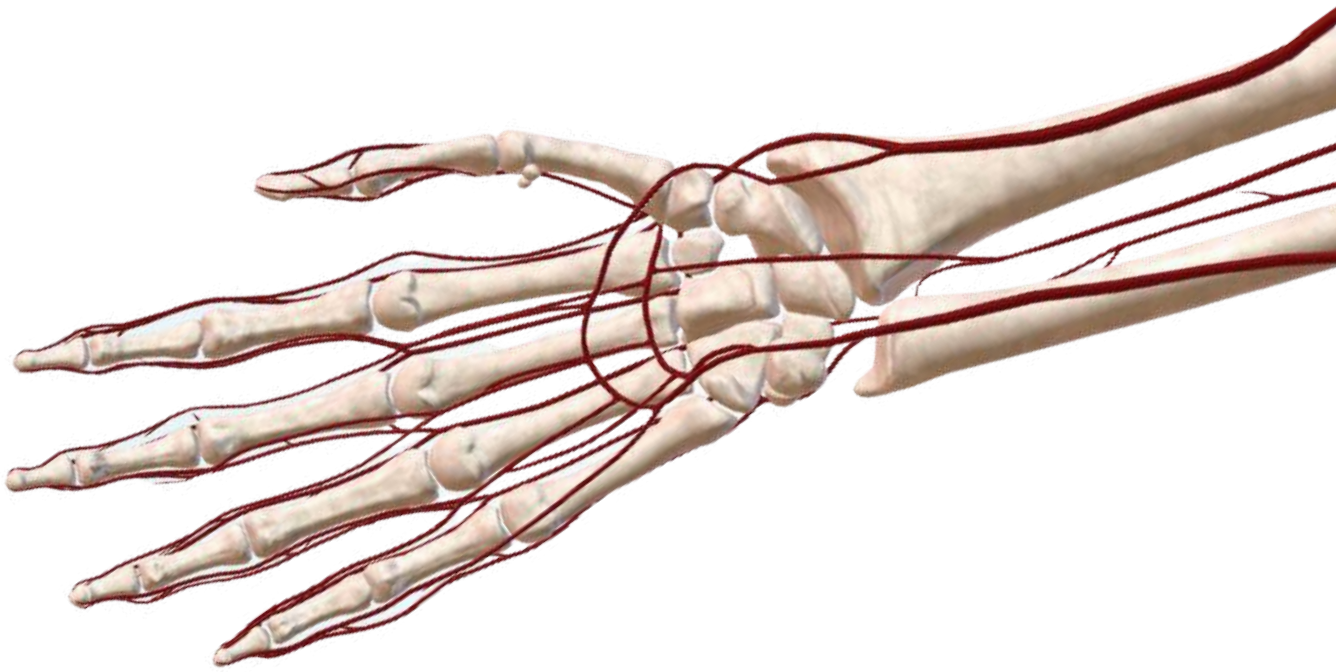
ClinicalPhysio

Course Handbook

Wrist and Hand Anatomy BootCamp

Lesson 7: Blood Supply of the Wrist and Hand



Contents

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Overview: Blood Supply

Introduction

In this tutorial, we are going to analyse the blood supply to the wrist and hand.

We are going to split this tutorial into **two different parts**:

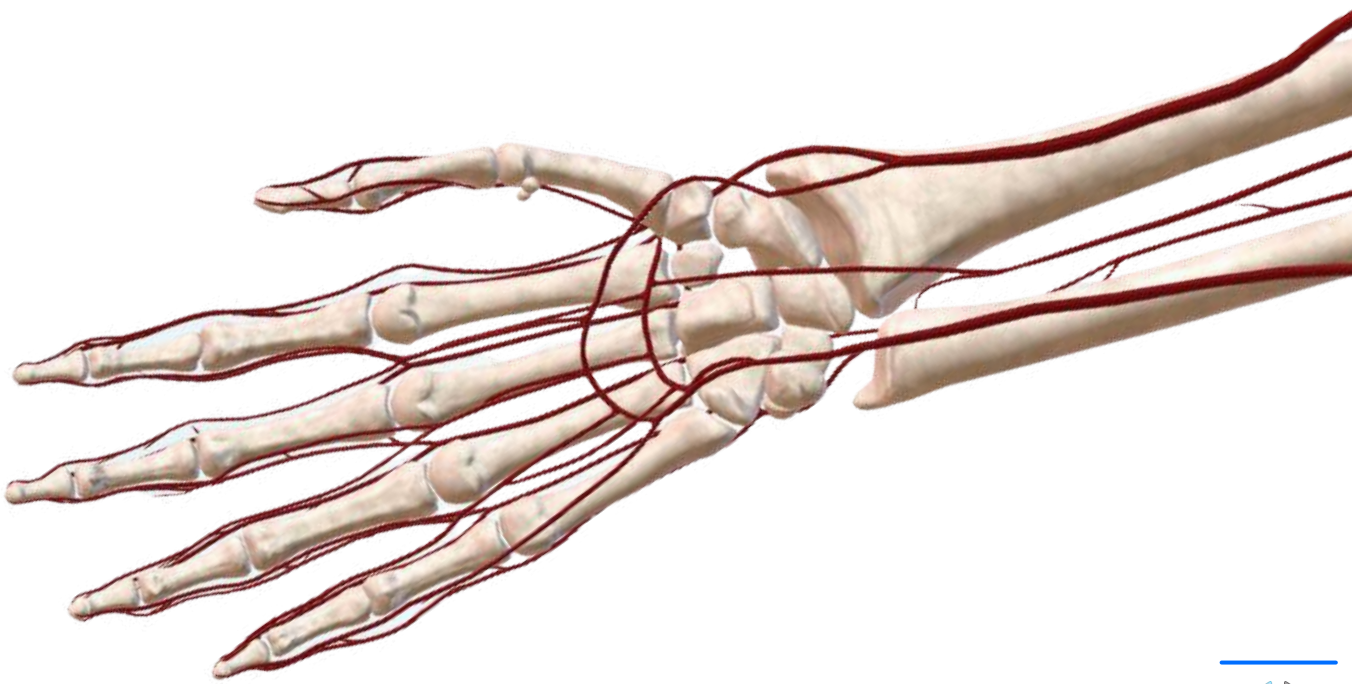
- Blood supply to the wrist (including proximal blood supply)
- Blood supply to the hand

Within musculoskeletal practice, we don't talk about the blood supply to joints as much as we do nerve supply, and this is likely to be because we see more pathologies in our MSK clinics which are related to nerve issues rather than vascular issues. It is often the case that patients with vascular pathologies are referred to other clinicians for care including their GP or a vascular consultant.

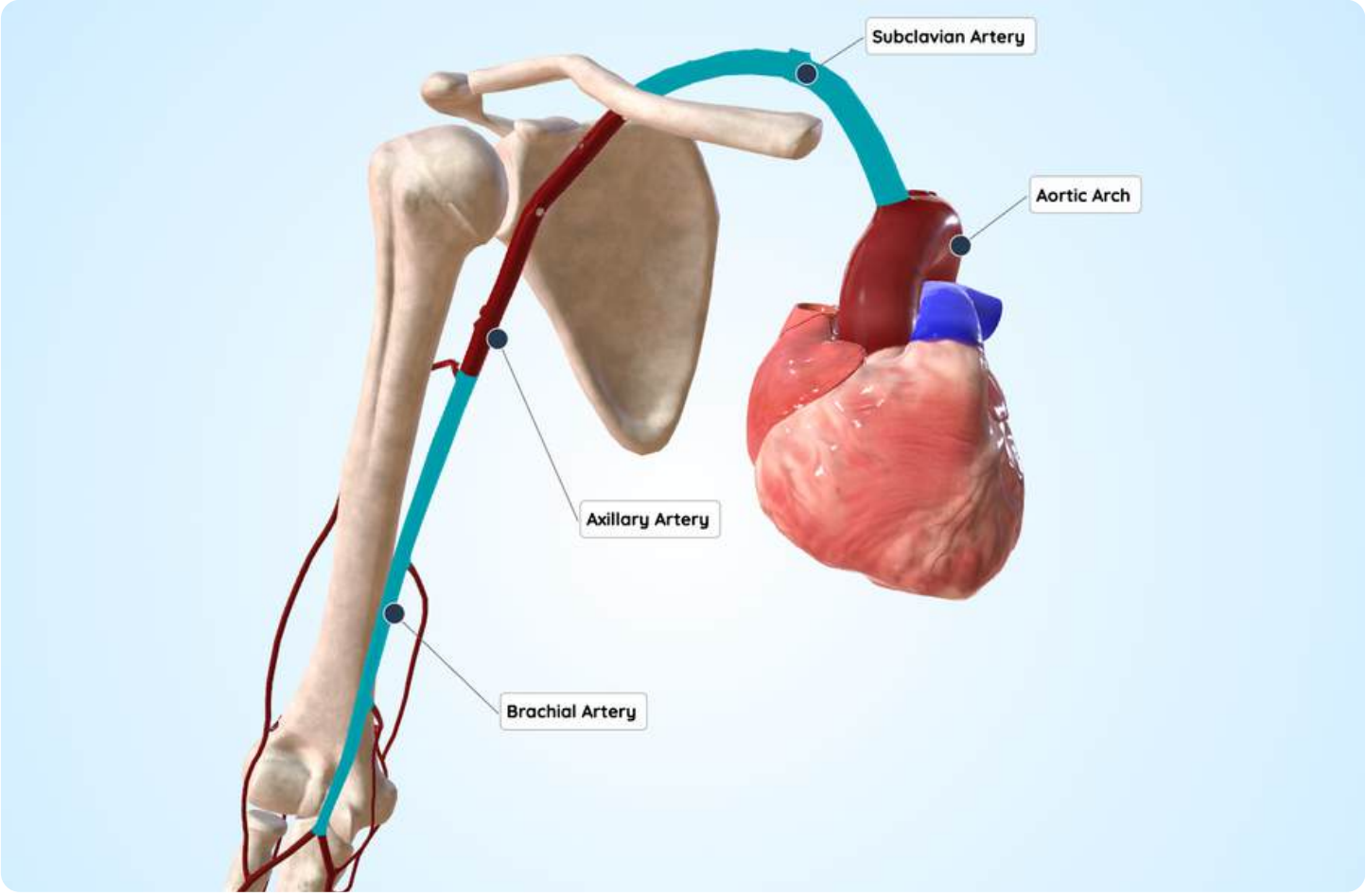
As you can probably guess, the wrist and hand has a relatively complex vascular structure with lots of different blood vessels in a very small area!

As a result of both of these points, we would absolutely recommend learning the blood supply to the wrist and hand in a more global format first; get used to the general structure before focussing on the individual vessels in detail.

One other brief point to mention... With the fact that it is such a complicated area, it is suggested that when researchers and anatomists were trying to label all these structures originally, they also would have found very small differences person to person. This means that you may find some small differences in the anatomy between different textbooks. However, these differences are often very minor, and negligible when it comes to the anatomy.



Blood Supply Proximal to Forearm



Blood Supply Proximal to the Elbow:

Let's take a moment to quickly explain how blood gets to the wrist from the heart.

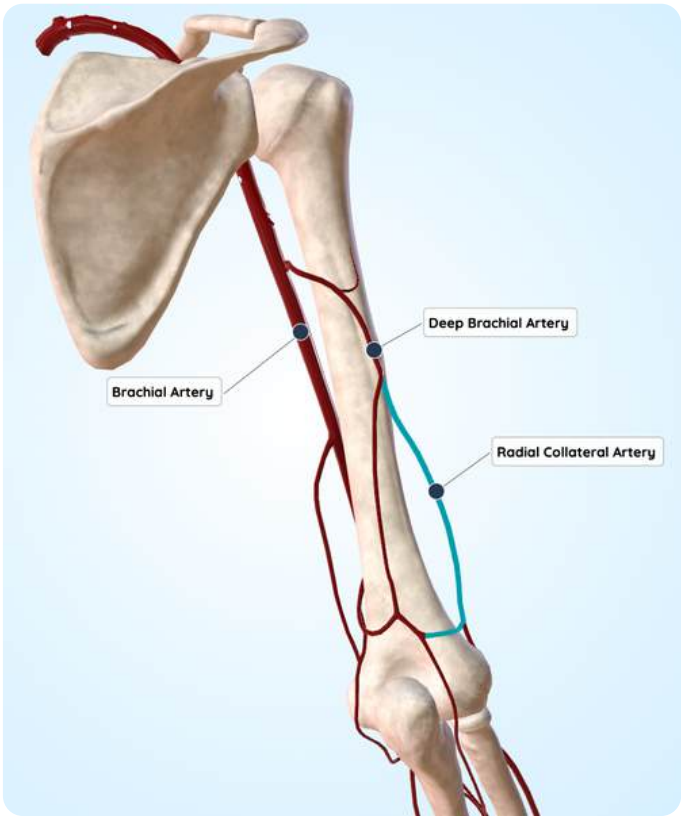
The major arterial structure exiting from the heart is the **Aortic Arch**, which has a few major arteries that branch off of it in order to supply various areas of the body.

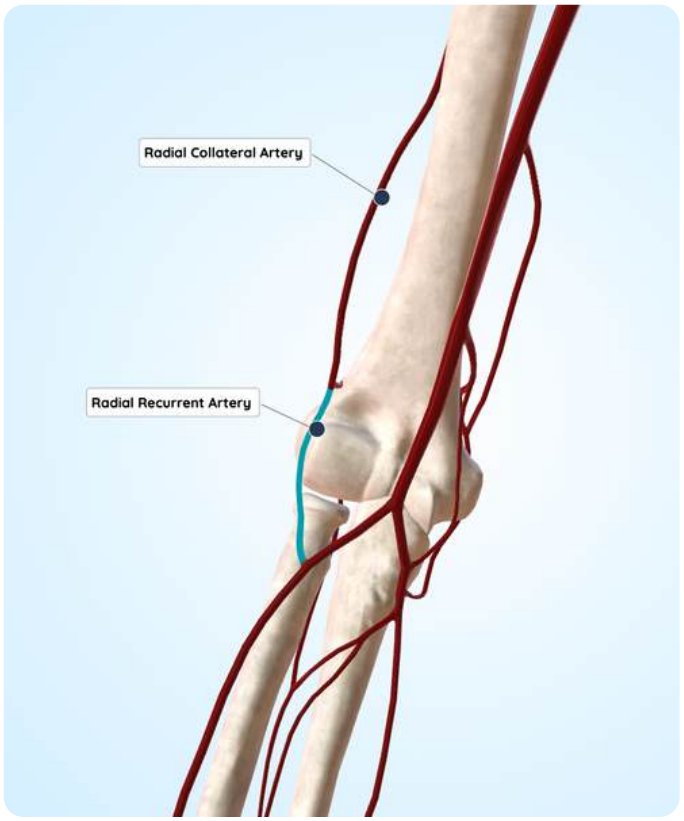
The key branch that we have that directs blood to the upper limb from the Aortic Arch is the **Subclavian Artery**. This major artery runs underneath the clavicle as the name suggests.

The Subclavian Artery terminates into the **Axillary Artery**. This artery runs through the axilla or the armpit region, as the name suggests and gives off some really important branches to the shoulder region.

The Axillary Artery then terminates into the **Brachial Artery**, and effectively all of the blood supply to the wrist and hand comes from branches of the Brachial Artery. So if there is a major injury to the brachial artery, you lose all blood supply going towards the wrist and hand.

Blood Supply Proximal to Forearm





Blood Supply Proximal to the Elbow:

A couple of vessels proximal to the elbow which are important to mention.

First we have the **Deep Brachial Artery**, which runs posteriorly at the humerus, and branches directly from the Brachial Artery.

The Deep Brachial Artery terminates into the **Radial Collateral Artery**, which we can see runs down the lateral side of the arm towards the anterior elbow, just superior to the lateral epicondyle of the humerus. It supplies blood to Extensor Carpi Radialis Longus.

Hopefully the name of this artery is easy to remember. Collateral structures (like collateral ligaments for example) are located on the sides of a joint, and with this artery having "Radial" in its name, it suggests that it is located on the radial side of the elbow joint.

The Radial Collateral Artery terminates into the **Radial Recurrent Artery** which supplies lots of wrist and finger extensor muscles. This makes sense as it runs over the lateral epicondyle, where lots of extensor muscles originate from. Muscles supplied by the Radial Recurrent Artery include Extensor Carpi Radialis Longus, Extensor Carpi Radialis Brevis, Extensor Carpi Ulnaris, Extensor Digitorum and Extensor Digiti Minimi to name a few.

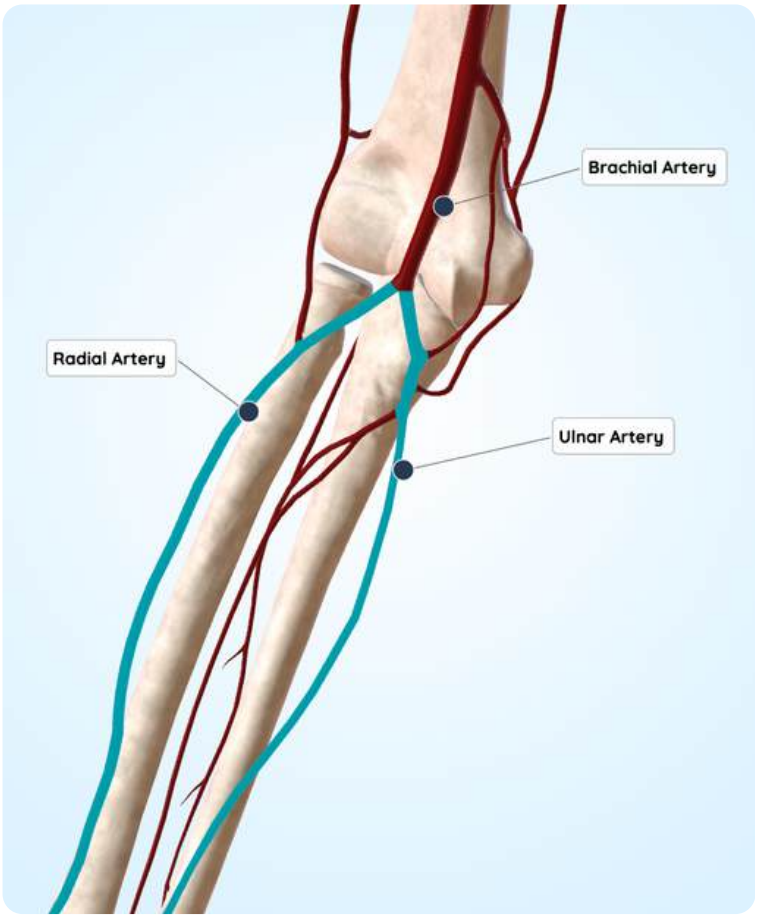
Blood Supply of the Forearm

Termination of Brachial Artery:

A really important division takes place in the cubital fossa, the anterior elbow crease, where the **Brachial Artery** terminates into the **Radial Artery** and the **Ulnar Artery**.

The Radial Artery runs all the way down the radius bone towards the wrist on the radial (lateral) side.

The Ulnar Artery runs all the way down the ulnar bone towards the wrist on the ulnar (medial) side.



Radial Artery:

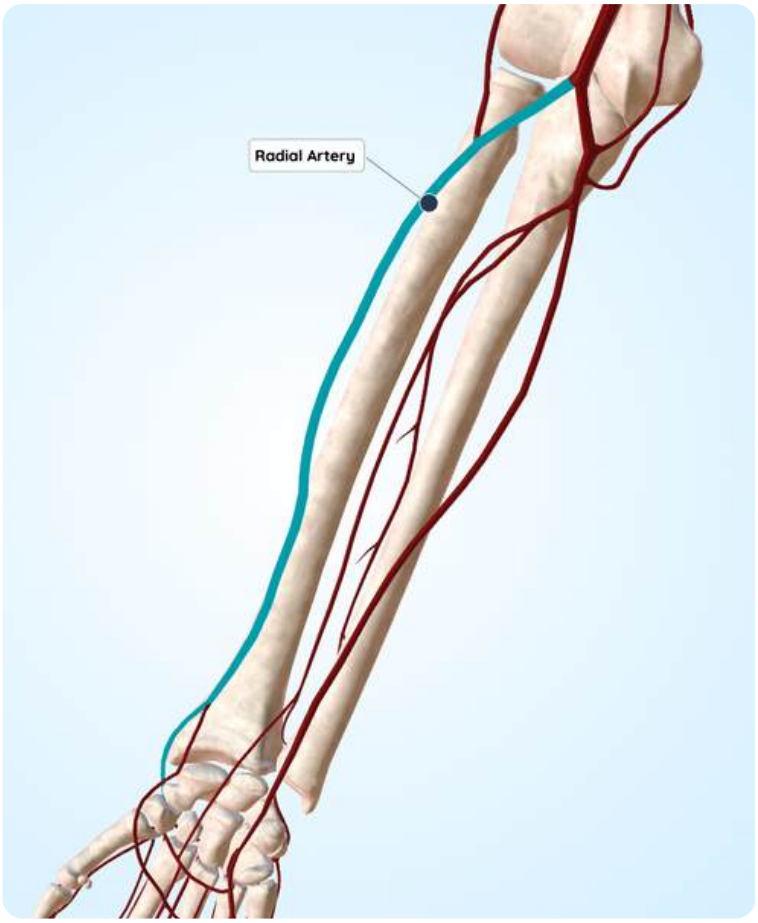
As well as the Brachial Artery, the Radial Artery also takes some supply from the Radial Recurrent Artery.

The Radial Artery then runs down the radius where it supplies muscles such as:

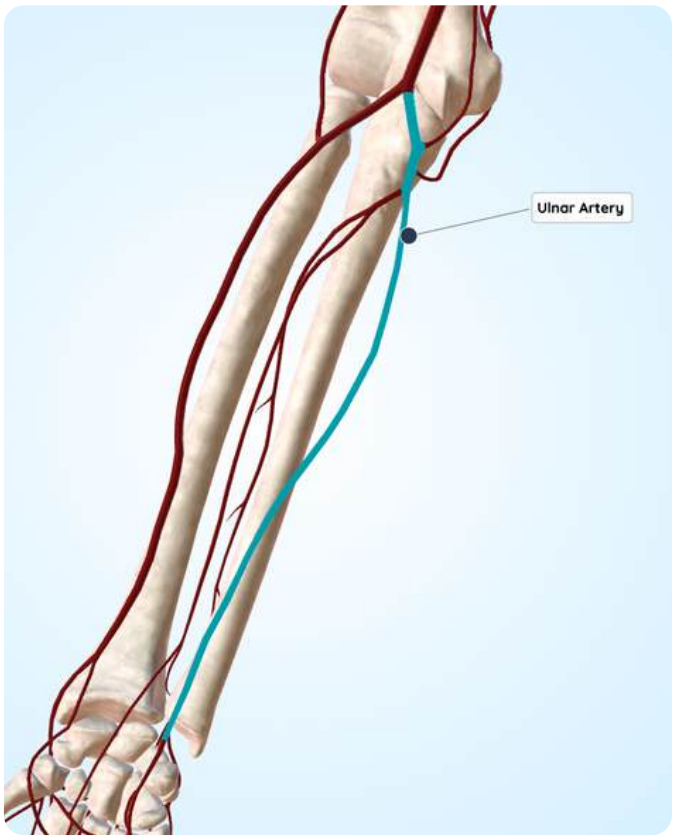
- Extensor Carpi Radialis Longus
- Extensor Carpi Radialis Brevis
- Flexor Carpi Radialis
- Flexor Pollicis Longus.

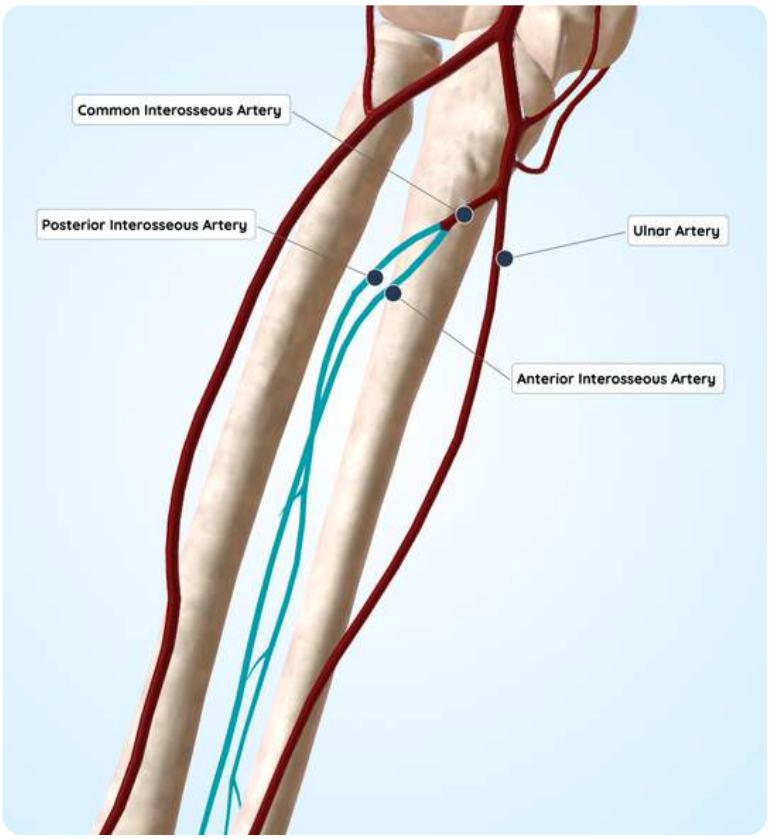
Notice how all the "Radialis" muscles are supplied by the Radial artery.

At the distal end of the radius, just proximal to our radial styloid is the point where we would place two fingers in order to take the **Radial Pulse**, the pulse of the Radial Artery.



Blood Supply of the Forearm





Ulnar Artery (and key branches):

The **Ulnar Artery** is the other terminal branch of the Brachial Artery and runs down the ulnar side of the forearm towards the hand, where it supplies muscles such as Flexor Carpi Ulnaris, Flexor Digitorum Profundus and Flexor Digitorum Superficialis.

Around the proximal ulna bone, there is a crucial branch from the Ulnar Artery which is the **Common Interosseous Artery**. This artery partly supplies Flexor Digitorum Superficialis.

The Common Interosseous Artery then splits into the **Anterior Interosseous Artery**, and the **Posterior Interosseous Artery**.

The Anterior Interosseous Artery runs down the anterior forearm, anterior to the Interosseous Membrane of the forearm. The Posterior Interosseous Artery runs down the posterior forearm, posterior to the Interosseous Membrane of the forearm. As we will see in the hand section, they then rejoin together (anastamose) to provide blood to the posterior or dorsal side of the hand at the Dorsal Carpal Arch.

These two vessels supply a lot of forearm muscles including Extensor Digitorum, Extensor Indicis, Extensor Digiti Minimi, Extensor Pollicis Longus, Extensor Pollicis Brevis and Abductor Pollicis Longus. The Anterior Interosseous Artery also supplies Flexor Digitorum Superficialis and Flexor Pollicis Longus.

Overview: Hand Blood Supply

The best way to show you the arterial structure to the hand is to start with the bigger global system. There are 3 really important arch-like structures around the hand, and effectively, the vast majority of the vessels that supply the hand come from these 3 arches. So if there is one key thought when it comes to the blood supply to the hand, it's understanding these 3 arches.

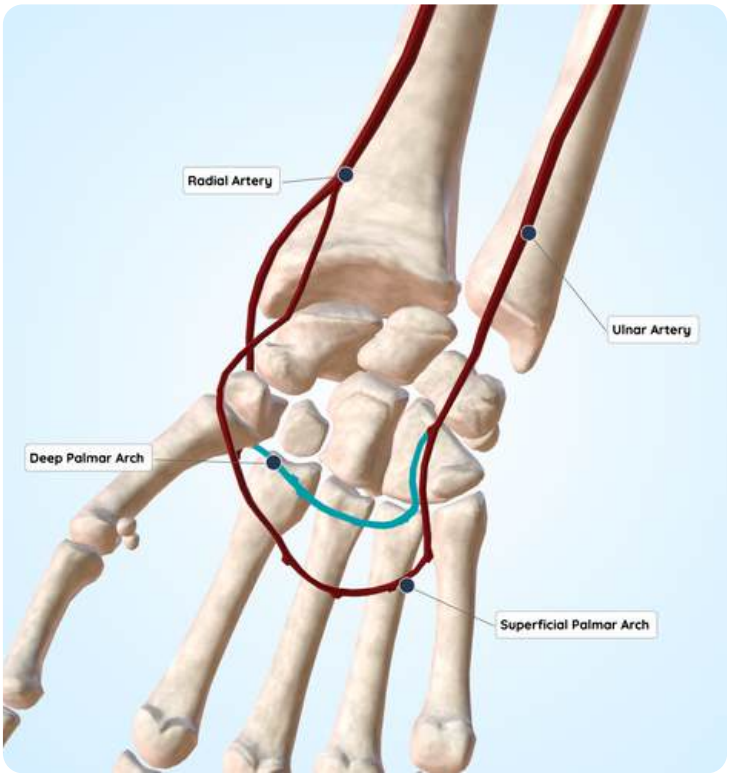
The 3 arches are:

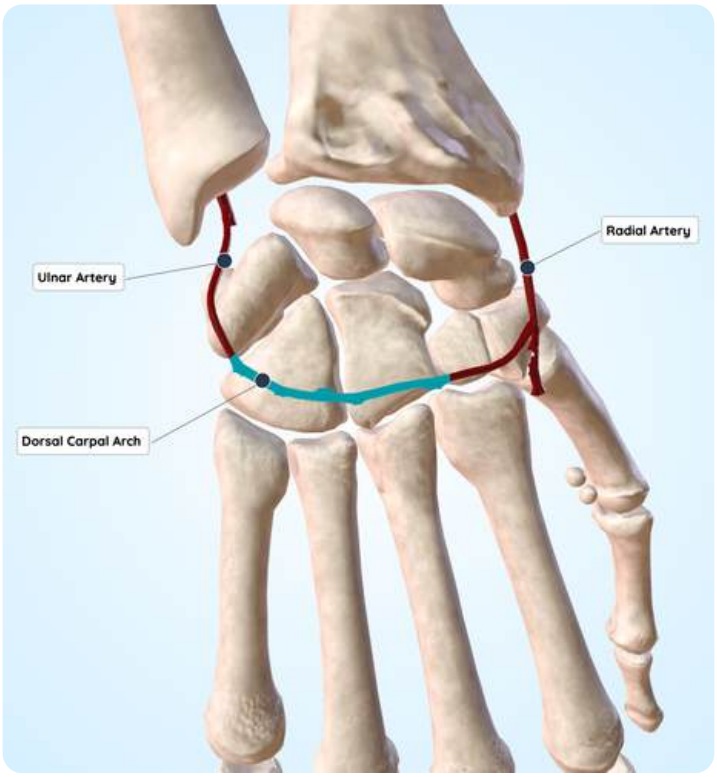
- **The Superficial Palmar Arch**
- **The Deep Palmar Arch**
- **The Dorsal Carpal Arch**

The **Superficial Palmar Arch** and the **Deep Palmar Arch** are located on the palmar or anterior side of the hand. The **Dorsal Carpal Arch** is located on the dorsal or posterior side of the hand.

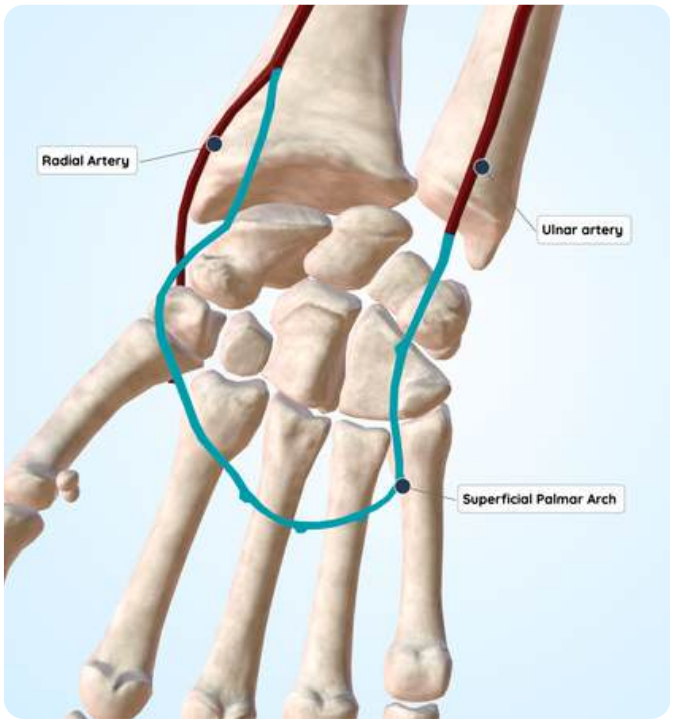
Each arch then has a series of different branches which run from the arch all the way to the distal aspect of the digits.

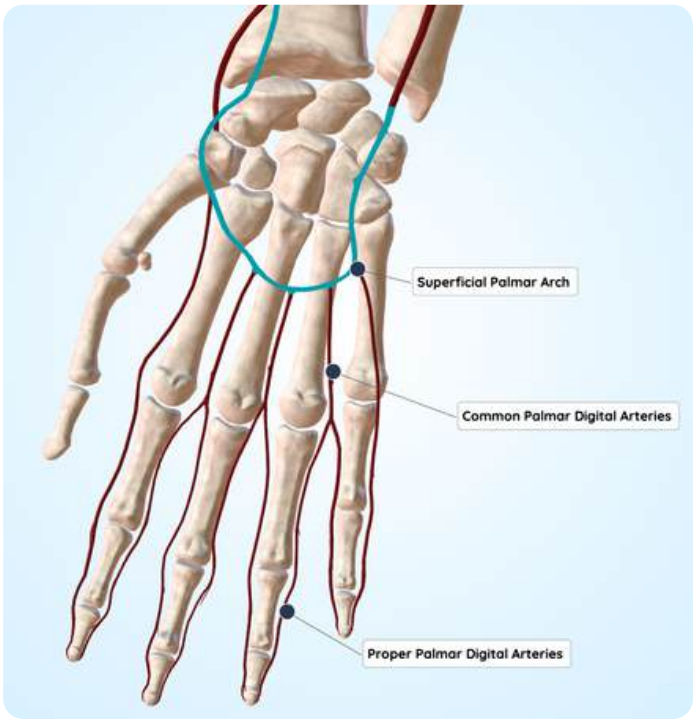
The really key thing to highlight is that each arch is formed from both the **Radial Artery** on the radial side and the **Ulnar Artery** on the ulnar side. This shows just how important these 2 arches are to the wrist and hand, because they supply the blood to each of these 3 key arches.





Superficial Palmar Arch





The **Superficial Palmar Arch** runs across the palmar surface of the hand, and is superficial to its counterpart, the Deep Palmar Arch. As mentioned, it is formed from the Radial Artery on its lateral side and the Ulnar Artery on its medial side.

It branches from the radius more proximally, just proximal to the radial styloid in fact, before swiping over the proximal metacarpal bases to join the Ulnar Artery. The Superficial Palmar Arch is said to be **mainly supplied by the Ulnar Artery**, with a smaller contribution from the Radial Artery. There are some muscles which are supplied directly by the Superficial Palmar Arch such as the Lumbricals, Abductor Digiti Minimi and Palmaris Brevis.

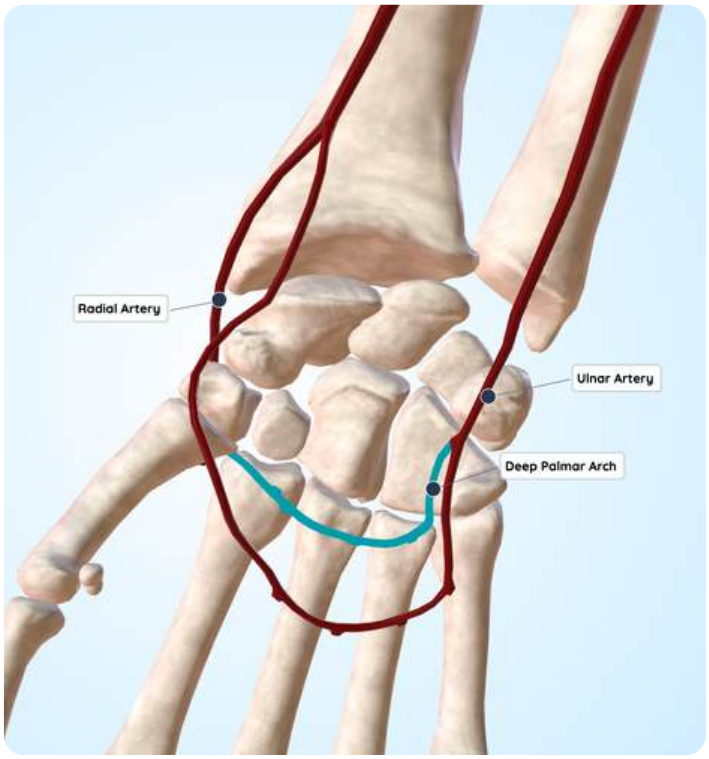
The Superficial Palmar Arch gives rise to a series of arteries that run towards the fingers. These are split into the **Common Palmar Digital Arteries**, and the **Proper Palmar Digital Arteries**.

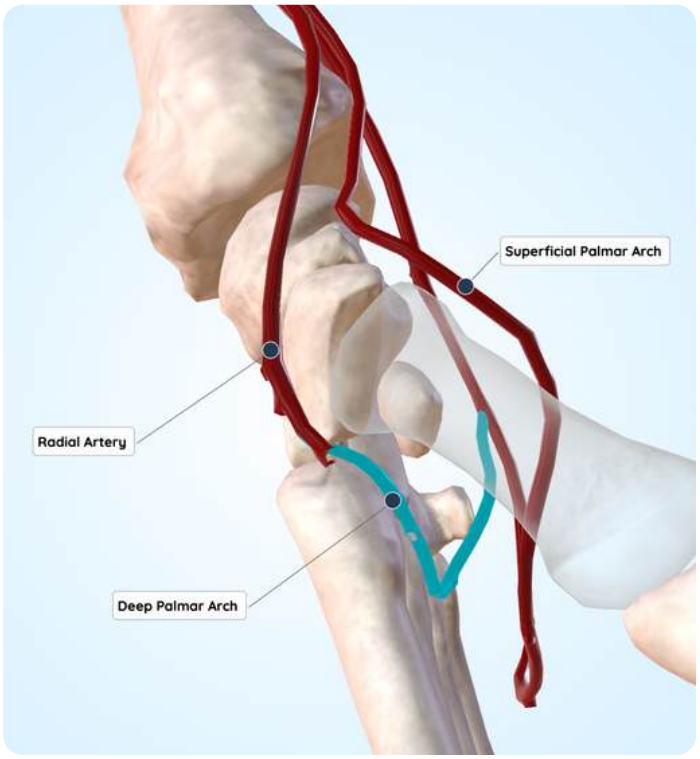
The **Common Palmar Digital Arteries** branch directly from the Superficial Palmar Arch, and then terminate to form the **Proper Palmar Digital Arteries** which run to the finger tips.

Note that in some sources:

- The Proper Palmar Digital Artery of the 5th digit actually branches directly from the Ulnar Artery, and may be referred to specifically as the Palmar Digital Artery
- The Proper Palmar Digital Artery of the 2nd digit actually branches from the Radialis Indicis Artery rather than the Common Palmar Digital Artery of the 2nd digit
- However, there is no need to be overly specific with this as an MSK clinician! The key concept to understand is that is that the Common Palmar Digital Arteries branch directly off the Superficial Palmar Arch, and they split around the MCPJ's to turn into the Proper Palmar Digital arteries, which run all the way to the fingertips.

Deep Palmar Arch

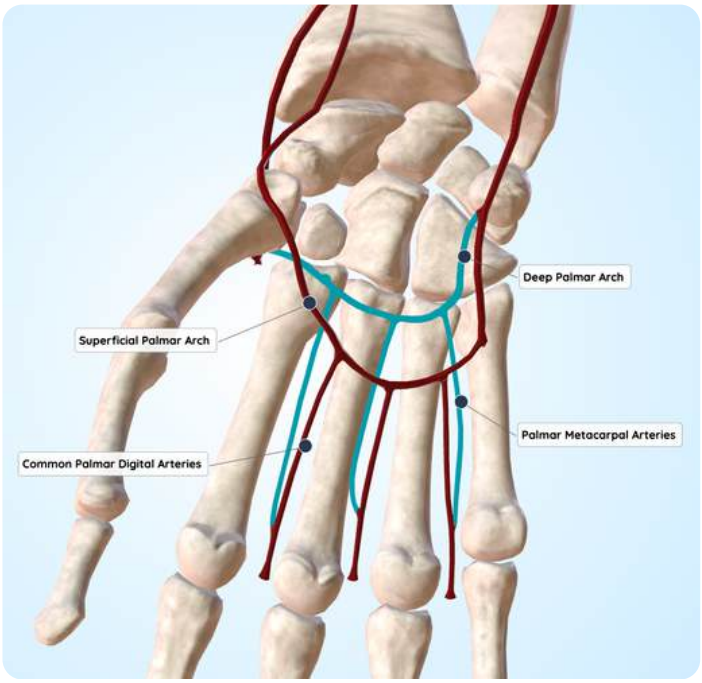




The **Deep Palmar Arch** naturally sits deeper than the Superficial Palmar Arch.
The Deep Palmar Arch takes most of its supply from the Radial Artery, with a smaller supply from the Ulnar Artery (which is the opposite of the Superficial Palmar Arch).

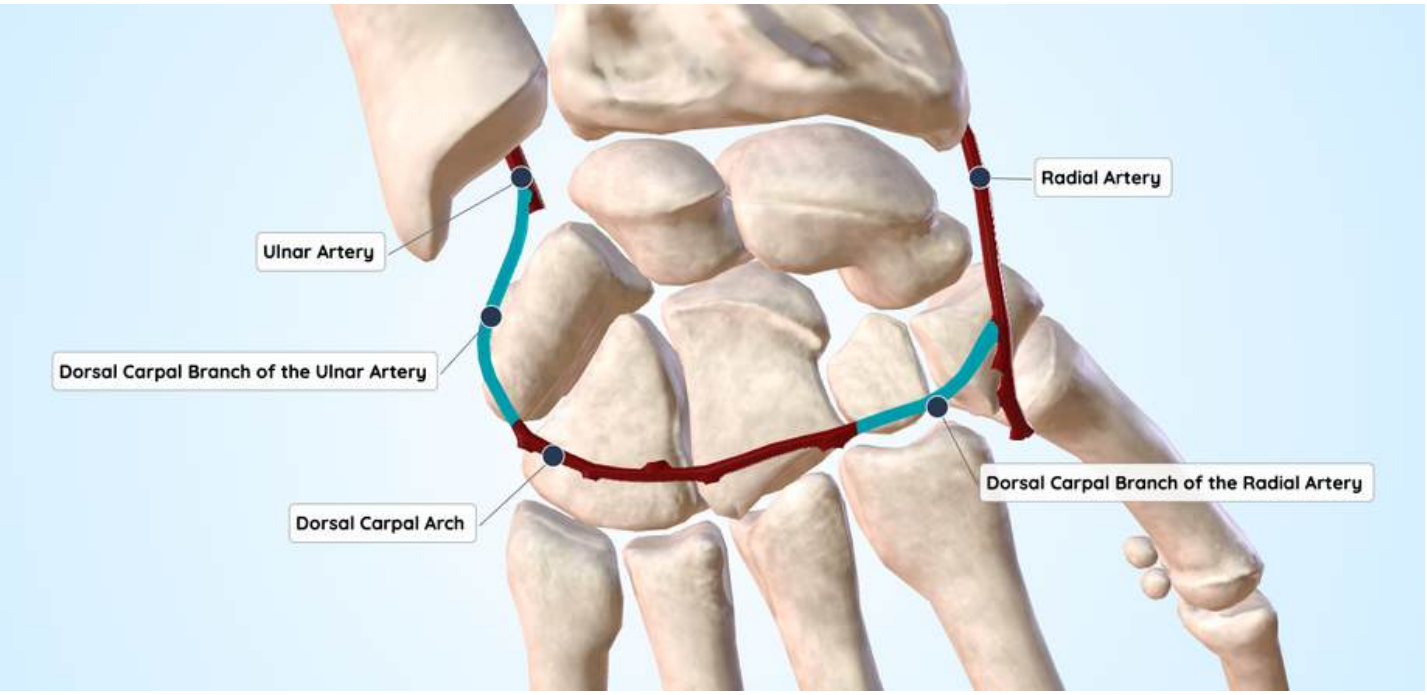
The above image on the right shows how it branches from the Radial Artery and runs in the webspace between the thumb and the index finger before running to the palmar side of the hand. Muscles which take their supply directly from the Deep Palmar Arch include Adductor Pollicis Muscle and the Palmar Interossei.

The biggest function of the Deep Palmar Arch (like the Superficial Palmar Arch) is to create a network of arteries which branch off of it, which are called the **Palmar Metacarpal Arteries**. We can see that there are 3 of these.



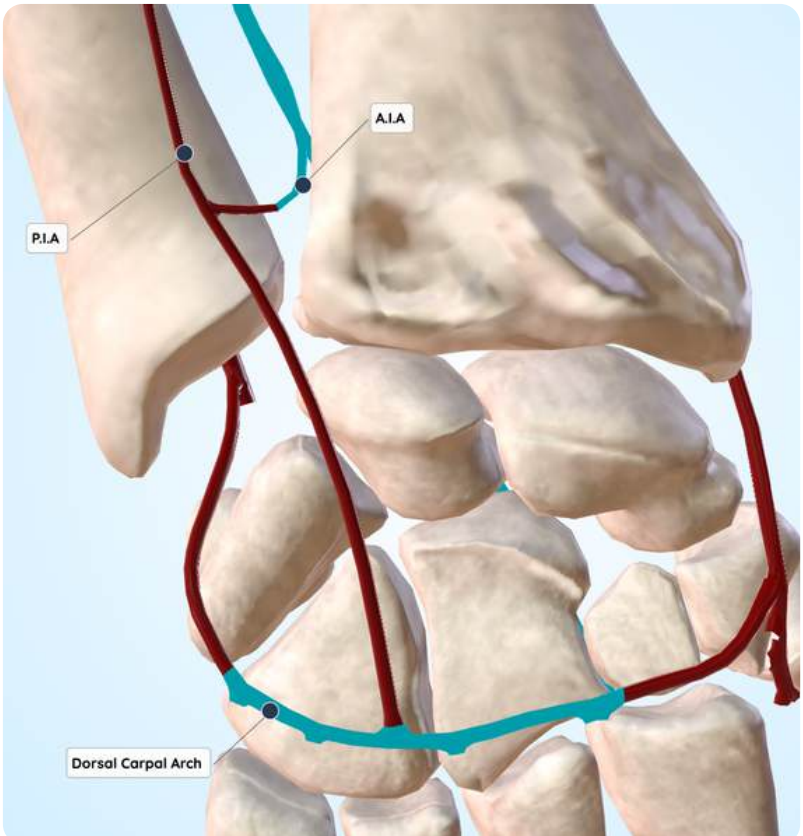
The **Palmar Metacarpal Arteries** (from the Deep Palmar Arch) join on or anastamose with the Common Palmar Digital Arteries that we saw coming from the Superficial Palmar Arch. This means that together, these sets of arteries create the additional arterial supply to the distal digits, the Proper Plantar Digital Arteries, which we saw on the last page.

Dorsal Carpal Arch



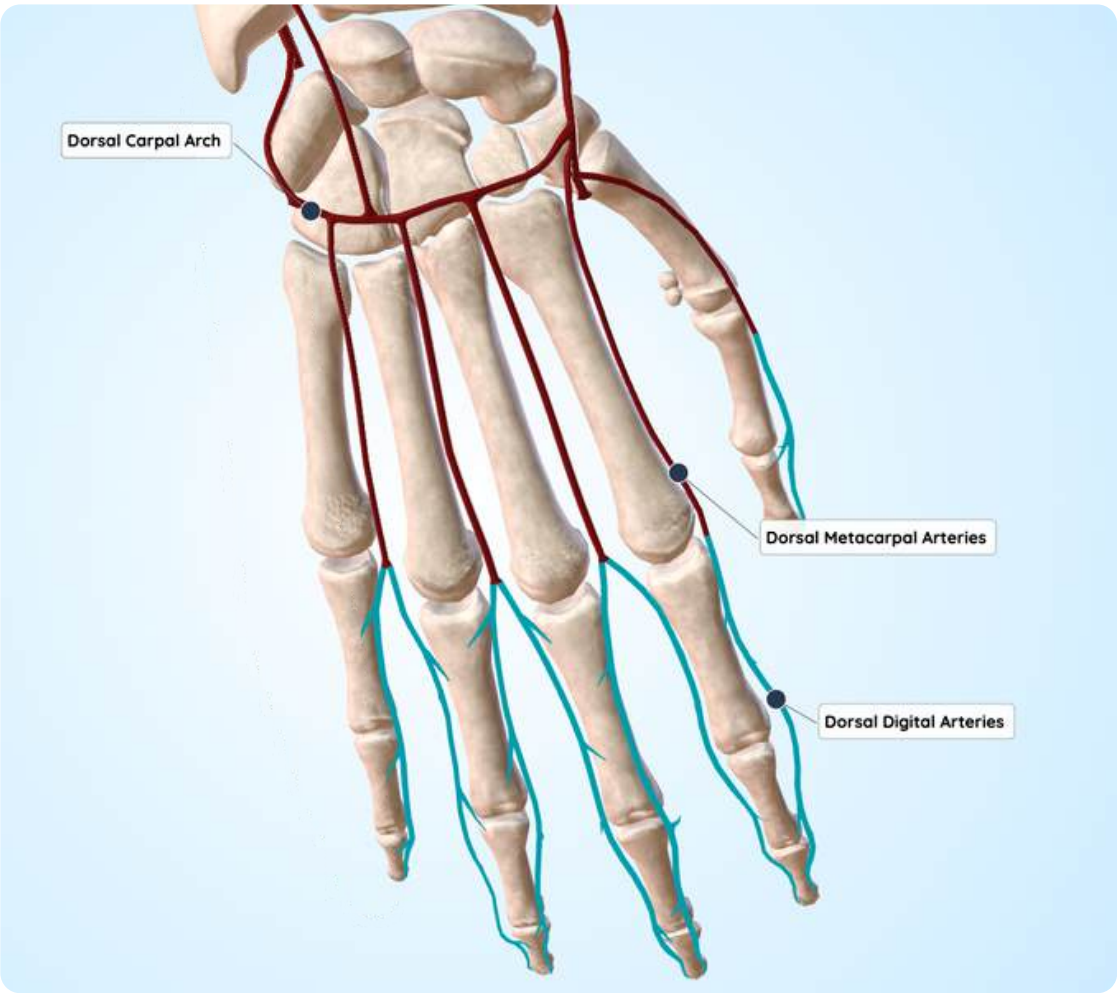
The key arch on the dorsal or posterior side of the hand is the **Dorsal Carpal Arch** (the arch, that runs on the dorsal side of the carpal bones).

This arch is also supplied by the Radial and Ulnar Arteries, with some specific branches. The Radial Artery has a specific branch that runs to the dorsum of the hand which is called the **Dorsal Carpal Branch of the Radial Artery**. The Ulnar Artery, which actually sits quite anteriorly, has its own branch which runs posteriorly towards the dorsum of the hand which is the **Dorsal Carpal Branch of the Ulnar Artery**. Therefore, it is these two key branches from the Radial and Ulnar Arteries, that supply the Dorsal Carpal Arch.



There is one other really important supply that comes into the Dorsal Carpal Arch. The **Anterior Interosseous Artery** and the **Posterior Interosseous Artery** join together or anastamose in the distal forearm, and their anastamosis carries on to insert into the Dorsal Carpal Arch.

Dorsal Carpal Arch



In the same way that the Deep Palmar Arch and the Superficial Palmar Arch had their own branches that ran to the fingers, the Dorsal Carpal Arch is the same.

The key arteries which branch off the Dorsal Carpal Arch are called the **Dorsal Metacarpal Arteries**; the arteries that run along the metacarpals on the dorsal side of the hand.

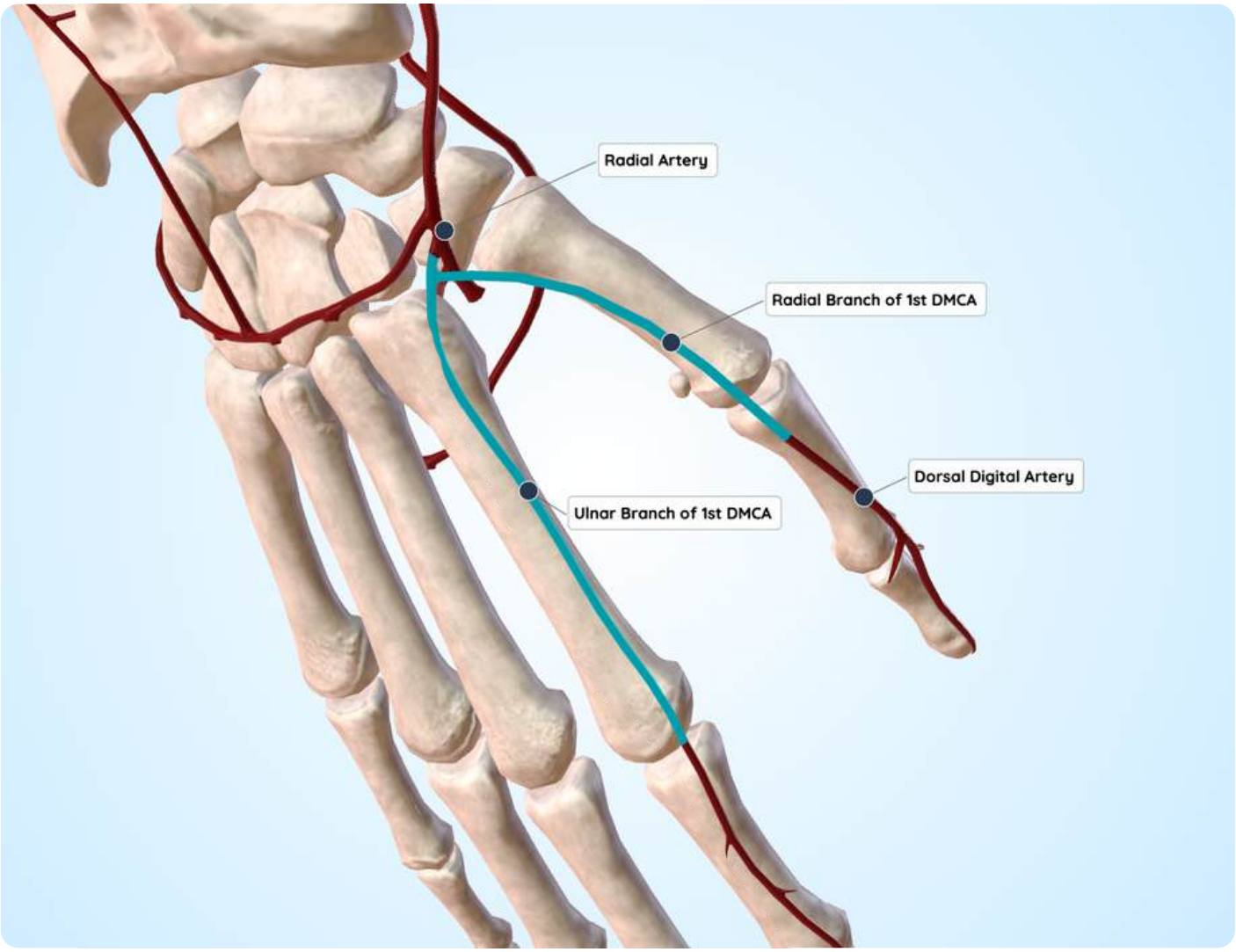
It's important for us to point out however, that the **1st Dorsal Metacarpal Artery** actually comes from the Radial Artery direct, whereas the **2nd, 3rd and 4th Dorsal Metacarpal Arteries** come directly from the Dorsal Carpal Arch.

These arteries supply the Lumbricals as well as the Dorsal Interossei.

The Dorsal Metacarpal Arteries then terminate into the **Dorsal Digital Arteries**, which run all the way to the distal phalanges of the digits.

Additional Arteries of the Thumb

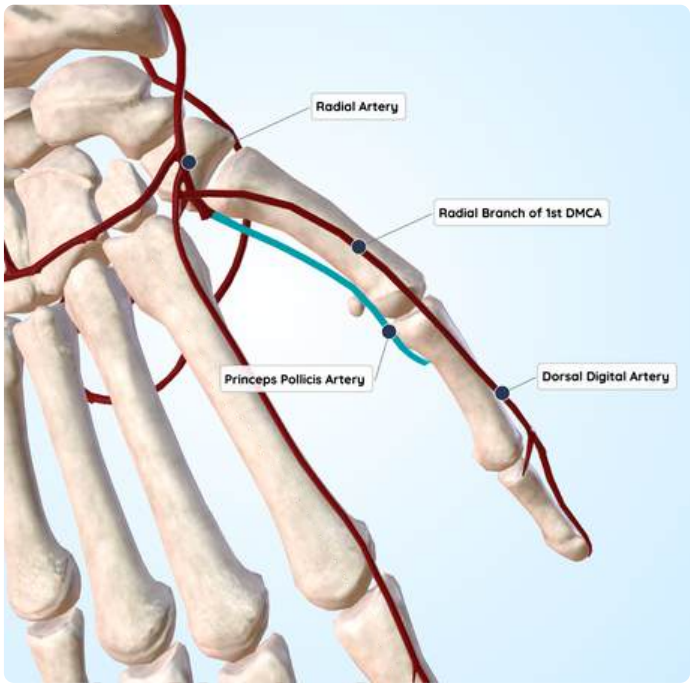
In the overview on page 2, we mentioned that you may find some small differences in textbooks for different arterial supply in the hand. One of the areas that definitely has differences is the thumb. Once again, the differences are negligible, and more importantly, we are going to teach you the way we think is best from our research around the subject as well.

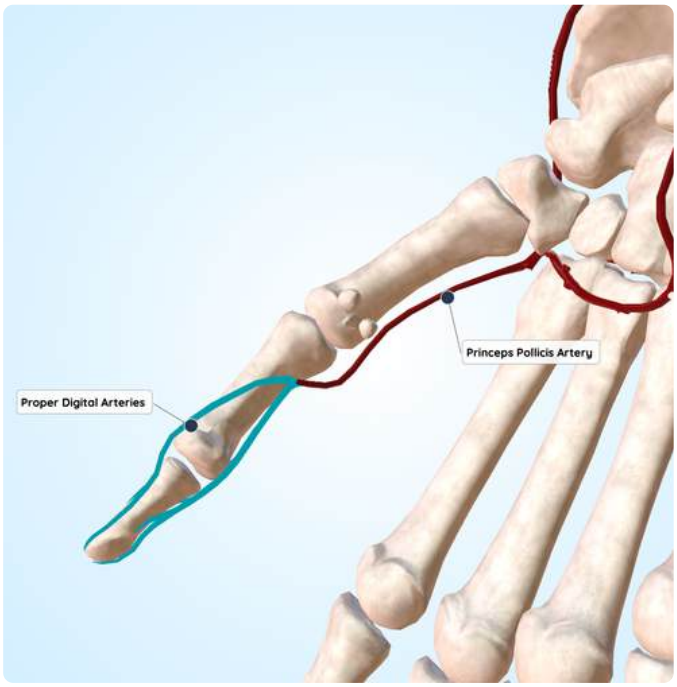


So first of all, we mentioned the **1st Dorsal Metacarpal Artery**. This artery branches directly from the Radial Artery itself, and we can see how it almost splits into two, with one branch going towards the thumb, and one branch going towards the 2nd digit. This means that the 1st Dorsal Metacarpal Artery is often referred to as one, but is actually split into the **Radial Branch of the 1st Dorsal Metacarpal Artery** which sits more radially of the two and supplies the thumb, and the **Ulnar Branch of the 1st Dorsal Metacarpal** which sits more medially of the two, and supplies the 2nd digit.

From the Radial branch of the 1st Dorsal Metacarpal Artery, we have the **Dorsal Digital Artery of the thumb**, just like the dorsal digital arteries that branch from the other Dorsal Metacarpal Arteries, which runs to the distal phalanx of the thumb dorsally.

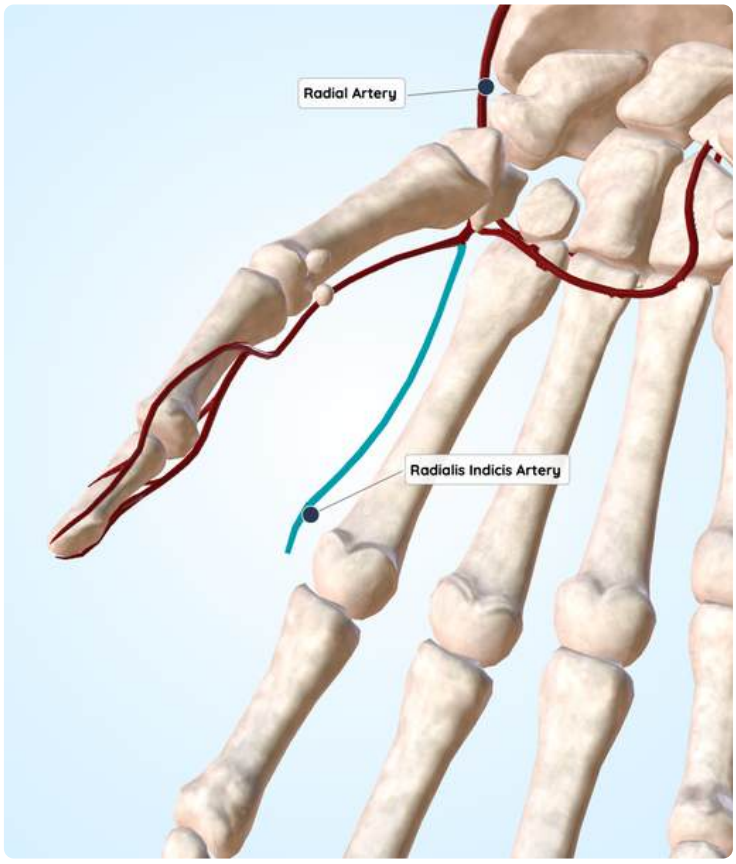
Additional Arteries of the Thumb





Another really key thumb artery, which also branches directly from the radial artery is the **Princeps Pollicis Artery**.

The Princeps Pollicis Artery supplies the Flexor Pollicis Brevis muscle, before it splits into the **Proper Digital Arteries of the thumb**, one that runs up the lateral side and one that runs up the medial side of the anterior thumb.



Finally, an important artery to revisit, which also branches directly from the radial artery is the **Radialis Indicis Artery**.

As you can imagine from its name, this runs up the index finger, the Radial half of the index finger infact, before terminating into the Proper Palmar Digital Artery for the 2nd digit.

Like the Princeps Pollicis Artery, it also supplies Flexor Pollicis Brevis.

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