Endothelial Glycocalyx Shedding During Shock and Resuscitation is Independent of Tissue Injury in a Porcine Shock Model

Michael Mullen[1,3,4], Raushan Lala[1,3], Shaun Pratt[2,3], Wendy Goodwin[2,3], Mark Midwinter[1,3]

1. School of Biomedical Sciences, The University of Queensland, St Lucia, QLD. 2. School of Veterinary Sciences, The University of Queensland, Gatton, QLD. 3. Jamieson Trauma Institute, Herston, QLD. 4. Ochsner Clinical School, New Orleans, LA.

Introduction

- The endothelial glycocalyx is a proteoglycan layer lining endothelial cells.
- Following injury, glycocalyx shedding is associated with microcirculatory dysfunction and compromised tissue perfusion.[1]
- Trauma patients with elevations in markers of glycocalyx shedding (including hyaluronan) have poorer longer-term outcomes (coagulopathy and organ failure).[2]
- In trauma with both tissue injury and haemorrhagic shock, the contribution of each insult to glycocalyx shedding is unclear.

Methods

- Anaesthetised pigs (n = 18) allocated to control (CON), haemorrhagic shock and resuscitation (HSR) and traumatic haemorrhagic shock and resuscitation (THSR) groups (figure 1).
- Femoral fracture and haemorrhage to MAP of 40 mmHg (THSR) or haemorrhage alone (HSR) and maintained for 60 minutes.
- Shocked groups were resuscitated with 0.9% saline and observed for 120 minutes.
- Plasma hyaluronan quantified (ELISA) during shock and resuscitation, with matched sampling in anaesthesia only controls.

Results: Haemorrhage and Resuscitation

- No difference in haemorrhage volume or saline resuscitation volume between THSR and HSR.

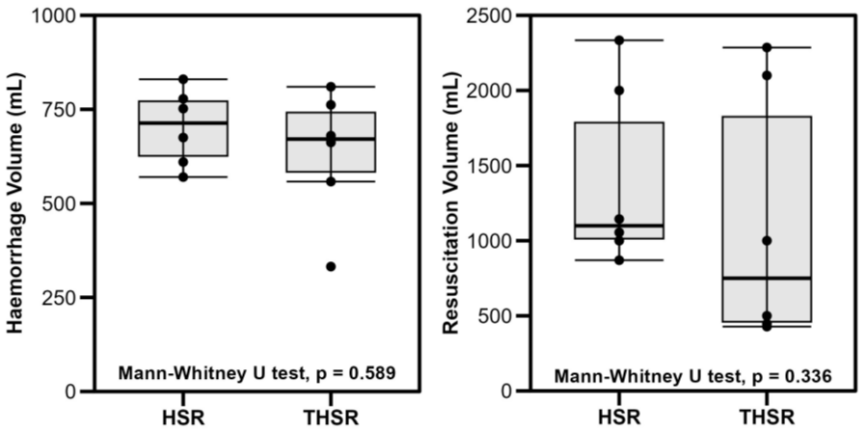

Figure 2. Haemorrhage and resuscitation volumes required to reach experimental endpoints (MAP 40 mmHg and MAP 80% of pre-shock respectively).

Results: Hyaluronan Elevation in THSR and HSR

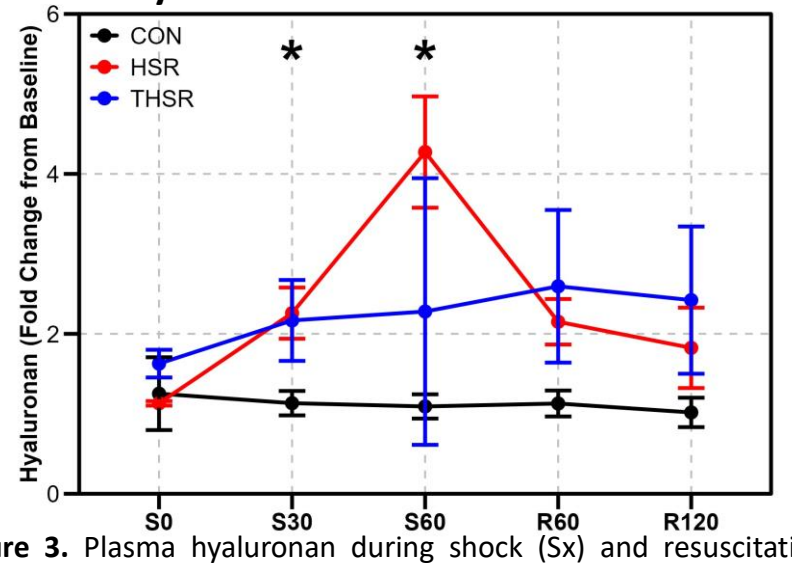

Figure 3. Plasma hyaluronan during shock (Sx) and resuscitation (Rx). Data normalised to BL and shown as median ± IQR. * $p < 0.05$ for HSR/THSR v CON by Dunn's post hoc after Kruskal Wallis test.

Methods

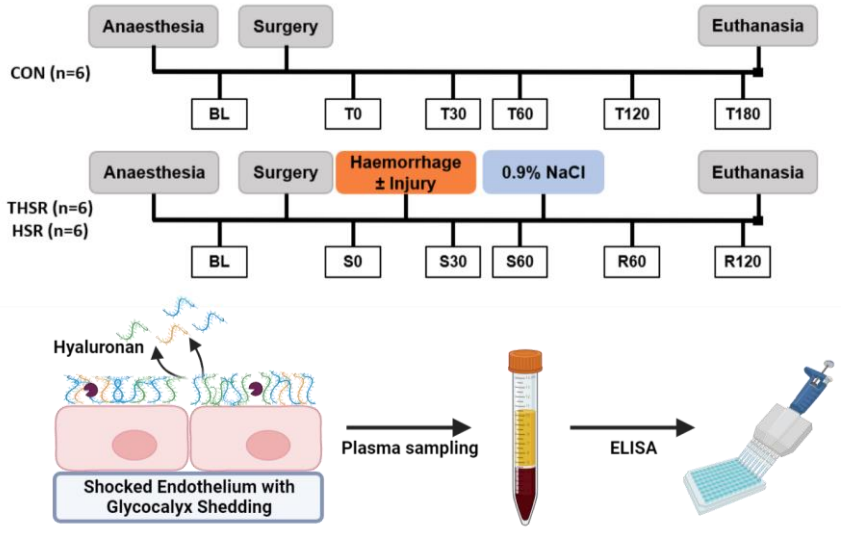

Figure 1. Experimental protocol (upper), blood sampling undertaken at marked timepoints. Hyaluronan quantified by ELISA. Created with Biorender.com

Discussion

- 2-4 fold increases in plasma hyaluronan compared to controls with both traumatic haemorrhage shock and haemorrhage shock alone (Sx timepoints).
- Downward trend (nonsignificant) in hyaluronan after resuscitation (Rx timepoints). May be related to haemodilution.
- Elevations in plasma hyaluronan during shock appears to be independent of tissue injury.
- Future directions include examination of coexisting phenomena such as microcirculatory dysfunction and development of coagulopathy.

1. J Trauma Acute Care Surg. 2018 Jan;84(1):81-88.
2. Shock. 2022 Jan 1;57(1):113-117.

The University Of Queensland AUSTRALIA

Ochsner Clinical School