

# THE EFFECTS OF DIFFERENT MATERIAL PROPERTIES ON THE HEMODYNAMICS OF HUMAN FETAL UMBILICAL VEIN/DUCTUS VENOSUS

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**Summary:** The umbilical vein is a vein which exist during development of the fetus. It carries oxygenated blood to the growing fetus. The ductus venosus connects intra-abdominal portion of the UV and the inferior vena cava (IVC) at the inlet of the right atrium. It sends one-third of the blood flow of the UV to the IVC . Due to increasing rate of abortion of the fetus, it is maybe interesting to study the possible abnormalities of blood flow in UV/DV. Therefore, the studying of hemodynamics of blood in UV/DV could predict the possibility some congenital heart diseases.

In this study, we have investigated the hemodynamics of blood flow based on four different mechanical properties of UV/DV including elastic (uniaxial test), elastic (circumferential), viscoelastic, and rigid. The results were compared to each other to see the effects of different we have assumed four different mechanical properties for UV including elastic 1 (uniaxial test method), elastic 2 (circumferential) , viscoelastic ( Ogden), and rigid material properties of UV/DV on the hemodynamic parameters on blood.

The velocity of blood is maximum in hyper elastic model comparing to lowest one in rigid case. The shear stress values are maximum again in hyper elastic model and minimum in rigid vein. The calculated isthmus pressure was maximum (403.2 Pa) in elastic 2 case where it was minimum in hyper elastic model (387.8 Pa).

Our results including the hemodynamics factors suggest that hyper elastic model has had more conformity to the relevant clinical and experimental results. In this study, we aimed to compare the hemodynamics parameters of the blood flow in UV/DV among two elastic models, hyper elastic, and rigid one. In this regard, the finite element analysis for the models were performed and the results were obtained for different vein material properties.