### Cases

**Case 1**

21 YO man presented with an AVM on the volar aspect of the hand.
1 surgical resection, 5 embolization procedures.

Recurrence of the tumor with active bleeding, a sensory deficit on pulp of the index and stiffness of the index finger. The arteriography confirmed that the tumor was dependent of the radial artery. An intervention was performed with total excision of the tumor and multiple vascular ligatures: deep palmar arch and radial artery, to reduce the blood flow. After excision, it persisted a wide cutaneous defect. A week later, an amputation at the base of the second metacarpal bone was performed allowing tensionless coverage by a local flap. A year later, he had a recurrence at the level of the first web. A surgical resection was repeated, with postoperative necrosis of the previous flap. A groin flap was performed and separated after 4 weeks. Two years after the surgery, he had no tumor recurrence.

**Case 2**

21YO woman had an AVM of the forearm that had become uncomfortable since she was 13 years-old.
2 embolizations were performed within the two days prior to surgery to avoid active bleeding [10]. On clinical examination, the forearm perimeter was 3.5 cm greater than the contratateral side. There was a Volkmann’s syndrome with fixed contracture of the 3 ulnar fingers. The interosseous muscles were functional and normal sensation on the ulnar side of the hand. The radial pulse was present. The patient complained of a permanent pain of her forearm score of 9 on the visual analogue scale.

Angiography showed that the AVM was related to the ulnar artery with normal diameters of the brachial and radial arteries. The tumor and of the atrophic forearm muscles were completely excised and palliative transfer of flexor digitorum profundus tendons of the ulnar digits to the index finger tendon was performed. The ulnar nerve had a voluminous neuroma greater than 10 cm and was transposed subcutaneously.

**Case 3**

19 YO woman had a venous malformation of the hand (VM) previously operated at age 7, 11 and 14. Recurrence occurred on the third and fourth fingers. Moreover, the middle finger proximal interphalangeal joint (PIP) had a 55° flexion contracture. Angiography showed interruption of the ring finger radial collateral artery, and both digital arteries of the middle finger proximal to the PIP joint, leading to poor vascularization of the two fingers. The fourth finger was operated first using dorsal and volar approaches to resect the tumor, however resection could not be complete, as the tumor seemed to be developing from the digital nerves. The cutaneous excess was resected reducing the finger to normal size using a local flap. At 8 months follow-up, total active motion of the ring was recovered.

### Discussion

**Try to restore a functional hand: Palliative transfers and neurolysis**

In the case 2, a palliative transfer was associated with tumor resection to restore the flexion of the ulnar fingers. The tenodesis permitted a functional recovery of the fingers flexion. There was chronic compression of the ulnar nerve that required decompression and transposition. The high pain was relieved by the tumoral resection and the nerve decompression.

**Recidive and embolization**

These tumors are prone to recur with a recurrence rate as high as 20% after embolization and 28% after surgery [1]. Even if there is some frequent recurrence with embolization, this technique should be always considered first in those complex situations. Embolization is an alternative for specific localization, where surgery is risky. It is also helpful within the two days prior to surgery to avoid active bleeding [10].


**Consider amputation**

Amputation should be considered in cases showing serious regional complications including tissue necrosis, loss of function or bleeding. Patient 1 had a sensory loss and PIP joint stiffness of the index finger from previous surgeries. The amputation of the index through the metacarpal base was an ideal option considering the moderate postoperative functional disability induced by this intervention.

Lu et al. [1] reported a case of a congenital hemangioma with repeated recurrences and significant impact on the patient’s daily life and where amputation improved the patient autonomy. Upton et al. reported a study on 270 vascular malformations. Among these, there were 14 severe AVMs and 10 needed amputation.

**Skin coverage:** Using a reliable flap is necessary, choosing a distant flap is recommended

Total excision can lead to soft cutaneous defect, especially in case of chronic ulceration. In those cases, coverage strategies have to be considered from the most simple to the most complex. After tumor excision, local flap after resection of the excess skin is an easy option with satisfactory cosmetic results. However, using a local flap is hazardous because of the multiple ligatures realized during the intervention and the risk of ischemia. Reconstruction using a distant flap such as the groin flap is a good option for the hand or the upper limb and is recommended in these case (case 1).
