Case Report

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Iatrogenic arteriovenous fistula and its surgical repair in an infant: A case report

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ABSTRACT

Arteriovenous fistula (AVF) is an abnormal connection between arteries and veins. Iatrogenic trauma constitutes the majority of arterial traumas in childhood. The most common post-traumatic complications are AVF, arterial aneurysm/pseudoaneurysm, hematoma, thrombosis, arterial dissection, and acute limb ischemia. Some small AVFs close themselves without treatment. However, larger AVFs can be treated with surgery, endovascular stents, or ultrasound-guided compression. Herein, we present surgical management of a 22-month-old male infant with a high-flow AVF located between the right radial artery and the adjacent vein.

Keywords: Arteriovenous fistula; complication; iatrogenic; pediatric.

Arteriovenous fistula (AVF) is an abnormal connection between an artery and a vein. Iatrogenic trauma constitutes the majority of arterial traumas in childhood. With increased use of invasive diagnostic tools in newborns, the incidence of iatrogenic trauma has been on the rise.[1,2] Frequent venous access, intraarterial monitorization, central/peripheral venous catheterization, and frequent blood collection are the main reasons for arteriovenous traumas in low-birth-weight and premature infants.[3,4] The prevalence of post-traumatic complications ranges from 0.3 to 2.6% with a higher rate of complications in the femoral artery than the radial artery.[5] The most common post-traumatic complications are AVF, arterial aneurysm/pseudoaneurysm, hematoma, thrombosis, arterial dissection, and acute limb ischemia.[3] In the literature, there are only three case reports with radial AVF formation following coronary angiography. In the definite diagnosis, Doppler ultrasonography (USG), arteriography, and magnetic resonance angiography (MRA) are used.[6,7]

Herein, we present surgical management of a male infant with a high-flow AVF located between the right radial artery and the adjacent vein.

CASE REPORT

A 22-month-old male infant was admitted to an external center with a swelling located just above the right wrist for one month (Figure 1). Physical examination and Doppler USG showed a high-flow AVF of the radial artery and adjacent vein at the wrist level. The patient was referred to our clinic. His medical history revealed a long-term follow-up in the intensive care unit with invasive arterial monitorization about 1.5 years ago. The radial, ulnar, and brachial pulses of the right upper limb were palpable without any ischemia sign. Laboratory test results were also normal. The patient was scheduled and prepared for surgery.

After the right upper limb was wrapped with bandage, the veins were drained and the arterial flow was interrupted. A 2.5 cm transverse incision was,

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Figure 1. Swelling just above the right wrist.

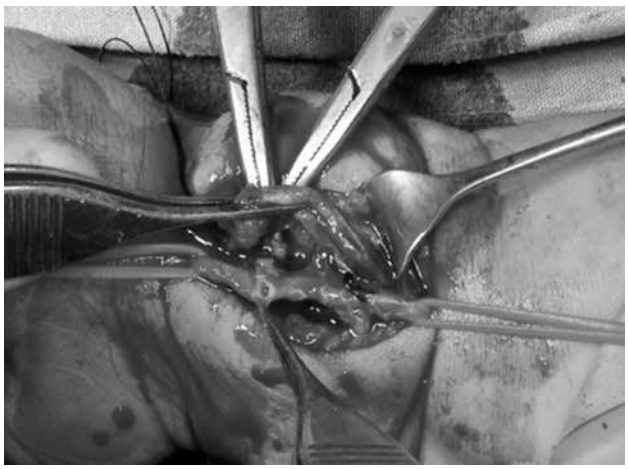

Figure 2. The fistulized zone located between radial artery and adjacent vein.

then, made into the marked site just above the right wrist which yielded thrill before surgery. The right radial and adjacent veins were reached. The fistulized zone was located between the radial artery and the adjacent vein (Figure 2). During dissection, the adjacent vein was ligated, and the radial artery defect was primarily repaired using 8/0 prolene suture. After surgery, the radial artery pulse was palpable without any fistulized flow. Manual Doppler USG revealed that triphasic flow continued in the ulnar and radial arteries. No blood transfusion was needed during and after surgery. No early complication was observed. The patient was discharged one day after surgery with oral acetylsalicylic acid 5 mg/day. At one-month follow-up visit, no thrill or murmur at the level of right wrist was observed and all pulses were palpable.

DISCUSSION

The most common causes of arterial traumas in adults include penetrating injuries, gunshot injuries, blunt traumas, and bone fractures.[7] Iatrogenic trauma is the main reason for arterial traumas in 66% of pediatric cases and umbilical artery catheterization, transfemoral cardiac catheterization, or transfemoral arteriography for diagnosis and monitorization may lead to these traumas. Most cases are diagnosed before the age of two.[8,9] The incidence of vascular trauma after arterial cannulation due to cardiopulmonary bypass is low. Freed et al.[9] reported that 67% of children aged under 10 years had vascular trauma after cardiac catheterization. In addition, AVFs may originate from puncture attempts for arterial blood gas, invasive arterial monitorization, and venous puncture in low-birth-weight newborns. Also, ischemia, aneurysm/pseudoaneurysm, hematoma, perforation, and thrombosis may lead to post-traumatic AVFs. Due to the smaller diameters of the veins in children than adults, the risk of post-traumatic complications is high in children. Post-traumatic complications include tissue loss, limb length discrepancy, ischemia, and necrosis and are associated with high morbidity and mortality.

The diagnosis should be made through a noninvasive method to avoid additional complications. Medical and surgical treatment options are available. Unless left untreated, microsurgery techniques can be used as early as possible.[1] Some small AVFs close themselves without treatment, while larger AVFs can be treated with surgery, endovascular stents, or USG-guided compression. There are several publications reporting favorable results with endovascular treatment of arterial injuries in adults.[8-10] However, small sample size and limited experience on endovascular techniques have led us to prefer surgical methods.[6]

Furthermore, a healthy circulation of the ulnar artery and palmar arch before and after surgery is critical for hand ischemia. Although there is a consensus on the diagnostic procedures and surgical indications for vascular traumas in adults,[11,12] no consensus has been established yet in pediatric cases. The prevalence of vascular traumas is low in children and surgery can be performed in a very few number of centers. If left untreated with an adequate size, venous return is increased due to the transition from high-systemic vascular resistance to the lower vascular resistance. As a consequence, increased volume leads to heart failure. If an AVF affects the lower limb, ischemia is frequent with a rate of ischemia and heart failure of 3.6%.[11-13] Different from adults, children should be closely followed for limb growth retardation, as they are still in the growth period. There are several studies reporting limb length discrepancy in children without any ischemia sign who failed to achieve complete recovery.[13,14] Furthermore, surgical strategy depends on the diameter and location of the AVF.

Surgical techniques include partial resection, ligation, excision, and primary repair. The use of covered stents and USG-guided compression are the other treatment options with lower efficacy. Some authors have also suggested that conservative methods are effective in the treatment of AVFs.[1]

Pain, paresthesia, and edema may occur in the early period following AVF operation. In delayed cases, irreversible heart failure, hand ischemia, thrombosis, or limb growth retardation can be seen due to high-flow AVF. Early diagnosis and treatment is critical to avoid these complications. Of note, a special attention should be paid to the radial artery interventions in pediatric cases and larger arteries should be used for puncture, if available. If a puncture is planned, the number of attempts should be minimized, and an USG-guided approach should be followed to decrease the complication rate.

In conclusion, AVFs should be diagnosed as early as possible using the least risky method to avoid a new AVF formation. Once the diagnosis is established, necessary precautions should be taken to prevent life-threatening complications such as limb ischemia or heart failure. Due to small vein diameters in children, the rate of stent thrombosis is high. Some authors have advocated the use of USG-guided compression as an alternative; however, there is a limited number of competent and experienced radiologists. We, therefore, prefer surgery in the first-line setting and it is an undeniable fact that more satisfactory long-term results can be achieved in patients undergoing a successful surgery.

Declaration of conflicting interests

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