

# Iatrogenic arteriovenous fistula in childhood

## *Fístula arteriovenosa iatrogênica em criança*

Amélia C. Seidel,<sup>1</sup> Fausto Miranda Jr.,<sup>2</sup> Lia Toda<sup>3</sup>

### Abstract

The authors report a case of iatrogenic brachial arteriovenous fistula in an infant secondary to arterial punctures to illustrate a serious complication of this procedure as well as to cite the diagnostic exams and the possible therapies.

**Key words:** arteriovenous fistula, vascular injury, infant, punctures.

### Resumo

Os autores relatam um caso de fístula arteriovenosa iatrogênica, secundária a punções arteriais, na artéria braquial de uma criança, para ilustrar uma complicação séria deste procedimento, bem como citar os exames de diagnóstico e as terapias disponíveis.

**Palavras-chave:** fístula arteriovenosa, lesão vascular, criança, punções.

Arteriovenous (AV) fistula is defined as an abnormal communication between the arterial and venous systems, which can be congenital or acquired.<sup>1,2</sup>

Most peripheral fistulas come as a result of penetrating traumas, usually gunshot wounds.<sup>1</sup> Iatrogenic injuries are responsible for 2 to 13% of AV fistulas observed in the civilian environment.<sup>3,4</sup> These are usually secondary to invasive diagnostic or therapeutic procedures, such as percutaneous renal biopsy, hemodialysis, cardiac catheterization, etc,<sup>1,5</sup> but there is little information regarding this complication by puncture, which is routinely performed, possibly due to hesitation in reporting them.<sup>5</sup>

Iatrogenic AV fistulas in infants are usually brought about by an arterial puncture performed in the neonatal period,<sup>6</sup> as these infants were prematurely born with respiratory insufficiency and needed multiple determinations of arterial gases.<sup>7</sup>

The purpose of this study is to present a case of brachial AV fistula secondary to multiple arterial puncture in a premature infant checked into a neonatal intensive care unit (ICU).

### Case report

Female infant at the age of 1 year and 3 months born to an 18-year-old mother, checked into the pediatrics ward of the *Hospital Regional Universitário de Maringá* and diagnosed with recurrent pneumonia.

Family members have reported that the child was born from a second pregnancy, with no complications up to the 36th week, when it was interrupted with a cesarean delivery due to premature separation of placenta and acute fetal suffering. At birth the baby weighed 2,140 g, presented a cephalic perimeter of 31 cm and length of 40.5 cm. In this procedure meconium aspiration was performed, causing brain damage (edema), as well as a convulsive crisis and

---

1. MD, School of Medicine, Universidade Estadual de Maringá (UEM), Maringá, PR, Brazil

2. MD, Department of Surgery, Vascular Division, Universidade Federal de São Paulo (UNIFESP), São Paulo, SP, Brazil.

3. MD, Hospital Regional de Maringá, Maringá, PR, Brazil.  
This study was carried out as part of the Angiology and Vascular Surgery Course, School of Medicine, Universidade Estadual de Maringá and the Graduate Program in Medicine of Universidade Federal de São Paulo.

Article submitted on January 12, 2005, accepted on March 3, 2005.

severe neonatal anoxia. The child remained in the neonatal ICU for 45 days, when she underwent arterial punctures so that blood could be collected and arterial gases could be determined. According to information obtained from medical reports, many punctures were performed, initially in the radial artery and afterwards in brachial arteries of both upper limbs. She was discharged from hospital in a stable condition, but presenting brain paralysis.

During the hospitalization period she was very restless, had fever (40 °C), and convulsive crises. Respiratory sounds and right hemithorax with apical crackles were present. The cephalic perimeter was 42 cm (microcephalus) and a thrill and bruit at the distal anterior surface of the left arm were present. This limb showed no signs of compromise in relation to the right one (trophic, color, temperature, and mobility alterations) and presented good distal perfusion.

The infant underwent complementary exams and results showed microcytic and hypochromic anemia and in the thorax radiography a right apex condensation was observed.

After vascular surgery evaluation an echo-color-Doppler flow of the arteries and veins of the left upper limb revealed the presence of AV fistula between the brachial artery and veins with its diameter reaching approximately 1.6 mm, located 3 cm above the interarticular cutaneous lines of the elbow. The brachial artery presented a diameter of 2.3 mm with systolic speed of 62.2 cm/s and diastolic speed of 27.8 cm/s. The brachial vein presented a diameter of 3.3 mm with presence of pulsatile flow, systolic speed of 50 cm/s and diastolic speed of 17.58 cm/s. The x-ray scanogram showed 23.5 cm in both upper limbs.

From the data obtained in the medical records the diagnostic hypothesis suggested an iatrogenic AV fistula secondary to multiple arterial punctures. During hospitalization pneumonia was treated avoiding all kinds of procedures in the left upper limb. With cardiology evaluation and an echocardiogram no compromise of the cardiovascular system as a consequence of the fistula was observed.

Given the severity of the neurological diagnostic, the physical hypodevelopment and the absence of circulatory complications an expectant conduct was the option and the infant was clinically observed every month by a multidisciplinary medical board.

## Discussion

Once congenital AV fistulas have been eliminated, iatrogenic fistulas represent nearly all traumatic AV fistulas<sup>6</sup> in infancy.

Very few reports of vascular complications due to venipuncture or arterial puncture are available and, due to a consequent lack of reports about the subject, an accurate incidence may not be known. Incidence of AV fistula secondary to venipuncture may be less than 0.03%. The pathogenic mechanism of an AV fistula secondary to vessel puncture remains uncertain.<sup>5</sup>

Knowing the frequency of arterial puncture in the brachial or femoral region during the neonatal period is essential.<sup>6</sup> The brachial artery and the median cubital vein are anatomically very near each other and can thus easily communicate even with a simple puncture.<sup>5</sup>

The physician should be aware of the possibility of incurring such an iatrogenic vascular injury in patients requiring multiple arterial punctures,<sup>7-9</sup> reason why they should be performed by qualified and experienced professionals.<sup>1</sup>

An AV fistula may be associated with a false aneurysm or there may be a channel formed,<sup>2</sup> as in the case presented.

The extension of the clinical manifestation is related to the size, duration and location of the fistula ranging from local to general alterations due to the stress in the cardiovascular system.<sup>10</sup> The related infant showed local alterations only characterized by the presence of a small tumor, thrill and bruit at the site of the lesion.

As in this case, the diagnosis of AV fistula located in the extremities<sup>2</sup> is relatively easy because of the local signs (thrill and bruit),<sup>4</sup> which eliminate certain congenital AV fistulas at this age (more frequently located in the cephalic, hepatic or pulmonary region). The absence of cutaneous signs and bone hypertrophy also makes this differentiation possible.<sup>6</sup>

For diagnosis, echo-color-Doppler flow evaluation of the brachial vessels was chosen. It is a non-invasive procedure, which shows the alteration of venous flow and the presence of multicolored speckled mass rather than a direct connection between an artery and a vein. Furthermore, it enables evaluation of the site and the extension of the lesion as well as measurement of the vessels proximal and distal to the AV fistula.<sup>11</sup> In some cases in which the communication of the fistula is

unique it is possible to make its compression and occlusion. It is also possible to follow the evolution of the fistula in cases like this, where the patient is young and presents another concomitant condition that increases the surgical risks. The surgical treatment can also be guided by the images of the ultrasound scanning, dismissing the use of contrast in the arteriography.

The natural history of pseudoaneurysms and AV fistulas that result from accidental or violent trauma seem to be different<sup>2</sup> and reveal a low incidence of spontaneous resolution and high likelihood of complications in the childhood, including bleeding, arterial thrombosis, skin erosions, adjacent nerve compression, venous hypertension or even congestive heart failure if the communication of the fistula and the shunt are significant.<sup>1,2,5</sup>

Despite the fact that small AV fistulas might occasionally close spontaneously, treatment in most cases is surgical<sup>1</sup> and should be performed as soon as possible, due to the rapid disease progress.<sup>2</sup>

The goals of surgery are the early eradication of the fistula, prevention of complications and the establishment of arterial and venous continuity.<sup>2</sup>

The endovascular treatment with percutaneous puncture in cases that do not respond to compression by echo-color-Doppler flow is a safe alternative with a high degree of technical success, low morbidity and short hospital stay. Short-term follow-up is encouraged, however, long-term follow-up of these procedures is necessary in order to evaluate the durability of the repair and absence of complications.<sup>12</sup>

In spite of all considerations aforementioned regarding the realization of angiography and indication of surgical treatment, the conduct in this case was expectant and until now the child has not presented any cardiovascular complications and has been attending the clinical follow-up regularly for 6 months.

## References

1. Norcross WA, Shackford SR. Arteriovenous fistula. A potential complication of venipuncture. *Arch Int Med* 1988;148: 1815-6.
2. Khougeer G, Okda AH. Difficult femoral arteriovenous fistula in a child. *Ann Saudi Med* [serial on line] 2000 Dec; 20(2): [2 screens]. Available from: URL: <http://www.kfshrc.edu.as/annals/202/99-172.htm>
3. Kollmeyer KR, Hunt JL, Ellman BA, et al. Acute and chronic traumatic arteriovenous fistulae in civilians. *Arch Surg* 1981;116(5-6):697-702.
4. Johnson G. Chronic traumatic peripheral arteriovenous fistulae. In: Rutherford RB. *Vascular surgery*. 2nd ed. Philadelphia: W. B. Saunders Co.; 1984. p. 913-7.
5. Ino T, Yazawa K, Kawamura S, Takeoka M, Yashiro N. Secondary arteriovenous fistula after a single arterial puncture. *Pediatr Int* 2001;43:179-80.
6. Bical O, Laborde F, Lecompte Y, Leca F, Hazan E, Neveux JY. Fistules artério-veineuses iatrogènes du nourrisson. *Arch Fr Pediatr* 1982;39:691-2.
7. Ontell SJ, Gauderer MW. Iatrogenic arteriovenous fistula after multiple arterial punctures. *Pediatrics* 1985;76:97-8.
8. Dzepina I, Unusic J, Mijatovic D, Bulic K. Pseudoaneurysm of the brachial artery following venipuncture in infants. *Pediatr Surg Int* 2004;20:594-7.
9. Gow KW, Mykytenko J, Patrick EL, Dodson TF. Brachial artery pseudoaneurysm in a 6-week-old infant. *Am Surg* 2004;70:518-21.
10. Fee HJ, Levisman J, Doud RB, Goulding AL. High-output congestive failure from femoral arteriovenous shunts for vascular access. *Ann Surg* 1976;183:321-3.
11. Verlato F, Zanon GF, Gamba PG, et al. Echo Doppler color flow (EDCF) evaluation of vascular pathology in pediatric age groups. *Int Angiol* 1996;15:321-7.
12. Criado E, Marston WA, Ligush J, Mauro MA, Keagy BA. Endovascular repair of peripheral aneurysms, pseudoaneurysms, and arteriovenous fistulas. *Ann Vasc Surg* 1997;11:256-63.

Corresponding author:

Amélia Cristina Seidel

Rua Dr. Gerardo Braga, 118, Jardim Vila Rica

CEP 87050-610 – Maringá, PR, Brazil

Phone: +55 (44) 269.1521 – Fax: +55 (44) 225.0999

E-mail: [seidel@wnet.com.br](mailto:seidel@wnet.com.br)