BIOMARKERS FOR OXIDATIVE STRESS AND ENDOTHELIAL DYSFUNCTION IN A COHORT OF INTENSIVE CARE PATIENTS WITH PREECLAMPSIA – PREDICTORS OF CRITICAL ILLNESS AND FUTURE CARDIOVASCULAR DISEASE

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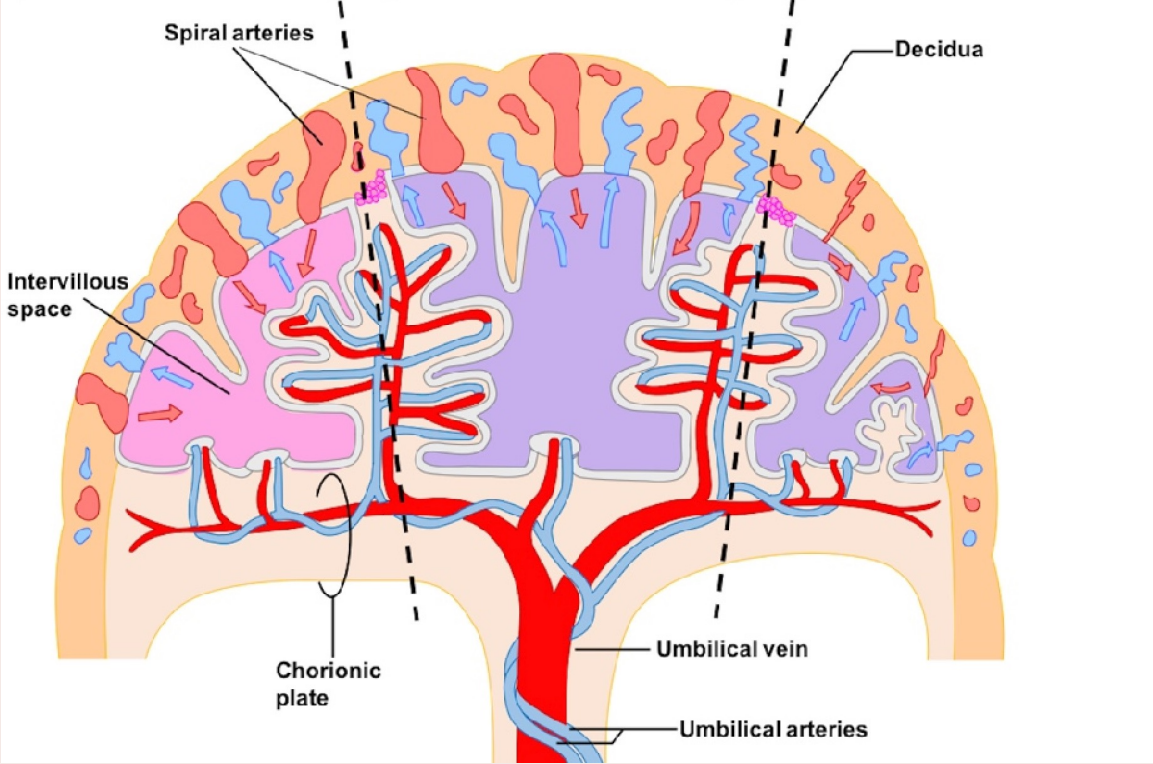
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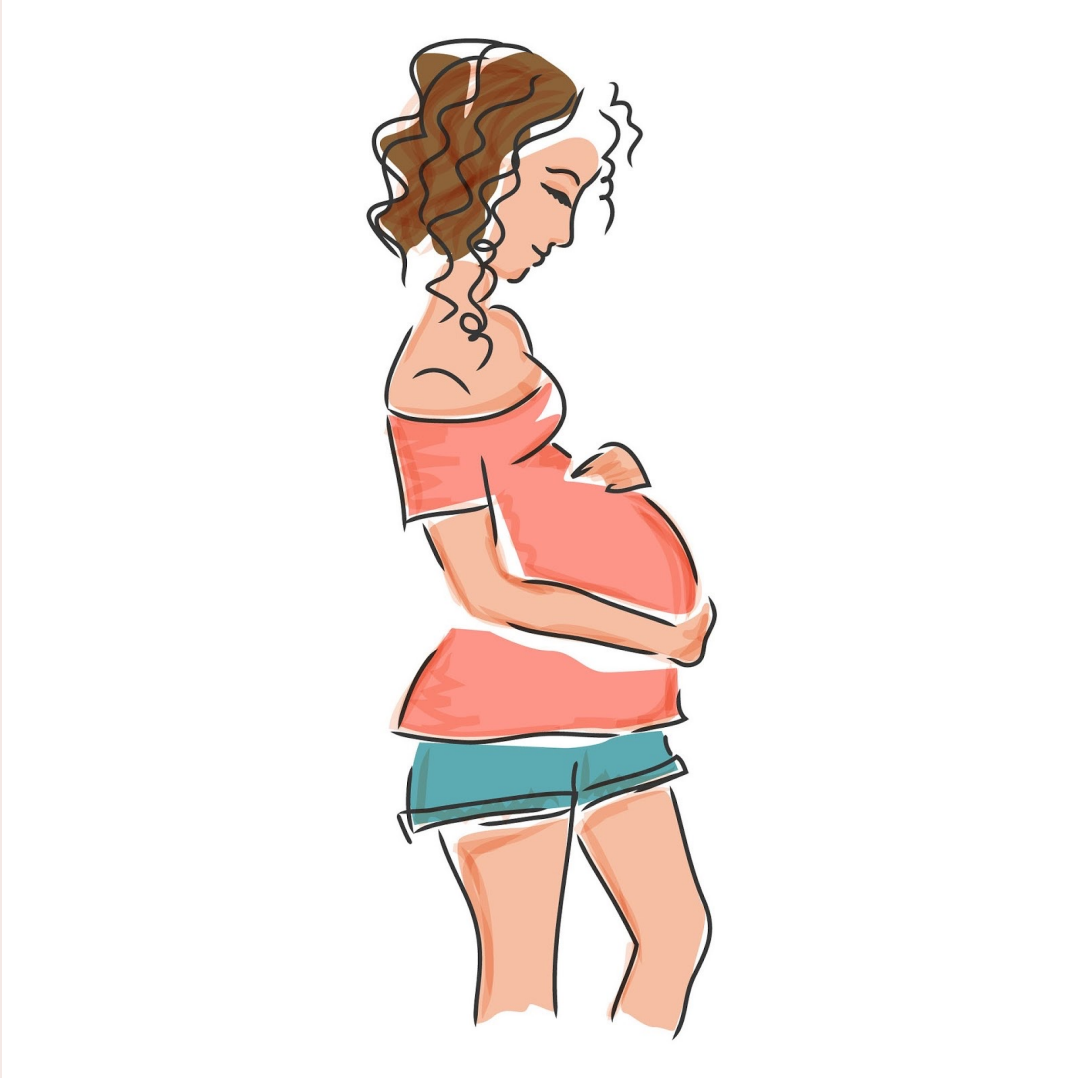
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Pathophysiology behind development of preeclampsia
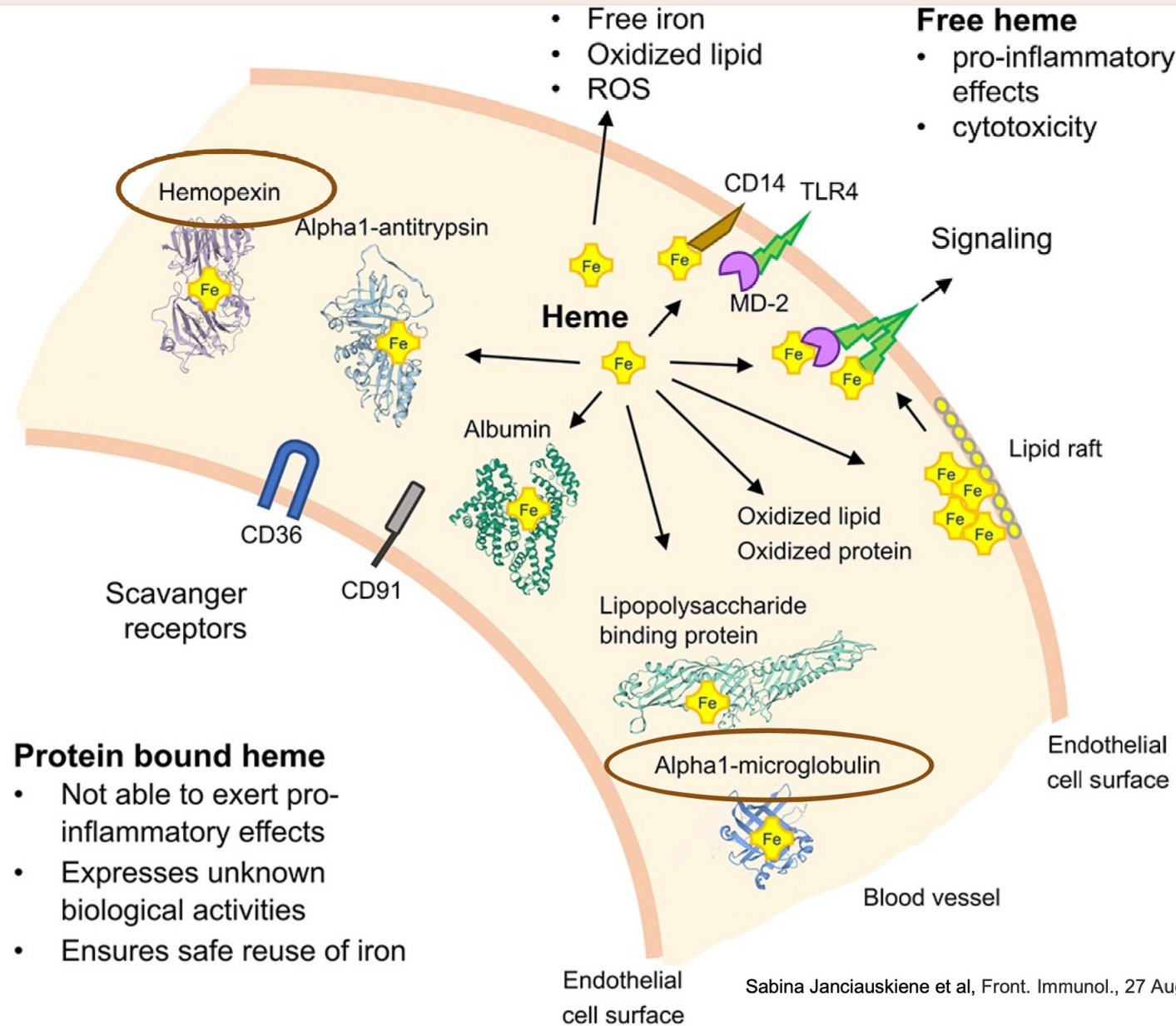
Malplacentation/placental factors

Judit Svensson-Arvelund, 2015

Maternal factors

Oxidative stress!

- Free iron
- Oxidized lipid
- ROS

Free heme
- pro-inflammatory effects
- cytotoxicity

Hemopexin

Alpha1-antitrypsin

CD14 TLR4

Signaling

Heme

MD-2

CD36

CD91

Scavanger receptors

Albumin

Lipid raft

Oxidized lipid
Oxidized protein

Lipopolysaccharide binding protein

Endothelial cell surface

Protein bound heme
- Not able to exert pro-inflammatory effects
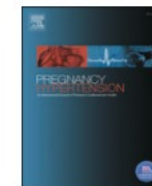- Expresses unknown biological activities
- Ensures safe reuse of iron

Alpha1-microglobulin

Blood vessel

Endothelial cell surface

Sabina Janciauskiene et al, Front. Immunol., 27 August 2020

Intensive care patients with preeclampsia – Clinical risk factors and biomarkers for oxidative stress and angiogenic imbalance as discriminators for severe disease

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ARTICLE INFO

ABSTRACT

Background: Approximately 180 mothers are treated in Swedish Intensive Care Units (ICU) due to preeclampsia each year. Although several clinical risk factors are known, prediction of critical disease is challenging. Two scavenger proteins, hemopexin (Hpx) and alpha-1-microglobulin (A1M) have been suggested to be associated with the oxidative stress seen in preeclampsia. The ratio of two other biomarkers, soluble fms-like tyrosine kinase (sFlt-1) to placental growth factor (PIGF), is predictive of adverse pregnancy outcomes.
Methods: In total 121 women were included in this study where we compared risk factors for preeclampsia, plasma levels of Hpx and A1M in ICU-patients with preeclampsia (n = 41) compared to uncomplicated pre-eclampsia cases (n = 40) and normotensive pregnancies (n = 40), with the objective to identify clinical risk patterns for severe disease. The sFlt-1/PIGF ratio was investigated in early and late onset preeclampsia ICU-patients. Blood samples were collected at admission to ICU and within 27 h postpartum for all groups.
Results: Hemopexin and A1M levels were significantly lower in the preeclampsia ICU-cohort compared to un-complicated preeclampsia patients. The sFlt-1/PIGF-ratio was elevated in the ICU-patients but there was no difference between early and late onset preeclampsia. The ICU-patients had more clinical risk factors, refractory hypertension, and an increased rate of emergency Caesarean section.
Conclusion: Intensive care patients have more clinical risk factors and a Hpx and A1M profile suggestive of depletion and thereby a reduced capacity to respond to oxidative stress. The ratios of sFlt-1/PIGF were high in the ICU-cohort and in accordance with pre-delivery levels predictive of adverse pregnancy outcomes.
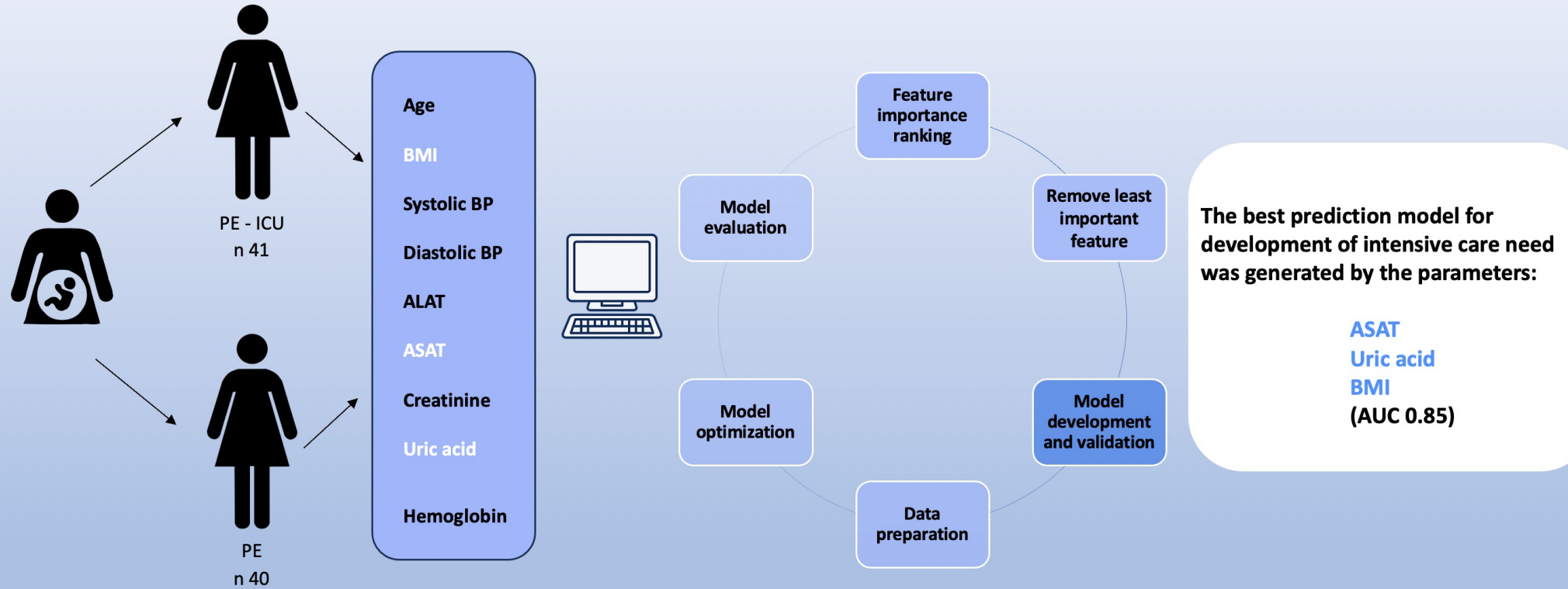
Predicting intensive care need in women with preeclampsia using machine learning – a pilot study

Camilla Edvinsson[a,b,c], Ola Björnsson[d,e], Lena Erlandsson[a], and Stefan R. Hansson [ID][a,f]

[a]Division of Obstetrics and Gynecology, Department of Clinical Sciences Lund, Lund University, Lund, Sweden; [b]Division of Anaesthesia and Intensive Care, Department of Clinical Sciences Lund, Lund University, Lund, Sweden; [c]Department of Anaesthesia and Intensive Care, Helsingborg Hospital, Helsingborg, Sweden; [d]Division of Mathematical Statistics, Centre for Mathematical Sciences, Lund University, Lund, Sweden; [e]Department of Energy Sciences, Faculty of Engineering, Lund University, Lund, Sweden; [f]Department of Obstetrics and Gynecology, Skåne University Hospital, Lund/Malmö, Sweden

ABSTRACT

Background: Predicting severe preeclampsia with need for intensive care is challenging. To better predict high-risk pregnancies to prevent adverse outcomes such as eclampsia is still an unmet need worldwide. In this study we aimed to develop a prediction model for severe outcomes using routine biomarkers and clinical characteristics.

Methods: We used machine learning models based on data from an intensive care cohort with severe preeclampsia (n=41) and a cohort of preeclampsia controls (n=40) with the objective to find patterns for severe disease not detectable with traditional logistic regression models.

Results: The best model was generated by including the laboratory parameters aspartate amino-transferase (ASAT), uric acid and body mass index (BMI) with a cross-validation accuracy of 0.88 and an area under the curve (AUC) of 0.91. Our model was internally validated on a test-set where the accuracy was lower, 0.82, with an AUC of 0.85.

Conclusion: The clinical routine blood parameters ASAT and uric acid as well as BMI, were the parameters most indicative of severe disease. Aspartate aminotransferase reflects liver involvement, uric acid might be involved in several steps of the pathophysiologic process of preeclampsia, and obesity is a well-known risk factor for development of both severe and non-severe preeclampsia likely involving inflammatory pathways..

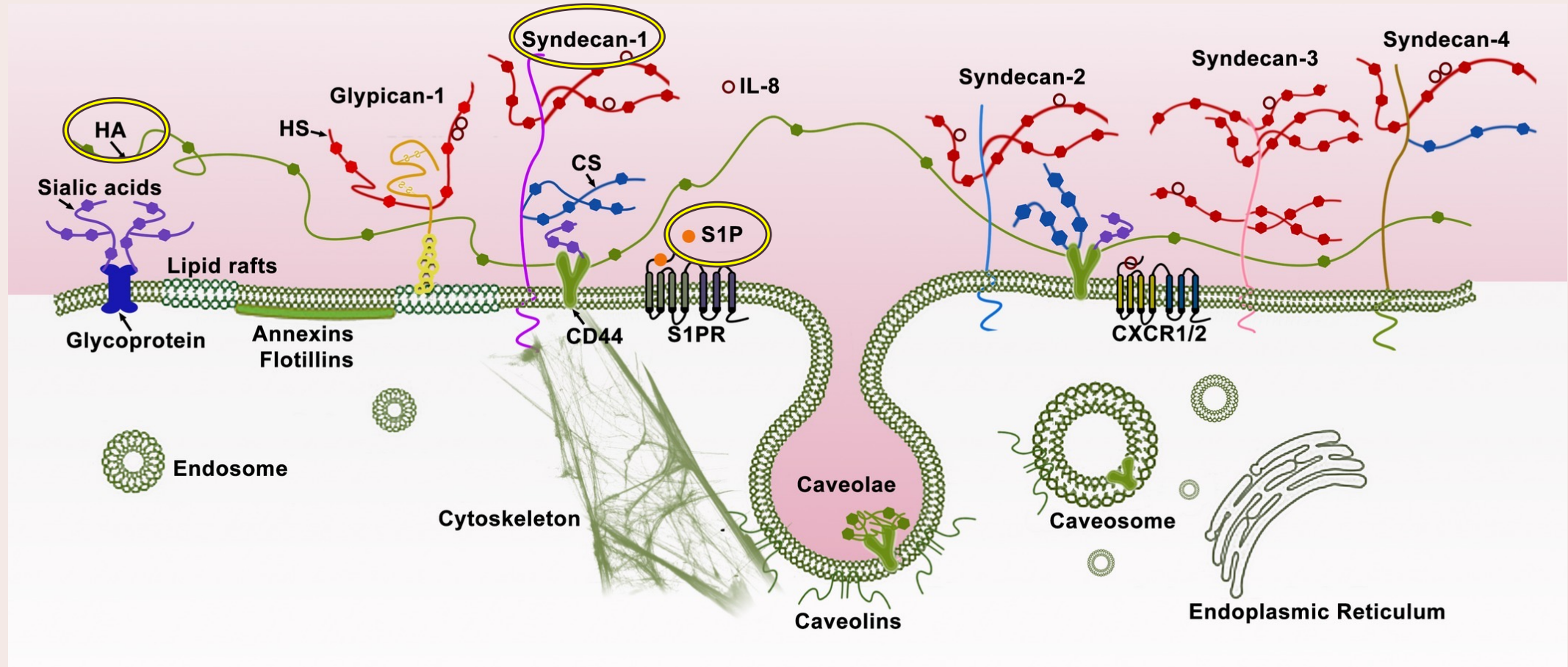Predicting intensive care need in women with preeclampsia using machine learning – a pilot study
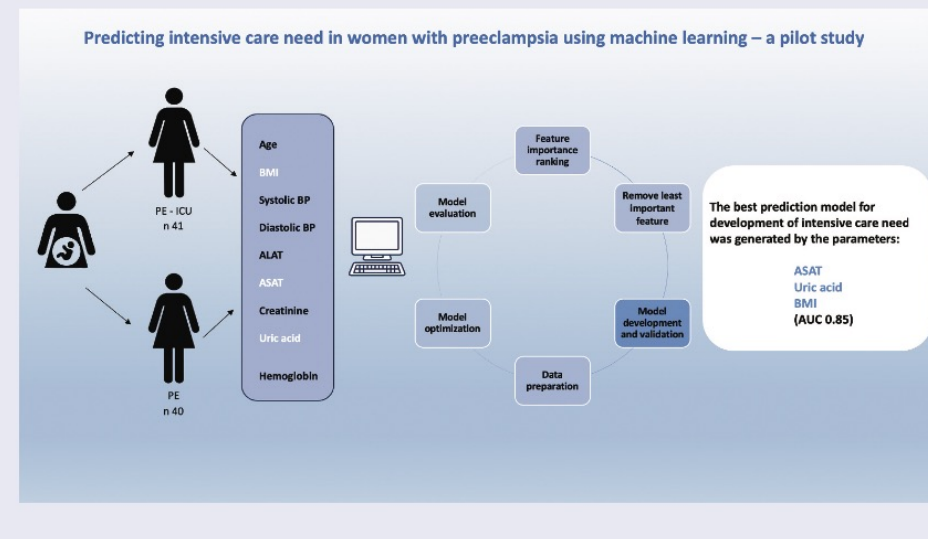
Sphingosine-1-phosphate and the glycocalyx

Zeng et al, 2017

SPHINGOSINE-1-PHOSPHATE, A CARDIOVASCULAR BIOMARKER REFLECTING ENDOTHELIAL INJURY IN PREECLAMPSIA

C EDVINSSON, F PIANI, L VANHERLE, F MATTHES, L ERLANDSSON, A MEISSNER, S R HANSSON

THEMED
REVIEW

Clare Oliver-Williams, PhD; Jasmine D. Johnson, MD and Catherine J. Vladutiu, PhD, MPH

Maternal Cardiovascular Disease After Pre-Eclampsia and Gestational Hypertension: A Narrative Review

HHS Public Access
Author manuscript

Interventions to Mitigate Risk of Cardiovascular Disease After Adverse Pregnancy Outcomes:

A Review

Original Article

Arterial Health After Preeclampsia: Role of Chronic Hypertension in the Early Vascular Aging (EVA) Study

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Research

JAMA | Original Investigation

Association Between History of Adverse Pregnancy Outcomes and Coronary Artery Disease Assessed by Coronary Computed Tomography Angiography

Sofia Sederholm Lawesson, MD, PhD; Eva Swahn, MD, PhD; Mats Pihlsgård, PhD; Therese Andersson, MD, PhD;
Oskar Angerås, MD, PhD; Elin Bacsovics Brolin, MD, PhD; Ellinor Bergdahl, MD, PhD; Marie Blomberg, MD, PhD;
Christina Christersson, MD, PhD; Isabel Gonçalves, MD, PhD; Omar Sigurvin Gunnarsson, MD;
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Anna Karin Wikström, MD, PhD; Simon Timpka, MD, PhD

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Original Investigation | Cardiology

Association of Hypertensive Disorders of Pregnancy With Future Cardiovascular Disease

Bilal Rayes, BSc; Maddalena Ardissino, MBBS; Eric A. W. Slob, PhD; Kiran Haresh Kumar Patel, MBBS; Joanna Girling, MBBS; Fu Siong Ng, MBBS, PhD

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Preliminary evidence that blocking the uptake of placenta-derived preeclamptic extracellular vesicles protects the vascular endothelium and prevents vasoconstriction

Lena Erlandsson[1,4✉], Lena Ohlsson[2,4], Zahra Masoumi[1], Mimmi Rehnström[1], Tina Cronqvist[1],
Lars Edvinsson[2,3] & Stefan R. Hansson[1,3]

SIGNS OF CARDIOVASCULAR DISEASE WITHIN TEN YEARS AFTER SEVERE PREECLAMPSIA WITH INTENSIVE CARE NEED COMPARED TO A SEDENTARY COHORT OF HEALTHY PREGNANCIES – THE PRE-HEART STUDY,

C EDVINSSON, K STEDING-EHRENBORG, A VENKATESHVARAN, L ERLANDSSON, S R HANSSON, E HEDSTRÖM