

# Effort thrombosis in a young triathlete: an unusual presentation of painless neck swelling secondary to right brachiocephalic vein thrombosis

Allana A M B, Teo L L S, Chuah B Y S, Liu T C, Cheah W K

## ABSTRACT

Effort thrombosis of the upper extremity is secondary to thrombosis of the axillary and/or subclavian veins that develop from heavy arm exertion. This case illustrates venous thrombosis of the right brachiocephalic vein in a 32-year-old man who presented with a cyst-like swelling in the right neck with no associated pain or trauma. Our patient, a trained athlete, was preparing for a triathlon at the time of presentation. He was treated by first-line therapy of subcutaneous and oral anti-coagulation medication. In this study, we highlight the importance of early investigation and treatment of symptomatic athletes so that long-term disability can be prevented. This study also shows the timely use of computed tomography imaging, which can help to identify the syndrome in previously undiagnosed patients.

**Keywords:** anti-coagulation, effort thrombosis, heavy arm exertion, neck swelling

*Singapore Med J* 2011;52(3):e37-e39

## INTRODUCTION

Effort thrombosis is defined as spontaneous, primary thrombosis of the axillary and subclavian veins.<sup>(1)</sup> It is also known as Paget-Schroetter syndrome.<sup>(1)</sup> First described independently by Von-Schroetter in 1884 in Vienna and by Paget in 1875 in London, the term 'effort thrombosis' was added due to the frequent association with exertion superimposed on anatomical compressive elements in the thoracic outlet.<sup>(2,3)</sup>

We describe the findings of an athlete who did not present with the typical symptoms and imaging findings for effort thrombosis. His diagnosis was confirmed on computed tomography (CT) neck imaging after taking into account his clinical history and relevant examination. This article also reviews literature on early diagnosis and management in symptomatic athletes and highlights the advantage of having a high index of suspicion, which



**Fig. 1** Contrast-enhanced coronal CT image of the neck shows dilatation of the lower right internal jugular vein (asterisk) and a thrombus in the right brachiocephalic vein (arrow).

leads to better prognosis and decreased disability.

## CASE REPORT

A 32-year-old Chinese man complained of sudden painless swelling in the right neck for two weeks, which was associated with mild headache. The patient denied any history of trauma, surgery, accidental pricks or injection at that site. He was a non-smoker and did not consume alcohol.

On examination, the swelling was found to be soft, fluctuant, non-tender with smooth edges and not compressible. It was felt to lie underneath the right sternocleidomastoid muscle and measured approximately 5 cm in size. The patient was afebrile on general physical examination, and had normal blood pressure and pulse rate, with no palpable lymph nodes. There was no pain or limited range of movement of the right upper limb.

CT imaging of the neck using a multidetector 64-slice CT scanner was performed to rule out any

Dow University of Health Sciences, Baba-E-Urdu Road, PO Box #942943, Karachi 74200, Pakistan

Allana AMB  
Medical Student

Department of Diagnostic Imaging, National University Hospital, 5 Lower Kent Ridge Road, Singapore 119074

Teo LLS, MBChB, FRCP  
Consultant

Department of Medical Oncology

Chuah BYS, MBChB, MRCP  
Consultant

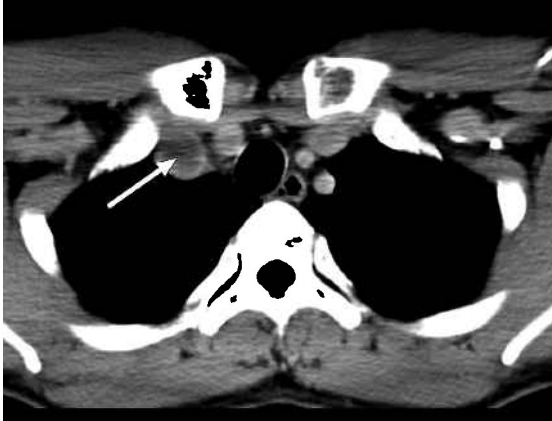
Department of Haematology

Liu TC, MBBS, MRCP  
Senior Consultant and Head

Department of General Surgery

Cheah WK, MBBS, FRCS  
Senior Consultant and Head

**Correspondence to:**  
Dr Lynette Teo  
Tel: (65) 6772 5207  
Fax: (65) 6779 7101  
Email: lynette\_ls\_teo@nuhs.edu.sg



**Fig. 2** Contrast-enhanced axial CT image of the neck shows the thrombus in the distended right brachiocephalic vein (arrow).

clinical suspicion of lymphangioma. This imaging was performed with and without intravenous contrast. The image showed fusiform dilatation of the lower right internal jugular vein (Fig. 1). This could be attributed to a filling defect within the patient's right brachiocephalic vein just before it joins the left brachiocephalic vein to form the superior vena cava, which was in keeping with a thrombus (Fig. 2). Given the patient's history of active participation in sports, weight training and additional training for triathlons, the above findings may be attributed to effort thrombosis of the upper extremity. On imaging, the upper superior vena cava and right subclavian veins appeared patent. No cystic lesions were found in the neck. There were also no enlarged cervical lymph nodes.

The patient commenced treatment immediately with 3 mg of oral warfarin a day. An initial course of subcutaneous enoxaparin 0.6 mg bd was also administered. When this study was being written, the patient was undergoing follow-up at the outpatient clinic for titration of his warfarin dose. He had declined follow-up CT imaging, as he was asymptomatic at that time and said that he would like to resume triathlon training.

## DISCUSSION

A triathlon is a multi-sport endurance event consisting of swimming, cycling and running in immediate succession.<sup>(4)</sup> The distance of each race may vary, but triathlons of all distances are considered to be endurance events where triathletes need to focus on aerobic training.<sup>(4,6)</sup> Resistance training is gaining acceptance among endurance athletes, as such training has been shown to improve performance through improvements in economy of motion.<sup>(5,6)</sup> Our patient was regularly involved in weights training, including training of his

upper limbs. This involves hyperabduction of the upper extremity with hypertrophy of the muscles of the upper limb (especially, the biceps brachii muscles).<sup>(1,3)</sup> This heavy exertion, along with hypertrophy of the muscles, may cause repeated trauma to the tunica intima of the blood vessels (in this case, the right brachiocephalic vein). This in turn leads to activation of the coagulation cascade, resulting in thrombosis.<sup>(7)</sup> Other than weights training, push-ups can also induce thrombosis in the upper limb veins.<sup>(8)</sup> There are also other possible risk factors for thromboembolism that are unique to athletes, one of them being substance abuse, e.g. the use of anabolic steroids, diuretics and erythropoietin, which could increase thromboembolic risks.<sup>(9)</sup> Other competitive athletes deliberately or inadvertently dehydrate themselves, resulting in increased blood viscosity, venous stasis and increased risk of thromboembolic events.<sup>(9,10)</sup>

Thrombosis can also occur if there is a mechanical obstruction to the vessels (e.g. cervical rib muscular bands), which can compress the vessels between the clavicle and the first rib.<sup>(11)</sup> The diagnosis of thrombosis is usually based on history and clinical examination. The symptoms of effort thrombosis of the upper limb typically consist of acute onset of diffuse upper limb swelling/oedema, aching pain over the affected region and loss of range of movement in the affected limb.<sup>(4,12)</sup> The swelling is usually temporarily resolved by lifting the arm above the head.<sup>(12)</sup> Our patient, however, did not exhibit any of these symptoms but presented with a localised and painless swelling on the right side of the neck. Initially, it was suspected to be a lymphangioma, as the thrombosis occurred in a more central location in the right brachiocephalic vein rather than the typical right subclavian and axillary veins. This right brachiocephalic vein thrombus caused upstream dilatation of the right internal jugular vein, with minimal effects on the right subclavian and axillary veins.

A range of investigations can be performed for this syndrome, including duplex ultrasonography, venography, magnetic resonance angiography (MRA) and conventional venography.<sup>(13)</sup> However, neither of these three options are always feasible; duplex ultrasonography is operator-dependent, while conventional venography is invasive and MRA may not be readily available. Although CT is currently not considered to be the main diagnostic modality for suspected upper limb thrombosis,<sup>(7,13)</sup> our case shows that multidetector CT with multiplanar reconstruction can play an important role in the diagnosis.

Anti-coagulation is the mainstay of treatment used in patients with effort thrombosis.<sup>(7)</sup> This is for therapeutic reasons as well as to prevent further vessel thrombosis.<sup>(7)</sup>

Thrombolysis is a more aggressive form of treatment that is reserved for candidates who are young and who have symptomatic superior vena cava syndrome.<sup>(7)</sup> Surgical intervention can also be performed successfully on those who present with an obvious anatomical anomaly, in which thoracic outlet decompression would suffice.<sup>(14)</sup> In our patient, oral anti-coagulation and close observation were sufficient as he had neither superior vena cava obstruction nor skeletal abnormality.

Effort thrombosis is known to occur in young trained athletes. The clinical presentation is typically characterised by acute diffuse upper limb swelling, pain over the affected region and loss of range of movement in the affected limb. Temporary resolution of swelling occurs following lifting of the arm above the head.<sup>(3,12)</sup> To the best of our knowledge, this is the first report of effort thrombosis of the upper limb occurring solely in the brachiocephalic vein rather than the usual locations of the subclavian or axillary vein. It resulted in a painless localised right-sided neck swelling without any right upper limb signs and symptoms. There is one other case report of a 42-year-old manual worker who presented with symptoms of superior vena cava obstruction secondary to bilateral thromboses of the subclavian and innominate (brachiocephalic) veins.<sup>(1)</sup> A delay in the diagnosis or recognition of this condition could lead to serious complications and permanent disability. These complications include post-thrombotic syndrome, which is related to residual thrombosis, superior vena cava syndrome, venous gangrene and brachial plexopathy.<sup>(15)</sup> Effort thrombosis should be suspected in athletes presenting with lower neck/upper arm masses with or without diffuse swelling and pain of the affected upper limb. Given the wide availability of multidetector

CT, this should be considered as the imaging modality of choice for diagnosis.

## REFERENCES

1. Youssef MYZ, Al Taweel T, Asfar S, Abdella N. Effort-induced venous thrombosis of the upper limbs. *Med Princ Pract* 2006; 15:299-302.
2. Aziz S, Strahley CJ, Whelan TJ Jr. Effort-related axillosubclavian vein thrombosis. A new theory of pathogenesis and a plea for direct surgical intervention. *Am J Surg* 1986; 152:57-61.
3. Vijaysadan V, Zimmerman AM, Pajaro RE. Paget-Schroetter syndrome in the young and active. *J Am Board Fam Pract* 2005; 18:314-9.
4. Suriano R, Bishop D. Physiological attributes of triathletes. *J Sci Med Sport* 2010; 13:340-7.
5. Korkia PK, Tunstall-Pedoe DS, Maffulli N. An epidemiological investigation of training and injury patterns in British triathletes. *Br J Sports Med* 1994; 28:191-6.
6. Laursen PB, Chiswell SE, Callaghan JA. Should endurance athletes supplement their training program with resistance training to improve performance? *J Strength Cond Res* 2005; 27:50-5.
7. Joffe HV, Goldhaber SZ. Upper-extremity deep vein thrombosis. *Circulation* 2002; 106:1874-80.
8. Toya N, Fujita T, Ohki T. Push-up exercise induced thrombosis of the subclavian vein in a young woman: report of a case. *Surg Today* 2007; 37:1093-5.
9. Koehle M, Lloyd-Smith DR, McKenzie DC. Exertional dyspnea in athletes. *Br Columbia Med J* 2003; 10:508-14.
10. Inoue K, Saito J, Miyazaki M, Ejiti S, Munakata M. A Kendo player with haemoptysis. *Lancet* 2004; 364:814.
11. Roos DB. Congenital anomalies associated with thoracic outlet syndrome. Anatomy, symptoms, diagnosis and treatment. *Ann J Surg* 1976; 132:771-8.
12. Medler RG, McQueen DA. Effort thrombosis in a young wrestler: a case report. *J Bone Joint Surg Am* 1993; 75:1071-3.
13. Baarslag HJ, Koopman MM, Reekers JA, van Beek EJ. Diagnosis and management of deep vein thrombosis of the upper extremity: a review. *Eur Radiol* 2004; 14:1263-74.
14. Urschel HC Jr, Razzuk MA. Paget-Schroetter syndrome: what is the best management? *Ann Thorac Surg* 2000; 69:1663-9.
15. Prandoni P, Bernardi E, Marchiori A, et al. The long term clinical course of acute deep vein thrombosis of the arm: prospective cohort study. *BMJ* 2004; 329:484-5.