

# CLINICAL CORELATION OF VASCULARITY OF SCAPHOID BONE

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## ABSTRACT:-

Vascularity of scaphoid has gained importance due to the cases of non union. Over the years studies of blood supply of scaphoid have been done. Three hundred scaphoids were obtained in Anatomy department of Subharti Medical College Sex and side of bone was not taken into consideration. Vascular foramina were counted on palmar and dorsal surfaces with help of loop lens and magnifying glass. Dissection of 15 fresh upper limbs was done. Polyster resin dye mixed with India ink was injected into brachial artery after which micro dissection for vasculartiy of scaphoid was done. Counting of foramina revealed that scaphoid having absence of foramina proximal to mid of waist only were at risk of non union while dissection also revealed that scaphoid has a rich collateral circulation, thus making any incidence of non union a rarity

**KEY WORDS:-** Microdissection, Scaphoid, Vascular foramina

## INTRODUCTION

Scaphoid is the commonest bone to be injured among carpal bone. That too have gained notice because of non union in cases of scaphoid (Mody et al 1993<sup>(1)</sup>, Person AD 2001)<sup>(2)</sup>. It hampers the function of most valuable part of human body the hand. Serious studies regarding number, size, position of nutrient foramina in all the carpal bones dates to the beginning of this century.

In 1932 Lutzeler<sup>(3)</sup> studied vascular supply of scaphoid and reported that vessels entered proximal half of scaphoid at the insertions of the volar lunate scaphoid ligament, dorsal lunate scaphoid ligament and ligamentum collaterale carpi radiale. In the distal half he observed smaller vessels penetrating the tuberosity and spreading only within the tuberosity.

Bohler (1943)<sup>(4)</sup> and later on Von Lanz (1959)<sup>(5)</sup> studied vascular supply to conclude that scaphoid got equal amounts of blood from volar and dorsal aspects. Extraosseous and intraosseous blood supply of scaphoid was described by Taleisnik, J Kelly in 1966<sup>(6)</sup>. In 1980 Gelberman & Menon<sup>(7)</sup> by their study on 15 fresh cadavers by injection and clearing technique reported that major blood supply to scaphoid is viva radial artery while in 2009 M.J. Ochmke<sup>(8)</sup> and his

associates found that since blood supply is available from palmar circulation a dorsal approach to scaphoid bone is possible.

As the fracture scaphoid is common in India the present work is undertaken to study blood supply of scaphoid and corelate it with its non union.

## MATERIAL AND METHOD

To study the vascular supply of scaphoid, the present work was done in the Department of Anatomy, Subharti Medical College, Meerut, TMMC & RC, Moradabad, MMC, Muzaffarnagar.

**(A)** Scaphoid bones were obtained from the department of anatomy and number of vascular Foramina were counted with the help of operating lens. Counting of vascular foramina in 300 specimen is done on the principle that number & site of arterial foramen taken as number & site of vessels entry.

On the non-articular surface of the bone numerous vascular foramina were found. Vascular foramina were counted with the help of loop lens on both palmar and dorsal surface and Vascular foramina in relation to the mid of waist of scaphoid were seen and grouped into vascular foramina on the palmar and dorsal surface proximal to mid of the waist and vascular foramina. on the palmar and dorsal surface distal to mid of the waist.

**(B)** In cadavers 15 fresh upper limbs brachial artery was dissected and cannulated with a plastic catheter (I/V cannula) two to three inches proximal to cubital fossa. Transverse incision were made at the

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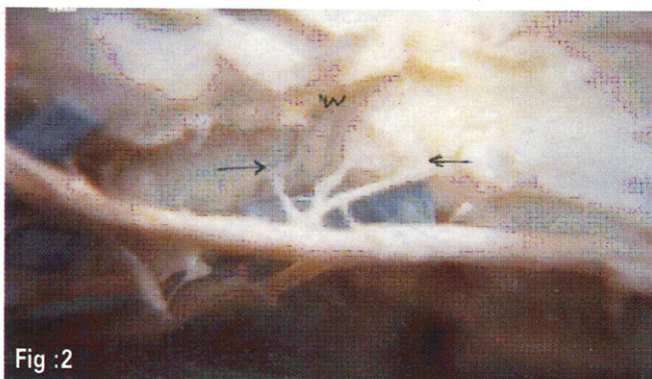
pulp of the distal phalanges of all digits to facilitate the outflow. In every specimen, the brachial artery was flushed with normal saline at room temperature until the outflow from the digital incision was clear. Polyester resin dye was pushed manually through a cannula into brachial artery. This dye is having a property of hardening the vessels. Dye was mixed ink to give colour. After this all the distal vessels became hard. As vessels became hard carpal arches and supply of scaphoid was dissected out. Vascular supply along radiocarpal ligament and on dorsal & lateral surface dissected out.

**OBSERVATION AND RESULT**

Radial artery is the main artery to supply the scaphoid. Scaphoid has got two major blood vessels along the palmar and dorsal surface, Vessels enter the bone through the non-articular surface. Both of these enter through the distal half.



**Fig :1**  
MICRODISSECTION SHOWING DORSAL BLOOD SUPPLY OF SCAPHOID A DIRECT BRANCH FROM RADIAL A.



**Fig :2**  
PRESENCE OF VESSELS BOTH PROXIMAL & DISTAL TO THE MID OF WAIST

**PALMAR BLOOD SUPPLY**

The arteries are arising directly from the radial artery in 83.33% of specimens while in 16.67% specimens they arise from the superficial palmar branch of the radial artery In 50% of specimens palmar division of anterior interosseous artery takes part in formation of anastomosis over the palmar aspect of bone. In 66.66% specimen a branch from the palmar intercarpal arch contributes in formation of anastomosis over scaphoid.

**DORSAL BLOOD SUPPLY**

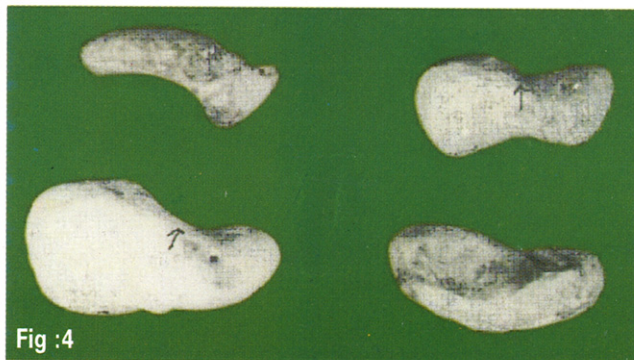
In 72.22% of specimens dorsal vessels were arising directly from the radial artery. In 19.55% of specimens dorsal branch arises from common stem of intercarpal artery. In 8.33% of specimens scaphoid receives its dorsal branch from both the radial artery as well as the intercarpal artery. In about 50% of specimens a dorsal branch from dorsal intercarpal arch, takes part in anastomosis over the scaphoids.

**Observations of the vascular foramina counting scaphoid:-**

Dried specimens of scaphoid bones were taken and vascular foramina counted. Side and sex



**Fig :3**  
PHOTOGRAPH SHOWING SCAPHOID WITH MORE FORAMINA ON DORSAL SURFACE THAN ON THE PALMAR SURFACE AND DISTRIBUTION OF MORE FORAMINA DISTAL TO MID OF WAIST



**Fig :4**  
SCAPHOID WITH NO FORAMINA PROXIMAL TO MID OF WAIST

was not taken into consideration. A total No. of 300 scaphoid were examined. (Fig 3&4)

**According to vascular formina scaphoid grouped into**

Scaphoid according to number of vascular foramina on the dorsal surface. These ranged between 1-10 in 6.36% specimens, foramina ranging between 11-20 were present in 65.45% specimens and between 21-32 in 28.18% specimens.

Maximum number of vascular foramina were seen on the dorsal surface in comparison to palmar surface. Average ratio between foramina on dorsal surface and palmar surface was 4:1

Scaphoid according to the number of the vascular foramina present on palmar and dorsal surfaces in relation to proximal and distal to mid of waist.

Thus, scaphoids are arranged in three groups according to foramina.

1. Foramina proximal to mid of waist. In 6% specimens there were no vascular foramina proximal to the mid of the waist. In 32.72% Specimens show one vascular foramina proximal to mid of waist and 61.28% specimens show more than one vascular foramins proximal to the mid of waist.
2. In 17.72% specimen one to two foramina distal to the mid of waist. In 82.28% specimens more than two vascular formina were present.

**DISCUSSION**

In wrist trauma, scaphoid fracture is the commonest injury following waist trauma, It commonly occurs through the waist. In studying vascular pattern, it was evident that good vascular supply of scaphoid is one of the important factor in the rarity of disease. In every specimen foramina is present distal to mid of waist, while 94% specimen have foramina proximal to mid of waist. To explain why proximal pole under go non union/necrosis following trauma in 1938 Obelitz & Halbstein <sup>(9)</sup> described the vascular foramina in the scaphoid bone. They observed that in 13% of bone the vascular foramina was absent proximal to mid of waist. The present study observed absence of foramina in 6% Further Obeltz & Halbstein observed in 20%

specimens there was one vascular foramina present proximal to mid of wist & in 67% specimen, there are two or more foramina proximal to mid of waist which compared to our study is 32.72% & 61.29% respectively.

These findings were significant, for the most of fractures of the scaphoid occurred through the waist of the bone in India in as well as in western population. Such fractures would completely interrupt the blood supply to the proximal pole of scaphoids lacking in vascular foramina proximal to mid of waist. These bones are considered at greatest risk for non union based on their vascular pattern. Other scaphoids having vascular foramina are not at greater risk for non-union following trauma.

By micro dissection it is confirmed that vascular supply of scaphoid is contributed by two sources, dorsal and palmar blood supply on dorsal and palmar surfaces respectively Radial artery is the main source of the blood supply while collateral circulation is formed by dorsal and palmar division of anterior interosseous artery with dorsal and palmar branch from intercarpal arch. This is consistent with findings of Taleisnik <sup>(6)</sup> and Kelly who found three systems of extra osseous arteries- dorsal vessels, distal vessels & a laterovolar group.

We also found that proximal four fifth of scaphoid receives blood supply from dorsal system as compared to two third while distal one fifth of scaphoid receives from palmar vascular system. In 1972 Barber et al <sup>(10)</sup> studied internal vascularity of eight specimens by injecting barium sulfate and clearing by Spaltehoz technique to conclude that major blood supply to scaphoid comes from dorsal aspect while Crettve S (1955) <sup>(11)</sup> based on a study of five specimen stated that there were small vessels entering the scaphoid on radio volar aspect.

Recent by M.J. Oehmke (2009) <sup>(8)</sup> reported possibility of dorsal approach to scaphoid bone due to the availability of blood supply from palmar circulation. Thus rich collateral circulation to the scaphoid by way of dorsal and palmar branches of anterior interosseous artery would ensure scaphoid vascularity in the event of segmental loss of radial artery at wrist. Similarly it is rare that a fracture of scaphoid would cause any incidence of non union because of collateral circulation alone.

### CONCLUSION

Scaphoid bone is the commonest bone to be fractured and Orthopedic surgeons have always been aware of the tendency of the scaphoid bone to manifest non union & cystic changes after fracture and trauma . In our study we also that 6% of scaphoid bone had no foramina proximal to waist of scaphoid bone and are thus more liable to undergo non union. These findings support the findings of previous workers.

Microdissection showed good collateral circulation on both palmar and dorsal aspect of scaphoid bone thus supporting Oehmke that dorsal approach to schaphoid bone is possible due to good palmar circulation.

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