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# Pain management in patients with vascular disease

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## Abstract

Vascular disease covers a wide range of conditions, including arterial, venous, and lymphatic disorders, with many of these being more common in the elderly. As the population ages, the incidence of vascular disease will increase, with a consequent increase in the requirement to manage both acute and chronic pain in this patient population. Pain management can be complex, as there are often multiple co-morbidities to be considered. An understanding of the underlying pain mechanisms is helpful in the logical direction of treatment, particularly in chronic pain states, such as phantom limb pain or complex regional pain syndrome. Acute pain management for vascular surgery presents a number of challenges, including coexisting anticoagulant medication, that may preclude the use of regional techniques. Within the limited evidence base, there is a suggestion that epidural analgesia provides better pain relief and reduced respiratory complications after major vascular surgery. For carotid endarterectomy, there is again some evidence supporting the use of local anaesthetic analgesia, either by infiltration or by superficial cervical plexus block. Chronic pain in vascular disease includes post-amputation pain, for which well-known risk factors include high pain levels before amputation and in the immediate postoperative period, emphasizing the importance of good pain control in the perioperative period. Complex regional pain syndrome is another challenging chronic pain syndrome with a wide variety of treatment options available, with the strongest evidence being for physical therapies. Further research is required to gain a better understanding of the underlying pathophysiological mechanisms in pain associated with vascular disease and the best analgesic approaches to manage it.

**Key words:** acute pain; chronic pain; vascular; peripheral arterial disease; vascular diseases; vascular surgical procedures

**Editor's key points**

- Pain associated with severe vascular disease can be the result of a combination of nociceptive, inflammatory, and neuropathic mechanisms.
- Cross-talk between sensory neurones and the sympathetic nervous system (sympathetic–afferent coupling) may contribute to the pain of vascular disease.
- There is no clear evidence that the choice of intraoperative or postoperative analgesic technique in patients undergoing amputation impacts on long-term outcome.
- Pre-emptive analgesic strategies may reduce the emergence of chronic pain states in patients with severe peripheral vascular disease.

Vascular disease refers to a complex and diverse range of disease entities that include arterial disease [peripheral arterial disease (PAD), renal arterial disease, and aneurysms], venous disease (including varicose veins and thromboembolic disease), lymphatic disease, Buerger's disease, and Raynaud's phenomenon (Table 1). Although cardiac disease is a major contributor to morbidity and mortality, for the purposes of this review, pain will be considered in the context of patients with vascular disease managed for non-cardiac vascular problems.

Pain is a key feature of vascular disease, with a major impact on quality of life and function.[26–28] Pre-existing chronic pain and multiple associated co-morbidities, such as impaired renal function, obesity, diabetes mellitus, cognitive impairment, and ischaemic heart disease, often complicate pain management in

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Table 1 Diseases included in the umbrella term 'vascular disease'. Please note that renal artery disease, thromboembolic disease, lymphatic disease, Buerger's disease, Raynaud's phenomenon, and in some instances, sickle cell crisis are also associated with the vasculature but are most frequently managed by physicians and are beyond the scope of this review

| Disease | Prevalence | Summary of pathological process | Postulated pain mechanisms involved | Related references |
|---|---|---|---|---|
| Peripheral artery disease | 12% of general population | Atherosclerotic occlusion of peripheral arteries, leading to tissue ischaemia | Nociceptive (early)<br>Ischaemic (late)<br>Neuropathic (late) | 1–6 |
| Aortic aneurysms | Dependent on location, age, and sex. Abdominal aortic aneurysms: 25/100 000 men and 12/100 000 women | Dilatation affecting all three layers of the vascular wall. Caused by degeneration of elastic laminae and leucocyte infiltration, leading to smooth muscle cell loss. Likely to be secondary to atherosclerosis (except in familial instances) | Nociceptive | 7–9 |
| Carotid artery disease | Dependent on age and location; 20% prevalence of non-stenosing plaques in common carotid | Atherosclerotic plaques, leading to occlusion of vessel lumen | Usually pain free<br>Nociceptive (after surgery) | 10 11 |
| Varicose veins | Dependent on age and sex. Overall ~16% | Valvular insufficiency in superficial veins, leading to increased pressure and dilatation. Possible genetic component shown in twin studies | Nociceptive<br>Inflammatory<br>Ischaemic | 12 13 |
| Chronic regional pain syndrome | 20/100 000 | Minor peripheral damage, leading to peripheral sensitization, inflammation, changes in muscle and bone, and eventual central sensitization and shift to facilitation in descending pain modulation | Neuropathic (with or without autonomic involvement)<br>Inflammatory | 14–17 |
| Thoracic outlet syndrome | Unclear | Compression of veins (2%), arteries (1%), and brachial plexus (95%) passing through thoracic outlet | Ischaemic<br>Neuropathic | 18–20 |
| Phantom limb and stump pain | 50–80% of amputees | Transection of nerve(s) at amputation leads to axonal sprouting and changed peripheral responses to stimuli, neuroma formation, sympathetic afferent coupling, and peripheral, and eventually, central sensitization | Neuropathic (with or without autonomic involvement) | 21–25 |

this patient group. Many vascular disease patients have had recurrent hospital admissions and multiple surgeries. Uncontrolled pain, acute or chronic, will result in pathophysiological changes, including an increased stress response and activation of the autonomic system, which may be particularly detrimental in patients with vascular disease.[29–32]

The mechanisms of pain applicable to vascular disease patients are multifaceted and incompletely understood. Knowledge of these processes is important to guide effective, targeted pain management, including a multimodal approach to analgesia.[33–36] We provide a summary of the pain mechanisms important in vascular disease, followed by an outline of the management of pain in the various contexts of vascular disease.

## Pain mechanisms relevant to vascular disease

A complex range of mechanisms underpins pain in patients with vascular disease. Nociceptive, inflammatory, and neuropathic