Nair *Ain-Shams Journal of Anesthesiology* (2019) 11:11
https://doi.org/10.1186/s42077-019-0028-8

Ain-Shams Journal of Anesthesiology

LETTER TO THE EDITOR Open Access

Strategies to restore/save the glycocalyx

Abhijit S. Nair

To the Editor,

Endothelial glycocalyx (EG) is an essential component of vascular endothelium. It plays an important role in maintaining vascular integrity. Its physiologic role is to maintain vascular permeability by forming a barrier between blood and endothelium, handling mechanotransduction and coordinating blood cell-endothelial interaction (Reitsma et al. 2007).

The function of mechanotransduction involves coordinating the blood flow-mediated shear stress in order to maintain vascular homeostasis. During systemic inflammatory syndromes such as sepsis, hemorrhagic shock, atherosclerosis, acute coronary syndrome, renal disorders and diabetes; EG gets degraded by a process which is orchestrated by several enzymes and reactive oxygen species (Alphonsu and Rodseth 2014). Inflammatory mediators are released by neutrophils and mast cells. The reactive oxygen species are derived from neutrophil-derived myeloperoxidase. Excessive vascular permeability, impaired mechanotransduction, and impaired anti-coagulation due to damage to endothelium are the effects seen after EG destruction.

Acute insult to EG is seen in perioperative situations like cardiac surgeries (on pump and off pump surgeries) trauma, and emergency surgeries such as patients in sepsis, vascular surgeries, and organ transplant surgeries. Perioperative hypervolemia is considered an important risk factor causing destruction of EG. Injudicious crystalloids and colloids used intraoperatively can lead to fluid overload causing extravasation, interstitial edema, and weight gain which can have negative post-operative outcomes. Measure to reduce EG damage is by avoiding hypervolemia and by using albumin for resuscitation in hypovolemic states and after an excessive intraoperative loss. Certain pharmacologic agents like anti-oxidants, doxycycline, TNF-α analog etanercept, hydrocortisone, antithrombin III, and volatile anesthetics have been used to prevent or treat EG damage (Song and Goligorsky 2018). All the above-mentioned agents have been used with variable efficacy; however, the data available is presently anecdotal.

Sulodexide, which is a purified glycosaminoglycan mixture comprising low-molecular weight heparin (80%) and dermatan sulfate (20%) is an oral preparation which has been used in type 2 diabetes mellitus patients, patients with vascular diseases and has been shown to restore EG after 2 months of oral therapy [250 LSU, i.e., lipasemic units twice daily] (Elleuch et al. 2016). However, its use is futile in acute situations like sepsis and perioperative period. Recently, Zhang et al. described the use of liposomal nanocarriers comprising of preassembled glycocalyx which can be used to restore damaged EG (Zhang et al. 2018).

The studies done in vitro have demonstrated successful restoration of EG when damaged vessels were treated with liposomal nanocarriers. These novel liposomal nanocarriers could be the answer to the perplexing entity of EG damage in varied situations. Although its use appears to be exciting and promising, more animal studies in sepsis and post-operative situations are needed to understand its use so that the results can later be explored in humans.

Abbreviation

EG: Endothelial glycocalyx

Acknowledgements

None.

Funding

None.

Availability of data and materials

Not applicable.

Authors' contributions

The corresponding author is the only author for this letter. The author contributed for review of literature, data collection, manuscript drafting, references check, editing, and finalizing the final draft. The author read and approved the final manuscript.

Ethics approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

Competing interests

The author declares that he has no competing interests.

Correspondence: abhijitnair@rediffmail.com
Department of Anaesthesiology, Basavatarakam Indo-American Cancer Hospital and Research Institute, Hyderabad, Telangana State 500034, India

Publisher's Note

Received: 16 February 2019 Accepted: 18 April 2019
Published online: 03 May 2019

References

Alphonsu CS, Rodseth RN (2014) The endothelial glycocalyx: a review of the vascular barrier. Anaesthesia. 69(7):777–784

Elleuch N, Zidi H, Bellamine Z, Hamdane A, Guerchi M, Jellazi N (2016) Sulodexide in patients with chronic venous disease of the lower limbs: clinical efficacy and impact on quality of life. Adv Ther 33(9):1536–1549

Reitsma S, Slaaf DW, Vink H, van Zandvoort MA, oude Egbrink MG (2007) The endothelial glycocalyx: composition, functions, and visualization. Pflugers Archiv 454(3):345–359

Song JW, Goligorsky MS (2018) Perioperative implication of the endothelial glycocalyx. Korean J Anesthesiol 71(2):92–102

Zhang X, Sun D, Song JW, Zullo J, Lipphardt M, Coneh-Gould L et al (2018) Endothelial cell dysfunction and glycocalyx—a vicious circle. Matrix Biol 71-72:421-431