症 例

# Axillo-axillary artery bypass for the treatment of subclavian artery occlusion caused by blunt injury

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**Abstract**

Blunt trauma to a subclavian artery can result in intimal tears and secondary thrombosis of the arterial lumen. We report a case of subclavian artery occlusion due to this mechanism. Arterial flow to the upper extremity was restored by axillo-axillary bypass grafting. This less invasive procedure may also decrease the morbidity and mortality as compared with that using thoracotomy or sternotomy.

**Key words;** blunt trauma, axillo-axillary bypass, subclavian artery, intimal tear

## Introduction

Blunt injuries to subclavian vessels are uncommon. The limited experience of surgeons with this type of trauma and the various clinical features make it a surgical challenge. We report a patient with acute subclavian artery occlusion due to a blunt injury, who was successfully treated by an axillo-axillary bypass grafting.

## Case Report

A 61-year-old woman involved in a car accident with her right clavicle compressed by the seatbelt was admitted to the emergency department. Physical examination showed contusion over the right shoulder without deformity and non-palpable right brachial pulse. The right upper extremity was noted to be pale. Initial computerized tomography (CT) scan demonstrated no hematoma or deformity around the right side of the neck or shoulder. An urgent aortography showed an occlusion in the mid-portion of the right subclavian artery with a parietal thrombus attached close to the origin of the vertebral artery (**Fig. 1A**). On the late phase of the aortography, axillary artery is visualized by collateral pathways (**Fig. 1B**). Thrombolytic therapy was considered as a contraindication, because of the risk of dislodging the thrombus to embolize up the vertebral artery. The ischemic symptoms of the right upper extremity deteriorated on the second admission day, and an axillo-axillary bypass grafting was indicated.

The patient was placed in a supine position, and both axillary arteries were exposed through an 8cm infraclavicular incision. First, a 6mm PTFE ringed graft was anastomosed end-to-side to the left axillary artery. A subcutaneous tunnel was created for passing the prosthetic graft through left to right side. The right axillary artery was encircled by an umbilical tape and gentle traction on the tape was done for avoiding dislodging the thrombi during the dissection. A linear thrombus was pulled out from the proximal side of the longitudinal incision of right subclavian artery. The fore flow from the proximal side was weak

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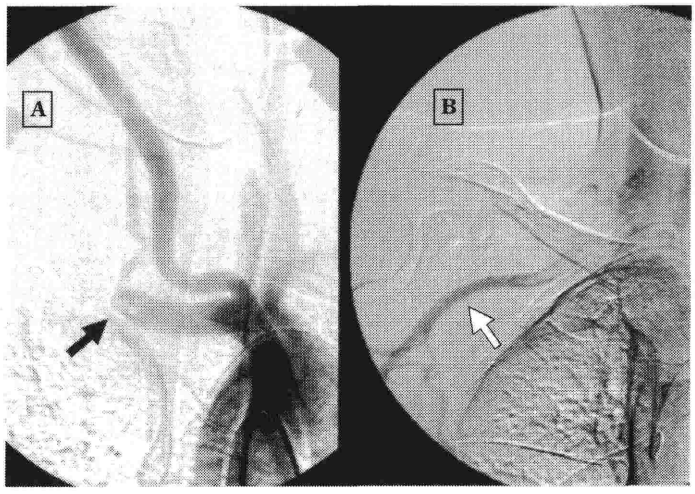


**Figure 1** (A) Arch aortography shows an occlusion in the second portion of the right subclavian artery with a parietal thrombus attached close to the origin of the vertebral artery (black arrow); (B) Delayed view shows the axillary artery is visualized in distal portion by collateral pathways (white arrow).

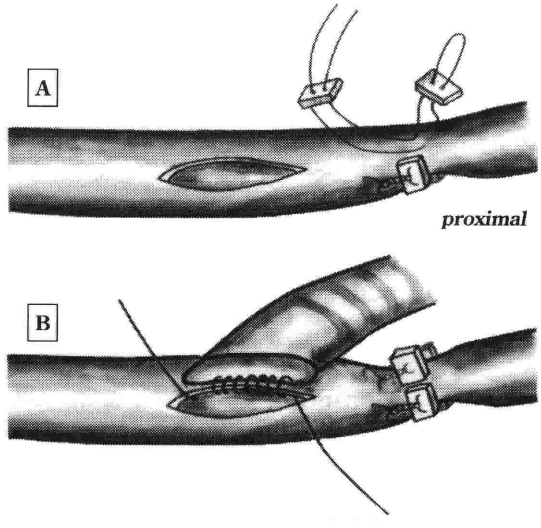


**Figure 2** (A) Oversewing the proximal side of right subclavian artery; (B) Anastomosing a 6mm PTFE graft to the right subclavian artery.

that revealed the occlusion of the subclavian artery. To prevent from washing out the residual thrombi to the vertebral artery by the flow from graft retrogradely, the proximal side of the arterial incision was oversewn (**Fig. 2A**). After irrigating the vessel, the graft was anastomosed end-to-side to the axillary artery to complete the revascularization of the right upper extremity (**Fig. 2B**). After the procedure, right brachial artery was immediately palpable. A selective left subclavian arteriography was performed postoperatively, demonstrated a good patency of the axillo-axillary bypass and an intact vertebral artery without any thrombus formation (**Fig 3A, B**).

## Discussion

Blunt injury to a subclavian artery is uncommon and accounts for only 2% to 3% of all reported subclavian artery injuries[1]. Two theoretical mechanisms for blunt subclavian artery injury have been proposed[2]. Either of these two mechanisms can cause

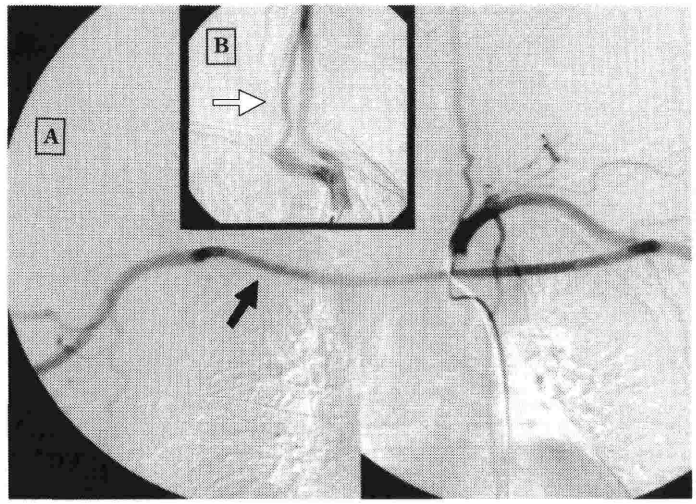


**Figure 3 Postoperative angiography shows (A) a patent graft (black arrow) from left to right subclavian artery; (B) the permanent occluded subclavian artery in second portion and an intact vertebral artery (white arrow).**

intimal tears with subendothelial exposure. This may produce localized thrombosis, which may narrow the arterial lumen and cause secondary arterial occlusion within hours of injury[3]. Physical findings associated with the occlusive subclavian arterial injury may be subtle. Severe ischemia of the extremity may be initially prevented by the collateral network around the shoulder. Subsequently, progressive ischemia resulted from multilevel arterial occlusion secondary to embolization of thrombus to the collateral pathway[4]. Arteriography is recommended for detecting the precise location of injury in carotid, innominate, or subclabian artery to allow planning of appropriate surgical approach. The subclavian artery continuity is preferably restored with segmental resection and primary end-to-end anastomosis, if not feasible, an interposition or a prosthetic bypass graft can be used safely because contamination is usually minimal in blunt trauma[5]. Recently, use of intravascular stents, and endovascular stented grafts has been reported for blunt subclavian artery injuries as a less invasive procedure[6]. The surgical approach to the subclavian artery varies depending on the location of the injury. In this case, the aortography showed an occlusive right subclavian artery with a parietal thrombus attached adjacent to the origin of the vertebral artery. There were no findings of hematoma or pseudoaneurysm formation on CT. Therefore, the treatment needed to complete the revascularization of the artery urgently as well as preventing the cerebral infarction. A supraclavicular approach could be an option, however the manipulation of proximal side of the subclavian artery could be increase risk of dislodging the parietal thrombus at the origin of the vertebral artery. The less invasive approach by intravascular therapy was considered as a contraindication by the same point of view. An axillo-axillary bypass was selected because the manipulation of the artery could be only at the distal site of the vessel. And further care was taken by oversewing the subclavian artery at the proximal side of graft anastmosed in order to avoid the blood flow washing out the residual thrombi adjacent to the vertebral artery. In 1971, Myers et al. described the first axillo-axillary artery bypass for subclavian artery revascularization as an effective alternative to other extrathoracic bypass procedures[7]. Perkins et al. reported a single-center experience of axillo-axillary bypass grafting for upper limb ischemia and subclavian steel syndrome with good symptom-free results in long-term follow-up[8]. Long-term durability of axillo-axillary grafts has been demonstrated and theoretical concerns

about the subcutaneous site of the grafts and potential problems with skin erosion have not been encountered in their series.

The axillo-axillary bypass grafting is utilized as an extra-anatomical bypass for symptomatic subclavian artery stenoses or occlusions in the vast majority of cases. A literature review identified no previous report of traumatic subclavian artery occlusion repaired by this procedure. Long-term follow-up will be needed to validate this alternative to the treatment of occlusive subclavian artery injuries in such selected cases.

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