Anatomic bases of medical, radiological and surgical techniques

High and low lateral approaches to the popliteal artery

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Abstract

Using a series of 20 dissections and two anatomic transverse sections of a lower limb, the authors investigated the lateral approaches to the popliteal artery. The high lateral approach (above the knee) is not very aggressive and gives access to the retro-genicular part of the popliteal artery. After cutaneous and fascial incision, a simple gap between the vastus lateralis and biceps femoris mm. allows easy exposure of the popliteal vessels after backward retraction of the sciatic nerve. The low lateral approach to the artery (below the knee) is very aggressive for the vessels, nerves, and ligaments of the area. It involves the resection of the upper fourth of the fibula and the isolation and protection of the common peroneal nerve. Nevertheless, these lateral approaches must be known and used when classic approaches (medial and posterior) are impossible.

Recent advances in vascular surgery lead us to look for new approaches especially within the framework of treatment of atherosclerotic lesions using bypass techniques. Indeed, arterial surgical procedures are increasingly made up of revision procedures, as patients' lifespans increase and atheromatous illness changes.

These repeat operations make surgery difficult, as the procedure takes place in sclerotic tissue and increases the risk of infection [10]. Furthermore, sepsis can contra-indicate an initial planned approach, particularly if located in the future operative site. Finally, the popliteal a. is often used during operations for revascularization of the lower limbs, the classic approaches being medial or possibly posterior. These approaches can be contra-indicated in case of sepsis, or made difficult by repeated surgical intervention (scarred area). All of this convinced us of the necessity of studying the anatomic bases of the supra- and infra-articular lateral approaches to the popliteal a., which are insufficiently used in arterial surgery of the lower limbs [8, 11].

Anatomic review

The popliteal a. is located behind the knee, measuring about 20 cm [2]. It starts from the superficial femoral a. where it crosses the tendinous ring of the adductor magnus m. at the medial edge of the femur [2, 3, 7, 9]. This origin is the most common, but previously studied anatomic variations exist (originating in the profunda femoris a.) [9]. Located below and outside the proximal third of its path, the popliteal a. then runs vertically to cross the popliteal fossa from inside the midline [2, 7, 9]. It ends at the inferior edge of the tendinous arch of the soleus m., where it divides into the anterior tibial a. and the tibiofibular trunk, which in turn gives off the posterior tibial and fibular aa. [2, 9]. Like its origin, the termination of the popliteal a. is the site of anatomic
variations both in level and division [1, 9]. The relations of the popliteal a. are multiple and can be divided into two groups [7].

**Parietal relations**

- In front the popliteal surface, the oblique popliteal lig. and the popliteus m;
- behind from top to bottom, the semimembranous m. and the popliteal fascia;
- on the medial aspect: from above down, the semimembranous m. and the medial part of gastrocnemius m.;
- on the lateral aspect from above down, the biceps femoris m., the lateral part of gastrocnemius m. and the plantaris m.

**Neurovascular relations**

- the popliteal v., located along the postero-lateral edge of the artery (if the popliteal v. is double, the popliteal a. runs between the two popliteal vv.)
- the tibial n., from the division of the sciatic n., follows the postero-lateral edge of the popliteal v.
- the common peroneal n., against the tendon of the biceps femoris m., diverges laterally from the popliteal a.
- the deep popliteal lymph nodes
- the small saphenous v. flows into the popliteal v.

During its journey the popliteal a. gives off numerous collateral branches whose destinations are articular, muscular and cutaneous. From a surgical point of view, the artery can be divided into three segments

- the high supra-articular popliteal a., from the adductor hiatus to the origins medial and lateral of gastrocnemius mm.

- the retro-articular median popliteal a., between the condylar origins of the gastrocnemius mm., in the intercondylar notch

- the low infraarticular popliteal a., from the articular space to the soleus arch.

**Material and methods**

The anatomic study was carried out on 20 dissections of 10 lower limbs, (5 right and 5 left), from specimens of either sex. We did not use all the specimens. One specimen was injected with neoprene latex in two colours (red for the arteries, blue for the venous elements). Ten other specimens were injected arterially with red neoprene latex. Among the ten dissected lower limbs, one (a right lower limb) was frozen for 48 hours then sectioned transversely by saw. Horizontal sections allowed study of the different relationships at several levels (Figs. 1, 2, 3). The dissection study was determined by the surgical segmentation of the popliteal a. and by the presence in this region, of the knee joint. Because of this, two types of lateral approaches were carried out in each specimen a high supra-articular approach and a low infra-articular approach, i.e. 20 dissections ten high, ten low. The dissection technique was the same in all cases, surgical technique as much as possible [6, 8, 10,11]. For the high lateral approach to the popliteal a., the incision was carried out between the relief of the iliobibial tract and the vastus lateralis m. in front, and the biceps femoralis m. behind. The opening of the femoral fascia, allowed entry into the popliteal fossa. The approach to the low popliteal a. was carried out by cutaneous incision opposite the head and proximal quarter of the fibula. It was deepened through the subcutaneous tissue and the musculo-tendinous attachments of the fibula, while isolating and protecting the