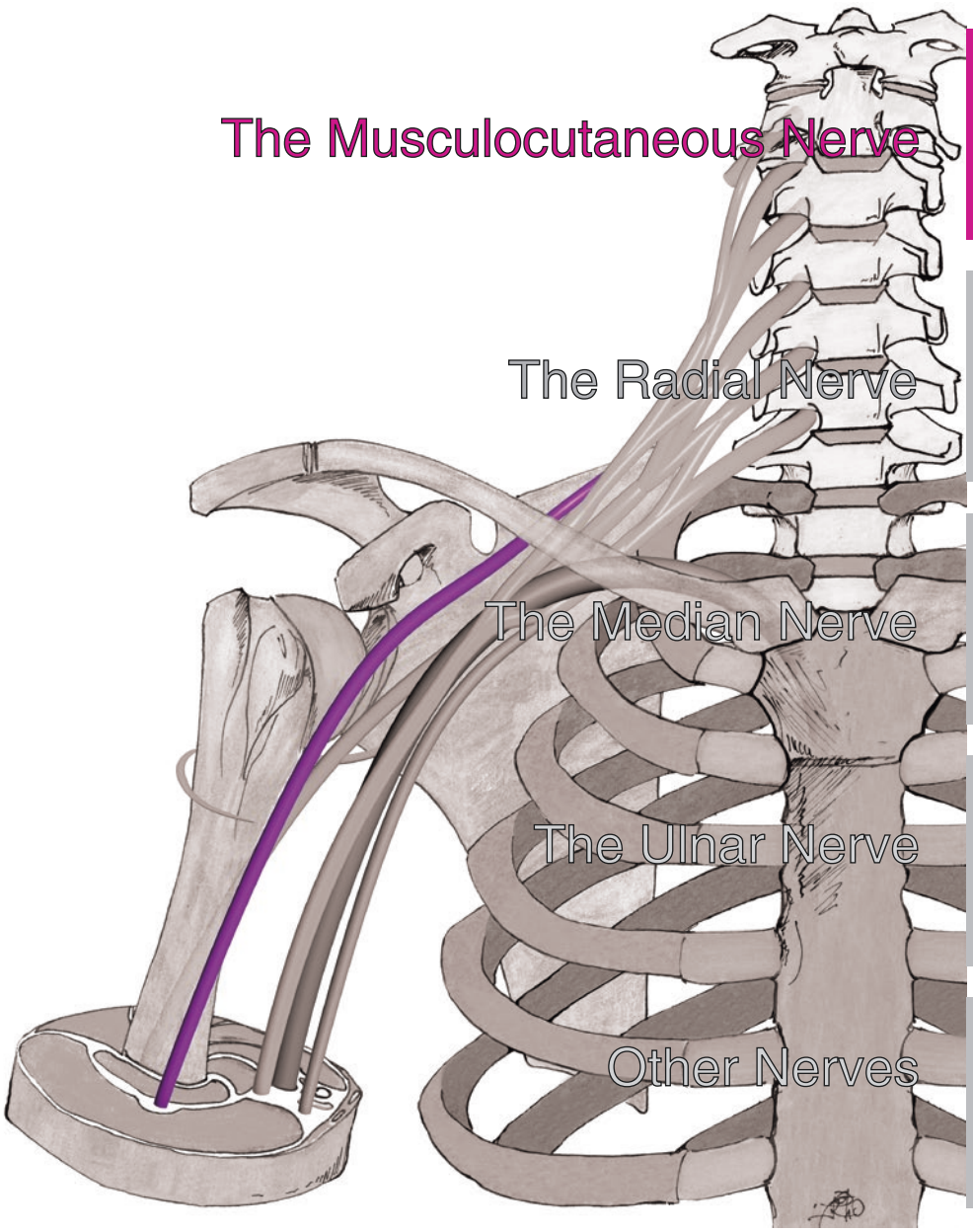


The Musculocutaneous Nerve

Morphological Data

The musculocutaneous nerve is a terminal branch of the brachial plexus. Its purpose is to allow the forearm's flexion; it is also responsible for the sensitive innervation of the forearm's lateral face until the thumb. It is a mixed nerve with its main part coming from the superior trunk of the brachial plexus and its minor part coming from the reunion of the anterior divisions of the middle trunk of the brachial plexus.

Origin

The musculocutaneous nerve is made up of neurofibres that find their origin in the C5 and C6 roots of the brachial plexus (Figure MC1). It starts outside and in front of the axillary artery. It constitutes a terminal branch of the lateral bundle of the brachial plexus.

At this level, it faces the axillary artery medially. The median nerve can be found in front of the artery, and the radial nerve behind it.

Path

After going past the apex of the coracoid process, the nerve heads slightly towards the outer part to go through the two heads of the coracobrachialis muscle, generally at a distance equivalent to four times the width of a finger under the apex of the process. The entry point of the nerve in the muscle can vary with a division of the nerve situated above and several motor branches already given off at this level (Figure MC2).

After going through the coracobrachialis muscle, the nerve leaves on its anterior and lateral face in order to penetrate the middle part of the arm, making its way between the biceps brachii muscle and the lower extremity of the coracobrachialis muscle. It then follows the brachial muscle in a groove situated between this muscle laterally and the biceps medially (Figures MC3, MC9 and MC11).

At the inferior third of the arm, it makes its way on the posterior face of the biceps brachii until the antecubital area, at the level of the lateral bicipital groove. At this point, the musculocutaneous nerve faces the tendon of the biceps brachii muscle medially and the brachioradialis muscle laterally (Figures MC5, MC10 and MC12).

The musculocutaneous nerve ends when it becomes the lateral cutaneous nerve of the forearm which is purely sensitive after having given off all of its motor collateral branches earlier. This transition happens where the musculocutaneous nerve emerges at the lateral edge of the biceps brachii muscle, generally at the level of the lateral epicondyle of the humerus (Figures MC2 and MC3).

Neurovascular Relations

At its origin, the musculocutaneous nerve faces the axillary artery.

In the arm, it moves away laterally from the brachial artery, which it faces remotely (Figure MC4).

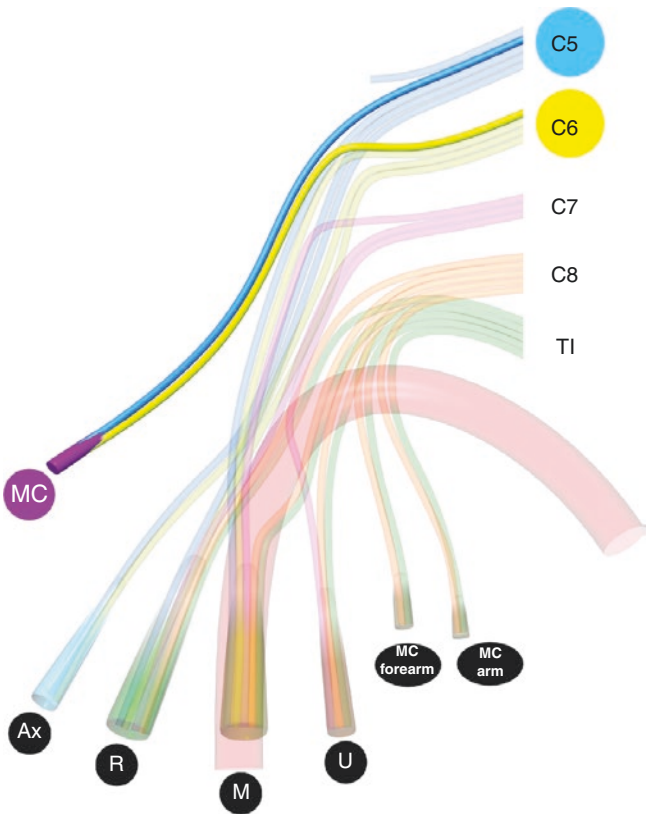


Figure MC1. Origin of the musculocutaneous nerve

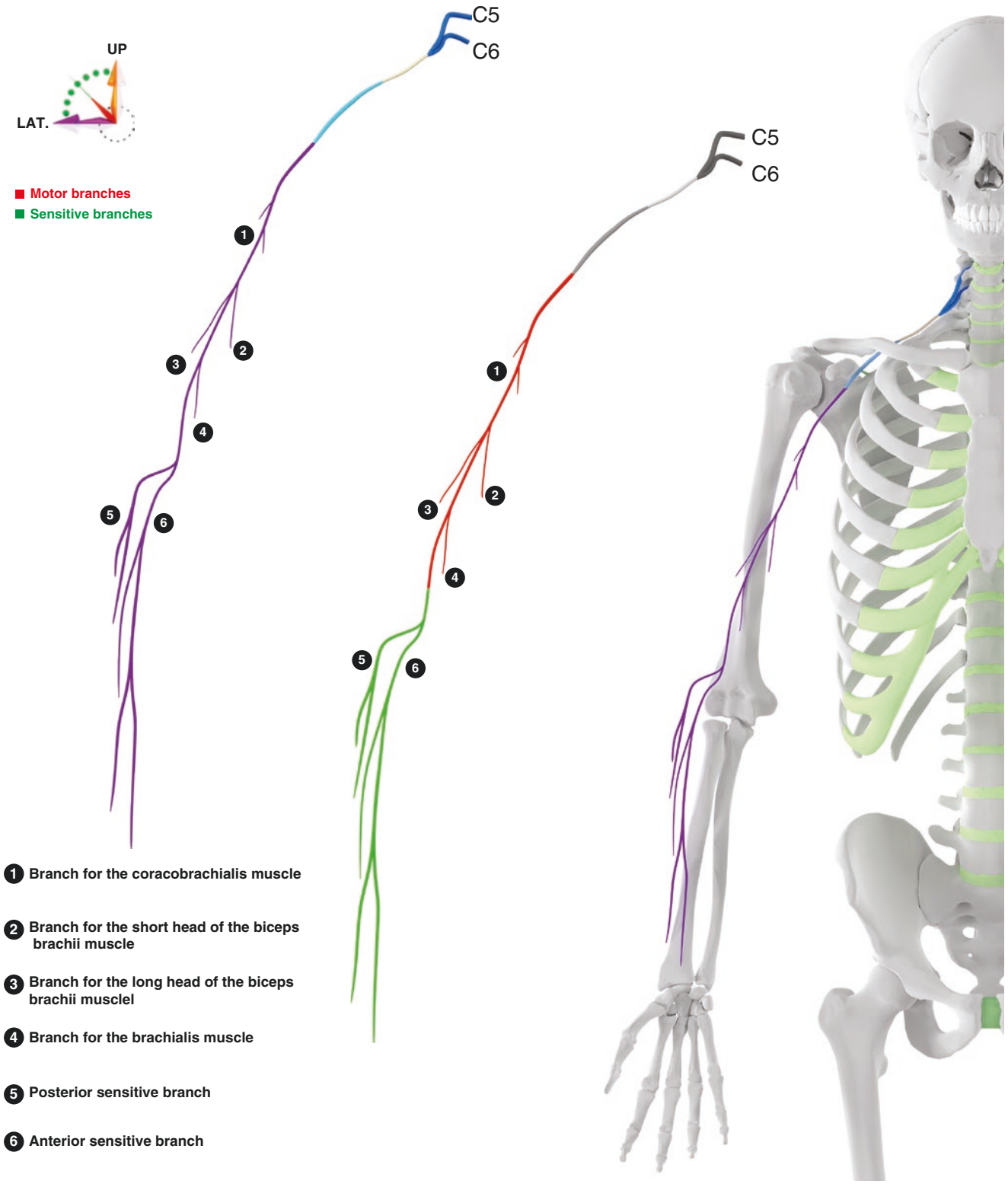


Figure MC2. Distribution of the musculocutaneous nerve and its relations with bones

The Musculocutaneous Nerve

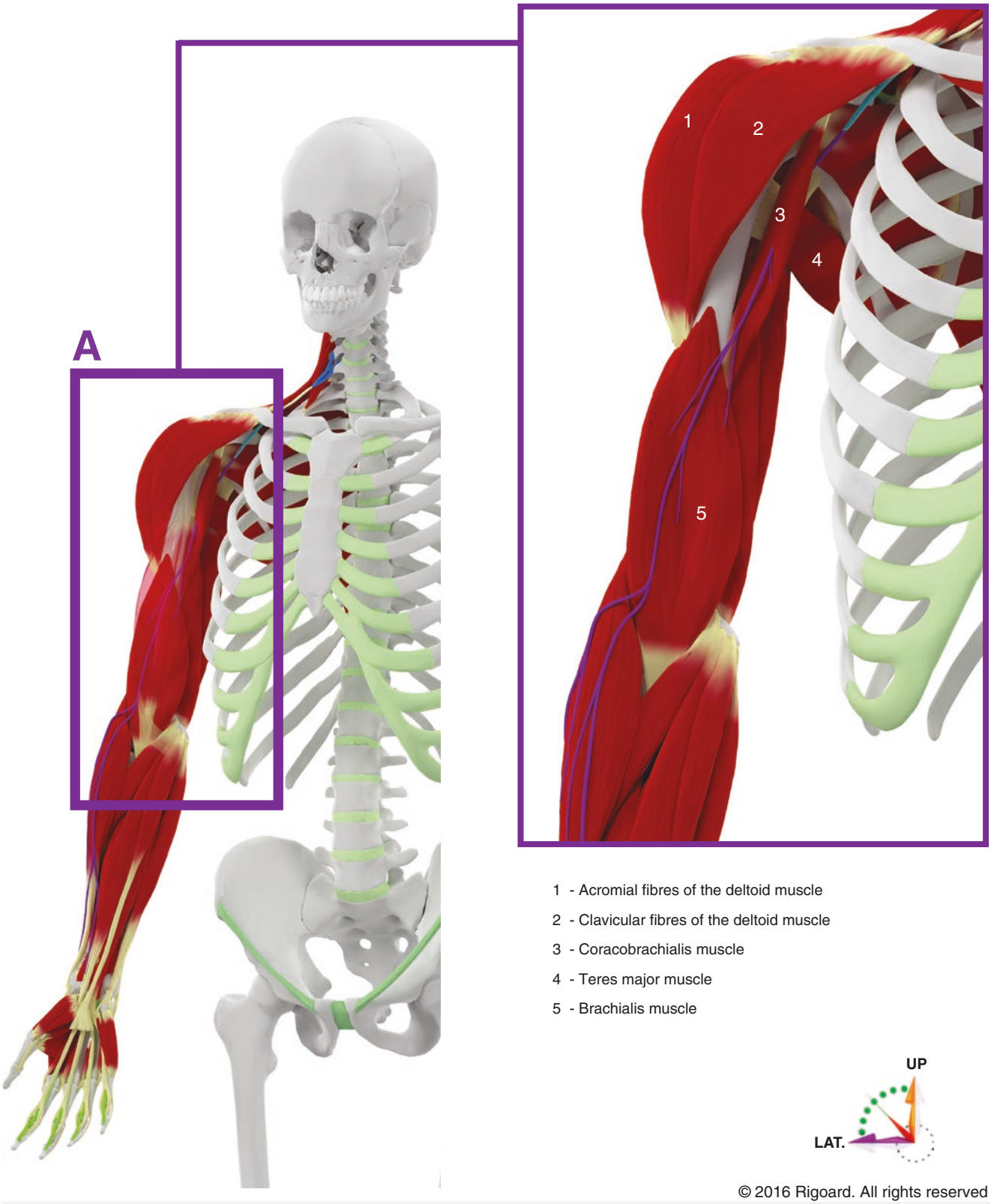
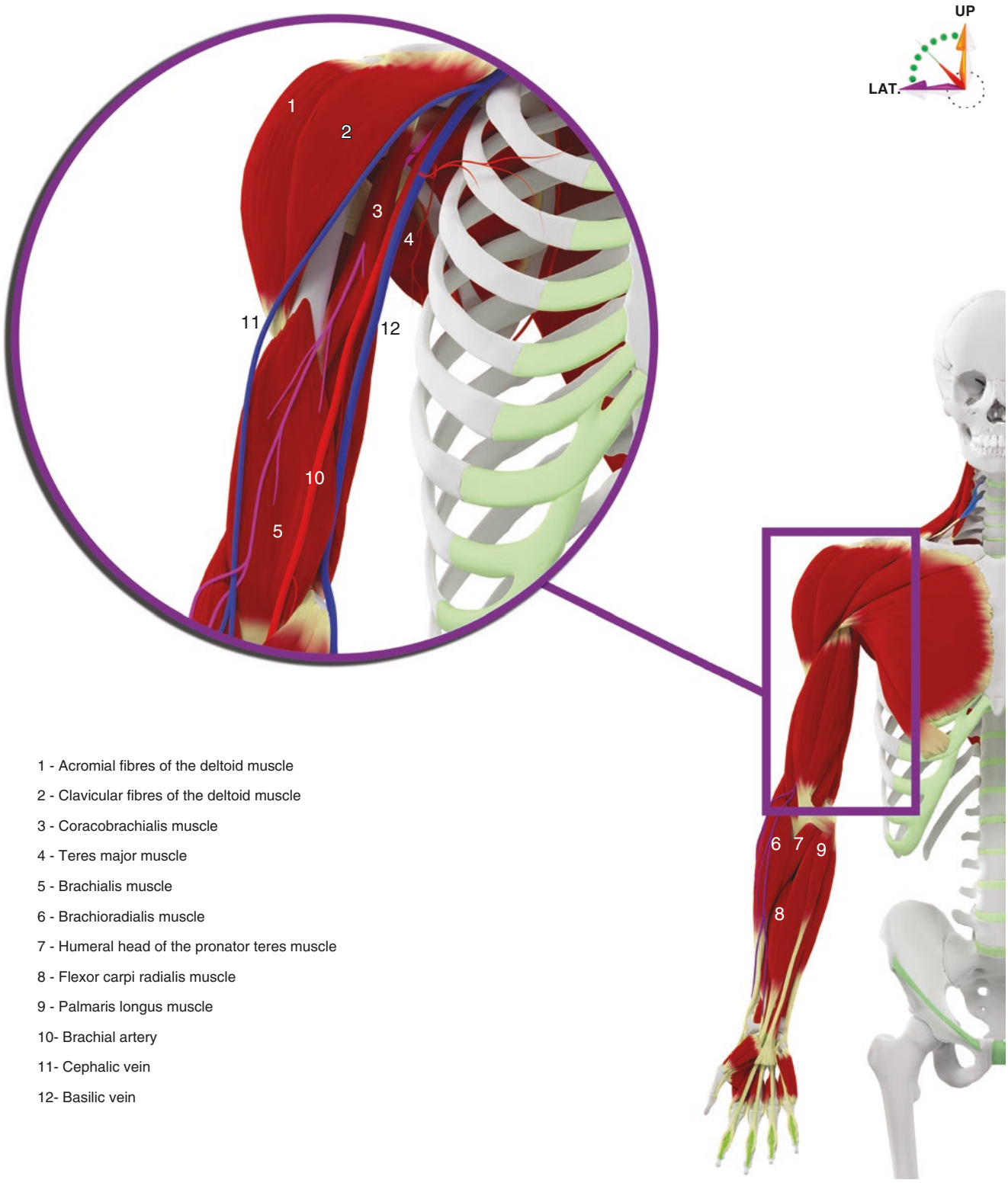


Figure MC3. Relations of the musculocutaneous nerve with muscles in the arm



1 - Acromial fibres of the deltoid muscle
2 - Clavicular fibres of the deltoid muscle
3 - Coracobrachialis muscle
4 - Teres major muscle
5 - Brachialis muscle
6 - Brachioradialis muscle
7 - Humeral head of the pronator teres muscle
8 - Flexor carpi radialis muscle
9 - Palmaris longus muscle
10- Brachial artery
11- Cephalic vein
12- Basilic vein

Figure MC4. Neurovascular relations as the musculocutaneous nerve goes through the coracobrachialis muscle

The Musculocutaneous Nerve

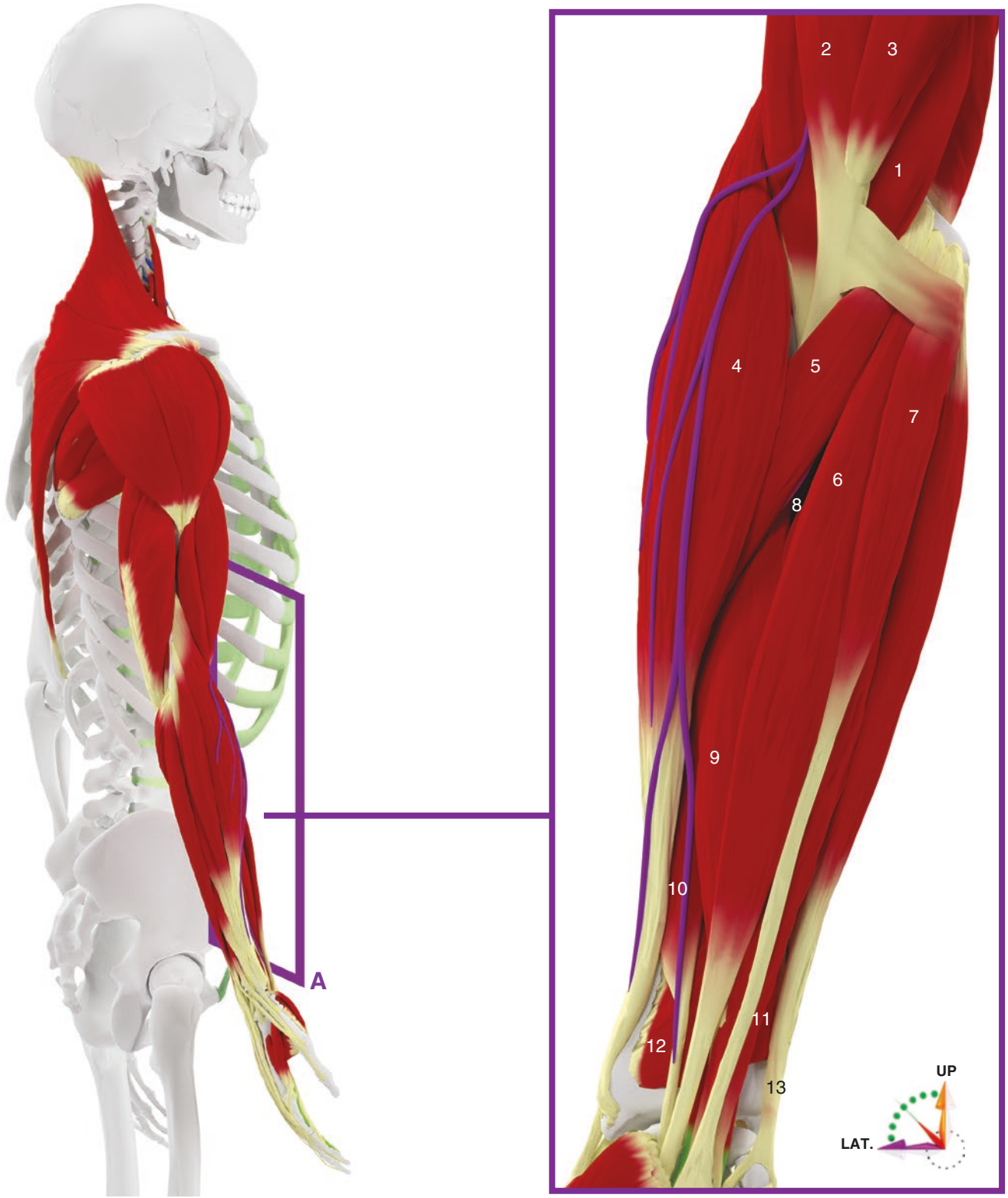


Figure MC5. Relations of the musculocutaneous nerve in the forearm

1 - Brachialis muscle

2 - Long head of the biceps brachii muscle

3 - Short head of the biceps brachii muscle

4 - Brachioradialis muscle

5 - Humeral head of the pronator teres muscle

6 - Flexor carpi radialis muscle

7 - Palmaris longus muscle

8 - Humeral head of the flexor digitorum superficialis muscle

9 - Radial head of the flexor digitorum superficialis muscle

10- Flexor pollicis longus muscle

11- Flexor digitorum profundus muscle

12- Pronator quadratus muscle

13- Flexor carpi ulnaris muscle

14- Brachial artery

15- Ulnar artery

16- Radial artery

17- Median antebrachial vein

18- Cephalic vein

19- Basilic vein

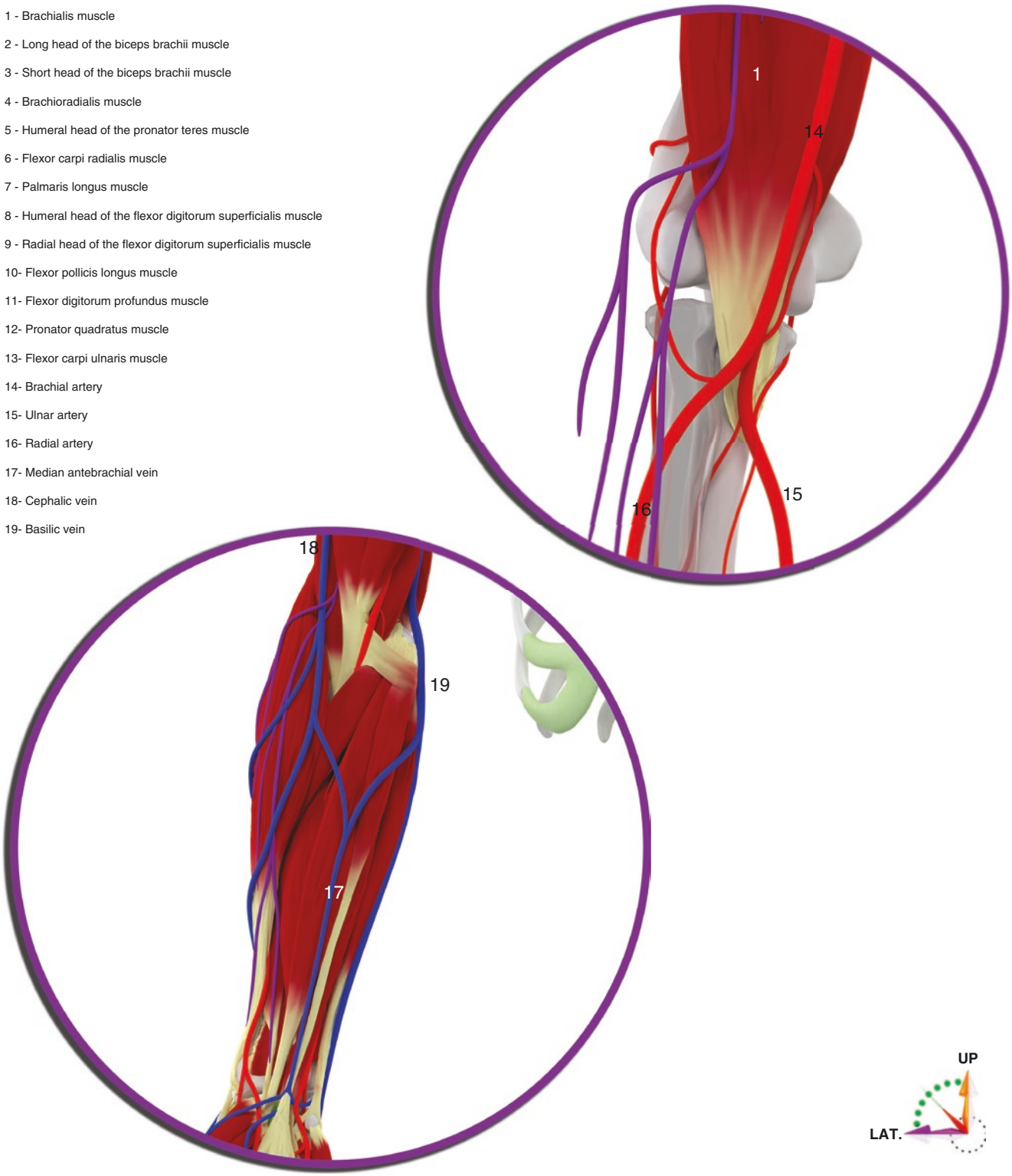


Figure MC6. Sensitive terminal branches of the musculocutaneous nerve and neurovascular relations

The Musculocutaneous Nerve

In the elbow, the musculocutaneous nerve lies against the brachialis muscle at the level of its distal insertions. The radial recurrent artery is located behind these, sticking closely to the lateral epicondyle (Figure MC6).

The division branches of the lateral cutaneous nerve of the forearm, itself being a terminal branch of the musculocutaneous nerve, are situated in the upper layers and part from the main arteries of the arm (Figure MC6).

Collateral Branches

The musculocutaneous nerve innervates the following branches in its path:

- A diaphyseal branch for the humerus.
- Vascular branches, heading towards the axillary artery and the brachial artery.
- Muscle branches linked to the brachial muscle, biceps brachii and coracobrachialis muscle. The latter generally receives two branches, an upper branch that parts from the nerve near its origin point and a lower branch, more remote (Figures MC2 and MC13).

Terminal Branches

The musculocutaneous nerve ends when it goes through the biceps brachii's aponeurosis at the level of the elbow pit and then becomes the lateral cutaneous nerve of the forearm.

The lateral cutaneous nerve of the forearm consists of two branches, one being anterior and the other posterior. They both make their way along the cephalic vein mostly to innervate the lateral face of the forearm (Figures MC6, MC14 and MC15).

Motor Function

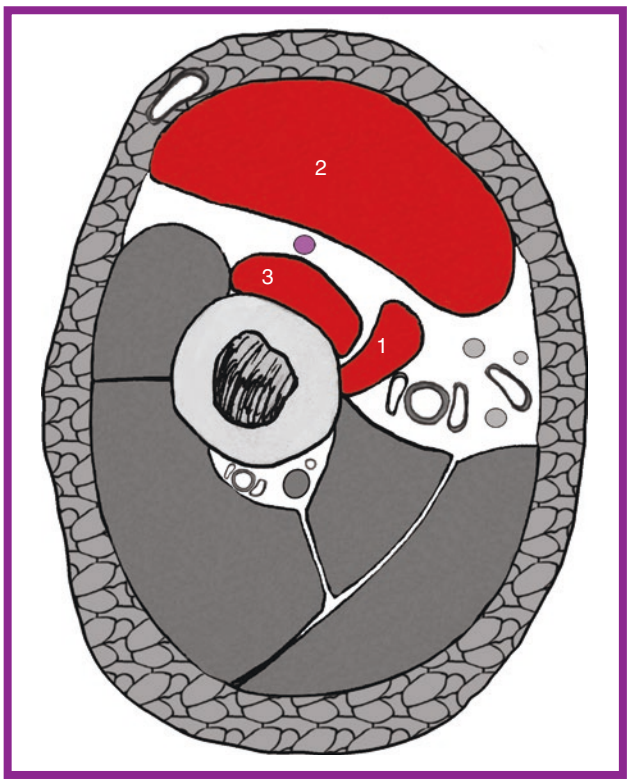
The musculocutaneous nerve innervates the coracobrachialis, biceps brachii and brachial muscles. It is thus meant for the flexion of the forearm on the arm and secondarily for supination thanks to the innervation of the biceps brachii muscle (Figures MC7 and MC8).

Sensitive Function

The sensitive function of the nerve is assured by its terminal branch, the lateral cutaneous nerve of the forearm. Its anterior branch heads towards the thenar eminence but does not take care of its innervation, and its posterior branch to the posterior and lateral face of the forearm (Figure MC8).

Anastomoses

The median nerve receives, in most cases, a branch of the musculocutaneous nerve. This nerve achieves an anastomosis at the level of the forearm with the radial nerve and on the dorsal face of the hand with the ulnar nerve.



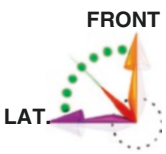


Figure MC7. Motor innervation of the musculocutaneous nerve

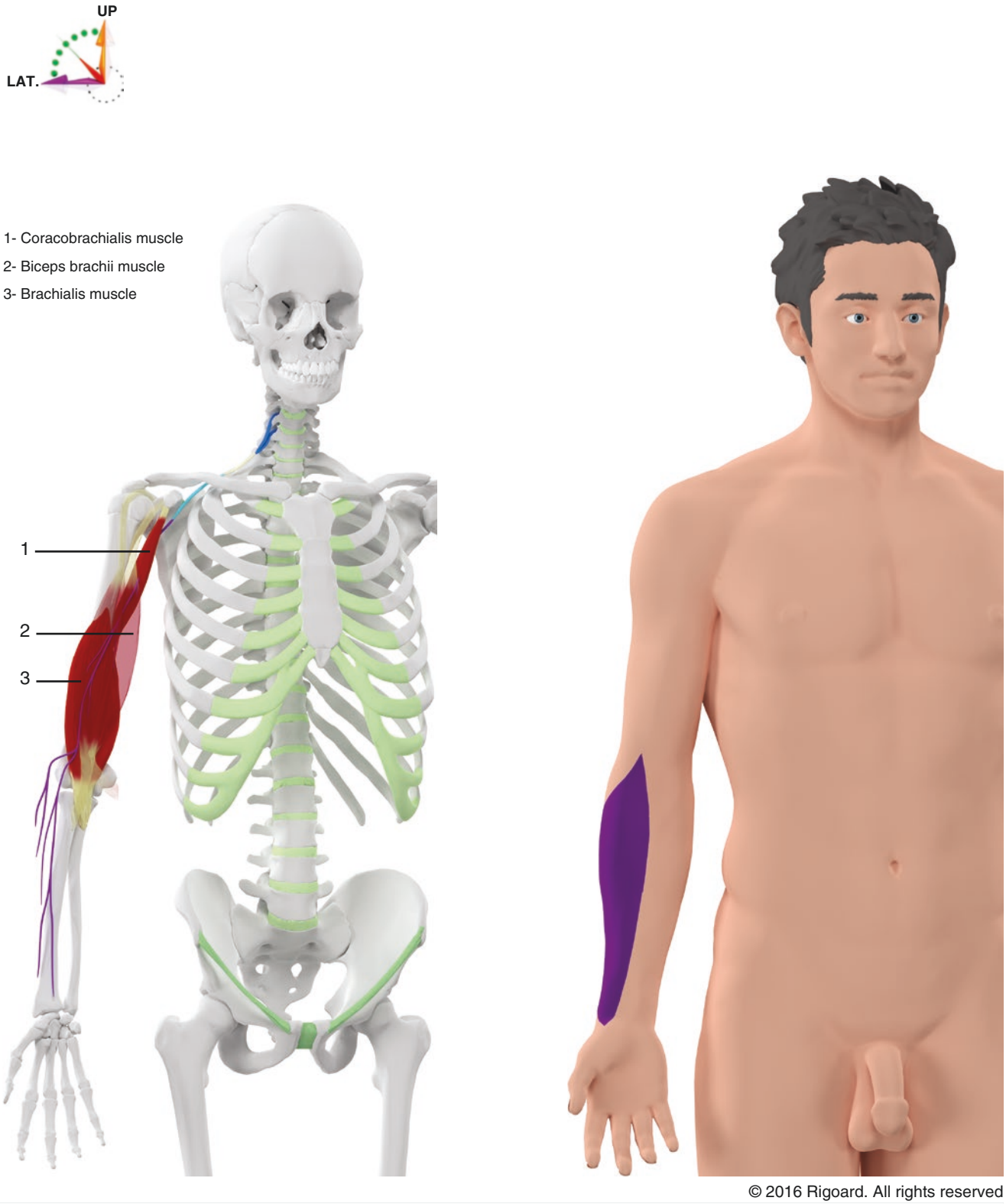
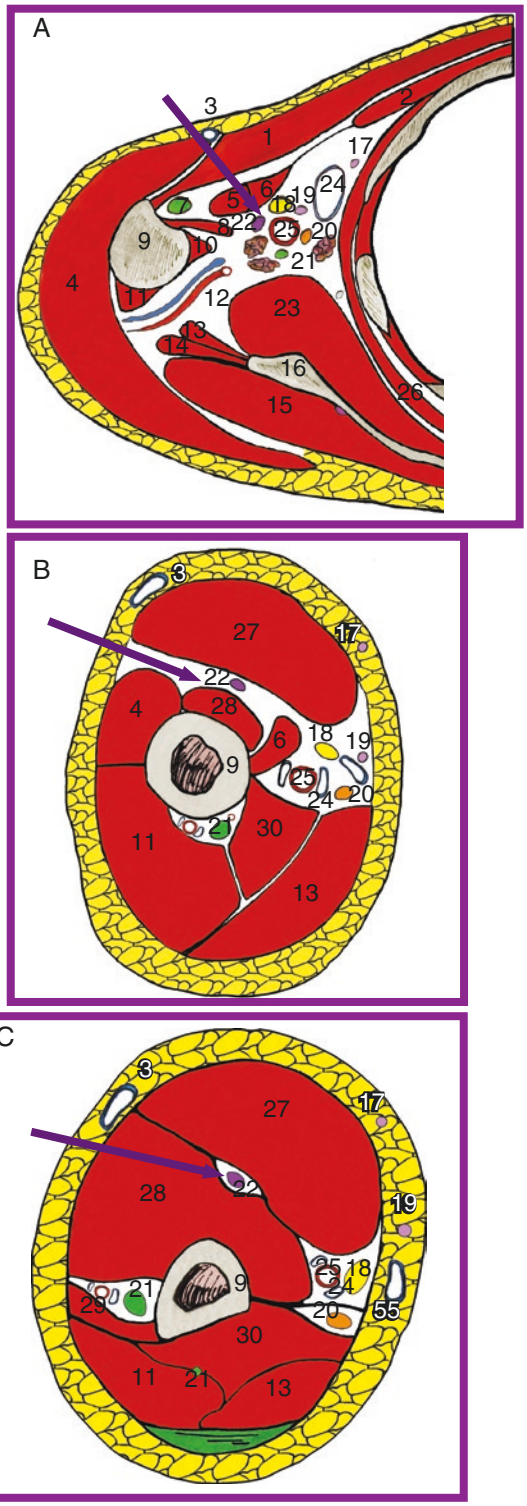


Figure MC8. Motor (**a**) and sensitive (**b**) innervation of the musculocutaneous nerve

The Musculocutaneous Nerve

1- Pectoralis major muscle
2- Pectoralis minor muscle
3- Cephalic vein
4- Deltoid muscle
5- Short head of the biceps brachii muscle
6- Coracobrachialis muscle
7- Tendon of the long head of the biceps brachii muscle
8- Latissimus dorsi muscle
9- Humerus
10- Teres major muscle
11- Lateral head of the triceps brachii muscle
12- Circumflex artery and axillary nerve
13- Long head of the triceps brachii muscle
14- Teres minor muscle
15- Infraspinatus muscle
16- Scapula
17- Medial cutaneous nerve of arm
18- Median nerve
19- Medial cutaneous nerve of forearm
20- Ulnar nerve
21- Radial nerve
22- Musculocutaneous nerve
23- Subscapularis muscle
24- Brachial vein
25- Brachial artery
26- Serratus anterior muscle
27- Biceps brachii muscle



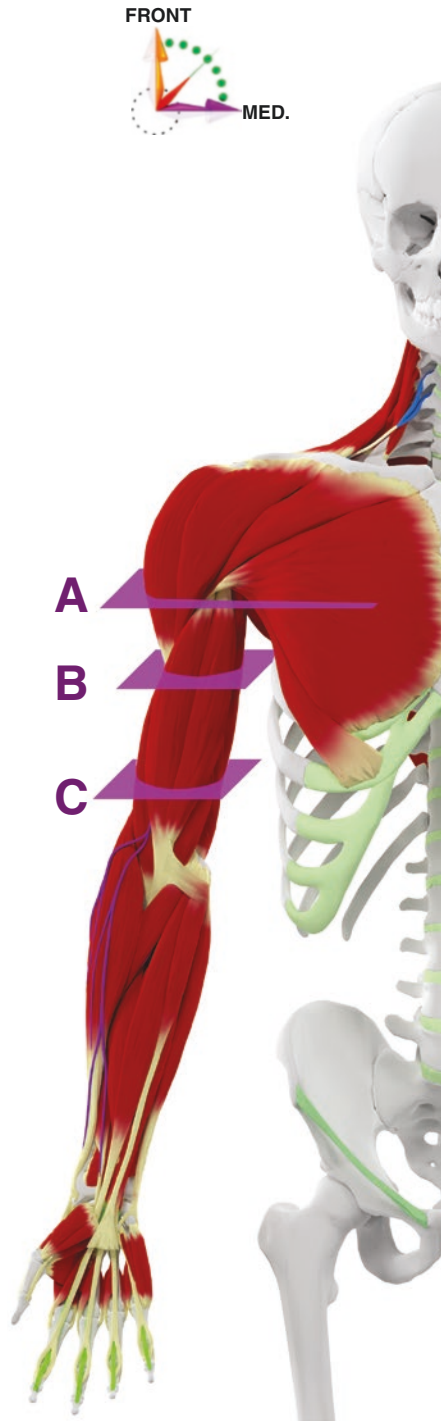
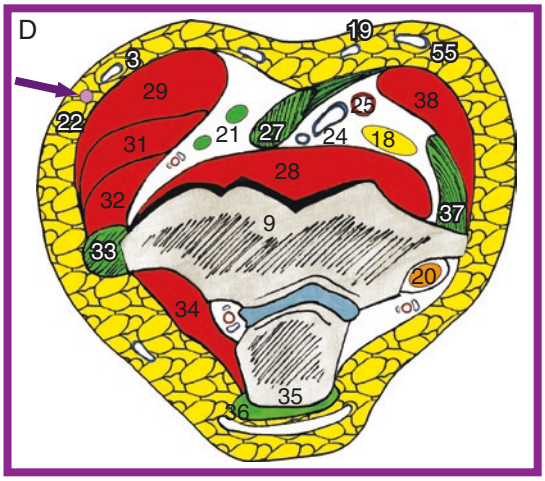
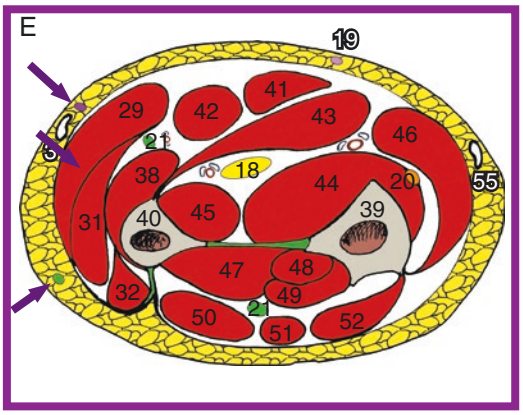
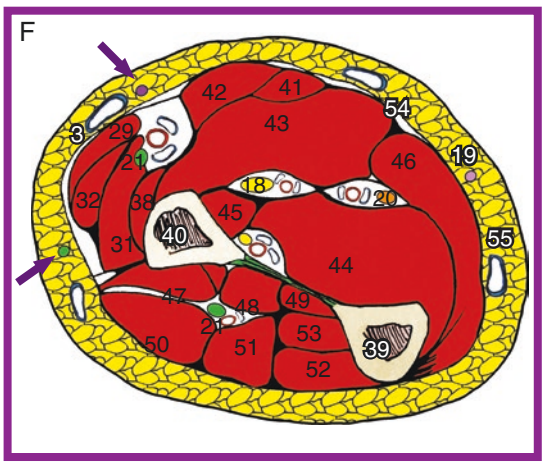


Figure MC9. Relations of the musculocutaneous nerve in the arm, axial views

28- Brachialis muscle
29- Brachioradialis muscle
30- Medial head of the triceps brachii muscle
31- Extensor carpi radialis longus muscle
32- Extensor carpi radialis brevis muscle
33- Tendon of epicondyle muscles
34- Anconeus muscle
35- Olecranon
36- Tendon of the triceps brachii muscle
37- Tendon of the median epycondylian muscles
38- Pronator teres muscle
39- Ulna
40- Radius
41- Palmaris longus muscle
42- Flexor carpi radialis muscle
43- Flexor digitorum superficialis muscle
44- Flexor digitorum profundus muscle
45- Flexor pollicis longus muscle
46- Flexor carpi ulnaris muscle
47- Abductor pollicis longus muscle
48- Extensor pollicis brevis muscle
49- Extensor pollicis longus muscle
50- Extensor digitorum muscle
51- Extensor digiti minimi muscle
52- Extensor carpi ulnaris muscle
53- Extensor indicis muscle
54- Median vein of the forearm
55- Basilic vein







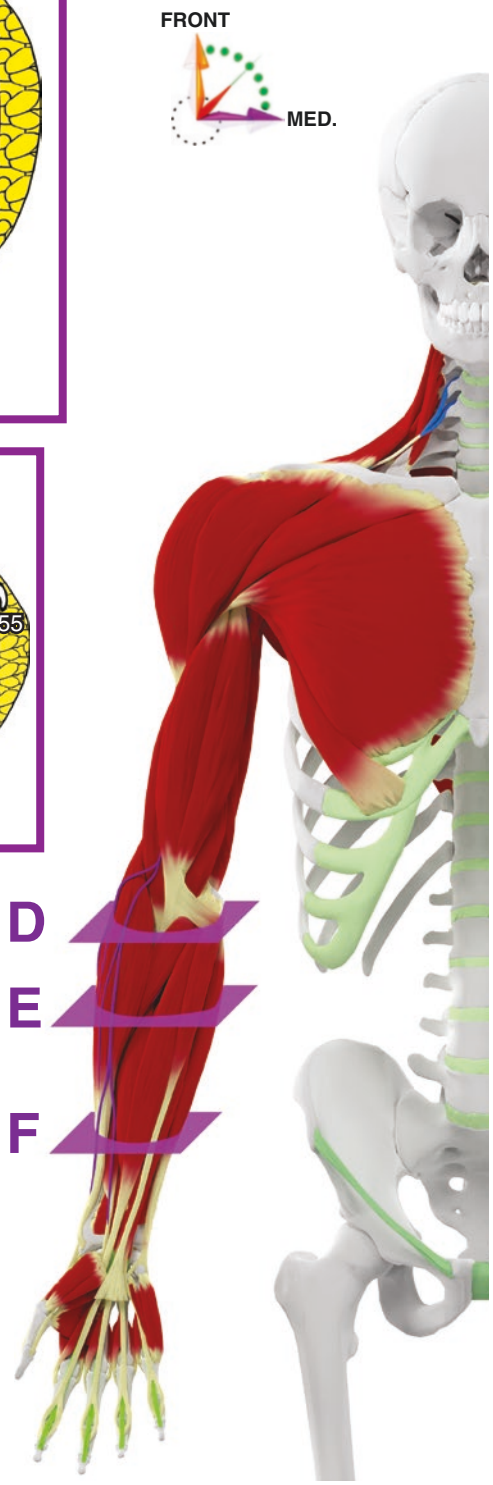


Figure MC10. Relations of the musculocutaneous nerve in the elbow and forearm, axial views

The Musculocutaneous Nerve

1- Pectoralis major muscle
2- Pectoralis minor muscle
3- Deltoid muscle
4- Long head of the biceps brachii muscle
5- Latissimus dorsi muscle
6- Humerus
7- Teres major muscle
8- Lateral head of the triceps brachii muscle
9- Medial head of the triceps brachii muscle
10- Subscapularis muscle
11- Scapula
12- Teres minor muscle
13- Infraspinatus muscle
14- Serratus anterior
15- Brachial vein
16- Brachial artery
17- Medial cutaneous nerve of arm
18- Median nerve
19- Medial cutaneous nerve of forearm
20- Ulnar nerve
21- Radial nerve
22- Axillary nerve

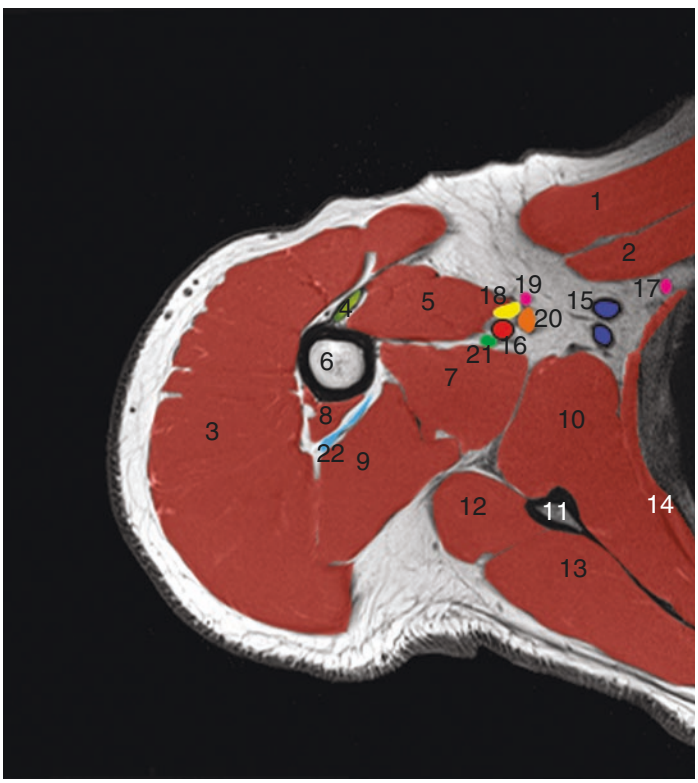
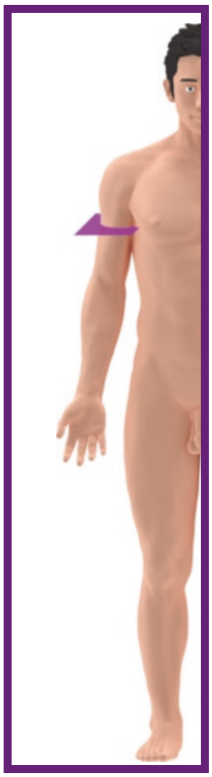
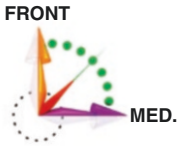
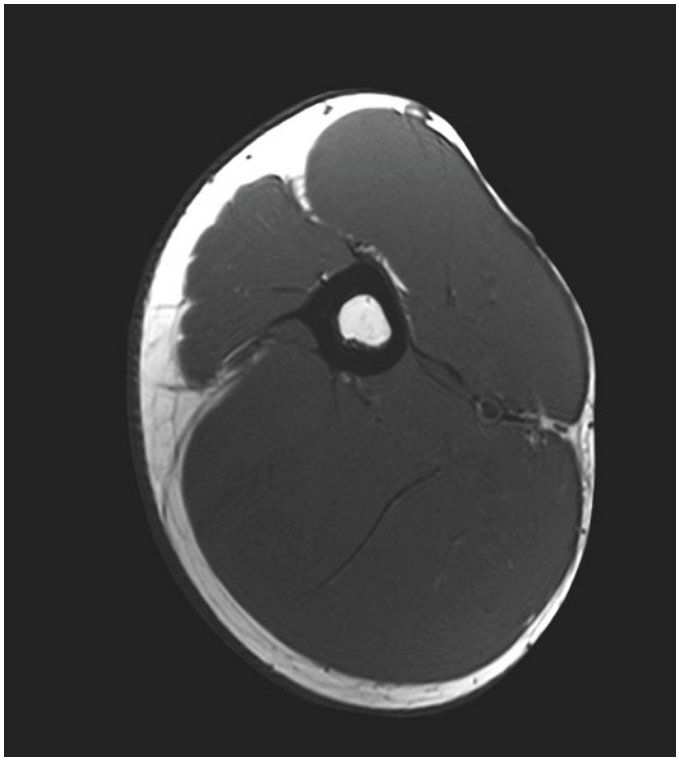


Figure MC11. MRI scans in the shoulder through the musculocutaneous nerve







1- Deltoid muscle

2- Humerus

3- Lateral head of the triceps brachii muscle

4- Medial head of the triceps brachii muscle

5- Brachial artery

6- Median nerve

7- Medial cutaneous nerve of forearm

8- Ulnar nerve

9- Cephalic vein

10- Basilic vein

11- Radial nerve

12- Musculocutaneous nerve

13- Long head of the triceps brachii muscle

14- Biceps brachii muscle

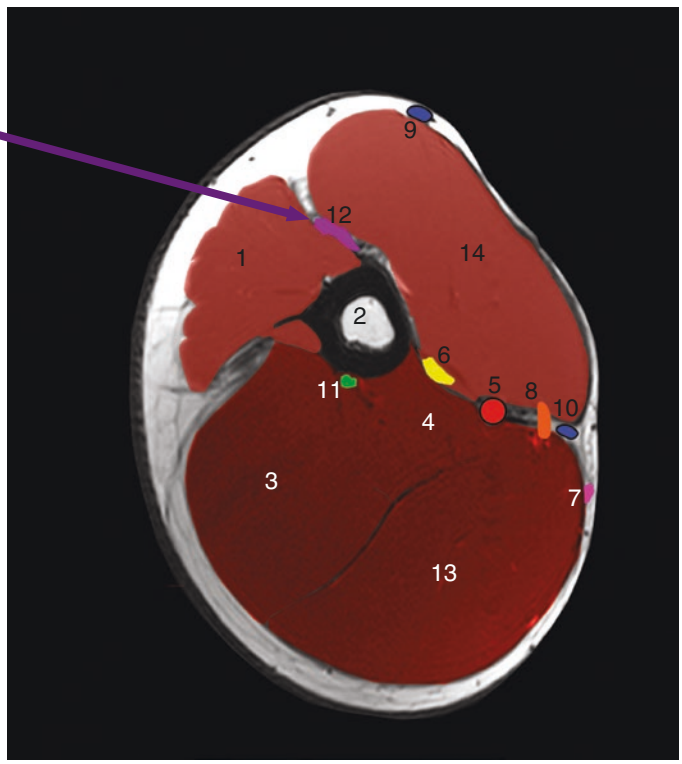
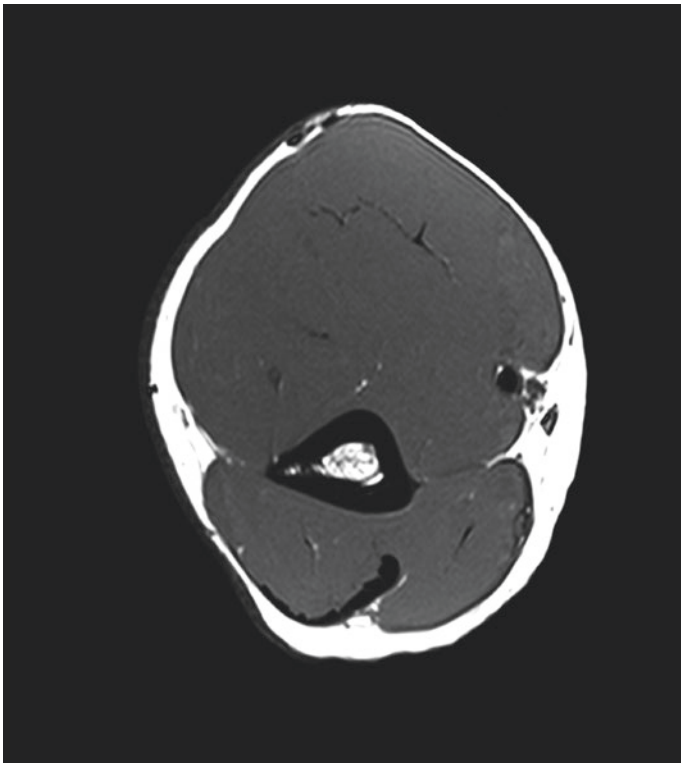
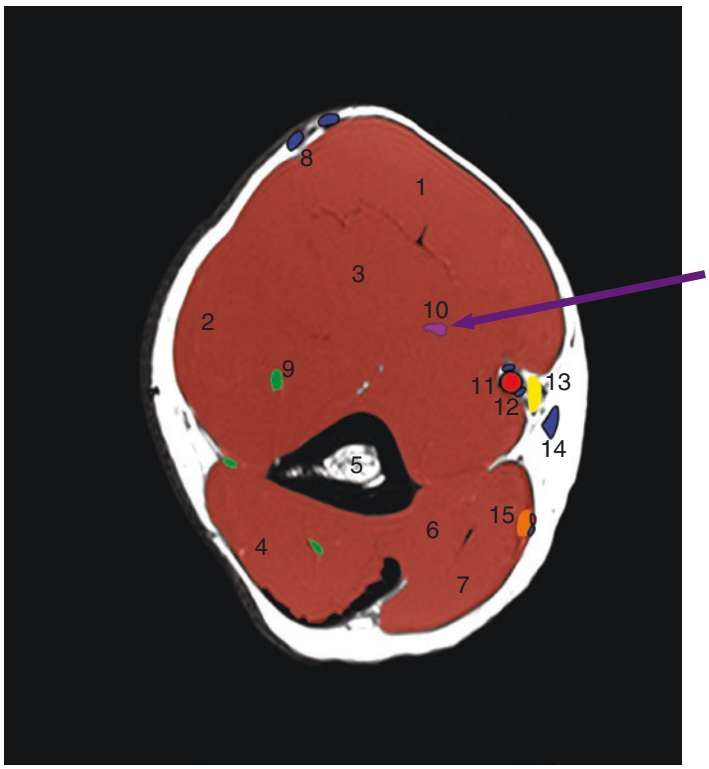


Figure MC12. MRI scans at the proximal third of the arm through the musculocutaneous nerve

The Musculocutaneous Nerve





1- Biceps brachii muscle

2- Brachioradialis muscle

3- Brachialis muscle

4- Lateral head of the triceps brachii muscle

5- Humerus

6- Long head of the triceps brachii muscle

7- Medial head of the triceps brachii muscle

8- Cephalic vein

9- Radial nerve

10- Musculocutaneous nerve

11- Brachial artery

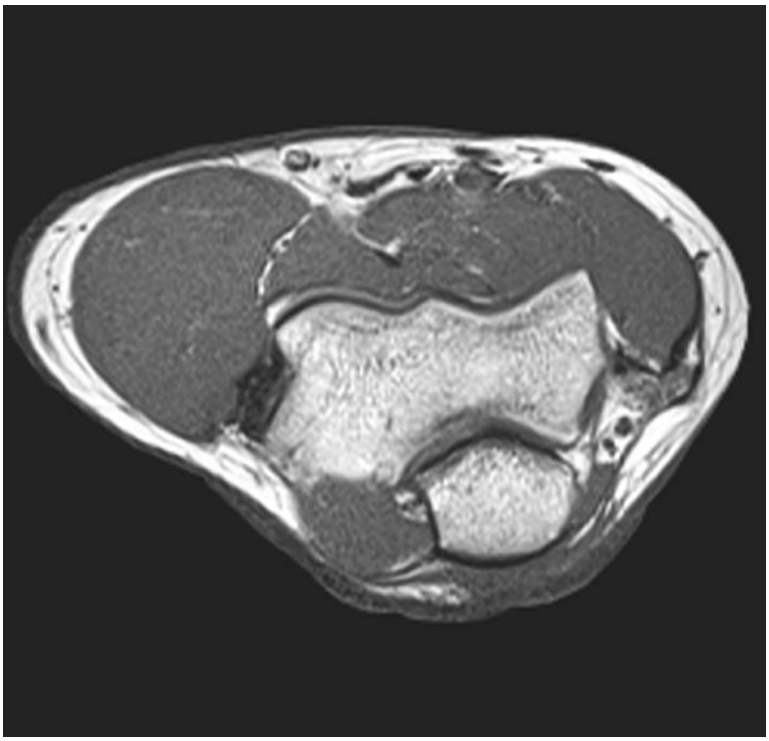
12- Brachial vein

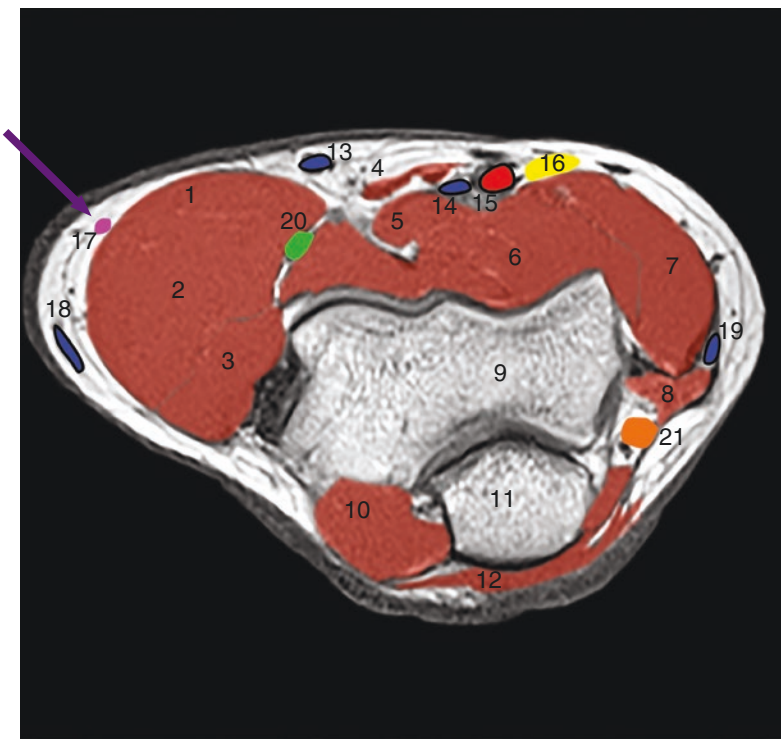
13- Median nerve

14- Basilic vein

15- Ulnar nerve

Figure MC13. MRI scans at the distal third of the arm through the musculocutaneous nerve





1- Brachioradialis muscle

2- Extensor carpi radialis longus muscle

3- Extensor carpi radialis brevis muscle

4- Biceps brachii muscle

5- Tendon of the long head of biceps

6- Brachialis muscle

7- Pronator teres muscle

8- Tendon of the median epycondylian muscles

9- Humerus

10- Anconeus muscle

11- Ulna

12- Triceps brachii muscle

13- Medial vein at the elbow

14- Brachial vein

15- Brachial artery

16- Median nerve

17- Musculocutaneous nerve

18- Cephalic vein

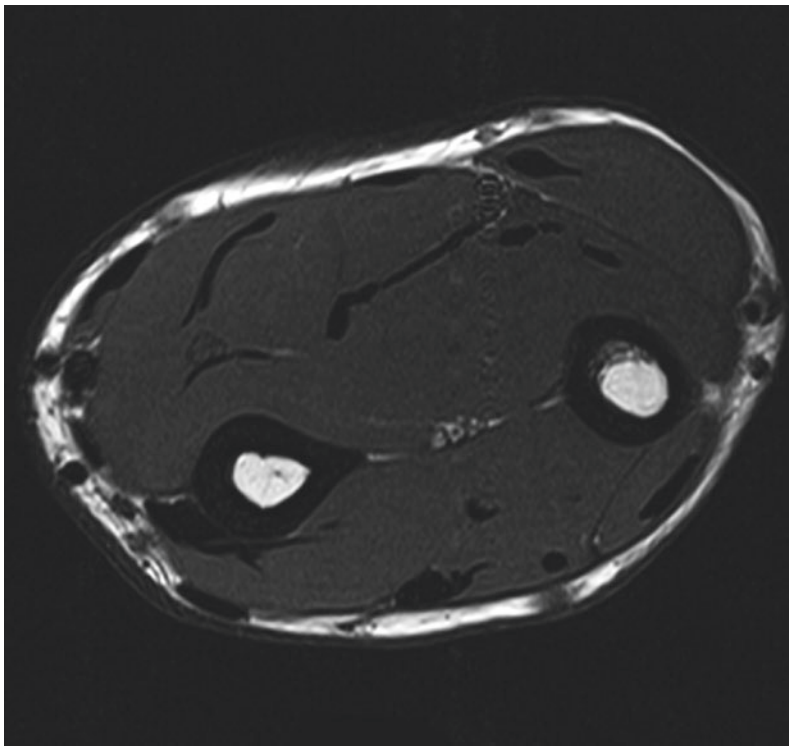
19- Basilic vein

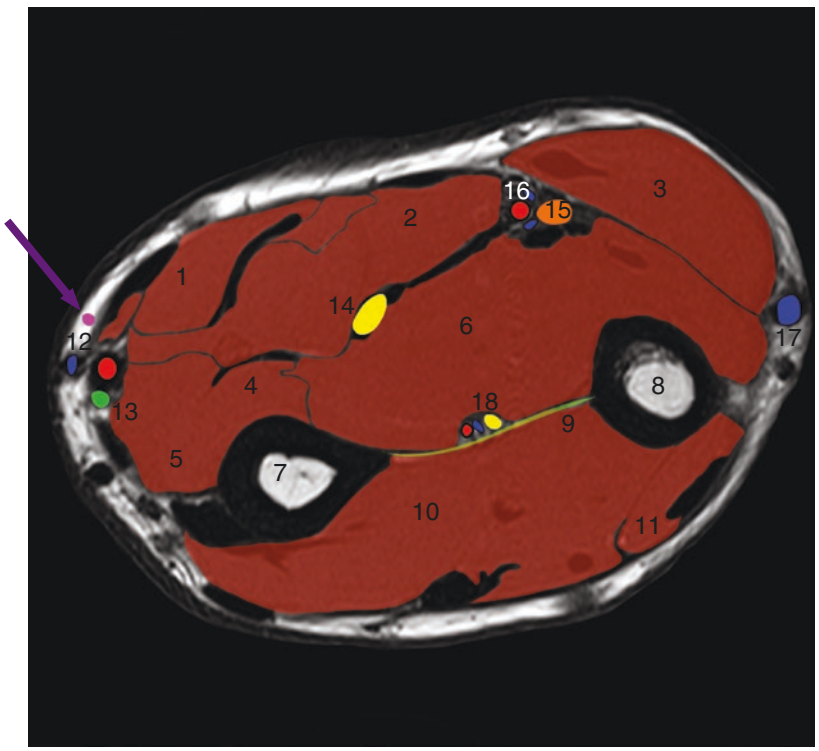
20- Radial nerve

21- Ulnar nerve

Figure MC14. MRI scans in the elbow through the musculocutaneous nerve

The Musculocutaneous Nerve





1- Flexor carpi radialis muscle

2- Flexor digitorum superficialis muscle

3- Flexor carpi ulnaris muscle

4- Flexor pollicis longus muscle

5- Extensor carpi radialis brevis muscle

6- Flexor digitorum profundus muscle

7- Radius

8- Ulna

9- Interosseous membrane of the forearm

10- Posterior compartment of the extensor digitorum muscles

11- Extensor carpi muscle

12- Radial artery and vein

13- Radial nerve

14- Median nerve

15- Ulnar nerve

16- Ulnar artery and vein

17- Basilic vein

18- Anterior interosseous artery, vein and nerve

Figure MC15. MRI scans in the forearm through the musculocutaneous nerve

Pathology

Isolated injuries of the musculocutaneous nerve are less frequent than those of other mixed nerves of the upper limb (Figure MC16).

Aetiology

- Traction: this can happen when one makes a brutal abduction movement and a lateral rotation of the arm, but it is not the main injury mechanism of the musculocutaneous nerve. If the injury is not brutal, the incriminated mechanism is more likely a disruption of the nerve's vascularisation rather than a direct injury.
- Division: this is generally postsurgical, or spontaneous in very rare cases.
- Compression: the musculocutaneous nerve can mainly be compressed at the level of two potential spots: the crossing point of the coracobrachialis muscle, at a distance equivalent to four times the width of a finger under the tip of the coracoid process, during a movement of brutal retropulsion of the scapula, and at the level of the elbow pit by the aponeurosis and the tendon of the biceps against the biceps brachii's fascia. This compression can also happen in the case of repeated and/or unusual efforts causing an abnormally intense contraction of the muscles in the upper part of the limb (mainly the biceps brachii, brachialis and coracobrachialis). If the injury is remote enough, it only affects the sensitive function of the nerve, the lateral cutaneous nerve of the forearm (as a reminder, the musculocutaneous nerve becomes the lateral cutaneous nerve of the forearm at the level of the lateral epicondyle of the humerus).

Clinical Signs

- Sensitive signs: hypoesthesia, neuropathic pain and/or paraesthesia concern the sensitive territory of the musculocutaneous nerve – the forearm's lateral face up to the thumb.
- Motor signs: the problem felt by the patient generally relates to a hypotonia of the biceps brachii. The motor dysfunction concerns the flexion of the forearm on the arm, especially when the arm is placed in a position of supination. When the injury is chronic, we can observe a global disuse atrophy of the muscles of the upper part of the limb. The bicipital reflex is not triggered anymore (C5), except in the case of an isolated injury of the lateral cutaneous nerve of the forearm.

Complementary Examinations

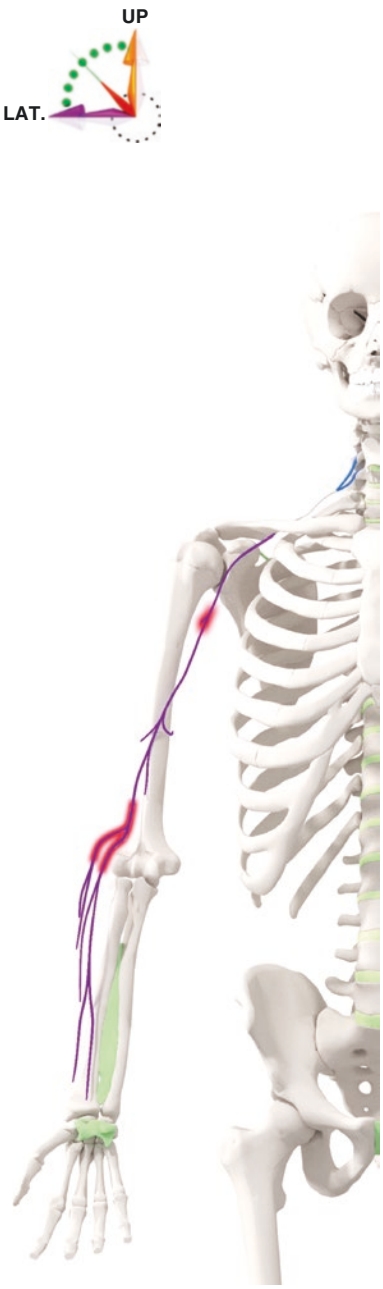
- An electroneuromyography allows the isolation of an axonal and/or demyelinating of the musculocutaneous nerve. First and foremost, it assesses the innervation of the biceps brachii muscle.

No other complementary examination is necessary in the case of clear clinical context.

Treatment

First-line treatment is analgesic and conservative. A surgical decompression will only be necessary if the conservative treatment remained unsuccessful after more than three months of follow-up.

The Musculocutaneous Nerve



a. Most common injury area of the musculocutaneous nerve.

b. Injury of the anterior branch of the musculocutaneous nerve after a fracture of the forearm's bone. From a clinical point of view, a hypoesthesia on the anterolateral face of the forearm can be observed.

c. Injury of the sensitive branches of the musculocutaneous nerve after a complex fracture of the distal extremity of the humerus

Figure MC16. Pathology of the musculocutaneous nerve.