

# Clinical Syndrome of Anomalous Position of the Popliteal Artery

## Differentiation from Juvenile Arteriopathy

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VARIATIONS of the arterial system of anatomic and clinical interest are numerous and for the most part have been described. The variations of the popliteal artery are relatively rare. Among them the best known is the high branching of the artery. Our observation concerns a very rare case of anomalous course of the popliteal artery. Instead of its normal position in the lower half of the popliteal fossa between the lateral and medial heads of the gastrocnemius, the artery encircles medially the medial head, passing under its femoral insertion, and then continues on its normal course. In this regard, a study of the literature revealed only two references, one by Hamming in 1959,<sup>1</sup> who reported a clinical case, and an earlier one by Stuart in 1879,<sup>2</sup> who described it during the dissection of a limb. There is also a case described by Chambardel-Dubreuil,<sup>3</sup> in which the popliteal artery was separated from the vein by an accessory slip of gastrocnemius muscle.

Because of the rarity of the anatomic finding and because of its characteristic clinical consequences, we believe it worth while to present the following case.

### Report of Case

A white, single, 28-year-old farmer gave a negative family history. He was discharged from military service because of pain in the left leg. A nonsmoker, he denied syphilis and other venereal diseases. In 1953 he suffered from sciatica on the left side, which was completely relieved by local therapy.

In the fall of 1954, when the patient was 22 years old, he first noted, only during ambulation, pain on the dorsal surface of the left foot,

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plus a sensation of coldness in the same area, and the foot assumed a pale color. The patient was forced to stop walking but was able to start again after 5 or 6 minutes' rest, when the foot had resumed its natural temperature and color.

Upon hospitalization in April 1955, oscillographic examination was normal except after exercise, when oscillographic index was slightly lower in the left leg. Thermometric examination showed a decline in temperature of the left foot. The circulation time by the fluorescein method showed a delay in the inguinal to foot section. Aortography was normal except for the left popliteal artery, which presented a fusiform aneurysm at the level of the knee joint.

He was treated with antispastic drugs and vitamin E, but the symptoms remained essentially the same, with intermittent claudication and ischemia after the first few steps in the inferior third of the left leg and foot. Later the patient also noted paresthesia in the left leg and foot, when he was seated with his knee bent sharply. A delay in growth was noted in the nails of the left foot. Other trophic disturbances, either superficial or deep, were absent.

The patient was admitted to our surgical clinic on March 13, 1961, when the physical examination revealed slight atrophy of the left leg; the supra-malleolar circumference of the right leg was 22.5 cm., and that of the left leg was 21 cm. The popliteal artery felt normal on the right; on the left, an expansive, direct pulsation, typically aneurysmal, was felt. The amplitude of the pulsation of the left tibial artery was somewhat less than normal. The blood pressure was 140/90 mm.

Laboratory tests of blood and urine were normal. An electrocardiogram showed probable enlargement of the left atrium, left ventricular hypertrophy, and diaphragmatic subepicardial ischemia.

The skin temperature showed a slight decrease in the left leg. There was a slight reduction in the oscillographic index of the entire leg. On arteriography (injection of 20 ml. of Triopac 400\* into the superficial femoral artery) in the oblique position the femoral artery appeared

\*2-Acetylamino-2,4,6-tri-iodo-benzoate of sodium. Manufactured by Cilag Co., Italy.

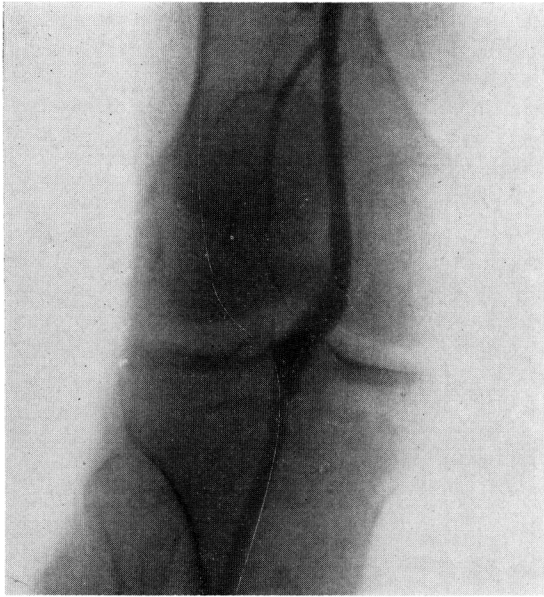


Figure 1

*Left femoral artery in anteroposterior position, showing fusiform aneurysmal enlargement of the arterial wall.*

normal. The popliteal artery, immediately below its origin, formed a curve, concave laterally, fairly well emphasized, and at the level of the articular rim, another small more acute curve, concave anteriorly, beneath which a small parietal notch was seen that narrowed the arterial lumen. In the anteroposterior position (fig. 1) the curve concave laterally was evident. The continuation of the artery appeared as a fusiform aneurysmal enlargement beneath which the parietal notch was still evident.

On the basis of these clinical findings the following possibilities were considered; popliteal dolico-mega-artery, simple arterial aneurysm, tumor of the popliteal fossa with medial displacement of the artery, arteriosclerotic stenosis of the artery with ischemic symptomatology distally and tortuosity of the vessel proximally, anomalous position of the vessel with initial arteritic changes.

The diagnosis of popliteal dolico-mega-artery, as intended by Leriche,<sup>4</sup> i.e., alteration of caliber and length of a segment, without evident pathologic cause, could not be excluded on the basis of the arteriographic findings. This condition does not usually give such prominent intermittent claudication and especially not after a few steps. Also, the paresthesia, when the patient is seated with knees sharply flexed, is not present, as it was in our case.

On the basis of palpation and arteriography

in the anteroposterior position, the diagnosis of simple arterial aneurysm can be considered. However, as can be seen from the oblique position, the parietal dilatation corresponded to a curve, concave anteriorly, of the artery, which in the anteroposterior position appears as an aneurysmal dilatation. Also the subjective symptomatology was not typical of aneurysm.

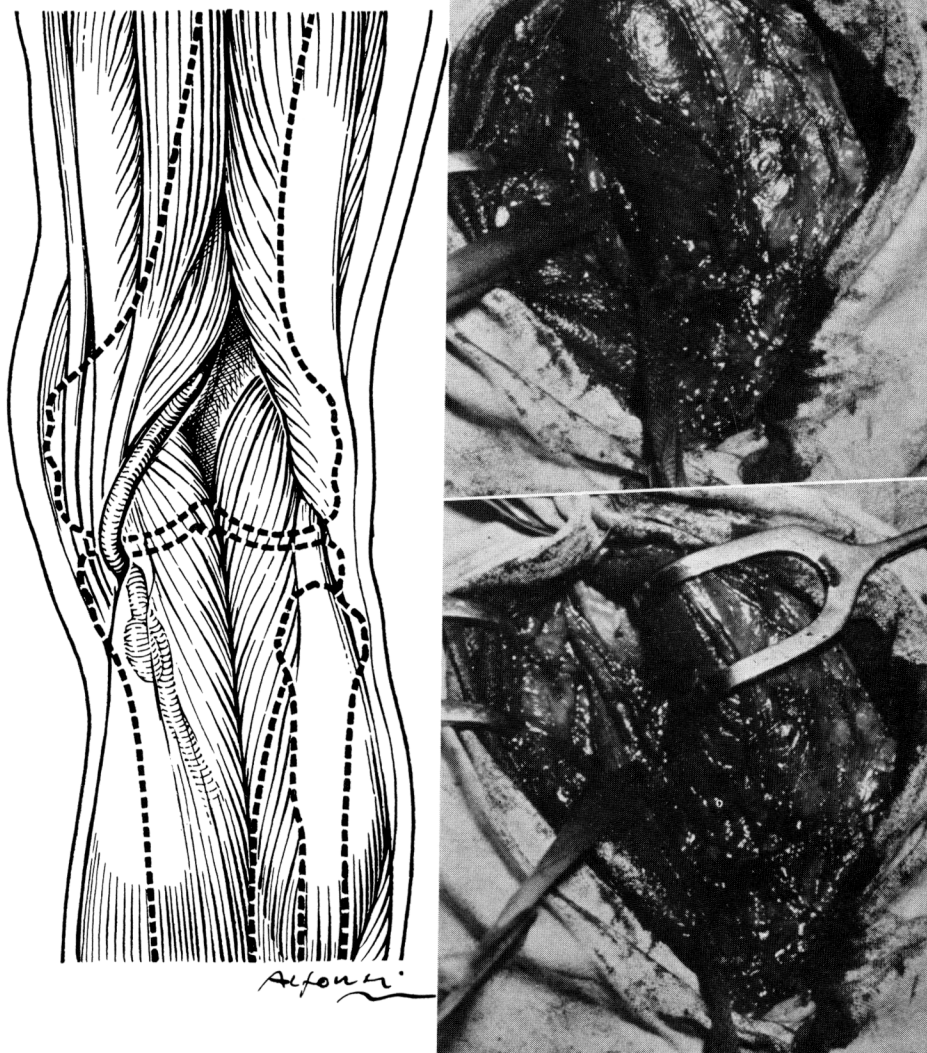
The diagnosis of a tumor with medial displacement of the popliteal artery could be eliminated immediately because of the absence of a palpable mass in the popliteal fossa.

A localized arteriosclerotic process, when the remaining arterial system appeared perfectly normal, could not be considered very likely. The most probable diagnosis was that of an anomalous position of the popliteal artery, as the case described by Hamming, with initial arteritic changes. The appearance of the symptoms at an early age, the characteristic subjective signs (early appearance of intermittent claudication immediately after a few steps and the paresthesia of the left leg and foot with the patient in a sitting position and knee sharply bent), the constancy of the syndrome, and its resistance to antispastic treatment in contrast with the slight oscillographic findings at rest, and especially the typical arteriographic findings, confirmed our diagnostic suspicions. We therefore proceeded to study the variations of the oscillometric curve at the inferior third of the leg, after having passively placed the foot in plantar hyperextension. In such a position, the stretching of the gastrocnemius and in particular of the medial head, would tend to interrupt the blood flow. Oscillations on the left completely disappeared but changed only slightly on the right, a clinical sign as yet not described and which because of its harmlessness and the simplicity of its application could be useful as an abnormal sign for differential diagnosis.

On the basis of the description of Hamming's case, in which the popliteal artery ran around the medial margin of the tibial head of the gastrocnemius, passing under the femoral insertion, it is evident that every stretch and contraction of this muscle must modify the arterial flow distally. This clinical sign of decisive importance in the differential diagnosis induced us to undertake the operation described below with precise preoperative diagnosis of an anomalous position of the left popliteal artery.

At operation the popliteal artery, which was situated medial to the nerve and vein, was isolated. At the level of the femoral insertion of the tibial head of the gastrocnemius, the artery presented a curve, concave laterally, embracing at first the medial margin of the same muscle and then proceeding under its tendinous insertion





**Figure 2**

Right, top. *Course of vessels after the incision of the superficial layers, the popliteal artery and vein run along the medial margin of the tibial head of the gastrocnemius muscle.* Right, bottom. *After laterally displacing the gastrocnemius muscle, the vascular bundle is better seen.* Left. *Scheme of the exact position of the popliteal artery.*

on the posterior face of the medial femoral condyle. The muscle, under which the artery appeared compressed, was displaced laterally with hooks (fig. 2). A portion of the muscle was sectioned and a wide gap made under its femoral tendinous insertion, thus liberating the artery, which then assumed a normal position. In this region the artery showed an aneurysmal dilatation about the size of a nut, for the most part

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thrombotic (fig. 3). An aneurysmorrhaphy with a heparin lavage of the vessel lumen was performed, so that the normal continuity and position of the artery were re-established (fig. 4). The incision was sutured and the leg was immobilized. The postoperative period was excellent. The arterial recanalization with its normal position was documented by the postoperative oscillometric examination. At the inferior part of the left leg

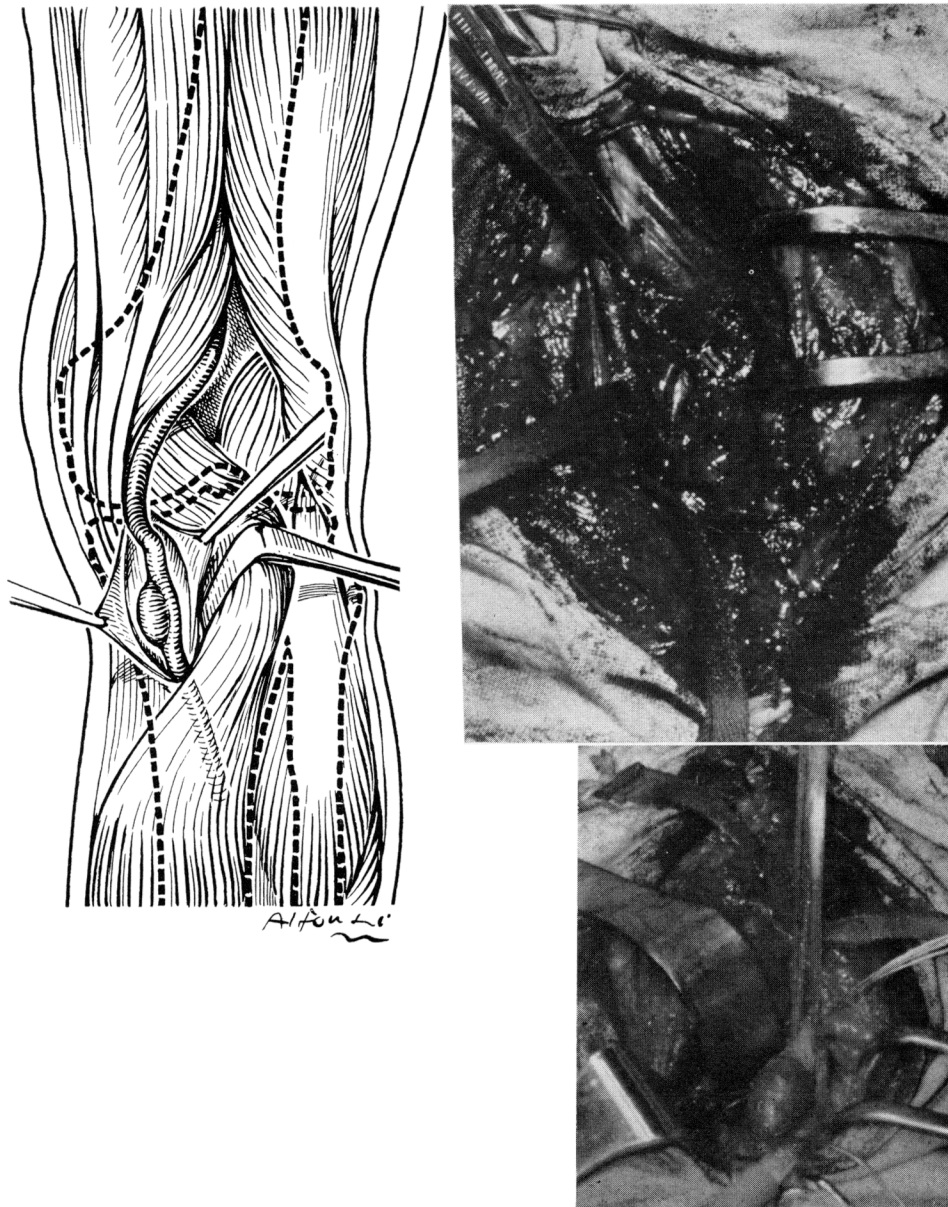


Figure 3

Right, top. *The wide tendinous insertion of the gastrocnemius muscle is raised.* Right, bottom. *After the incision of the tendinous fascia, the aneurysm appears in the artery immediately underneath.* Left. *Scheme of the exact position of the aneurysm.*

there was a wave, which although low in amplitude, did not show variations after forced plantar hyperextension. The decrease of the arterial flow was logically due to the postoperative stupor of the popliteal artery, which previously slightly decreased in caliber, has been further reduced by the end-aneurysmorrhaphy.

#### Conclusion

This case lends itself to some general considerations of clinical interest.

To begin with, we think the above finding is not so exceptional as it may seem. Many cases pass unobserved either because they are

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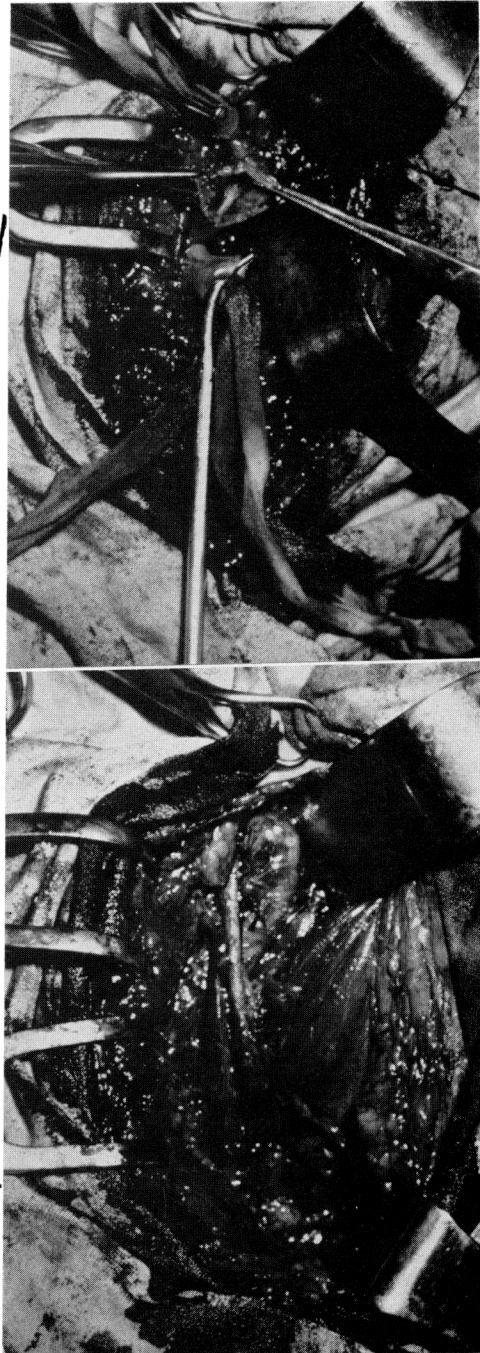
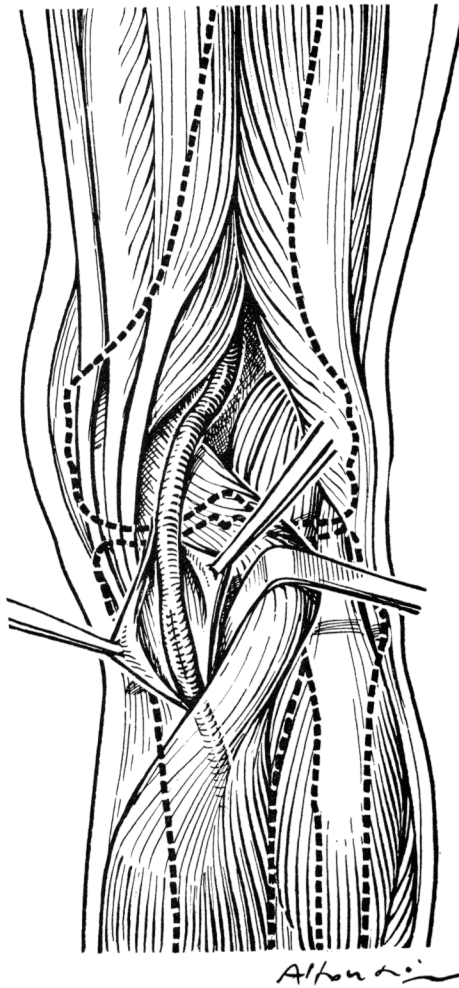


Figure 4

Right, top. *The artery is ligated proximally and distally to the aneurysm and emptied of its thrombus.* Right, bottom. *Reconstruction of the vessel wall with re-establishment of the blood flow.* Left. *Scheme of the position of the artery after the operation.*

mistaken for early arteriopathies or because of the dearth of symptoms, especially the ob-

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jective symptoms, at least at the beginning of the pathologic manifestations.

Our case, in fact, had been treated in other clinics for 7 years without the exact diagnosis having been made. Only with the arteriographic finding was the diagnosis suspected. Even in the advanced stage, however, when the arterial lesions may cause gangrene with consequent amputation of the limb, this could occur under the diagnostic label of juvenile arteriopathy.

The early recognition of the congenital alteration is very important clinically from the point of view of its evolution. Evidently the arterial section that runs under the tendinous insertion of the gastrocnemius muscle is subjected continuously while walking to repeated trauma at every step, because of the compression between the bony surface and the contracted muscle. After a certain period of time the blood vessel wall undergoes pathologic lesions that may vary from an aneurysmal dilatation, in part thrombotic, as in our case, to a complete thrombosis of the lumen as in the case of Hamming.

Logically, the final evolution of this congenital malformation is gangrene of the limb; diagnosis therefore becomes a clinical necessity, even more so because the therapy may be completely effective.

We have been able to unite in a few clinical signs the essential characteristics of the syndrome:

1. It begins at an early age without signs of generalized arterial lesions.

2. Appearance of intermittent claudication immediately after the first steps and not after a prolonged march as generally happens in arteriopathic patients.

3. Appearance of paresthesia of the foot while the patient is seated with the knee at a sharp angle, i.e., in a position of stretch on the gastrocnemius muscle.

4. Negative oscillometric tracing of the inferior third of the leg with the foot in forced plantar hyperextension.

5. Typical arteriographic findings as described in our case and in that of Hamming.

Without the aid of the arteriographic findings, however, the diagnosis could be suspected by the first three clinical symptoms and definitely ascertained by the oscillographic tracing carried out according to our description.

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