

# Case Report: An Unusual Presentation of Bilateral Subclavian Stenosis in a Patient with Asymptomatic Hypotension

Authors' Contribution:  
Study Design A  
Data Collection B  
Statistical Analysis C  
Data Interpretation D  
Manuscript Preparation E  
Literature Search F  
Funds Collection G

ABCDEF G 1 **Ming Ren Toh**  
ABCD G 2 **Deanna Lee**  
ABCD 2 **Karthikeyan Damodharan**  
ABCD 2 **Mohammad Arif Abdullah**

1 Duke-NUS (National University of Singapore) Medical School, Singapore, Singapore  
2 Department of General Medicine, Sengkang General Hospital, Singapore, Singapore

**Corresponding Author:** Ming Ren Toh, e-mail: e0011132@u.duke.nus.edu  
**Conflict of interest:** None declared

**Patient:** Male, 63  
**Final Diagnosis:** Bilateral subclavian artery stenosis  
**Symptoms:** Hypotension  
**Medication:** —  
**Clinical Procedure:** —  
**Specialty:** General and Internal Medicine





**Objective:** Rare disease  
**Background:** Subclavian stenosis is an uncommon clinical condition associated with severe cardiovascular complications, usually presenting with claudication and subclavian steal syndrome. Here we describe the rare case of bilateral subclavian artery stenosis in an asymptomatic patient.

**Case Report:** Our patient was a 63-year-old chronic smoker with no prior medical history whose chief complaint was dyspnea from an exacerbation of his chronic obstructive pulmonary disease (COPD). He was hypotensive with blood pressure 74/56 mmHg at admission, which raised suspicion for sepsis, adrenal insufficiency but the workup (renal panel, full blood count and synacthen tests) were normal. He quickly recovered after we treated his COPD exacerbation, but his hypotension persisted despite repeated fluid challenges. To evaluate for structural causes of his hypotension, we performed a full cardiovascular examination with 4 limb blood pressure measurements and found upper limb hypotension and lower limb hypertension. Subsequent imaging with ultrasound and computed tomography confirmed the presence of bilateral subclavian artery stenosis. Our diagnosis was thus bilateral subclavian artery stenosis secondary to atherosclerosis from chronic smoking. The patient was subsequently referred to vascular surgery for consideration of surgical revascularization.

**Conclusions:** Bilateral subclavian stenosis is extremely rare and requires a high index of clinical suspicion. Early diagnosis is important in the primary prevention of associated cardiovascular diseases.

**MeSH Keywords:** Atherosclerosis • Hypotension • Subclavian Steal Syndrome

**Full-text PDF:** <https://www.amjcaserep.com/abstract/index/idArt/918583>

 1474   3  12



## Background

Subclavian stenosis is an uncommon condition associated with cardiovascular complications. Half of all patients with subclavian stenosis are found to have coronary artery disease while another one-third would develop carotid or vertebral disease [1]. The left subclavian artery is more commonly affected than the right subclavian artery which branches from the innominate artery. Here, we present a rare case of bilateral subclavian stenosis in an asymptomatic individual with persistent hypotension.

## Case Report

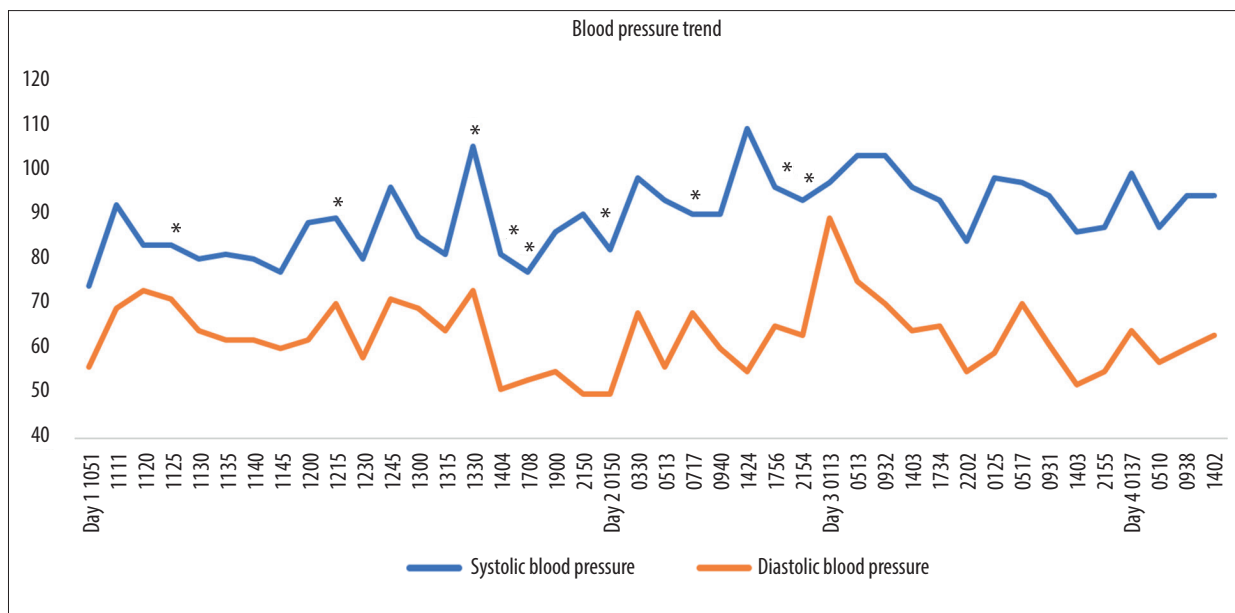
Patient A is a 63-year-old Malay male with a 50 pack-year smoking history and chronic obstructive pulmonary disease (COPD) who was admitted for an infective exacerbation of COPD. At the emergency department, he was breathless and hypotensive. His dyspnea improved with 2 cycles of nebulized salbutamol/ipratropium and a single dose of prednisolone 30 mg. However, he was persistently hypotensive despite fluid resuscitation (Figure 1).

His clinical presentation of hypotension and COPD exacerbation raised initial suspicions of sepsis. Preliminary investigations revealed mild hyperlactatemia (3.8 mmol/L). However, he was afebrile, non-toxic looking and his renal panel and inflammatory markers were unremarkable (total white cell count:  $5.99 \times 10^9$  cells/L, C-reactive protein: 2.2 mg/L). Hence, systemic hypoperfusion was unlikely. Nonetheless, we proceeded fluid

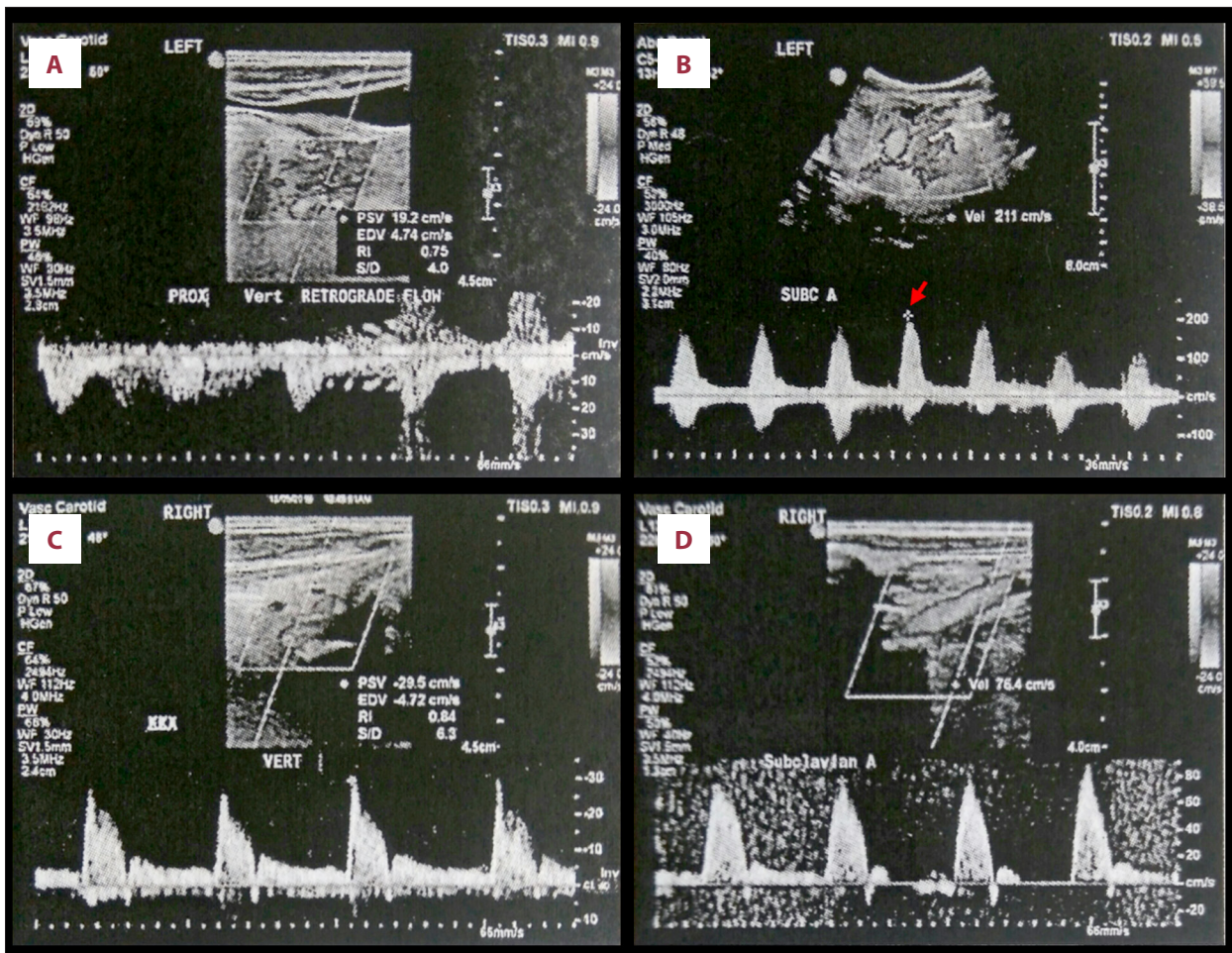
challenges (6 pints of Hartmann's over 24 hours) with limited response (Figure 1).

Besides sepsis, we considered the differential diagnosis of hypocortisolism. His 8 am serum cortisol level was low (85 nmol/L) and synacthen test results were equivocal: serum cortisol rose from 129 (basal) >420 (30 minutes) >484 nmol/L (60 minutes). His inadequate synacthen response (below 500 nmol/L) was not significant, considering his recent prednisolone use might have blunted the response [2]. Furthermore, he did not exhibit any signs of hypocortisolism such as postural giddiness and orthostatic hypotension. Hence, we ruled out the diagnosis of hypocortisolism. A repeat hypocortisolism screen at follow-up consult showed appropriate synacthen response: 190 (basal) >539 (30 minutes) >610 nmol/L (60 minutes).

To investigate for structural causes of his hypotension, we re-examined his cardiovascular system and noted differential pulses and blood pressures. Bilateral radial, brachial, and posterior tibial pulses were not palpable while the carotid, femoral, popliteal, and the dorsalis pedis pulses were well-felt. Lower limb blood pressures were higher than those of upper limbs (left leg: 151/79 mmHg; right leg: 152/75 mmHg; left arm: 106/69 mmHg; right arm: 118/82 mmHg). Ultrasound duplex scan of neck arteries showed signs of left subclavian artery steal syndrome (Figure 2A, 2B). Retrograde flow pattern and increased flow velocity of 211 cm/sec were observed in the left vertebral and subclavian arteries respectively. For the right-sided arteries, normal antegrade flow and triphasic waveform were noted in the vertebral and subclavian arteries respectively (Figure 2C, 2D).



**Figure 1.** Timeline of care showing the blood pressure trend with several episodes of hypotension despite multiple fluid challenges (represented as asterisk).



**Figure 2.** Ultrasound duplex scan of (A) left vertebral artery showing retrograde flow pattern and (B) left subclavian artery showing increased flow velocity of 211 cm/s (arrow) suggesting subclavian artery steal syndrome. (C) Right vertebral artery showed slightly reduced flow velocity and late-systolic deceleration which might be a sign of mild subclavian steal phenomenon and (D) right subclavian artery showed normal triphasic waveform.

Insignificant stenoses were demonstrated in bilateral common, internal and external carotid arteries.

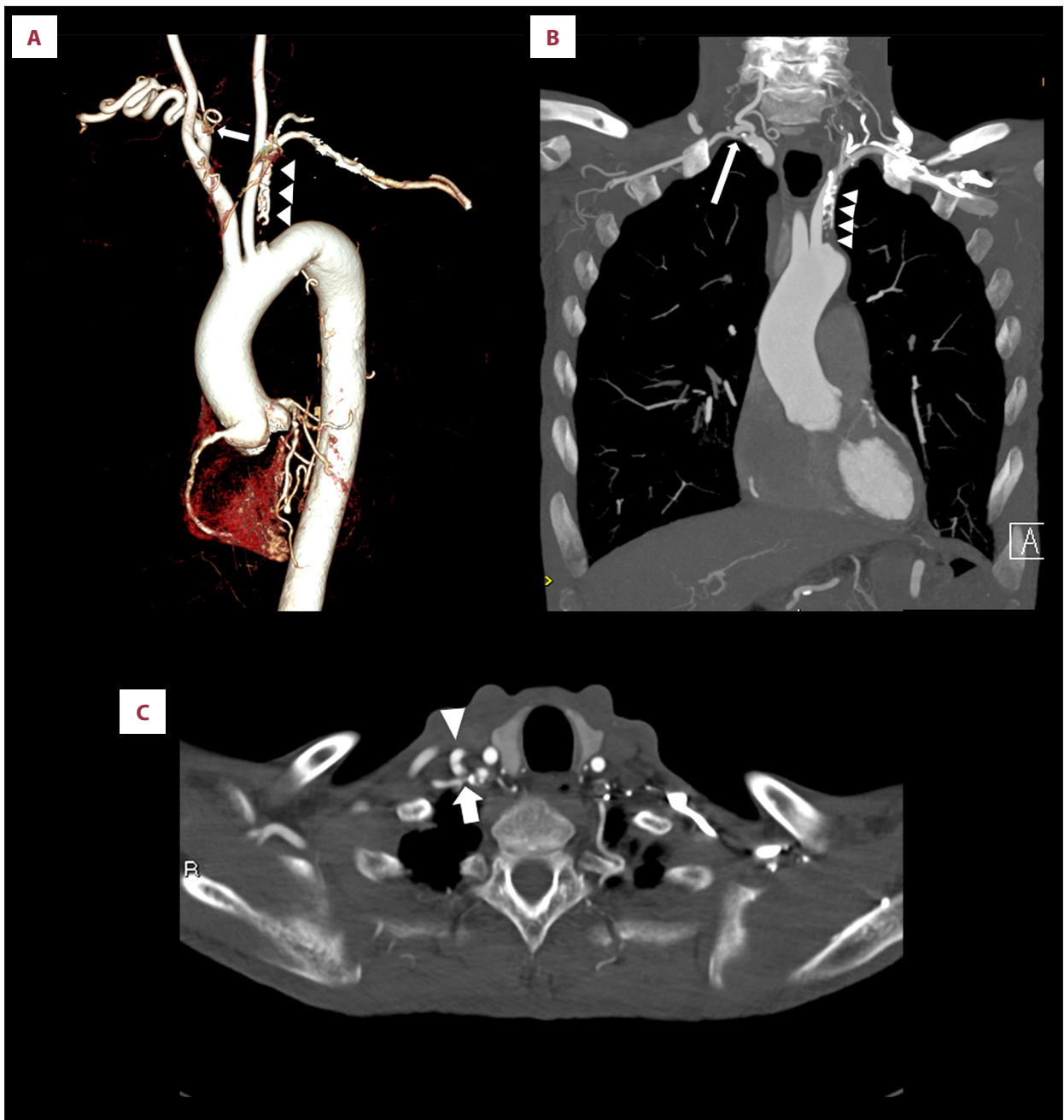
To delineate the stenosis, we performed a computed tomography aortography of his thoracic aorta which showed extensive atherosclerotic stenosis of his proximal left subclavian artery from the origin, and focal stenosis of the right subclavian artery (Figure 3A–3C). Prominent collaterals were noted around both subclavian arteries, suggestive of a chronic compensatory process. His superior mesenteric artery also demonstrated stenosis with the formation of multiple upper abdominal collaterals. In view of the widespread arterial stenosis, we evaluated for renal artery stenosis with ultrasound duplex of the renal arteries. No renal artery stenosis was detected.

Etiologies of subclavian stenosis included atherosclerosis, thoracic outlet syndrome, and vasculitis such as Takayasu arteritis. Given his smoking history and thrombo-calcific appearance of

the lesions, we attributed his arterial stenosis to atherosclerosis and referred him to vascular surgery. His workup for diabetes and hyperlipidemia, and both screens, were normal (hemoglobin (Hb)A1c 5.6%; total cholesterol 3.91mmol/L; triglycerides 0.97 mmol/L; low-density lipoprotein [LDL] 2.17 mmol/L). He was counselled on smoking cessation and initiated on both aspirin 100 mg OM (in the morning) and simvastatin 20 mg ON (in the evening) for primary prevention of cardiovascular complications. Revascularization was not offered due to the lack of ischemic symptoms.

## Discussion

We present this case to highlight the importance of measuring blood pressure in all 4 limbs in patients with persistent asymptomatic hypotension. In most settings, unilateral upper limb blood pressure is measured. Discrepancies in the limb blood



**Figure 3.** (A) Computed tomography (CT) reconstructed and (B) CT coronal images showing left subclavian thrombosis and atherosclerosis (arrowheads), right subclavian artery stenosis (arrow). (C) CT axial image showing right subclavian thrombosis (arrow) and collaterals from the costocervical trunk (arrowhead).

pressure are most commonly seen between the left and right arms. In a population-based study of 6814 participants with no known cardiovascular diseases, subclavian stenosis (interarm blood pressure difference of 15 mmHg or greater) was seen in less than 5% of the cohort [3]. All lesions were unilateral [3].

Bilateral stenosis is significantly less common. In a study on 23 500 patients with cardiovascular risk factors, 272 patients

had subclavian artery stenosis or occlusion. Only 2 patients had bilateral stenosis (<0.1% of the study cohort), with more advanced atherosclerosis seen in the left subclavian artery [4]. In unilateral stenosis, the left subclavian artery is more commonly involved than the right [5]. Likewise, patient A had more extensive stenosis of the left subclavian artery and flow reversal observed only in the left vertebral artery. The left subclavian artery originates at a more acute angle, which may

result in greater turbulence and accelerate the atherosclerotic process [6].

Subclavian stenosis can be diagnosed on indirect imaging such as duplex ultrasonography and computed tomography aortography. On duplex ultrasonography, subclavian stenosis manifests as increased systolic flow velocity and post-stenotic turbulence, as well as signs of subclavian steal syndrome. Subclavian steal syndrome is largely benign except in patients with high grade steal phenomenon (permanent retrograde flow through the entire cardiac cycle) [4,7]. These patients would experience symptoms of vertebrobasilar insufficiency such as vertigo and syncope. A 56-year-old male with bilateral subclavian stenosis was reported to experience sudden onset of giddiness and right arm tingling after self-administration of sublingual nitrate [8]. He developed refractory hypotension and was diagnosed with iatrogenic arterial hypotension. Inotropes were initiated followed by admission to intensive care unit. On repeat physical examination, bilateral lower limb hypertension and left carotid bruit were noted. Imaging of the subclavian arteries showed partial stenosis of the innominate artery and occlusion of the left subclavian artery. His innominate artery was revascularized and his giddiness resolved with residual right arm tingling. In another case of bilateral subclavian stenosis, a 71-year-old female with recurrent decompensations of her congestive heart failure (CHF) was admitted to the intensive care unit for inotrope support [9]. Initial differentials of the progressive CHF included infiltrative cardiomyopathies and myocarditis which were excluded on endomyocardial biopsy. The diagnosis became apparent when the blood pressure was measured via the femoral arterial line. Her femoral blood pressure (left leg: 170/80 mmHg) was raised in comparison to the brachial blood pressure (left arm: 83/74 mmHg; right arm: 60/39 mmHg). She was treated with anti-hypertensives in view of high femoral arterial blood pressure and unstable CHF. No further readmissions for decompensated CHF were noted thereafter. In contrast, patient A remained asymptomatic despite high grade subclavian steal. His retrograde flow in the vertebral arteries might have been compensated by the abundance of collaterals and the preserved integrity of his carotid arteries. Therefore, he did not require invasive intervention and was managed with primary prevention strategies.

Risk factors for subclavian stenosis included diabetes, hypertension, hyperlipidemia and smoking [3]. Patients with significant

subclavian stenosis (greater than 50%) are predisposed to cardiovascular events such as myocardial infarction, and vertebrobasilar insufficiency-related conditions such as stroke [3,10,11]. Patients may not present with symptoms of claudication nor risk factors, as seen in our patient whose only risk factor was chronic smoking. A high degree of clinical suspicion is necessary to diagnose and workup for this condition.

A strength in our approach to the persistent hypotension was the revisiting of clinical history and physical examination. Our case report highlights the importance of a comprehensive cardiovascular physical examination which may be overlooked in the practice of modern medicine where laboratory and imaging services are readily available. His diagnosis would have been missed had we not repeated the blood pressure measurement on all 4 limbs. In retrospect, a potential setback in our pursuance of the hypotension was the issue of over-investigation. The patient did not complain of any giddiness or claudication and had hitherto been functioning normally in his activities of daily living. The costly laboratory and imaging investigations would add substantial financial burden to the patient who was sustaining on daily allowances from his ageing mother. Nonetheless, early diagnosis and treatment of his atherosclerotic disease might be beneficial in reducing his risks for future cardiovascular events.

## Conclusions

Early diagnosis is crucial for the primary prevention of potential cardiovascular events. Useful clues as illustrated in this case study include the persistent of hypotension in an otherwise asymptomatic individual with cardiovascular risk factors. Four limb blood pressure measurement should be routinely performed in these patients [12].

## Acknowledgements

We would like to thank the patient for consenting to the publication of this case report and the Department of Internal Medicine, Seng Kang Hospital for its support in the publication.

## Conflict of interests

None.

## References:

1. Caesar-Peterson S, Qaja E: Subclavian artery stenosis, in StatPearls [Internet]. 2018, StatPearls Publishing
2. Kane KF, Emery P, Sheppard MC, Stewart PM: Assessing the hypothalamo-pituitary-adrenal axis in patients on long-term glucocorticoid therapy: The short synacthen versus the insulin tolerance test. *QJM*, 1995; 88(4): 263–67
3. Aboyans V, Kamineni A, Allison MA et al: The epidemiology of subclavian stenosis and its association with markers of subclinical atherosclerosis: The Multi-Ethnic Study of Atherosclerosis (MESA). *Atherosclerosis*, 2010; 211(1): 266–70
4. Ackermann H, Diener H, Dichgans J: Stenosis and occlusion of the subclavian artery: ultrasonographic and clinical findings. *J Neurol*, 1987; 234(6): 396–400
5. Bosiers M, KoenDeloose K, Verbist J, Peeters P: Subclavian and vertebral arteries: Angioplasty and stents, in *endovascular surgery (Fourth Edition)*, Moore WS, Ahn SS (eds.), W.B. Saunders: Philadelphia PA, 2011; Chapter 36: 387–92
6. Bornstein N, Norris J: Subclavian steal: A harmless haemodynamic phenomenon? *Lancet*, 1986; 328(8502): 303–5
7. Thomassen L, Aarli JA: Subclavian steal phenomenon clinical and hemodynamic aspects. *Acta Neurol Scand*, 1994; 90(4): 241–44
8. Rughani AI, Visioni A, Hamill RW, Tranmer BI: Subclavian artery stenosis causing transient bilateral brachial diplegia: An unusual cause of anterior spinal artery syndrome. *J Neurosurg Spine*, 2008; 9(2): 191–95
9. Jahangiri B, Al-Shammeri O, Veinot JP et al: An unusual case of hypertensive diastolic heart failure with bilateral subclavian artery stenosis. *Can J Cardiol*, 2009; 25(2): 111–12
10. Weinberg I, Gona P, O'Donnell CJ et al: The systolic blood pressure difference between arms and cardiovascular disease in the Framingham heart study. *Am J Med*, 2014; 127(3): 209–15
11. Alcocer F, David M, Goodman R et al: A forgotten vascular disease with important clinical implications. Subclavian steal syndrome. *Am J Case Rep*, 2013; 14: 58–62
12. Pickering TG, Hall JE, Appel LJ et al: Recommendations for blood pressure measurement in humans and experimental animals. *Circulation*, 2005; 111(5): 697–716