Kardiologie heute

Unfallkrankenhaus Berlin, 25. November 2011

Medical University of Graz

Invasive Kühlung beim kardiogenen Schock

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Klin. Abt. für Kardiologie
Zentrum Innere Medizin
Medizinische Universität Graz

Indikationen der Hypothermie

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Herz- und Neurochirurgie √

Koma nach Reanimation √

Kardiog. Schock nach Rean.: MH ist nicht schädlich (√)

STEMI: protektiv in einer Pilotstudie (√)

Apoplex: unklar ?

SHT/ICB: unklar ?

Lungenversagen

Milde Hypothermie beim kardiogenen Schock: Wo kann sie indiziert sein?

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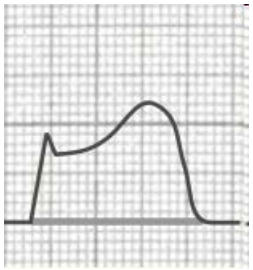
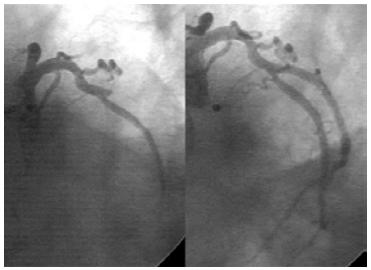
MH

MH





Rehab

STEMI

PCI

Pump-Versagen, Schock

SIRS/Sepsis/MOV

Wie groß wird ein Herzinfarkt?

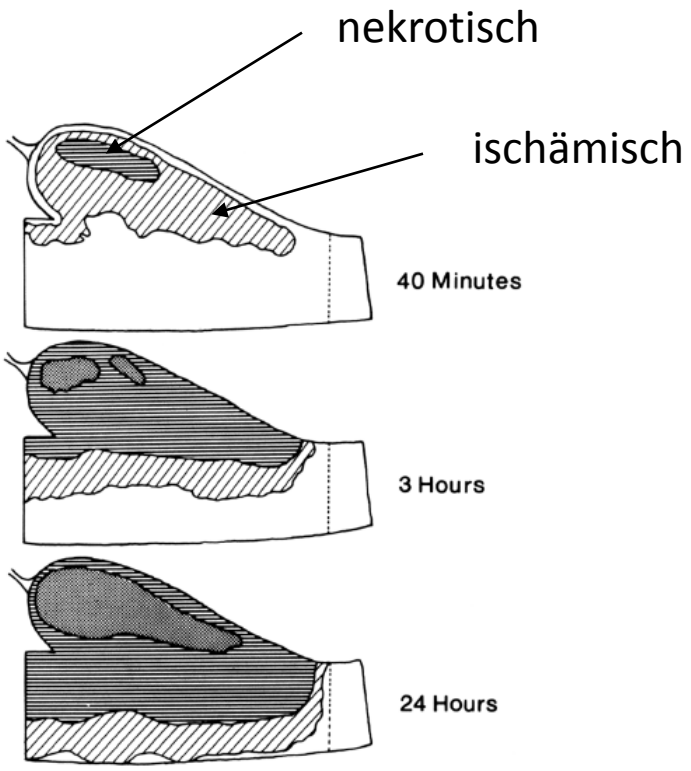
nicht beeinflußbar:

- Größe des ischämischen Areals
- Restdurchblutung während der Ischämie

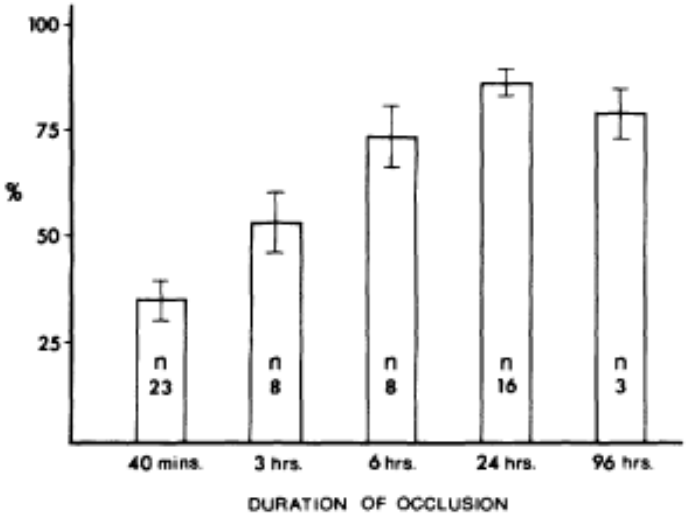
beeinflußbar:

- Dauer der Ischämie
- Sympathotonus/metabolische Rate während Ischämie
- **Modus der Reperfusion**

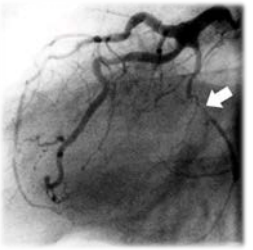
Infarktgröße: Dauer der Ischämie



Infarktgröße



Aspisol
Efient/Brilique
Heparine



Reimer et al. , Circulation 1977

Infarktgröße: Durchblutung und Katecholamine

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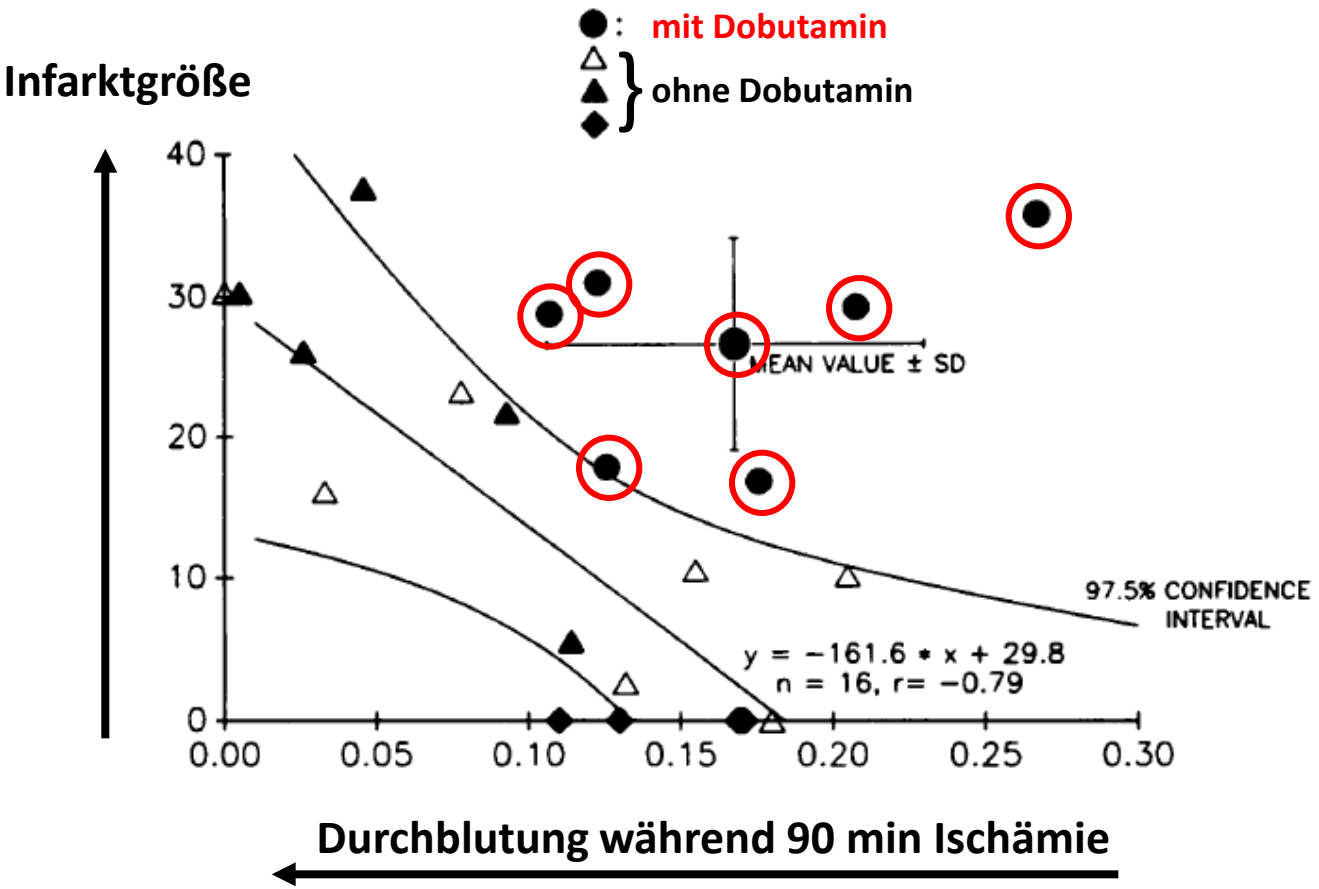

Schulz et al., Circulation 1993

Hypothermie senkt die Infarktgröße: Es funktioniert im Experiment

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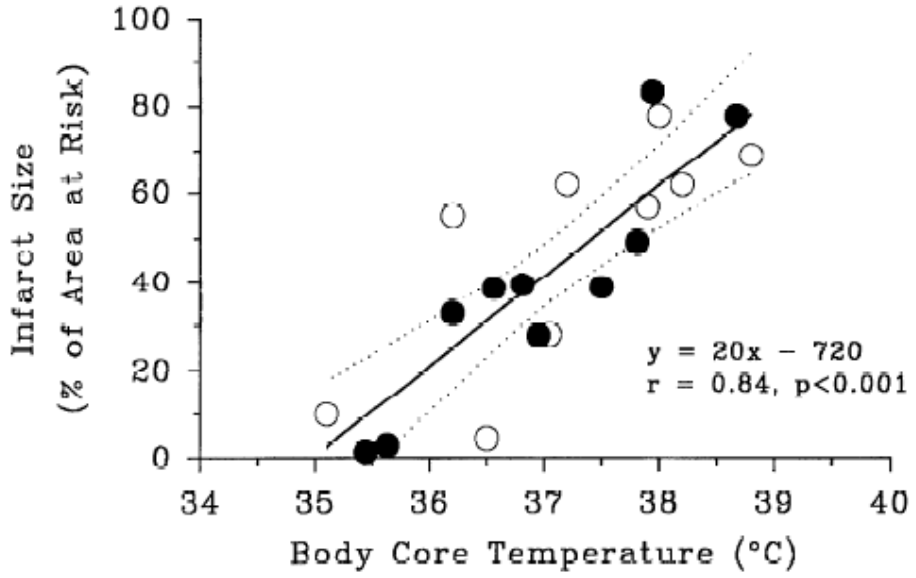
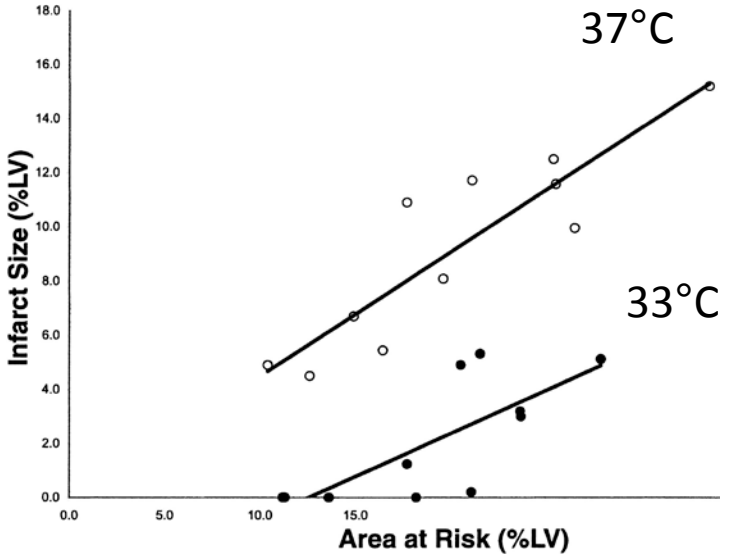
Schwein in vivo, Kühlung <u>während</u> der Ischämie





Duncker et al., AJP 1996

Dae et al., AJP 2002

Hypothermie bei Patienten: Die falsche Studie - Das Ende des Hype

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Hypothermia in the prevention of MI – COOL-MI

COOL-MI Trial (Radiant)

No difference in Day 30 SPECT infarct size (1° endpoint)

Control Arm (13.8%) vs. Hypothermia Arm (14.1%), p = 0.83

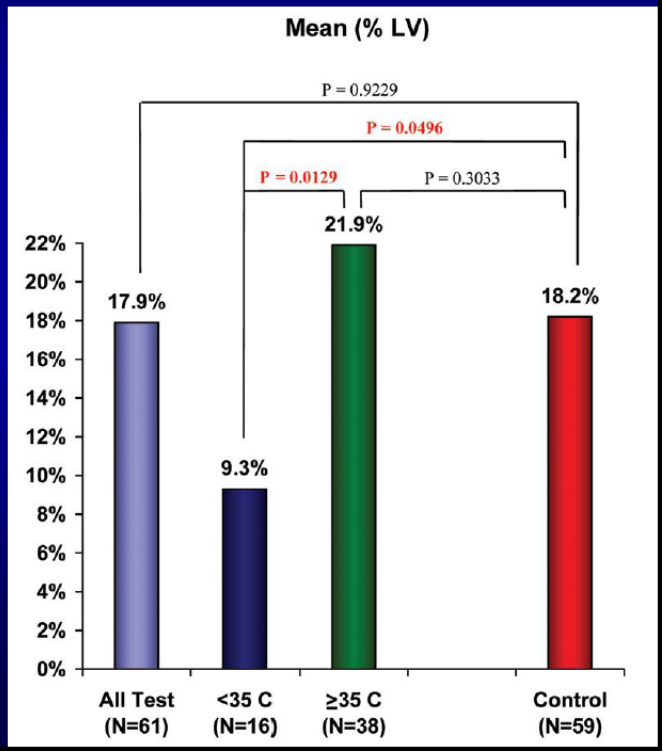
Cooling deemed safe and well-tolerated (94% tolerated hypothermia).

Possible "dose-response" relationship in anterior MI subgroup

Anterior MIs –

Day 30 SPECT Infarct Size

49% reduction in infarction size in precooled patients



MH vor vs nach der Reperfusion

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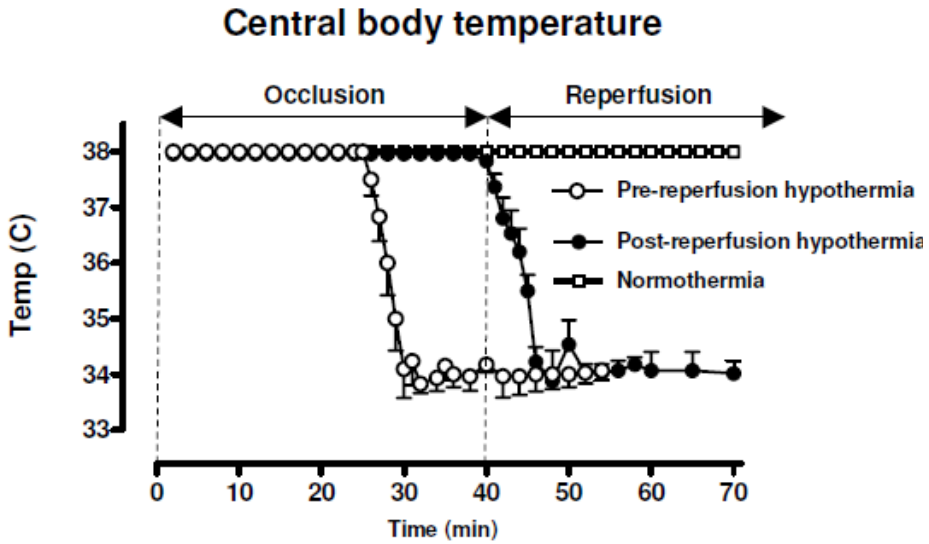
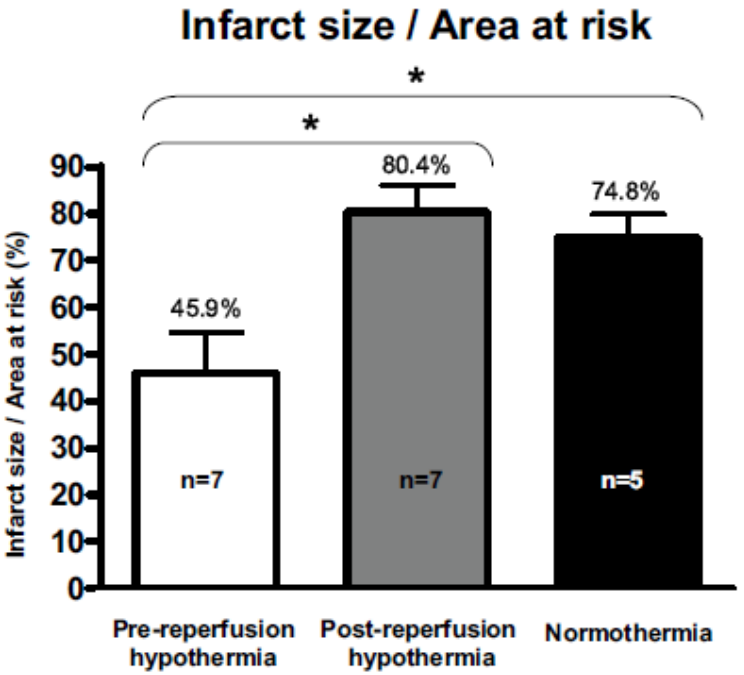
Schwein in vivo, Kühlung vor Reperfusion





Götberg, BMC 2008

Schneller kühlen!

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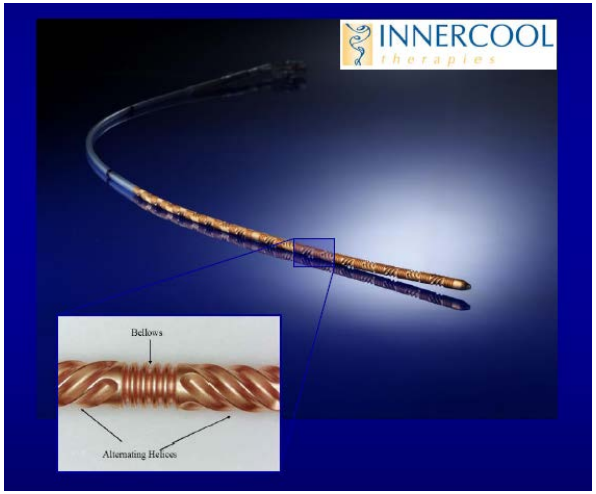
1000 ml cold saline (4°C)

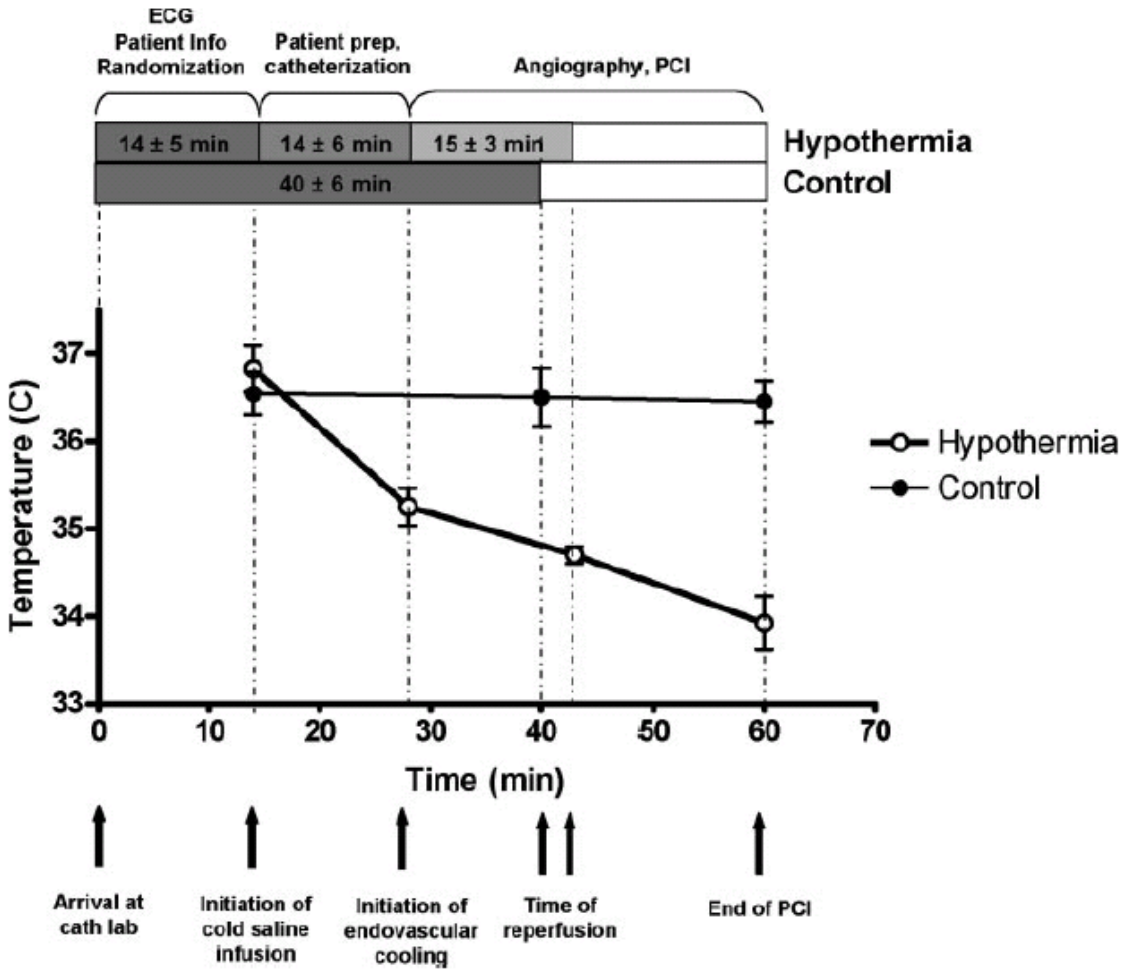
Quick initiation of hypothermia



1-2 Liter eiskalte Lösung

intravaskuläres Kühlen

Induktion einer MH < 35°C bei Patienten mit STEMI



Götberg, Circ CI 2010

MH bei Patienten mit STEMI

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time to reperfusion

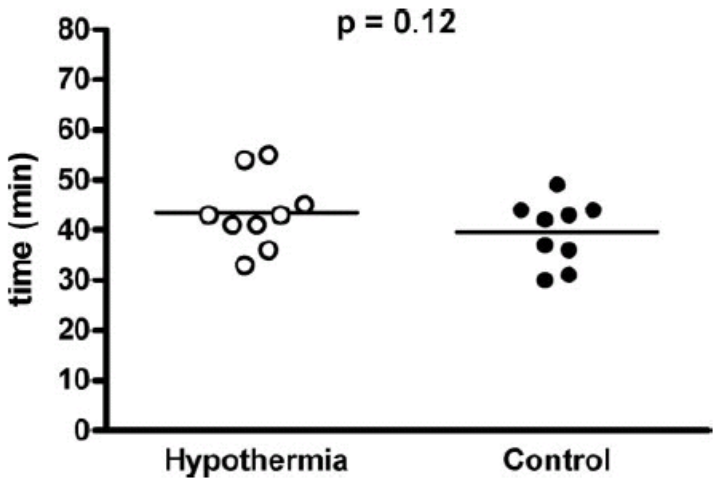
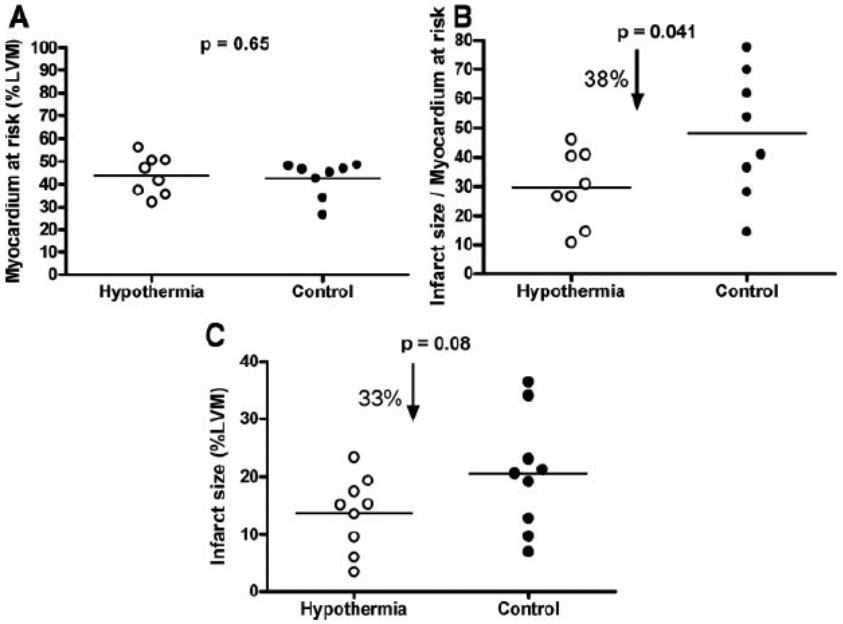


Figure 2. Time from arrival at the hospital until reperfusion (door-to-balloon time). There was no significant delay in reperfusion caused by hypothermia treatment.

area-at-risk and infarct size (MRT)



Chill-MI, 60 vs 60 Pat. multizentrisch

Götberg, Circ CI 2010

Oscar Langendorff (*1853, †1908)

Medical University of Graz

(Aus dem physiologischen Institut in Rostock.)

Untersuchungen am überlebenden Säugethierherzen.

Mitgetheilt von

O. Langendorff.

II. Abhandlung.

Ueber den Einfluss von Wärme und Kälte auf das Herz der warmblütigen Thiere.

(Nach Versuchen von **O. Langendorff** und Dr. **Czeslaw Nawrocki.**)

Hierzu Tafel V, VI, VII u. VIII und 14 Textfiguren.

In meiner ersten Mittheilung über das isolirte Warmblüterherz (1) habe ich gezeigt, dass es gerade so wie das Froschherz von der Temperatur beeinflusst wird. Aenderte man die Wärme des durch das Koronarsystem fliessenden Blutes, so änderte sich entsprechend die Schlagzahl; dem rapiden Ablauf der Zusammenziehungen des warmen stand die träge Kontraktion des abgekühlten Herzens gegenüber. Ich zeigte ferner, dass das Herz noch bei Speisung mit stark abgekühltem Blut seine Schläge nicht einstellt.

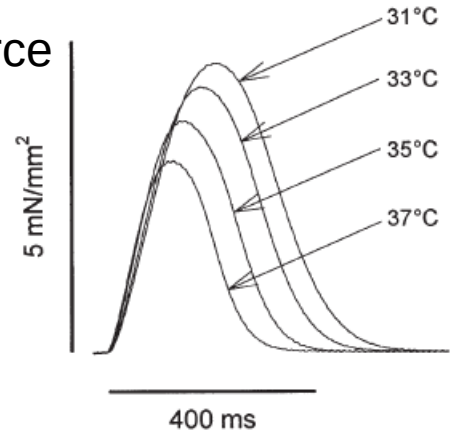
Langendorff O (1897) Untersuchungen am überlebenden Säugetierherzen. Über den Einfluss von Wärme und Kälte auf das Herz der warmblütigen Tiere. Pflügers Arch 66: 355–400

MH: normal heart

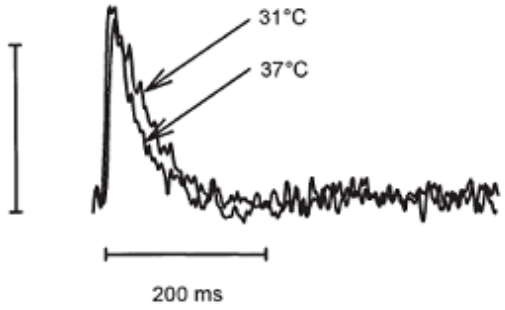
isolated human cardiac muscle strips

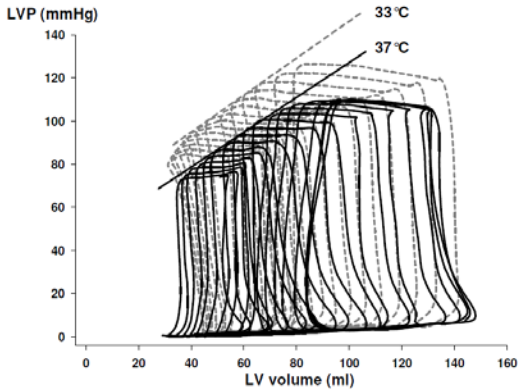
pig in vivo

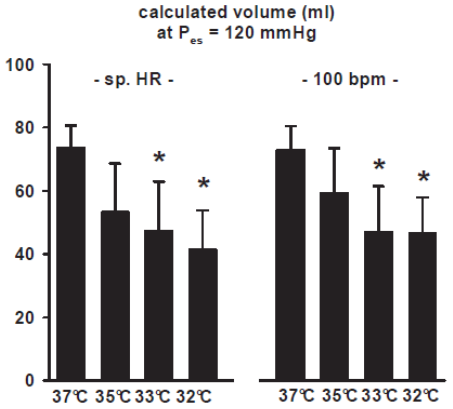
force



calcium







Weisser et al., Basic Res Cardiol 96: 198-205 (2001)

Post et al., Acta Physiol (2010)

Experimental setup

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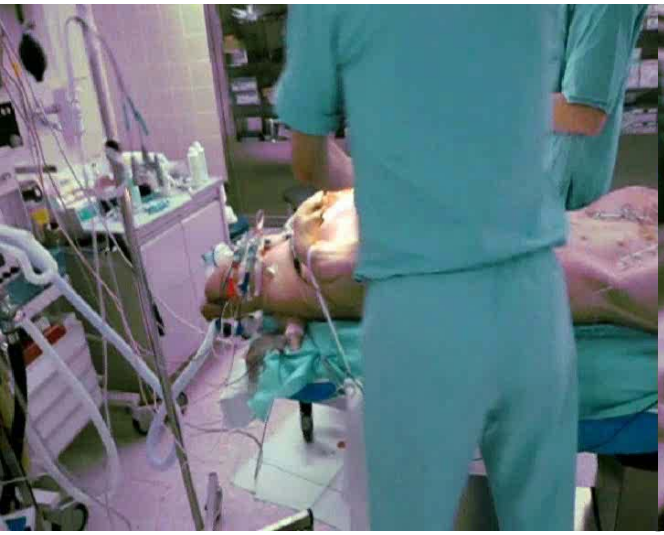

Resuscitation

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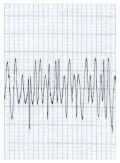

38 °C, n=8

33 °C, n=8 (129±8 min)

CC
Defib. 200 J
1 mg adrenaline

M M m M M M M

C C 5‘ 90±8‘‘ 10‘ 50‘ 60‘ 120‘ 120‘

50‘ 60‘ 120‘ 120‘ pace

ROSC

volume 24 ml/kg
cooling started

Time

0 10min 1h 2h 4h 6h

M: saline, CO, BGA art./ven., blood samples, aortic occlusion
m: saline, CO, BGA art./ven., blood samples

Resuscitation: LVP

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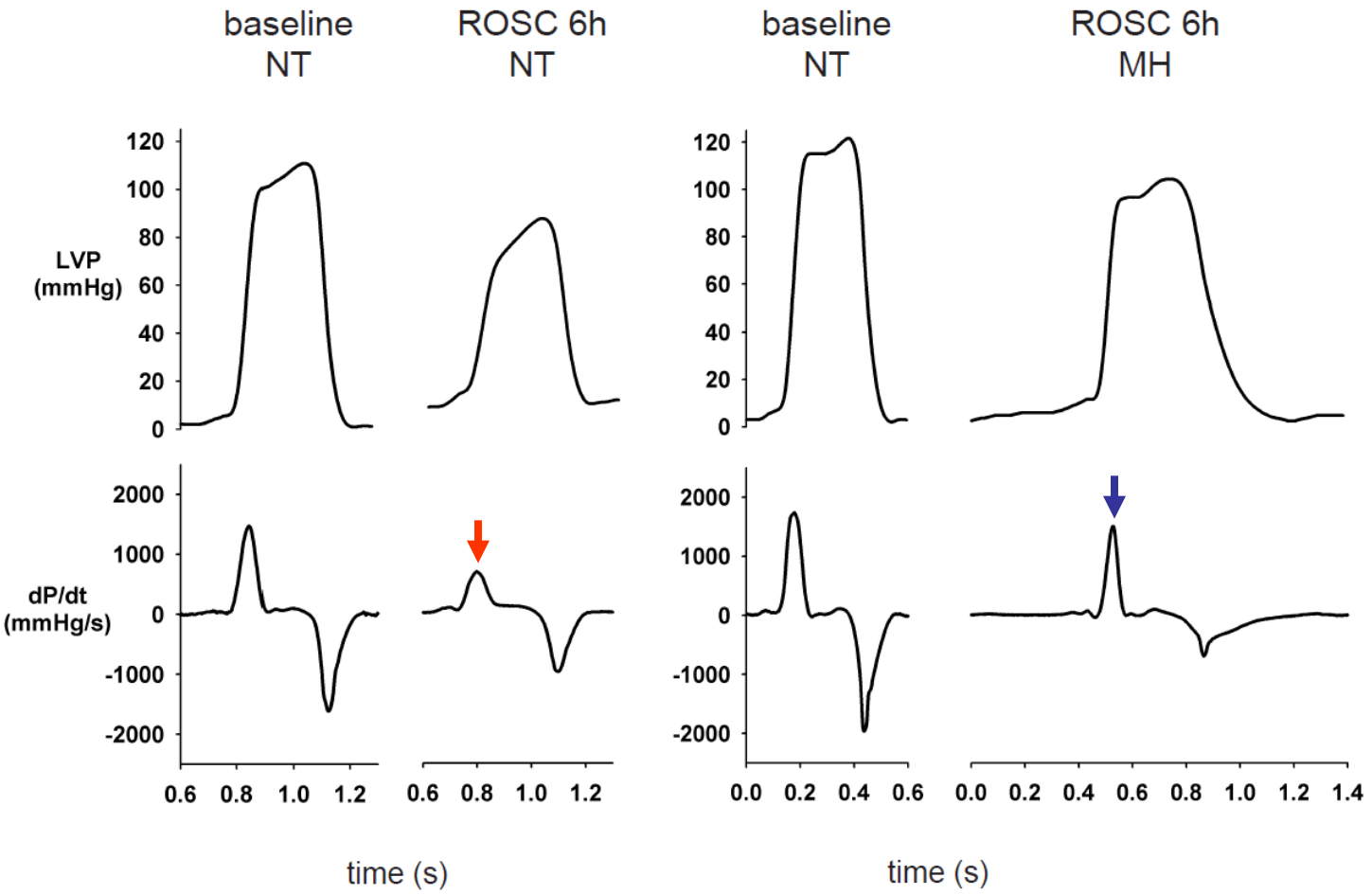
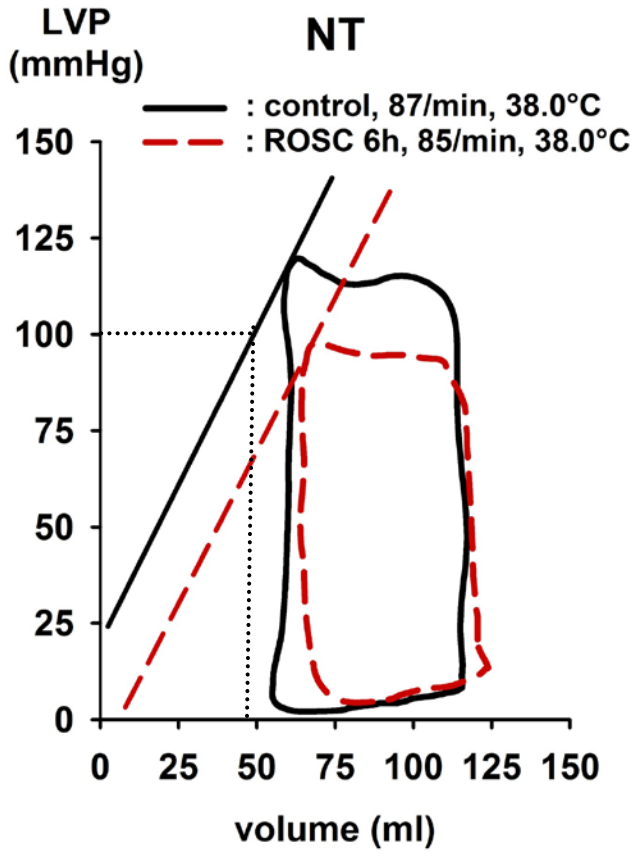
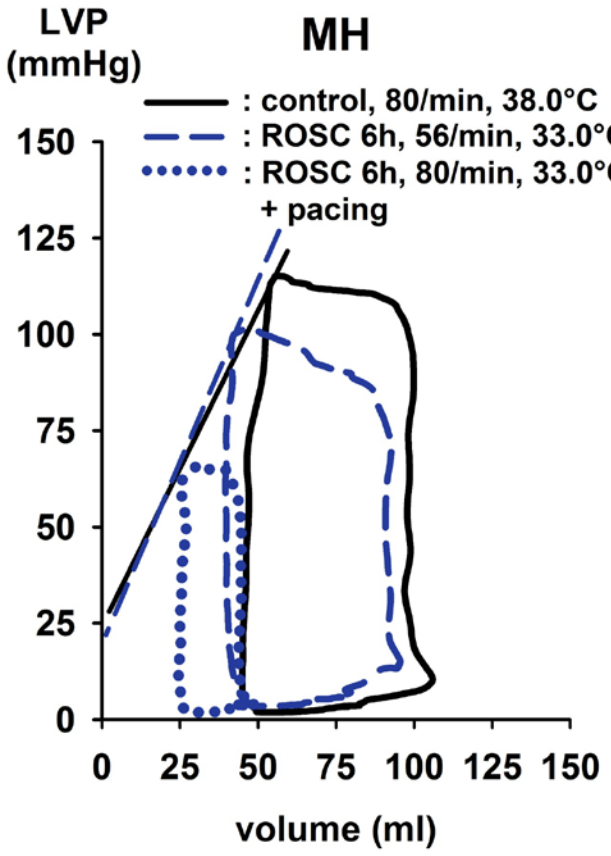
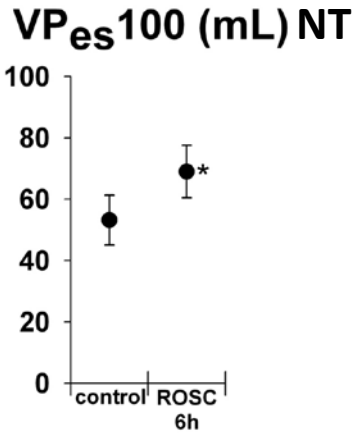


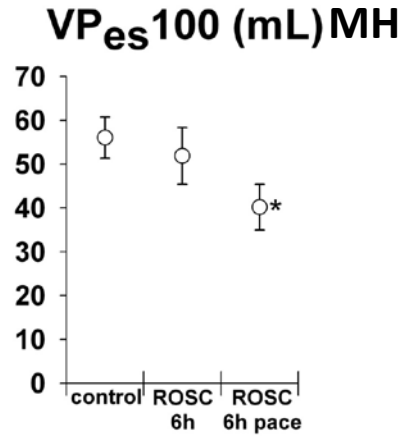
Schwarzl et al., Acta Physiol 2011

MH is a positive inotrope









Schwarzl et al., Acta Physiol 2011

Resuscitated porcine heart: No further sympathetic activation during MH

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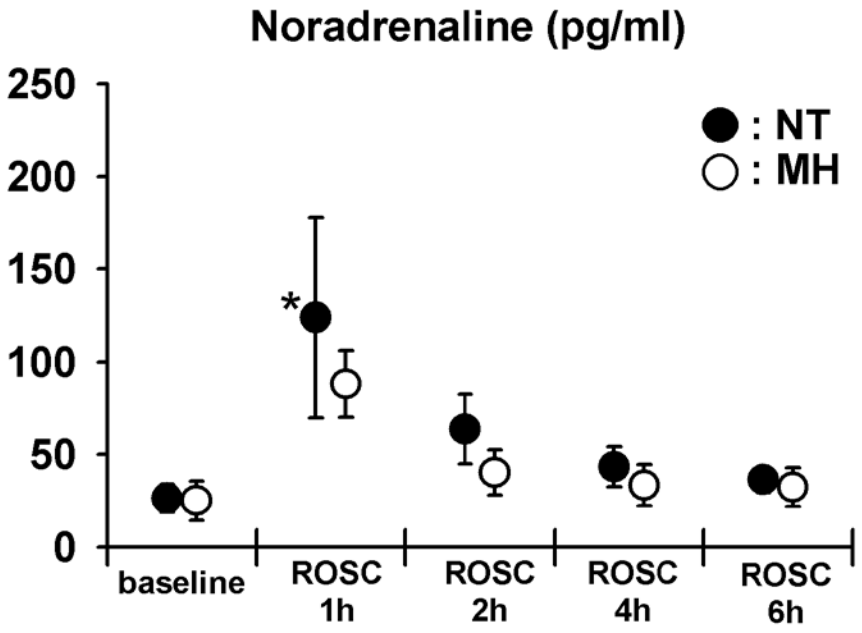

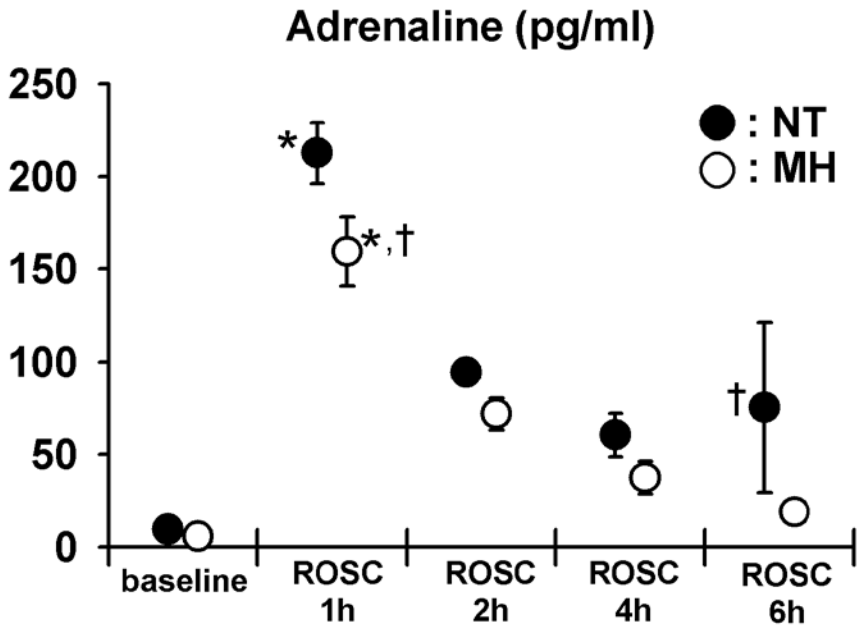

Schwarzl et al., Acta Physiol 2011;203:409–18.

No-reflow myocardial infarction

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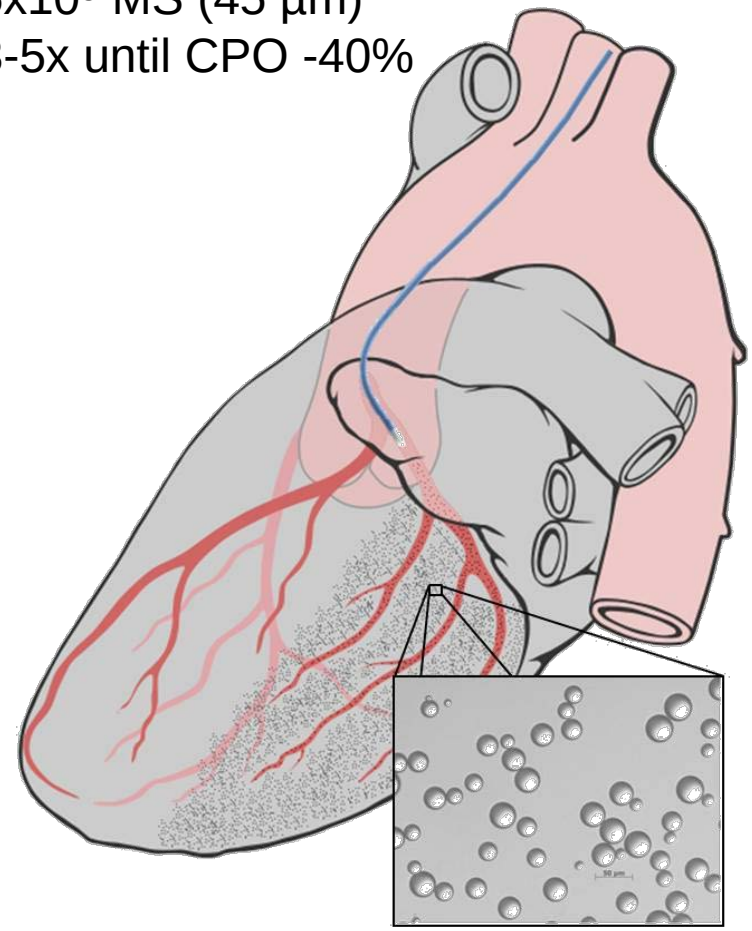
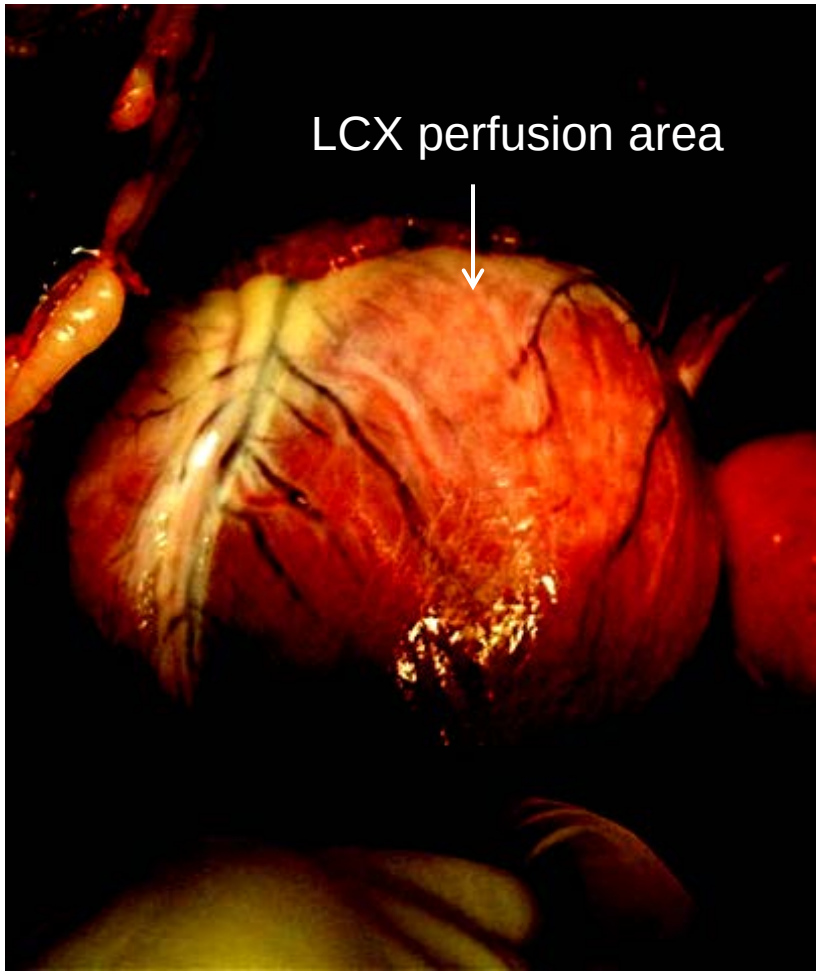
$5x10^5$ MS (45 µm)
3-5x until CPO -40%





MH in acute MI

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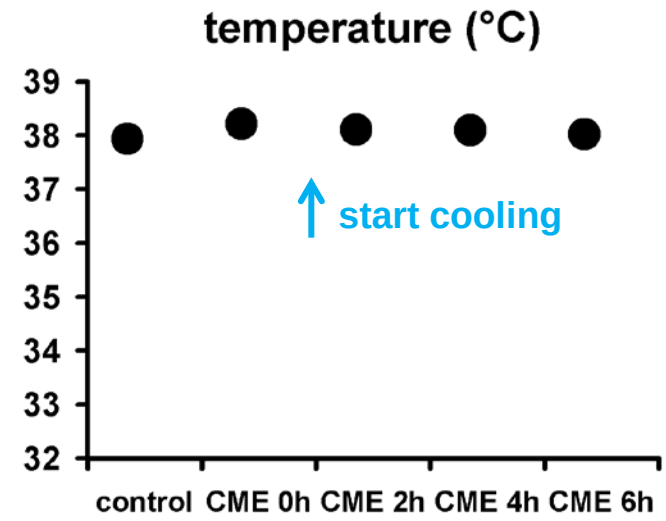
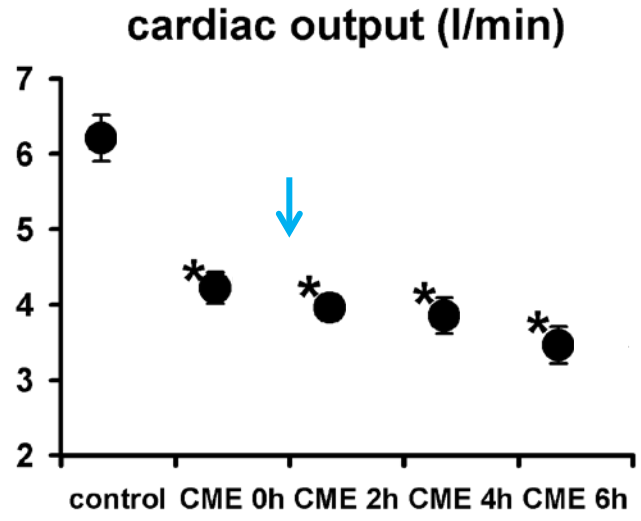
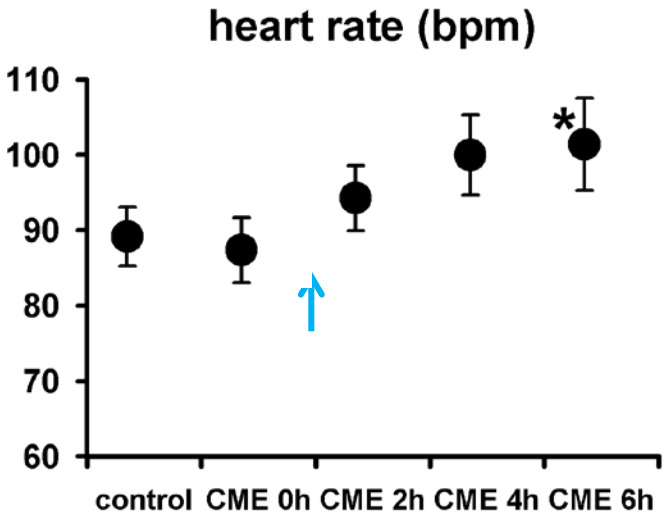
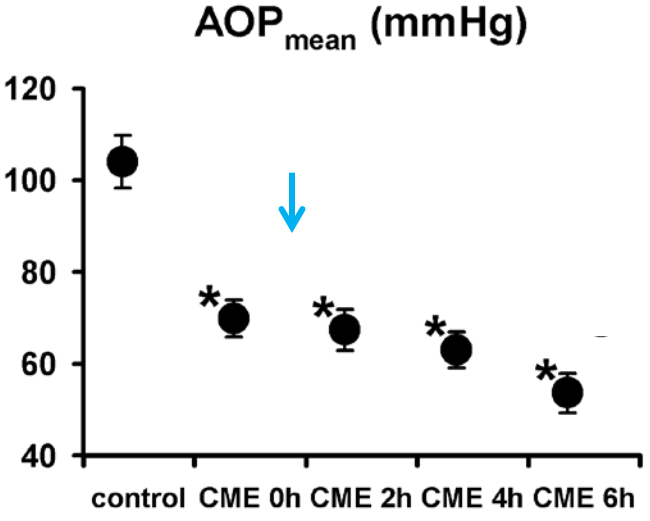




NT (38 °C after CME)

* p<0.05 vs. control





Schwarzl et al., DGK abstract 2011

MH in acute MI

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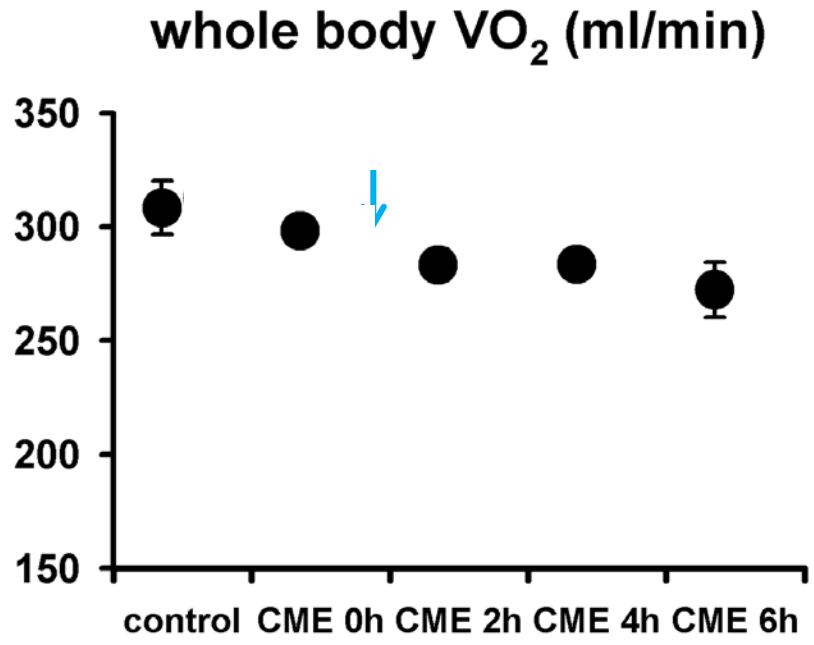
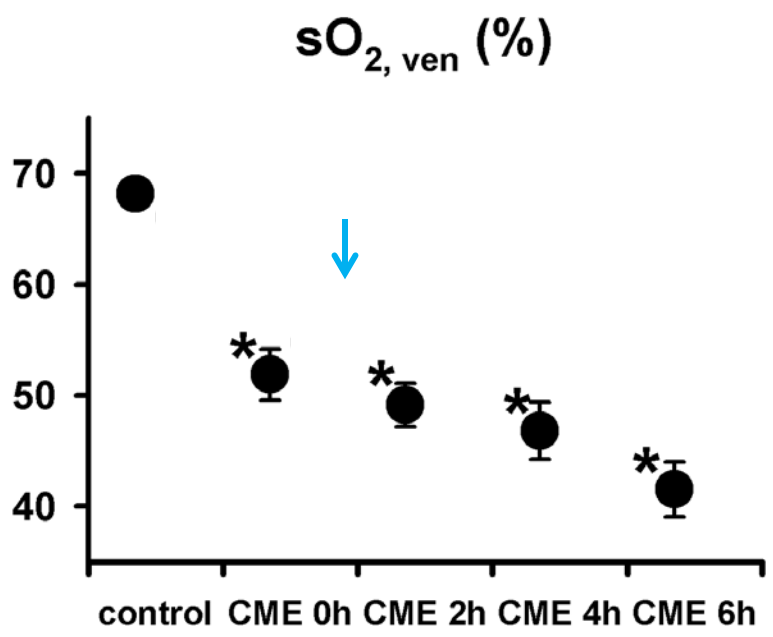
● NT (38 °C after CME)
○ MH (33 °C after CME)
* p<0.05 vs. control
† p<0.05 vs. NT





Schwarzl et al., DGK abstract 2011

MH in cardiogenic shock

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systemic oxygen demand | **systemic oxygen supply**

hypothermia ↑

↓ preload
inotropes
pacing
IABP
Impella
ECMO

Schwarzl et al., DGK abstract 2011

MH in endotoxinemia (LPS)

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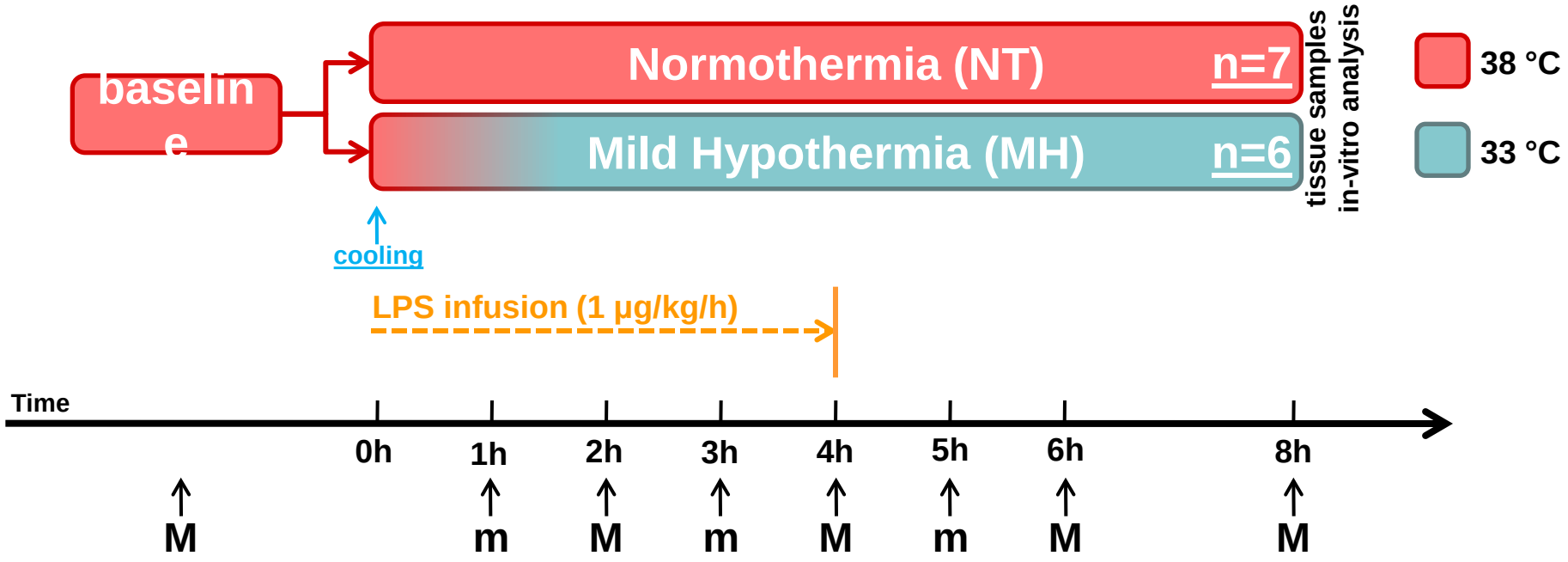

M: haemodynamics, aortic occlusion, pacing, cytokines, blood samples, catecholamines, heart rate variability

m: haemodynamics, cytokines

Schwarzl et al., AHA abstract 2011

LPS + MH/Systemic haemodynamics: MH preserves systemic vascular resistance

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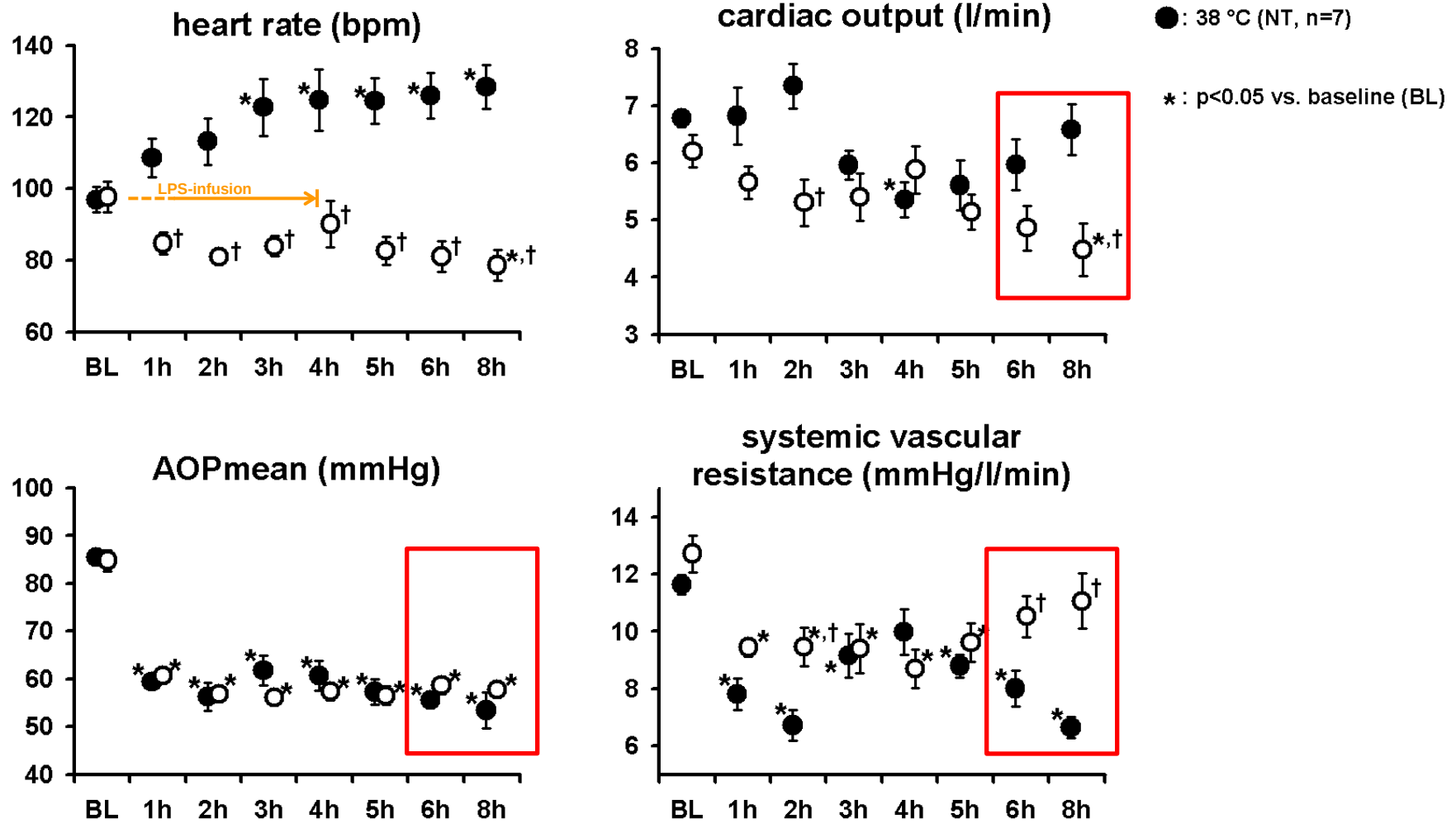

Schwarzl et al., AHA abstract 2011

LPS + MH: autonomic tone, ß-adrenergic myocardial responsiveness

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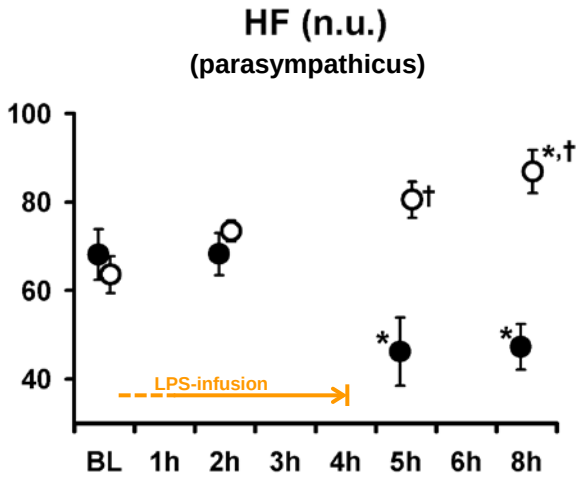

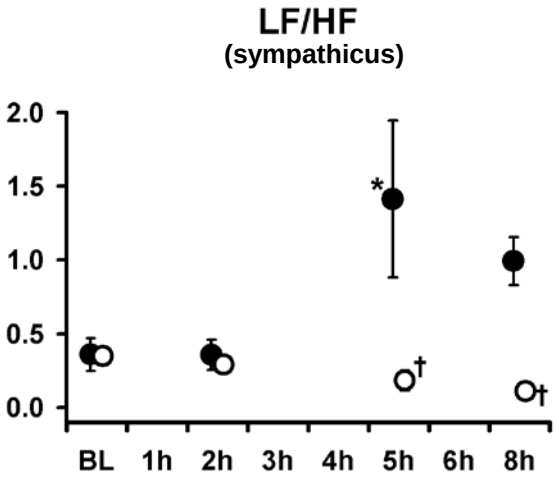

●: 38 °C (NT, n=7)
○: 33 °C (MH, n=6)

∗ : p<0.05 vs. baseline (BL)
† : p<0.05 vs. MH

LPS + MH: preserved systemic oxygen supply/demand balance

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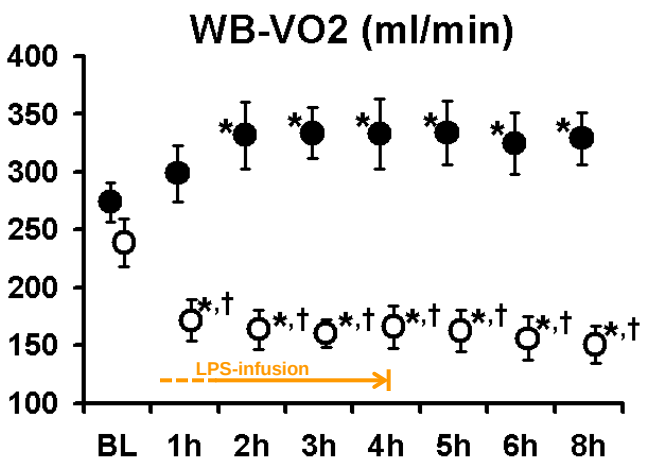

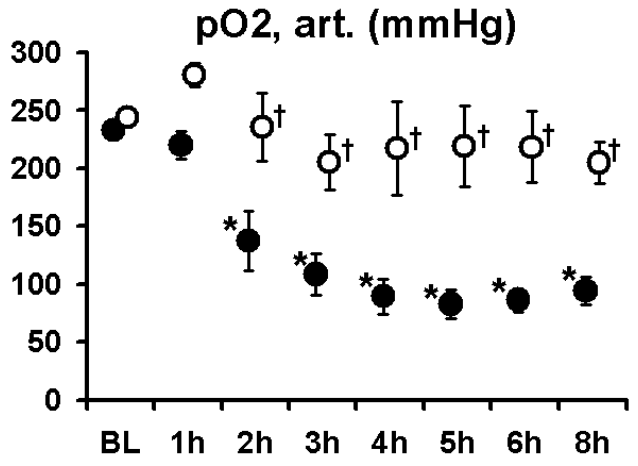

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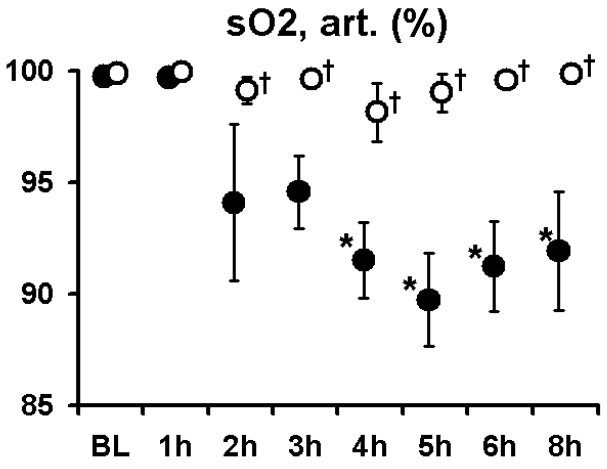
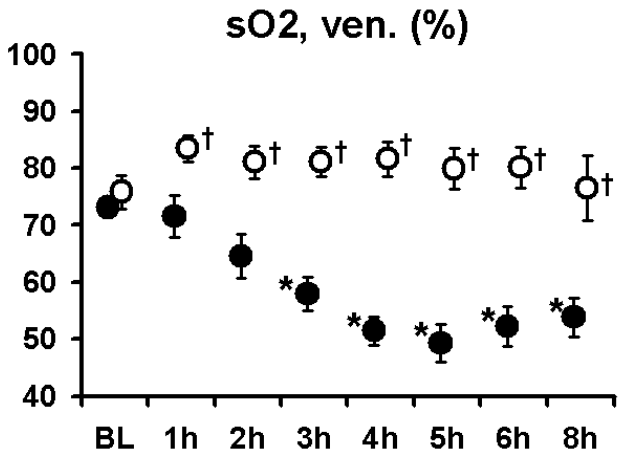
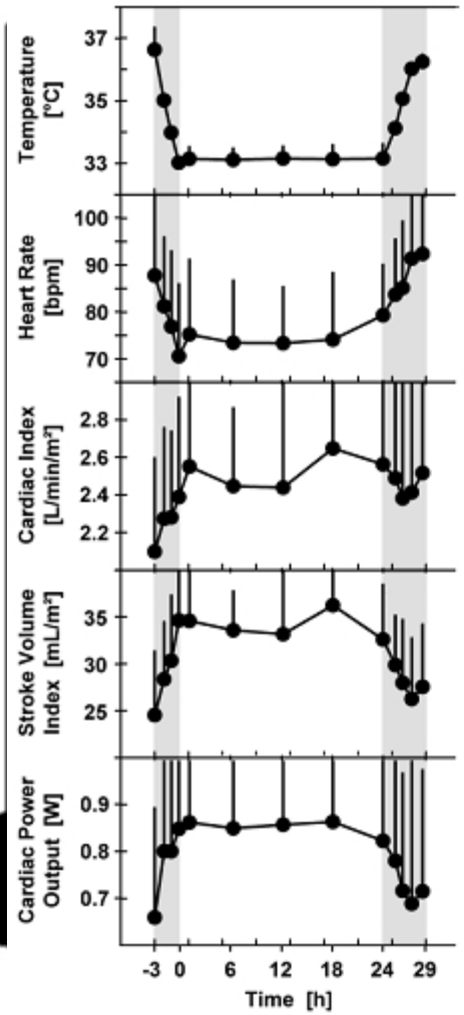
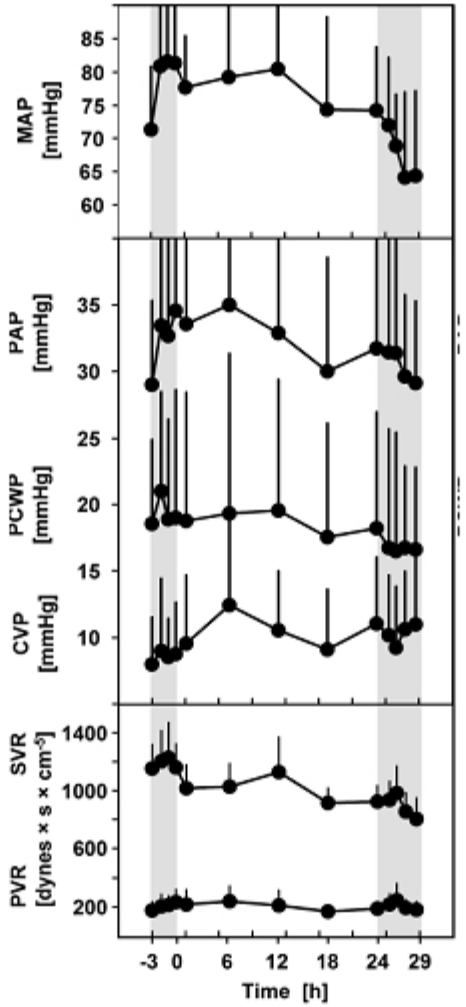




Schwarzl et al., AHA abstract 2011

Patients (n=14): MH during cardiogenic shock





Zusammenfassung

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Patienten:

- MH vor Reperfusion reduziert die Infarktgröße bei STEMI
  → multizentrische Studie Chill-MI
- Der kardiogene Schock ist keine Kontraindikation für MH
  → wahrscheinlich protektiv → Studien

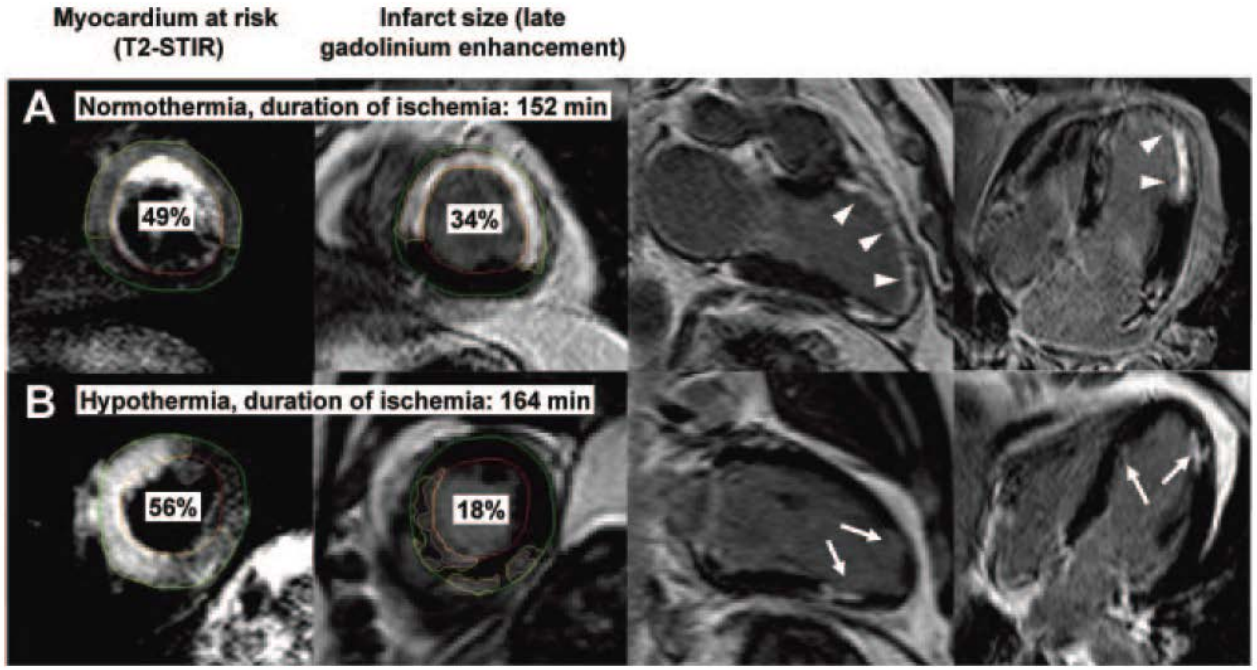
Experimentell:

- MH ist ohne sympathische Aktivierung positiv inotrop
- MH induziert eine diastolische Dysfunktion
  → durch spontane Bradykardie kompensiert
- MH erhöht den systemischen Gefäßwiderstand
- MH verbessert für einen gegebenen CO die SvO2
- MH ist (kurzfristig) lungenprotektiv

Vielen Dank!

Prä-Reperfusion MH reduziert die Infarktgröße bei STEMI

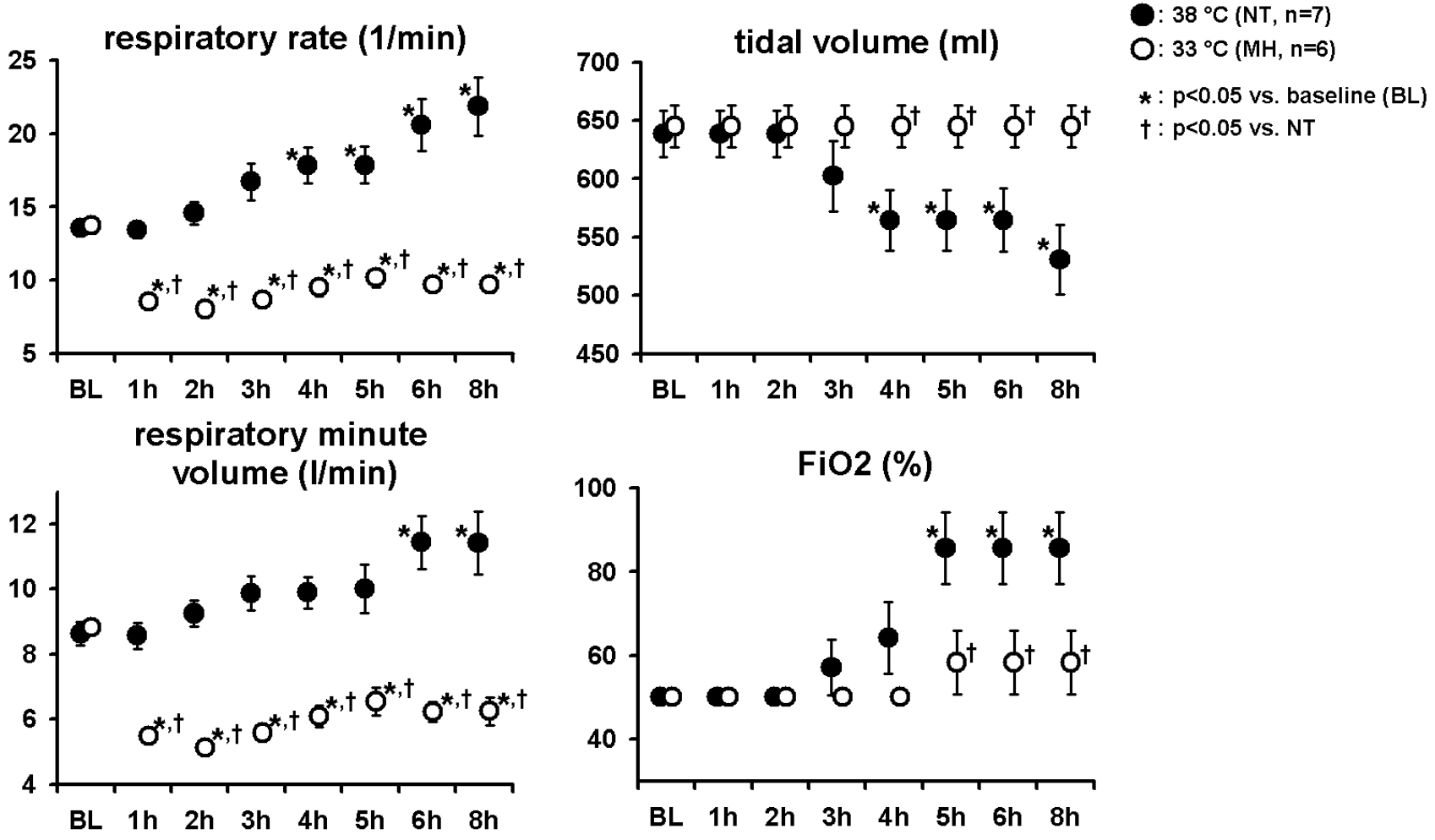
Medical University of Graz



Götberg, Circ CI 2010

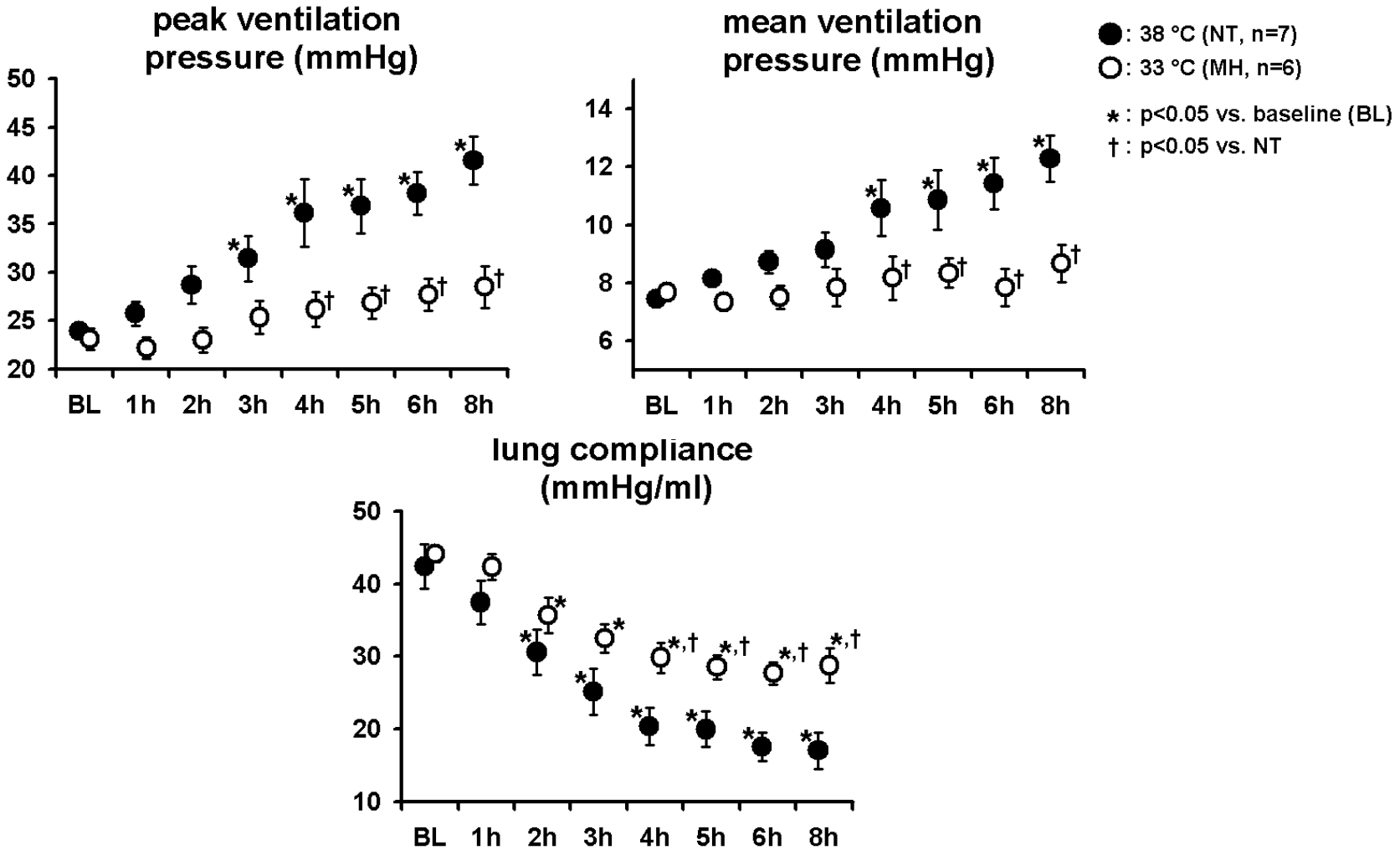
Ventilation parameters

Medical University of Graz



Pulmonary mechanics

Medical University of Graz



Schwarzl et al., AHA abstract 2011