THE ARTERIAL SUPPLY OF THE ELBOW JOINT STUDIED BY PLASTIC INJECTION AND PUTRIFICATION TECHNIQUE

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SUMMARY

The detailed arterial anatomy of the elbow joint is of special importance in case of fracture reconstruction or for choice and position of an endoprosthetic implant. In our study, we used the plastic injection and putrification technique to demonstrate the arterial supply of the head of the radius. We used fresh (non-fixed) specimens, taken from adult human cadaver upper extremities. After the vessels were rinsed with NaCl-solution, Acrifix was injected into the vessels. When hardening was completed , enzymatic dissolving of the soft tissue with Biozym SE was started. The putrified tissue was removed by warm tap water.

It has been observed that the arterial supply of the elbow joint derives from the arterial network formed by the branches of the brachial , the radial and the ulnar arteries.

Key words: *Elbow joint, arteries, plastination and putrification.*

ÖZET

Articulatio cubiti'nin ayrıntılı arteriel anatomisi kırık rekonstrüksiyonu ya da endoprostetik implantın seçimi ve uygulanmasında özel bir öneme sahiptir. Çalışmamızda caput radii'nin arteriel kanlanmasını göstermek için formaldehit ile fikse edilmemiş (fresh), erişkin insan üst ekstremitelerinden alınan örneklerde plastik enjeksiyon ve pütrifikasyon tekniğini kullandık. Damarlar NaCl solüsyonu ile yıkandıktan sonra Acrifix enjekte edildi. Acrifix katılaştığında Biozym SE ile yumuşak dokuların enzimatik çözünmesi başlatıldı. Pütrifiye dokular ılık çeşme suyu ile yıkanarak uzaklaştırıldı.

Çalışmamızda articulatio cubiti'nin kanlanmasının a.brachialis, a.radialis ve a.ulnaris'den gelen dalların oluşturduğu rete articulare cubiti'den sağlandığı gözlemlendi.

Anahtar sözcükler: *Articulatio cubiti, arterler, plastinizasyon ve pütrifikasyon.*

INTRODUCTION

The arterial supply of the elbow joint is given by the perforating branches of the adjacent extraosseus arteries. Taking care of the special properties of the vascularisation will prevent iatrojenic destructions (1,2). Nutrient arteries have a special importance for fracture healing ; avascular bone necrosis may be the result in case of their damage. In addition to the intraosseus distrubution of these arteries, their extraosseus pathway is important for choosing the surgical approach or for implanting a prosthesis (2). Arterial supply of the elbow joint comes from the arterial network of the elbow joint (4).

The arterial network of the elbow joint is constituted by four recurrent arteries and the anastomoses between the descendant branches of the brachial artery (5,6):

In front of the lateral epicondyle the recurrent radial artery anastomoses with the radial collateral artery which comes from the A. profunda brachii.

In front of the medial epicondyle the anterior ulnar recurrent artery anastomoses with the inferior ulnar collateral artery.

Behind the medial epicondyle the posterior ulnar recurrent artery anastomoses with the inferior ulnar collateral artery and the superior ulnar collateral artery.

Behind the lateral epicondyle the interosseus recurrent artery anastomoses with the middle collateral branch of the A. profunda brachii and the inferior ulnar collateral artery (7,8) (Fig 1).

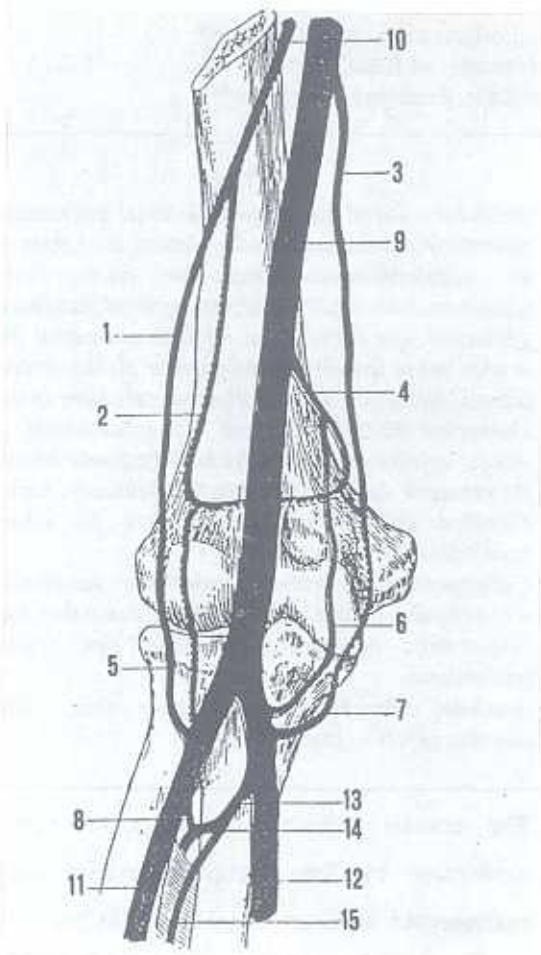

Figure 1: The arterial anastomoses around the elbow joint (From the Gray's Anatomy)
1. Radial collateral artery
2. Middle collateral branch of A.profunda brachii
3. Superior ulnar collateral artery
4. Inferior ulnar collateral artery
5. Radial recurrent artery
6. Anterior ulnar recurrent artery
7. Posterior ulnar recurrent artery
8. Interosseus recurrent artery
9. Brachial artery
10. A.profunda brachii
11. Radial artery
12. Ulnar artery
13. Common interosseus artery
14. Posterior interosseus artery
15. Anterior interosseus artery

Given by the superior and inferior ulnar collateral arteries the A. profunda brachii anastomoses with the radial recurrent artery, the anterior ulnar recurrent artery and the posterior ulnar recurrent artery. This guaranties a continuous blood circulation between the arm, the forearm and the hand.

MATERIAL AND METHODS

MATERİAL and METHODS

Unfixed human upper extremities were used. The elbow joints were isolated from the arms by cutting them approximately 10 cm proximally and distally. The still frozen specimens were put in running cold tap water. The vessels were rinsed with NaCl-solution for getting out the blood and making them free. The stump of the vessels were ligated (2).

Plastic injection: The *Acrifix substance (approximately 30-35 ml) was injected proximally into the vessels with low pressure until it appeared at the distal stump of the vessels. The specimens were installed on an acrylic angle by fixing the humerus and the ulna with stainless-steel screws. Then the specimens were put in warm tap water for the hardening of the injected substance for nearly three hours. For control of hardening, a little rest of Acrifix was filled into a glove (2).

Putrification: After the hardening of Acrifix was completed, enzymatic remove of the soft tissues started. For digesting the collagenious components of the skin, a solution of KOH 5% was used for nearly three hours. After that the enzymatic dissolving of the soft tissue was started with *** Biozym SE (during this

* Injection substance:Acrifix 190 ® (Röhm) 93%,hardener 4 %,red-colored due

** *Enzymatic solution:Biozym SE ® 2g/L + 1 soup spoon Na2CO3 (pH 9-9.5) (2).

procedure the temperature was constant at 60°C and the solution was changed every second or third day). While keeping the specimens in a bucket the solution was rinsed and the putrified tissue was removed with warm tap water for not destroying the specimens.

RESULTS

The distal end of the humerus and the proximal parts of the radius and the ulna own a rich arterial network which derives from the posteromedial and posterolateral sources (Fig 2).

The arterial network of the specimens is constituted by the anastomoses between the radial recurrent artery, the anterior ulnar recurrent artery, the posterior ulnar recurrent artery, the interosseus recurrent artery and the radial collateral artery, the inferior ulnar collateral artery, the superior ulnar collateral artery and the middle collateral artery (Fig 2,3,4).

It has been observed that the arterial vessels will reach the radial head only by its neck region (Fig2).

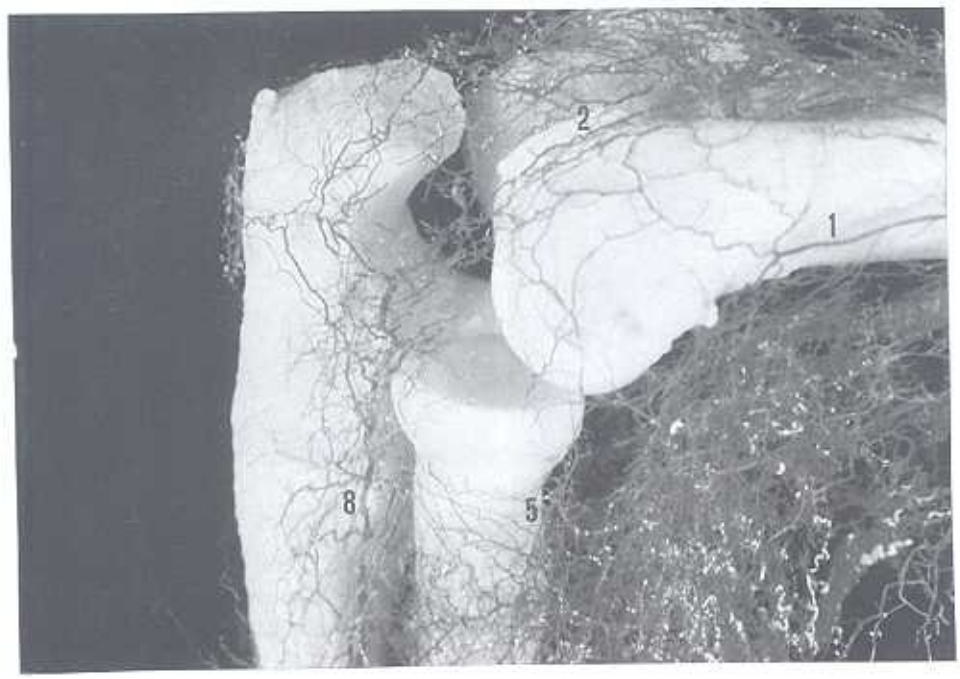

Figure 2: The blood supply of the elbow joint.

1. Radial collateral artery
2. Middle collateral branch of A.profunda brachii
5. Radial recurrent artery
8. Interosseus recurrent artery

Figure 3: The blood supply of the elbow joint.
2. Middle collateral branch of A.profunda brachii
3. Superior ulnar collateral artery
4. Inferior ulnar collateral artery
8. Interosseus recurrent artery

Figure 4:
2. Middle collateral branch of A. profunda brachii
7. Posterior ulnar recurrent artery
8. Interosseus recurrent artery

DISCUSSION

There are some but no sufficient data about the blood supply of the elbow joint in the literature. Our findings agree with the descriptions of the classical anatomy textbooks (4-8).

Yamaguchi et al. described that the arterial supply of the elbow joint is constituted by the anastomoses of the superior ulnar collateral artery, the inferior ulnar collateral artery, the radial collateral artery, the middle collateral artery, the radial recurrent artery, the anterior ulnar recurrent artery, the posterior ulnar recurrent artery and the interosseus recurrent artery (1).

Giebel et al. emphasized that the blood comes from the radial recurrent artery, the anterior ulnar recurrent artery, the posterior ulnar recurrent artery, the interosseus recurrent artery to the proximal end of the ulna and the radius, and the vessels supplying

the head of the radius pierced the bone from the distal part of the articular circumference(2).

Girard et al. described that the blood supply of the head of the radius is constituted by the branches entering the neck of the radius (3). Our findings support these results.

CONCLUSION

The blood supply of the elbow joint depends on the local arteries. These arteries can be easily damaged during osseous reconstruction because of the tension or the trauma.

Knowledge of the detailed arterial anatomy is important for preventing iatrogenic accidents.

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