ABSTRACT

In recent years, the principles and concepts of fluid dynamics have been used to study the problems related to living systems, which are essential in scientific and medical applications. It is found that, such concepts with appropriate modifications can help in understanding the mechanism and function of various body organs under normal and diseased conditions.

In this view, the following problems have been studied from fluid dynamical point of view by taking into account, the effects of characteristics of blood flow through stenosed arteries. The problems include overlapping stenosis, stenosis and post stenotic dilatation, and multiple stenoses with magnetic effect. Since, these flow problems play an important role in physiological situations, we briefly describe the concepts of stenosis to understand the problems which are studied in this thesis.

It is widely known that, an unnatural growth may develop on the inner wall of the artery at any location of the blood vessel system which is known as Atherosclerosis or stenosis. It is caused due to the accumulation of fat components, which constricts the flow of fluid through arteries. The effect of stenosis on the circulatory system can be known by studying the behavior and flow characteristics in its vicinity.

The physiological systems are very complex in nature. Several assumptions have to be made to analyze the flow problems through mathematical models. Such assumptions are:

- The blood is treated as steady incompressible, homogeneous and axi-symmetric.
- The stenosis developed in the artery is axially symmetric.
- The maximum height of the stenosis is much less as compared to the length and obstructed radius of the artery, i.e. $(\delta/R_0 << 1, R_e (2\delta/L_0) << 1$ and $2R_0/L_0 \sim (1))$.
- Some Bio fluids act as Newtonian fluids.

In this thesis, mathematical analysis of non-Newtonian fluid flows through constricted tubes in diverse conditions has been investigated. Owing to this, the flow problems are linearized and the equations for the flow resistance, shear stress on the wall have been derived.
An attempt has been made in this thesis to analyze the flow problems in stenotic regions under different situations, such as overlapping stenosis, stenotic and post stenotic dilatations, multiple stenoses with magnetic effect etc.

In this thesis different types of non-Newtonian fluids are considered such as Herschel-Bulkley fluid, Micropolar fluid, Jeffery fluid etc;

For Herschel-Bulkley fluid, the resistance to the flow increases with stenosis height, stress ratio parameter, the power law index, length of the stenosis and yield stress but decreases with the wall shear stress, inclination, height of the stenotic dilatation and magnetic effect.

In case of micropolar fluid, the flow resistance increases with stenosis height and coupling number and it reduces for the micropolar fluid parameter, stenotic dilatation and length of the tube.

According to Jeffrey fluid flow, it is noticed that, the velocity decreases with stenosis height and Jeffrey fluid parameter, but it increases with post stenotic dilatation and Jeffrey fluid parameter. It is also observed that, the shear stress on wall decreases for the post stenotic dilatation and increases with Jeffrey fluid parameter, but it increases along the stenosis height, and reduces with the Jeffrey fluid parameter.