



**ARRESTO CARDIACO:
PER UN PERCORSO
INTEGRATO
DELL'AZIENDA
OSPEDALIERO
UNIVERSITARIA DI
FERRARA**

**Sabato 5 ottobre
2013**

**Aula Magna Nuovo
Arcispedale S. Anna**

Cona, Ferrara



IPOTERMIA TERAPEUTICA

Dott. C.Lupi

U.O. Anestesia e Rianimazione Ospedaliera

Dir. Dott. R.Zoppellari

UN PO' DI STORIA...

ANNALS OF SURGERY
A Monthly Review of Surgical Science Since 1885



1851

Hypothermia in Surgery Analysis of 100 Clinical Cases°

HENRY SWAN, M.D., ROBERT W. VIRTUE, M.D., S. GILBERT BLOUNT, JR., M. D.,
AND LORENCE T. KIRCHER, JR., M.D.

Denver, Colorado

From the Departments of Surgery and Medicine, University of Colorado School of Medicine, Denver, Colorado

I. INTRODUCTION
TWO YEARS AGO, at the 1953 meeting of this physical state of an homothermic individual in whom the body temperature is below the normal range for that individual. For man



1980-1990

Profound Cardiac Hypothermia °

CHARLES A. HUFNAGEL, M.D., PETER W. CONRAD, M.D., JOSEPH
SCHANNO, M.D., ROQUE PIFARRÉ, M.D.

From the Laboratory for Surgical Research of Georgetown University Medical Center, Washington, D. C.

DIRECT and definitive total correction of aortic valvular stenosis and incompetence, and related lesions require exposure of the cardiac arrest produced by the physical agent cold alone. The complexity of the procedures which

1950-1960

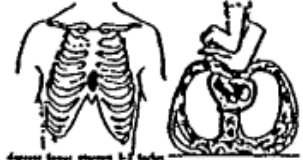


Peter Safar MD
1964

HEART-LUNG RESUSCITATION

I FIRST AID: OXYGENATE THE BRAIN IMMEDIATELY

- IF UNCONSCIOUS**
Airway - TILT HEAD BACK
- IF NOT BREATHING**
Breathe - INFLATE LUNGS 3-5 TIMES, MAINTAIN HEAD TILT
MOUTH-TO-MOUTH, MOUTH-TO-NOSE, MOUTH-TO-NOSE, BAG-MASK
- FEEL PULSE
 - IF PRESENT - CONTINUE LUNG INFLATIONS
 - IF ABSENT -



Circulate - COMPRESS HEART ONCE A SECOND. ALTERNATE 2-3 LUNG INFLATIONS WITH 15 STERNAL COMPRESSIONS UNTIL SPONTANEOUS PULSE RETURNS.

II START SPONTANEOUS CIRCULATION

- Drugs - EPINEPHRINE:** 1.0 mg (1.0 CC OF 1:1000) I.V. OR 0.5 mg INTRACARDIAC. REPEAT LARGER DOSE IF NECESSARY
- SODIUM BICARBONATE:** APPROXIMATELY 2.75 G/50 CC (1/2 DOSE IN CHILDREN) I.V. REPEAT EVERY 5 MINUTES IF NECESSARY
- E. K. G. - FIBRILLATION:** EXTERNAL ELECTRIC DEFIBRILLATION. REPEAT SHOCK EVERY 1-3 MINUTES UNTIL FIBRILLATION REVERSED
- IF ASYSTOLE OR WEAK BEATS: EPINEPHRINE OR CALCIUM I.V.
- Fluids - I.V. PLASMA, DEXTRAN, SALINE**
Do not interrupt cardiac compressions and ventilation. If necessary, use vasopressors as needed.
- AFTER RETURN OF SPONTANEOUS CIRCULATION USE VASOPRESSORS AS NEEDED, e.g. NOBEPHEPHINE (Levophed) I.V.



III SUPPORT RECOVERY

- Gauge** EVALUATE AND TREAT CAUSE OF ARREST
- Hypothermia** START WITHIN 30 MINUTES IF NO SIGN OF CNS RECOVERY
- Intensive Care** SUPPORT VENTILATION: TRACHEOTOMY, PROLONGED CONTROLLED VENTILATION, GASTRIC SUCROSE AS NECESSARY
- SUPPORT CIRCULATION
- CONTROL CONVULSIONS
- MONITOR

Figure 1. Heart-lung resuscitation (cardiopulmonary-cerebral resuscitation). First composition in 1961, Pittsburgh, PA. Reproduced with permission from Safar P. *et al.* *Advanced Life Support: A Manual of Cardiopulmonary-Cerebral CPR.* J Iowa Medical Society 1964 (Nov); pp 629-635.

IPOTERMIA

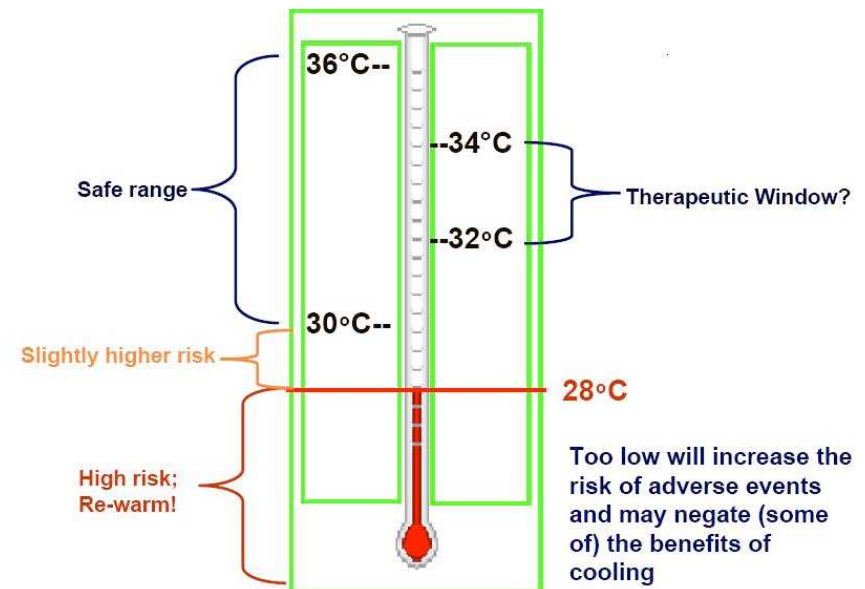
Temperatura corporea del “core” o centrale (< 35° C o < 95° F)

IPOTERMIA ACCIDENTALE (spontanea , non controllata)

IPOTERMIA INDOTTA (controllata , terapeutica)

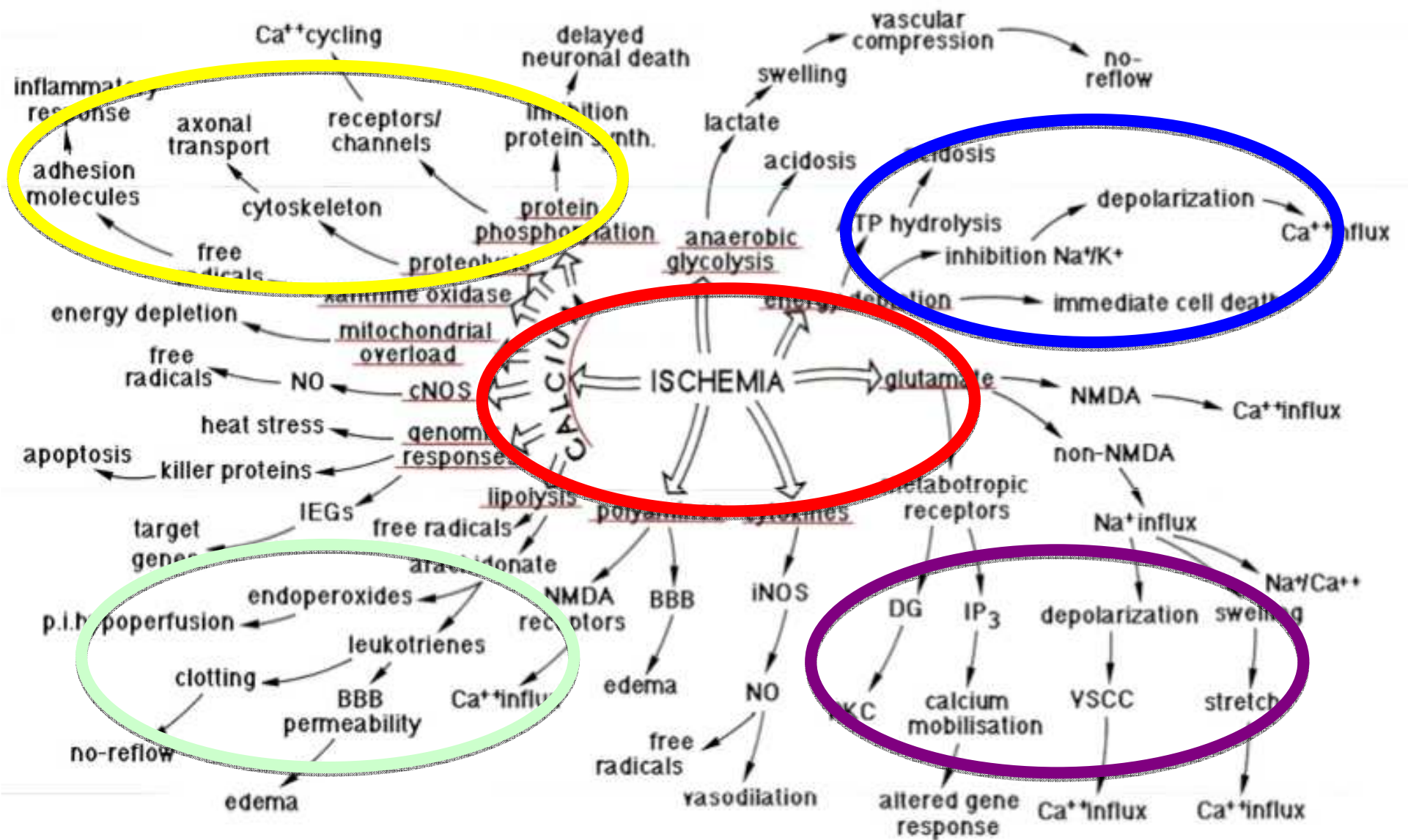
Grado di ipotermia: Temperatura core

Lieve	33-36 °C
Moderata	28-32 °C
Severa	18-28 °C
Profonda	5-18 °C
Ultra-profonda	<5 °C

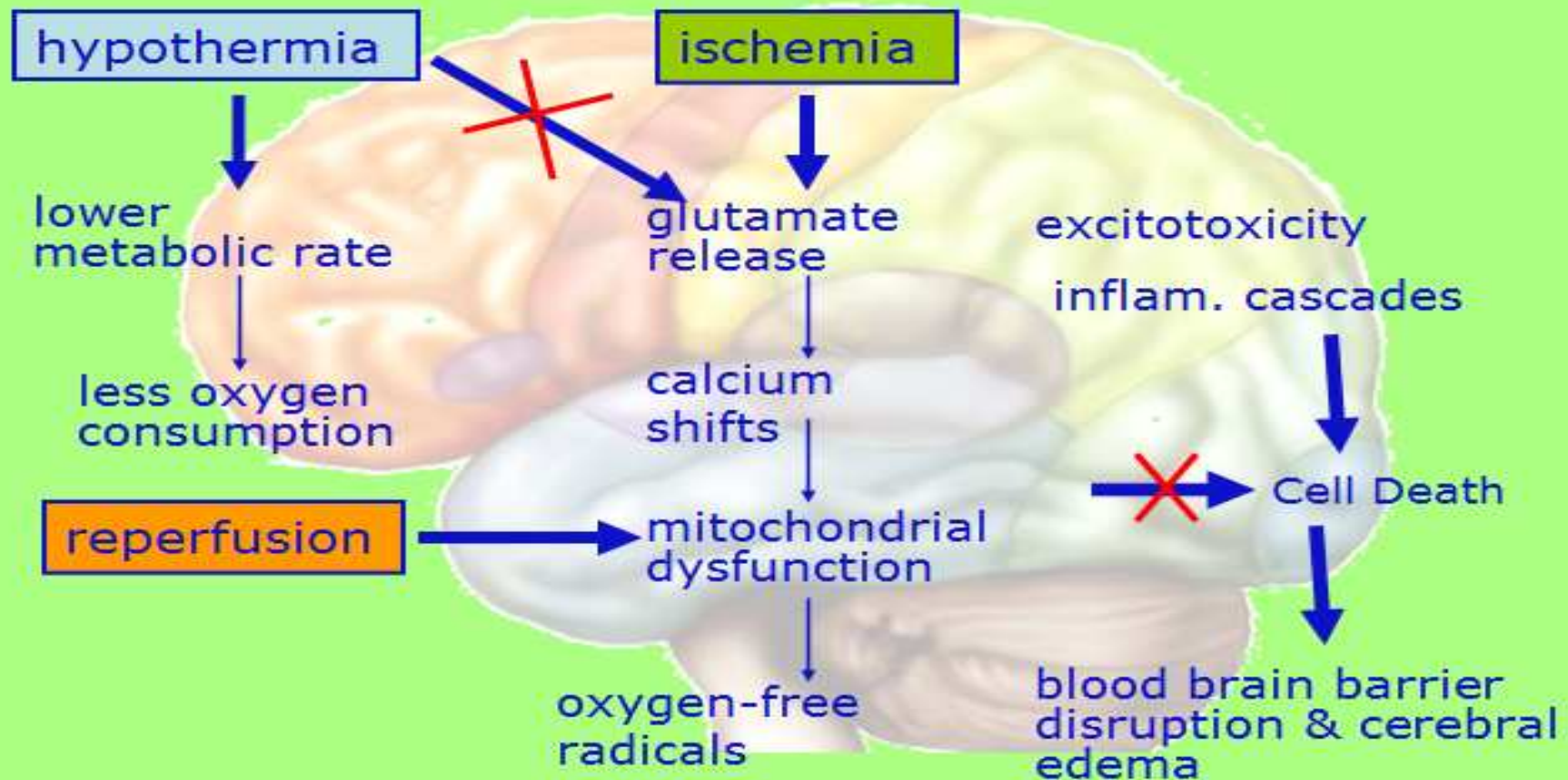


Perché?

ISCHEMIA: MECCANISMO SEMPLIFICATO



Mechanisms



Geocadin RG, Koenig MA, Jia X et al. Management of brain injury after resuscitation from cardiac arrest. *Neurol Clin.* 2008;22:487-506.

IPOTERMIA : Perché?

- Riduce la richiesta di O₂ nelle aree ischemiche
- Rallenta l'attività enzimatica per la formazione dei radicali liberi
- Protegge e stabilizza la membrana lipoproteica cellulare
- Riduce l'acidosi intracellulare (riduce i lattati)
- Inibisce la biosintesi, il rilascio e l'uptake dei neurotrasmettitori eccitatori.



The New England Journal of Medicine

Established in 1812 as THE NEW ENGLAND JOURNAL OF MEDICINE AND SURGERY

VOLUME 346

FEBRUARY 21, 2002

NUMBER 8

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G.D. CLUREMAN

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THE HYPOTHERMIA AFTER CARDIAC ARREST
STUDY GROUP

Treatment of Comatose Survivors
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after Cardiac Arrest 612
P.J. SAFAR AND P.M. KOCHANEK

CLINICAL IMPLICATIONS OF BASIC RESEARCH

Genes, Microbes, and T Cells — New
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C.O. ELSON

SOUNDING BOARD

Blood and Disaster — Supply and Demand 617
P.J. SCHMIDT

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Intensive Care Med (2004) 30:556–575
DOI 10.1007/s00134-003-2152-x

REVIEW

Kees H. Polderman

**Application of therapeutic hypothermia
in the ICU: opportunities and pitfalls
of a promising treatment modality.
Part 1: Indications and evidence**

Intensive Care Med (2004) 30:757–769
DOI 10.1007/s00134-003-2151-y

REVIEW

Kees H. Polderman

**Application of therapeutic hypothermia
in the intensive care unit**
Opportunities and pitfalls of a promising
treatment modality—Part 2: Practical aspects
and side effects



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Studi Randomizzati controllati Prospettici

1. Studio policentrico europeo (9 centri)
2. Studio policentrico australiano (4 ospedali)

Criteri di inclusione:

ROSC (+mancata risposta comandi verbali) dopo FV/TV extra-H

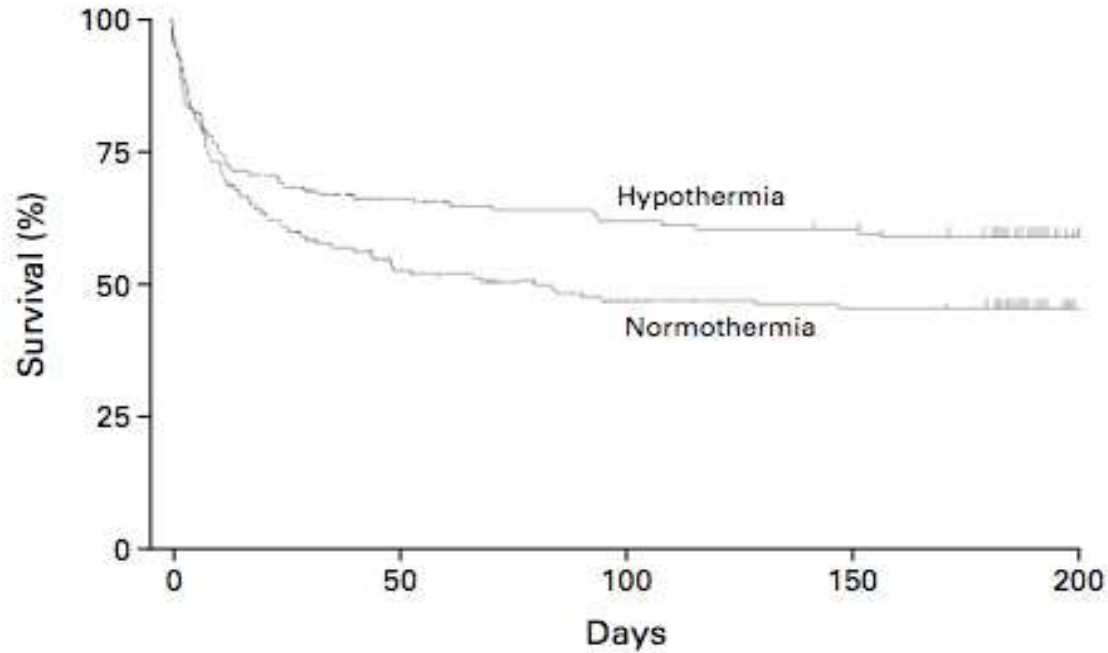
Tempi tra: collasso e RCP : tra 5'-15' intervallo fra arresto e ROSC < 60'

Criteri di esclusione:

Shock cardiogeno refrattario (PAS<90mmHg nonostante uso di amine), Ipossia persistente (spO2<85%), aritmie gravi, gravide, cause non cardiache di ACR (ictus, trauma, intossicazioni)



The New England



N° di pazie
Randomizz

Metodo di
Ipotermia

	NO. AT RISK				
Hypothermia	137	92	86	83	11
Normothermia	138	74	66	64	9

Figure 2. Cumulative Survival in the Normothermia and Hypothermia Groups.

**Outcome Neurologico
positivo (= deficit
assenti o moderati)**

Gruppo IpoTermia : **55%**
Gruppo NormoTermia : **39%**
(RR 1.40; 95% CI 1.08-1.81)

Gruppo IpoTermia : **49%**
Gruppo NormoTermia : **26%**
(RR 1.85; 95% CI 0.97-3.49)

Mortalità a 3 mesi

Gruppo IpoTermia : **41%**
Gruppo NormoTermia : **55%**
(RR 0.74, 95% CI 0.58-0.95)

Gruppo IpoTermia : **51%**
Gruppo NormoTermia : **68%**
(RR 0.76; 95% CI 0.52-1.10)

COMPLICANZE

TABLE 4. COMPLICATIONS DURING THE FIRST SEVEN DAYS AFTER CARDIAC ARREST.*

HACA study group, *NEJM*, 2002

COMPLICATION	NORMOTHERMIA	HYPOTHERMIA
	no./total no. (%)	
Bleeding of any severity†	26/138 (19)	35/135 (26)
Need for platelet transfusion	0/138	2/135 (1)
Pneumonia		
Sepsis	of hypothermia on mortality was slightly stronger (risk ratio, 0.62; 95 percent confidence interval, 0.50 to 0.95).	percent] and 98 of 135 in the hypothermia group [73 percent], $P=0.70$). Sepsis was more likely to develop in the patients with hypothermia than in those with normothermia, although this difference was not statistically significant (Table 4). The total number of complications was not significantly higher in the hypothermia group than in the normothermia group ($P=0.09$).
Pancreatitis		
Renal failure		
Hemodialysis		
Pulmonary		
Seizures		
Lethal or		
Pressure s		

Complications

The proportion of patients with any complication did not differ significantly between the two groups (93 of 132 patients in the normothermia group [70

DISCUSSION

Our results show that among patients in whom spontaneous circulation had been restored after cardiac arrest due to ventricular fibrillation, systemic cool-

NEL 2005



- Comatose out-of-hospital adult patient with ROSC after VF:
Class IIa recommendation
- In-hospital arrest, other rhythms: Non VF, PEA, Asystole e.g.
Class IIb recommendation

NEL 2010

Circulation
JOURNAL OF THE AMERICAN HEART ASSOCIATION



Part 9: Post-Cardiac Arrest Care : 2010 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care
Mary Ann Peberdy, Clifton W. Callaway, Robert W. Neumar, Romergryko G. Geocadin, Janice L. Zimmerman, Michael Donnino, Andrea Gabrielli, Scott M. Silvers, Arno L. Zaritsky, Raina Merchant, Terry L. Vanden Hoek and Steven L. Kronick

Circulation. 2010;122:S768-S786

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Resuscitation

journal homepage: www.elsevier.com/locate/resuscitation



European Resuscitation Council Guidelines for Resuscitation 2010 Section 4. Adult advanced life support

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^c Anaesthesia and Intensive Care Medicine

Resuscitation (2008) 79, 350–379



available at www.sciencedirect.com

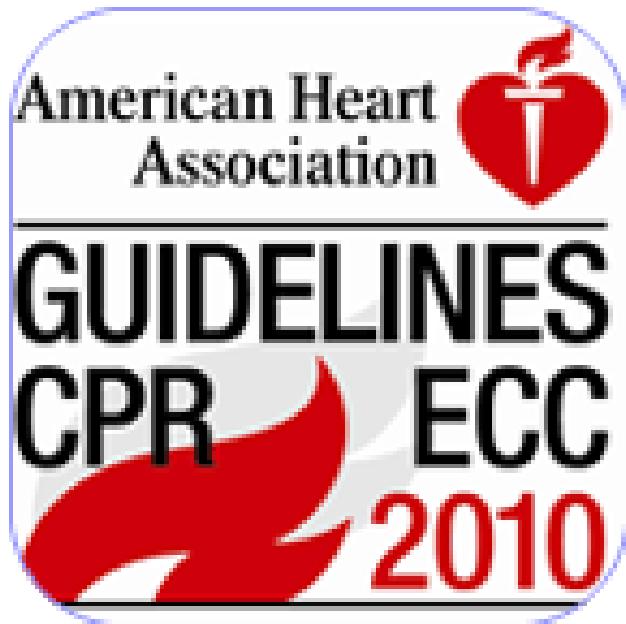
ScienceDirect

journal homepage: www.elsevier.com/locate/resuscitation



ILCOR CONSENSUS STATEMENT

**Post-cardiac arrest syndrome: Epidemiology, pathophysiology, treatment, and prognostication
A Scientific Statement from the International Liaison Committee on Resuscitation; the American Heart Association Emergency Cardiovascular Care Committee; the Council on Cardiovascular Surgery**



- Comatose out-of-hospital adult patient with ROSC after VF:
Class I recommendation
- In-hospital arrest, other rhythms: Non VF, PEA, Asystole e.g.
Class IIb recommendation

THERAPEUTIC HYPOTHERMIA

Unconscious adult patients with spontaneous circulation after out-of-hospital VF cardiac arrest should be cooled to 32–34 °C for at least 12–24 h.¹⁷⁷ Most experts currently recommend cooling for at least 24 h. Although data support cooling to 32–34 °C, the optimal temperature has not been determined. Induced hypothermia might also benefit unconscious adult patients with spontaneous circulation after out-of-hospital cardiac arrest from a nonshockable rhythm or in-hospital cardiac arrest.¹⁷⁷ Although the optimal timing of initiation has not been clinically defined, current consensus is to initiate cooling as soon as possible. The therapeutic window, or time after ROSC at which

Dal 2007

Regione Emilia Romagna e Ministero Salute

Gruppo di Studio:

Gravi cerebropatie acquisite post acute

Registro Utstein Arresti Cardiaci

*Applicazione protocollo operativo condiviso con
altre Rianimazioni*

PROTOCOLLO RIANIMAZIONE FERRARA

CRITERI DI INCLUSIONE

- FV extraospedaliera (Classe I)
- PEA/Asistolia extraospedaliera (Classe IIb)
- ACC intraospedaliero (Classe II b)
- Intervallo collasso – RCP <15 min
- GCS < 9
- ROSC con ritmo ed emodinamica stabile
- Età' >18 anni

PROTOCOLLO RIANIMAZIONE FERRARA

CRITERI DI ESCLUSIONE

- Trauma, Ictus, Intox, stato male epilettico
- Gravidanza
- NCH maggiore intracranica < 10 gg
- Malattia terminale
- Sanguinamento in atto
- T iniziale < 30 °C
- grave deficit neuro preACC
- Coagulopatia primitiva preesistente
- Shock cardiogeno refrattario

PROTOCOLLO RIANIMAZIONE FERRARA

FASE 1 INDUZIONE

Appena possibile, nel minor tempo possibile

- fluidi 4°C 30-40ml/Kg in 30'-40';
- teli ghiacciati: inguini, ascelle, collo
- materasso ad aria
- raggiungere 32°-34° entro 8 h
- analgesedazione e curarizzazione
- Goal emodinamici: PAM > 60 (liquidi + amine); PVC 12-15; SvO2 > 70%
- Goal Ventilatori: paO2 > 100; paCO2 40-45 → adattare fiO2, peep, p.inspir
- trattare alterazione elettroliti
- mantenere normoglicemia: Glu 100-150

PROTOCOLLO RIANIMAZIONE FERRARA

FASE 2 MANTENIMENTO

- Mantenere 32°-34° per 24h
- analgesedazione e curarizzazione (ev BIS e TOF)
- Emodinamica: PAM > 60 (liquidi + amine); PVC 12-15; SvO2 > 70%
- Ventilazione: PaO2 > 100; PaCO2 40-45, P/F > 300
- Bilancio idroelettrolitico (K, Mg, Na, Glu)

Monitoraggio:

ECG, IBP, SpO2, EtCO2, PVC, EGA

Temperatura: Catetere vescicale con termistore/ Sonda esofagea

Diuresi

SvO2

Elettroliti

Coagulazione

PROTOCOLLO RIANIMAZIONE FERRARA

FASE 3 RISCALDAMENTO

Dopo 24h STOP IPOTERMIA

- Riscaldamento passivo :

0.2- 0.5 °C/h; durata 8-12 h

Eventuale Riscaldamento attivo dopo 6-8 h

Se T aumenta > 1 °C/h: rallentare processo (materassino refrigerante, ghiaccio)

Mantiene analgesedazione per tutta la fase di rewarming

Evitare brivido

Evitare overshooting di temperatura: FANS o PARACETAMOLO

ATTENZIONE :

Ipotensione da ipovolemia relativa (Vasodilatazione)

Aumento Potassiemia

Glicemia

DATI RIANIMAZIONE FERRARA (2007-2012)

6° Congresso Nazionale Società Italiana Anestesia Rianimazione Emergenza e Dolore
Ferrara 28-30 maggio 2009

MILD THERAPEUTIC HYPOTHERMIA AFTER CARDIAC ARREST: OUR EXPERIENCE

C. Lupi, S. Lamborghini, E. Ferri, S. Rinaldi, M. Vason, S. Bortolazzi, T. Matarazzo, P. Tonini, G. Mantovani, R. Zoppellari

ANAESTHESIA AND INTENSIVE CARE UNIT, S. ANNA UNIVERSITY HOSPITAL, FERRARA, ITALY

BACKGROUND

In the year 2007, our group was enrolled in the "Gravi Cerebropatie Acquisite Post Acute" study, handled by Emilia Romagna Region and financed by the Italian Health Ministry.

The application of a mild therapeutic hypothermia protocol after cardiac arrest was also considered in this study.

In patients treated with mild hypothermia after cardiac arrest, an improvement of neurological outcome has been shown by many authors (1,2).

These results enabled this practice to get included in international guidelines of post-resuscitation management after cardiac arrest (3).

The aim of our study was to assess the outcome of patients admitted to our ICU after cardiac arrest during the period from 1/10/07 to 31/1/09.

MATERIALS AND METHODS

We analyzed patients, aged 18-80 years, admitted to our ICU after cardiac arrest (In-Hospital and Out-Hospital) either treated or non-treated with Induced Hypothermic Therapy (IHT).

This procedure was codified by a protocol consisting of deep sedation and paralysis and active cooling to reach 32-34 °C within 4-6 hours by ice cold fluids, cool air blankets, ice packaging of the limbs. Hypothermia was maintained for 24 hours, then passive warming started.

Cardiovascular, metabolic and neurological monitoring was performed.

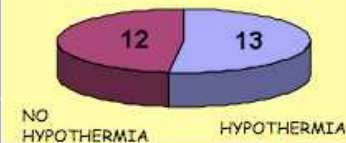
RESULTS

During the study period, 25 patients were admitted to our ICU after cardiac arrest (15 males and 10 females; mean age 63,9 ± 14,5). Twelve patients were excluded from the hypothermia protocol: three >80 years, nine with GCS > 9. Thirteen patients were treated with mild hypothermia. Before cardiac arrest they all presented a CPC (Cerebral Performance Category) 1-2. The outcome is outlined in the tables below. Complications during procedure were few: 1 patient presented arrhythmia and 1 developed a ventilator associated pneumonia, but no sequelae affected patients outcome or caused the procedure to be discontinued.

IHT EXCLUSION CRITERIA

AGE LIMIT	> 80 years
GCS	> 8
ETIOLOGY	traumatic or neurologic or metabolic
HAEMODYNAMICS	refractory cardiogenic shock
DOWNTIME	ROSC > 60 min from collapse
	ACLS started > 15 min from collapse

CARDIAC ARREST ICU ADMISSIONS



2009

OUTCOME OF THE NON-TREATED PATIENTS

DATI RIANIMAZIONE FERRARA (2007-2012)

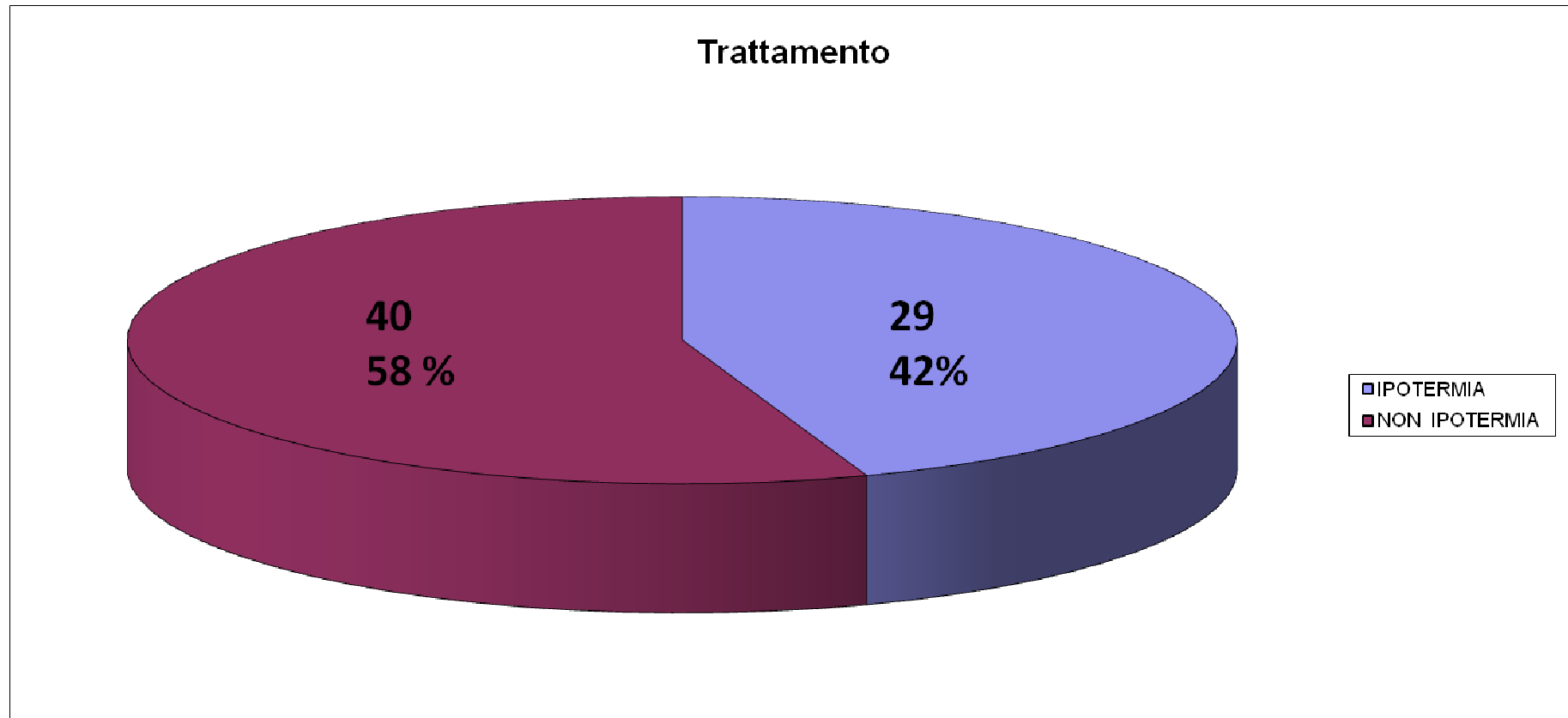


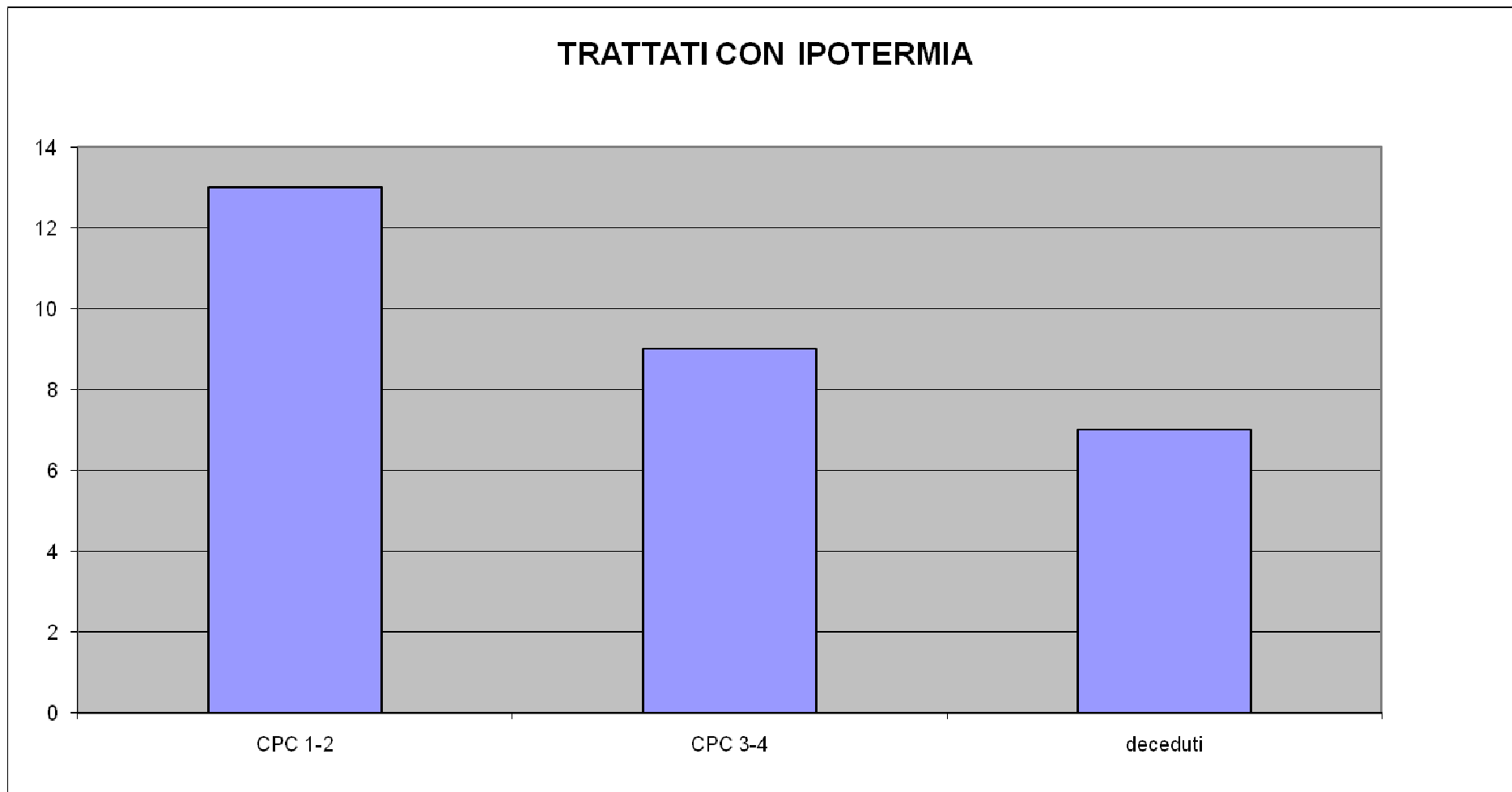
Table 21-9. Quality of Care for In-Hospital Cardiac Arrest

	Overall
Time to first shock within 3 min*	92.1% (91.0%–93.2%)
Hypothermia after resuscitation maintained between 32°C and 34°C	35.6% (30.5%–40.7%)

*Among those with a first recorded rhythm of ventricular fibrillation, pulseless ventricular tachycardia, or shockable by automated external defibrillator.

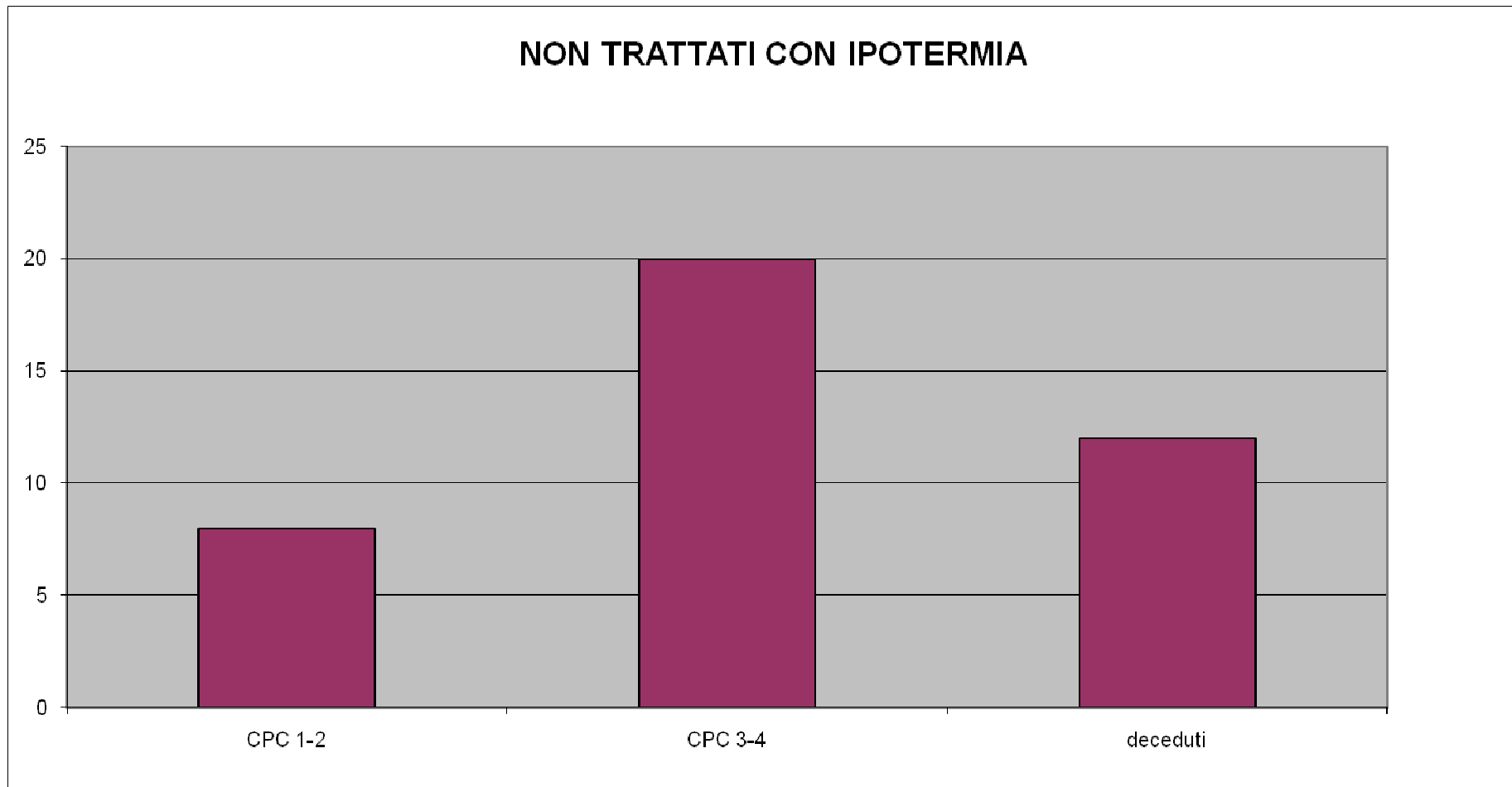
IPOTERMIA: 29 PZ TRATTATI

CPC Cerebral Performance Category
1: Good cerebral function
2: Partial cerebral dysfunction
3: Severe cerebral dysfunction
4: Coma or vegetative state
5: Death



IPOTERMIA: 40 PZ NON TRATTATI

- CPC Cerebral Performance Category
- 1: Good cerebral function
 - 2: Partial cerebral dysfunction
 - 3: Severe cerebral dysfunction
 - 4: Coma or vegetative state
 - 5: Death



NEL 2013....

- 13 ACC
- IPOTERMIA:
 - 5 pz (2 In-H, 3 Out-H)
 - 8 pz esclusi (Trauma, NCH, ORL, Shock cardio)
 - Appropriatazza: > 90%

CONCLUSIONI

- Metodica riconosciuta e standardizzata
- Utilizzo routinario e appropriato
- Registro Arresti Intra/Extra
- Sistemi Raffreddamento



GRAZIE