Effect of Newtonian peripheral layer on non-Newtonian core layer in an elastic tube

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1. INTRODUCTION & OBJECTIVE

Since most of the biological systems (arteries, intestines, gastrointestinal tract etc.) are elastic in nature, it is much essential to study the transport of biofluid flows through elastic tubes. In particular the study of blood flows through an artery plays an important role in the fundamental understanding, diagnosis and treatment of many cardiovascular diseases. Hence, over the past years many laboratory experiments have been conducted to investigate the properties of fluid flow through tubes. Among several investigations in the area of fluid dynamics, the Poiseuille law is considered to be very significant as it describes the relation between the flux and the pressure gradient. It has been recognized that the vascular system consists largely of a complex configuration of branched elastic tubes. The existence of elasticity for pulse wave originating from the heart was first pointed out by Young (1808). Womersley (1957) studied oscillatory flows in arteries and suggested a constrained elastic tube as a model of arterial flow and pulse transmission. Many biological ducts are coated with a fluid having different properties from that of pumped fluid (Best & Taylor, 1958) and these ducts are elastic in nature. In all such cases flow demands a two-fluid model with elastic boundary. In addition, biofluids such as blood can be described well using two-fluid models rather than single fluid model. In the present paper, the flow of a Casson fluid in contact with a Newtonian fluid is considered. The problem is subjected to analyze how the ratio of viscosities of two fluids, elastic parameters and casson parameter influence the flux flow rate.

2. RESULTS & HIGHLIGHTS OF IMPORTANT POINTS

Analytical expressions have been obtained for velocity, flux and equation for interface between two fluids is derived. The flux increases for increasing values of elastic parameters, Casson parameter and decreases with the values of ratio of viscosities. When coefficient of viscosity tends to one, ratio of radii tend to one and Casson parameter tends to zero, our results are in good agreement with the existing results for the flow of single viscous fluid in an elastic tube.

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