

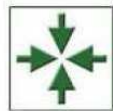
P.O. UMBERTO I NOCERA INFERIORE

**DIPARTIMENTO DI ONCO-EMATOLOGIA**



## NUOVI PARAMETRI EMATOLOGICI: VALIDAZIONE ED APPLICAZIONE NELLA PRATICA CLINICA

**Paolo Danise**



FONDAZIONE IRCCS  
ISTITUTO NAZIONALE  
DEI TUMORI



**EMATOLOGIA  
DI LABORATORIO:**  
percorsi diagnostici e obiettivi clinici.

**Milano, 11-12 Novembre 2010**



# NUOVI PARAMETRI EMATOLOGICI: VALIDAZIONE ED APPLICAZIONE NELLA PRATICA CLINICA

- **Aspetti generali**
- **RDW – implicazioni cliniche**
- **Aspetti qualitativi dei reticolociti**
- **Eritroblasti – responsabilità del dato**
- **Mielodisplasia**

## **FUNZIONI DI UN NUOVO PARAMETRO**

Migliorare la capacità del laboratorio nel fornire dati accurati

Indirizzare il laboratorista o il clinico verso un sospetto di patologia

Fornire uno strumento di monitoraggio di un percorso clinico-terapeutico

Aprire nuove frontiere diagnostiche

## **Un nuovo parametro nasce dalla ricerca industriale**

La ricerca industriale ha una indiscutibile (ed accettabile) motivazione economica

Raramente un nuovo parametro nasce da una richiesta clinica

Il primo target della ricerca industriale è il laboratorista

Il passaggio al campo clinico non ha alcun percorso strutturato e consolidato

Questo passaggio è una terra di nessuno in cui possono (devono?) agire industria, società scientifiche, singoli operatori

# OSTACOLI NELLA VITA DI UN NUOVO PARAMETRO

Analizzatore dipendenza



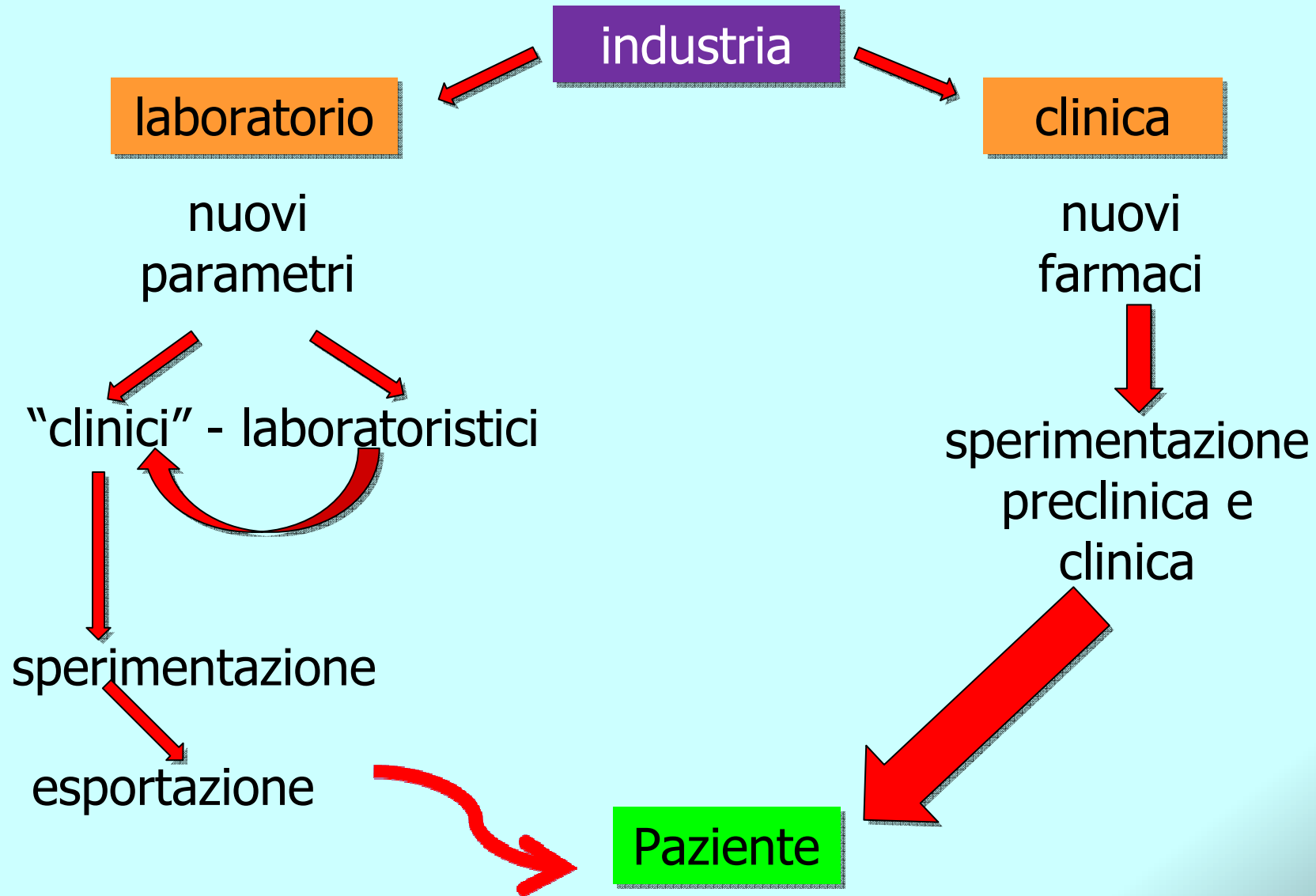
Scarso impatto della cultura di laboratorio

Difficoltà del laboratorista a comprendere il reale potenziale clinico

Scarsa pubblicizzazione in campo clinico



# Sviluppo della ricerca



# Parametri emocitometrici "tradizionali"

Operatore

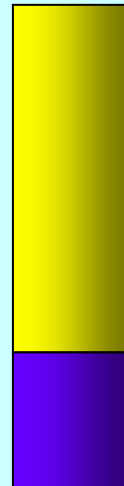
Analizzatore

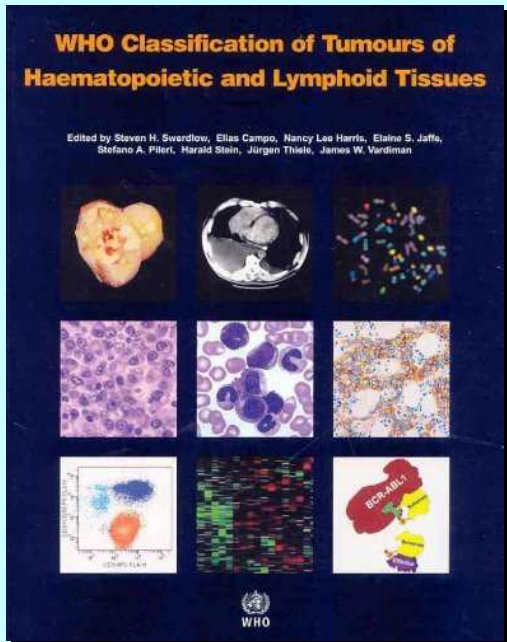


# "Nuovi" parametri ematologici

Operatore

Analizzatore





## Why classify?

Classification is the language of medicine: diseases must be described, defined and named before they can be diagnosed, treated and studied



## **Emocitometria classica:**

L'operatore monitora i parametri strumentali, valida i dati, decide approfondimento

**"serve" il clinico**

## **"Nuovi" parametri ematologici:**

L'operatore può validare il dato, può promuoverne l'esportazione, ne diviene il referente culturale

**"accompagna" il clinico**

L'allarme strumentale *non*  
è un parametro



comunicare un allarme  
strumentale vuol dire  
comunicare incapacita' a  
definire la presenza o  
meno di quanto suggerito  
dallo strumento



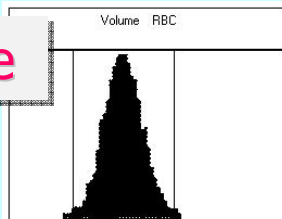
# RDW

Parametro sintetico (o riduttivo?): è una rappresentazione numerica della ampiezza di una curva di distribuzione volumetrica

Manca di standardizzazione metodologica, pur avendo una univocità terminologica rara nei nuovi parametri strumentali

Ha trovato posto in molte pubblicazioni cliniche, con scarso approfondimento fisiopatologico

normale



elevato



Am J Clin Pathol. 1983 Sep;80(3):322-6.

**Improved classification of anemias by MCV and RDW.**

[Bessman JD](#), [Gilmer PR Jr](#), [Gardner FH](#)

Arch Intern Med. 1988 Apr;148(4):822-4.

**Erythrocyte anisocytosis. Visual inspection of blood films vs automated analysis of red blood cell distribution width.**

[Simel DL](#), [DeLong ER](#), [Feussner JR](#), [Weinberg JB](#), [Crawford J](#).

Health Services Research Field Program, Durham Veterans Administration  
Medical Center, NC 27705

JAMA. 1992 Sep 16;268(11):1413.

**High red cell distribution width in alcoholics: not  
due to liver disease.**

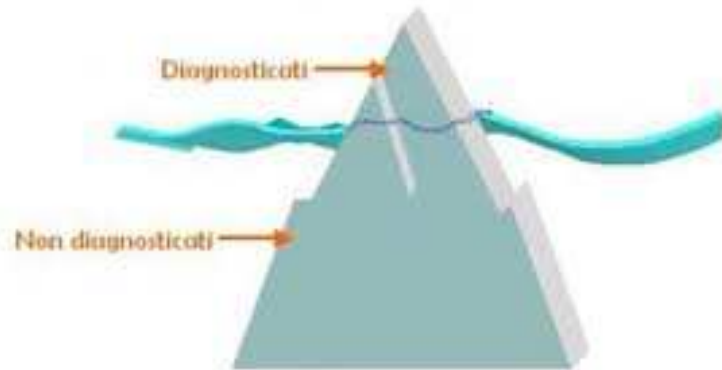
Seppä K, Sillanaukee P.



## RDW E CELIACHIA



### L'iceberg della celiachia



SONO DISPONIBILI

***OSTIE SENZA GLUTINE***

PER LA SANTA COMUNIONE



## **Increased Red Cell Distribution Width and coeliac disease**

Brusco G. et al Dig. Liver Dis. 2000

## **RDW: new screening test for coeliac disease?**

Guglielmi V. et al Minerva Med 2002

L'incremento di RDW risulta la più frequente anomalia ematologica (57.9 - 67%) in adulti CD

L'incremento di RDW può essere considerato predittivo di CD ed autorizzare alla ricerca di anticorpi specifici

L'RDW elevato è più frequente dell'anemia sideropenica nei pazienti CD

L'RDW diviene normale dopo dieta priva di glutine

## **Monitoring dietary compliance in coeliac disease using red cell distribution width**

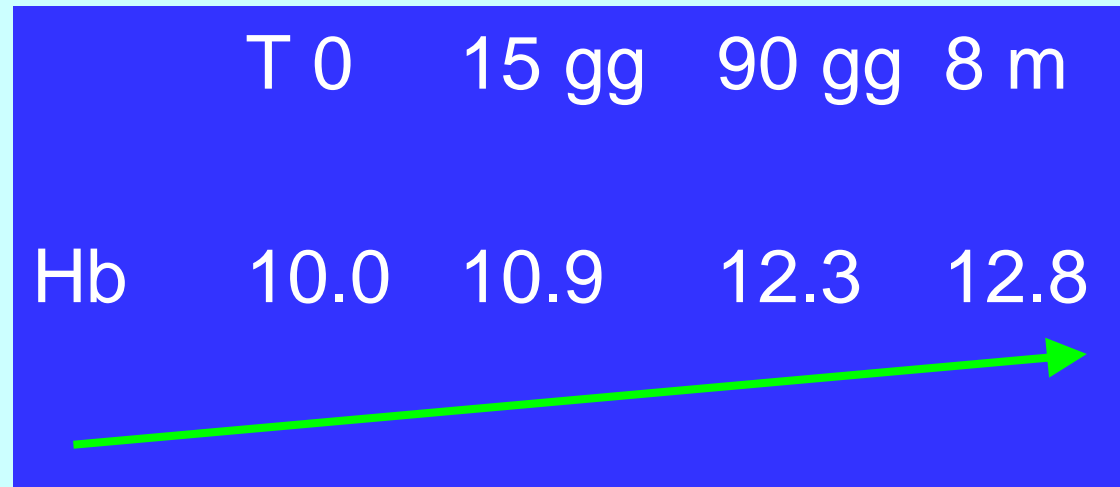
**Mitchel R M et al. Int. J. Clin. Pract. 2002**

Significativo decremento di RDW (17.3 vs 13.8%) dopo 12 mesi di dieta, corrispondente a siero conversione degli EMA e normalizzazione di ferro sierico, B 12 e folati

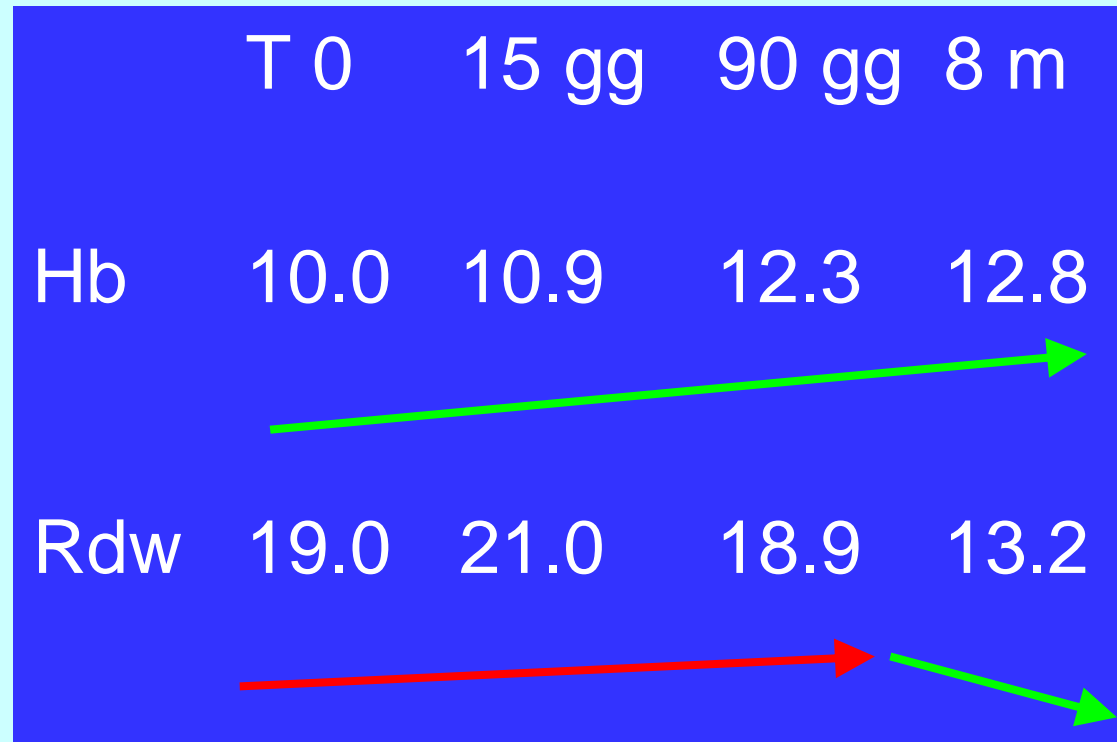
Il monitoraggio dell'RDW è un semplice mezzo per valutare la risposta alla dieta nella malattia celiaca



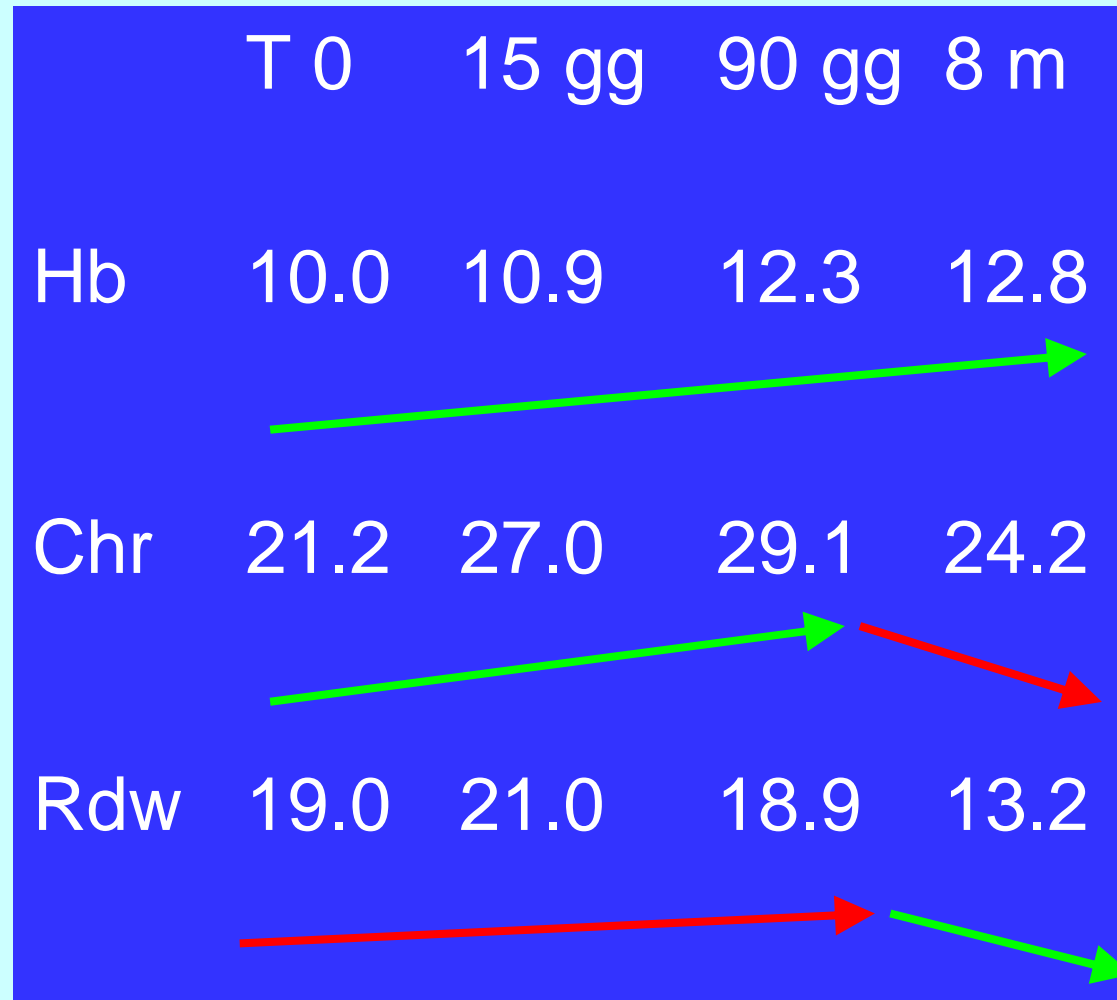
**S.F. anni 42 ♀ ipermenorrea, anemia sideropenica, celiachia  
(hb 10,0 g/dl MCV 68.5 fl ferritina 5ng/ml)**



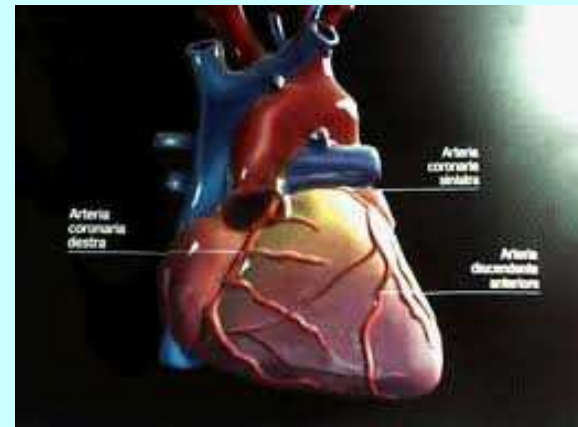
**S.F. anni 42 ♀ ipermenorrea, anemia sideropenica, celiachia  
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**S.F. anni 42 ♀ ipermenorrea, anemia sideropenica, celiachia  
(hb 10,0 g/dl MCV 68.5 fl ferritina 5ng/ml)**



# RDW E PATOLOGIE CARDIOLGICHE



Exp Clin Cardiol. 2010 Fall;15(3):37-40.

**High red blood cell distribution width is closely associated with risk of carotid artery atherosclerosis in patients with hypertension.**

Wen Y.

Am J Cardiol. 2010 Oct 1;106(7):988-93. Epub 2010 Aug 11.

**Red cell distribution width and risk of coronary heart disease events.**

[Zalawadiya SK](#), [Veeranna V](#), [Niraj A](#), [Pradhan J](#), [Afonso L](#).

Department of Internal Medicine, Wayne State University Detroit Medical Center,  
Detroit, Michigan, USA.

In conclusion, a higher RDW appears to be a powerful independent predictor of future CHD risk.

Am J Cardiol. 2010 Feb 1;105(3):312-7. Epub 2009 Dec 21.

## **Relation between red cell distribution width and clinical outcomes after acute myocardial infarction.**

[Dabbah S](#), [Hammerman H](#), [Markiewicz W](#), [Aronson D](#).

Department of Cardiology, Rambam Medical Center, and the Bruce Rappaport Faculty of Medicine and Research Institute, Technion, Israel Institute of Technology, Haifa, Israel.

Eur J Heart Fail. 2010 Mar;12(3):213-4

## Red cell distribution width in chronic heart failure: a new independent marker for prognosis?

[Hammarsten O](#), [Jacobsson S](#), [Fu M](#).

Am J Cardiol. 2009 Sep 15;104(6):868-72.

## **Usefulness of red cell distribution width as a prognostic marker in pulmonary hypertension.**

[Hampole CV](#), [Mehrotra AK](#), [Thenappan T](#), [Gomberg-Maitland M](#), [Shah SJ](#).

Section of Cardiology, Department of Medicine, University of Chicago,  
Chicago, Illinois, USA.

In conclusion, RDW is independently associated with death in patients with PH and performs better as a prognostic indicator than N-terminal-pro-B-type natriuretic peptide (NT-pro-BNP)

Thromb Haemost. 2009 Sep;102(3):581-7.

## **Red cell distribution width (RDW) as a predictor of long-term mortality in patients undergoing percutaneous coronary intervention.**

[Poludasu S](#), [Marmur JD](#), [Weedon J](#), [Khan W](#), [Cavusoglu E](#).

Division of Cardiology, Department of Medicine, State University of New York, Downstate Medical Center, Brooklyn, NY 11203-2098, USA

Higher **RDW** was a strong and independent predictor of long-term mortality in patients undergoing PCI **who were not anaemic at baseline.**



J Card Fail. 2009 Aug;15(6):517-22. Epub 2009 Mar 9.

## **Relation between red cell distribution width with echocardiographic parameters in patients with acute heart failure.**

[Oh J](#), [Kang SM](#), [Hong N](#), [Choi JW](#), [Lee SH](#), [Park S](#), [Shin MJ](#), [Jang Y](#), [Chung N](#).

Cardiology Division, Yonsei Cardiovascular Center and Cardiovascular Research Institute, Seoul, Korea

**CONCLUSIONS:** We found a novel relation between **higher levels of RDW** and elevated E/E' in patients with AHF. This novel finding raises the possibility that a simple marker, RDW may be associated with elevated LVFP in patients with AHF.

J Gerontol A Biol Sci Med Sci. 2010 Mar;65(3):258-65. Epub 2009 Oct 30.

## **Red cell distribution width and mortality in older adults: a meta-analysis.**

[Patel KV](#), [Semba RD](#), [Ferrucci L](#), [Newman AB](#), [Fried LP](#), [Wallace RB](#), [Bandinelli S](#), [Phillips CS](#), [Yu B](#), [Connelly S](#), [Shlipak MG](#), [Chaves PH](#), [Launer LJ](#), [Ershler WB](#), [Harris TB](#), [Longo DL](#), [Guralnik JM](#).

Laboratory of Epidemiology, Demography, and Biometry, National Institute on Aging, Bethesda, Maryland 20892-9205, USA

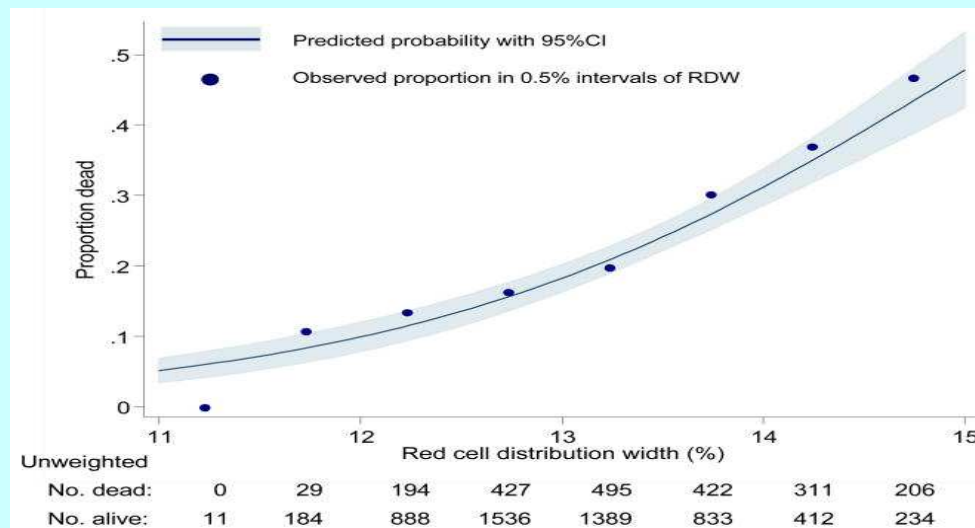
**CONCLUSIONS:** **RDW** is a routinely reported test that **is a powerful predictor of mortality** in community-dwelling older adults with and without age-associated diseases. **The biologic mechanisms underlying this association merit investigation.**

Arch Intern Med. 2009 Mar 9;169(5):515-23.

## Red blood cell distribution width and the risk of death in middle-aged and older adults.

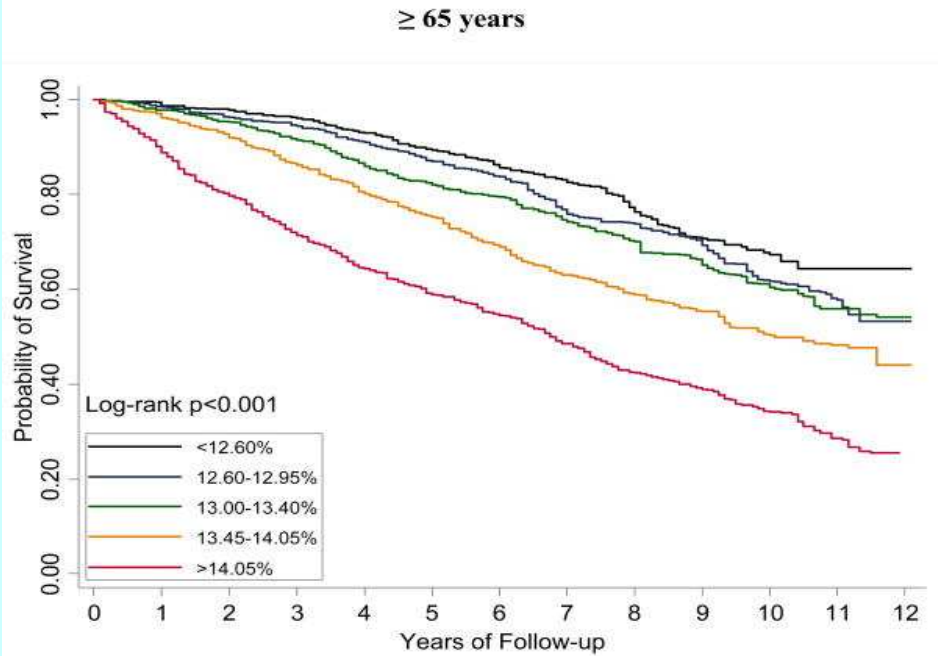
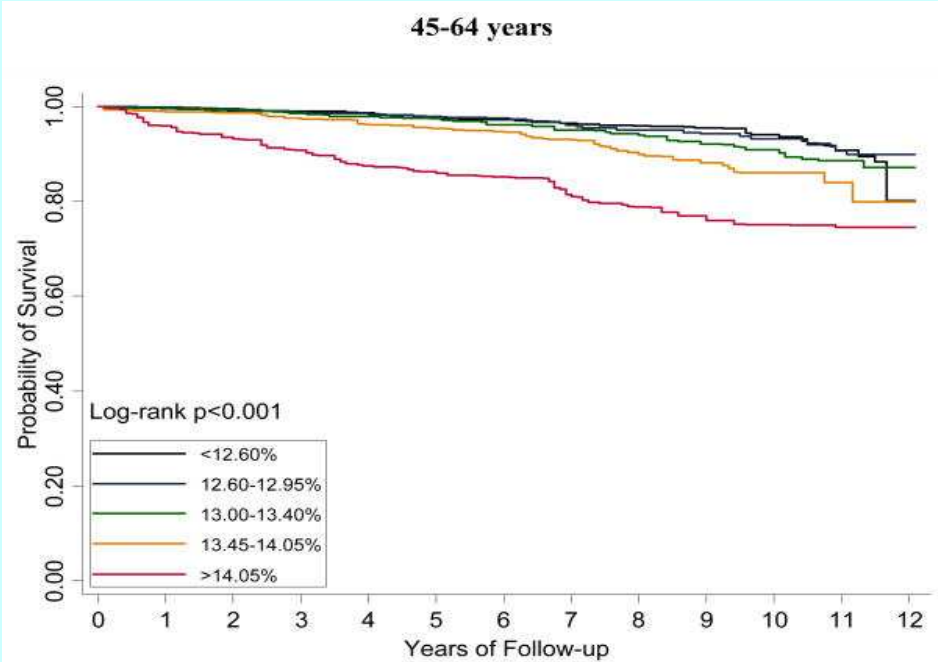
[Patel KV](#), [Ferrucci L](#), [Ershler WB](#), [Longo DL](#), [Guralnik JM](#).

Laboratory of Epidemiology, Demography, and Biometry, National Institute on Aging, 7201 Wisconsin Ave, Ste 3C309, Bethesda, MD 20814, USA



**CONCLUSION:** Red blood cell distribution width is a widely available test that is a strong predictor of mortality in the general population of adults 45 years or older

**RDW**



Clin Nutr. 2010 Oct;29(5):600-4. Epub 2010 Mar 23.

**Serum antioxidants and inflammation predict red cell distribution width in older women: the Women's Health and Aging Study I.**

[Semba RD](#), [Patel KV](#), [Ferrucci L](#), [Sun K](#), [Roy CN](#), [Guralnik JM](#), [Fried LP](#).

Johns Hopkins University School of Medicine, Baltimore, MD 21287, United States

**CONCLUSION:** Serum selenium is an independent predictor of RDW and may potentially mediate effects on RDW through IL-6.

# RETIColocITI

Il conteggio dei reticolociti costituisce la più scottante evidenza della difficoltà di esportazione di un nuovo parametro

Costituisce un dato fondamentale nella diagnostica delle anemie

È utile per la massima parte dei medici non ematologi che affrontano la stragrande maggioranza delle anemie

È ancora a tutt'oggi ampiamente sottorichiesto e non è diventato uno strumento diagnostico ordinario



## Aspetti qualitativi dei reticolociti

- Gli indici reticolocitari costituiscono un' *istantanea* sullo stato di salute dell'eritropoiesi
- Gli indici eritrocitari costituiscono il *riassunto* degli ultimi 3 mesi dell' eritropoiesi
- La valutazione comparata è forse lo strumento più importante nello studio di una anemia

# RETICOLOCITI ADVIA 120, SYSMEX XE 2100, PENTRA DX 120 CORRELAZIONE DI CONTEGGI E PARAMETRI QUALITATIVI

P. DANISE, A. ROVETTI, D. AVINO, G. RESCIGNO, A. DI PALMA, G. MORELLI C. ESPOSITO, E. GRIMALDI\*  
DIAGNOSTICA EMATOLOGICA P.O. UMBERTO I NOCERA INFERIORE  
\* EMATOLOGIA DI LABORATORIO UNIVERSITA' FEDERICO II NAPOLI

756 pazienti (343m, 413f, età media 47, range 2 gg. – 87 anni).

	<i>r</i>	<i>p</i>
<b>MCVr / MRV</b>	<b>0,82</b>	<b>&lt; 0,001</b>
<b>Ret He / CHr</b>	<b>0,87</b>	<b>&lt; 0,001</b>
<b>MCVr / CHr</b>	<b>0,78</b>	<b>&lt; 0,001</b>
<b>MRV / CHr</b>	<b>0,64</b>	<b>&lt; 0,001</b>
<b>MRV / Ret He</b>	<b>0,65</b>	<b>&lt; 0,001</b>
<b>MCVr / Ret He</b>	<b>0,68</b>	<b>&lt; 0,001</b>



# STUDIES ON RED BLOOD CELL DIAMETER

## III. THE RELATIVE DIAMETER OF IMMATURE (RETICULOCYTES) AND ADULT RED BLOOD CELLS IN HEALTH AND ANEMIA, ESPECIALLY IN PERNICIOUS ANEMIA

By ELBERT LAPSLEY PERSONS

*(From the Medical Service of the Collis P. Huntington Memorial Hospital of Harvard University and the Thorndike Memorial Laboratory of the Boston City Hospital)*

(Received for publication April 15, 1929)

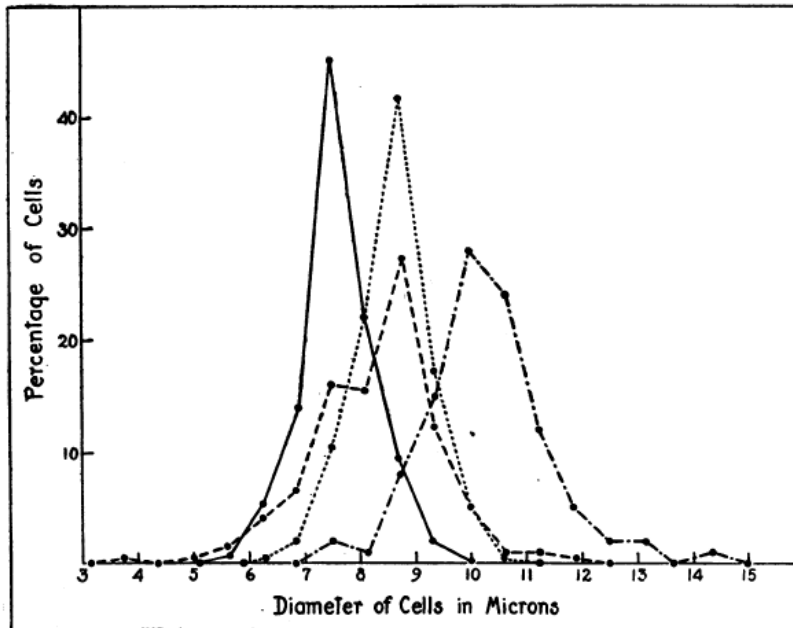


FIG. 1. FREQUENCY CURVES OF THE SIZE RELATIONSHIPS BETWEEN THE DIAMETERS OF RETICULOCYTES AND ADULT RED BLOOD CELLS IN NORMAL BLOODS AND IN A CASE OF PERNICIOUS ANEMIA

### CONCLUSIONS

1. There is a very intimate relationship between the sizes of reticulocytes (immature) and adult red blood cells in the same blood, as indicated by the fact that the shapes of the cell diameter distribution curves are almost identical.

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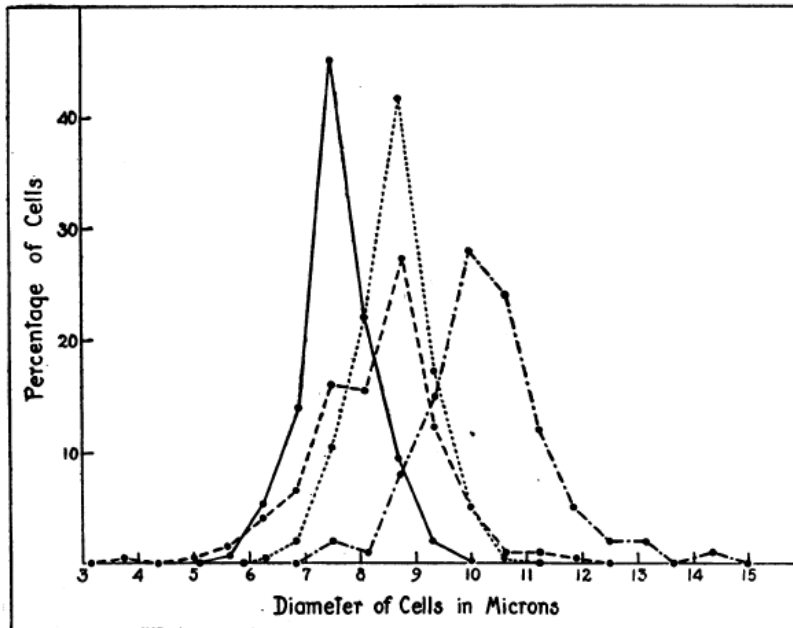


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### CONCLUSIONS

2. Reticulocytes of normal bloods average enough larger than adult red blood cells of the same bloods so that the ratio of mean reticulocyte diameter to mean adult red blood cell diameter varies from about 1.12 to 1.15.

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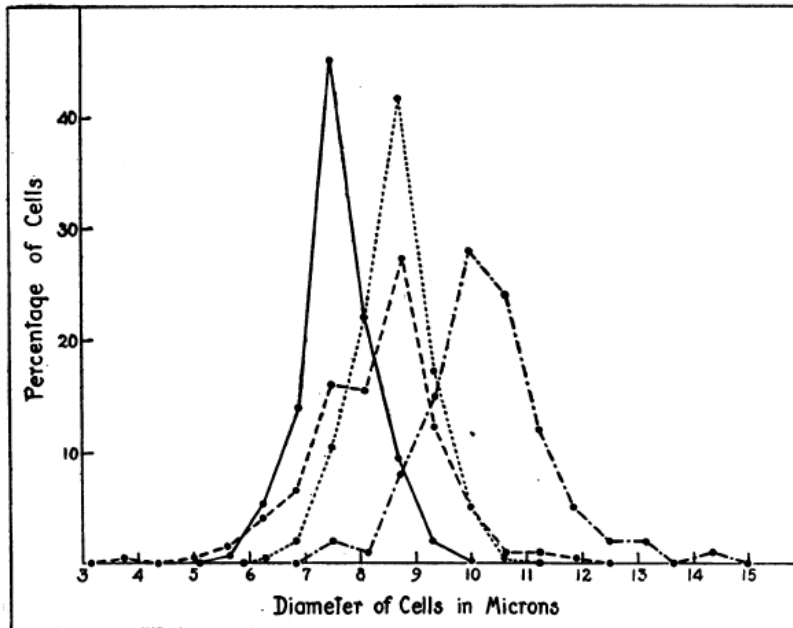


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### CONCLUSIONS

3. In chronic "secondary" anemias the reticulocytes are relatively smaller than those from normal bloods, so that this ratio varies from 1.06 to 1.10.

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*(From the Medical Service of the Collis P. Huntington Memorial Hospital of Harvard  
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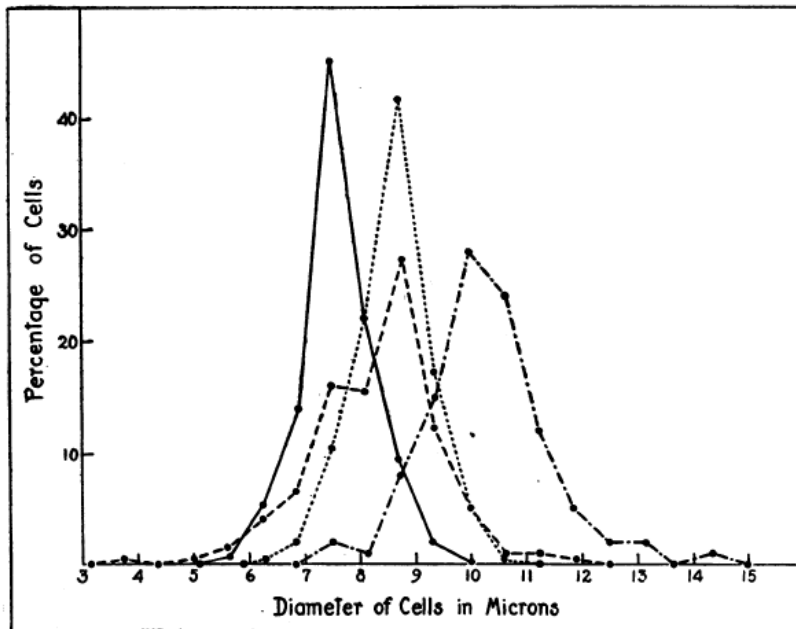


FIG. 1. FREQUENCY CURVES OF THE SIZE RELATIONSHIPS BETWEEN THE DIAMETERS OF RETICULOCYTES AND ADULT RED BLOOD CELLS IN NORMAL BLOODS AND IN A CASE OF PERNICIOUS ANEMIA

### CONCLUSIONS

4. In cases of pernicious anemia having low red blood cell counts (600,000 to 2,200,000 per cubic millimeter) the reticulocytes are much larger than the adult red blood cells, so that the ratio between the mean diameters is between 1.21 and 1.29. This may be characteristic of the blood picture of this disease.

....dopo 70 anni....

Blood. 1994 May 15;83(10):3100-1.

**Reticulocyte hemoglobin content (CHr): early indicator of iron deficiency and response to therapy.**

[Brugnara C](#), [Laufer MR](#), [Friedman AJ](#), [Bridges K](#), [Platt O](#)

Department of Laboratory Medicine, Children's Hospital, Boston, MA

Am J Clin Pathol. 1994 Nov;102(5):623-32.

**Automated reticulocyte counting and measurement of reticulocyte cellular indices. Evaluation of the Miles H\*3 blood analyzer.**

[Brugnara C](#), [Hipp MJ](#), [Irving PJ](#), [Lathrop H](#), [Lee PA](#), [Minchello EM](#), [Winkelman J](#).

Department of Laboratory Medicine, Children's Hospital, Boston, MA

Blood. 1995 Feb 1;85(3):818-23.

**Simultaneous measurement of reticulocyte and red blood cell indices in healthy subjects and patients with microcytic and macrocytic anemia.**

[d'Onofrio G](#), [Chirillo R](#), [Zini G](#), [Caenaro G](#), [Tommasi M](#), [Micciulli G](#).

Research Center for the Development and Clinical Evaluation of Automated Methods in Hematology, Università Cattolica del Sacro Cuore, Rome, Italy

# Contenuto di emoglobina reticolocitaria (CHr)

Un valore ridotto indica che l'eritropoiesi in atto non riceve un adeguato apporto di ferro

Variazioni di CHr riflettono rapidamente cambiamenti della eritropoiesi (efficacia della terapia o deficit di apporto)

JAMA. 2005 Aug 24;294(8):924-30.

**Screening healthy infants for iron deficiency using reticulocyte hemoglobin content.**

[Ullrich C](#), [Wu A](#), [Armsby C](#), [Rieber S](#), [Wingerter S](#), [Brugnara C](#), [Shapiro D](#),  
[Bernstein H](#).

Department of Medicine, Children's Hospital, Boston, USA

**CONCLUSIONS:** A CHr of less than 27.5 pg is a more accurate hematological indicator of iron deficiency compared with hemoglobin of less than 11 g/dL



Am J Hematol. 2008 Apr;83(4):307-10.

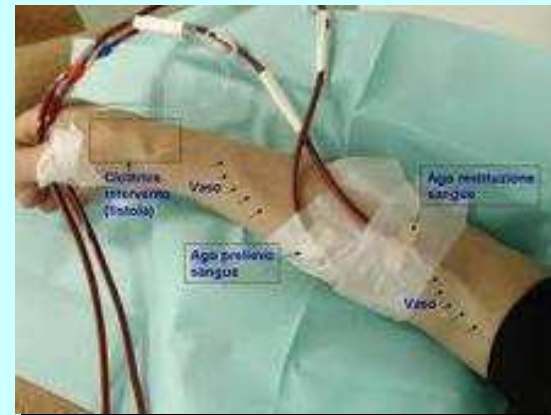
## **Reticulocyte hemoglobin content.**

[Mast AE](#), [Blinder MA](#), [Dietzen DJ](#).

Blood Research Institute, Blood Center of Wisconsin, Milwaukee,  
WI 53201-2178, USA

reticulocyte hemoglobin content is a recent addition to an expanding list of biomarkers that can be used to differentiate iron deficiency from other causes of anemia.

# CHr ed insufficienza renale



Am J Kidney Dis. 2010 Sep;56(3):540-6. Epub 2010 Jul 16.

## **Analytical and biological variation in measures of anemia and iron status in patients treated with maintenance hemodialysis.**

[Van Wyck DB](#), [Alcorn H Jr](#), [Gupta R](#).  
DaVita Inc, Denver, CO, USA

TSAT and ferritin test results, **unlike reticulocyte Hb content**, have limited value in evaluating changes in iron status within individual hemodialysis patients

L'anemia nella IRC è legata alla bassa produzione di eritropoietina da parte del rene

Jensen et al. J.Am. Soc. Nephrol 1994

L'uso della terapia con eritropoietina è raccomandato dalle Società scientifiche in ambito nefrologico, con produzione di linee guida

KDOQI Am. J. Kidney Dis. 2007

## Effetti della correzione dell'anemia mediante esas

DIMINUIZIONE DI:

astenia,  
ridotta resistenza alla fatica,  
deficit delle difese immunitarie  
deficit cognitivo

Furuland Nephrol. Dial. Transplant. 2003  
Provenzano Clin. Nephrol. 2004

L'effetto dell' epo nel rallentare la progressione  
dell'insufficienza renale è mediata dal raggiungimento di  
livelli ottimali di hb

KDOQI Am J Kidney Dis 2007

# FERRO, EPO e IRC



# Variability of ferritin measurements in chronic kidney disease; implications for iron management.

Ford BA, Coyne DW, Eby CS, Scott MG.

Kidney Intern. 2009

single serum ferritin values should not be used to guide clinical decisions regarding treatment of chronic hemodialysis patients with intravenous iron due to significant analytical and intraindividual variability.

# MONITORAGGIO DEL FERRO

## linee guida KDOQi

Somministrazione di ferro per os o  
e.v. per mantenere

Ferritina > 200ng/ml %  
saturazione della transferrina > 20% Hb  
reticulocitaria > 29 pg nei pazienti dializzati



ma.....

Pazienti dializzati in terapia con alte dosi di epo:

Incrementi di Hb rispetto a pazienti non ricevanti ferro anche con ferritina compresa fra 500 e 1200 ng/ml e sat tfr  $\geq$  25%

*Coyne DW J Am Soc Nephrol 2007*

# PARAMETRI UTILIZZABILI

% di eritrociti ipocromici ( $> 10$ )

Contenuto di emoglobina  
reticolocitaria (CHr)

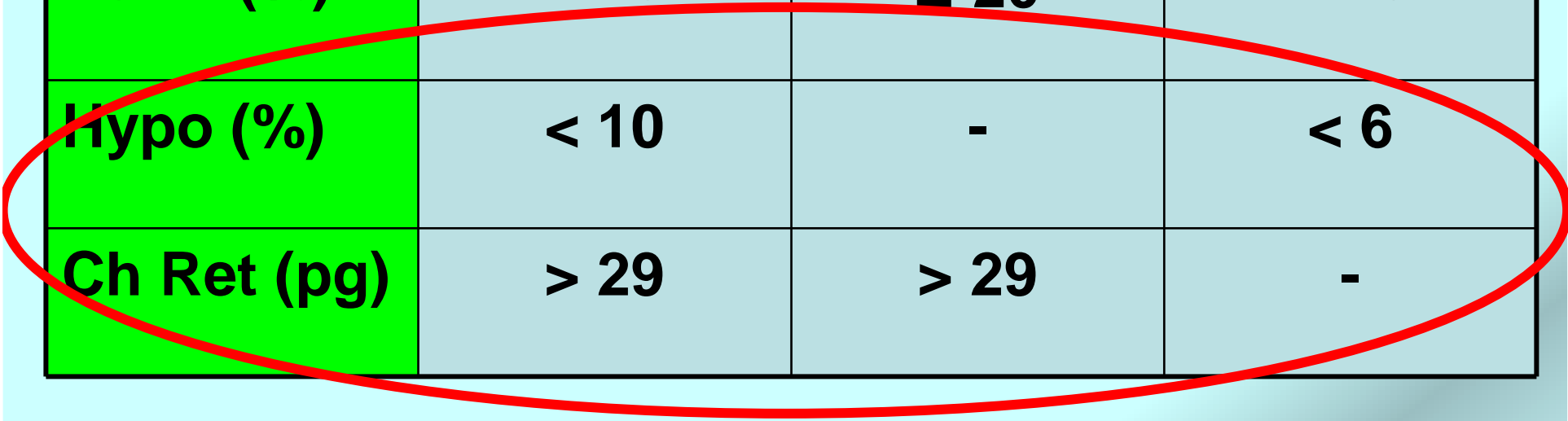
Brugnara et al. Effects of subcutaneous recombinant human erythropoietin in normal subjects: development of decrease reticulocyte hemoglobin content and iron deficient erythropoiesis. J. Lab.Clin.Med. 1994

Mittman et al.: Reticulocyte hemoglobin content predicts functional iron deficiency in hemodialysis patients receiving rHuEpo. Am. J. Kidney Dis. 1997

Fishbane et al.: Reticulocyte hemoglobin content in the evaluation of iron status of hemodialysis patients Kidney Int. 1997

# VALORI TARGET NELL'IRC

	<b>EPBG 2004</b>	<b>KDOQI 2007</b>	<b>UKRA 2007</b>
<b>HB (g/dl)</b>	<b>&gt; 11</b>	<b>11 - 12</b>	<b>10,5 – 12,5</b>
<b>FERRITINA</b>	<b>&gt; 100</b>	<b>&gt;200</b>	<b>&gt;200</b>
<b>TSAT (%)</b>	<b>&gt; 20</b>	<b>≥ 20</b>	<b>&gt; 20</b>
<b>Hypo (%)</b>	<b>&lt; 10</b>	<b>-</b>	<b>&lt; 6</b>
<b>Ch Ret (pg)</b>	<b>&gt; 29</b>	<b>&gt; 29</b>	<b>-</b>



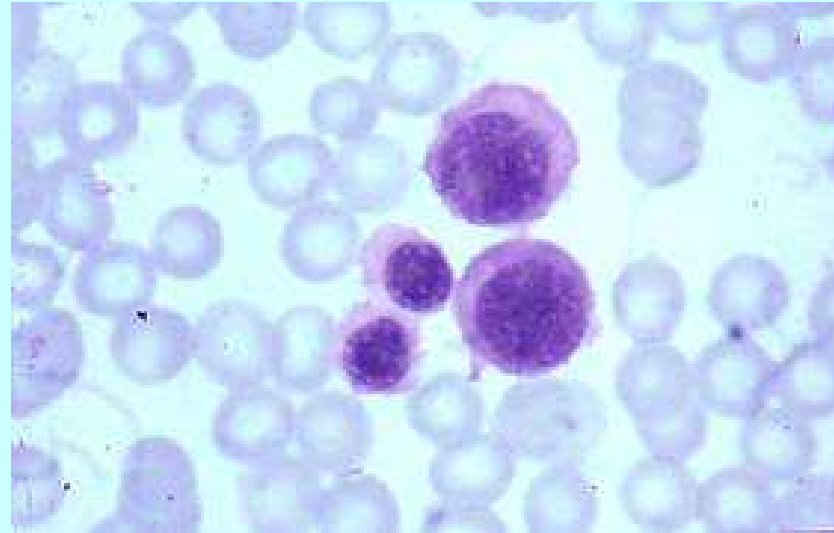
Scand J Clin Lab Invest. 2009;69(3):365-70.

Erythrocyte and reticulocyte indices in iron deficiency in chronic kidney disease: comparison of two methods.

Maconi M, Cavalca L, Danise P, Cardarelli F, Brini M.

L'uso di parametri simili ottenuti con differenti analizzatori può contribuire alla oggettivizzazione di un dato, promuovendone l'esportabilità

## CONTEGGIO DEGLI ERITROBLASTI



GROEN J. Blood 1948: The occurrence of normoblasts in the peripheral blood in congestive heart failure

SCHWARTZ S.O. JAMA 1954: Significance of nucleated red blood cells in peripheral blood

FRUMIN A.M. Circulation 1959: Nucleated red blood cells in congestive heart failure

Weick J.K., Hagedorn A.B., Linman J.W.

## Leukoerythroblastosis

Diagnostic and Prognostic Significance

Mayo Clin. Proc., 49: 110-113 1974

Although 63% of patients had diseases that were either malignant or potentially malignant, **more than one third of the patients manifesting the phenomenon of leukoerythroblastosis had less serious disease.**

Refer to: Tavassoli M: Erythroblastemia. West J Med 122:194-198, Mar 1975

# Erythroblastemia

MEHDI TAVASSOLI, MD, *La Jolla, California*

The significance of erythroblastemia must be considered in the context of the clinical setting in which it is found.

Circulating nucleated red cells indicate intravascular hemopoiesis or disruption of marrow structure or the inability of the bone marrow's screen mechanism to prevent their passage into circulation. In the latter situations, it usually indicates an unfavorable prognosis.

**CONTEGGIO DEGLI ERITROBLASTI BASATO SU  
SCATTER, VOLUME, CONDUTTIVITA', DENSITA'  
NUCLEARE E COLORAZIONE CITOCHEMICA:**

**SIEMENS ADVIA 2120  
BECKMAN COULTER LH 750**

**CONTEGGIO DEGLI ERITROBLASTI BASATO  
SULLA FLUORESCENZA:**

**SYSMEX XE 2100  
ABBOTT SAPPHIRE  
ABX PENTRA 120 DX**



→ J Matern Fetal Neonatal Med. 2005 Mar;17(3):199-201

## **The correlation between automated hematology and manually read smears for the determination of nucleated red blood cells in umbilical cord blood.**

[McCarthy JM](#), [Capullari T](#), [Spellacy WN](#).

Department of Obstetrics and Gynecology, University of South Florida College of Medicine, Tampa,

→ **Neonatology**  
formerly Biology of the Neonate

Neonatology 2007;92:205-208  
DOI: [10.1159/000102096](https://doi.org/10.1159/000102096)

Received: September 4, 2006  
Accepted after revision: January 15, 2007  
Published online: April 30, 2007

### **Nucleated Red Blood Cells in Term Fetuses: Reference Values Using an Automated Analyzer**

Alessandro Rolfo<sup>a</sup> Mariacaterina Maconi<sup>b</sup> Simona Cardaropoli<sup>a</sup>  
Marilisa Biolcati<sup>a</sup> Paolo Danise<sup>c</sup> Tullia Todros<sup>a</sup>

NRBC %	1,27	±	1,7
NRBC abs.	228	±	324

Normal parameters included: gestational age, type of delivery, weight, 1' and 5' Apgar score

## Nrbc nel sangue periferico

- 1) "disturbo" nella conta di wbc
- 2) "allarme" che suggerisce la presenza e consente la correzione della conta wbc
- 3) conteggio automatico che ottimizza la qualità del dato, ma apre nuovi quesiti diagnostici

# PRESENZA DI NRBC IN CIRCOLO

NEONATI E PREMATURI (fisiologica)

ANEMIA E PATOLOGIE EMATOLOGICHE

SEVERI STATI IPOSSICI (cardiaci e polmonari)

NEOPLASIE

# Nrbc in neonatologia



**Sofferenza cerebrale perinatale da danno ipossico**

**Madri sovrappeso, asmatiche, con diabete gestazionale**

**Esposizione intrauterina a mediatori dell'inflammazione**

**Esposizione a fumo attivo e passivo in gravidanza**

**Sindrome da aspirazione di meconio**

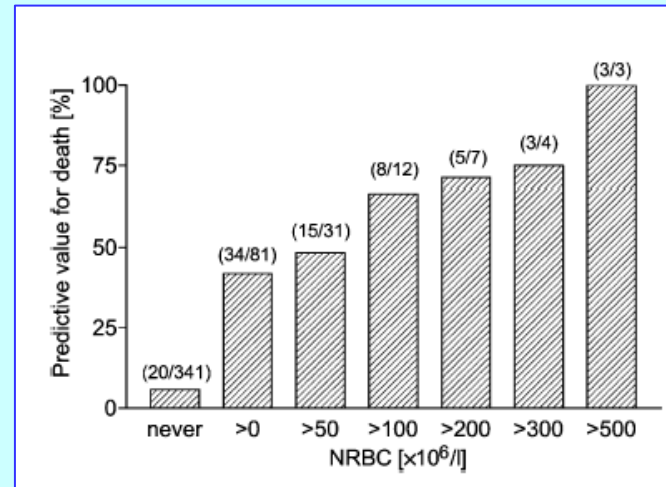
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# Estimation of the Mortality Risk of Surgical Intensive Care Patients Based on Routine Laboratory Parameters

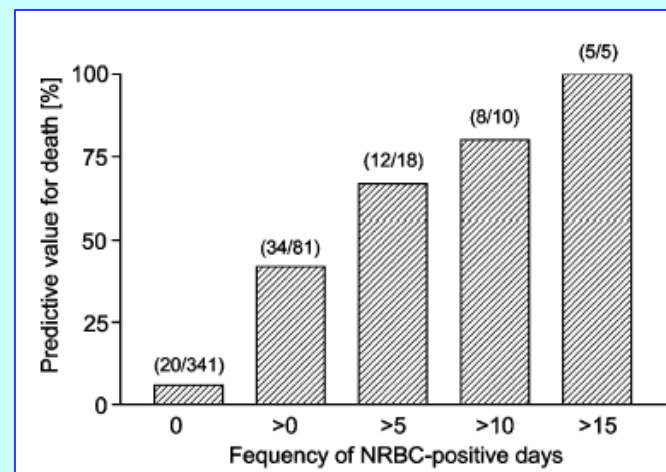
A. Stachon<sup>a</sup> A. Becker<sup>a</sup> T. Holland-Letz<sup>b</sup> J. Friese<sup>c</sup> R. Kempf<sup>a</sup> M. Krieg<sup>a</sup>

<sup>a</sup>Institute of Clinical Chemistry, Transfusion and Laboratory Medicine, <sup>b</sup>Department of Medical Informatics, Biometry, and Epidemiology, and <sup>c</sup>Department of Surgery, Ruhr University Bochum, Bochum, Germany

## RISK OF DEATH AND NUMBER OF NRBC IN PERIPHERAL BLOOD



## RISK OF DEATH AND PERSISTENT PRESENCE OF NRBC IN PERIPHERAL BLOOD



Lehnhardt M., Katzy Y., Langer S., Druecke D., Homann H.H., Steinstresser L. et al.

***Prognostic significance of erythroblasts in burns.***

Plast Reconst. Surg. 2005;115:120-127

Stachon A., Lehnhardt M., Katzy Y., Holland Letz T., Steinau H.U., Krieg M.

***Making the case for adapting the abbreviated burn severity index to include erythroblast count.***

J. Wound Care 2005 ;14:97-100

**Il numero di eritroblasti in circolo ha valore prognostico nei pazienti ustionati e può essere inserito in uno score di gravità delle ustioni**

**Persistent nucleated red blood cells in peripheral blood is a poor prognostic factor in patients undergoing stem cell transplantation.**

[Otsubo H](#), [Kaito K](#), [Asai O](#), [Usui N](#), [Kobayashi M](#), [Hoshi Y](#).

Division of Blood Transfusion, Jikei University Hospital, 3-19-18 Nishi Shinbashi, Minato-ku, Tokyo 105-8471, Japan. [otsubo@jikei.ac.jp](mailto:otsubo@jikei.ac.jp)

**Persistent NRBC in peripheral blood is a poor prognostic factor, and suggested that monitoring NRBC after SCT might provide useful clinical information.**



Clin Chem Lab Med. 2009;47(12):1539-42.

**Nucleated red blood cells and soluble transferrin receptor in thalassemia syndromes: relationship with global and ineffective erythropoiesis.**

[Danise P](#), [Amendola G](#), [Di Concilio R](#), [Cillari E](#), [Gioia M](#), [Di Palma A](#), [Avino D](#), [Rigano P](#),  
[Maggio A](#).

Department of Laboratory of Hematology, Umberto 1 degrees Hospital, Nocera Inferiore,  
Salerno, Italy.

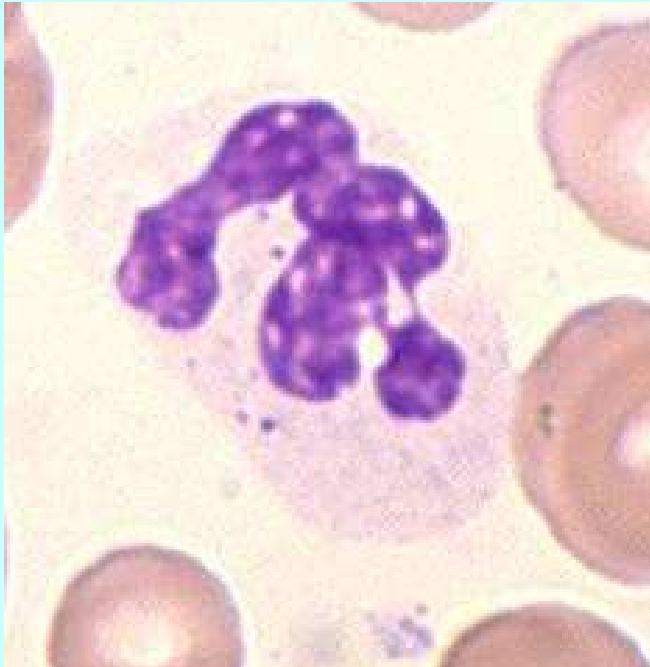
Il recettore solubile della transferrina correla con l'entità della eritropoiesi, sia efficace che inefficace.

Il conteggio degli eritroblasti correla con l'eritropoiesi inefficace.

Presenza di eritroblasti alla diagnosi, durante la terapia ed in remissione in alcune patologie ematologiche

<b>DISEASE</b>	<b>%POS at diagnosis</b>	<b>During chemotherapy</b>	<b>At hematological remission</b>
<b>Chronic Myeloid Leukemia</b>	<b>100</b>	<b>/</b>	<b>0</b>
<b>Myelodysplastic Syndromes *(epo therapy)</b>	<b>62.5</b>	<b>59.1*</b>	<b>/</b>
<b>Acute Leukemias</b>	<b>45</b>	<b>39.3</b>	<b>0</b>
<b>Non Hodgkin's Lymphoma</b>	<b>34.8</b>	<b>42,1</b>	<b>0</b>
<b>Hodgkin's Lymphoma</b>	<b>0</b>	<b>35</b>	<b>0</b>
<b>Multiple Mieloma</b>	<b>0</b>	<b>52.6</b>	<b>0</b>

## Nuovi parametri e sindromi mielodisplastiche



La diagnosi di displasia è frequentemente occasionale, essenzialmente morfologica e trae spesso la sua origine dal laboratorio

**1991..**

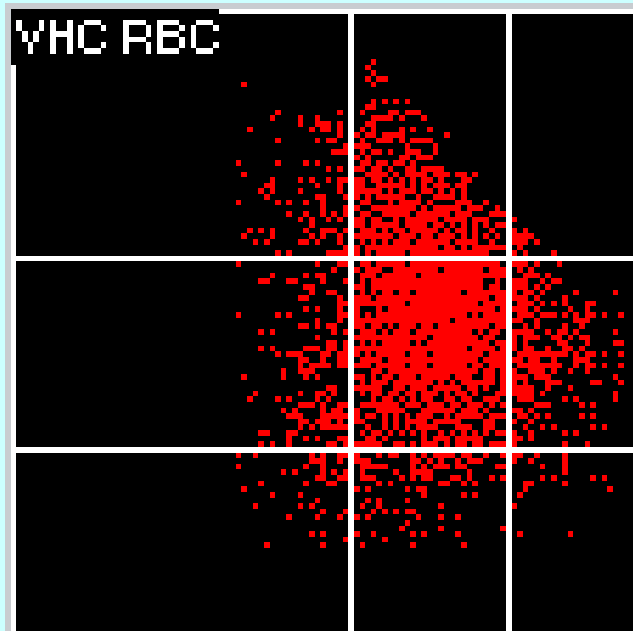
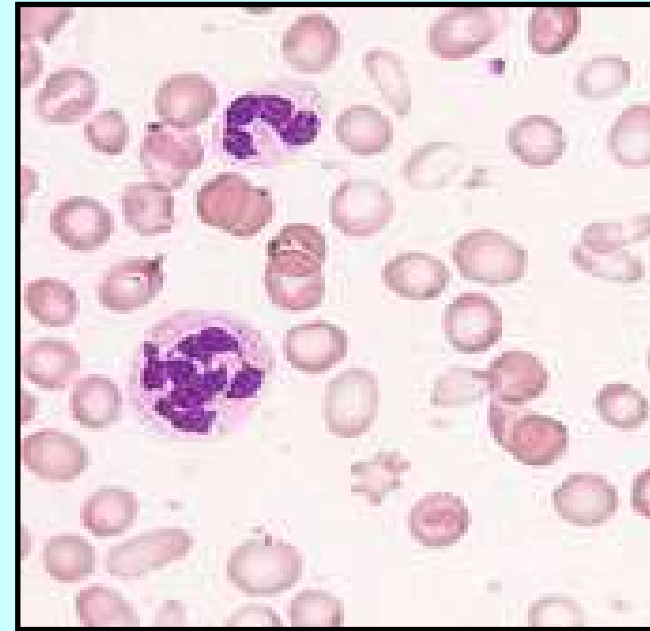
III

### La citoematologia automatizzata nelle sindromi mielodisplastiche

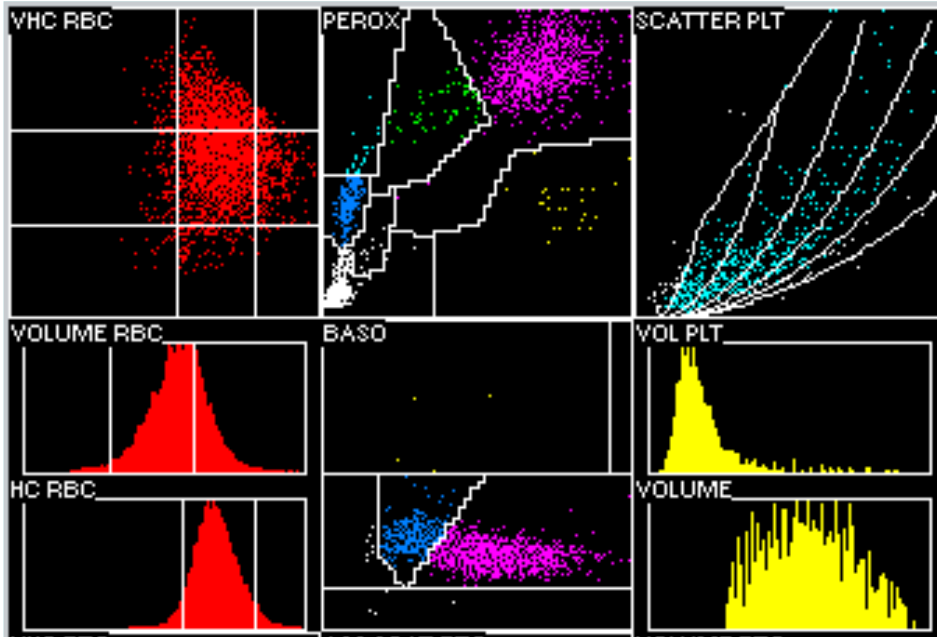
P. Cappelletti, B. Milanesi\*, D. Signori,  
P. Daretto, F. Falcomer

Servizio di Chimica e Microscopia Clinica, Ospedale di  
Pordenone - U.S.L. N°11 "1" Laboratorio di Analisi chimico-  
cliniche e microbiologia - Ospedali Civili- Brescia.

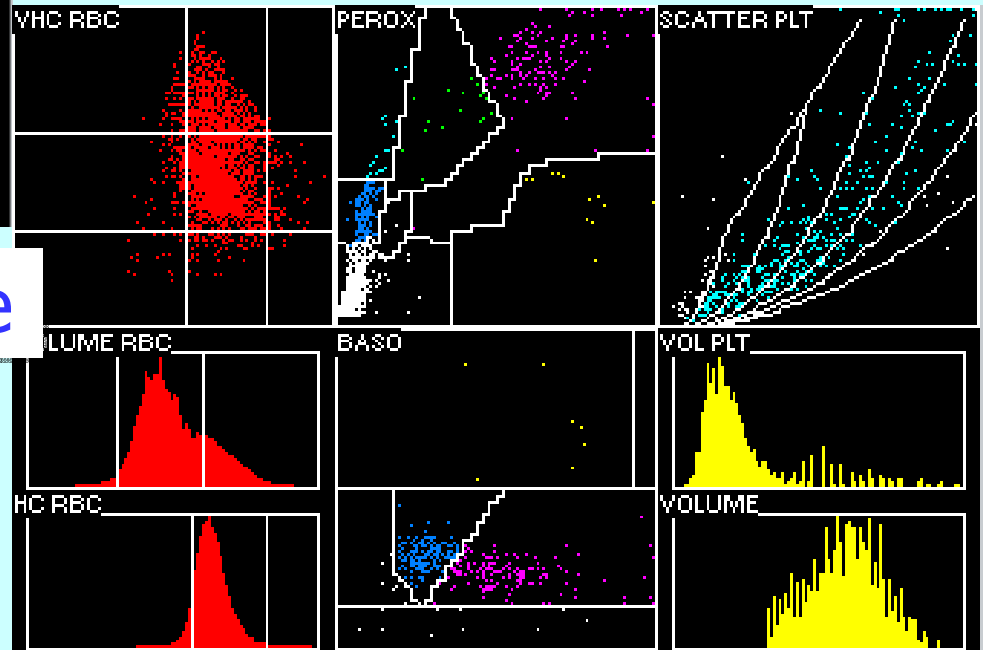
Le anomalie cellulari  
nelle MDS producono  
anomalie morfologiche  
ben note e riconoscibili



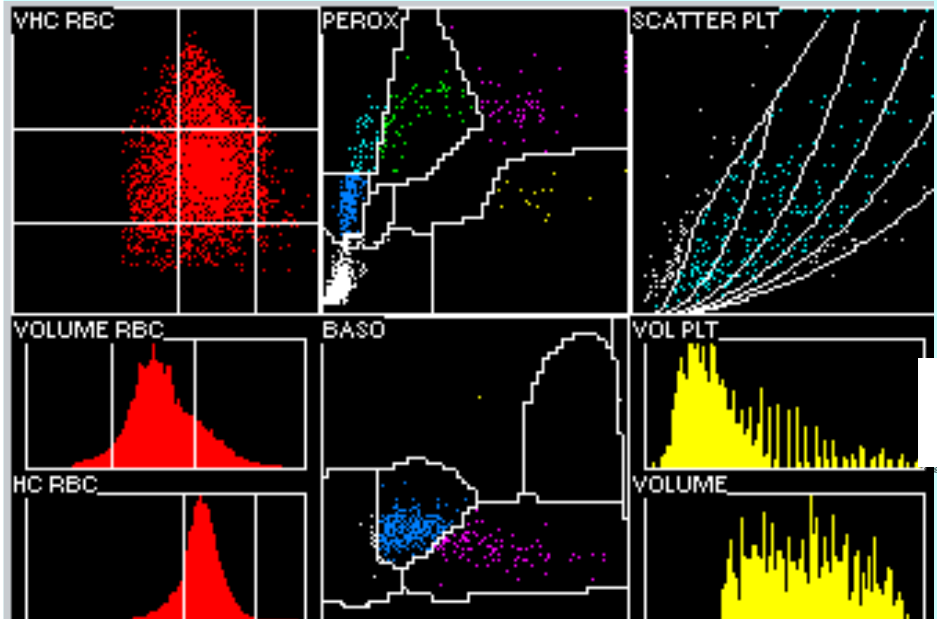
Le anomalie cellulari  
producono segnali anomali  
strumentali che presentano  
caratteristiche di oggettività  
e riproducibilità



Displasia unilineare



Displasia bilineare



Displasia trilineare

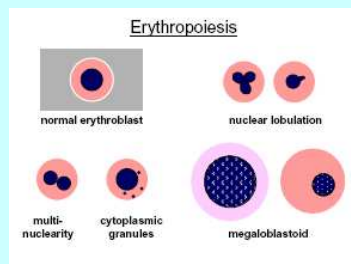
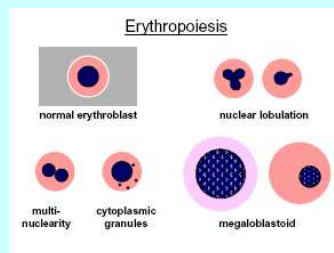
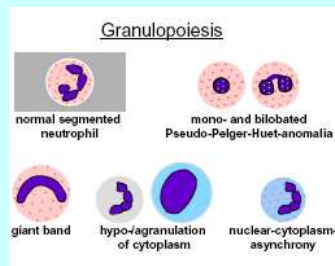
Il limite più importante delle anomalie riscontrate in automazione è la tecnologia - dipendenza

I vantaggi sono costituiti dalla immediatezza di osservazione e dalla riproducibilità

ORIGINAL ARTICLE

A. Cantù Rajnoldi · S. Fenu · G. Kerndrup ·  
 E. R. van Wering · C. M. Niemeyer · I. Baumann ·  
 for the European Working Group on Myelodysplastic  
 Syndromes in Childhood (EWOG-MDS)

## Evaluation of dysplastic features in myelodysplastic syndromes: experience from the morphology group of the European Working Group of MDS in Childhood (EWOG-MDS)



**Table 2** Concordance of FAB categories between the observers

Case	Observer			
	1	2	3	4
1	CMML	CMML	AML	RAEB
2	AML M6	RAEB	RAEB	RAEB-t
3	RAEB	RAEB	RAEB	RAEB
4	RA	CMML	CMML	RAEB
5	RA	RA	RAEB	RAEB
6	AML M6	RAEB	RAEB	RAEB-t
7	RAEB	RAEB	RAEB-t	RAEB
8	RAEB-t	RAEB-t	RAEB	RAEB
9	CMML	CMML	RAEB	RAEB
10	RAEB-t	RAEB-t	RAEB	RAEB-t
11	CMML	CMML	RAEB-t	RAEB
12	RA	RA	no MDS	RA
13	RAEB	AML	RAEB	RAEB-t
14	RA	no MDS	RA	RA
15	RAEB	RAEB	RA	RAEB
16	RAEB-t	RAEB-t	RAEB	RAEB
17	RAEB	RAEB	RAEB	AML M7
18	RA	RA	no MDS	RA

# EVALUATION OF THE ERYTHROPOIESIS IN PATIENTS WITH MYELOYDYSPLASTIC SYNDROME GOOD RESPONDERS TO TREATMENT WITH ERYTHROPOIETIN, 5-AZACITIDINE AND LENALIDOMIDE

Danise P.(1) Rovetti A.(1) Di Palma A.(1) Avino D.(1) Caliendo I.(1) Rivellini F.(2)  
Maconi M.(3) D'Arco A.M.(2)

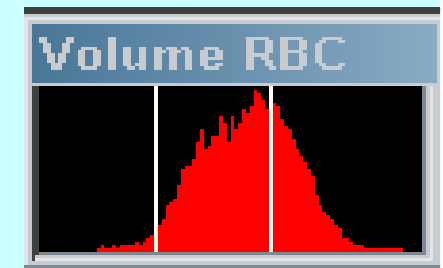
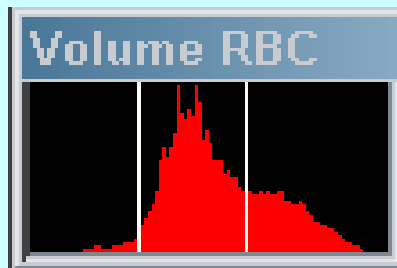
(1)Laboratory Haematology Unit and (2)Oncology Haematology Department, P.O. Umberto I Nocera Inferiore (Sa) (3)Laboratory Medicine A.O. S.Maria Nuova, Reggio Emilia



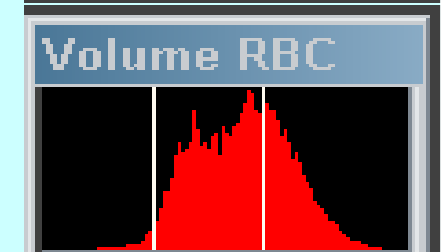
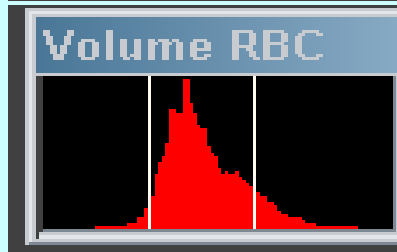
**BASELINE**

**A 6 MESI**

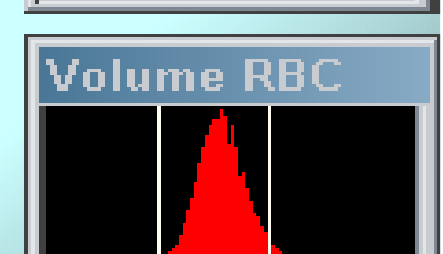
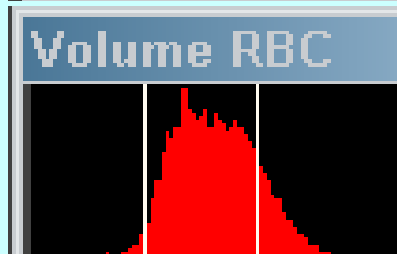
**ERITROPOIETINA**



**5 AZACITIDINA**



**LENALIDOMIDE**





**“EL HOMBRE VALE POR LO QUE SIRVE  
NO POR LO QUE SABE  
Y MENOS POR LO QUE TIENE”**

**Manuel Velasco Suarez**

**Chiapas 1914-2001**