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CASE REPORT

Successful Management of Incidentally-Detected Subclavian Stenosis During Anesthetic Preparation for Spinal Surgery: A Case Report

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Background: Subclavian artery stenosis is mainly caused by atherosclerotic changes, which may result in ischemic events in the upper limbs and the central nervous system. Other etiological causes include radiation exposure, vasculitis, neurofibromatosis, external compression syndrome, and fibromuscular dysplasia. The conventional anesthetic challenge for these patients is to maintain cerebral perfusion.

Case Presentation: We present a case of incidentally discovered left subclavian stenosis in a 65-year-old male who was admitted for spinal surgery. The patient had a history of peripheral arterial disease, diabetes mellitus, and heavy smoking. During the preoperative assessment, the blood pressure readings in the department were within the normal range. In the operating theater, blood pressure readings of the two arms revealed readings of 136/85 mmHg and 235/114 mmHg in the right and left arms, respectively. Accordingly, the operation was postponed for further evaluation of the increased interarm systolic blood pressure difference. Computed tomography angiography revealed focal stenosis at the origin of the left subclavian artery, causing approximately 90% narrowing. The patient underwent a successful subclavian artery angioplasty.

Conclusion: It is important to report BP readings of blood pressure in both arms of patients with a history of peripheral arterial disease, heavy smoking, or severe metabolic syndrome. Patients with subclavian stenosis are prone to increased inter-arm systolic blood pressure difference. Accordingly, the bilateral measurement of BP is a simple test with valuable impact on the preanesthetic assessment in an emergency setting.

Keywords: general anesthesia, catheterization, peripheral vascular diseases, smoking

Introduction

An increased inter-arm systolic blood pressure difference (IASBPD) is usually considered ≥ 10 mmHg, and the reported prevalence of the population ranges between 3.6% and 9.4%.[1–3] IASBPD > 10 mmHg is usually associated with subclavian artery stenosis, cerebrovascular disease, stroke, cardiovascular morbidity and mortality, atherosclerosis, and left ventricular hypertrophy.[1–3]

Subclavian artery stenosis is associated with significant morbidity and mortality. Subclavian artery stenosis may result in upper-limb ischemia associated with cranial and cardiac insults.[4] Many etiological factors are associated with the development of subclavian artery stenosis, the most important and common of which are atherosclerotic changes. Arteritis, inflammation due to radiation exposure, and external compression have been reported. Fibromuscular dysplasia and neurofibromatosis are associated with subclavian artery stenoses. Many reports have estimated the incidence of subclavian stenosis in the general population to be between 3–18%.[4,5] The conventional anesthetic challenge for these patients could be maintaining organ perfusion (especially cerebral perfusion) and thus avoiding ischemic damage when the actual blood pressure is unknown.[6] According to the latest guidelines for hypertension management, blood pressure should be checked in both arms.[7,8] Despite these recommendations, bilateral measurement of blood pressure is often not

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performed and easily missed.[9,10] In this respect, an investigation showed that 30% of hypertensive patients were falsely known as normotensive when blood pressure was measured in one arm.[11] These clinical recommendations should be reflected in a focused manner during the perioperative period where the fluctuation and complications IASBPD is more profound.

In this article, we present a case of incidentally discovered left subclavian artery stenosis in a patient admitted for spinal surgery through the bilateral measurement of blood pressure with subsequent reveal of IASBPD.

Case Presentation

A 65-year-old male patient, known to have long-standing type 2 diabetes mellitus (DM), hyperlipidemia, and peripheral vascular disease, was admitted for case of L4-L5 spinal canal stenosis prior to spinal surgery. The patient complained of low back pain that was aggravated by activity, and magnetic resonance imaging (MRI) confirmed the presence of spinal canal stenosis.

Upon evaluation, the patient reported a history of right lower-limb angioplasty as a result of chronic lower-limb ischemia. Additionally, the patient was a heavy smoker with poor DM control. Moreover, the patient denied any history of shortness of breath, chest pain, or peripheral edema, and the vital signs, including blood pressure (BP) in the right arm, were within normal ranges. Electrocardiography revealed normal sinus rhythm with signs of left ventricular hypertrophy. Echocardiography revealed an ejection fraction of 55%, with concentric left ventricular hypertrophy and good left ventricular systolic function. Complete laboratory investigations were conducted, including complete blood count, kidney function tests, lipid profile, and HbA1c, and all investigations were within normal ranges, except for an HbA1c level of 8.9%. At that time, the patient was only on oral hypoglycemic agents. Accordingly, the cardiology team labeled the patient at a low risk of general anesthesia. Furthermore, the patient was started on sliding-scale insulin therapy.

The following day, at the time of spinal surgery in the operating theater, airway assessment was conducted and revealed a Mallampatti Grade II, adequate mouth opening, normal temporomandibular joint, and a full range of neck movement. Normal vesicular breath sounds were heard bilaterally on chest examination, and those of the other systems were normal. Vital signs showed a regular pulse rate of 75 beats/min, O2 saturation of 95%, and a normal temperature. However, BP was measured in both arms and was 136/85 mmHg and 235/114 mmHg in the right and left arms, respectively. Accordingly, surgery was postponed to further evaluate the increase in IASBPD.

Accordingly, computed tomography (CT) angiography of the aorta and its branches revealed focal stenosis at the origin of the left subclavian artery, causing approximately 90% narrowing. Furthermore, minimal atherosclerotic changes were detected in the abdominal aorta, without significant stenosis (Figures 1 and 2). After a multidisciplinary meeting, the decision was made to perform percutaneous transluminal angioplasty of the left subclavian artery. A femoral approach was used with a short introductory sheath and a guiding catheter. After the angiography of the aortic arch, selective catheterization of the subclavian artery was performed that, 7 Fr multipurpose guiding catheter was placed at the ostium of the target lesion and crossed using a steerable guidewire. Pre-dilatation was performed using a 4 or 5-mm in diameter balloon. After percutaneous transluminal angioplasty was performed, an angiogram was obtained and a balloon-expandable stent was deployed successfully (Video S1 and Figure 3). No intraoperative of immediate postoperative complications were detected. The patient was discharged on aspirin 100 mg once a day, atorvastatin 20 mg once a day, clopidogrel 75 mg once a day, amlodipine 5 mg once a day, and regular oral hypoglycemic agents. One week later, the BP readings were 135/86 mmHg and 141/89 mmHg in the right and left arms, respectively. Regarding his lower back pain, he preferred to be treated with local injections and physiotherapy. The patient was followed 6 months later with an uneventful outcome.

Discussion

To the best of our knowledge, this is a rare case of incidentally detected left subclavian artery stenosis in a patient scheduled for spinal surgery. The BP reading recorded in the ward revealed normal reading of the right arm. However, during preoperative preparation, high BP readings of the left arm were recorded, and the patient subsequently underwent CT angiography, which revealed the presence of severe subclavian stenosis. Kim et al reported a case of bilateral subclavian stenosis discovered during pancreatectomy surgery.[12] Similarly, Mandal et al documented the presence of bilateral subclavian stenosis before hernia repair surgery.[6] Adams et al reported a case of left subclavian artery stenosis

Figure 1 Coronal view of CT angiography indicating left subclavian stenosis at the origin (by arrow).

that occurred during surgery for femoral neck fracture surgery.[13] Asymmetrical atheromatous narrowing of the subclavian or brachial arteries is expected to become more common with increasing age, leading to lower pressures in the arteries distal to the narrowing and significant inter-arm BP differences.[12]

Arising from the arch of the aorta, two subclavian arteries supply both the upper limbs and parts of the cranium and thorax. The right subclavian artery arises indirectly from the arch of the aorta through a relatively short brachiocephalic artery, which bifurcates into the subclavian and right common carotid arteries and the left subclavian artery, and directly from the arch of the aorta. Both subclavian arteries are divided into five branches: internal thoracic artery, vertebral artery, cost cervical trunk, thyrocervical trunk, and dorsal scapular artery. The subclavian artery terminates at the axillary artery, at the lateral border of the first rib.[5]

Subclavian artery stenosis can be identified by an IASBPD of 15 mm Hg and is present in 1.9% of the entire population and in 7% of the clinical population.[14] A difference of 15 mmHg detected by noninvasive BP measurement

Figure 2 3D construction of the CT angiography indicating left subclavian stenosis at the origin (by arrow).

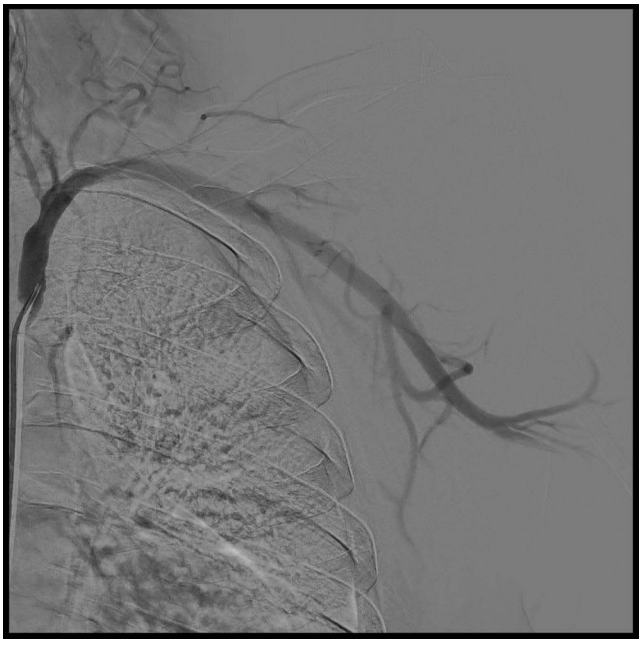

Figure 3 Fluoroscopic X-ray image during the percutaneous angioplasty indicating re-canalization of the previously stenosed segment.

identifies all patients with subclavian artery narrowing of greater than 50%.[15] Our patient had an IASBPD of 30–35 mmHg, suggesting subclavian artery stenosis of greater than 50%, and blood pressure readings obtained from this arm would not represent true systemic blood pressure.

On physical examination, the pathognomonic sign of subclavian artery stenosis is a discrepancy in blood pressure readings between the two arms. A blood pressure discrepancy of 10–15 mmHg indicates the need for further evaluation, whereas a blood pressure discrepancy of 15 mmHg is a strong indicator of subclavian artery stenosis and mortality, with a sensitivity of 15% and specificity of 96% for diagnosing significant lesions.[16] A greater blood pressure discrepancy of 40–50 mm Hg between both arms was associated with more severe symptoms and was correlated with the need for intervention.[16] NICE clinical guideline for hypertension states that a difference in systolic blood pressure less than 10 mm Hg can be regarded as normal, while a difference greater than 10 mm Hg is found in 40.3% patients after stroke, 11.2% patients suffering from hypertension and 7.4% with diabetes.[17,18] In patients with high cardiovascular risk, inter-arm blood pressure difference > 10 mm Hg can occur in more than 38% of the population.[19] A recently published meta-analysis 1 concluded that the observation of a ≥ 15 mmHg systolic inter-arm difference is a specific, but not sensitive, indicator of peripheral vascular disease, as confirmed by a reduced ankle-brachial pressure index and specifically stenotic subclavian disease demonstrated on angiography.[1] Regarding the role of regional anesthesia in these cases, Mehmedovic et al conducted a study and found that regional anesthesia for carotid subclavian bypass surgery proved to be a feasible and effective anesthetic procedure compared with general anesthesia.

The major limitation point is nature of the single-case, since this is an individual case report, its findings cannot be generalized to all patients with subclavian artery stenosis.

Conclusions

This study highlights the value of the clinical correlation between findings in history, physical examination, and differences in blood pressure readings. Preanesthetic evaluation is the cornerstone to be gained with greater appreciation in the emergency setting, including not only a targeted physical examination, but also a comprehensive examination of all available patient histories. It is also important to document readings of both arms in patients with a history of peripheral arterial disease, heavy smoking, or severe metabolic syndrome not only at the perioperative settings, but also during the outpatient practice. Patients with subclavian stenosis are prone to increased inter-arm systolic blood pressure difference.

Abbreviations

IASBPD, interarm systolic blood pressure difference; DM, diabetes mellitus; MRI, magnetic resonance imaging; CT, computed tomography; BP, blood pressure.

Availability Data and Materials

Data supporting the findings of this study are available from the corresponding author upon reasonable request.

Ethics Approval

Institutional review board is not required for this type of article.

Consent for Publication

Written informed consent was obtained from the patient for the publication of this case report and any accompanying images. A copy of the written consent form is available for review by the editor of the journal. We confirmed that the privacy of the participants was preserved and that the data was anonymized and kept confidential.

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Disclosure

The authors declare that they have no competing interests in this work.

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