HUMANITAS
MATER DOMINI

Recupero sangue perioperatorio

Roma, 22/23 settembre 2011

A cura di
Giovanni Albano
Responsabile U.O. Anestesia e Rianimazione
Humanitas Mater Domini (Castellanza – VA)

Situazione Attuale

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… due grandi sistemi …

• **WASH:** Il sangue viene raccolto con ACS e viene lavato tramite sistemi di centrifuga. Si reinfondono solamente RBC con HCT>50%

• **NO WASH:** Il sangue viene raccolto senza ACS e dopo essere stato separato da surnatante e lipidi e aver ricevuto una doppia filtrazione, viene reinfuso tramite una sacca di reinfusione al paziente.

State of the art

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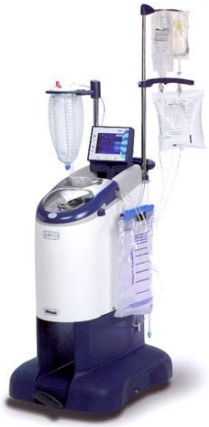
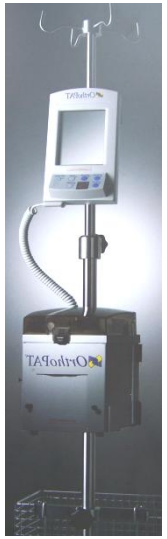
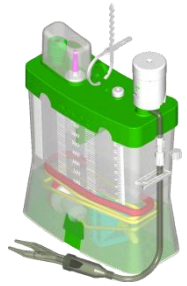
WASH





IBRID

NO WASH



Wash

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WASH SYSTEM

- Praticamente l'unica metodica di recupero intraoperatoria
- Qualità migliore (lavaggio) e vantaggi "trasfusionali" (↑Ht)
- Soprattutto in cardiochirurgia e ortopedia ma anche se con minori vantaggi in altre chirurgie (urologia, vascolare, neurochirurgia, trapianto di fegato)
- Chirurgia oncologica (solo con alcune indicazioni)
- Controindicazioni (contaminazione batterica del campo operatorio ed alcune patologie che riducono la resistenza dei globuli rossi come anemia falciforme e talassemia)

SVANTAGGI

Macchinari dedicati

Costi

Tempo

Logistica

Wash

ACCORGIMENTI

- Aspirazioni mai superiori a 150mmHg
- Fori di aspirazione non troppo grandi
- Non aspirazione del sangue depositato direttamente nel cardiotomo
- Anticoagulazione secondo indicazione

No Wash

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NO WASH SYSTEM

- Applicazioni soprattutto in ambito ortopedico (sempre meno utilizzato in cardiochirurgia)
- Variabilità di prodotti
- Necessità di sedimentazione
- Apparentemente facile manegevolezza e standardizzazione

No Wash

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LIMITI

- Limitazione del periodo di raccolta (max 6h)
- Limitazione volume sangue reinfuso (max 1000ml)
- Sedimentazione per un periodo almeno superiore ai 20/30 min dopo la raccolta per l'eliminazione del surnatante

No Wash

Prodotti della coagulazione attivati

Prodotti della degranulazione piastrinica

Prodotti della degranulazione leucocitaria

Emoglobina libera

Sostanze bioattive come citochine, anafilotossine, fattori attivati del complemento

Sicurezza del sangue non lavato?

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The method of retransfusion of unwashed, filtered wound blood still is quite widely used and by many is considered an easy, inexpensive, safe, and reliable technique for effective blood saving by autologous transfusion.[2-7] The question is whether the method still fits into modern transfusion medicine.

The main indications for direct retransfusion of wound blood are mediastinal drain after cardiac surgery;[2] postoperative wound drain after orthopedic surgery,[3] especially after application of a tourniquet; and some intraoperative applications in vascular surgery.[4] In cardiac

Hansen and Pawlik·

Transfusion2004;44:45s-53s

Il sangue non processato è efficace e sicuro quanto il sangue lavato?

Sicurezza del sangue non lavato?

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This means that bioactive contaminants are not only released from blood but also from the tissues of the wound. Retransfused, these cells and mediators exceed their normal local function, but now act systemically. In

TABLE 2. Bioactive contaminants demonstrated in unwashed wound blood[11,21,28-32,36-60]

Coagulation activation
- Thrombin generation: TATIII↑, F1/F2SP↑, ATIII↓
- Fibrin generation: FG↓, FGDP↑, FM↑
- Activation and/or loss of factors: FXIIa↑, FXIIIa↑, PTT↓, FVc↓, FXIII↓

PLT activation and degradation
- Serotonin↑, histamine↑, PAI-1↑, PDEGF↑, βTG↑, TxA2↑, TxB2↑↑, PF4↑

Fibrinolysis activation
- FDP↑, AP↓, PAP↑, PG↓, D-dimers↑, tPA↑

WBC activation/degradation
- IL-1α↑, IL-1β↑, IL-4↑, IL-6↑↑, IL-8↑, IL-10↑, TNF-α↑, sTNFR↑, IL-1Ra↑, elastase↑, EPX↑, MPX↑, PGE2↑, ECP↑, PGI_2↑, leukotrienes↑

Complement activation
- C′1↓, C′3↓, C′5↓, C′3a↑, C′5a↑, terminal C′-complex (sC′5a-9)↑

Hemolysis
- fHb↑, LDH↑

Inflammation activation
- Free radicals, endothelins, NO, phospholipase A_2, microaggregates

Innalzamento fino a 5000 volte!!

Abbreviations: AP = antiplasmin; βTG = β-thromboglobulin; C′3a = activated complement factor 3; ECP = eosinophilic cationic protein; EPX = eosinophilic protein X; FDP = fibrin degradation products; FG = fibrinogen; FGDP = fibrinogen degradation products; fHb = free hemoglobin; FM = fibrin monomers; FSP = fibrin split products; FXIII = coagulation factor XIII; FXIIa = activated coagulation factor XII; IL = interleukin 6; MPX = myeloperoxidase; PAI = plasminogen activator inhibitor; PAI-1 = plasminogen activator inhibitor type 1; PAP = plasmin–antiplasmin complex; PF4 = PLT factor 4; PG = plasminogen; PGE_2 = prostaglandin E2; PTT = prothrombin time; sC′ 5a-9 = terminal C′-complex; sTNFR = soluble receptor for tumor necrosis factor; TAT = thrombin–antithrombin complex; tPA = tissue plasmin activator; TxB_2 = thromboxane B2.

Hansen and Pawlik. Transfusion2004;44:45s-53s

Sicurezza del sangue non lavato?

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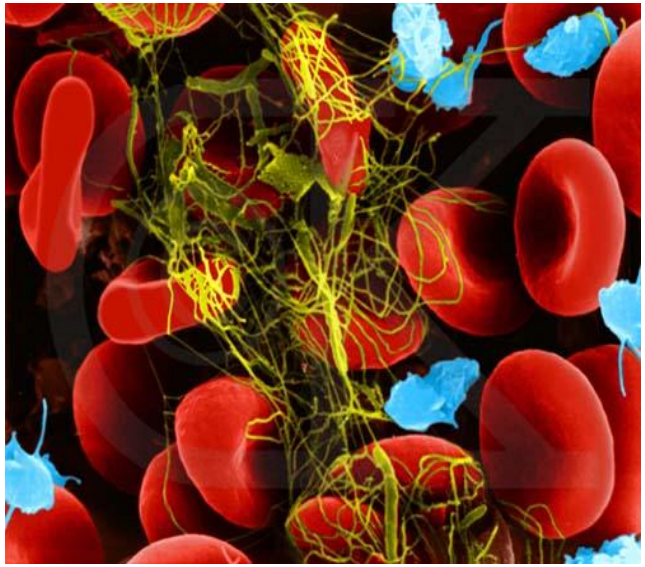
TABLE 1. Pathophysiology of retransfusion of unwashed wound blood

Processes	Products	Consequences
Tissue damage	Cell debris	Microembolism
Hemolysis	Free Hb	Renal failure
Cell degradation	Electrolytes	Electrolyte disturbances
Cell activation	Proteases	Respiratory failure
Mediators	Cytokines	Circulatory failure
Foreign materials	RES overload	Immunosuppression
Coagulation	Factor activation and consumption	Thrombosis
Fibrinolysis	Plasminogen activation	Bleeding
PLT activation	Degranulation	DIC
Contact activation	Complement activation	MOF
Anticoagulants	Kinins	SIRS
Irrigation fluids	And many more	Volume overload

Abbreviations: MOF = multiorgan failure; SIRS = systemic inflammatory reaction syndrome; RES = reticulo endothelial system.

Hansen and Pawlik·

Transfusion2004;44:45s-53s



Some of the contaminants in wound blood have been identified as the main mediators of coagulopathy, disseminated intravascular coagulation (DIC), acute respiratory distress syndrome (ARDS), systemic inflammatory reaction syndrome (SIRS), and multiorgan failure (MOF).[16,17] It is paradoxical to recognize these factors as substantial in a number of pathogenic pathways and at the same time to transfuse them in considerable quantities or to aim to prevent transfusion-induced immunomodulation by infusion of potent immunomodulating mediators in high amounts. Finally, it should be

Gli studi

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Activation of Plasma Coagulation by Retransfusion of Unwashed Drainage Blood After Hip Joint Arthroplasty

A Prospective Study

Jochen Duchow, MD,* Michael Ames, MD,* Thomas Hess, MD,* and Ulrich Seyfert, MD†

The Journal of Arthroplasty Vol. 16 No. 7 2001

- 12 patients undergoing cementless hip joint arthroplasty were retransfused with unwashed drainage blood collected postoperatively.

- **Global coagulation parameters**, **coagulation factors** (factor V:C, factor VIII:C, activated factor XII, and factor XIII) and **markers of thrombin generation** (F1+2 Fibrin split products, thrombin-antithrombin complexes), **fibrin generation** (fibrinogen and fibrin degradation products), and **fibrinolysis** (D-dimers, thrombin degradation products, plasminogen) were determined.

Gli studi

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Coagulation Parameters After Retransfusion of Unwashed Blood

The Journal of Arthroplasty Vol. 21 No. 3 2006

Ulf Helwig, MD,* Stefan Schauß, MD,* Andrea Berghold, PhD,† and Herbert Ziervogel, MD‡

- Coagulation parameters after unwashed shed blood in **22 patients** having elective joint arthroplasty
- Comparison with patients without retransfusion
- Twenty-two patients with a total hip or knee arthroplasty **received a mean of 611.4 mL** unwashed but filtered shed blood
- **No complications were observed during or after the reinfusion of salvaged blood**

Gli studi

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Recupero Perioperatorio delle Perdite Ematiche

….. it has been previously reported that for a total unwashed salvaged blood volume of 1000–1500 mL there is enough circulating haptoglobin to bind the reinfused plasma free Hb, avoiding possible renal damage …..

Muñoz M, García-Vallejo JJ, Ruiz MD, et al. Transfusion of postoperative shed blood: laboratory characteristics and clinical utility.

Eur Spine J 2004; ***13(Suppl.*** *1): S107–13*

Gli studi

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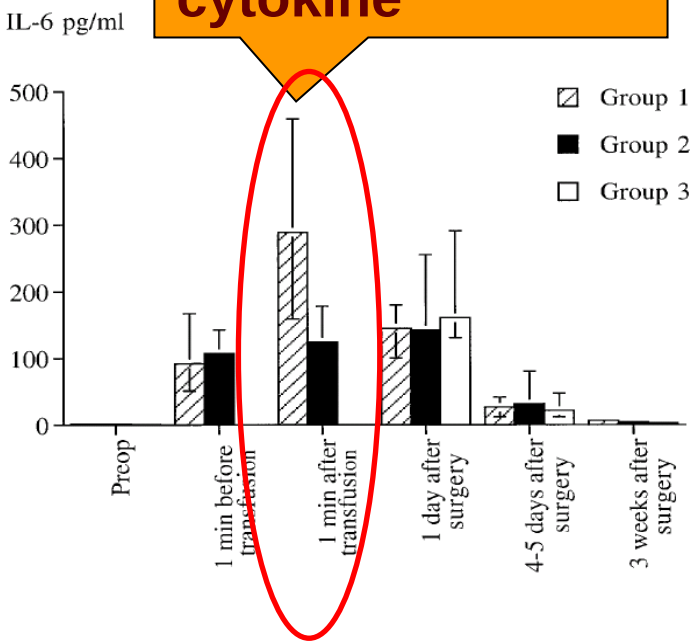
Maria Tylman
Jan Peter Bengtson
Anders Åvall
Monica Hyllner
Anders Bengtsson

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

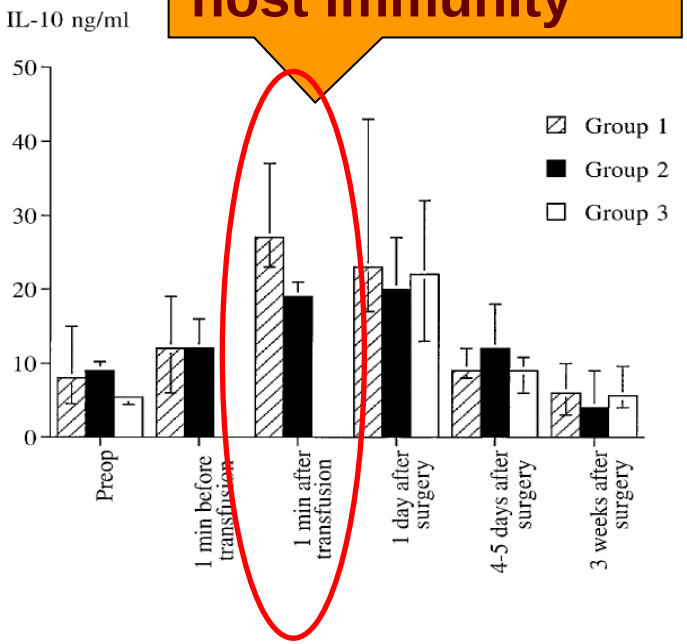
Intensive Care Med (2001) 27: 1379–1384

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

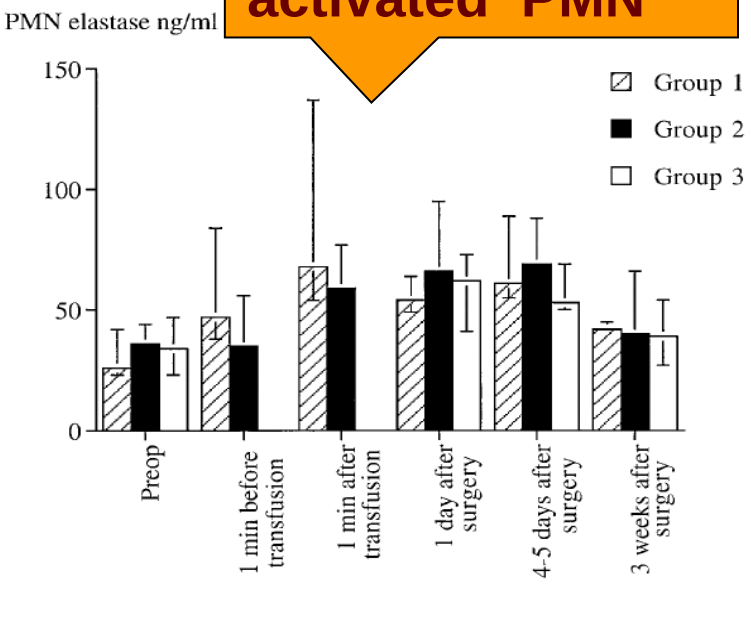
IL-6 Proinflammatory cytokine



IL- 10 suppression of host immunity



PMN elastase produced by activated PMN



There were no wound infection in any of the 3 groups

Coronary Surgery Without Cardiotomy Suction and Autotransfusion Reduces the Postoperative Systemic Inflammatory Response

Martin Westerberg, MD, Anders Bengtsson, MD, PhD, and Anders Jeppsson, MD, PhD

Department of Cardiothoracic Surgery, Sahlgrenska University Hospital, and Department of Anesthesia and Intensive Care, Eastern Hospital, Gothenburg, Sweden

(Ann Thorac Surg 2004;78:54–9)

Table 2. Changes From Baseline in TNF-α, IL-6, and C3a Concentration in Retransfusion and No-Retransfusion Groups

	Retransfusion (n = 12)	No Retransfusion (n = 17)	*p* Values Two-Way ANOVA
Δ-TNF-α (pg/mL)			
CPB + 10 minutes	6.2 ± 1.7	3.4 ± 1.0	Time <0.001
CPB + 2 hours	6.3 ± 1.0[a]	2.3 ± 1.3	Group 0.063
CPB + 24 hours	0.6 ± 0.4	0.4 ± 0.8	Interaction 0.147
Δ-IL-6 (pg/mL)			
CPB + 10 minutes	5.9 ± 2.3	12.0 ± 2.5	Time <0.001
CPB + 2 hours	40.9 ± 4.8	40.6 ± 5.9	Group 0.088
CPB + 24 hours	125.3 ± 31.2[a]	58.8 ± 7.2	Interaction 0.004
Δ-C3a (ng/mL)			
CPB + 10 minutes	4,085 ± 927	2,996 ± 447	Time <0.001
CPB + 2 hours	1,542 ± 601	598 ± 125	Group 0.047
CPB + 24 hours	−64 ± 119	−266 ± 105	Interaction 0.41

Gli studi

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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

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

SPECIAL REPORT: STS WORKFORCE ON EVIDENCE BASED SURGERY

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

The Society of Thoracic Surgeons Blood Conservation Guideline Task Force:
Victor A. Ferraris, MD, PhD (Chair), Jeremiah R. Brown, PhD, George J. Despotis, MD, John W. Hammon, MD, T. Brett Reece, MD, Sibu P. Saha, MD, MBA, Howard K. Song, MD, PhD, and Ellen R. Clough, PhD

The Society of Cardiovascular Anesthesiologists Special Task Force on Blood Transfusion:
Linda J. Shore-Lesserson, MD, Lawrence T. Goodnough, MD, C. David Mazer, MD, Aryeh Shander, MD, Mark Stafford-Smith, MD, and Jonathan Waters, MD

The International Consortium for Evidence Based Perfusion:
Robert A. Baker, PhD, Dip Perf, CCP (Aus), Timothy A. Dickinson, MS, Daniel J. FitzGerald, CCP, LP, Donald S. Likosky, PhD, and Kenneth G. Shann, CCP

Division of Cardiovascular and Thoracic Surgery, University of Kentucky, Lexington, Kentucky (VAF, SPS), Department of Anesthesiology, University of Pittsburgh Medical Center, Pittsburgh, Pennsylvania (JW), Departments of Anesthesiology and Critical Care Medicine, Englewood Hospital and Medical Center, Englewood, New Jersey (AS), Departments of Pathology and Medicine, Stanford University School of Medicine, Stanford, California (LTG), Departments of Anesthesiology and Cardiothoracic Surgery, Montefiore Medical Center, Bronx, New York (LJS-L, KGS), Departments of Anesthesiology, Immunology, and Pathology, Washington University School of Medicine, St. Louis, Missouri (GJD), Dartmouth Institute for Health Policy and Clinical Practice, Section of Cardiology, Dartmouth Medical School, Lebanon, New Hampshire (JRB), Department of Cardiothoracic Surgery, Wake Forest School of Medicine, Winston-Salem, North Carolina (JWH), Department of Anesthesia, St. Michael's Hospital, University of Toronto, Toronto, Ontario (CDM), Cardiac Surgical Research Group, Flinders Medical Centre, South Australia, Australia (RAB), Department of Surgery, Medicine, Community and Family Medicine, and the Dartmouth Institute for Health Policy and Clinical Practice, Dartmouth Medical School, Hanover, New Hampshire (DSL), SpecialtyCare, Nashville, Tennessee (TAD), Department of Cardiac Surgery, Brigham and Women's Hospital, Harvard University, Boston, Massachusetts (DJF), Division of Cardiothoracic Surgery, Oregon Health and Science University Medical Center, Portland, Oregon (HKS), Department of Cardiothoracic Surgery, University of Colorado Health Sciences Center, Aurora, Colorado (TBR), Department of Anesthesiology, Duke University Medical Center, Durham, North Carolina (MS-S), and The Society of Thoracic Surgeons, Chicago, Illinois (ERC)

Gli studi

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“Cochrane 2006 meta analisi (studi randomizzati) 1++”

- Utilizzo di RPO riduce la % di pazienti trasfusi con sangue allogenico
- Efficacia > in chirurgia ortopedica rispetto alla cardiochirurgia
- Poca differenza in chirurgia ortopedica tra sangue non lavato e lavato
- Non sembrano  le complicanze post-operatorie (trombosi, infezioni,reintervento per sanguinamento, infarto miocardico)

Gli studi

HUMANITAS MATER DOMINI

"Cochrane 2006 meta analisi (studi randomizzati) 1++"

- 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

- Concludono che la pratica del recupero post-operatorio appare giustificata in chirurgia ortopedica maggiore (anca, ginocchio, colonna) mentre sembra meno utile in cardiochirurgia (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

Linee Guida

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“ ….. la sicurezza del sangue non lavato rimane ancora oggetto di discussione , nonostante la maggior parte degli studi effettuati abbia riportato un numero limitato di complicazioni severe……”

“ ….. senza dubbio il sangue lavato risponde ai criteri di moderna medicina trasfusionale ….”

S.I.M.T.I.

“Raccomandazioni sulla trasfusione peri-operatoria”

2010

No wash ibrid

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… è il SURNATANTE la causa di tutti i mali .. ?????

Grazie al **sensore elettronico** posto tra il reservoir e la sacca di trasfusione, il surnatante e la parte lipidica non vengono trasferite nella sacca di reinusione.

Il sensore è “intelligente” perchè la parte di surnatante è differente in ogni paziente.

Il sensore riconosce e blocca automaticamente ‘l’intera’ parte di surnatante.

Studio

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Studio Comparativo dispositivo di drenaggio Orthopas vs. Orthopas Dry Wash vs. Cell Saver Humanitas Mater Domini

BBTS 28th Annual Conference Bournemouth UK 9th – 11th September 2010

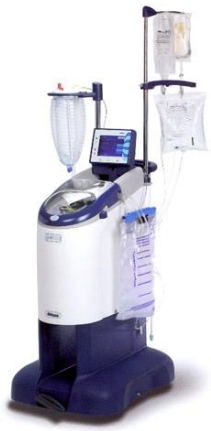
G.Albano, G.Inghilleri, M.Parrinello, U.Borromeo

Studio prospettico, randomizzato in 50 pazienti sottoposti ad intervento di protesi totale di ginocchio e anca primaria, standard ed elettiva, cementata e non cementata, con valutazioni in termini di impatto sugli elementi figurati del sangue, della flogosi e del danno d'organo, mediante il confronto del sistema di recupero tipo:

OrthoPas (No wash)

OrthoPas Dry Wash (Ibrid) (Wash)

Cell Saver



Risultati dello studio

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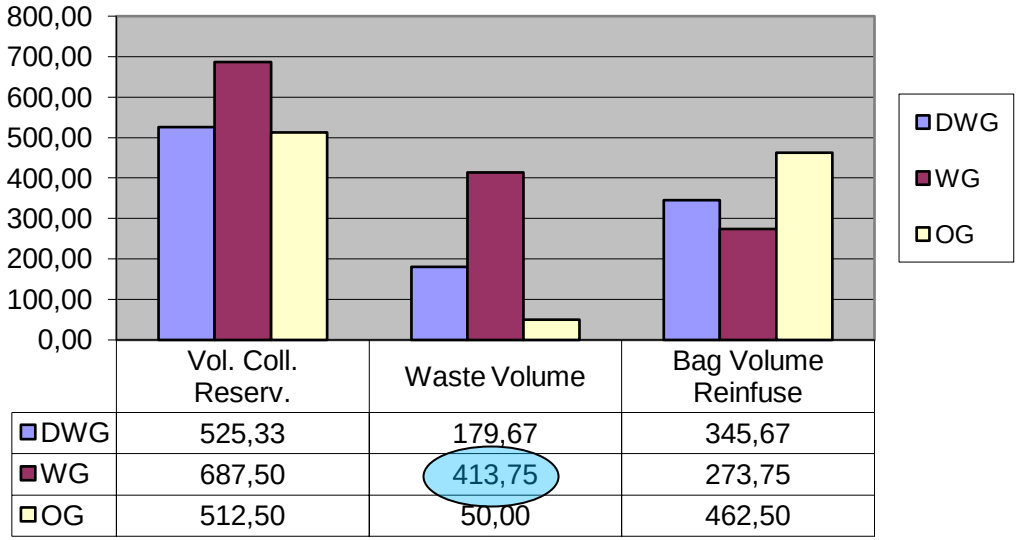
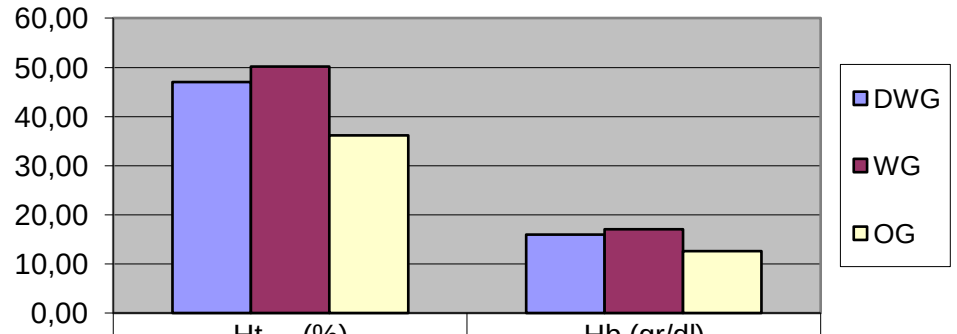
BLOOD VOLUME (ml)



	Vol. Coll. Reserv.	Waste Volume	Bag Volume Reinfuse
DWG	525,33	179,67	345,67
WG	687,50	413,75	273,75
OG	512,50	50,00	462,50

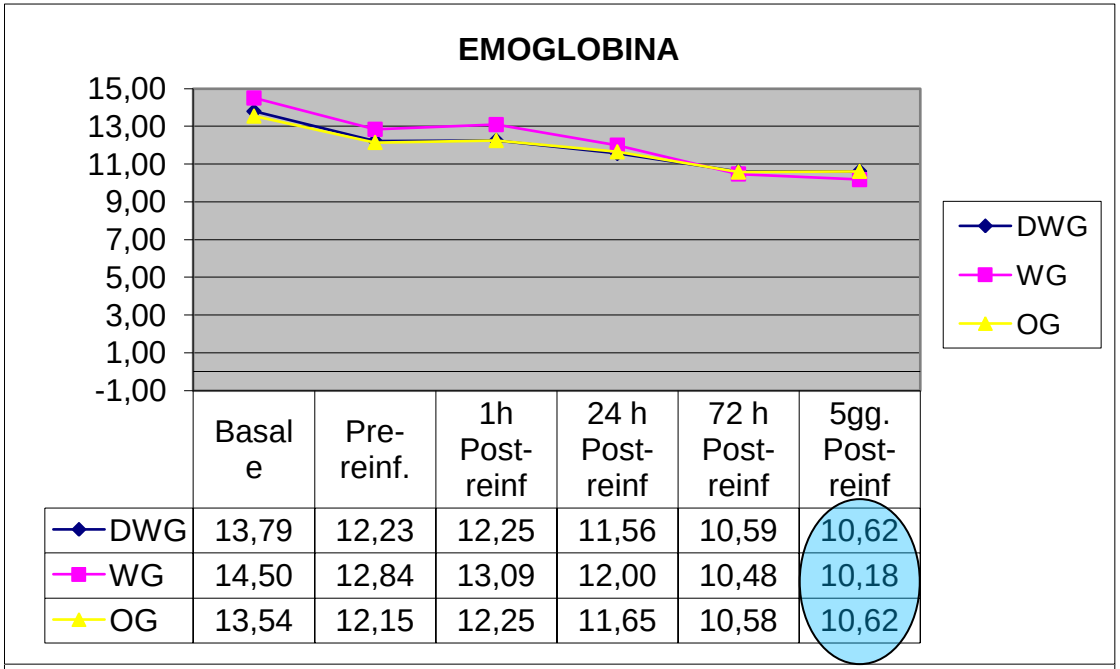
BLOOD COUNT BAG VOLUME



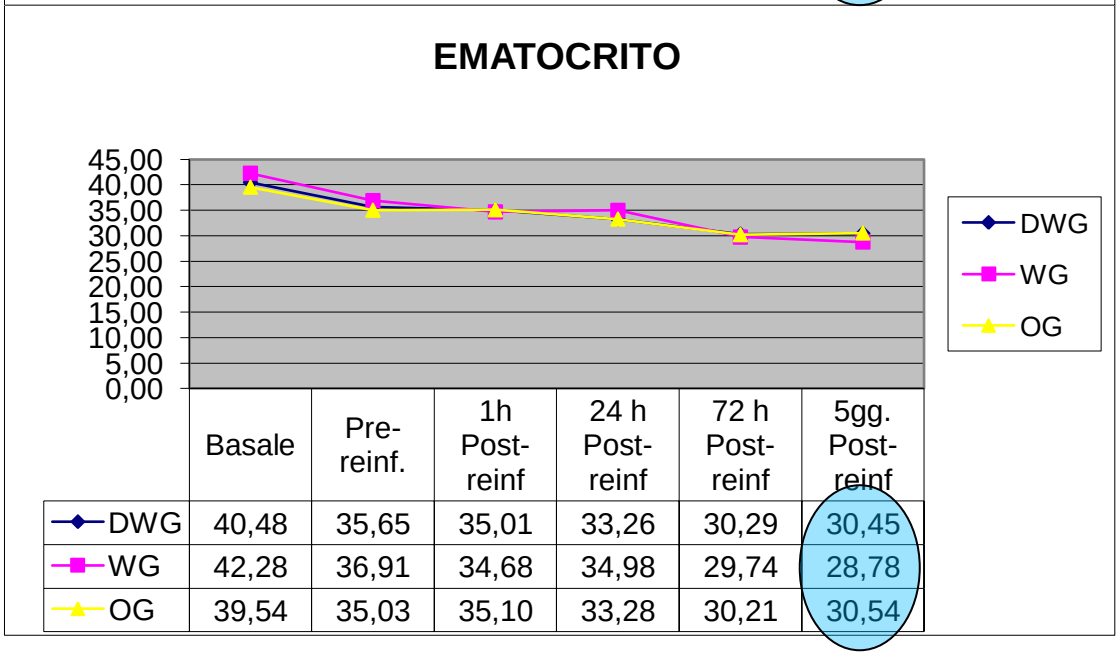
	Ht (%)	Hb (gr/dl)
DWG	47,03	15,98
WG	50,19	17,05
OG	36,19	12,58

Risultati dello studio

HUMANITAS MATER DOMINI



	Basale	Pre-reinf.	1h Post-reinf	24 h Post-reinf	72 h Post-reinf	5gg. Post-reinf
DWG	13,79	12,23	12,25	11,56	10,59	10,62
WG	14,50	12,84	13,09	12,00	10,48	10,18
OG	13,54	12,15	12,25	11,65	10,58	10,62



	Basale	Pre-reinf.	1h Post-reinf	24 h Post-reinf	72 h Post-reinf	5gg. Post-reinf
DWG	40,48	35,65	35,01	33,26	30,29	30,45
WG	42,28	36,91	34,68	34,98	29,74	28,78
OG	39,54	35,03	35,10	33,28	30,21	30,54

Risultati dello studio

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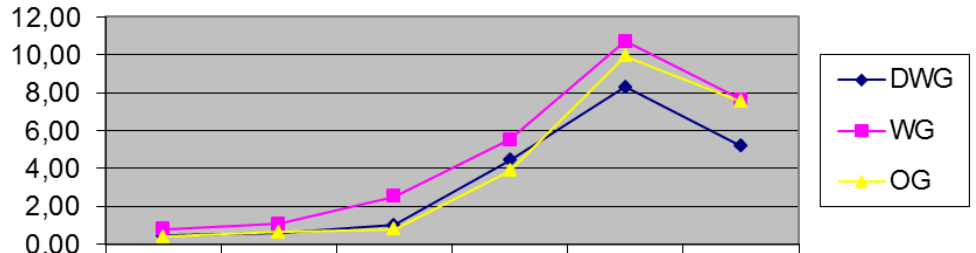
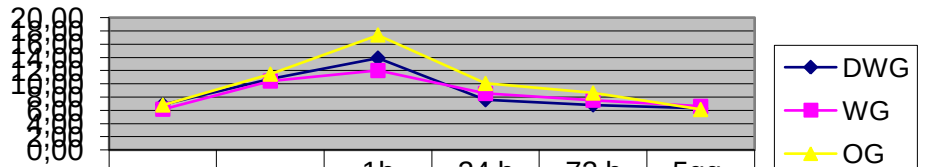
PROTEINA C REATTIVA



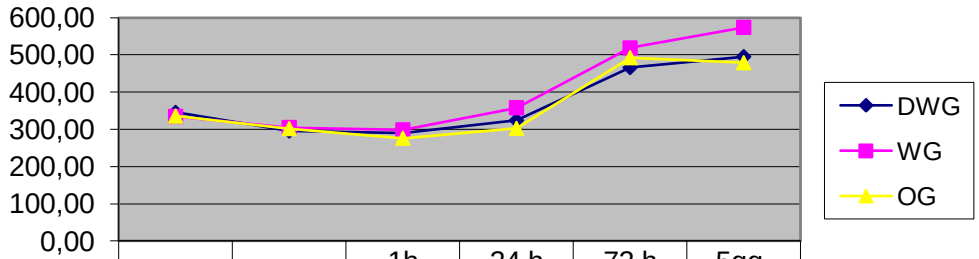
	Basale	Pre-reinf.	1h Post-reinf	24 h Post-reinf	72 h Post-reinf	5gg. Post-reinf
DWG	0,47	0,63	1,02	4,46	8,30	5,18
WG	0,81	1,08	**2.54**	5,52	10,72	7,62
OG	0,38	0,64	0,79	3,89	9,96	7,54

WBC ($10^3/mm^3$)



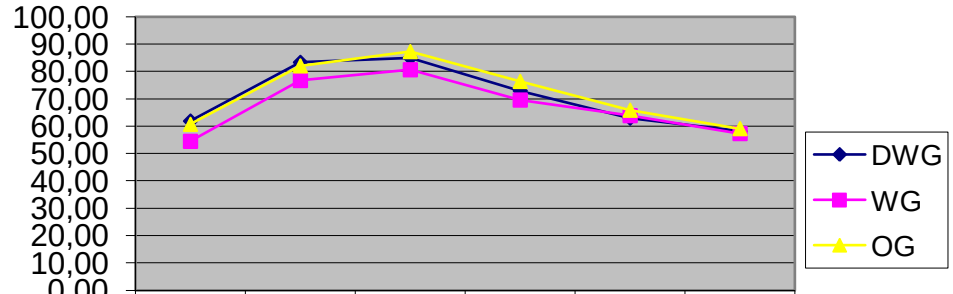
	Basale	Pre-reinf.	1h Post-reinf	24 h Post-reinf	72 h Post-reinf	5gg. Post-reinf
DWG	6,87	10,71	13,90	7,60	6,83	6,31
WG	6,17	10,43	12,02	8,55	7,54	6,60
OG	6,80	11,47	17,40	10,07	8,62	6,12

FIBRINOGENO



	Basale	Pre-reinf.	1h Post-reinf	24 h Post-reinf	72 h Post-reinf	5gg. Post-reinf
DWG	345,33	295,47	290,33	324,00	465,80	495,07
WG	334,67	304,92	298,58	358,00	518,50	573,75
OG	335,50	301,92	276,25	302,50	492,33	478,92

NEUTROFILI

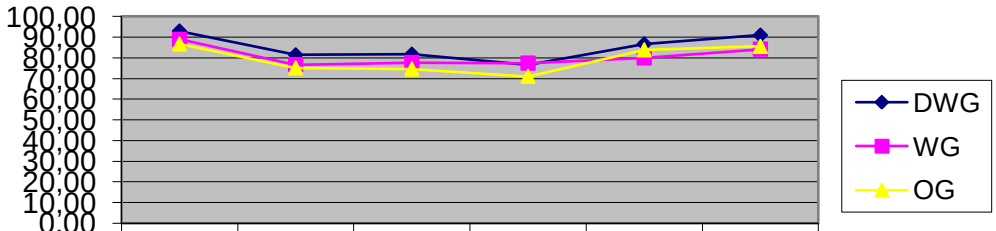


	Basale	Pre-reinf.	1h Post-reinf	24 h Post-reinf	72 h Post-reinf	5gg. Post-reinf
DWG	61,85	83,31	84,97	72,92	62,91	58,14
WG	54,44	76,68	80,60	69,53	63,83	57,28
OG	60,67	82,03	87,24	76,33	65,82	59,08

Risultati dello studio

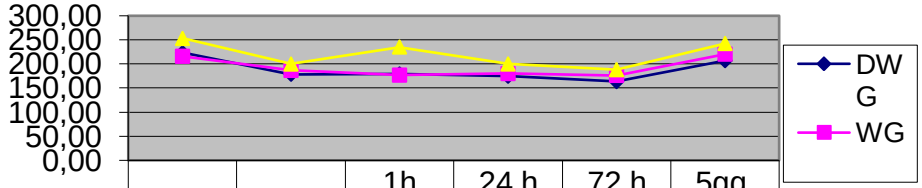
HUMANITAS MATER DOMINI

PT



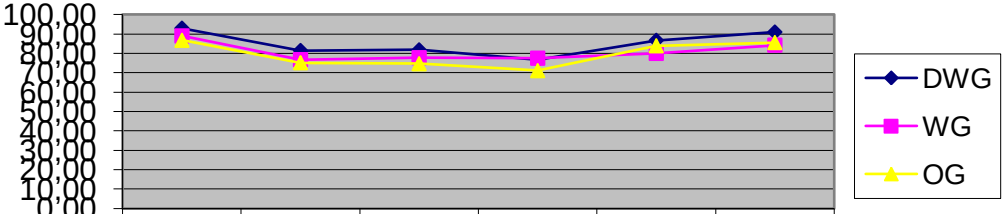
	Basale	Pre-reinf.	1h Post-reinf	24 h Post-reinf	72 h Post-reinf	5gg. Post-reinf
DWG	93,00	81,47	81,80	76,67	86,73	91,00
WG	89,00	76,75	77,75	77,50	80,00	84,25
OG	86,75	75,17	74,64	71,08	83,92	85,58

PIASTRINE



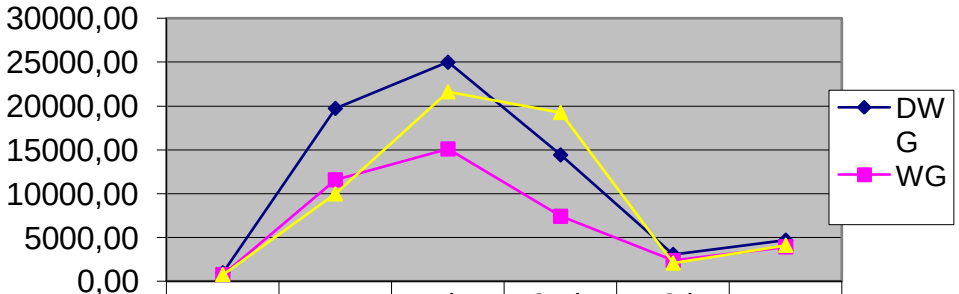
	Basale	Pre-reinf.	1h Post-reinf	24 h Post-reinf	72 h Post-reinf	5gg. Post-reinf
DWG	222,87	178,60	179,07	174,53	163,33	206,73
WG	215,75	186,50	176,75	179,92	176,17	220,17
OG	252,67	199,67	234,92	199,75	188,00	242,17

PTT



	Basale	Pre-reinf.	1h Post-reinf	24 h Post-reinf	72 h Post-reinf	5gg. Post-reinf
DWG	93,00	81,47	81,80	76,67	86,73	91,00
WG	89,00	76,75	77,75	77,50	80,00	84,25
OG	86,75	75,17	74,64	71,08	83,92	85,58

D-DIMERO

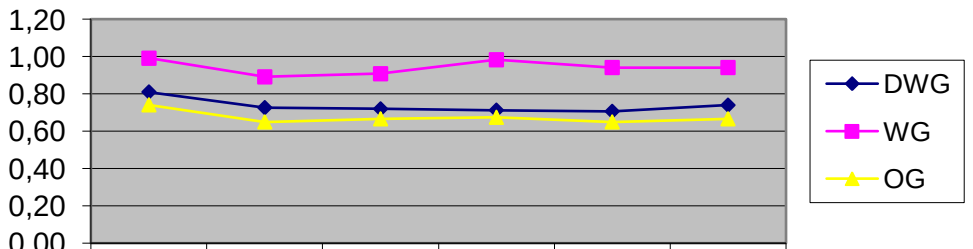


	Basale	Pre-reinf.	1h Post-reinf	24 h Post-reinf	72 h Post-reinf	5gg. Post-reinf
DWG	988,93	19731,	24996,	14425,	3077,3	4705,2
WG	772,25	11581,	15105,	7427,0	2383,7	3942,3
OG	778,50	9980,3	21625,	19264,	2094,6	4122,9

Risultati dello studio

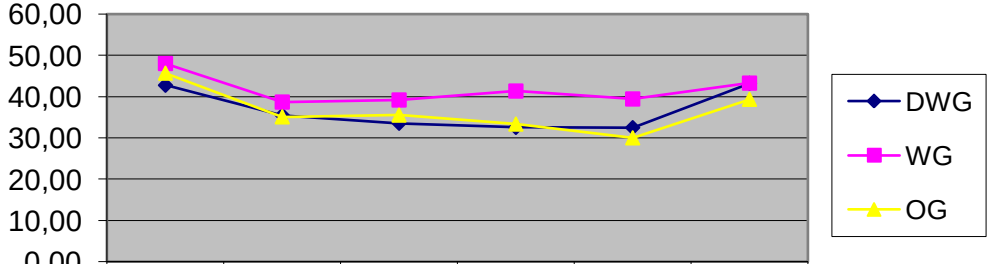
HUMANITAS MATER DOMINI

CREATININA



	Basale	Pre-reinf.	1h Post-reinf	24 h Post-reinf	72 h Post-reinf	5gg. Post-reinf
DWG	0,81	0,73	0,72	0,71	0,71	0,74
WG	0,99	0,89	0,91	0,98	0,94	0,94
OG	0,74	0,65	0,67	0,68	0,65	0,67

UREA

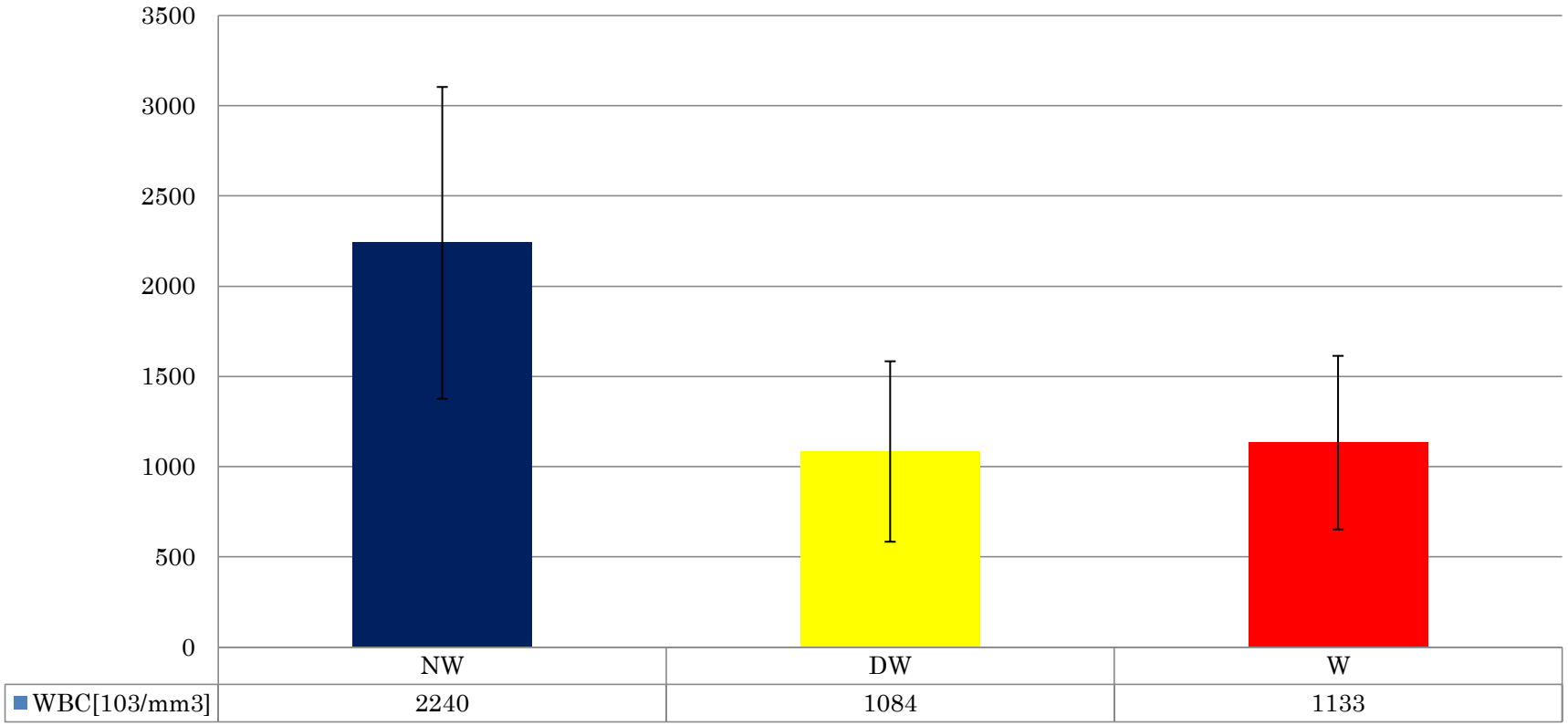


	Basale	Pre-reinf.	1h Post-reinf	24 h Post-reinf	72 h Post-reinf	5gg. Post-reinf
DWG	42,73	35,47	33,53	32,53	32,47	43,20
WG	48,00	38,67	39,17	41,33	39,42	43,25
OG	45,67	35,08	35,50	33,33	30,00	39,33

Risultati dello studio – sacca di ritrasfusione

HUMANITAS MATER DOMINI

WBC in the reinfusion bag [$10^3/mm^3$]

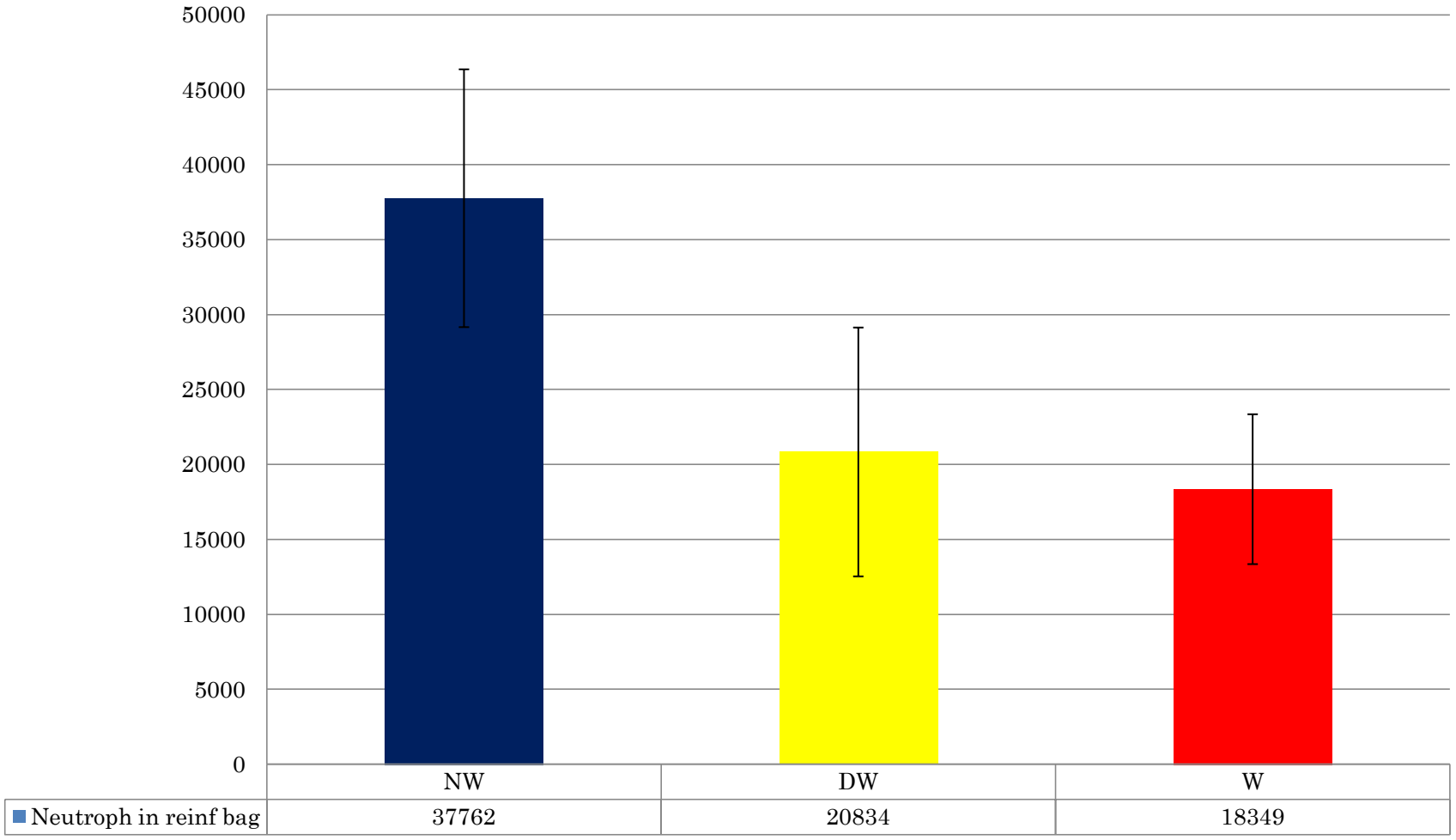


DRY WASH vs NO WASH = - 52%
WASH vs DRY WASH = + 4,5%

Risultati dello studio – sacca di ritrasfusione

HUMANITAS MATER DOMINI

Neutroph in reinfusion bag [n°/mm³]

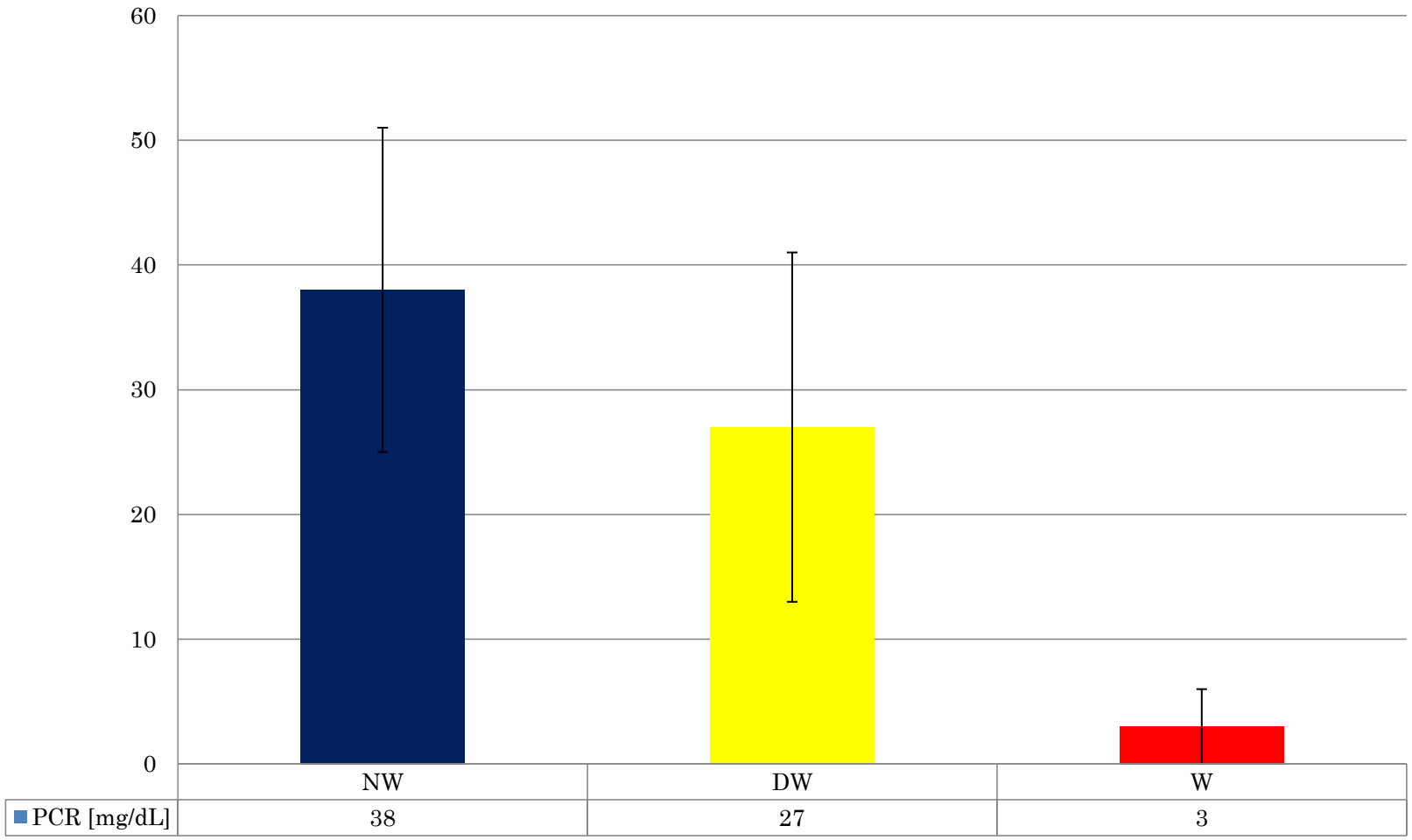


DRY WASH vs NO WASH = - 81%
WASH vs DRY WASH = - 13,5 %

Risultati dello studio – sacca di ritrasfusione

HUMANITAS MATER DOMINI

PCR [mg/dl] in the reinfusion bag

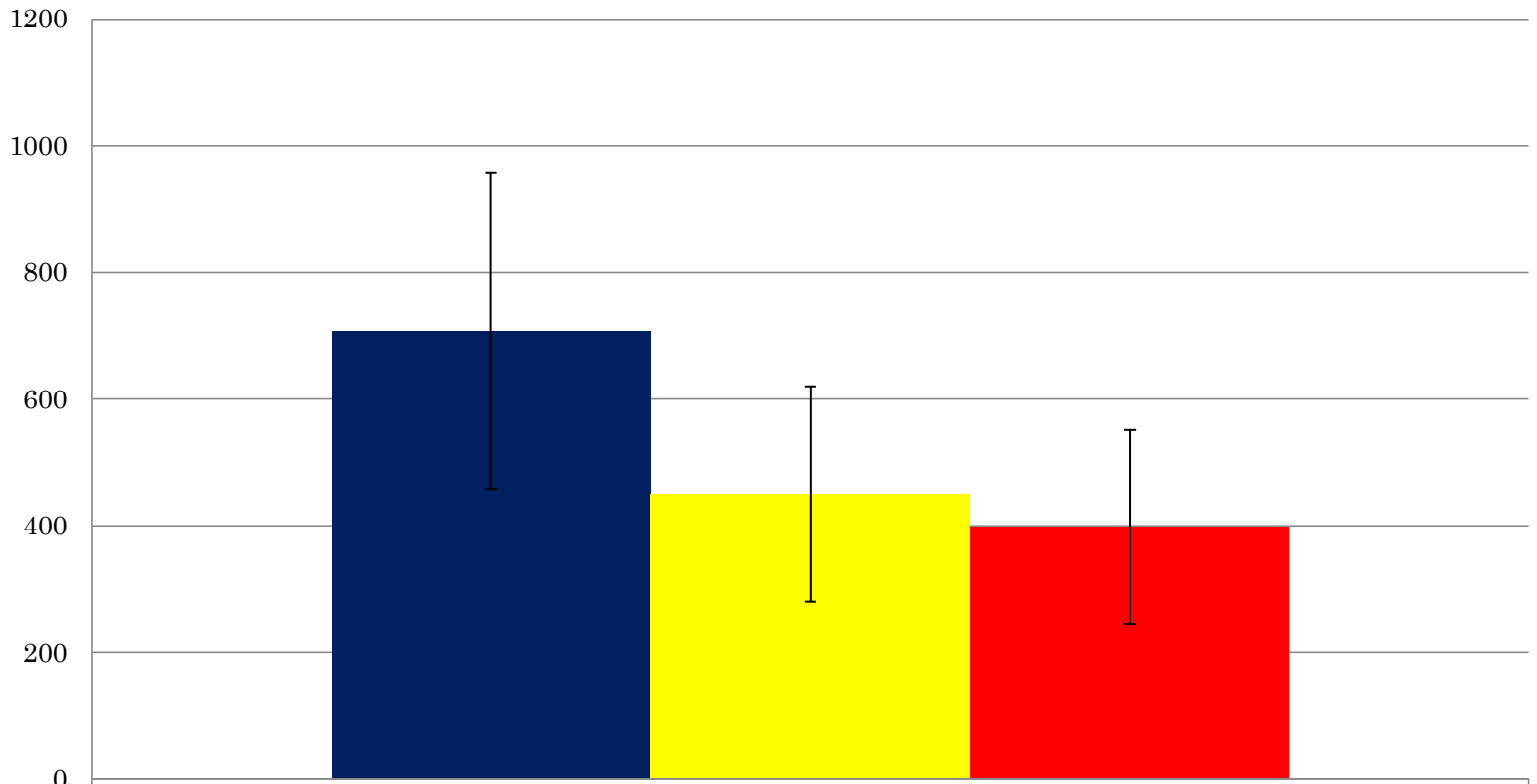


DRY WASH vs NO WASH = - 41%

Risultati dello studio – sacca di ritrasfusione

HUMANITAS MATER DOMINI

FPH [mg/dl] in the reinfusion bag



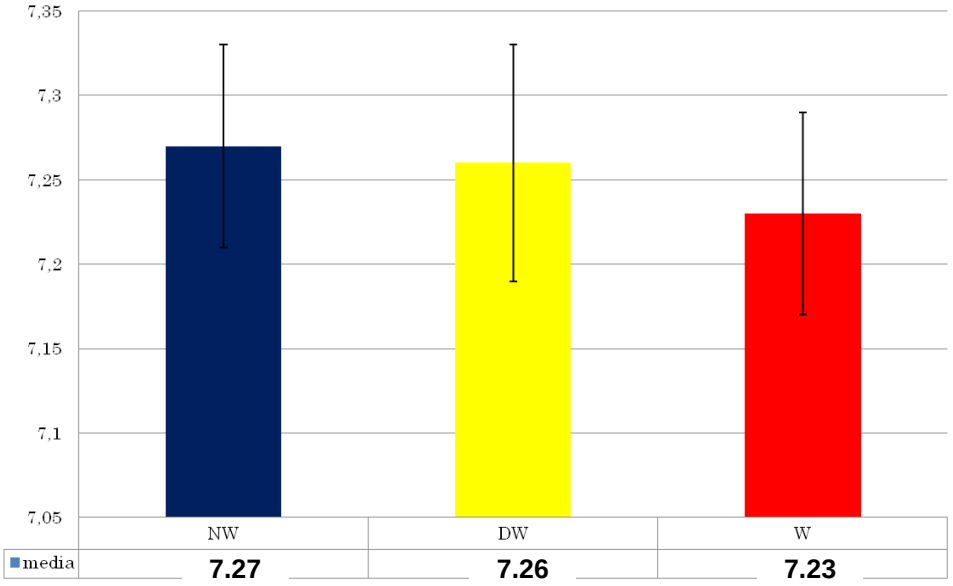
	FPH [mg/dl]
NO WASH	707
DRY WASH	450
WASH	398

DRY WASH vs NO WASH = - 57 %
WASH vs DRY WASH = -13 %

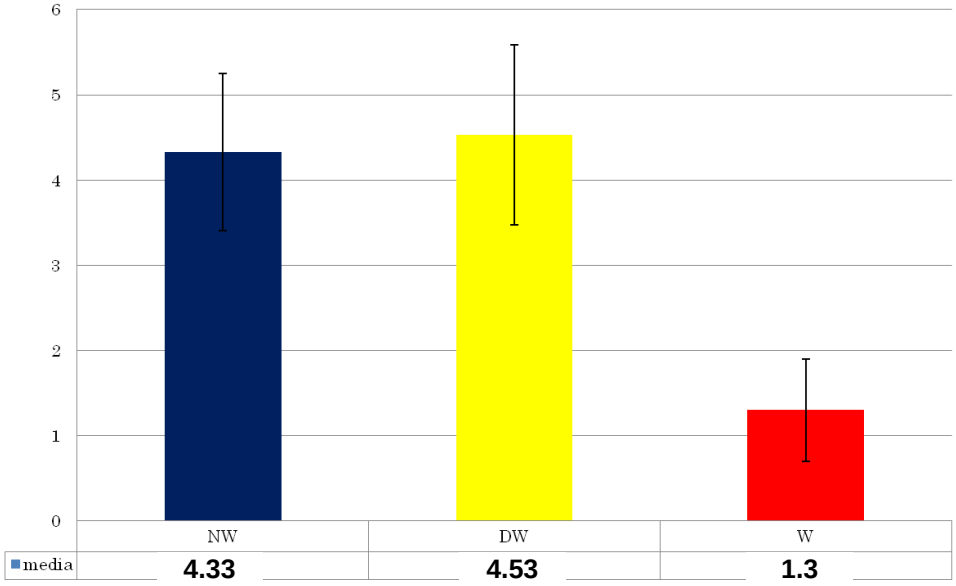
Risultati dello studio – sacca di ritrasfusione

HUMANITAS MATER DOMINI

PH



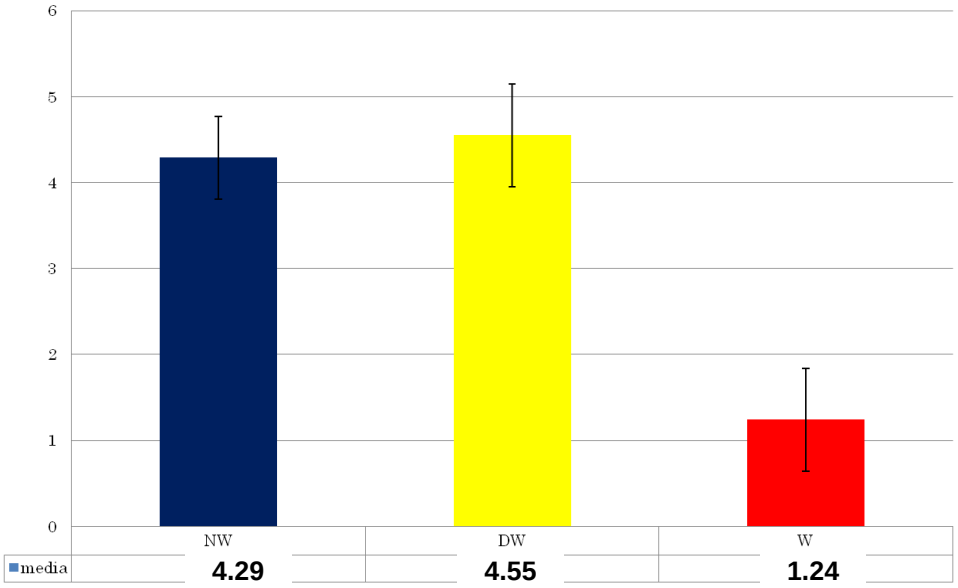
LATTATI (mmol/l)



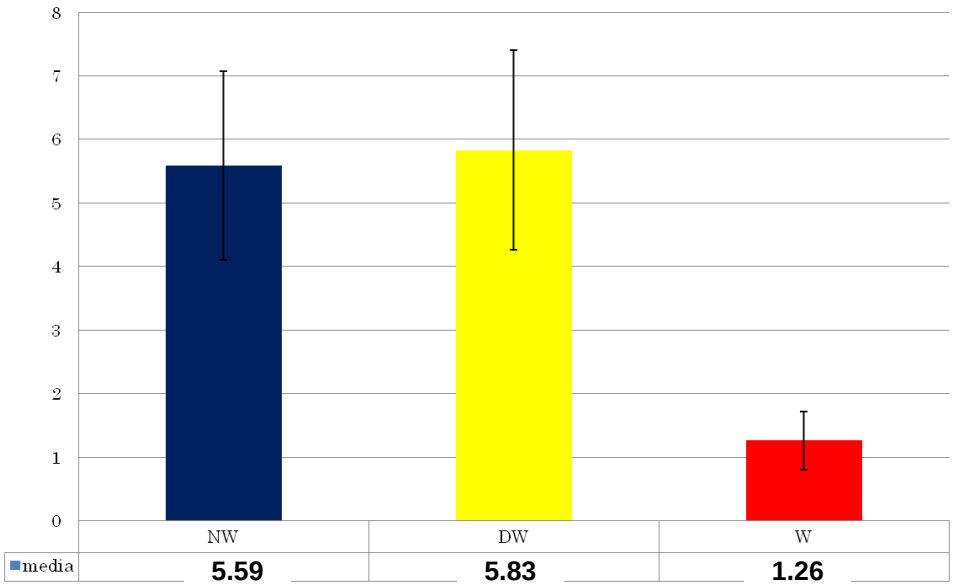
Risultati dello studio – sacca di ritrasfusione

HUMANITAS MATER DOMINI

K+



Proteine Totali [gr/dl]



Conclusioni … trigger reinfusionali

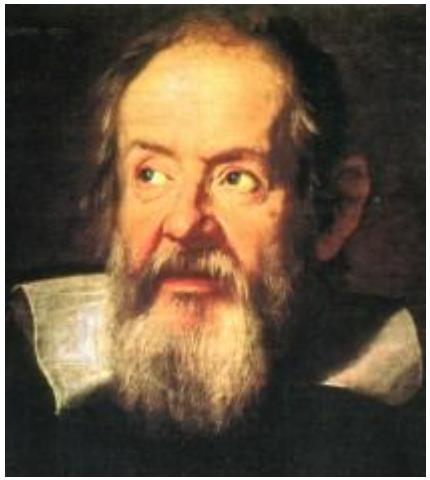
HUMANITAS MATER DOMINI

Valutazione quantitativa

- perdite < a 500 / 600cc giustificano il RPO anche in pazienti con Hb compresa tra 12gr/dl e 15gr/dl ??
- se perdite attese tra 500 e 1200cc in caso di sistema NO WASH focalizzare e personalizzare la quantità di surnatante
- se perdite > 1200cc utilizzare sistemi di lavaggio dell'emazie

Valutazione qualitativa

esistono parametri di esclusione efficaci oltre alla suggerita Hb libera ?... (ad esempio, Lattati, K)



…… non giudicatemi perché vi appaia che io ami

la "tecnologia" più degli uomini e più di Dio …

…. allo stesso modo non condannatemi

perché ai vostri occhi vi sembri un uomo "falsamente umile" ….

…. ma vi prego di credere io amo solo e soltanto

la "tecnologia dell'umiltà" …..

"Galileo Galilei"