



## SMOKING AND PERIPHERAL ARTERIAL DISEASE



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“About 80% of the patients whose legs or extremities I have to amputate are current smokers. If they are not current smokers, then they almost certainly used to smoke. If patients presenting with PAD have never smoked, I have cause to doubt whether they have the disease at all.”

Mr. Daryll Baker, Consultant vascular surgeon, Royal Free Hospital

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# Summary

“The effect of smoking on the health of this nation is devastating. Smoking undoubtedly predisposes patients towards vascular disease of all types. The problem with Peripheral Arterial Disease is that, because it doesn’t actually kill people, it is seriously under-researched. But what we do know for sure is that smoking exacerbates practically every form of PAD.”

**Mr. Robert Bagg, Senior Physician, King George Hospital, Essex**

Peripheral Arterial Disease (PAD) is a type of vascular disease that affects the arteries. Most forms of peripheral arterial disease are caused by a gradual build-up of fatty material in the walls of the artery. This condition is called “atherosclerosis”.

Over time, one or more of the principal arteries may become so narrow that they are unable to deliver oxygen-rich blood to the body’s extremities. In severe cases, the blockage can cause gangrene requiring amputation of the affected limb.

Smoking is the most important, preventable risk factor for peripheral arterial disease. Smokers have a 10-16 times greater risk of developing PAD than people who have never smoked. Some types of arterial disease are almost exclusively found in smokers.

PAD is a common disorder but because it is not directly life-threatening, it has not received the same degree of attention or research as coronary heart disease. But PAD may be a precursor of heart disease since people with narrowed peripheral arteries are also more likely to have a narrowing of the coronary arteries.

PAD mostly occurs in the elderly. In the United Kingdom an estimated 2.7 million people aged over 55 have some degree of PAD. The incidence increases with advancing age, with an estimated incidence of 15% to 20% in people aged over 70.

About half of all people with PAD have no obvious symptoms and the first indication of arterial disease may be a heart attack or stroke. Approximately one third of patients diagnosed with PAD will die within five years and about one half die within ten years, primarily due to a heart attack or stroke.

The most effective treatment for PAD is to stop smoking. This single measure reduces the risk of disease progression amongst patients with peripheral arterial disease and dramatically reduces the need for limb amputation and the risk of premature death.

# Case studies

## **William Gosden**

William is a 67-year old carpenter-joiner from Northampton. He was a 40-a-day smoker and had smoked for 50 years.

*“Five years ago I began to experience aching and a tightness in my calf muscles. Gradually the aches began to spread until they affected my back. I didn’t take much notice at first and thought the back pain related to an injury I had some years ago. Eventually I thought I’d better see my doctor who referred me to a vascular clinic.*

*After a full vascular assessment I was diagnosed with peripheral arterial disease. I had a blocked artery above his knee (superficial femoral artery ), and widespread disease throughout the other leg.*

*I was strongly advised by the vascular team to stop smoking. I was told that if I did not stop smoking I was in danger of losing one, or possibly both legs.*

*I began smoking at 16 – around the same time I became a semi-professional footballer for Coventry City. As I was still fit and active, the threat of having my legs amputated was a huge incentive to stop smoking. I attended one of the vascular stop smoking clinics for 6 weeks and used the 16 hour nicotine patches. After just three weeks of stopping smoking, I found a huge improvement in my legs and walking became much easier and painless.*

*Now, after a year of being an ex-smoker I realise that smoking is a fool’s game. It’s just not worth the risk. My advice to any smoker would be to quit while you are healthy. Don’t wait until you get sick – it might be too late.”*

## **John Beighton**

John is a freelance educational consultant. Now aged 58, John is unusual in that he only started smoking when he was 47.

*“A major life-changing experience and an increasing amount of time spent socialising with smokers led me to take up the habit. However, after just ten years smoking, albeit quite heavily at 20-30 cigarettes a day, I suddenly lost the use of my left hand.*

*Prior to this dramatic event, I had been receiving treatment for skin cancer. I had experienced a tingling sensation in my left arm on a few occasions but was not particularly worried about it. But when I was finally admitted to hospital, I was told that I had had a number of minor strokes, almost certainly due to smoking. The artery leading to my left arm was 80% blocked and I had to undergo an operation to clear the build up of plaque from the carotid artery (carotid endarterectomy). I was warned that if I did not stop smoking I was in danger of having a major stroke that could be fatal.*

*I stopped smoking the day I went into hospital. I managed to stop without the use of any nicotine replacement therapy and have remained a non-smoker ever since.*

*Losing the use of my left hand, even temporarily, was a frightening experience. Thankfully, due to*

*the swift action of the surgeon and the fact that I have successfully stopped smoking, my arm is functioning again.*

*I was surprised at how easily I recovered. And I am delighted that senses of taste and smell have returned too, since these had been dulled by smoking. I do miss the 'after dinner' cigarettes but have learned to live without them. I feel a thousand times better for having finally rid myself of a habit that might have killed me."*

### **Brandon Carmichael**

Brandon is a 24-year old American student who developed Buerger's disease in 1999. He dedicates his time to raising awareness about the dangers of smoking and to campaigning against tobacco.



Brandon Carmichael

*"It started in December 1999, my senior year in high school, when I cut my left big toe on a piece of glass. I had been smoking since the age of 15.*

*My toe refused to heal. My parents and I went to see doctor after doctor after doctor. After a month, we were referred to a vascular specialist. He asked me if I smoked, which puzzled me, as I couldn't see what that had to do with my toe. He told me that I might have Buerger's disease.*

*After an angiogram at the Mayo Clinic ([www.mayoclinic.com](http://www.mayoclinic.com)) showed that I had a blockage in the blood vessel of my left knee, I was diagnosed as having Buerger's disease. The clinic used a range of technologies to improve the circulation in my left leg, including a giant pump like a space boot. After a week of this I was sent home with a miniature pump to use and all sorts of ointments. It took until October or November for my toe to get better. I had had that simple cut for ten months.*

*Thinking I was invincible and not caring what my doctors diagnosed me with, I started to smoke again. This lasted for about two months. I must say it was a huge mistake. The skin of my big toe broke down and suddenly there was an ulcer there.*

*Another angiogram showed that the blockage in my knee was now about 6 – 8 inches long. The ulcer on my toe was as deep as the bone. The doctors, fearing a bone infection, decided to amputate the toe and bypass the blocked artery using plastic tubing.*

*After the operation, I needed to get away from it all, and I went on holiday with a buddy. However, while we were away, our car broke down, and while we were waiting for help, I smoked three cigarettes.*

*One night in June I woke up to find that my left leg was as cold as ice and dark purple. The pain was indescribable. I was taken to ER and another angiogram showed that the bypass in my knee had ended up plugging up. Also those three cigarettes I had smoked in Albuquerque were responsible for a blood clot in each of my wrists. Before I knew it, my left foot had four black toes and one huge ulcer. I can't put into words how painful this was. My doctors and I decided it was time to amputate.*

*So on July 12th, 2000, my left leg was amputated about 5-6 inches below my knee. I am very*

*thankful that I still have that 5-6 inches; I can't imagine how anyone can walk with a prosthetic knee.*

*Individuals with Buerger's Disease know how difficult it is to stop smoking. Unfortunately many of them have relapses with cigarettes. I found myself being one of them. I ended up smoking for about two months again in 2003. Now I have an ulcer on my right thumb. It scares me because I can't imagine life without my thumb.*

*I hope you can learn from my mistake and never pick up smoking or chewing tobacco. I know if I could go back, I would never start smoking."*

See Brandon's full story at [www.smokinggotme.com](http://www.smokinggotme.com)

### **Angie Dormer**



Angie Dormer

Angie was first diagnosed with arterial disease more than 25 years ago. In 2000 she set up a support group for fellow sufferers of the disease.

*"I was a young smoker when my struggles with PAD started in 1978. I had tripped on a kerbstone and begun feeling persistent pain in my right leg. As well as being a smoker, I was taking the Pill. My GP referred me to a vascular surgeon who diagnosed PAD and told me to stop smoking immediately or risk losing my right leg!*

*I had to have an arterial bypass in my leg at the age of just 22. I subsequently fell pregnant and was warned that this could be dangerous because of the additional strain it would put on my legs. The PAD problem recurred and I underwent a patch to the original graft.*

*At the start I lived in Camberley, and following a move to Sutton I was referred to Professor Greenhalgh and his excellent team at Charing Cross Hospital. In 1984 I underwent a second bypass which also subsequently had to be patched. Following a further move to Hastings I began to smoke again for a short time and I was embarrassed to find that they could tell from the condition of my blood vessels that I had been smoking! This led to a third by-pass in 1994. The bypass was not totally successful and I had to have a balloon angioplasty. I have also since had to have balloon angioplasty on my left leg which seems to be successful.*

*My problems with PAD have continued for many years and I still suffer from constant pain. I currently have a blockage at my right knee but surgery is being avoided. The pain in my leg has led to problems with my posture and a general sense of exhaustion and poor health leading to a spinal fusion.*

*In association with the British Vascular Foundation, my husband Colin and I launched a support group for sufferers of PAD in 2000. We felt that there was not enough information, knowledge or support available out there for people affected by PAD, be they sufferers or their carers. The response has been limited but we are always keen to hear from other sufferers. We can be contacted by e-mail - [vast@thedormers.gioserve.com](mailto:vast@thedormers.gioserve.com) - or on 01424 850005. I wish I had known in 1978 what I know now about the link between smoking and PAD."*

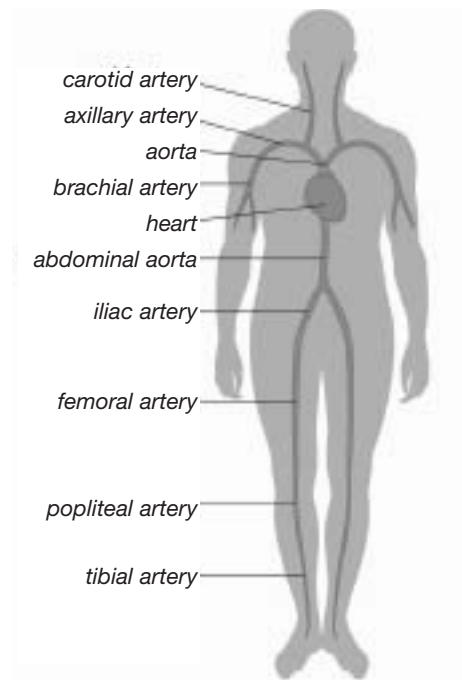
# Peripheral Arterial Disease

## What is peripheral arterial disease?

Peripheral arterial disease (PAD) is a type of vascular disease that affects the arteries. ('Vascular' refers to any blood vessel and includes veins as well as arteries.) Arteries are the blood vessels that take oxygen-rich blood from the heart to all parts of the body. PAD usually affects the legs but it can also occur in the arteries to the arms and abdominal organs.

*The main arteries. In peripheral arterial disease, the arteries which supply blood to the legs become narrowed or completely blocked off. The narrowing of the artery usually happens in the upper part of the leg.*

*Illustration courtesy of the British Heart Foundation.*



Most forms of peripheral arterial disease are caused by a gradual build-up of fatty material in the walls of the artery. This condition is called “atherosclerosis” and the fatty material is known as “atheroma”. In time, arteries may become so narrow that they cannot deliver enough oxygen-rich blood to the body’s extremities. The presence of atheroma can also cause a blood clot (thrombus) to form, blocking the artery completely. In severe cases or if the condition remains untreated, the blockage can cause gangrene requiring amputation of the affected limb.

People with peripheral arterial disease are also likely to have narrowed arteries in other parts of the body. If there is a narrowing in the coronary arteries (which supply blood to the heart), this can cause angina or a heart attack. If the arteries to the neck are affected, it can interfere with the flow of blood to the brain and may cause a stroke.<sup>1</sup>

Thus the potentially debilitating risks from PAD are limb loss, stroke (carotid endarterectomy) or death, commonly triggered by a heart attack.

## How many people are affected?

In the UK, about 2.7 million people, i.e. 1 in 6 (16.6%) aged over 55, have some degree of peripheral arterial disease.<sup>2</sup> The incidence increases with advancing age, with an estimated incidence of 15% to 20% in people aged over 70.

## **Smoking and peripheral arterial disease**

Smoking is the most important, preventable risk factor for peripheral arterial disease. Smokers have a 10-16 times greater risk of developing PAD than people who have never smoked.<sup>3</sup> In fact, the rarity of PAD among non-smokers was noted as early as 1960 when a study of 520 non-diabetic patients aged under 60 with PAD found that 97.5% of the patients were smokers.<sup>4</sup> Eleven percent of those who continued to smoke, but none who stopped, had amputations within five years.

The first major longitudinal study to demonstrate the strong association between cigarette smoking and peripheral arterial disease was the US Framingham study established by the National Heart Institute in Massachusetts in 1949. The study followed 5127 men and women for 16 years and found a significantly higher incidence of intermittent claudication in smokers as compared with nonsmokers.<sup>5</sup> Other retrospective studies conducted in the 1970s concluded that atherosclerosis (thickening and narrowing of the arteries) was greatest in heavy smokers and least in non-smokers.<sup>6</sup>

Many other investigations have found high smoking rates among patients with PAD. For example, one study found that 98 percent of patients with aortoiliac disease (PAD of the iliac artery) and 91 percent of patients with PAD of the femoral artery were cigarette smokers.<sup>7</sup>

Another study evaluated the association of risk factors in 109 patients with PAD. Cigarette smoking was found to be the most prominent risk factor, occurring in 90% of patients with aortoiliac (iliac artery) or combined disease and in 75% of patients with PAD in the femoral artery. The onset of symptoms occurred at an average of 8 to 10 years earlier in smokers than in nonsmokers.<sup>8</sup>

The risk of peripheral arterial disease increases in proportion to the number of cigarettes smoked. Heavy smokers are three times more likely to develop intermittent claudication – a severe pain in the legs or buttocks that is brought on by exercise and relieved by rest.<sup>1</sup>

### **How smoking causes PAD**

The exact mechanism by which smoking induces atherosclerosis is not fully understood. However, smoking appears to cause PAD in a number of ways. Chemicals in tobacco smoke damage endothelial cells which line the walls of blood vessels. This has the effect of increasing permeability to lipids (fats) and other blood components. Smoking stimulates the formation of the fatty-substance known as atheroma. This has the effect of narrowing the arteries, reducing the amount of blood that can flow through them. Reduced blood flow to the smaller blood vessels and capillaries leads to a shortage of oxygen in those tissues: a condition known as ischaemia.

Nicotine and carbon monoxide also cause a constriction of blood vessels. This problem is exacerbated by the fact that tobacco smoke reduces oxygen supply to the tissues because carbon monoxide in tobacco smoke attaches to haemoglobin (found in red blood cells) leading to elevated levels of carboxyhaemoglobin. The lack of oxygenated blood causes ischaemia, which can cause ulceration and gangrene.

Smoking also encourages thrombosis (blood clots) by increasing platelet stickiness. (Platelets are one of three types of elements found in blood and are involved in the formation of blood clots.)<sup>9</sup>

### **Other contributory factors**

In addition to smoking, two other principal risk factors for peripheral arterial disease are raised **cholesterol levels** and **hypertension** (raised blood pressure). The risk is cumulative when more than one risk factor is present. Age, sex, and family history are also important risk factors but clearly cannot be modified. Other risk factors include diabetes, obesity and raised homocysteine levels.<sup>10 11</sup>

**Age** – Age is a significant factor. One study reported that nearly half of the cases occurred in people aged over 70. A higher percentage of patients with arterial disease smoked than did patients without arterial disease.<sup>12</sup>

**Sex** – PAD is more common in men but atherosclerosis is the primary cause of mortality in both men and women and accounts for a high degree of morbidity among both sexes. There is some evidence of a growing incidence of the disease among women, reflecting an ageing population, an increase in obesity and the greater longevity of women.<sup>13</sup>

**Diabetes** - People with diabetes have a significantly increased risk of peripheral arterial disease and the risk is compounded if other risk factors, such as smoking are present. One study noted a 50 percent greater incidence of PAD in diabetics who smoked than in those who did not.<sup>5</sup>

“As a vascular surgeon, I regularly have to operate on patients with Peripheral Arterial Disease. Smoking impairs the circulation and reduces the amount of oxygen in the blood. This may lead to intermittent claudication, where the patient complains of pain in the calf when walking.

“Progressive disease leads to foot ulcers and pain at rest - critical limb ischaemia - where the flow of blood to the limb is too poor to maintain healthy tissue. Sadly, this may ultimately mean that the leg must be amputated. Smoking greatly increases the risk of vascular disease, and of limb loss. I strongly advise my patients who smoke to stop at the earliest opportunity.”

Mr. James Johnson, Consultant Vascular Surgeon, Council Chairman, British Medical Association

### **Symptoms of PAD**

Around 50% of patients with PAD have no obvious symptoms and the first indication of arterial disease may be a heart attack or stroke.<sup>14</sup> Of those who do report problems the most frequent symptom is intermittent claudication.

#### **Intermittent claudication**

The most common sign of PAD is cramping in the calf muscles, thighs or buttocks whilst walking or exercising. Slowing down or stopping the exercise reduces the demand of the leg muscles for oxygen, resulting in an easing of the pain. This complaint is called intermittent claudication (named after the Roman Emperor Claudius who is said to have walked with a limp).

Around 5% of people aged 60 and over suffer from intermittent claudication as a result of PAD.<sup>15</sup> This equates to around 600,000 people in the UK. For about a quarter of these people, the symptoms become severe and progressive. In some cases, the sufferers may eventually lose the use of their legs and be unable to walk. As the PAD develops, sores and ulcers can develop on the legs and feet. In the worst case scenario, patients may need to have a leg or foot amputated. Typically around 5% of patients with claudication will require amputation.<sup>5</sup>

“About 80% of the patients whose legs or extremities I have to amputate are current smokers. If they are not current smokers, then they almost certainly used to smoke. If patients presenting with PAD have never smoked, I have cause to doubt whether they have the disease at all.”

Mr. Daryll Baker, Consultant vascular surgeon, Royal Free Hospital

#### Ischaemic rest pain

If the causes of intermittent claudication are not addressed, the condition can persist and become more serious. As the blood supply to the limb deteriorates, the pain can become almost continuous, i.e. it is not relieved by resting the affected limb. This is known as ischaemic rest pain and affects mainly the foot or lower leg. Ischaemic rest pain is often accompanied by ulcers and tissue death (gangrene). If the damage to the blood vessels is irreparable, the affected part has to be amputated. In the UK, around 10,000 people per year suffer from critical limb ischaemia each year. Many patients will undergo bypass surgery which may save the limb but many thousands will still require amputation.



*Ischaemic ulcer caused by inadequate blood supply.*

Almost 50% of patients with critical ischaemia die within 5 years of the appearance of their symptoms.<sup>16</sup> Critical limb ischaemia has been estimated to cost the health service over £200 million a year in the UK.<sup>17</sup>

#### Specific types of Peripheral Arterial Disease

##### Buerger's Disease (Thromboangiitis Obliterans)

This is a rare form of arterial disease found almost exclusively among smokers. The cause of Buerger's disease is unknown but the close association between Buerger's disease and tobacco use is indisputable. In this debilitating, chronic disease, the arteries and veins of the hands and feet become acutely inflamed and there is an increased risk of blood clotting (thrombosis). As the vessels become obstructed, the flow of blood to the extremities is drastically diminished. The pulse is typically weak or absent from nearby arteries.

In severe cases patients develop large skin ulcers. If this disease worsens and gangrene develops, the affected limb may need to be amputated. Even this may not halt the progress of the disease, and

“The most depressing thing about Buerger's Disease is seeing the victims still smoking. This is the one disease I can honestly say I have only ever seen in smokers.”

Dr. David Tunnadine, General Practitioner (retired)



*Gangrene of the toes due to PVD.*



*Skin ulcerations and gangrene of the fingers from Buerger's disease.*



*Amputation due to Buerger's disease.*

multiple amputations are not uncommon in sufferers who continue to smoke or chew tobacco. Buerger's disease is unusual in that it primarily affects young people. It most often strikes young men between the ages of 20 and 40 who are heavy cigarette smokers. Although most Buerger's patients are heavy smokers, the disease has been reported in moderate smokers and users of smokeless tobacco.<sup>18</sup> There appears to be a genetic predisposition to the disorder. In addition, Buerger's disease may be an autoimmune condition in which the patient's body tissues are attacked by his or her own immune system, triggered by a component of tobacco.<sup>18</sup> Patients wishing to save their limbs must stop smoking immediately upon diagnosis.

### **Visceral arterial occlusive disease**

Some studies have reported an association between cigarette smoking and visceral arterial occlusive disease. This is a form of PAD affecting the abdominal organs (viscera). Occlusive refers to the blocking of the arteries. One study found that smoking was nearly twice as common in patients with non-malignant hypertension associated with renal artery stenosis (narrowing of the kidney arteries) as in those patients with hypertension of comparable severity without renal artery disease.<sup>19</sup>

### **Abdominal Aortic Aneurysm**

An aneurysm is an abnormal dilation or expansion of the aortic wall due to degenerative or inflammatory destruction of the components of the wall. Smoking is the risk factor most strongly associated with abdominal aortic aneurysms, followed by age, high blood pressure, high blood cholesterol and atherosclerosis. Heavy smokers have as much an eightfold increase in the incidence of abdominal aortic aneurysm.<sup>20</sup>

Men are ten times more likely than women to have an abdominal aortic aneurysm of 4cm or greater. However, while aneurysms are less prevalent among women, when present they rupture 3 times more frequently in women and at a smaller aortic diameter. Rupture is also more common among current smokers and those with hypertension.<sup>21</sup>

Abdominal aortic aneurysm is common in the elderly but often remains undiagnosed until a rupture occurs, which carries a fatality rate of over 90%.<sup>22</sup> Of those who undergo emergency repair, mortality is over 40%.<sup>23</sup> However, most aneurysms detected by screening are small, which provides the opportunity to modify risk factors to reduce aneurysm growth. Smoking appears to increase the rate of growth of abdominal aneurysms.<sup>24</sup> Stopping smoking may therefore arrest the growth of the aneurysm and reduce the risk of rupture and premature death.

### **Risk of CHD or stroke**

As noted above, in addition to the potential loss of mobility, leading in some cases to amputation, the greatest risk for people with PAD is a heart attack or stroke. In the Framingham study, for example, one third of all patients with intermittent claudication had evidence of cardiovascular disease or congestive heart failure.<sup>10</sup> Ten years after the onset of claudication, 47% of the men and 43% of the women had died, compared with an expected mortality of 12.5% and 10% respectively. In other words, the presence of intermittent claudication increases the mortality rate four-fold in both men and women. Other researchers have concluded that peripheral arterial disease carries at least a 30% risk of death within five years and almost 50% within 10 years, primarily due to heart attack (60%) or stroke (12%).<sup>25</sup>

## Secondhand smoke and PAD

There is now considerable evidence to show that exposure to secondhand smoke (SHS) increases the risk of coronary heart disease in non-smokers.<sup>26</sup> The mechanisms by which this occurs suggests that secondhand smoke exposure could also increase the risk of PAD. In particular, arterial endothelial dysfunction has been reported to be associated with SHS<sup>27</sup> and non-smokers exposed to tobacco smoke have been shown to have greater levels of atherosclerosis, compared to people not exposed.<sup>28</sup> Other research suggests that passive smoking may exert an adverse effect on platelet activation in the peripheral arteries.<sup>29</sup>

“Most people think smoking gives you lung cancer, but it blocks your arteries up as well. The danger is especially bad if you have high blood pressure and diabetes as well. All my patients smoke. I don’t believe I have ever seen a patient with blocked blood vessels who does not smoke. Five percent of my patients end up with a major amputation, and half of these die within two years. The cause of death is heart attack or stroke brought on by immobility arising from the amputation, not to mention some patients’ continuing to smoke.”

Mr. Frank Cross, Consultant vascular surgeon, St. Bartholomew’s Hospital, London

## Treatment – Relative risk and success rates of different interventions

The type of treatment given to patients with peripheral arterial disease will depend on the extent and severity of the conditions. Some people with intermittent claudication may be able to arrest progression of the disease simply by **stopping smoking, modifying their diet** and/or **taking up exercise**, whilst people with advanced limb ischaemia may require a bypass operation.

One of the commonest forms of treatment is **angioplasty**. This is a surgical procedure during which the fatty deposit is squashed and flattened back against the walls of the blood vessel, using a tiny balloon at the end of a catheter which is usually inserted into the artery at the patient’s groin. When the end of the catheter reaches the blockage, the balloon is inflated to create space inside the blood vessel. The balloon is then deflated and removed.

Other patients may need to have an **arterial bypass**, in which blood - which was not able to flow down a blocked vessel - is diverted through an artificial vessel to reach the tissues which need it. Like angioplasty, bypass operations are much more likely to succeed in patients who do not smoke. However, a quarter of angioplasties and bypasses fail within a year. When this happens, tissues die and may start to rot. At this point, amputation is urgently necessary.

Whatever the severity of the condition, if a patient smokes, the single most effective treatment for PAD is to stop smoking. Stopping smoking increases walking distance by two or three-fold in more than 8 out of 10 people with PAD. Heavy smoking may also undermine the effectiveness of anti-platelet medication.<sup>30</sup> The importance of stopping smoking cannot be over-emphasised, as shown in the following studies.

### **The benefits of stopping smoking**

Stopping smoking reduces the risk of disease progression amongst patients with peripheral arterial disease and dramatically reduces the need for limb amputation and the risk of premature death.<sup>14</sup>

A study of 390 patients with PAD who were either ineligible or unfit to undergo operative treatment were given advice including cessation of smoking, walking exercise, a low cholesterol diet, and vitamin E therapy. Of 277 patients who smoked, 164 were able to stop smoking. Eighty-five percent of patients who stopped smoking showed improvement in symptoms of PAD compared with only 20 percent among those who continued to smoke. Interestingly, the degree of improvement was greater among the ex-smokers compared to those who had never smoked, demonstrating that smoking is a key modifiable risk factor.<sup>31</sup>

Juergens and colleagues studied 520 patients with non-diabetic PAD, approximately 50 percent of whom continued to smoke despite medical advice to quit. Of those who continued to smoke, approximately 10 per cent eventually required amputation, but no amputations were necessary in patients who successfully stopped smoking.<sup>4</sup>

A study of 245 women with PAD examined the relative risk of disease in ex-smokers compared to continuing smokers.<sup>32</sup> The study found that the risk dropped dramatically after stopping smoking. In ex-smokers who had not smoked for 5 years or more the risk was near normal, with a risk ratio of 1.06. Patients who had not smoked for between 1-5 years had a risk ratio of 1.70. By contrast, patients who continued to smoke up to 20 cigarettes a day had a risk ratio of 11.53 while those who smoked more than 20 a day had a risk ratio of 15.56.

Stopping smoking also affects the long-term success of reconstructive arterial surgery. For example, there is a three-fold increased likelihood of failure of a bypass in the femoral artery in those who continue to smoke more than five cigarettes a day, compared to those who do not smoke or smoke fewer than five cigarettes per day.<sup>33</sup> Studies have shown that the patency rate – that is, the rate at which the artery remains unobstructed – is significantly lower among smokers one year after surgery compared to non-smokers.<sup>34</sup>

Stopping smoking is clearly essential for people with peripheral arterial disease. Those who do so may avoid operation while those who continue to smoke may lose a limb whether or not they have surgical treatment.

# ASH policy recommendations

PAD is an alarmingly poorly understood consequence of smoking. Many people simply do not realise that smoking can cause such grave damage to their limbs. Because PAD is such a major threat to public health, and a significant drain on the NHS, ASH recommends the following policy measures which are supported by experts in the field:

- The health consequences of PAD should be included in the range of pictorial health warnings to be featured on cigarette packs. The Brazilian government has already done this (see below)

## Brazilian health warnings

Left: The warning states: "He is a victim of tobacco. Smoking causes vascular disease that can lead to amputation."

Right: The warning states: "This necrosis was caused by tobacco consumption."



- A smoker with PAD should be included in the Department of Health's TV anti-smoking campaign so that all viewers can see the damage it does and hear a sufferer's story.
- Health practitioners should routinely warn patients who smoke of the risks of peripheral arterial disease.
- Research should be conducted to investigate the cost effectiveness and viability of providing screening for people at high risk of PAD, particularly people aged over 60 who have ever smoked.

## Useful contacts and websites

[www.smokinggotme.com](http://www.smokinggotme.com) Brandon Carmichael's full story

[www.bvf.org.uk](http://www.bvf.org.uk) The BVF funds research into vascular disease, provides patient information and aims to raise awareness of vascular disease amongst the general public.

[www.bhf.org.uk](http://www.bhf.org.uk) Website of the British Heart Foundation. A useful resource for all facets of vascular and coronary health.

[www.vascularsociety.org.uk](http://www.vascularsociety.org.uk) aims to promote the best possible care for vascular patients

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