Results: In study #1, after circulatory arrest of one-hour in deep Hth (15°C), recovery was complete, even with histologically almost normal brains. In study #2, after arrest of two hours in profound Hth (±10°C), functional and morphologic cerebral recovery were better than after two hours arrest with deep Hth (15°C). In study #3, adding washout with an organ preservation solution did not improve outcome further. Results were not worse in study #4, with avoidance of systemic heparinization (by heparin-bonded CPB circuit); nor in study #5, in which hemodilution was only to Hct 15%, not 5% as before.

Conclusions: Clinical trials in selected cases of resuscitative surgery under CPB-induced profound hypothermic arrest of one hour are justified.

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Blood Lactate: An Improved Marker of Injury Severity and Outcome in the Triage of Multiple Patients Following Traumatic Injury

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Introduction: Blood lactate has been shown to reflect the severity of tissue hypoperfusion and thus predict survival in shock states. The initial lactate level may be used as an objective measure of prehospital traumatic shock and independently predict injury severity and mortality.

Methods: Data were collected on 4,367 adult trauma victims admitted directly to a Level-I trauma center over a two-and-one-half-year period. Serum lactate was measured pre-resuscitation on admission.

Results: Patients were placed into one of five groups based on serum lactate and compared with respect to Injury Severity Score (ISS) and Mortality (MORT). The lactate groups predicted increasing intergroup differences for ISS (p <.001) and decreasing Glasgow Coma Score (GCS) and Trauma Score (p <.05). Controlling for age, ISS and GCS, there was a significant association between lactate and mortality (p <.001). Lactate had a stronger correlation with both injury severity and mortality (r = .36) than do admit vital signs, blood pressure and heart rate (r = .14).

Lactate (mMol/l)	N	ISS*	GCS*	Mortality (%)*
<2.0	1572	8.2	14.7	1.0
2.1–4.0	1992	14.0	14.0	3.3
4.1–8.0	663	23.7	12.0	16.1
8.0–12.0	91	31.1	9.6	38.5
>12.1	49	37.5	8.6	57.1

*Intergroup Differences p = .05

Conclusions: Lactate can be used as a rapid, independent prognostic indicator of injury severity and mortality for the triage of trauma victims. Lactate levels are much more reproducible and do not depend on level of medical training or experience of the care provider. Advances in lactate analyzers have made prehospital use feasible with levels available in less than 90 seconds. Lactate should be used in disaster triage.

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Brain Trauma by Epidural Brain Compression Canine Outcome Model: Prolonged Resuscitative Moderate Hypothermia

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Objective: The first study with of epidural brain compression dog model revealed that post-insult hypothermia (Hth) of 31°C for five hours (h) prevented secondary intracranial pressure (ICP) rise, but subsequent 35°C did not. The incidence of delayed brain herniation was the same after normothermia versus hypothermia. For this second study, it was hypothesized that Hth of 31°C for 48 h and slow re-warming can prevent brain death.

Methods: Twenty-one dogs were anesthetized with N_2:O_2-halothane, and paralyzed with pancuronium. Ventilation was controlled to 72 h. The insult was produced by epidural balloon inflation to ICP 62 mmHg for 90 min. After balloon deflation, intensive care was continued to 96 h. Group I (n = 10) received surface cooling from 15 min of balloon inflation to core T 31°C, which was maintained to 48 h. Rewarming was from 48 to 72 h.

Results: Nine of 10 dogs in Group I and eight of 10 dogs in Group II followed protocol. After balloon deflation, mean ICP increased to 20 mmHg in Group I at a mean of 2 h 30 min and in Group II at a mean of 22 h 15 min (p = .002). Five of nine dogs in Group I vs eight of eight in Group II survived with intermittent positive pressure ventilation (IPPV) to 72 h (p = .03). Ipsilateral macroscopically damaged brain tissue volume (focus + penumbra) was 2,094 ±1,340 mm^3 in Group I, versus 950 ±626 mm^3 in Group II (p <.08). The volume of the necrotic focus (mean 217 vs 220 mm^3) and the degree of cerebellar downward shift (mean 6.85 vs 4.86 mm) showed no group difference. ICP increase to brain herniation and vermis downward shift occurred in 7/9 in Group I vs 4/8 in Group II, and occurred later in Group II. Bleeding diathesis and pulmonary infection occurred more often in Group II.

Conclusions: Resuscitative cerebral Hth of 31°C for 48 h after brain trauma may help keep ICP low and reduce the volume of damaged brain tissue. It may reduce but does not reliably prevent delayed brain herniation during rewarming. Prolonged moderate hypothermia may cause extra-cerebral complications. Additional ICP control measures are needed.

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