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Short Communication

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Flow Dynamics and Wall Shear Stresses in a Bifurcated Femoral Artery

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Abstract

The present paper presents peak wall shear stresses and velocities in a bifurcated femoral artery. This artery is modeled along with blockage downstream of bifurcation, blockage at bifurcation, blockage downstream of stented femoral artery. The femoral artery is subjected to peripheral artery disease. A two-dimensional computational fluid dynamic analysis is conducted in all the models, assuming steady blood flow and seventy percent plaque. However, the blood viscosity and blood pressure vary in the femoral artery models as they are subjected to other medical conditions. Femoral artery bifurcates into profunda femoris and the bifurcation angles are assumed to vary at 30, 45 and 60 degrees. The blocked bifurcated artery is replaced with a wall stent and in many cases, a blockage develops downstream of the bifurcated stented artery as a consequence of stent implantation. The wall shear stresses and velocities results from the bifurcated and blocked femoral arterial models are compared to a normal artery characteristic. Further, a comparative study has been conducted along the blocked bifurcated artery with and without the stent.

Introduction

Bilateral common iliac arteries are bifurcated from aorta . Iliac arteries are further branched into internal and external iliac arteries. Femoral arteries are a part of external iliac arteries and reach the lower extremities after passing under inguinal ligament. Further downstream, the common arteria femoralis branches off as profunda femoris which are susceptible to atherosclerosis. Atherosclerosis commonly begins when plaque starts build up within the artery and atherosclerosis within the lower extremity it's called Peripheral Artery Disease (PAD). Peripheral artery disease is split into asymptomatic and symptomatic disease. PAD affects quite 12 million people within the us and it increases with age. Globally, 27 million people are suffering from PAD and other atherosclerotic diseases . Among the prevailing PAD patients, 20% of the patients suffer with lameness annually. the amount of discharges recorded per annum supported chronic PAD are 413000 and 88000 patients get admitted in hospital that suffer with low extremity arteriography. Studies have recognized an overlap between cerebral, coronary and peripheral artery disease. as an example , among patients with peripheral artery disease, there's sixty percent possibility of getting arteria coronaria disease (CAD) and 35% percent possibility of getting severe triple-vessel CAD with depressed ventricular function. Additional risk factors like smoking, diabetes, hypertension increase the prevailing problem. Approximately 14 to 90% of the patients suffer with CAD and PAD. Cerebrovascular disease (CBVD) occurs in PAD patients and it's observed that 30% stenosis occurs within the carotid arteries. However, a number of the above mentioned problems like smoking, diabetes and hypertension are defined as inflammatory triggers. These triggers promote stress and enhance inflammatory paths either directly or indirectly. PAD is additionally observed commonly in 33% of identical twin pair's and 31% of fraternal twin pairs thanks to heritability. Lower Extremity PAD patients are often tested using noninvasive vascular laboratory tests a

Methods

Statistics show that patients with PAD are more likely to suffer from CAD, CBVD, cardiac and cerebrovascular disease (CCVD). additionally to those arterial diseases, many PAD patients also are suffering from diabetes, hypertension and anemia . These comorbidities needs further analysis. Risk factors related to these conditions are predicted and clinical studies were conducted using the edge of ankle-brachial index. There are 50 to 400% chances of getting CCVD in PAD patients once they are related to hypertension. Adding to the present, bifurcated arteries have blockages at the bifurcation and most of the studies are supported coronary and carotid arteries. Besides, the main risk is related to a mixture of PAD, diabetes and further complication. Common arteria femoralis has small diameter vessels in diabetic patients and ladies . So, punctures round the femoral head are described because the ideal puncture site . As smoking adds more issues to the prevailing problems within the arteria femoralis , flowmediated vasodilation method are often induced into the artery through exercise. Hence smoking might be neglected within the present study. Furthermore, anemia is another significant issue in patients with acutemyocardial infarction that causes a rise in mortality . Pre and post stent analysis was conducted at the bifurcation of intracranial artery. the speed variations and therefore the wall shear stresses are studied and compared to watch the effect of stent placement on flow dynamics at the bifurcation . Hence, various medical conditions play a serious role in atherosclerosis affected arteries. Thus within the present work, peak wall shear stresses and velocities are computed from the PAD and co-morbid affected bifurcated blocked arteria femoralis models

Conclusion

On the opposite hand, the utmost difference in velocity in high vital sign affected arteria femoralis is noted between 60 and 30 degree bifurcation. an identical effect of maximum difference in velocity is noted between 60 and 30 degree bifurcation artery with high vital sign and anemia and high vital sign and diabetes. the smallest amount percentage difference in velocities in high vital sign , anemia and high vital sign affected femoral arteries are recorded between 45 and 30 degree bifurcation. In contrast, in diabetic and high vital sign affected arteria femoralis , the smallest amount percentage difference in velocity is observed between 45 and 60 degree bifurcation.