Anatomical Snuffbox and it Clinical Significance. 
A Literature Review 

La Tabaquera Anatómica y su Importancia Clínica. Una Revisión de la Literatura 

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SUMMARY: The anatomical snuffbox is a small triangular area situated in the radial part of the wrist, often used to perform clinical and surgical procedures. Despite the frequency with which this area is used, there is scarce information in literature about its details. The objective of this study is detailed knowledge of the anatomical snuffbox’s anatomy and its components, the reported alterations at this portion, besides the clinical uses and significance of this area.

KEY WORDS: Hand; Wrist; Anatomical Snuffbox; Radial artery; Cephalic vein; Superficial branch of radial nerve; Scaphoid.

INTRODUCTION

The anatomical snuffbox (AS) is a depression in wrist’s radial part, limited by the tendons of abductor longus muscle, extensor pollicis brevis and extensor pollicis longus muscles (Latarjet & Ruíz-Liard, 2007). This little triangular area is often used to perform clinical procedures as the cannulation of the cephalic vein, and surgical procedures as placing arteriovenous fistula between the radial artery and cephalic vein, among other uses.

According to Tubbs et al. (2006) there is scarce detailed information about AS in literature.

To do this review, we consulted articles in English and Spanish, published in PubMed and ScienceDirect databases. The research was realized using terms like “anatomical snuff box” and “fovea radialis”. Anatomy texts were also used.

ANATOMY

AS is a depression located in radial part of the wrist (Fig. 1), is laterally limited by the tendons of abductor pollicis longus and extensor pollicis brevis muscles, and medially limited by the tendon of extensor pollicis longus muscle (Latarjet & Ruíz-Liard). This triangular structure presents a base formed by the distal margin of the retinaculum of extensor muscles (Kahle et al., 1995), and a vertex conformed by the attachment of the tendons of extensor pollicis longus and extensor pollicis brevis muscles (Fig. 2) (Latarjet & Ruíz-Liard). The roof is formed by the skin and superficial
Fig. 2. Posterior view of radial part of the right wrist. 1= tendon of abductor pollicis longus muscle; 2= tendon of extensor pollicis brevis muscle; 3= tendon of extensor pollicis longus muscle; 4= cephalic vein; 5= terminal branches of the superficial branch of radial nerve; 6= radial artery; 7= superficial branch of radial nerve; 8= retinaculum of extensor muscles; 9= tendon of extensor carpi radialis longus muscle; 10= tendon of extensor carpi radialis brevis muscle.

Fig. 3. Posterior view of radial part of the left wrist. 1= tendon of abductor pollicis longus muscle; 2= tendon of extensor pollicis brevis muscle; 3= tendon of extensor pollicis longus muscle; 4= cephalic vein; 5= terminal branches of the superficial branch of radial nerve; 6= radial artery; 7= superficial branch of radial nerve; 8= retinaculum of extensor muscles; 9= tendon of extensor carpi radialis longus muscle; 10= tendon of extensor carpi radialis brevis muscle.
fascia, in where we can fine the cephalic vein (CV) and superfi- 
cial branch of the radial nerve (SBRN) (Tubbs et al.), and the 
ground is conformed by the distal radius, scaphoid, trap ezi um and the base of the first metacarpal bone (Grechenig et al., 1999).

There are the tendons of the extensor carpi radiialis 
muscles and the radial artery (RA) at the AS bottom (Fig. 3) 
(Kahle et al.; Rouviere & Delmas, 2005; Latarjet & Ruiz- 
Liard). The mentioned artery origins the dorsal carpal branch 
at this level (Kahle et al.) and the princeps pollicis artery 
(Latarjet & Ruiz-Liard).

According to Testut & Latarjet (1975), in a live 
person, when the muscles that circumscribe this area contract, 
the skin becomes depressed forming a prolonged shallow 
fossa, in which the ancient deposited their snuff before 
drawing it directly through the nostrils; therefore its name.

Regarding its size, in the study of Tubbs et al., the 
average height of the AS was 6 cm and the average width at 
its base was 1.5 cm.

In terms of content, the SBRN is one of its terminal 
branches of the radial nerve (Rouviere & Delmas). Both 
Rouviere & Delmas as Latarjet & Ruiz-Liard, indicate that 
this branch has 3 terminals; one lateral branch, one 
intermediate and one medial. The study by Tubbs et al., 
showed that the SBRN in general was deep to the VC and had two branches that crossed the AS in 29 of the 30 samples, and 3 branches in 1 of 30 samples. These branches originated always distally to the tendon of extensor pollicis brevis 
muscle. Samarakoon et al. (2011) dissected 25 wrists and 
forearms, and observed that in most of the samples (68%), 
the CV and the SBRN crossed each other at least once, and 
even twice. In a study by Robson et al. (2008), the cephalic 
vein was closely related (<2 mm) with the SBRN in 80% of 
cases (20 of 25 dissections).

According Mehigan & McAlexander, (1982) the CV 
and RA almost invariably coursed through the AS and was 
found less than 5 mm one from another. In the study by 
Robson et al., in two of the 25 upper limbs, both the lateral 
cutaneous nerve of forearm (LCNF) and SBRN were very 
close (<2 mm) to the CV (the LCNF at the ulnar side and 
SBRN deep to the CV). In the other samples, only the SBRN 
was closely related to the CV. Tubbs et al., Observed that 
70% of the samples were connections between the vena 
comitante of the RA and the CV within the limits of the AS. 
Also they noted that the CV was found more frequently in 
the medial part of the AS.

Rouvière & Delmas describe that AR in the AS 
penetrates going deep to the tendons of the abductor pollicis 
longus and extensor pollicis brevis muscles. Also they noted 
that the mentioned artery is in the bottom of this structure, 
onto Trapezium bone. However Tubbs et al., showed that in 
most cases the RA is located very near the base of the 
AS and not located distally within this region. Robson et al., 
found that the RA was closely related (<2 mm) with the 
SBRN, near the styloidy process of radius in 48% of 
samples, while 24% were close to LCNF, rather than SBRN. 
In all cases, these nerve branches were either superimposed 
on the artery or located on radial side of it. Kahle et al. and 
Rouviere & Delmas indicate that at the level of AS, AR 
originates the dorsal carpal branch, Latarjet & Ruiz-Liard, add 
that also originates the princeps pollicis artery at this 
level. In the study by Tubbs et al., both arteries originated 
at AS level in all samples. In one sample, two dorsal carpal 
branches were observed, and in another, a small branch of 
the princeps pollicis artery travelled superficially along the 
CV. In addition, five samples showed a muscular branch 
originating from the princeps pollicis artery or directly from 
the RA for the adductor pollicis brevis muscle.

Berger et al. (2003) states that the dorso-ulnar corner 
of the AS contains only the tendon of extensor carpi radiialis 
longus muscle, but according to Tubbs et al., the tendon of 
extensor carpi radiialis brevis can also be found in the AS, 
depending on how distal the retinaculum of extensor 
muscles is, and how medial the dorsal tubercle of the radius 
is found.

Corfitsen et al. (1989) describe, in a radiological 
study, a pad of fat within the AS. Tubbs et al., observed this 
shapely fat collection between the styloidy process and the 
base of the first metacarpal in all samples. This pad 
completely covered the RA in its passage by the AS in most 
samples.

ALTERATIONS AT ANATOMICAL SNUFFBOX 
LEVEL REPORTS

Yoshii et al. (2000) described the cases of two patients 
with compression of the SBRN, due to a ganglion cyst. Amar 
et al., (2012) reported the case of a 40 years old patient with 
a compressive lipoma affecting the lateral terminal branch 
of the SBRN at this level.

Naeem et al. (2012) reported that after a failed attempt 
to canalize the CV in the AS, a woman suffered a strong 
electric pain irradiated from the back of the hand to the pos-
terior region of the upper portion of right arm, with a loss of 
sensitivity in the first interdigital space and radial side of 
the thumb. Nine months after, she was diagnosed with a 
neuroma of the SBRN.
There are several reports in the literature of lesions of the RA at the AS, including; aneurysms (Miura et al., 2004; Luzzani et al., 2006;), an aneurysm initially misdiagnosed as a ganglion cyst (Walton & Choudhary, 2002), idiopathic aneurysm (Santos et al., 2008), bilateral aneurysm in a patient with Marfan syndrome (Yukios et al., 2009), mycotic aneurysm of the dorsal carpal branch (Poirier & Stansel, 1972) and traumatic aneurysms (Wenger et al., 1980).

McNamara et al. (1998) noted that between 1984 and 1995, nine patients were treated with spontaneous thrombosis of the radial artery in the region of the AS, all of whom had ischemic symptoms in the index finger and/or the thumb.

**ANATOMICAL SNUFFBOX USES AND CLINICAL SIGNIFICANCE**

According to Naeem et al., the dorsal radial portion of the wrist is a popular site for venous cannulation, as the CV can be easily identified there. Samarakoon et al., indicate that superficial position of the SBRN is vulnerable to injury during this procedure.

Kretschmer et al. (2001) indicate that the SBRN is the third most injured peripheral nerve, after accessory and common fibular nerves. This injury may be the result of fractures, lacerations, sustained pressure or may be iatrogenic (Robson et al.). Both Robson et al. and Samarakoon et al., indicate that to avoid iatrogenic injury of the SBRN, need to avoid cannulation of the CV in the distal third of the forearm. Viale et al. (2001) concluded that to avoid injury to this nerve, CV puncture must be at least 12 cm above the styloid process of the radius.

Recent advances in ultrasound technology have allowed both morphological analysis and functional assessment of various diseases, based on the control of blood flow by Doppler ultrasound (Ban et al., 2005). The wave forms obtained by this method are influenced by the angle between the ultrasound beam and the direction of blood flow. Said angle of incidence is critical in the analysis, and should be less than 60° to reduce the error to less than 20%. If the angle of incidence is close to 0°, the signals will be more accurate. At AS level, average incidence angle is 11.5±10.8°, so that this region is ideal for Doppler blood flow analysis (Ban et al.).

Kochi et al. (2003) argue that monitoring blood flow by color Doppler method in the AS is useful to examine the permeability of radial and ulnar arteries, thus evaluating the circulation of the hand, before harvesting the RA for coronary artery bypass grafting, and can be clinically applied as a reliable alternative to Allen test.

In 1982, Bonalumi et al., noted that the surgically created arteriovenous fistula (AVF) had become the method of choice for achieving vascular access for hemodialysis maintenance. They conducted between 1972 and 1980, 177 AVF from end to end in the AS between the CV and the RA of the non dominant upper limb in patients undergoing hemodialysis. The survival rate was 83.1% at 12 months and 46.3% at 6.5 years, levelling up to 9 years. The average survival rate was 6 years. In his article he indicates that 50% of final failures were due to aneurysm formation by repeated venous puncture at the same site and subsequent obliteration of the upper venous segment. From the 154 AVF made during five years at the AS level between the CV and RA, by Mehigan & McAlexander, 132 (86%) produced a satisfactory blood access that worked for 6-60 months. In 15 patients (9.7%), there was venous congestion of fingers; which was solved ligand the CV distally to the fistula. Bonalumi et al., explained that factors that seem to lead to AVF failure are the preference of dialysis personnel to inserting needles into the dilated areas, and patient’s desire to always want the same vein puncture site due to insensitivity of skin in that area. According to Giacchino et al. (1979), the correct procedure for a fistula should to be changed the venipuncture site at each dialysis moment, thus allowing a regular distention of whole venous tract.

Mehigan & McAlexander indicate that the first site chosen for hemodialysis should be as distal as possible in the limb, while preserving the more proximal areas for future access. Almost constant anatomical juxtaposition of RA and CV in the AS make fistula procedure exceptionally simple, requiring minimal dissection and the preservation of the more proximal sites for later fistula, in case of being necessary. According Bonalumi et al., the AS can be regarded as the most distal site available for vascular access for hemodialysis. Mehigan & McAlexander added that due to the minimal dissection performed with this technique, wound complications and morbidity are very low.

Stanziale et al. (2008), concluded that the AVF is the best vascular access for chronic hemodialysis in patients with end-stage renal disease.

Tao et al. (2010), compared AVF in the AS and AVF in the forearm in 214 hemodialysis patients with chronic renal failure, to see what was the best method for permanent vascular access before kidney transplantation. They found that the permeability rate was significantly higher in the group of the AS at 2-3 years (p <0.05), and rates of incidence of pseudoaneurysm and congestive heart failure were significantly lower in the AS (p <0.05), which concluded that the AVF in the AS should be the first choice in the permanent vascular access.
Regarding aneurysm of RA, Poirier & Stansel, indicate that the most frequent sites of aneurysms in the hand are the thenar and hypothenar eminence, as they are the two most prominent regions which are most often used for protection. Santos et al., added that one of the factors that predispose to the formation of RA aneurysms are multiple puncture attempts.

Ellis & Mahadevan (2010) indicate that increased tenderness on palpation in the AS is characteristic of the fracture of the scaphoid bone. Mallee et al. (2014) add that this is the most sensitive clinical test, however, if only this test is used, up to 13% of scaphoid fractures could be undiagnosed. Tubbs et al., indicate that we must also consider the fracture of distal radius, base of the first metacarpal and the trapezium bone, as they all are part of the floor of the AS. They also note that the radiological displacement of the fat pad located on the AS may suggest a fracture of one of the osseous components forming the floor of the AS, similar to the displacement of fat seen on fractures of ulna olecranon.

Doyle & Botte (2003) concluded that as the tendons of the extensor carpi radialis muscles and extensor muscles of the thumb are in the AS, intersection syndrome, where symptomatic friction between these tendons is created, can occur in the AS.

CONCLUSIONS

Due to the multiple procedures that are performed at this level, the precise knowledge of the area and its components are crucial to avoid risks and possible consequences, such as injury to the superficial branch of the radial nerve, arteriovenous fistulas failures and radial artery aneurysms due to multiple attempts of puncture.

This review provides detailed information about the anatomical snuffbox and its clinical relevance, which can be used by health professionals maneuvering at this level, and anatomists to enhance the detail of his dissections.

REFERENCES


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