



Review Article



Crutch Walking-Induced Neurovascular Complications

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Received: 27 July 2018

Accepted: 29 August 2018

Version of Record Online: 10 September 2018

Citation

Misawa Y, Takeishi K (2018) Crutch Walking-Induced Neurovascular Complications. Open J Surg Case Rep 2018(1): 01-03.

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Abstract

Background/Purpose: The use of crutches is frequently necessary in orthopedic patients. However, improper use of crutches may lead to neurovascular complications. **Material and Methods:** We reviewed studies written in English that were published between January, 1980 and the end of June, 2018, regarding crutch walking-induced complications. Our survey revealed three case reports that described nerve complications and eight that described vascular complications following crutch usage. **Results:** Muscle weakness and sensory disturbances likely occurred due to nerve injury, while axillary and or brachial artery stenoses and aneurysms lead to rupture or thromboembolism in the upper extremities. Nerve injuries developed in patients who had used one or multiple crutches for only a transient period, and in these cases, crutches were most often used due to leg fractures. Most vascular complications occurred in those who had used crutches for over fifty years, and the main reasons for crutch usage in these cases were poliomyelitis and lower limb amputation. **Discussion:** The proper use of crutches is essential. Users should be aware of the possibility of crutch-induced neurovascular injury and they should be followed with serial imaging even if no ischemic episodes occur in the upper extremity.

Keywords

Axillary Artery Aneurysm; Brachial Artery Aneurysm; Crutch Walking; Nerve Complication; Upper Limb Ischemia

Introduction

Chronic crutch users are at an increased risk for developing neurovascular complications induced by improper use of crutches. Nerve complications can cause muscle weakness and/or sensory disturbances. Chronic axillary and or brachial compression can lead to vascular complications such as aneurysm formation with or without rupture, and peripheral thrombosis of the upper extremity. Arterial stenotic lesions can also occur. These complications are well-recognized entities, and such cases continue to be reported. The aim of this study is to identify studies that have described crutch walking-induced neurovascular complications.

Materials and Methods

We reviewed studies written in English that were published. As of the end of June, 2018 We searched using the following key words: crutch user, axillary artery aneurysm, axillary artery stenosis, brachial artery aneurysm,

brachial artery stenosis, and axillary nerve. Using a PubMed search, we reached seventy-one articles. Some of them were duplicated. Articles before January, 1980 and others showing complications of the abdomen or lower extremities were excluded. Finally, we identified fifteen reports describing crutch-induced neurovascular complications. We focused on clinical features of neurovascular complications and treatment modalities for them.

Results

We identified eleven case reports describing crutch-induced complications, a review article, and the others referring to the complications. No reports referring to venous complications were encountered.

Nerve injury

Three articles highlighted cases with muscle weakness and/or sensory disturbances that implicated nerve injuries. Murphy et al., reported a forty-two-year-old patient with long thoracic nerve palsy after using a single axillary crutch [1]. During weight bearing after internal fixation of a fractured left tibia and fibula, the patient began using one axillary crutch on the right side. The resulting asymmetric gait pattern forced the crutch into his chest wall, which led to a right-sided long thoracic nerve palsy. The nerve dysfunction had not recovered six months after the injury.

Raikin et al., treated a thirty-six-year-old man with axillary crutches for mobilization after a femur fracture [2]. Unfortunately, bilateral radial nerve compressive neuropathy subsequently developed. The patient was then treated with static cock-up wrist splinting and discontinuation of the axillary crutches. Return of sensory and motor function was delayed, occurring at nine months.

Another report by Macneal et al., described two patients who developed persistent anterior interosseous nerve palsy after the use of forearm crutches [3]. These cases were managed conservatively, but little clinical improvement was seen for over four months.

Vascular injury

Eight articles highlighted cases with crutch-induced vascular complications. In 1995, Feldman et al., reported two cases with axillary artery aneurysmal changes and one with a stenotic lesion [4]. These three cases were chronic crutch users without exact identifiable crutch-using periods. We reported in 2009 the case of a fifty-seven-year-old patient with bilateral brachial and axillary artery aneurysms who was a chronic axillary

crutch user secondary to childhood poliomyelitis [5]. Repeated thromboembolic episodes of the right upper extremities required surgical intervention. Eight years later, the aneurysm of the left brachial and axillary artery became enlarged and thrombosed, and he underwent successful resection of the aneurysm and revascularization with an autologous saphenous vein graft interposition for prevention of aneurysmal rupture and ischemic episodes [6].

Van der Horst described a case with a ruptured axillary artery aneurysm [7], and Moon et al., reported two cases with axillo-brachial arterial injuries secondary to crutch trauma as a source of recurrent emboli to the upper extremity [8]. In the latter cases, crutch-induced arterial injury caused emboli without aneurysms. Four other reports described cases with axillary and or brachial artery aneurysms with ischemic episodes of the upper extremities [9-12].

Discussion

Chronic axillary crutch users are at an increased risk of developing neurovascular complications [13]. Muscle weakness and sensory disturbances may implicate nerve injury, while axillary and or brachial artery stenoses and aneurysms can lead to rupture or secondary thromboembolic episodes in the upper extremities [1-11]. For crutch users, supporting weight on the upper support of the crutches is thus not recommended because it can lead to neurovascular damage [13]. The nerve injuries developed in patients with transient use of one or multiple crutches, while the main reason for crutch usage in these cases was fractures of the legs. Correct crutch fitting and early identification of signs of such injuries are strongly recommended.

As recovery from altered sensory and motor function took more than six months in the cases mentioned above, the proper use of crutches is essential in the prevention and treatment of nerve injury [13]. Clinicians must consider potential compromise of the long thoracic nerve and brachial plexus if the crutch is used inappropriately.

In general, axillary and or brachial aneurysms are rare. They usually occur due to infection or an iatrogenic etiology, and a true aneurysm is even more rare [14]. All patients with vascular complications had used crutches for a long-term period (longer than fifty years) [5,6,9,10,12]. The other case was also after the chronic use of a crutch [4]. In 1980, Ettien concluded in his review article that chronic axillary crutch use in the patient with an acute, noncardiac embolism of the upper extremity should suggest the diagnosis of crutch-induced axillary artery aneurysm [15]. The main reasons for chronic crutch use in the

cases we reviewed were poliomyelitis and lower limb amputation [5,6,9,10]. Repeated long-term microtrauma may lead to the formation of vascular injuries. Proper crutch use is essential to prevent such complications, and a wheel chair use might stand for an alternative strategy for long-term crutch users.

The treatment of crutch-induced vascular injuries with peripheral thromboembolism must be performed before permanent sequelae develop. Serial follow-up of crutch-induced aneurysms may lead to an adequate time for treatment. Most cases can be treated successfully with surgical excision and/or vascular grafting [11,15]. Other cases may respond to catheter intervention for a focal artery stenosis [4].

Conclusion

Crutch users should be aware of the possibility of crutch-induced neurovascular injury. Proper crutch use without supporting weight on the upper support of the crutch may prevent neurovascular injury. Serial imaging of the upper extremity is necessary for definite diagnosis and proper treatment of vascular complications.

Acknowledgment

We thank Peter Mittwede, MD, PhD, from Edanz Group (www.edanzediting.com/ac) for editing a draft of this manuscript.

References

- Murphy MT, Journeaux SF (2006) Case reports: long thoracic nerve palsy after using a single axillary crutch. *Clin Orthop Relat Res* 447: 267-269.
- Raikin S, Froimson MI (1997) Bilateral brachial plexus compressive neuropathy (crutch palsy). *J Orthop Trauma* 11: 136-138.
- Macneal P, Crome CR, McNally S (2017) Persistent anterior interosseous nerve palsy following forearm crutch use. *BMJ Case Rep* 2017.
- Feldman DR, Vujic I, McKay D, Callcott F, Uflacker R (1995) Crutch-induced axillary artery injury. *Cariovasc Intervent Radiol* 18: 296-299.
- Konishi T, Ohki S, Saito T, Misawa Y (2009) Crutch-induced bilateral brachial artery aneurysms. *Interact Cardiovasc Thorac Surg* 9: 1038-1039.
- Takazawa I, Ohki S, Misawa Y (2018) Crutch-induced aneurysms of the bilateral upper arms. *Ann Cardiovasc Surg* 1: 1008.
- Van der Horst RL, Van den Hoven I, Daemen JA (2018) Emergent treatment of ruptured axillary artery aneurysm. *Ann Vasc Surg* 47: 281.e11-281.e14.
- Moon IS, Hwang JK, Kim JI (2010) Recurrent upper extremity embolism due to a crutch-induced arterial injury: a different cause of upper extremity embolism. *Ann Vasc Surg* 24: 554.e7-554.e12.
- Furukawa K, Hayase T, Yano M (2013) Recurrent upper limb ischemia due to a crutch-induced brachial artery aneurysm. *Interact Cardiovasc Thorac Surg* 17: 190-192.
- Morisaki K, Kuma S, Okazaki J (2014) Recurrent brachial artery embolism caused by a crutch-induced axillary artery aneurysm: report of a case. *Surg Today* 44: 1355-1358.
- Lee AW, Hopkins SF, Griffen WO Jr (1987) Axillary artery aneurysm as an occult Source of emboli to the upper extremity. *Am Surg* 53: 485-486.
- Vahedian-Ardakani J, Vahedian M, Nabavizadeh F (2011) Aneurysm of brachial Artery following axillary crutch. *Iran Red Crescent Med J* 13: 285-286.
- Borrelli J, Haslach HW Jr (2013) Experimental characterization of axillary/underarm interface pressure in swing-through crutch walking. *J Rehabil Res Dev* 50: 423-436.
- Schunn CD, Sullivan TM (2002) Brachial arteriomegaly and true aneurysmal degeneration: case report and literature review. *Vasc Med* 7: 25-27.
- Ettien JT (1980) Crutch-induced aneurysms of the axillary artery. *Am Surg* 46: 267-269.