

Subclavian artery reconstruction with femoral vein for ballistic injury in a 3-year-old boy

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ABSTRACT

Few descriptions of using the femoral vein as an arterial replacement exist in the pediatric surgical literature. A 3-year-old child sustained a gunshot wound to the right subclavian artery, which resulted in ischemia to the upper extremity. The left femoral vein was harvested and used to reconstruct the subclavian artery. This report highlights a rare case of subclavian artery reconstruction using a femoral vein conduit in a young child after a penetrating injury. (*J Vasc Surg Cases Innov Tech* 2023;9:101349.)

Keywords: Pediatric vascular trauma; Penetrating vascular injuries; Subclavian artery injury

Pediatric vascular trauma is exceedingly uncommon, accounting for approximately <1% of pediatric traumatic injuries. Vascular injuries in the pediatric population are less well studied than in the adult trauma literature, the management strategies are ill-defined, and the long-term outcomes are widely unknown.¹ Historically, the femoral vein has been used in adults for a variety of clinical situations requiring vascular reconstruction but rarely in trauma and even more infrequently in pediatric vascular trauma. Our patient was treated at a tertiary care level one facility. This case demonstrates the utility and usefulness of the femoral vein in the subclavian artery position as a conduit for challenging vascular reconstructions after pediatric traumatic injuries.

CASE REPORT

A 3-year-old boy presented to the emergency department via ambulance in stable condition after sustaining a gunshot wound to the upper, right anterior chest through a car window during a family altercation. The patient was a back seat passenger in a stationary automobile. On physical examination, the patient was awake, alert, and moving all extremities. His vital signs were stable (heart rate, 114 beats/min; blood pressure, 102/84 mm Hg from the left arm; respiratory rate, 17 breaths/min; temperature, 36.8°C). The arterial brachial pressure was diminished in the right arm (60/42 mm Hg). An entrance wound at the right mid-infraclavicular line with a stellate exit wound through the upper back at the scapular level

was noted. The right upper extremity was cool and pulseless but low amplitude, monophasic Doppler signals were audible at the right wrist. Neurosensory and motor function was grossly intact with minimal bleeding contained to the site of injury. A chest radiograph revealed a pulmonary contusion with hemopneumothorax (*Fig 1*). Computed tomography angiography demonstrated injury to the right subclavian artery, terminating at the second portion (*Fig 2*).

The right subclavian and axillary arteries were exposed through supraclavicular and infraclavicular incisions. A short, 2-cm section of the second portion of the subclavian artery was found to be obliterated and thrombosed at each end. The subclavian vein and brachial plexus were not injured. The damaged ends of the artery were excised, and this segment of the subclavian artery was replaced with a 5-cm segment of reversed femoral vein in an end-to-end fashion and tunneled under the left clavicle (*Fig 3*). The diameter of the vein was oversized by 10% to 20% of that of the subclavian artery. The femoral vein was harvested from the adductor canal of the left thigh to the femoral vein bifurcation, and the deep femoral vein was preserved. Fasciotomies on the left leg were not required.

Circulation was successfully restored to the right upper extremity. Before dismissal, the blood pressures were equal in both arms, and computed tomography angiography demonstrated a patent interposition graft without defects. The patient was discharged 4 days postoperatively after drain and chest tube removal. Compression therapy was used on the left lower extremity, but anticoagulation was not prescribed. At early follow-up, the child had +2 palpable pulses at both wrists with no lower extremity swelling or limb dysfunction. At the 3-year follow-up, an upper extremity arterial duplex ultrasound examination and noninvasive arterial vascular studies with segmental pressures revealed triphasic arterial waveforms in both upper extremities with normal wrist brachial indexes. No limb length discrepancies were noted (*Fig 4*). The patient's family provided written informed consent for the report of the patient's case details and imaging studies.

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Fig 1. Radiograph demonstrating pulmonary contusion with hemopneumothorax.



Fig 2. Computed tomography angiogram demonstrating the injury within the vessel terminating at the second portion of the right subclavian artery.

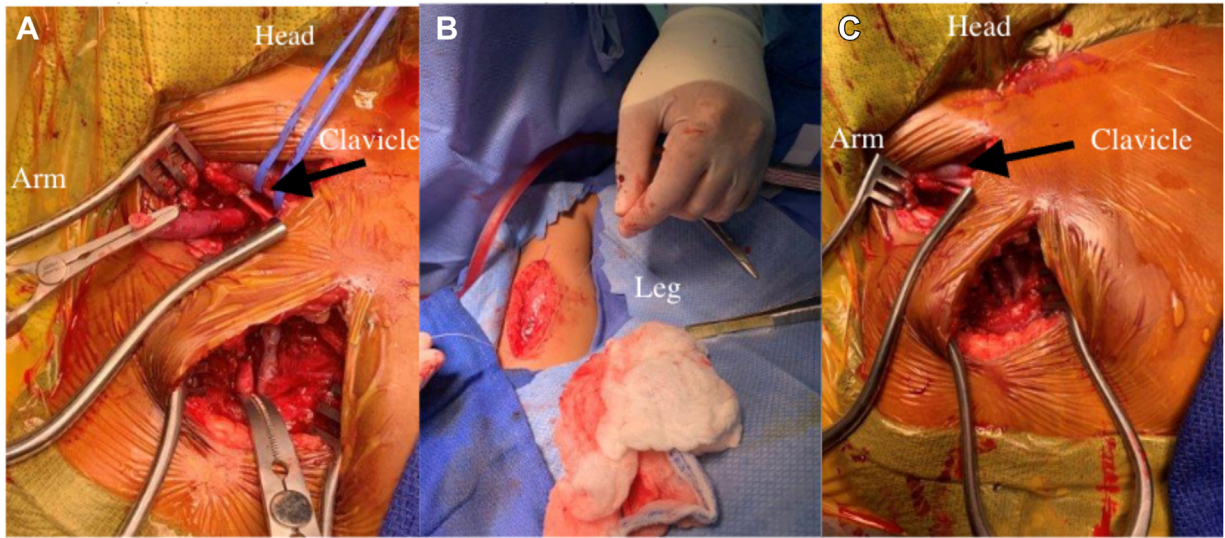


Fig 3. **A**, Explorative surgery through a standard over and under approach to the right subclavian and axillary arteries. **B**, Harvesting the femoral vein from the common femoral vein to above the adductor. **C**, Subclavian artery repaired in an interposition fashion.

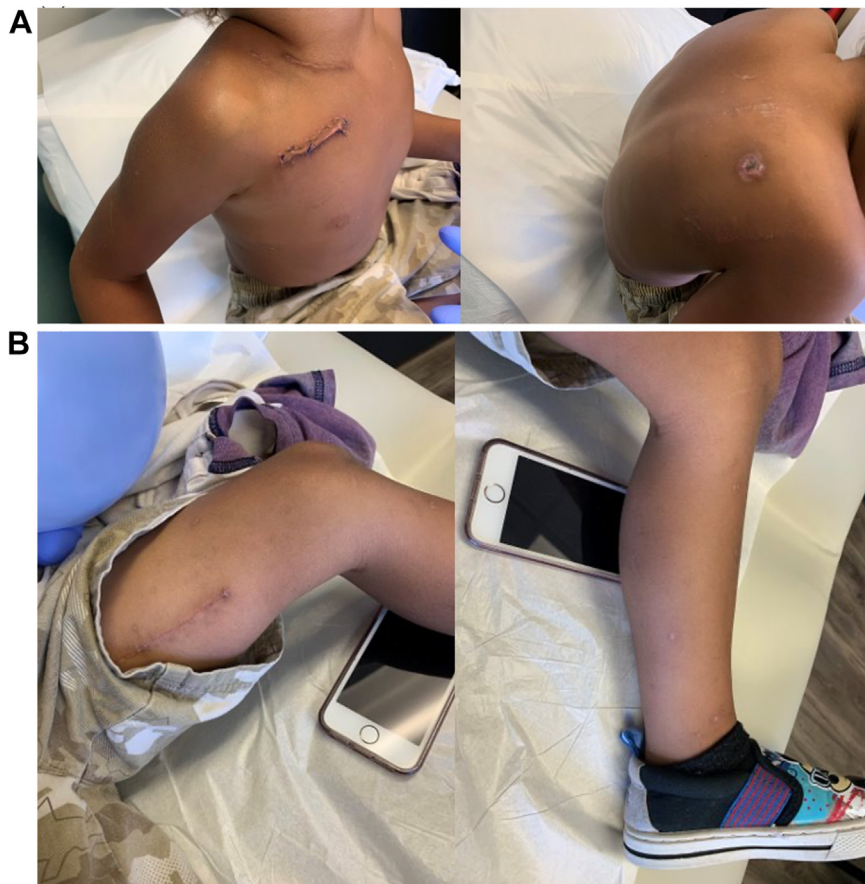


Fig 4. **A**, At 4 weeks of follow-up, the child has normal vascular examination findings with no lower extremity swelling and is functioning normally. **B**, Femoral vein harvest site with minimal swelling present.

DISCUSSION

The femoral vein as a conduit has historically served an important role for central or major venous reconstruction, with the advantages of improved blood flow and long-term patency. The use of femoral vein grafts in arterial replacement in adults is also well established for various clinical situations such as aortic–iliac graft infections, infrainguinal vessel reconstruction, mesenteric artery bypass in a hostile abdomen, and in complicated vascular access cases.^{2,3}

The femoral vein has been established as a safe and effective conduit in cases in which previous vascular repairs have failed due to infection or suboptimal autogenous conduit size.⁴ The advantages of femoral vein grafts are the superior patency rates, size compatibility for larger vessels, and the characteristic to withstand infected fields.^{5,6}

Reports of the use of femoral vein in infants and children has been limited to congenital heart surgery.⁷ We were unable to find prior reports of the use of the femoral vein as an arterial replacement for the subclavian artery in small children. Bouziane et al⁸ reported the use of the femoral vein in an adolescent to replace the aortoiliac segment that became stenotic after a prior aortic injury. Additionally, the safety of femoral vein harvest and its consequences in this age group are unknown.

The pediatric population has the unique challenge of issues related to growth discrepancies after vascular reconstruction. The potential for graft stenosis or obstruction due to the child's ongoing growth remains enigmatic.⁹ Therefore, techniques such as graft oversizing or staged procedures could be required to accommodate for this potential concern.

CONCLUSIONS

The use of the femoral vein as an arterial conduit has rarely been described nor its usefulness discussed in

the pediatric surgical literature. To the best of our knowledge, this is the first report of subclavian arterial reconstruction using a femoral vein in a young child. The femoral vein in the subclavian artery position appears to be an ideal conduit and could have other applications in challenging reconstructions in pediatric vascular trauma.

DISCLOSURES

None.

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