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Review paper of overlapping stenosis in artery

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ABSTRACT: Blood diseases are considered one of the most common diseases in the world for humans, which occurs as a result of abnormal growth on the artery wall, which leads to strokes and heart attacks, given that the artery is a tube. There are many types of narrowing of the arteries that can be described mathematically. In this research, we will explain again considering the overlapping stenosis of the artery and describing it mathematically.

Keywords: Artery, Stenosis, overlapping, growth

1. INTRODUCTION

Stenosis is an arterial disease that results in narrowing of blood vessel due to collection of plaque on the wall of arteries. It reduces the flow of blood and the situation gets worse when this stenosis also produces a thrombus within the vessel, (i.e., a blood clot is formed inside the artery). In this scenario, the flow through such diseased arteries is improved by using a catheter. The blood flow problem for an artery having stenosed walls was explained by Ponalagusamy [1].

- **(1996)** Chakravarty and Mandal [2] stated that the presence of an overlapping stenosis in the artery is more critical than of a mild one. For this reason, researches have shown an increased interest to evaluate the effects of this kind of stenosis with different conditions and methods..
- **(2010)** Srivastava et al $ [3] studied the presence of red cells in an overlapping nar-rowed catheter artery by calculating the characteristics of blood flow. It was observed that the resistance increases with the increase in the size of the narrowing.
- **(2012)** Mekheimer and Kot [4], discussed blood flow between two eccentric tubes where the inner tube represents catheter while the outer tube was a tapered artery with stenosis. Blood flow was analyzed mathematically by using the perturbation method considering it as a Newtonian fluid for stenosis overlapping is artery.
- **(2016)** Jian et al [5], used the Mathematics program to calculate the results of the blood characteristics of a catheter artery with overlapping stenosis based on Newtoni-an blood with symmetric mild stenosis.
- **(2021)** . Bakheet, A., Alnussairy, E. A. [6] , studied the magnetic-mechanical effects of unstable blood flow on Casson's fluid through an artery mean of overlapping stenosis. The mathematical model of the problem was solved by using the pressure correction method with Mac's algorithm to understand the phenomenon of blood flow in the diseased artery.

2. MATHEMATICAL MODEL

The schematic diagram for the overlapping stenosis under consideration is shown in Fig. 1. Following Chakravarty and Mandal [7], the geometry of the elastic (moving wall) arterial wall of the time variant overlapping stenosis for different taper angles is written mathematically as:

$$R(z,t) = \begin{bmatrix} (mz + R_0) - \dfrac{\delta \cos\phi}{l_0}(z-d) & \left\{ \begin{array}{c} 11 - \dfrac{94}{3l_0}(z-d) \\ + \dfrac{32}{l_0^2}(z-d)^2 \\ - \dfrac{32}{3l_0^3}(z-d)^3 \end{array} \right\} \\ = (mz + R_0)\,\Omega(t) & \Omega(t), d \le z \le d + \dfrac{3l_0}{2} \\ \text{otherwise (1)} & \end{bmatrix} \tag{1}$$

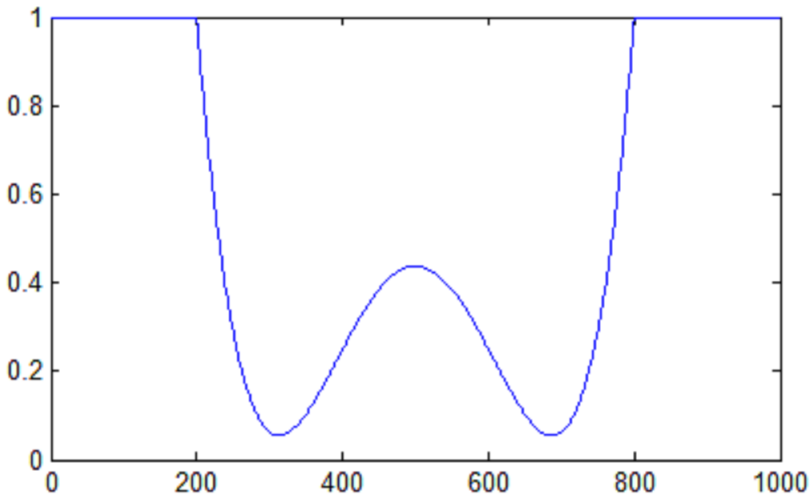

FIGURE 1. Geometry of overlapping

Where $R(z,t)$ is the radius of the tapered arterial segment in the constricted region. R_0 Is the constant radius of the normal artery without stenosis, ϕ is the Angle of tapering, $3l_0/2$ is the engh of overlapping stenosis, d is the location of the stenosis $\delta cos\phi$ is the critical value of the overlapping stenosis $m = tan\phi$ is the slope of the tapered vessel, b is the constant ωis the represents the angular frequency of forced oscillation, t is the time.

3. RESULTS AND DISCUSSION

The equation for overlapping stenosis was developed by MATLAB by taking different values tapered angle $\phi = -0.5, 0, 0.5$ and different values of stenosis height $\delta^* = 0.1, 0.2, 0.3$,radius of the normal artery without stenosis , $R_0 = 1$ and time $t = 0.5$, and location of the stenosis $d = 1.4$.

We can show geometry of overlapping stenosed tapered artery for different tapered angle $\phi = -0.5, 0, 0.5$ the parameter $L = 3,\ R = 1,\ l_0 = 1,\ d = 1.4, \delta^* = 0.4, t = 0.5$.

We can show geometry of overlapping stenosed tapered artery for different stenosis height δ^* the parameter $L = 3,\ R = 1,\ l_0 = 1,\ d = 1.4, t = 0.5\ , \phi = 0$ and $\delta^* = 0.1, 0.2, 0.3$.

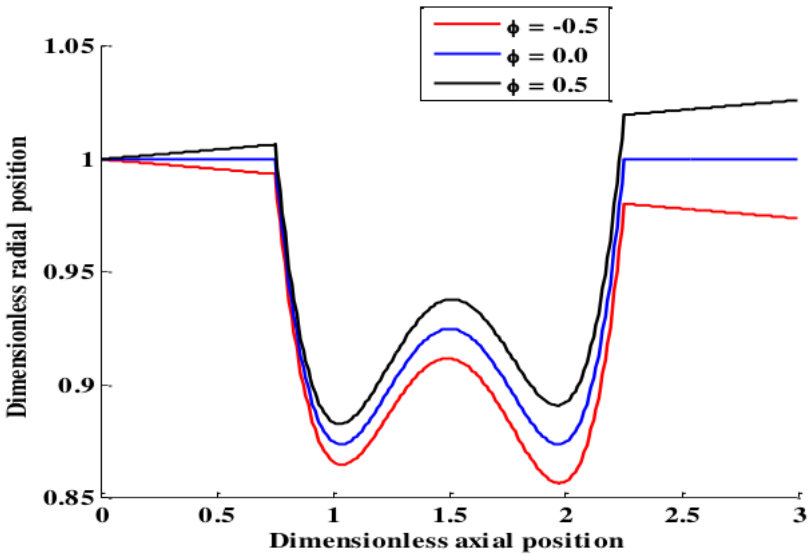

FIGURE 2. **Geometry of overlapping stenosed tapered artery for different angle of** ϕ

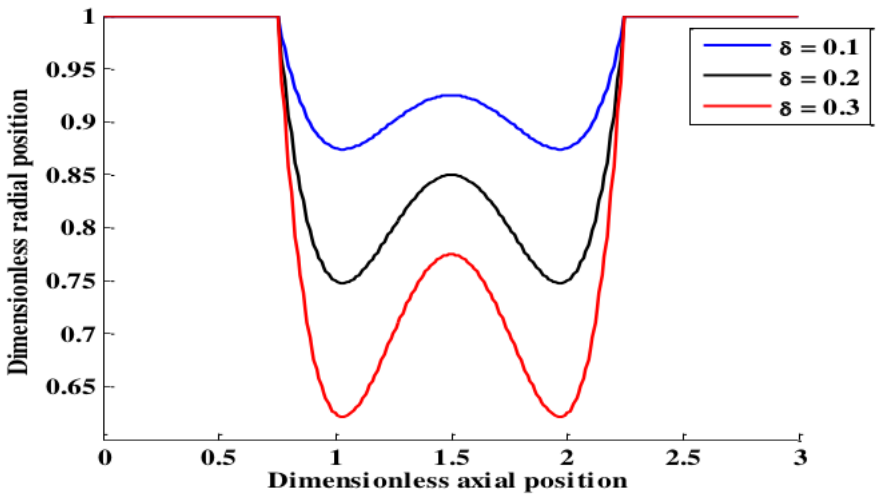

FIGURE 3. **Geometry of overlapping stenosed artery for different** δ^* **.**

4. CONCLUSION

mathematical model to illustrate the stenosis of overlapping arteries.The results were obtained using the MATLAB code. Figure (2) shows different values of the tapered angle, taking the value of the highest height of the stenosis in the artery. As for Figure (3), different values are given for the height of the stenosis.

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CONFLICTS OF INTEREST

The author declares no conflict of interest.

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