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Review Article

Peripheral Artery Disease and Buerger-Allen Exercise

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Abstract

Diabetes mellitus (DM) is a chronic metabolic disorder characterized by high blood sugar levels resulting from the body's inability to produce or effectively use insulin. It can lead to various complications, including peripheral artery disease (PAD). PAD is a condition characterized by the narrowing or blockage of arteries that supply blood to the limbs, typically the legs. Exercise plays a crucial role in managing both DM and PAD. Buerger-Allen exercises (BAEs), also known as lower extremity exercises, are specific exercises designed to improve circulation in the legs and feet. These exercises are particularly beneficial for individuals with PAD, as they help increase blood flow to the affected limbs, reduce symptoms, and improve overall cardiovascular fitness. BAE has the following steps elevating the legs, pumping the feet, rotating the ankles, bending the knees, and lowering the legs. The exercise starts by elevating the legs to a level above the heart. This position helps to reduce swelling and improve blood flow. These exercises are typically performed in a controlled manner, with multiple repetitions of each movement. The frequency and duration of BAEs may vary based on an individual's condition and their healthcare provider's recommendations. It is essential to consult a healthcare professional before starting any exercise regimen, especially if the patient has DM or PAD, to ensure that the exercises are safe and suitable for your specific situation. Many research studies proved that BAE is very effective in reducing PAD among DM patients.

Keywords: Buerger-Allen exercise, diabetes mellitus, peripheral artery disease

Introduction

Peripheral artery disease (PAD) is one of the major complications of type II diabetes mellitus (DM).

PAD is a condition characterized by the narrowing or blockage of the arteries that supply blood to the extremities, particularly the legs. It is primarily caused by atherosclerosis, a buildup of plaque within the arterial walls, which restricts blood flow.[1] Common symptoms of PAD include leg pain, cramping, weakness, numbness, and slow wound healing.

Peripheral arterial disease (PAD) in the legs or lower extremities is the narrowing or blockage of the vessels that carry blood from the heart to the legs.[2] It is primarily caused by the buildup of fatty plaque in the arteries, which is called atherosclerosis.[3]

Diabetes can affect the entire body and increase the risk of various complications, including cardiovascular disease, kidney disease, nerve damage, eye problems, and PAD.[4]

The relationship between PAD and diabetes is bidirectional. Diabetes increases the risk of developing PAD, while PAD in turn can exacerbate the complications of diabetes by impairing blood flow and compromising tissue health.[5] Therefore, it is crucial for individuals with diabetes to be aware of the increased risk of PAD and to manage their condition effectively through lifestyle modifications, medication, and regular medical check-ups.

In individuals with diabetes, the risk of developing PAD is significantly higher due to several factors, including:

- Accelerated atherosclerosis: High blood sugar levels in diabetes can damage blood vessels and accelerate the development of atherosclerosis, leading to PAD.
- Neuropathy: Diabetes can cause nerve damage known as diabetic neuropathy. Peripheral neuropathy, affecting the

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nerves in the legs and feet, can mask the pain associated with PAD, delaying diagnosis and treatment.
- Microvascular disease: Diabetes can also affect the small blood vessels, leading to microvascular disease. This can further contribute to reduced blood flow and impaired wound healing in individuals with PAD.

Classification Of PAD[6]

Stage 0	Asymptomatic
Stage 1	Mild claudication
Stage 2	Moderate claudication
Stage 3	Severe claudication
Stage 4	Rest pain

Buerger exercises are considered important prophylactic exercises for diabetic patients to improve circulation and control problems with diabetic foot later on, reduce peripheral neuropathy symptoms with diabetic patients, promote collateral blood circulation, and improve skin pressure perfusion. Buerger exercises augmented by active exercises of the feet. These exercises consist in flexion, extension, and circumduction of the ankles and are done during the phase of dependency of the legs, as suggested in 1931 by Allen (1887–1958). The Buerger-Allen exercise (BAE), also known as the Buerger's test or simply the Buerger test, is a diagnostic test used to assess the arterial circulation in the lower limbs. It is named after Leo Buerger and Edgar Allen, the physicians who developed the test.[7]

The purpose of the BAE is to evaluate the presence of peripheral arterial disease (PAD) and to determine the level and extent of arterial blockages in the lower extremities. It is particularly useful in diagnosing Buerger's disease, also known as thromboangiitis obliterans, which is a non-atherosclerotic inflammatory condition that primarily affects the small and medium-sized arteries and veins of the extremities. The exercises consist of leg elevation from 45 to 90° followed by the dependency of the leg and finally resting with the leg in the horizontal position, aimed to improve leg and feet circulation.[8]

BAE is performed by the following steps:
1. Positioning: The patient lies supine (on their back) on an examination table with their legs elevated at a 45–90° angle for approximately 2 min. This position allows for the venous blood to drain out of the legs.
2. Elevation: The legs are then lowered to a dependent position (hanging down) off the table, and the feet are allowed to hang freely.
3. Observation: The physician or healthcare provider observes the color of the patient's feet and toes. In a normal response, the feet and toes would turn pale due to reduced blood flow when they are elevated. On lowering the legs, the blood flow should be restored, and the feet and toes should regain their normal color within 10 s.
4. Repeat: The exercise is repeated several times to assess the speed and adequacy of the arterial blood flow recovery. Delayed or insufficient blood flow recovery may indicate the presence of arterial blockages or PAD.[9]

Discussion

DM is the main health problem in the present scenario. The one of the most important complications of DM is PAD. PAD is one of the most recognized major health problems in the elderly.[10] Diabetes is a significant risk factor for the development and progression of PAD. Elevated blood sugar levels in diabetes can damage blood vessels and contribute to the formation of atherosclerosis, leading to PAD. In addition, both conditions share common risk factors such as age, obesity, hypertension, dyslipidemia (abnormal lipid levels), and smoking.

Having both PAD and diabetes can worsen the symptoms and complications of each condition. Diabetes can cause neuropathy (nerve damage), which can mask the typical pain associated with PAD, leading to delayed diagnosis and treatment. Moreover, poor circulation resulting from PAD can further aggravate diabetic foot problems, making it more challenging to heal wounds, and increasing the risk of infections and amputations.

PAD and diabetes require a comprehensive approach involving lifestyle modifications and medical interventions. PAD and DM often coexist, and their relationship can lead to more severe consequences for individuals. Early detection, comprehensive management, and a collaborative approach between health-care providers are crucial to minimize the impact of these conditions on a person's health and quality of life.

Conclusion

PAD is a serious condition that requires medical attention and management. Although there is no cure for PAD, various treatment options are available to alleviate symptoms, improve quality of life, and reduce the risk of complications.[11] These treatments typically involve lifestyle modifications, such as regular exercise, smoking cessation, and a healthy diet, to control underlying risk factors. BAE is one of the effective remedies for increasing ABI in PAD.

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Conflicts of interest

None of the authors has any conflicts of interest to declare.

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