzioni ipo-ipertoniche

alcool

perossido di idrogeno

adrenalina

betadine



Floseal

Hemostatic Matrix



Controindicazioni : metodiche no wash

Contaminazione particelle lipidiche

Leucodeplezione parziale

Stromi cellulari

Attivazione sostanze procoagulanti

Prodotti di degradazione del fibrinogeno

Agenti fibrinolitici
Agenti infiammatori attivati
Citokine, complemento,
endotossine,
Fattori tissutali, Hb libera

*Svenmarker S 2003, Spanier T 2000,
Reents W 1999, Dalrymple-Hay MJ 1999,
Morris JJ 1994, Roberts SR 1991,
Boonstra PW 1985,*

Via estrinseca coagulazione

Particelle lipidiche,
tromboemboli

Disfunzioni neurologiche

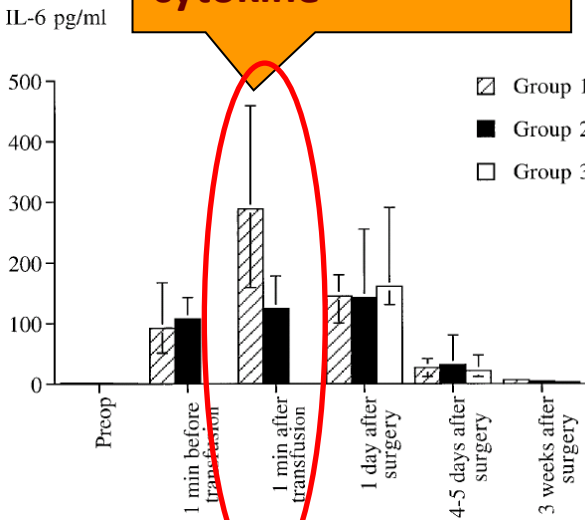
Maria Tylman
 Jan Peter Bengtson
 Anders Åvall
 Monica Hyllner
 Anders Bengtsson

Release of interleukin-10 by reinfusion of salvaged blood after knee arthroplasty

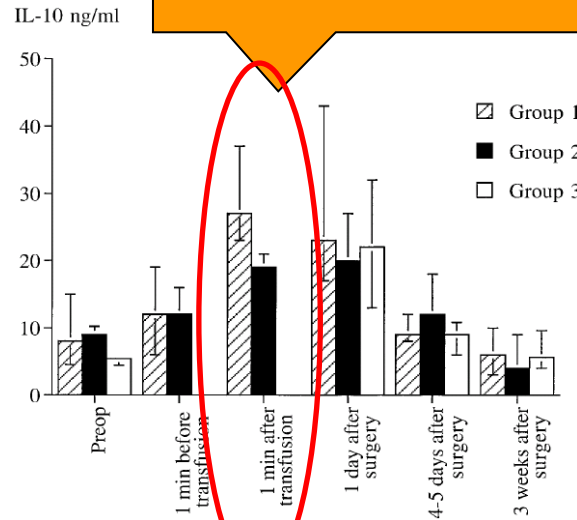
Intensive Care Med (2001) 27: 1379–1384

Group 1: untreated blood; **Group 2:** washed blood; **Group 3:** No blood

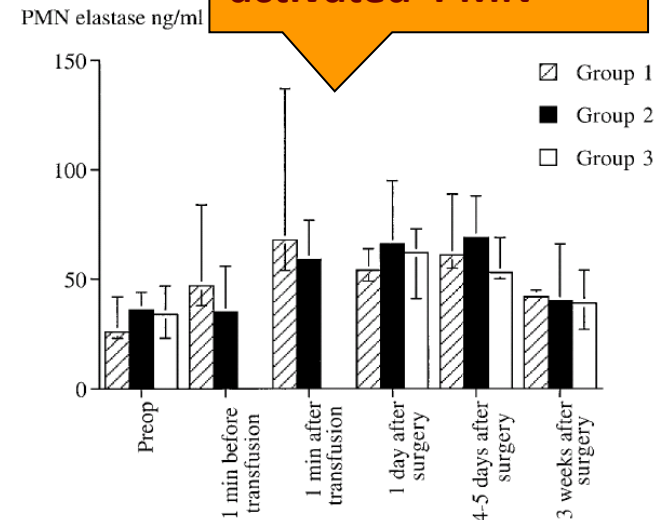
IL-6
 Proinflammatory
 cytokine



**IL-10 suppression
 of host immunity**



**PMN elastase
 produced by
 activated PMN**



SENSORE INTELLIGENTE



QUALITY SENSOR DESCRIPTION

- 1 Holding system (hook)
- 2 Open/close button
- 3 RBC's sensor + automatic clamp
- 4 Hook for transfer bag
- 5 Procedure key-pad



DRY-WASH

Contesti chirurgici differenziati e multidisciplinari

Applicazione Chirurgia d'urgenza :
Traumi emorragici

Applicazione in ambito ostetrico-
ginecologico- PPH /Peripartum

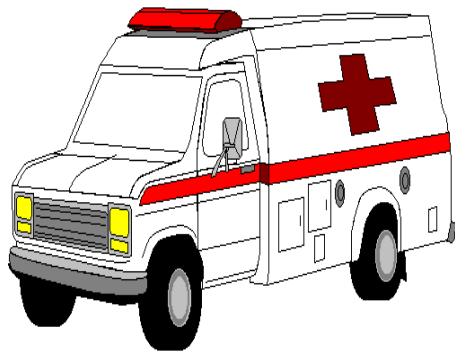
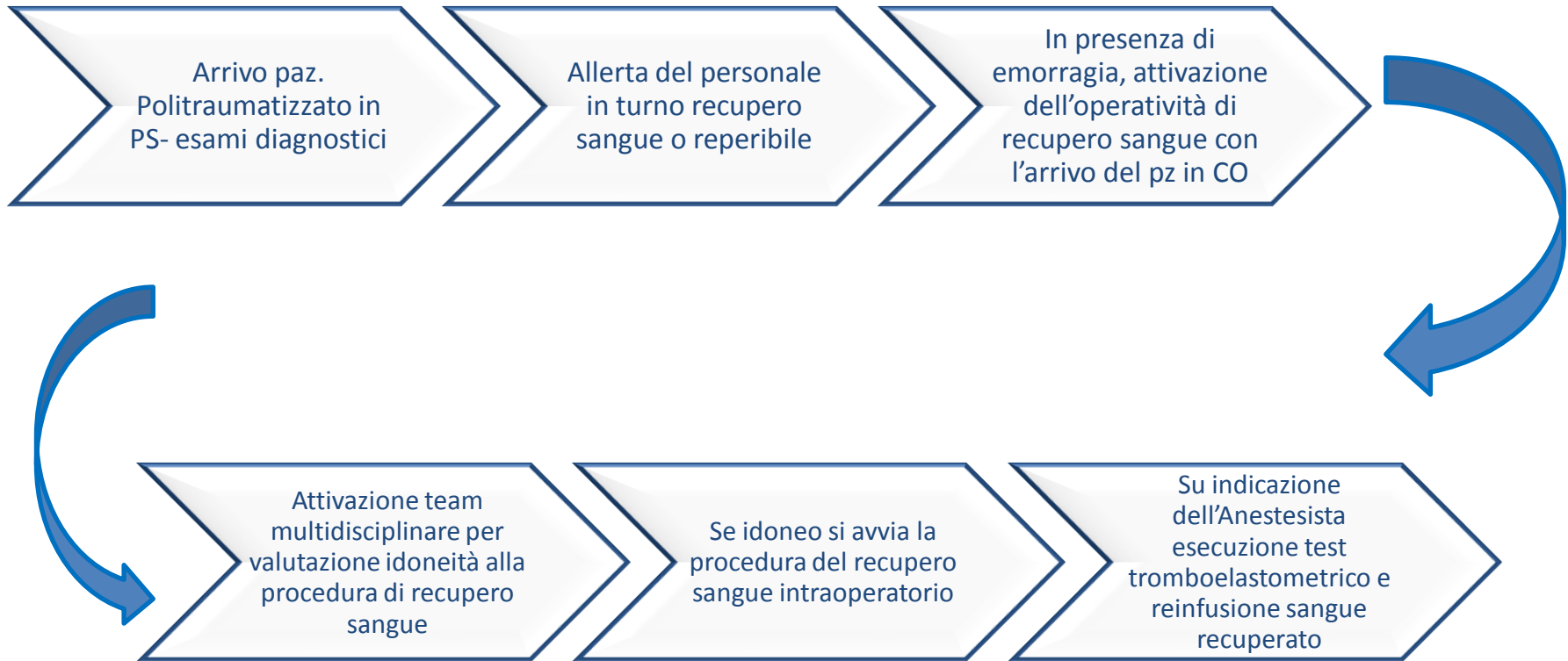
Applicazione Chirurgia trapianti :
Trapianti di cuore , fegato

Applicazione Chirurgie d'urgenza

Strategie associate



Introduzione ai parametri SpHb e PVI



Fasi del recupero sangue in ostetricia

Aspirazione del liquido amniotico nel contenitore del perduto

Inizio aspirazione sangue dal campo operatorio

Se ≥ 1000 ml, lavaggio del sangue recuperato e infusione col filtro deleucocizzante



Applicazioni nei trapianti : cuore /fegato



Intraop

- Priming
- CEC
- Eparinizzazione



Postop

- Scelta e gestione drenaggi
- Operatività

4- Valutazione e controllo strumentazioni (HTA)

1

- Monitoraggio del singolo strumento identificato con il numero di serie

2

- Effettuare i CQ ad ogni aggiornamento del software

3

- Elenco attrezzature e registrazione degli interventi e CQ eseguiti

Qualità del prodotto eritrocitario da recupero

(Pool 20% Ht)

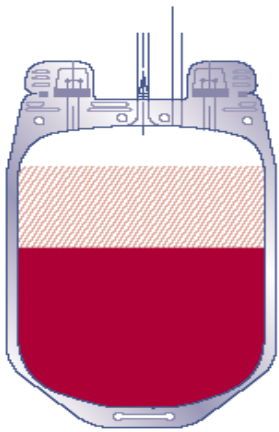
Ematocrito 73%

RBC Recovery 83%

Rimozione Albumina 99.1%

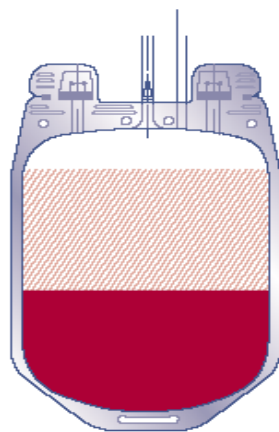
Rimozione Eparina 99.8%

Rimozione Hb libera 97.3%



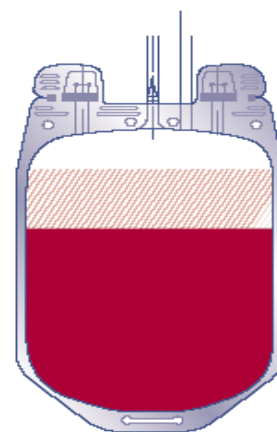
GR concentrati di banca

Ht medio 60%



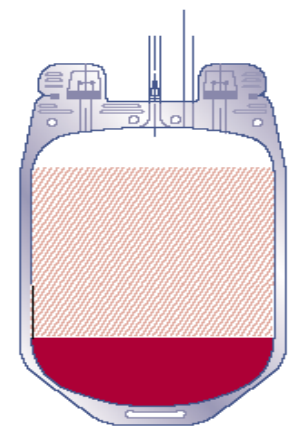
GR Lavati tramite bowl

Ht medio 50%



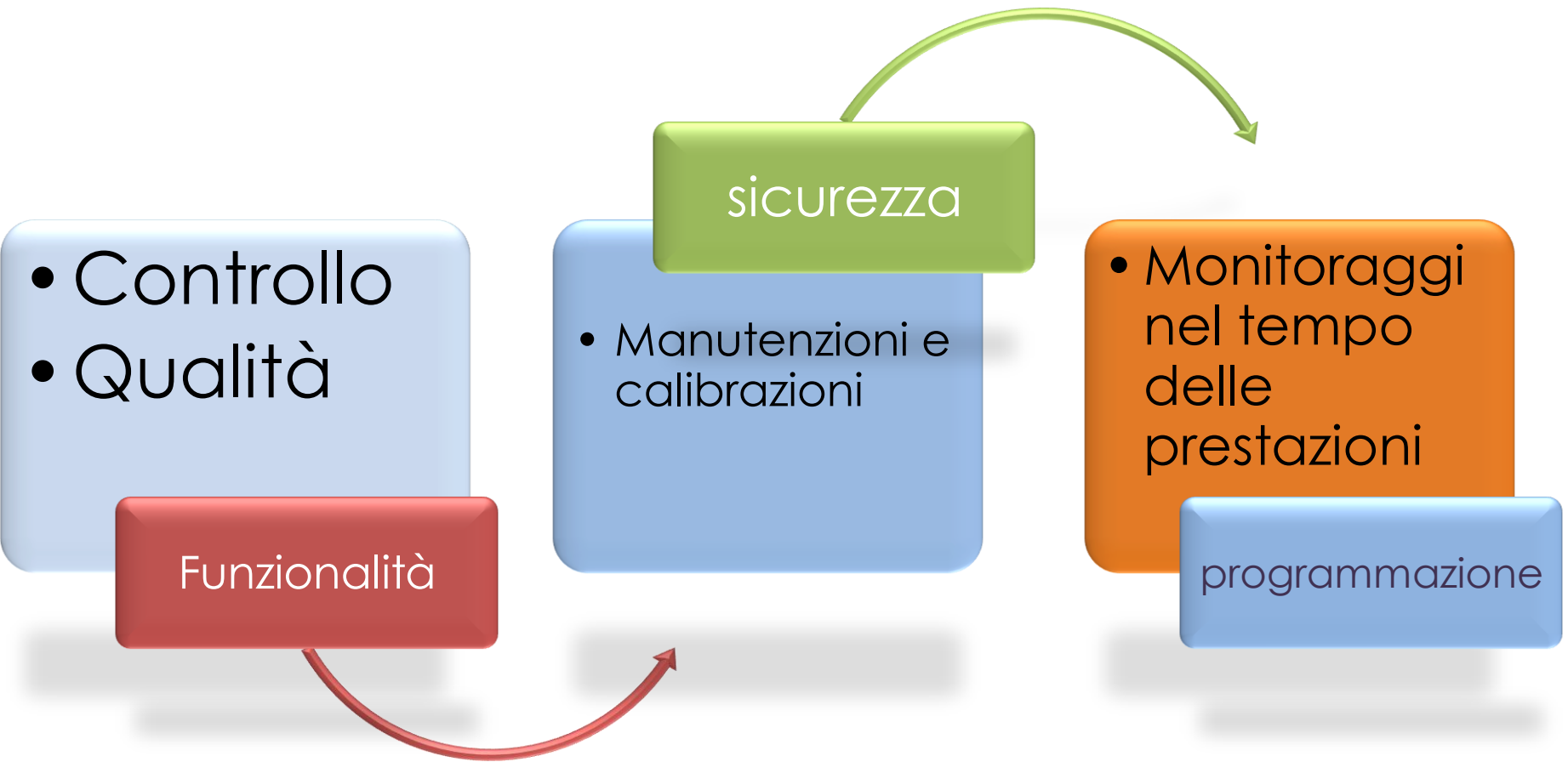
GR lavati con OrthoPAT

Ht medio 72%



Sangue reinfuso con sistemi no-wash

Ht medio 20/25%



Parametri di valutazione C.Q.

Hb

Hct

EGA

*Controlli
Microbiologici
di sterilita*

Formazione e certificazione personale addetto

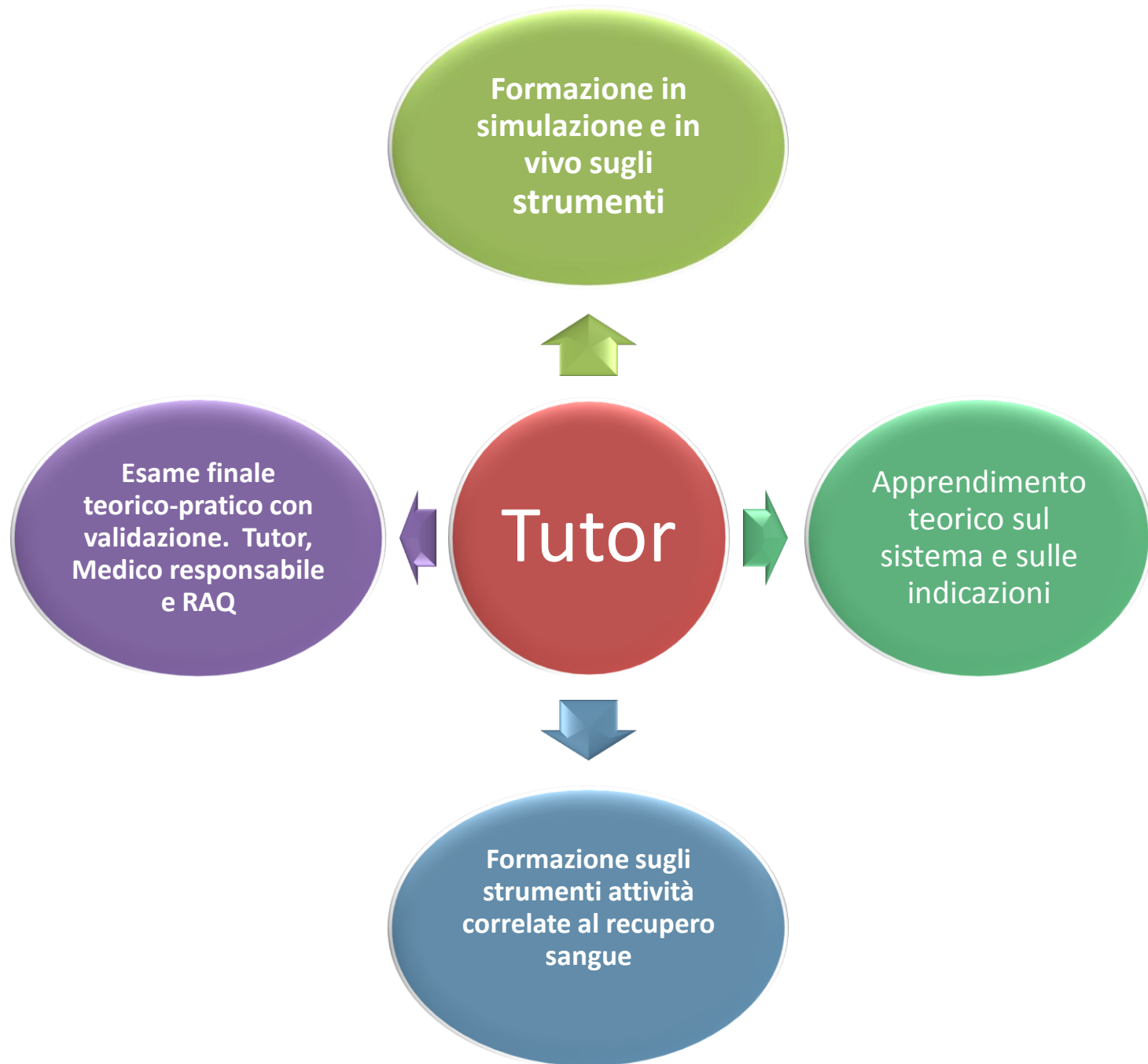


Ex
vivo

- Formazione
- Applicazione

In
vivo

- Sistemi applicativi
- Verifica periodica



Indicatori di efficacia

*IRS (Indice Recupero Sangue) N° Unità equivalenti ottenuto con Recupero sangue / N° Totale di recuperi effettuati

IRS = 1 APPROPRIATO

IRS <1 INEFFICACE

IRS > 1 EFFICACE

RISPARMIO EMOCOMPONENTI (gennaio-settembre 2017)

§ Totale unità di emazie recuperate (168 unità) Euro : 22.848,00

§ Totale Plasma risparmiato (468 unità) “ Euro : 79.560,00

§ Totale Pool piastrinici risparmiati (70 unità) “ Euro : 16.146,00

.....Take Home Messages



Strategie integrate e
multidisciplinari
condivise



Valutazione
appropriatezza di utilizzo
Training
Analisi retrospettiva
Audit



Continuo miglioramento
applicativo strumentale e
utilizzo di software
multiparametrici

