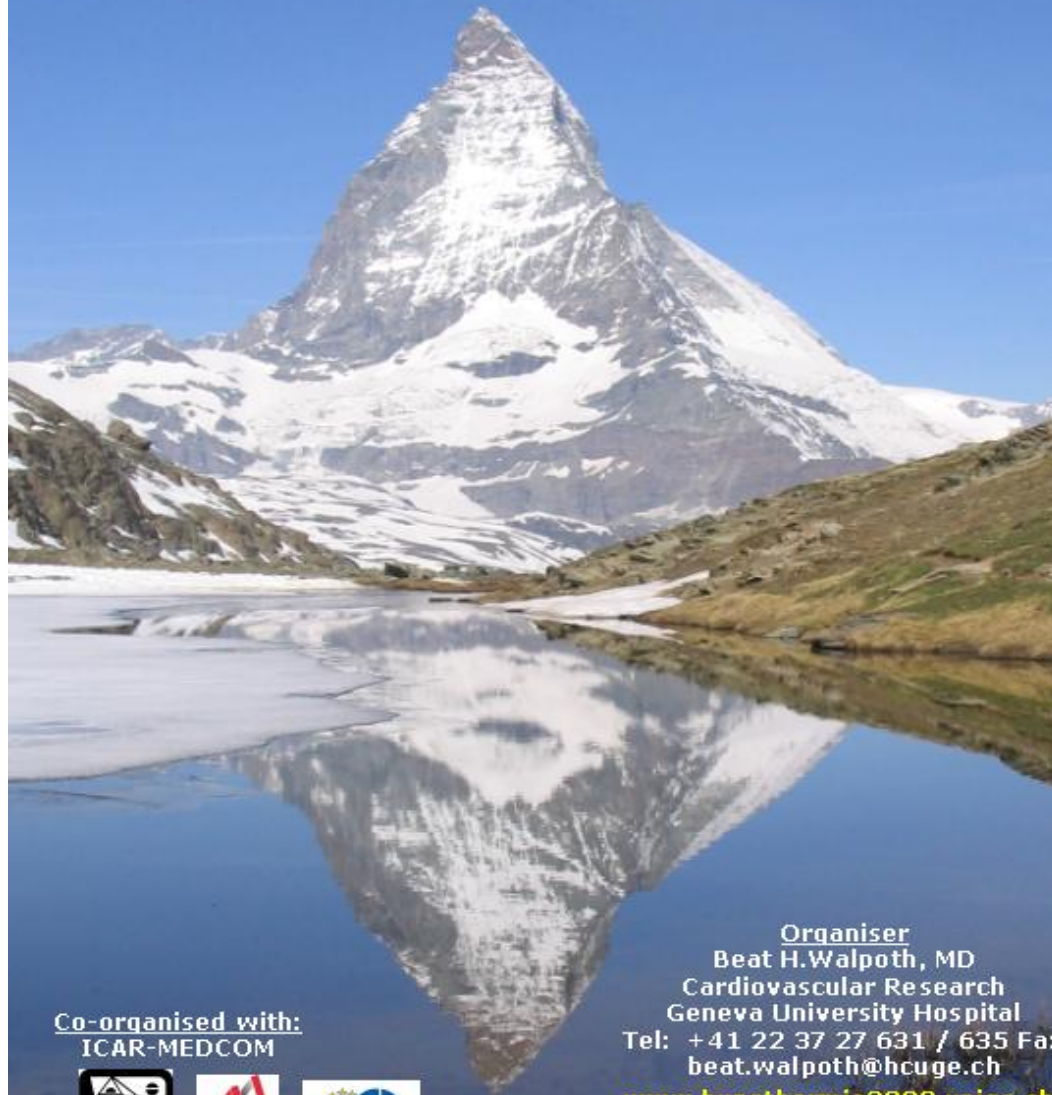


**2nd International Symposium on
ACCIDENTAL HYPOTHERMIA
25 September 2009
ZERMATT, SWITZERLAND**



Co-organised with:
ICAR-MEDCOM



Organiser
Beat H. Walpoth, MD
Cardiovascular Research
Geneva University Hospital
Tel: +41 22 37 27 631 / 635 Fax
beat.walpoth@hcuge.ch

www.hypothermia2009.unige.ch



UNIVERSITE
DE GENEVE

HUG
Hôpitaux Universitaires de Genève

2nd International Symposium on Accidental Hypothermia Zermatt, Switzerland - 25 September, 2009

WELCOME ADDRESS

- Organised bi-annually by leading European Universities involved in treatment of hypothermia victims
- 1st Symposium held in Cortina d'Ampezzo by the University of Verona
- Co-organised with ICAR-MEDCOM regrouping mountain rescue professionals from over 50 countries



2nd International Symposium on Accidental Hypothermia

Zermatt, Switzerland - 25 September, 2009

AIM OF THE SYMPOSIUM

"Towards better outcome"

- Sharing worldwide experiences
- Educating rescue and hospital staff
- Improve networking, COST actions
- Coordinating research collaborations FP7
- Increase awareness of accidental hypothermia
- Launch International Hypothermia Registry (IHR)
- Create Hypothermia Working Group
- Establish legal basis for IHR



2nd International Symposium on Accidental Hypothermia Zermatt, Switzerland - 25 September, 2009

SCIENTIFIC PROGRAMME - I

Organisers: Beat H. WALPOTH, Hermann BRUGGER, Giuseppe FAGGIAN, Marie MEYER, Bruno JELK

08.15 – 08.30	Introduction	<i>Walpoth BH</i>
08.30 – 10.00	Hypothermia Pathophysiology / Aetiology <u>Chair:</u> Zafren K, Richon J Body Reaction to Cold High Altitude and Hypothermia Hypothermia Rescue Case Reports: - Crevasse rescue with minimal motion of hypothermic patients - 4-hours ground transportation of hypothermic 'pulseless' patient	<i>Girardet P, Ledoux X Richalet J-P Jelk B, Reisten O Ellerton J</i>
10.00 – 10.30	International Hypothermia Registry Demonstration <i>during Coffee break</i>	<i>Baumann Ph</i>
10.30 – 12.00	Pre-hospital/Rescue of Hypothermic Patients <u>Chair:</u> Boyd J, Pfeiffhofer W Dilemmas of pre-clinical field therapy Treatment of Hypothermic Patients, with and without Polytrauma Hypothermia in Avalanche Victims Temperature Measurements in Hypothermia	<i>Durrer B Cauchy M Brugger H Ledoux X, Metraux G, Walpoth BH</i>
12.00 – 13.00	Plenary Lecture <u>Chair:</u> Walpoth BH 10-years after the deepest accidental hypothermia survival: what has changed?	<i>Bågenholm A, Naesheim T, Skagseth A</i>

2nd International Symposium on Accidental Hypothermia Zermatt, Switzerland - 25 September, 2009

10th ANNIVERSARY
of survival of the deepest accidental hypothermia case

- Our Honorary Guest Lecture will come from the team of Tromsø, Norway.
- Anna, Torvind and Arne will present the accident, rescue, outcome and lessons learned over the last 10 years

Anna :
• 13.7°C

• 9 hours of
resuscitation



M. Gilbert et al: Lancet 2000;335:375-376



2nd International Symposium on Accidental Hypothermia

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SCIENTIFIC PROGRAMME II

13.00 – 14.00 **Moderated Poster Session**

Moderators: Brodman M, Blancher M
on-site Lunch provided

14.00 – 15.30 **Hospital Treatment & Rewarming**

Chair: Faggian G, ZenRuffinen G

Non-invasive ICU rewarming

Cardio-pulmonary bypass rewarming (CPB)

Advantages of heparin-bonded CPB circuits + case report

Can we improve in-hospital treatment in hypothermic CPR?

Recent Initiatives to Study Accidental Hypothermia
in the Netherlands

Paal P

Khabiri E

Horisberger J

Mair P

Bierens J

Baumann Ph

15.30 – 16.00 **International Hypothermia Registry Demonstration**

during Coffee break

16.00 – 17.30 **Hypothermia Outcome / Registry / Research**

Chair: Brugger H, Mair P

International Hypothermia Registry

Hypothermia Research

Open Issues: Hypoglycaemia, ATP Depletion

Clinical Perspectives of Hypothermia Research

Closing Remarks & Hypothermia COST Project

Meyer M, Walpoth BH

Tveita T

Paal P

Faggian G

Walpoth BH

8 CME Credits given from the Société Suisse de Médecine d'Urgence et de Sauvetage (SSMUS/SGNOR)



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PATRONAGE



International Society for
Mountain Medicine



International mountaineering
and Climbing Federation



European Society for
Artificial Organs



Austrian Society of
Mountain Medicine



Italian Society of
Mountain Medicine



German Society for mountain
& Expedition Medicine



Swiss Society of
Mountain Medicine



Société Suisse de Médecine d'Urgence
et de Sauvetage (SSMUS)



Groupe d'Intervention
Médicale en Montagne



THE BARE FACTS

HYPOTHERMIA IN SWITZERLAND



Spencer
Tunick
2007
Aletsch Glacier

DIFFICULT RECOVERY AT 4,500 METRES

Jack hammer freedom
from ice-embedding



FIVE YEARS AFTER HYPOTHERMIC CARDIAC ARREST

Core temperature 17.5°C

Total arrest time 240 mins



HYPOTHERMIA RECORDS

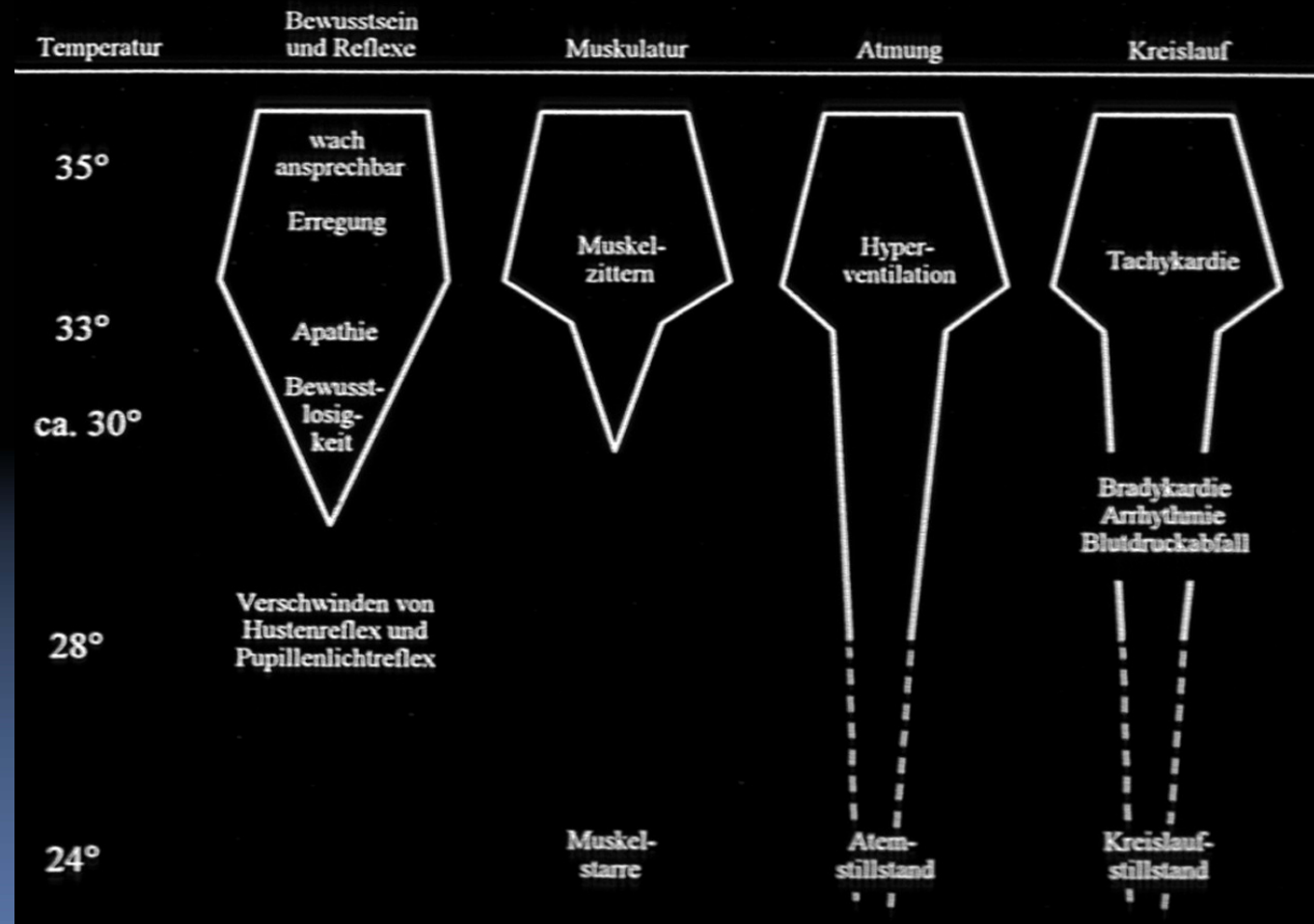
- **9°C**: lowest induced hypothermia with Survival (*Niasi et al*)
- **13.7°C**: lowest temperature of accidental hypothermia with survival (*Gilbert et al*)?
- **20 mins**: longest immersion with survival of an adult
- **66 mins**: longest cold water immersion with survival of a child

STAGES OF HYPOTHERMIA

I (35-32°C)

II (32-28°C)

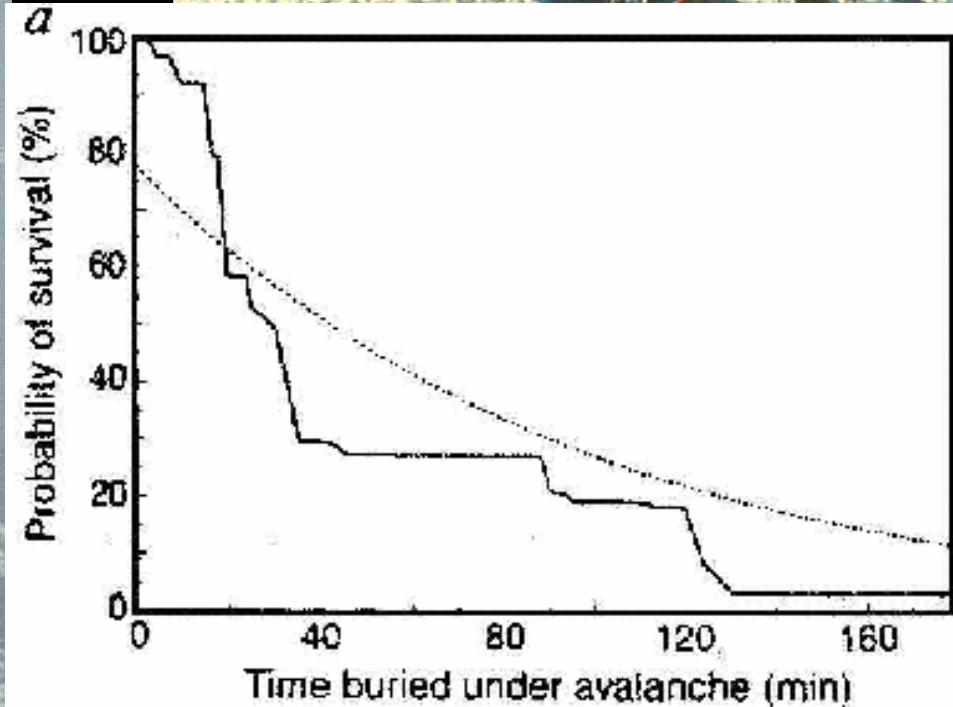
III (<28°C)



ASPHYXIA vs HYPOTHERMIA

RACE AGAINST TIME

? Detectors
? Flying Weather
? MD on site



PROBLEMS ON RESCUE:



Presence of vital signs ?

Core temperature < 28°C

Potassium < 12 mmol/l

Cardio-respiratory arrest

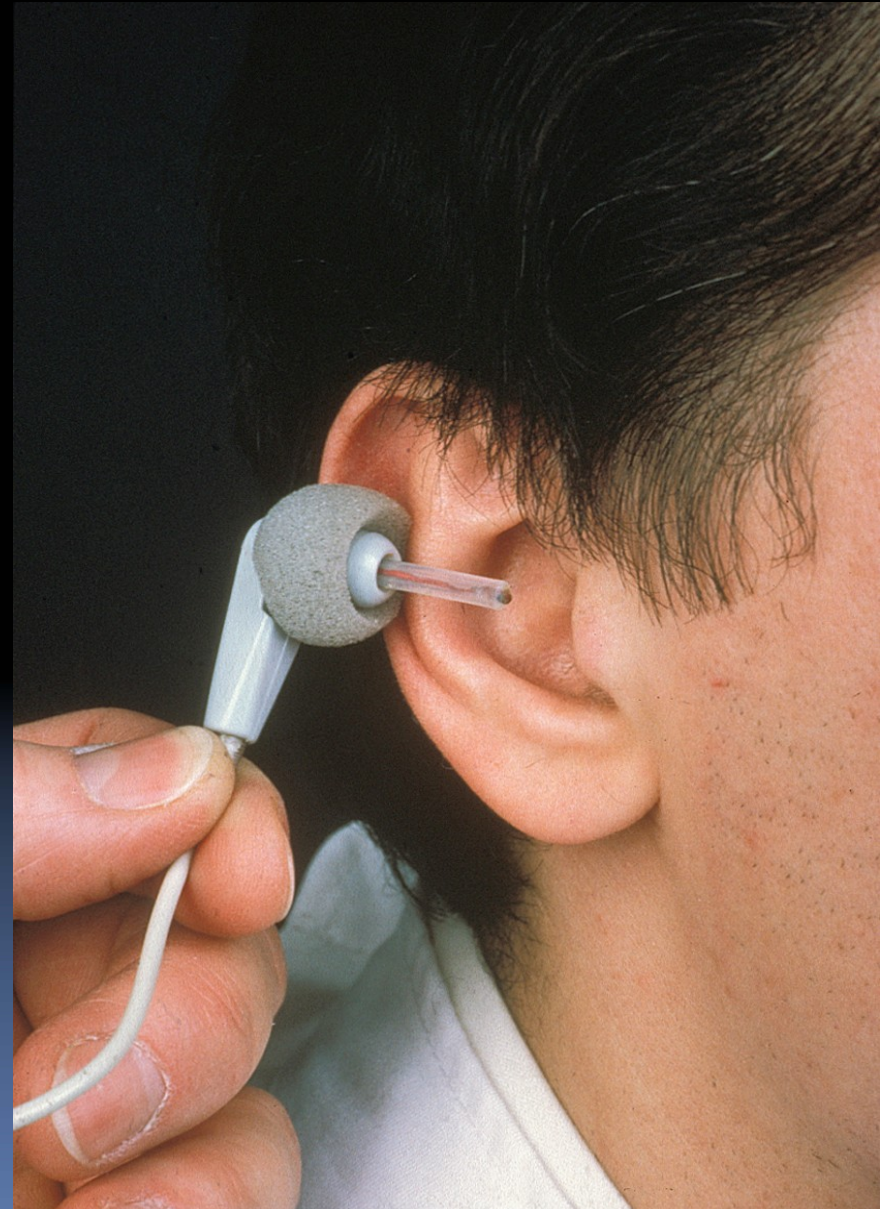
« Rescue death »

Perform normal CPR
(frequency and strength)

CORE TEMPERATURE: ? EPI TYMPANIC

Good in maintained circulation
(tympanic artery is a branch
of carotid artery)

Remember: false high
temperatures cannot be obtained
if adequately measured



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SWISS MULTI-CENTRE FOLLOW-UP STUDY

15/32 Survivors of accidental
deep hypothermia with
cardiac arrest, rewarmed by
cardiopulmonary bypass

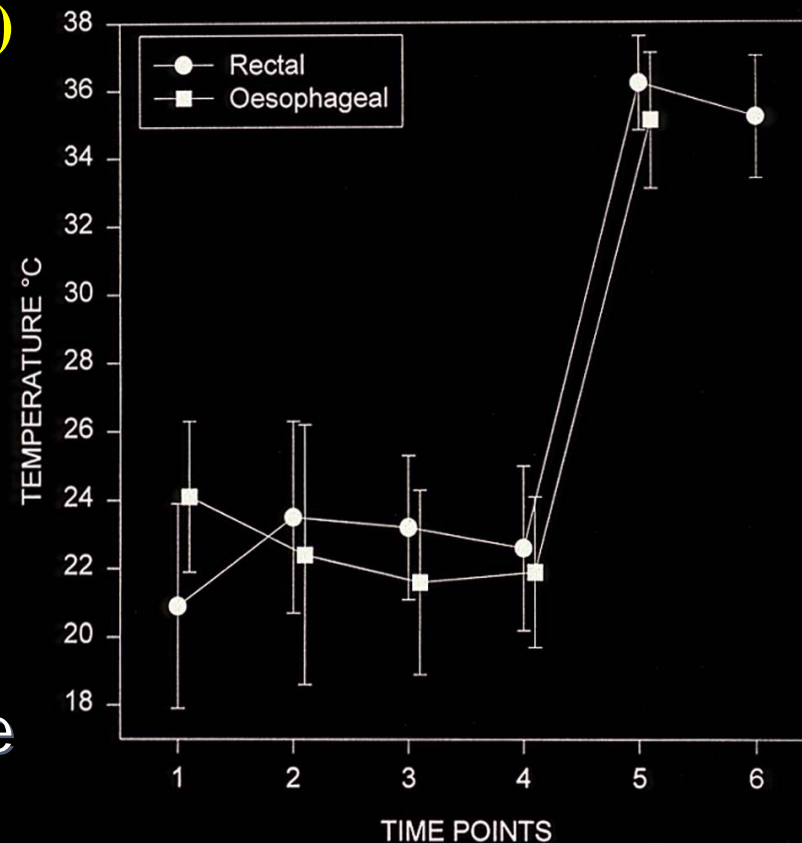
- University of Bern (n= 9)
- University of Zürich (n= 4)
- University of Lausanne (n = 2)

TIME COURSE AND TEMPERATURES FROM RESCUE TO SURVIVAL

Mean Time in minutes / (Range)

- Arrest (no CPR)
39 ± 53 (0 – 135)
- Arrest (with CPR)
151 ± 40 (89 – 130)
- CPB time until Sinus Rate
45 ± 56 (1 – 240)
- Total time until Sinus Rate
224 ± 71 (148 – 355)

TIME COURSE OF TEMPERATURE CHANGES



1-Recovery, 2-First hospital, 3-University Hospital, 4-Pre-CPB, 5-Post-CPB, 6-ICU

REWARMING METHODS

Passive: Body's heat production (isolation!) 1°C/h

Active external: Airway warming 1-2°C/h

Hot pad (burns!) 2°C/h

Forced air 2-3°C/h

Active invasive: Warm lavages 4-6°C/h

CPB 8-10°C/h

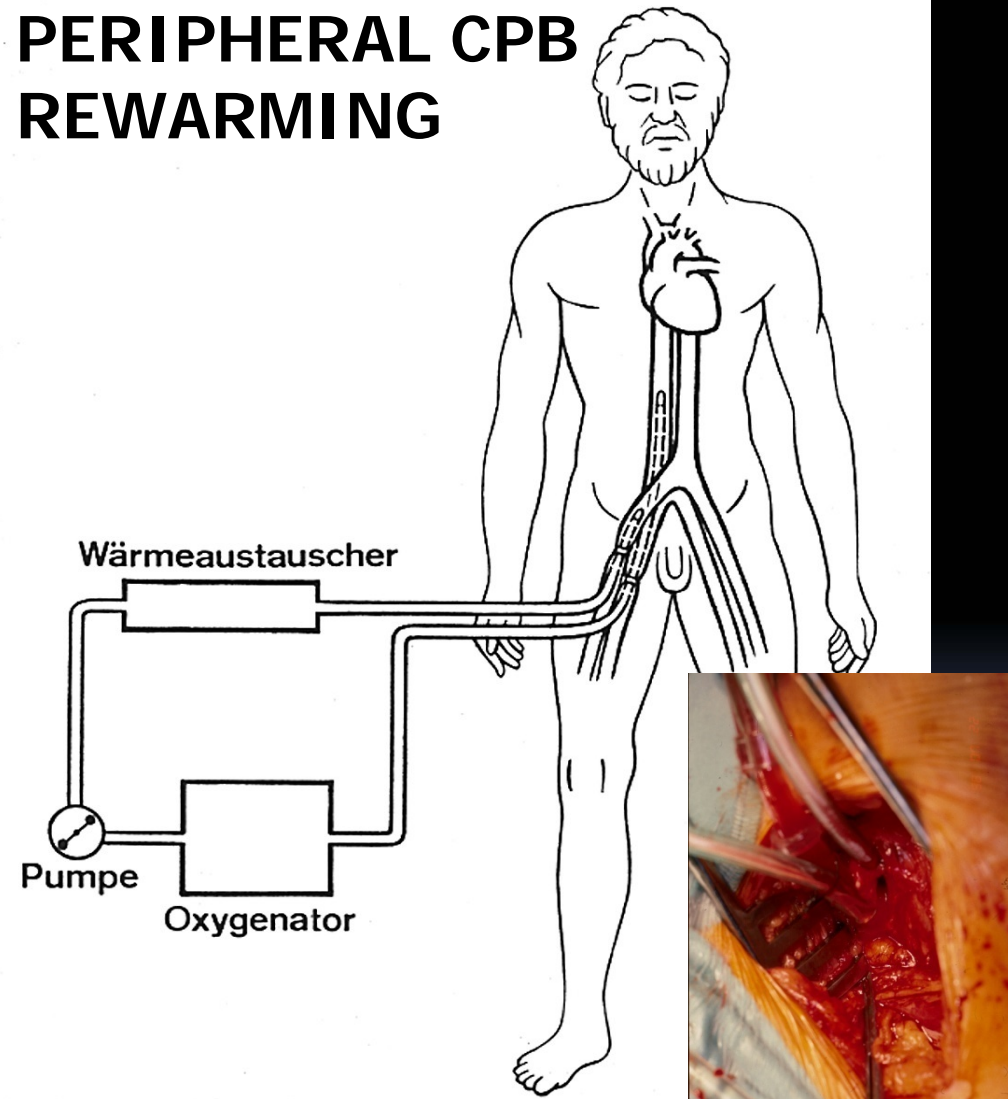


(CAVE: $\Delta T < 10^\circ$)

CARDIOPULMONARY BYPASS REWARMING

- CPB time (min)
 103 ± 46 (60–240)
- Temp. start (oeso)
 $21.9^\circ \pm 2.2$ (19–25)
- Temp. end (oeso)
 $35.1^\circ \pm 2$ (32–38)
- Rewarming rate
 7.7 ($^\circ\text{C/hr}$)
Sinus rate at a mean
temperature of 32°C :
Spontaneous (n=7)
Defibrillation (n=8)

PERIPHERAL CPB REWARMING



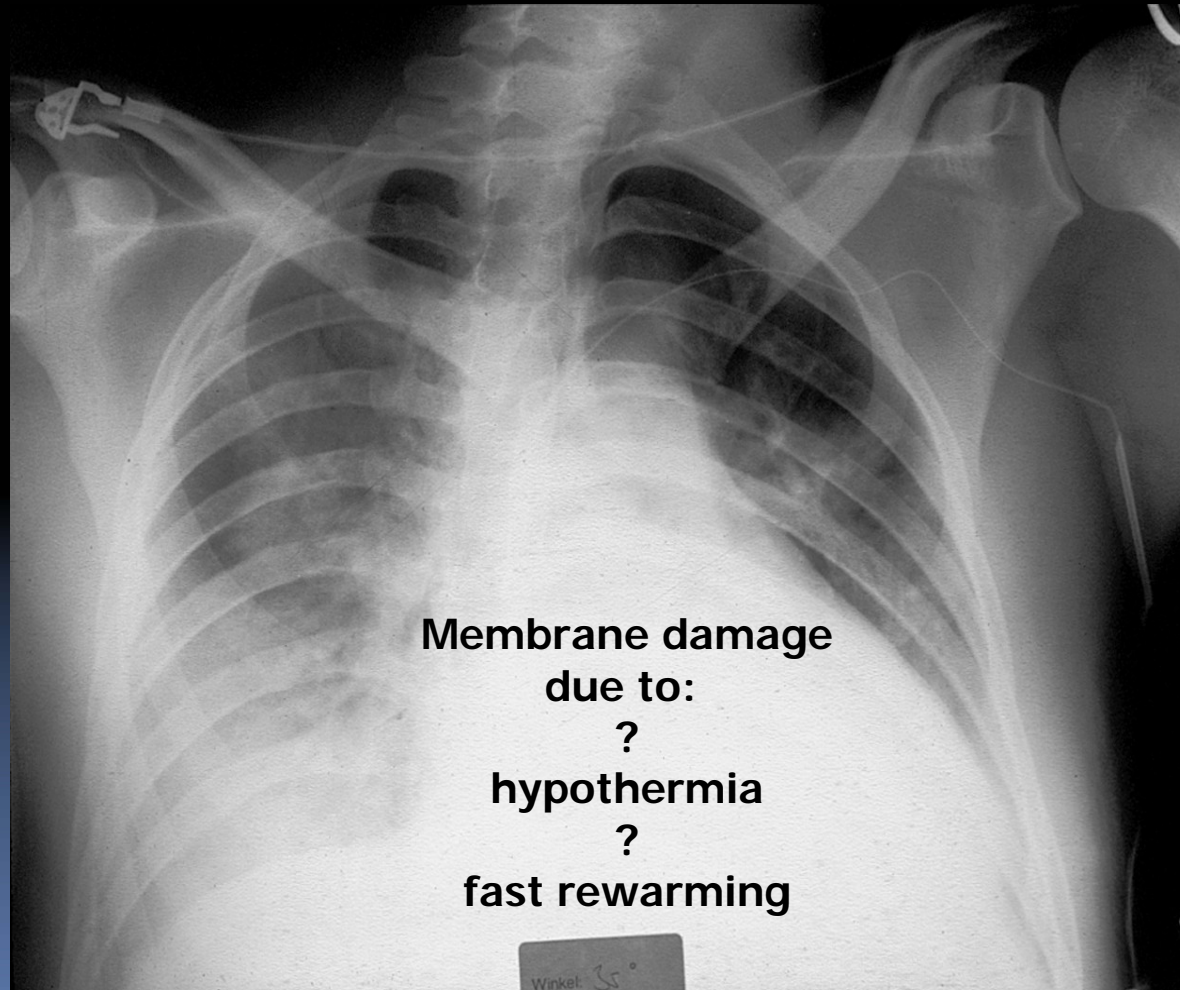
Althaus U et al, Ann Surg 1982;195:492-5

ADVANTAGES OF CPB REWARMING

- Organ perfusion and oxygenation
- Fast rewarming ?
- Core rewarming before periphery
- Rapid metabolic correction
- Improve micro-circulation (haemodilution)
- Detoxification by dilution / filtration

POST REWARMING COMPLICATIONS

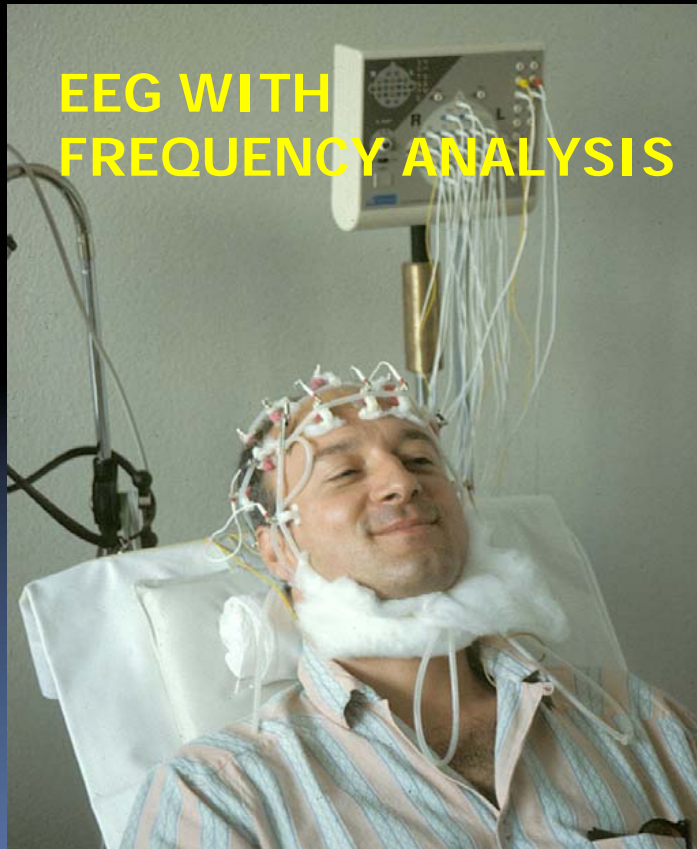
- 6 pulmonary oedema
- 2 pneumonia
- 2 ARDS
- 3 pneumothorax
- 1 cardiac arrhythmia/
1 pericarditis
- 3 anuria/
2 haematuria
- 9 neurological
dysfunctions



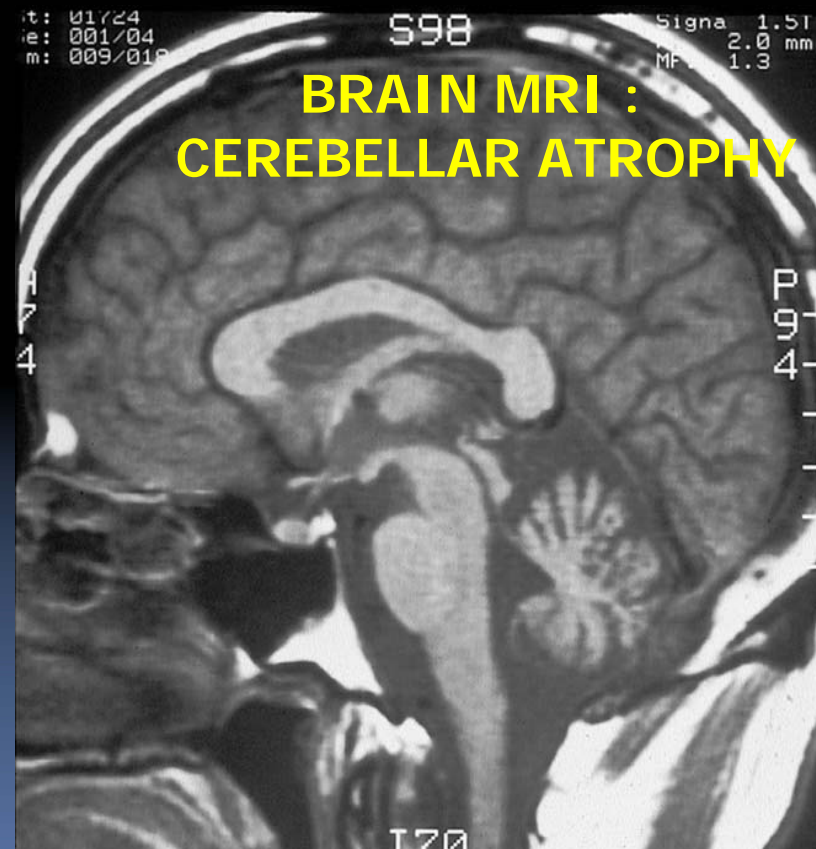
AFTER HOSPITAL DISCHARGE

- 10 further hospitalisations(40 days)
- 8 ongoing problems (117 days)
- 13 back to work (137 days)
- 7 married/children

EEG WITH
FREQUENCY ANALYSIS



BRAIN MRI :
CEREBELLAR ATROPHY



REASONS FOR GOOD OUTCOME

- Hypothermia, brain protection
- No asphyxia (despite 1 avalanche)
- Young, healthy (no homeless)
- Professional rescue organisations
- Fast rescue, CPR & treatment
- CPB rewarming

TABLE FOR DECISION MAKING

9. MANAGEMENT

SEVERE ACCIDENTAL HYPOTHERMIA WITH CARDIAC ARREST AND POTENTIAL ASPHYXIA

RECOVERY
Vital signs

present

absent

absent

rescue
death

CPR

CPR

CPR

TRANSPORTATION
Cardio-respiratory
resuscitation

apparent death, cardio-respiratory arrest

HOSPITAL ADMISSION
Clinical status

core temperature $<30^{\circ}\text{C}$

Temperature

adult K <10
child K <12

adult K >10
child K >12

LABORATORY
K(mmol/l)

CPB

CPB

declare
death

rewarming

rewarming

DECISION

CONCLUSIONS

- All survivors of accidental hypothermia feel healthy and are free of symptoms at follow-up
- Results confirm that CPB rewarming is very promising for patients with accidental deep hypothermia, even after prolonged circulatory arrest

2nd International Symposium on Accidental Hypothermia
Zermatt, Switzerland - 25 September, 2009
Worldwide Launch of International Hypothermia Registry

- Accidental deep hypothermia:
rare, insufficiently diagnosed
- Lack of knowledge to improve management
- Worldwide data base
- IHR Working Group
- Establish consensus guidelines
- Increase awareness

www.hypothermia2009.unige.ch



2nd International Symposium on Accidental Hypothermia

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Worldwide International Hypothermia Registry

- **Internet-based English survey**
- **Eligibility: all interested hospitals/rescue centres**
- **Includes:**
 - **victims with core body $T^{\circ} < 32^{\circ}\text{C}$, preference for $T^{\circ} < 28^{\circ}\text{C}$ with cardiac arrest.**
 - **accidental hypothermia of any origin (exposure/avalanche/immersion/suicide attempt...)**
- **Registry components:**
 - **Anonymous patient data**
 - **Accident data**
 - **Prehospital treatment**
 - **Hospital treatment, rewarming method, clinical and laboratory data**
 - **Post-rewarming complications**
 - **Outcome**
- **Data access and analysis by nominated international working group**





INTERNATIONAL HYPOTHERMIA REGISTRY (IHR)

*M. Meyer, Ph. Baumann, B.H. Walpoth &
The International Hypothermia Working Group*

www.hypothermia-registry.org

PRE-HOSPITALISATION

 HUGO International Hypothermia Registry IHR IHR Prehospitalisation	 IHR	<input type="button" value="Save"/> <input type="button" value="Save and Close"/> <input type="button" value="Cancel"/>	Philippe Baumann connected since 09:10 until 10:11 <input type="button" value="Quit"/> IHR local data manager / center of Geneva Patient : <u>PATIENT 17 Patient 17 (M)</u> N° : 80000342 <input type="button" value="Change"/> Stored consent <input type="button" value="Patient consent given"/>
Accident Features Medical Features			
Accident Features			
Accident Date	<input type="text" value="07/09/2009"/>	Accident Time	Hours <input type="text" value="3"/> Minutes <input type="text" value="24"/>
Type of accident	<input type="radio"/> -- <input checked="" type="radio"/> Water <input type="radio"/> Alpine <input type="radio"/> Urban/Rural		
Water			
Context of accident (water)	<input type="radio"/> -- <input type="radio"/> Immersion <input checked="" type="radio"/> Submersion		
Temperature (water) known	<input type="radio"/> -- <input type="radio"/> Unknown <input checked="" type="radio"/> Known	Température (water)	<input type="text"/> [C°]
Time in water (water)	<input type="radio"/> -- <input type="radio"/> Unknown <input checked="" type="radio"/> Known	Time in water	Days <input type="text" value="--"/> Hours <input type="text" value="--"/> Minutes <input type="text" value="--"/>
Rescue			
Rescue on site by Companions/Self	<input type="radio"/> -- <input checked="" type="radio"/> First on site <input type="radio"/> Second on site		
Rescue on site by Paramedics	<input type="radio"/> -- <input checked="" type="radio"/> First on site <input type="radio"/> Second on site		
<input checked="" type="checkbox"/> Rescue on site by Physician	<input type="radio"/> -- <input checked="" type="radio"/> First on site <input type="radio"/> Second on site	Name	<input type="text"/> Organization <input type="text"/> City <input type="text"/>
Medicated rescue arrival date	<input type="text" value="23/09/2009"/>	Hours	<input type="text" value="19"/> Minutes <input type="text" value="27"/>
Interval between accident and rescue 16 (days) 16 (hours) 3 (minutes)			

HOSPITALISATION

 HUGO International Hypothermia Registry IHR IHR Hospitalisation		<input type="button" value="Save"/> <input type="button" value="Save and Close"/> <input type="button" value="Cancel"/>	<div style="display: flex; justify-content: space-between;"> Philippe Baumann connected since 09:10 until 10:14 <input type="button" value="Quit"/> </div> <div style="display: flex; justify-content: space-between;"> IHR local data manager / center of Geneva </div> <div style="display: flex; justify-content: space-between;"> Patient : PATIENT 17 Patient 17 (M) N° : 80000342 <input type="button" value="Change"/> </div> <div style="display: flex; justify-content: space-between;"> Stored consent Patient consent given </div>
---	---	---	--

Pre-rewarming management of the patient	Data on rewarming	Intensive Care after Rewarming	Comments
---	-------------------	--------------------------------	----------

Arrival time at rewarming hospital

Arrival time at rewarming hospital Date :  Hours: -- Minutes: --

Neurologic evaluation

Arrival hospital Glasgow ☐ -- ☒ Possible ☐ Impossible Glasgow score : O: 2 V: 3 M: 3 --Tot: 8

Global Glasgow Score

Eye opening ☐ -- ☐ None ☒ To pain ☐ To speech ☐ Spontaneous

Verbal response ☐ -- ☐ None ☐ Incomprehensible ☒ Inappropriate ☐ Confused ☐ Oriented

Motor response ☐ -- ☐ None ☐ Extension ☒ Flexor response ☐ Withdrawal from pain ☐ Localizes pain ☐ Obeys commands

Left pupil	Right pupil
Reactive to light <input checked="" type="radio"/> -- <input type="radio"/> Yes <input type="radio"/> No <input type="radio"/> Unknown	Reactive to light <input checked="" type="radio"/> -- <input type="radio"/> Yes <input type="radio"/> No <input type="radio"/> Unknown
Size <input checked="" type="radio"/> -- <input type="radio"/> Normal <input type="radio"/> Mydriasis <input type="radio"/> Miosis <input type="radio"/> Unknown	Size <input checked="" type="radio"/> -- <input type="radio"/> Normal <input type="radio"/> Mydriasis <input type="radio"/> Miosis <input type="radio"/> Unknown

Core T° determined at hospital admission

Core T° ☒ -- ☐ Unknown ☐ Known

Shivering present ☒ -- ☐ Yes ☐ No

ECG

 ECG recordings --

Circulation

Defibrillation ☒ -- ☐ Yes ☐ No ☐ Unknown

Cardiovascular arrest ☒ -- ☐ Yes ☐ No ☐ Unknown

Systolic blood pressure [mmHg] Diastolic blood pressure [mmHg] Heart rate [/min]

Major concomitant trauma

☒ -- ☐ Yes ☐ No ☐ Unknown

Major concomitant disease

☒ -- ☐ Yes ☐ No ☐ Unknown

Major concomitant intoxication

☒ -- ☐ Yes ☐ No ☐ Unknown

Drug administration

Drug administration ☐ -- ☒ Yes ☐ No ☐ Unknown

Drug	Dose	Unit	How many times	Drug response	Other drug
 General anaesthetics: narcotics or sedatives	123	mg	4	Yes	

Fluid replacement



Fluid replacement ☐ -- ☒ Yes ☐ No ☐ Unknown


Fluid replacement volume [ml] Warmed ☐ -- ☒ Yes ☐ No ☐ Unknown Temperature [C°]

Airway rewarming

Airway rewarming ☐ -- ☒ Yes ☐ No ☐ Unknown

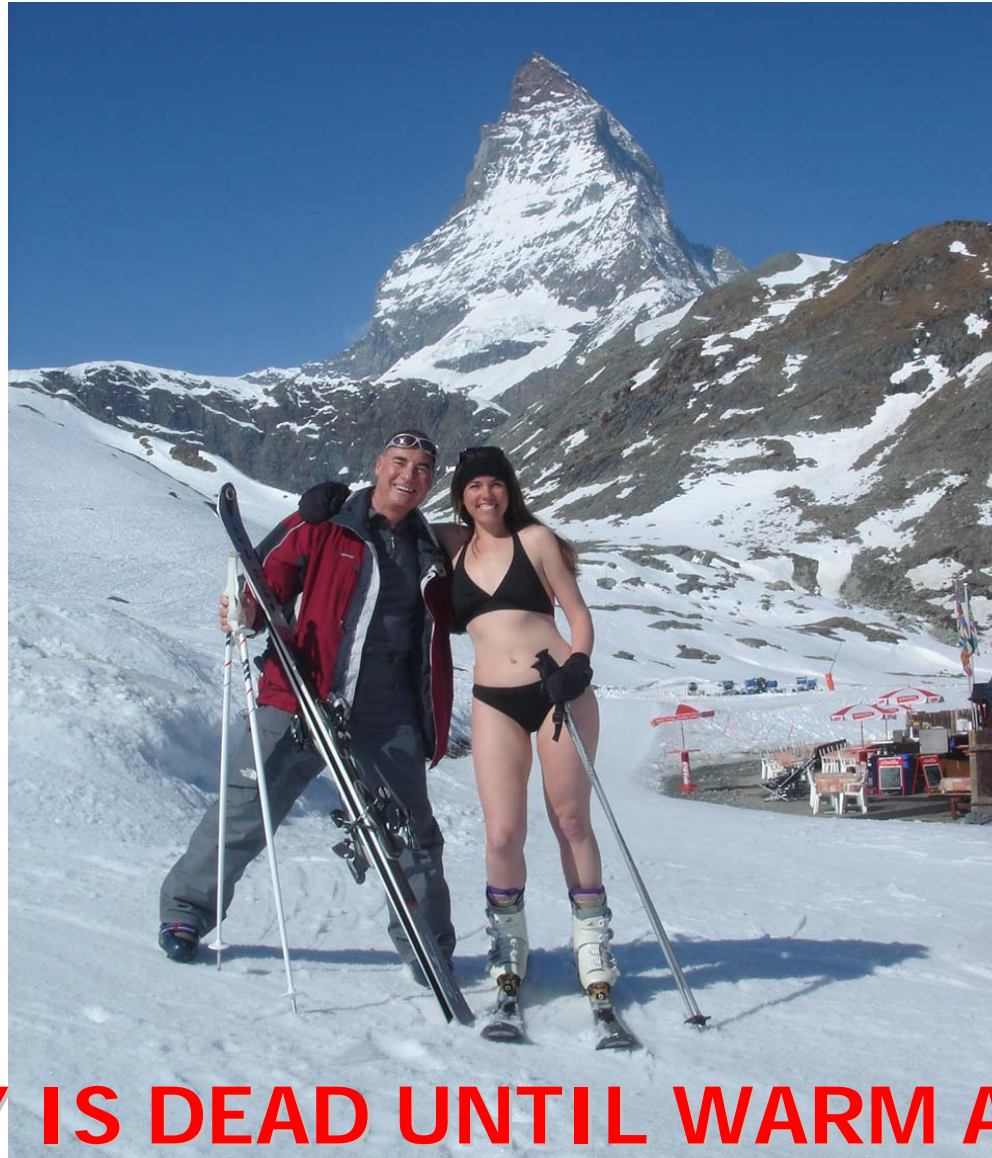
OUTCOME

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--	--	---	---	---

Outcome at 1 year Comments	
Outcome assesment date Outcome assessment date <input type="text"/> 	
Consent status Patient 's consent given <input checked="" type="radio"/> -- <input type="radio"/> Yes <input type="radio"/> No <input checked="" type="radio"/> Patient consent given	
Time spent in hospital/rehabilitation after ICU Time spent in hospital/rehabilitation after ICU <input checked="" type="radio"/> -- <input type="radio"/> Yes <input type="radio"/> No <input type="radio"/> Unknown	
Alive after 1 year Alive after 1 year <input checked="" type="radio"/> -- <input type="radio"/> Yes <input type="radio"/> No <input type="radio"/> Unknown	
Neurologic evaluation Outcome Glasgow <input checked="" type="radio"/> -- <input type="radio"/> Unknown <input type="radio"/> Known Glasgow score : O: 0 V: 0 M: 0 --Tot: 0	
Long term complications	
Neurological : CNS long term complications	<input checked="" type="radio"/> -- <input type="radio"/> Had none <input type="radio"/> Improvement <input type="radio"/> Stable <input type="radio"/> Deterioration <input type="radio"/> Unavailable
Neurological : PNS long term complications	<input checked="" type="radio"/> -- <input type="radio"/> Had none <input type="radio"/> Improvement <input type="radio"/> Stable <input type="radio"/> Deterioration <input type="radio"/> Unavailable
Cardiac long term complications	<input checked="" type="radio"/> -- <input type="radio"/> Had none <input type="radio"/> Improvement <input type="radio"/> Stable <input type="radio"/> Deterioration <input type="radio"/> Unavailable
Pulmonary long term complications	<input checked="" type="radio"/> -- <input type="radio"/> Had none <input type="radio"/> Improvement <input type="radio"/> Stable <input type="radio"/> Deterioration <input type="radio"/> Unavailable
Digestive long term complications	<input checked="" type="radio"/> -- <input type="radio"/> Had none <input type="radio"/> Improvement <input type="radio"/> Stable <input type="radio"/> Deterioration <input type="radio"/> Unavailable
Renal long term complications	<input checked="" type="radio"/> -- <input type="radio"/> Had none <input type="radio"/> Improvement <input type="radio"/> Stable <input type="radio"/> Deterioration <input type="radio"/> Unavailable
Metabolic long term complications	<input checked="" type="radio"/> -- <input type="radio"/> Had none <input type="radio"/> Improvement <input type="radio"/> Stable <input type="radio"/> Deterioration <input type="radio"/> Unavailable
Musculoskeletal long term complications	<input checked="" type="radio"/> -- <input type="radio"/> Had none <input type="radio"/> Improvement <input type="radio"/> Stable <input type="radio"/> Deterioration <input type="radio"/> Unavailable
Other long term complications	<input checked="" type="radio"/> -- <input type="radio"/> Had none <input type="radio"/> Improvement <input type="radio"/> Stable <input type="radio"/> Deterioration <input type="radio"/> Unavailable

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BEAT WALPOTH'S VIEW ON HYPOTHERMIA !



"NOBODY IS DEAD UNTIL WARM AND DEAD"

LESSONS LEARNED FROM :

- Accidental Hypothermia

(31,000 citations)

- Induced Therapeutic Hypothermia

(20,000 citations)

Treatment of traumatic brain injury with moderate hypothermia.

Marion DW, Penrod LE, Kelsey SF, Obrist WD, Kochanek PM, Palmer AM, Wisniewski SR, DeKosky ST.

N Engl J Med. 1997 Feb 20;336(8):540-6.

Hypothermia therapy after traumatic brain injury in children.

Karakitsos D, Karabinis A.

N Engl J Med. 2008 Sep 11;359(11):1179-80.

Clinical practice. Neurologic prognosis after cardiac arrest.

Young GB.

N Engl J Med. 2009 Aug 6;361(6):605-11. Review.

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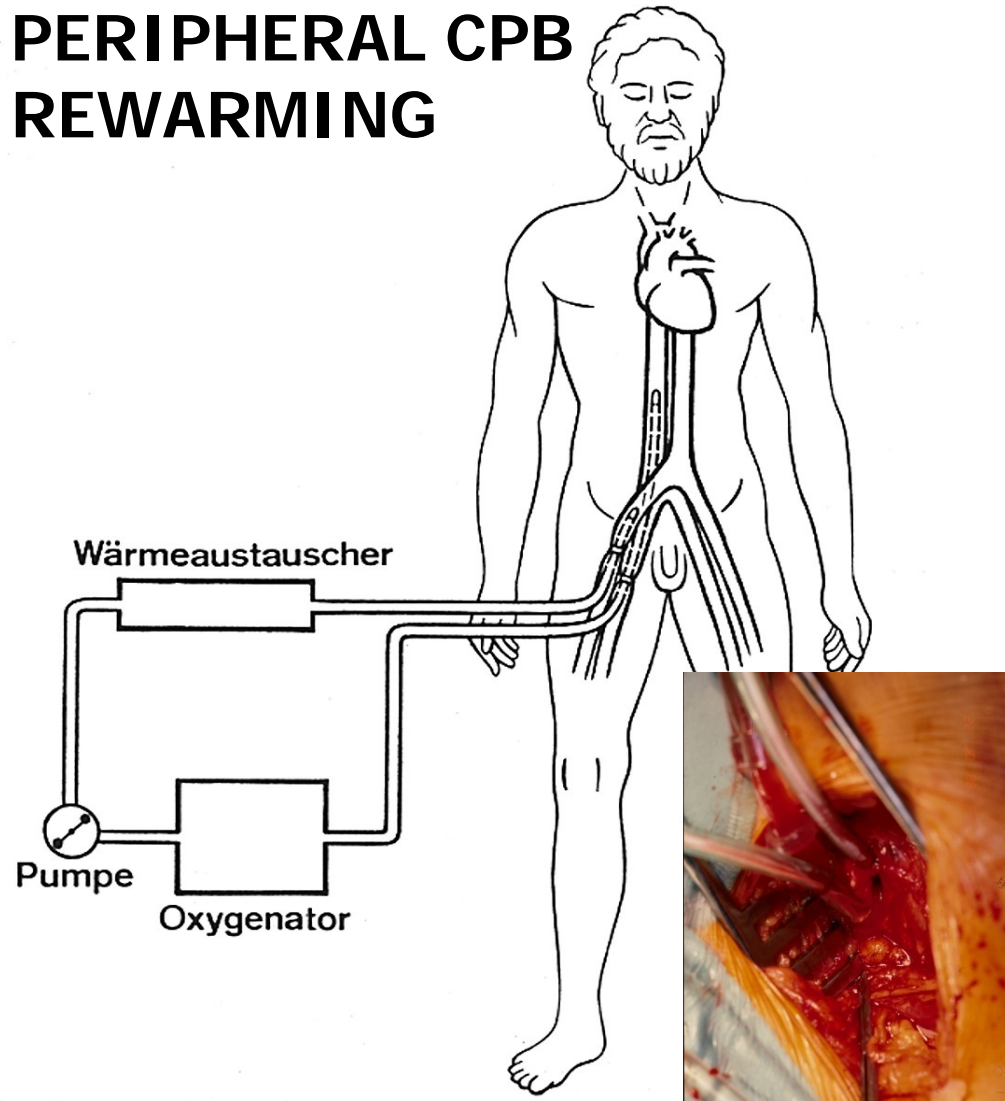
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- CPB time (min)
 103 ± 46 (60–240)
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Althaus U et al, Ann Surg 1982;195:492-5

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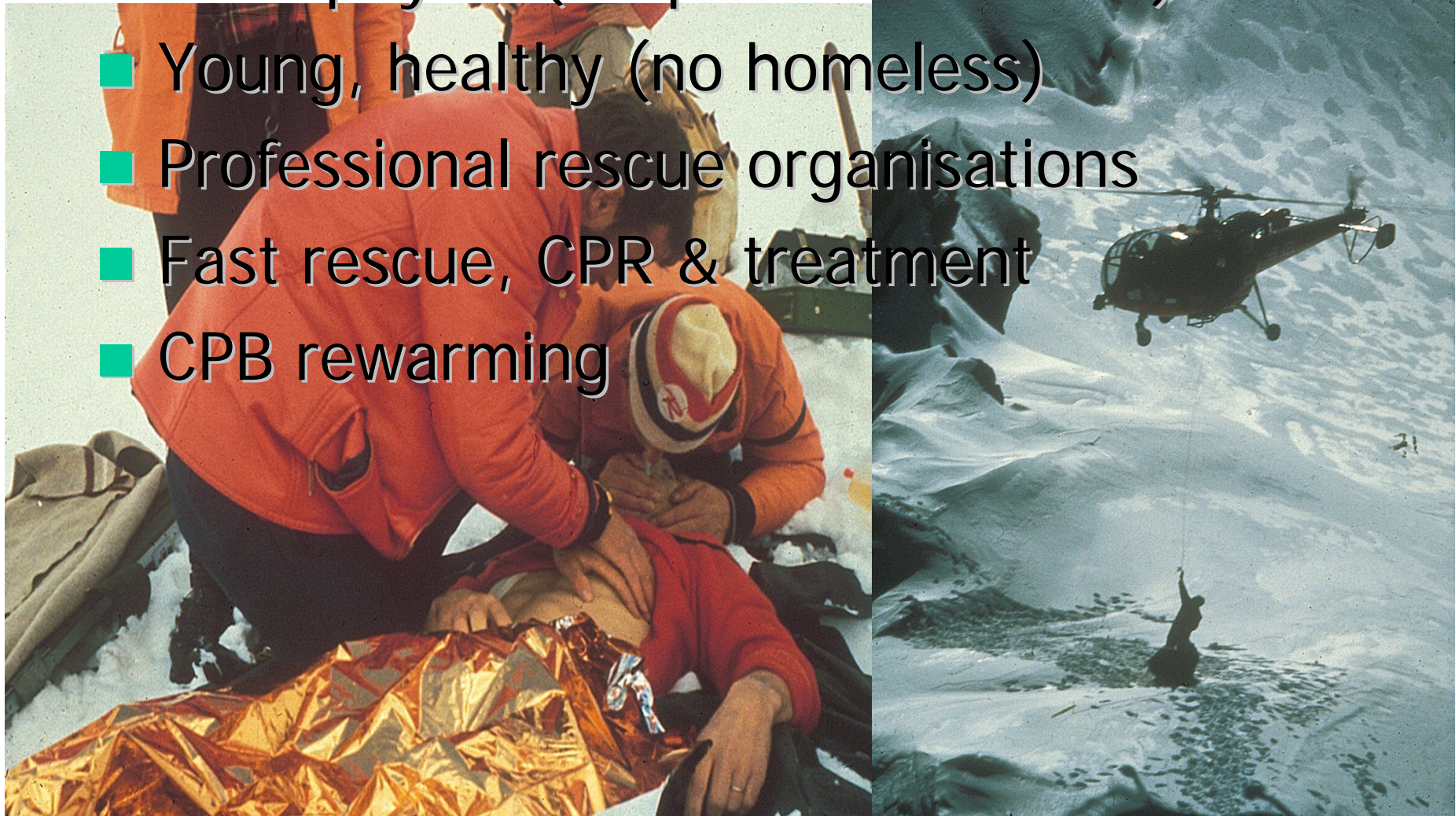


TABLE FOR DECISION MAKING & MANAGEMENT

