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Original Research Article

Angiosome study of the first digital feet space, for reconstruction of the digital tip

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ABSTRACT

Background: The concept of angiosome explains the anatomical variations that exist between the vessels of different regions of the body and helps to understand the contributions of arterial blood supply to the skin and adjacent structures, dividing the human body into three-dimensional vascular blocks.
Methods: This was an observational and descriptive study. In both lower extremities of 5 corpses with adequate tissue preservation in the operating room attached to the teaching area of the National Institute of Forensic Sciences in Mexico City. Angiosome study of the medial neurocutaneous flap of the second toe of both feet was performed.
Results: The average, in centimeters, of the surface of the flaps was 1.57 cm x 2.47 cm, the average diameter of the inter-metatarsal digital artery was 1.1 millimeters and the average diameter of the veins draining the angiosome was 1.4 millimeters. The most constant anatomy was that of the nerve, which was present in all cases, with the digital nerve forming the neurosome of the flap.
Conclusions: To obtain optimal results in microsurgery transfers, it is necessary to have a technique that is quick for harvesting the flap and with adequate systematization so as not to injure the neurovascular bundle, this is achieved through complete anatomical knowledge, without forgetting the main variants.

Keywords: Angiosome, Digital tip injury, Hand surgery, Neurocutaneous transfer

INTRODUCTION

The concept of angiosome explains the anatomical variations that exist between the vessels of different regions of the body and helps to understand the contributions of arterial blood supply to the skin and adjacent structures, dividing the human body into three-dimensional vascular blocks. The dynamic physiological

territory that irrigates an artery can expand or retract from its anatomical territory depending on the pathophysiological conditions.[1] In 1987 Taylor and Palmer introduced the angiosome concept, they also did the contribution of the concept of CHOKE vessels, which join an angiosome with another same. The work of Taylor and Palmer began with a mapping of 40 vascular territories bilaterally, found 374 cutaneous perforating arteries with a diameter of 0.5 mm or greater.[2] With the reconstruction techniques based on microsurgery and super microsurgery, the study of angiosomes has increased, since each angiosome corresponds to a portion of tissue to be transferred for the possible treatment of a complex wound.

Digital tip injury

The digital tip lesion is any wound from the distal edge of the pulp to the insertion of the deep flexor tendon.[3] The pulp is the anatomical and functional unit that covers the distal phalanx, formed by a multi lobular fatty pad, compartmentalized in multiple septa, with great content of nerve units that give sensitivity and proprioception.

Mechanism of injury

The main mechanisms of injury include sharp cutting, crushing and tearing, less frequently thermal lesions and vascular alterations. These injuries usually occur mainly as occupational accidents in the industrial area or in the pediatric population that presents mostly crushing injuries.

Treatment

The treatment options of the digital tip injury are based on escalating modes of treatments, which includes from conservative management, closure by secondary intention to super microsurgery, skin graft, composite graft, local flaps, regional and transfers through microsurgery. The super microsurgery is the most advanced currently in reconstruction, for it requires highly specialized equipment, preferably optics of more than thirty magnifications, nylon suture of 12-0 and vascular claps for vessels smaller than 0.5 mm. The digital tip has great regenerative capacity, which gives it a good recovery prognosis, provided that the surgical treatment is chosen and carried out correctly.

METHODS

An observational and descriptive study was carried out. In both lower extremities of 5 corpses with adequate tissue preservation in the operating room attached to the teaching area of the National Institute of Forensic Sciences in Mexico City. The angiosome study of the medial neurocutaneous flap of the second toe of both feet was performed. Under safety conditions, wearing a cap, gloves, gown and lenses in the operating room, the flaps were lifted and the neurovascular bundle was dissected. For the study of the angiosome, the pedal artery was infiltrated with activated acrylate with red monomer until the infiltrate had venous return and thus the angiosome could be stained without infiltration being extravasated. The sizes, and the measurements of both the flaps and the neurovascular bundle were quantified identifying the anatomical relationship between them. Clinical photographs were taken, the measurements were made with the program image J.

RESULTS

The average, in centimeters, of the surface of the flaps was 1.57 cm x 2.47 cm, the average diameter of the inter-metatarsal digital artery was 1.1 millimeters and the average diameter of the veins draining the angiosome was 1.4 millimeters. The most constant anatomy was that of the nerve, which was present in all cases, with the digital nerve forming the neurosome of the flap.

The artery that perfuses all angiosomes, is the inter-metatarsal digital artery. The vascular relationship and most frequent nervous was; vein, artery and nerve, with a ratio of two veins per each artery, relationship present in all dissections. In 100% of the crops of the angiosomes primary closure could be performed.

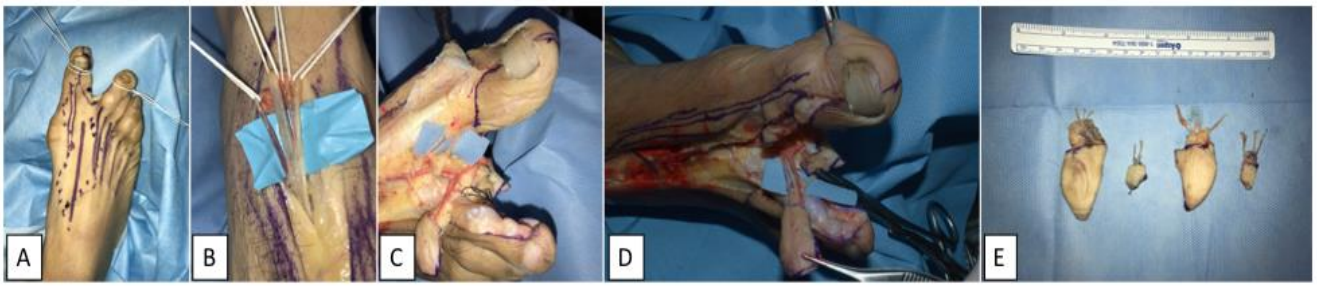

Figure 1: Adhesions formation, A) arterial and venous topographic marking of the angiosome of the first digital space, B) From left to right vein, artery, vein and nerve of the foot, C) Raising the flap of the first digital space in its lateral portion, D) Mapping by angiosome neurovascular bundle acrylate infiltration, E) Metrics of the angiosome with its respective neurosome, venosome and perforasome.

DISCUSSION

The use of the hand by each individual, without exclusion of gender, age, activity or profession, requires an integral digital tip, when losing this anatomical area, the hand requires the integrity of the digital tip and by losing this anatomical area, the hand is unable to adequately perform most of its functions, hence the importance of making the greatest effort for optimal reconstruction. A poor amputation or reconstruction of the digital tip results in chronic pain and loss of sensation, which will invariably evolve into partial work disability. Since Taylor et al. published his study of vascular territories, the interest in documenting its subdivisions has been presenting greater relevance, since, for the reconstruction of complex wounds, it is not enough to apply a simple skin coverage.[4] Currently, we must evaluate the sensitivity, the reestablishment of the wound with tissues more paired with the injured area and the search for the lowest possible morbidity of the donor area. Because of the importance of the digital tip, it is necessary to make the greatest effort, in order to have optimal results, in most cases, this can only be achieved by microsurgical transfer.[5-10]

CONCLUSION

The neurocutaneous transfer of the second finger in its medial portion has all the advantages in digital tip reconstruction, especially when there is a nerve injury and, the cutaneous loss does not exceed any joint. Its harvest for transfer is safe and it is not necessary to have an invasive vascular anatomy study, since it has a constant vascular and nervous pattern, which guarantees both the neural regeneration of the flap and the adequate arterial blood supply with sufficient venous drainage. The study in corpses of angiosomes, with acrylate-based vascular infiltration technique, can help to diminish the learning curve and optimize the times in the operating room, in addition to obtaining greater safety in the harvest of the flap, which is translates into greater success in the reconstruction of the digital tip with microsurgical techniques. To obtain optimal results in microsurgery transfers, it is necessary to have a technique that is quick for harvesting the flap and with adequate systematization so as not to injure the neurovascular bundle, this is achieved through complete anatomical knowledge, without forgetting the main variants.

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