Protein s100b is not a biomarker of cerebral tissue injury during general anaesthesia in piglets

Nicola G. Clausen[1,2,3], Steen Antonsen[4], Nelly Spielmann[2], Tom G. Hansen[1], Markus Weiss[2,3], Simone K. Ringer[5]

[1]Department of Anaesthesiology and Intensive Care, Odense University Hospital, Denmark,[2]Children's Research Center, University Children's Hospital of Zurich, Switzerland
[3]Department of Anaesthesiology, University Children's Hospital Zurich, Switzerland, [4]Department of Clinical Biochemistry, Odense University Hospital Svendborg, Denmark
[5]Section Anaesthesiology, Vetsuisse Faculty University of Zurich, Switzerland

Background:

Hypotension (HT) and/or hypocapnia (HC) during general anaesthesia (GA) in infants can result in cerebral damage. (1) In piglets exposed to hypotension during sevoflurane anaesthesia we demonstrated signs of neuronal dysfunction and early neuronal ischemia on magnetic resonance imaging (MRI). (2) Elevated serum levels of calcium-binding protein s100b have been demonstrated in patients with cerebral injury (head trauma, perinatal intraventricular haemorrhage and asphyxia). (3, 4) The aim of this study was to investigate whether s100b can be used as a perioperative bio marker for cerebral neural injury.

Method:

Using a previously reported piglet model causing neuronal damage (2) we investigated if s100b is applicable as a biomarker of neuronal injury during GA. By random drawing, 57 sevoflurane-midazolam anaesthetized piglets (4-6 weeks of age) were allocated to control (n=9; group 'C'), hypotension (n=18; group 'HT'), hypocapnia (n=20; group 'HC') or combined hypotension and hypocapnia (n=10: group 'HTC'). Hypotension (MAP 35-38 or 27-30 mmHg) was induced by blood withdrawal (10 ml/kg) and nitroprusside infusion and hypocapnia by hyperventilation (target $PaCO_2$ 28-30 mmHg or 23-25 mmHg). S100b in serum was measured by chemiluminescent immunoassay at baseline, before (Tr0) and after treatment (Tr60) and following a 60 min recovery period (postTr60) (figure 1). We compared serum s100b during stable GA and GA with periodic hypotension, hypocapnia and/or combined hypotension/hypocapnia. Additionaly, albumin was measured to estimate haemodilution. β2MG was measured to estimate any change in renal elimination of small proteins as s100b.

Results:

S100b and albumin decreased over time (p_{s100b} = 0.001; $p_{Albumin}$ <0.000) (figure 2). This was independent of treatment for s100b (p = 0.105). β2MG was higher than controls at Tr60 in group HT and HTC (p_{HT} = 0.001; p_{HTC} = 0.003). In group HTC albumin was decreased compared to controls at Tr60 (p = 0.011) and at postTr60 both lower than controls (p < 0.000) and group HC (p = 0.038).

Conclusion:

S100b does not reflect neuronal injury induced by periodic systemic hypotension and/or hypocapnia during GA in piglets and cannot be used as a bio marker of neuronal injury in the perioperative settings. Hypotension resulted in temporarily increased levels of β2MG exceeding hemodilution.

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Table 1: Demographics and anaesthesia data

	Overall	Controls	Hypotension	Hypocapnia	Hypocapnia + Hypotension
Number of piglets (n)	57	9	18	20	10
Age (days)	33.5 ± 5.9	30.8 ± 6.7	34.9 ± 5.7	33.3 ± 5.4	34.1 ± 5.5
Weight (kg)	6.6 ± 0.7	6.6 ± 0.8	6.5 ± 0.7	6.4 ± 0.7	6.9 ± 0.7
Time induction to start of treatment (min)	220.5 ± 35.7	211.9 ± 37.8	236.1 ± 44.3	210.9 ± 26.0	219.6 ± 20.2
Time induction to end of recovery (min)	343.7 ± 37.9	338.8 ± 33.6	360.9 ± 51.1	333.9 ± 24.6	337.0 ± 22.0

Values are mean ± SD (standard deviation)

Figure 1: Experimental outline illustrating timepoints for s100b sampling

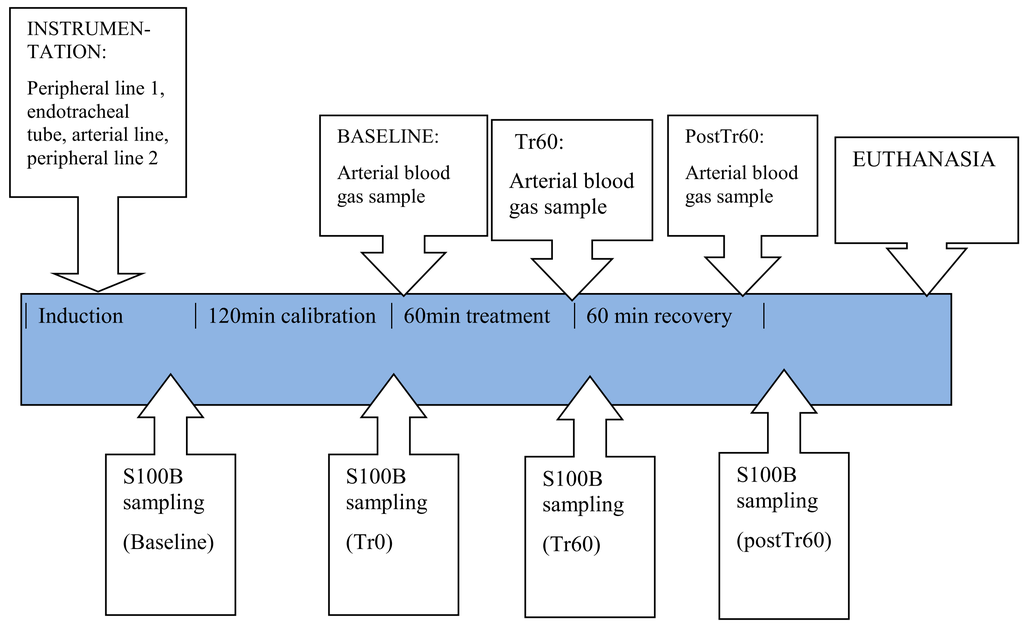
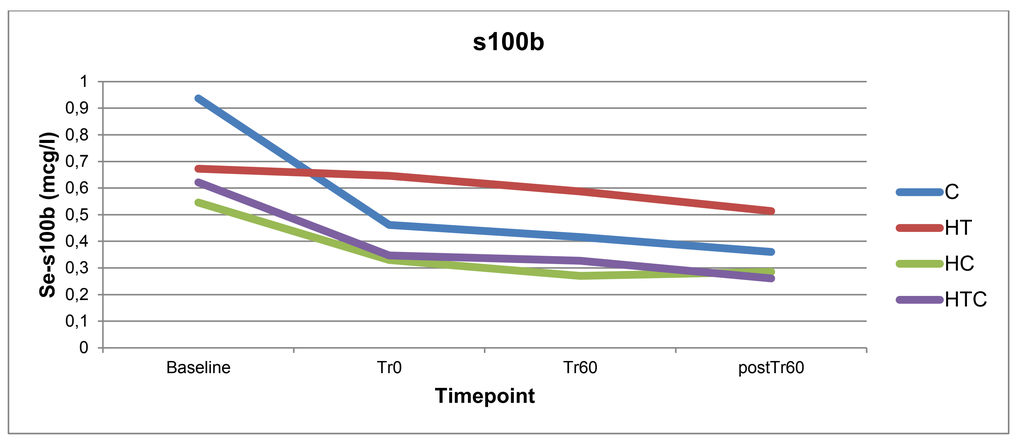
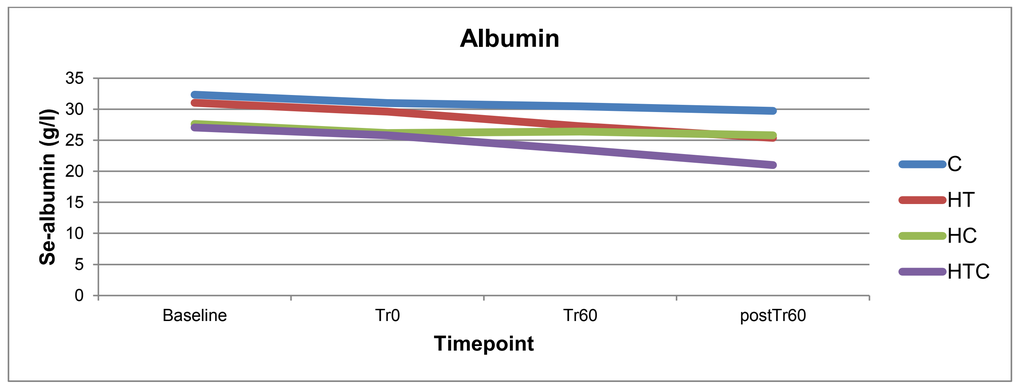
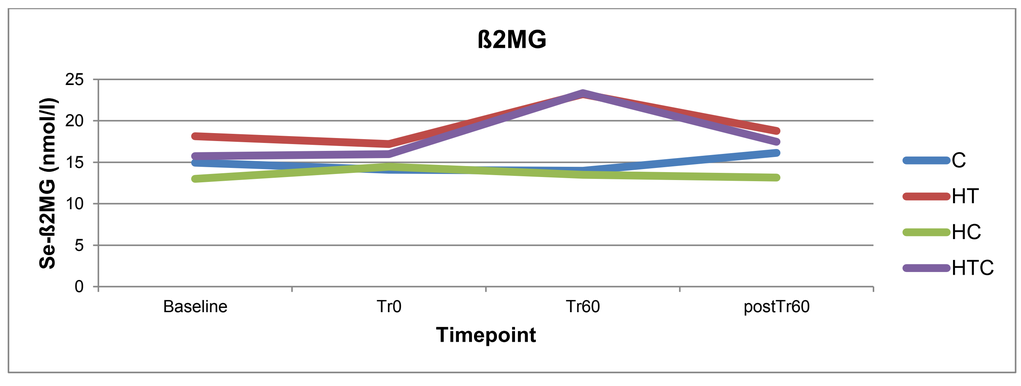


Figure 2: Serum-levels (means) of s100b, albumin and ß2-microglobulin (ß2MG) for each treatment group (hypotension = HT, hypocapnia = HC, hypotension/hypocapnia = HTC, controls = C at timepoints baseline (B), treatment start (Tr0), treatment end (Tr60) and end of recovery (postTr60).







UNIVERSITY CHILDREN'S HOSPITAL ZURICH

SDU UNIVERSITY OF SOUTHERN DENMARK

Dept. Anaesthesiology and Intensive Care

OUH Odense University Hospital