

The Doctor is in the Pool

Shoulder anatomy

By Brian Goldman

Mobility over power, balance with flexibility: the shoulder is all of that. Whenever I think about the shoulder, which I do a lot since I swim, I think about how intricate it is. I think about how all of the parts have come together in evolutionary history to develop into the wonderful structure it is. In this article I will briefly discuss the shoulder anatomy. In the next article we will review what can go wrong with the shoulder. Finally, in a third article I will see how we as swimmers are affected by the shoulder's limitations and what we can do to avoid injury.



On to anatomy:

I have always had trouble visualizing things from pure description. I work much better by looking at a picture or holding up a model when learning anatomy or understanding how to get from point A to point B. For that reason, I recommend pulling out your GRAY'S ANATOMY (not the TV show) or googling "shoulder anatomy". Look at a picture when going through this description. It will stick in your head much better. You may ask "why not include a picture here?" The reason is: most sources are protected by copyright laws. Some useful links are: <http://www.webmd.com/pain-management/picture-of-the-shoulder> and for those who like video <http://video.about.com/orthopedics/Anatomy-of-Shoulder.htm>

Bones and joints

Think of the shoulder as a cool-looking, weirdly shaped, perfect structure. It consists of the scapula (shoulder blade) aligned with two other bones, the humerus (upper arm) and the clavicle (collar bone).

The **scapula** looks like a wide, flat sail that is laid across the back of the thorax (rib cage). It is triangular in shape and has two impressive projections that stick out forward off the top of the shoulder blade. The higher projection is called the acromion. The other projection is called the coracoid process. It sticks out just below the acromion and extends more towards the front of the body (anteriorly). Along the back of the scapula lies the scapular spine. It divides the scapula into two unequal parts, an upper suprascapular section and a larger, lower infrascapular region. These distinctions are important as many of the muscles, which attach to the scapula, are generally confined to one or the other section.

The **humerus** is the large arm bone that extends from the shoulder region to the elbow. There is nothing funny about it.

The **clavicle** or "collarbone" extends from the base of the neck anteriorly (front side of the body) and travels laterally (sideways) and posteriorly (towards the back) to the acromion, the anteriorly-oriented projection off the scapula.

Those three bones form joints to create the shoulder girdle.

The end of the scapula opposing the humerus is called the glenoid. The joint between the glenoid and the humerus is the main shoulder joint. It is called the glenohumeral joint. The cavity of this joint is covered on both sides by articular cartilage (smooth white tissue that allows the bones to glide over each other). This joint looks like a ball and socket: the ball being the head of the humerus and the socket being the glenoid cavity. If you held them up against each other you would see right away that they really aren't a tight ball and socket like the hip joint. That is all in the design, allowing for a broader, flatter connection, which

permits more flexibility and less stability. The joint is stabilized by a ring of tough, elastic tissue (fibrous cartilage), called the labrum.

The next joint is the acromioclavicular (AC) joint. It is composed of a contact between the lateral aspect of the clavicle and the top of the scapula (earlier called the acromion). You can feel it on yourself by running your fingers along your collarbone to its natural end, which is marked by a small upward bump. If you have dislocated your shoulder in the past or developed some arthritis there, the bump may not be so small!

The third joint of the shoulder girdle is actually at the other end of the clavicle. It is between the sternum and the clavicle and thus called the sternoclavicular joint.

A fourth articular surface is the scapulothoracic surface. It is not an actual joint but is an important feature of the shoulder girdle. It lies between the anterior scapular surface, which is smooth and flat and slightly coved, and the back of the ribcage which neatly parallels the scapula.

The muscles

In this summary we will limit our discussion to the group of muscles called the rotator cuff and mention also the biceps and deltoid muscles. There are other associated muscles that are involved in scapular stability and surrounding structures but we will have to leave those for another day.

The **rotator cuff muscles** are a group of four muscles that have a wide base of origin on the scapula and insert narrowly on the humeral head. The visual we were always given as med students was to think of the muscles as fingers on your hand. The wrist is attached to the scapula and the fingers extend to the humeral head and individually hold on. Activation of the muscles leads to movement of the humerus such as elevation, abduction, adduction, etc. With the simultaneous activation of muscles to hold the scapula still (stabilizers), the humerus will move primarily allowing for a proper arm swing like in backstroke or freestyle.

The rotator cuff muscles include the supraspinatus, the infraspinatus, teres minor and subscapularis. The supraspinatus is responsible for shoulder abduction (elevating the arm up and away from the body). The infraspinatus and teres minor contribute to abduction and external rotation (turning the arm out, like opening up a right refrigerator door to the right with your right hand). The subscapularis is responsible for internal rotation. (That would be the motion required to close the same refrigerator door with the right hand.) It is the largest of the 4 muscles.

The **deltoid muscle group** is not one of the rotator cuff muscles. It lies on top of the four rotator cuff muscles and totally covers them. The deltoids act as shoulder abductors. The deltoids arise from the scapula at the acromion and attach to the humerus partway down the arm, not right at the top like the rotator cuff muscles.

The **biceps muscles** have two main bodies or heads. The long head crosses the front of the head of the humerus and inserts on the scapula. The biceps contribute to shoulder movements somewhat. Most of the effects are at the elbow.

Bursae

Bursae are fluid filled sacs that cushion and bathe tendons and ligaments at and around the joints. I will only mention one bursa concerning the shoulder: the subacromial bursa. It is located below the acromion process of the scapula and enjoys the company of the rotator cuff tendons, especially the supraspinatus tendon.

Ligaments

Ligaments are fibrous tissue connectors that stretch from one bone to another. They are not attached to a muscle though they often are intimately involved with adjacent muscles. There are numerous tendons associated with the shoulder girdle. Sadly we cannot explore them today.

Nerves and blood vessels

NCMS has asked me not to talk about the nerves and blood vessels for fear that one of their readers would take out a contract on me. It was explained that most of the readers are not anatomy geeks and would rather spend their time in front of the computer or Smartphone playing solitaire or looking at swimming stats.

See you at Nationals!