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[2] Twetman S, Axelsson S, Dahlgren H, Holm AK, Källestål C, Lagerlöf F, et al. Caries-preventive effect of fluoride toothpaste: A systematic review. Acta Odontol Scand 2003;61:347-55.

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[3] Fleischer W, Reimer K. Povidone iodine antisepsis. State of the art. Dermatology 1997;195 Suppl 2:3-9.

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[6] Hosmer D, Lemeshow S. Applied logistic regression, 2nd edn. New York: Wiley-Interscience; 2000.

Chapter in book

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[8] World Health Organization. Oral health surveys - basic methods, 4th edn. Geneva: World Health Organization; 1997.

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Original Article

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Study of Variant Innervations of Extensor Carpi Radialis Brevis Muscle with its Clinical Importance

Sharadkumar Pralhad Sawant*, Dope Santoshkumar A., MBBS, MS (Anatomy)**

Abstract

Aim: To study the nerve supply to the extensor carpi radialis brevis muscle.

Materials and Methods: 100 upper limbs of 50 donated embalmed cadavers (45 males & 5 females) of age group ranging from 70 to 80 years were studied in the department of Anatomy at K. J. Somaiya Medical College, Sion, Mumbai, INDIA, the nerve supply to Extensor carpi radialis brevis muscle was observed. The finding was noted after thorough and meticulous dissection of the upper limbs of both sides. The arterial pattern of upper limb were also observed. The photographs of the variations were taken for proper documentation.

Results / Observations: In 36 specimens of the upper limbs, the nerve supply to extensor carpi radialis brevis was from the deep branch of radial nerve i.e. the posterior interosseous nerve. In the remaining 64 upper limbs, the nerve supply to extensor carpi radialis brevis was from the angle of bifurcation of radial nerve in 22 specimens and from the superficial branch of radial nerve i.e. the radial nerve proper in 42 specimens.

Conclusions: The awareness of the nerve supply to extensor carpi radialis brevis from superficial branch of radial nerve is clinically important for surgeons dealing with entrapment or compressive neuropathies, orthopaedicians operating on the fractures of the lower end of the humerus, anaesthetist performing pain management therapies on the upper limb and physiotherapist doing electromyography for evaluating and recording the electrical activity produced by skeletal muscles. A lack of knowledge of such type of variations might complicate surgical repair.

Keywords: Extensor Carpi Radialis Brevis; Superficial Radial Nerve; Nerve Variation; Surgeons; Compressive Neuropathies; Orthopaedicians; Fractures; Anaesthetist; Pain Management Therapy; Physiotherapist; Electromyography.

Introduction

The extrinsic extensor muscles of the hand are located in the back of the forearm and have long tendons connecting them to bones in the hand, where they exert their action. Extrinsic denotes their location outside the hand. Extensor denotes their action which is to extend, or open flat, joints in the hand. The extensor carpi radialis brevis is one of the superficial muscles of the extensor compartment of the forearm. The extensor carpi radialis brevis muscle is shorter and thicker than the extensor carpi radialis longus muscle. It arises from the lateral epicondyle of the humerus, by a tendon common to it and the three following muscles; from the radial collateral ligament of the elbow-joint; from a strong aponeurosis which covers its surface; and from the intermuscular septa between it and the adjacent muscles. The fibers end about the middle of the forearm in a flat tendon,

Author's Affiliation: *Associate Professor, Department of Anatomy, K. J. Somaiya Medical College, Somaiya Ayurvihar, Eastern Express Highway, Sion, Mumbai-400 022, **Assistant Professor, Dept of Anatomy, Government Medical College, Latur-413512 (Maharashtra)

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which is closely connected with that of the extensor carpi radialis longus muscle, and accompanies it to the wrist; it passes beneath the abductor pollicis longus and extensor pollicis brevis, then beneath the dorsal carpal ligament, and is inserted into the dorsal surface of the base of the third metacarpal bone on its radial side. Under the dorsal carpal ligament the tendon lies on the back of the radius in a shallow groove, to the ulnar side of that which lodges the tendon of the extensor carpi radialis longus, and separated from it by a faint ridge. The tendons of the two preceding muscles pass through the same compartment of the dorsal carpal ligament in a single mucous sheath. The extensor carpi radialis brevis muscle may split into two or three tendons of insertion to the second and third or even the fourth metacarpal. The extensor carpi radialis longus and brevis muscles may unite into a single belly with two tendons. The cross slips between the two muscles may occur. The extensor carpi radialis intermedius rarely arises as a distinct muscle from the humerus, but is not uncommon as an accessory slip from one or both muscles to the second or third or both metacarpals. The extensor carpi radialis accessorius is occasionally found arising from the humerus with or below the extensor carpi radialis longus and inserted into the first metacarpal, the abductor pollicis brevis, the first dorsal interosseous, or elsewhere. The extensor carpi radialis longus muscle is supplied by the radial nerve and the extensor carpi radialis brevis muscle by the deep branch of the radial nerve (posterior interosseous nerve). The extensor carpi radialis longus and brevis muscles receive blood from the radial artery.[1] It is a universally accepted fact that the variation in the nerve supply to any muscle of the extremity is of definite surgical importance in order to avoid any error surgery.

Material and Methods

100 upper limbs of 50 donated embalmed cadavers (45 males & 5 females) of age group ranging from 70 to 80 years were studied in the department of Anatomy at K. J. Somaiya Medical College, Sion, Mumbai, INDIA, the nerve supply to the extensor carpi radialis brevis muscle was observed. The finding was noted after thorough and meticulous dissection of the upper limbs of both sides. The superficial muscles of the extensor compartment of the forearm were separated from each other, starting with the tendons at the wrist. The three anterolateral muscles the brachioradialis, extensor carpi radialis longus and brevis were completely separated from the extensor digitorum and the supinator muscle which lay deep in these muscles, was exposed. The deep branch of the radial nerve, the posterior interosseous nerve, was dissected. The nerve which supplied extensor carpi radialis brevis was then identified in all the specimens. Observations were made on the basis of origin of the nerve to the extensor carpi radialis brevis either from the angle of bifurcation of radial nerve or from the deep branch of the radial nerve or from the superficial branch of the radial nerve. The arterial pattern of upper limb were also observed. The photographs of the variations were taken for proper documentation.

Results / Observations

The nerve to the extensor carpi radialis brevis arose from the deep branch of the radial nerve before it entered the supinator muscle in 36 upper limbs. In the remaining 64 upper limbs, the nerve supply to extensor carpi radialis brevis was from the angle of bifurcation of radial nerve in 22 specimens and from the superficial branch of radial nerve i.e. the radial nerve proper in 42 specimens (Table 1). The radial nerve was divided most commonly above the level of the lateral epicondyle in 60%, followed by its division at the level of the lateral epicondyle in 30% and in the remaining 10% limbs, it was divided below this level (Table 2). In 78% of the limbs, the radial nerve divided into two branches i.e. superficial and deep branches and in the remaining 22% limbs, it showed three divisions, the third being the nerve to the extensor carpi radialis brevis (Table 3). In none of the specimen the nerve to

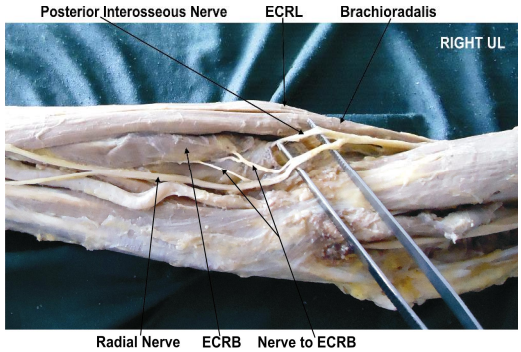
Table 1: Nerve supply to extensor carpi radialis brevis muscle

Nerve supply to extensor carpi radialis brevis muscle derived from	No. of specimes	%
Deep branch of the radial nerve	36	36
Angle of bifurcation of radial nerve	22	22
Superficial branch of radial nerve	42	42

Table 2: Division of radial nerve

Division of radial nerve	No. of specimes	%
Above the level of lateral epicondyle	60	60
At the level of lateral epicondyle	30	30
Below the level of lateral epicondyle	10	10

Figure 1: Showing photographic presentation of the nerve to the extensor carpi radialis brevis arising from the superficial branch of the radial nerve i.e. radial nerve proper.



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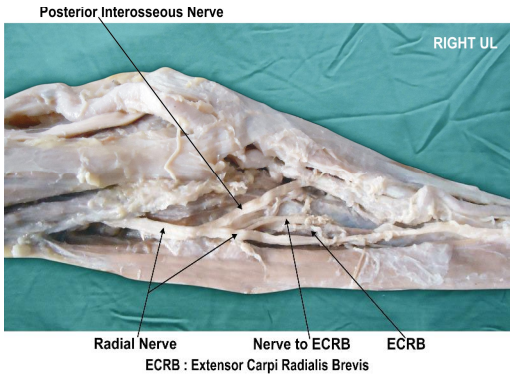

Figure 3: Showing photographic presentation of the nerve to the extensor carpi radialis brevis arising from the superficial branch of the radial nerve i.e. radial nerve proper

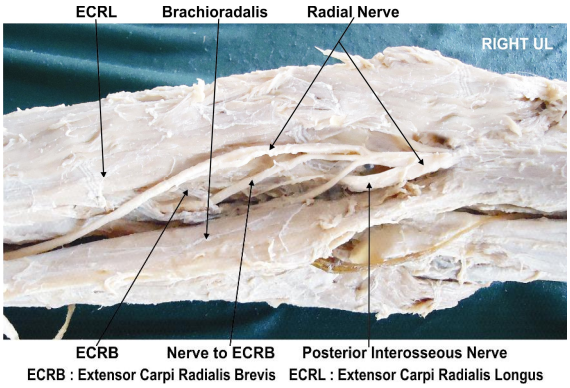

Figure 4: Showing photographic presentation of the nerve to the extensor carpi radialis brevis arising from the superficial branch of the radial nerve i.e. radial nerve prope

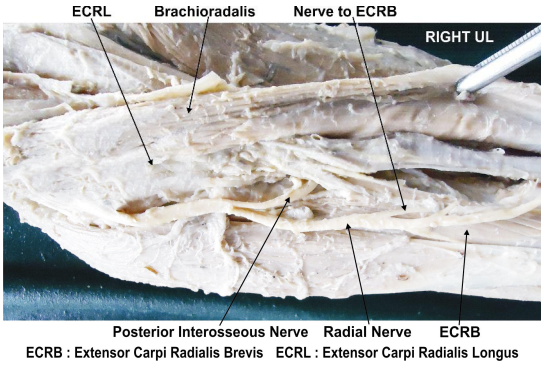

Figure 5: Showing photographic presentation of the nerve to the extensor carpi radialis brevis arising from the superficial branch of the radial nerve i.e. radial nerve proper

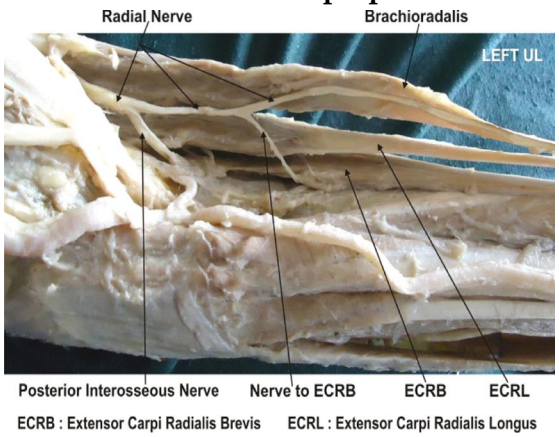

Figure 6: Showing photographic presentation of the nerve to the extensor carpi radialis brevis arising from the superficial branch of the radial nerve i.e. radial nerve proper

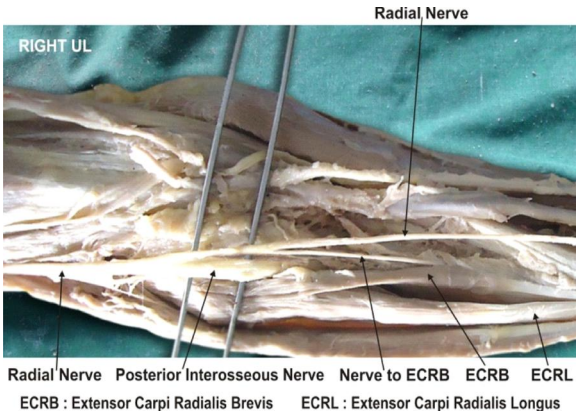

Figure 7: Showing photographic presentation of the nerve to the extensor carpi radialis brevis arising from the superficial branch of the radial nerve i.e. radial nerve proper

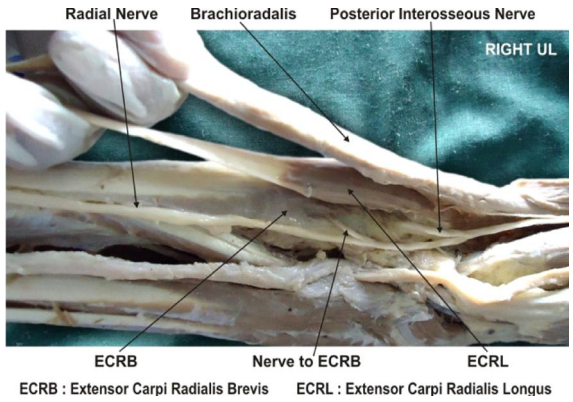

Figure 8: Showing photographic presentation of the nerve to the extensor carpi radialis brevis arising from the angle of bifurcation of the radial nerve

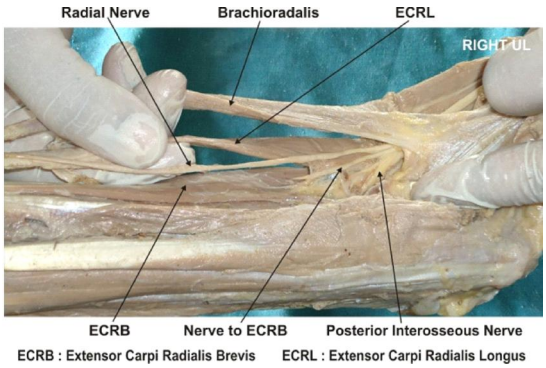

Figure 9: Showing photographic presentation of the nerve to the extensor carpi radialis brevis arising from the angle of bifurcation of the radial nerve

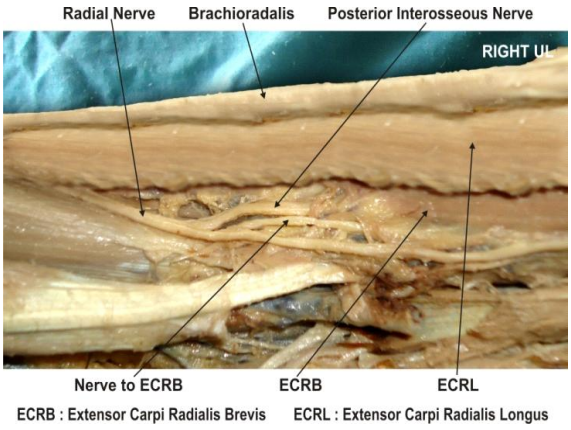

Table 3: Division of radial nerve

Division of radial nerve	No. of specimes	%
Into two branches - superficial branch and deep branch of the radial nerve.	78	78
Into three branches - superficial branch, deep branch of the radial nerve and nerve to the extensor carpi radialis brevis.	22	22

the extensor carpi radialis brevis was seen to arise from the radial nerve trunk above the level of its division.

Discussion

The nerve supply to the extensor carpi radialis brevis muscle is studied by many authors in the past.[2,3,4,5,6,7,8] The superficial branch of the radial nerve i.e. radial nerve proper is a purely sensory nerve and the nerve supply to the extensor carpi radialis brevis muscle is from the posterior interosseous nerve. The standard text books did not mention about the nerve supply to the extensor carpi radialis brevis arising from the superficial branch of the radial nerve i.e. radial nerve proper.[1] The incidence of the nerve supply to the extensor carpi radialis brevis muscle from the superficial branch of the radial nerve i.e. radial nerve proper had been reported by Salisbury, Al- Qattan and Brash as 56%, 48%

Table 4: Comparison with previous studies as gleaned from literature

Nerve supply to the extensor carpi radialis brevis from superficial branch of the radial nerve i.e. radial nerve proper	No. of specimes	%
Salisbury – 1938 (**9**)	56	56
Al- Qattan - 1996 (**10**)	48	48
Brash - 1955 (**11**)	21	21
Sawant et al - 2012 (**Present study**)	42	42

and 21% limbs respectively.[9,10,11] In the present study the nerve supply to the extensor carpi radialis brevis muscle from the superficial branch of the radial nerve i.e. radial nerve proper was observed in 42 upper limbs.

Compared with the previous studies the incidence of the origin of the nerve to the extensor carpi radialis brevis muscle from the superficial branch of the radial nerve i.e. radial nerve proper documented in the present study was higher than the study of Brash and lower than the study of Salisbury and Al-Qattan (Table 4). In the present study it was also observed in 22 specimens the radial nerve divides into three branches, superficial branch of radial nerve i.e. the radial nerve proper, deep branch of the radial nerve (posterior interosseous nerve) and nerve to the extensor carpi radialis brevis muscle. The nerve supply to the extensor carpi radialis brevis muscle was from that terminal branch of the radial nerve i.e. nerve to the extensor carpi radialis brevis muscle. This high percentage cannot be ignored as a rare variation. In tennis elbow the muscle involved is the extensor carpi radialis brevis.[12] The non-inflammatory, chronic degenerative changes occurs in the origin of the extensor carpi radialis brevis muscle.[13] The knowledge of the variant nerve supply to the extensor carpi radialis brevis muscle is important before injecting corticosteroid injections in the treatment of tennis elbow.[14] The surgeons performing Z-shaped tenotomy on tennis elbow to lengthen the tendon of extensor carpi radialis brevis must be aware of this variation in order to avoid unwanted complications.[15,16] Variations in the nerve supply of the extensor carpi radialis brevis are important in the clinically. The extensor carpi radialis brevis may be spared in injuries to the posterior interosseous nerve, thereby explaining the preservation of some wrist function clinically after penetrating injuries which may otherwise result in a complete wrist drop. Similarly, the injuries to the superficial radial nerve, which is suppose to be a sensory nerve, may lead to pain during the extension of the wrist and slight weakness on the extension on the wrist joint due to involvement of the nerve supply of the extensor carpi radialis brevis.[17] Recently, extensor carpi radialis brevis has also gained importance for use in 'free functional muscle transfer' i.e. transfer of a muscle with its motor nerve and vascular pedicle from one site of the body to another distant site, in order to restore the motor function.[18] The knowledge of the variations in the nerve supply is thus important while this muscle is being harvested. It is well known that the normal origin and the course of the nerve to the extensor carpi radialis brevis lie very close to the posterolateral aspect of the radius, a frequent site of pathology (e.g. infections and tumours), trauma and surgical procedures.[19,20,21] The anterior approach to the elbow and the variations in this approach are used frequently in the surgical management of proximal radial fractures, as well as a variety of other pathologies.[22,23] Such manouvers involve the separation of the extensor carpi radialis brevis distally, with resultant exposure of the radial nerve and its branches.[24] Hence, the knowledge of variations of the nerve supply of the extensor carpi radialis brevis is essential in preventing injury to this nerve branch by the retractors.

Clinical significance

The awareness of the nerve supply to extensor carpi radialis brevis from superficial branch of radial nerve is clinically important for surgeons dealing with entrapment or compressive neuropathies, orthopaedicians operating on the fractures of the lower end of the humerus, anaesthetist performing pain management therapies on the upper limb and physiotherapist doing electromyography for

evaluating and recording the electrical activity produced by skeletal muscles. A lack of knowledge of such type of variations might complicate surgical repair.

Conclusion

The nerve supply to the extensor carpi radialis brevis from the superficial branch of the radial nerve is not a rare occurrence. This should be mentioned in the standard text-books of anatomy and plastic surgery. The knowledge of the variations in the nerve supply of extensor carpi radialis brevis is important for plastic surgeons performing 'free functional muscle transfer'.

Competing interests

The author declare that he has no competing interests.

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Original Article

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A Study on the Vascular Foramen at the Ends of the Ulna and the Nutrient Foramen on the Ulna

Harish A. Wankhede*, P.B. Hosmani, M.M. Baig***, Dipti A. Nimje******

Abstract

Long bones are supplied by one or two main diaphyseal nutrient arteries. Along with these nutrient arteries numerous epiphyseal and metaphyseal arteries passes through the vascular foramina which penetrate bones near their ends, often at fairly specific sites. This epiphyseal and metaphyseal arterial supply is richer than the diaphyseal supply. In the present study 220 dried human adult ulnas were studied. The vascular foramina at the upper and lower ends of the ulna were observed and numbered. Topographical distributions of the nutrient foramina's were also studied. Results were analyzed statistically. It shows that the difference between the number of vascular foramina at the upper and lower end of ulna is highly significant. So study concluded that the upper end of the ulna has rich blood supply than the lower end. Therefore the lower end is more liable for ischemic necrosis, non-union and delayed union when get fractured. Knowledge of such vascular foramina at the end of long bone is important to clinicians, surgeons and anatomist in the present era of modern surgeries like microvascular bone grafting.

Keywords: Nutrient arteries; Vascular foramina; Ulna; Bone grafting.

Introduction

Long bones are supplied by one or two main diaphyseal nutrient arteries which enter the shaft obliquely through nutrient foramina leading into nutrient canals. Their sites of entry and angulations are almost constant and characteristically directed away from the dominant growing epiphysis. Nutrient arteries do not branch in their canals, but divide into ascending and descending branches in the medullary cavity. These approach the epiphyses, dividing repeatedly into smaller helical branches close to the endosteal surface. These endosteal vessels are vulnerable during operations which involve passing metal implants into the medullary cavity, e.g. intramedullary nailing for fractures.[1]

Near the epiphysis they are joined by terminal branches of numerous metaphyseal and epiphyseal arteries. The former are direct branches of neighboring systemic vessels, the latter come from periarticular vascular arcades formed on non-articular bone surfaces. Numerous vascular foramina penetrate bones near their ends, often at fairly specific sites; some are occupied by arteries, but most contain thin-walled veins. Within bone, the arteries are unusual in consisting of endothelium with only a thin layer of supportive connective tissue. The epiphyseal and metaphyseal arterial supply is richer than the diaphyseal supply. The epiphyseal and metaphyseal arteries exceed the diaphyseal supply when the nutrient artery is destroyed. In immature long bones the supply is similar, but the epiphysis is a discrete vascular zone.[1]

Most of the studies on the vascular supply of long bones are done on the nutrient foramen, but very few studies are done on the vascular foramina at the ends of the long bone. Rogers and Gladstone (1950)[2] studied the

Author's Affiliation: *Junior Resident-III, **Associate Professor, ***Professor & Head, ****Junior Resident-II, Department Of Anatomy, Dr. V. M. Government Medical College, Solapur, Maharashtra.

Reprint's request: Dr. Harish A. Wankhede, Junior Resident-III, Department Of Anatomy, Dr. V. M. Government Medical College, Solapur, Maharashtra. Mobile no.: +919763403561

E-mail: drharrywan@gmail.com

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]vascular foramina and arterial supply of distal end of the femur in human. They concluded that vessels passing through vascular foramina at the ends of the long bones play an important role in the blood supply of the bone and prevention of ischemic necrosis in the distal end of femur. Tandon (1964)[3] carried the study on the vascular foramina at the two ends of ulna of human and concluded that the upper end of the ulna has got more blood vessels passing into the bone than the lower end.

Present study is carried out for the morphological study on the vascular foramina at the ends of the ulna and the study of the nutrient foramen on the ulna.

Material and Methods

220 dried human adult ulnas were studied. 101 ulnas belong to right side and 119 belong to left side. Age and sex were not defined. Length of the ulna was measured on the osteometric board. The vascular foramina at the upper and lower ends of the ulna were observed and numbered. Those foramina which admitted a metal wire of diameter 0.5 mm were designated as large and other as small.[3]

The vascular foramina at the upper end of the ulna were classified into the four groups:

1) Superior group- foramina on the superior surface of the olecranon process.
2) Anterior group- foramina on the anterior surface of coronoid process.
3) Medial group- foramina on the medial aspect of the medial surface of the olecranon and coronoid process.

Fig 1: Foramina on superior surface

Fig 2: Foramina on anterior surface

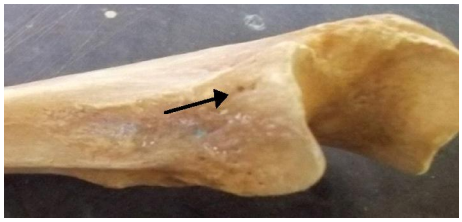


Fig 3: Foramina on lateral surface

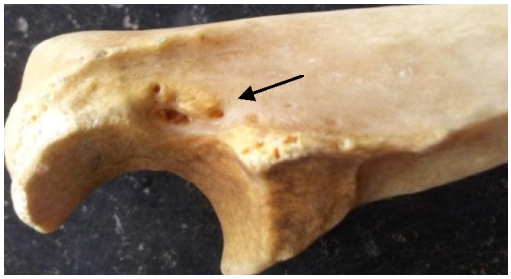
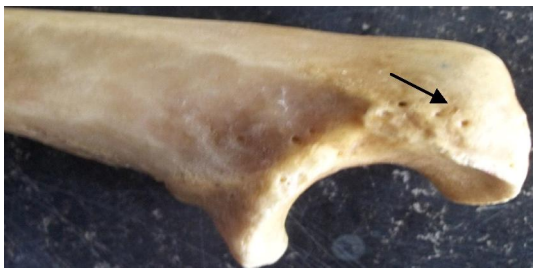


Fig 4: Foramina on medial surface



4) Lateral group- foramina on the lateral surface of the olecranon and coronoid process.

The vascular foramina at the lower end of the ulna were classified into the two groups:

1) Superior group- foramina on all aspects of the lower end of ulna except the inferior surface.
2) Inferior group- foramina on the inferior surface of the lower end.

Unpaired t-test was used for the difference between two groups; i.e. vascular foramina at the upper and lower end of the ulna.

The nutrient foramina were identified by the presence of a well-marked groove and slightly raised edge at the commencement of the canal.[4] Distance of the nutrient foramen from the upper end of the ulna was noted. Location

Fig 5: Foramina on superior surface

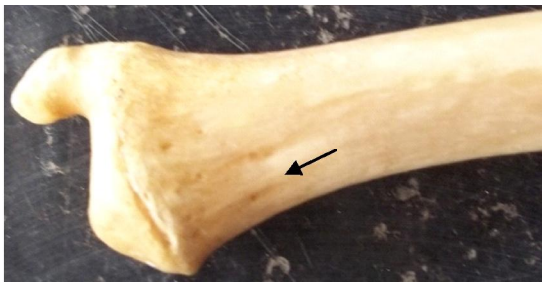


Fig 6: Foramina on inferior surface

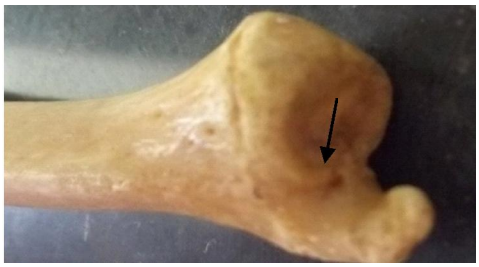
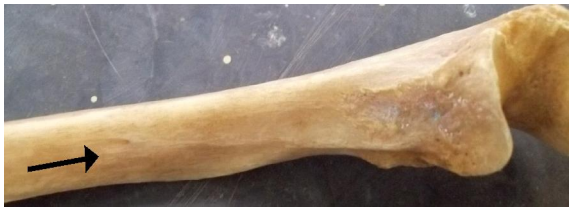


Fig 7: Nutrient foramina on the antero-medial surface of the ulna.



of the foramen was classified topographically into 1/5th, 2/5th, 3/5th, 4/5th and 5/5th part from the upper end of the ulna.

Results / Observations

Following observations were noted:

Mean value of the vascular foramina at the upper end of the ulna is given in table 1 and range is given in table 2.

Table 1: Showing distribution of the vascular foramina on the upper end of the ulna

Surface of the bone	Large vascular foramens (Mean ± S.D.)		Small vascular foramens (Mean ± S.D.)	
	Right	Left	Right	Left
Superior	1.03 ± 0.93	1.15 ± 1.07	2.6 ± 1.7	2.27 ± 1.48
Anterior	0.70 ± 1.13	0.28 ± 0.67	4.64 ± 2.47	4.5 ± 2.47
Medial	1.93 ± 1.15	1.93 ± 1.11	4.78 ± 2.14	4.81 ± 2.34
Lateral	0.45 ± 0.74	0.48 ± 0.72	3.62 ± 1.82	3.62 ± 1.76
Total mean	1.02 ± 0.64	0.96 ± 0.74	3.91 ± 1.01	3.8 ± 1.13

Table 2: Showing range of vascular foramens on the upper end of the ulna

Surface of the bone	Large vascular foramens (Range)		Small vascular foramens (Range)	
	Right	Left	Right	Left
Superior	0-4	0-6	0-8	0-8
Anterior	0-6	0-4	1-12	0-11
Medial	0-5	0-5	1-12	0-12
Lateral	0-3	0-3	1-10	0-12

Table 3: Showing distribution of the vascular foramina on the lower end of the ulna

Surface of bone	Large foramen (Mean ± S.D.)		Small foramen (Mean ± S.D.)	
	Right	Left	Right	Left
Superior	0.11 ± 0.43	0.01 ± 0.12	4.35 ± 1.96	4.47 ± 2.1
Inferior	0.51 ± 1.18	0.43 ± 0.74	0.9 ± 0.95	0.98 ± 0.99
Total mean	0.31 ± 0.28	0.22 ± 0.29	2.62 ± 2.43	2.72 ± 2.46

Table 4: Showing range of the vascular foramina on the lower end of the ulna

Surface of bone	Large foramen (Range)		Small foramen (Range)	
	Right	Left	Right	Left
Superior	0-3	0-1	0-10	1-14
Inferior	0-8	0-4	0-4	0-4

Table 5: Showing the topographical distribution of the nutrient foramina in the ulna

Topographical position of nutrient foramina	Right	Left	Total
1/5th	0.9%	-	0.45%
2/5th	67.3%	79.8%	74.09%
3/5th	37.6%	24.3%	30.45%
4/5th	-	-	-
5/5th	-	-	-

Mean value of the vascular foramina at the lower end of the ulna is given in table 3 and range in table 4.

Unpaired t-test was applied for comparison of difference between two groups; i.e. vascular foramina at the upper end and the lower end of the ulna. t-test value for larger vascular foramina on right side is 10.16, $p<0.01$ (highly significant) and on left side is 10.11, $p<0.01$ (highly significant). t-test value for small vascular foramina on right side is 4.90, $p<0.01$ (highly significant) and on left side is 4.33, $p<0.01$ (highly significant). It shows that the difference between the number of vascular

Table 6: Comparison between previous and present study on the vascular foramina on the upper end of the ulna (Mean ± S.D.)

Study		Superior surface		Anterior surface		Medial surface		Lateral surface	
		Large	Small	Large	Small	Large	Small	Large	Small
Tandon (1964)	Right	2.58 ± 0.98	2.37 ± 0.99	3.45 ± 1.09	7.14 ± 1.4	2.52 ± 0.9	4.73 ± 1.26	4.29 ± 1.18	9.36 ± 1.8
	Left	2.56 ± 1.11	2.32 ± 0.98	3.45 ± 1.11	7.23 ± 1.4	2.63 ± 0.95	5.15 ± 1	4.3 ± 1.06	9.8 ± 1.28
Present study	Right	1.03 ± 0.93	2.6 ± 1.7	0.70 ± 1.13	4.64 ± 2.47	1.93 ± 1.15	4.78 ± 2.14	0.45 ± 0.74	3.62 ± 1.82
	Left	1.15 ± 1.07	2.27 ± 1.48	0.28 ± 0.67	4.5 ± 2.47	1.93 ± 1.11	4.81 ± 2.34	0.48 ± 0.72	3.62 ± 1.76

Table 7: Comparison between previous and present study on the vascular foramina on the lower end of the ulna (Mean ± S.D.)

Study		Superior surface		Inferior surface	
		Large	Small	Large	Small
Tandon (1964)	Right	0.03 ± 0.18	1.61 ± 0.81	5.24 ± 0.85	0.35 ± 0.74
	Left	0.01± 0.12	1.78 ± 0.85	5.29 ± 0.9	0.43 ± 0.81
Present study	Right	0.11 ± 0.43	4.35 ± 1.96	0.51 ± 1.18	0.98 ± 0.99
	Left	0.01± 0.12	4.47 ± 2.1	0.43 ± 0.74	0.43 ± 0.81

foramina at the upper and lower end of ulna is highly significant.

Topographical distribution of the nutrient foramina is shown in table 5.

Discussion

Tandon (1964)[3] carried the study on the vascular foramina at the two ends of ulna of human and concluded that the upper end of the ulna has got more blood vessels passing into the bone than the lower end. Present study findings also shows that the number of vascular foramina at the upper end are numerous than that on the lower end. And small vascular foramina exceed the larger foramina on both ends of ulna.

Murlimanju et al. (2011)[4] conducted the study on the nutrient foramina on the ulna. The topographical distribution of the nutrient foramina on the ulna shows that in most of the bones the nutrient foramina is located on the upper $2/5^{th}$ part of the ulna and few on the upper $3/5^{th}$ part. In present study also similar findings were found.

Table 8: Comparison between previous and present study on the topographical distribution of the nutrient foramina on the ulna

Topographical distribution	1/5th	2/5th	3/5th	4/5th	5/5th
Murlimanju et al. (2011)	-	83.6%	16.4%	-	-
Present study	0.45%	74.09%	30.45%	-	-

Study done by Vinay and Kumar (2011)[5] topographically divides the ulna into three regions upper $1/3^{rd}$, middle $1/3^{rd}$ and lower $1/3^{rd}$. In right sided ulna 50% nutrient foramina was located in upper $1/3^{rd}$ and 50% in middle $1/3^{rd}$ and in left sided ulna 38.9% was in upper $1/3^{rd}$ and 61.1% in middle $1/3^{rd}$ part of the ulna.

Giebel et al. (1997)[6] studied the arterial supply of the forearm bones to access vessels suppling it and for choice and position of implant to minimize vascular damage since the operative exposure of a fracture causes disturbances in the blood supply, which often leads to a prolonged process of healing or even healing problems like fracture non-union, which is frequently located at the forearm.

Greene (2006)[7] has quoted that variety of causes lead to non-union but most commonly, it can be attributed to disturbance in vascularity or inadequate stability.

Maheshwari (1997)[8] has quoted that the fracture of ulnar shaft at the junction of middle and lower-thirds is prone to delayed and non-union. Impairment of blood supply to the fragments of fractured bone is one of the contributory factors for non-union.

Conclusion

The present study concludes that the number of vascular foramina at the upper end of the ulna exceeds the foramina on the lower end and also the topographical distribution of the nutrient foramina is greater on the upper $2/5^{th}$ part of the ulna. So, it shows that the upper end of the ulna has rich blood supply than the lower end. Therefore the lower end is more liable for ischemic necrosis, non-union and delayed union when get fractured. Also intra-medullary nailing for fixing fracture can damage the nutrient artery; in such cases vasculature at end of the bone plays an important role in the supply of nutrition.

Therefore the knowledge of such vascular foramina at the end of long bone is important to clinicians, surgeons and anatomist in the present era of modern surgeries like microvascular bone grafting and also in conventional surgeries like internal fixation by intra-medullary nailing to preserve the vascular supply of bone.

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Original Article

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Analysis of Dermatoglyphics in Pulmonary Tuberculosis Cases

Karan Bhagwan Khairnar, MBBS, MD*, Prashant Amanrao Bhusari, MBBS, MS**

Abstract

Introduction: Dermatoglyphics is scientific study of epidermal ridges and their configuration on palmar and plantar region. The factor which is responsible for genetic correlation of pulmonary tuberculosis is functional mutants of mannose binding protein. It plays important role in inheritance. Epidermal ridge pattern is also determined by genetics.

Aims & Objectives: To find out various Dermatoglyphic features in patients of pulmonary tuberculosis. To study the statistical significance of the difference found in patients and normal individuals.

Observations: This study was attempted in two groups i.e. one with 100 patients (72-males, 28-females) having pulmonary tuberculosis and the other with 100 healthy adult (72-males, 28-females) of same age groups 20-45 years.

Results & Conclusions: There is decrease in number of hands in which 'c' line termination is towards '9' in left hands of female patients than controls. Significant decrease in number of female patients having I_3 pattern in their right hands as compared to female controls. We found Dermatoglyphic analysis proven to have advantages as a diagnostic tool in certain diseases including pulmonary tuberculosis. It can use as for the prevention & control of disease.

Key words: Dermatoglyphics; Epidermal ridges; Tuberculosis; Prevention.

Introduction

The study of epidermal ridge patterns of the skin of the fingers, palms, toes, and soles is known as 'Dermatoglyphics'. Man has always wondered about skin over the palms and soles which is peculiar in having epidermal ridges, lacks hair and sebaceous glands, sweat glands are numerous. These epidermal ridges are known as friction ridges and are seen in all primates, because they help to counteract slipping.[1] The Harold Cummins coined the term Dermatoglyphics in 1926.[2] Dermatoglyphics literally means skin carvings. The tuberculosis is partly genetic and partly environmental. The study of Dermatoglyphics was pioneered long back by Galton (1892)[3]. Patterns once established never change throughout life.[4] Functional mutants of mannose binding protein are associated with pulmonary tuberculosis, which plays important role in inheritance and epidermal ridge pattern is also determined by genetics.[5] During 3rd & 4th month of foetal life ridges are diffentiated in their definitive forms & remain permanent throughout the life. The original feature does not change if there is no injury. Very little study has been conducted so far, as far as Dermatoglyphics in pulmonary tuberculosis is concerned. Considering all above facts, the present study is under taken to find out various Dermatoglyphic features in pulmonary tuberculosis patients and compare them with normal individuals and

Author's Affiliation: *Assistant Professor, Dept of Anatomy, MVPS Dr. Vasantrao Pawar Medical College, Adgaon, Nasik 03, State: Maharashtra, Country: India, **Associate Professor & Head, Dept of Anatomy, MVPS Dr. Vasantrao Pawar Medical College, Adgaon, Nasik 03, State: Maharashtra, Country: India.

Reprint's request: Dr. Karan Bhagwan Khairnar, MBBS, MD, Assistant Professor, Dept of Anatomy, MVPS Dr. Vasantrao Pawar Medical College, Adgaon, Nasik 03, State: Maharashtra, Country: India. Contact No. 07507177677.

Email: khairnarkaran@gmail.com

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to see differences found are statistically significant or not.

Aims and Objectives

To find out various Dermatoglyphic features in patients of pulmonary tuberculosis.

To study the statistical significance of the difference found in patients and normal individuals.

Material and Methods

The present study has been carried out on 200 individuals: Negative controlled study with two arms from the age group between 20-45 yrs, one with 100 patients (72-males; 28-females) having pulmonary tuberculosis and other with 100 healthy adult (72-males; 28-females).

Materials used for fingerprint are as follows: 'Kores' duplicating ink, Porcelain tile, Wooden table of suitable height, Cotton gauge ball, Printing paper, Towel, Pressure pad , Spirit, Soap , Water. Disposable Mask

Instruments used for qualitative and quantitative analysis for the study are: Scale, Protractor, Pencil, Needle, Compound magnifying lens.

Collection of data

From West Maharashtra region the patients selected and were diagnosed clinically as having pulmonary tuberculosis (sputum positive test). Controls are selected from the same age groups without any respiratory problem or any symptoms related to pulmonary tuberculosis. Family history was taken to exclude other diseases.

Method

Standard ink method is used in present study.[6] To keep the hand clean and dry spirit was used because it removes remaining oil and other dirt.

Palm printing

Palm prints of both hands were obtained after inking with the help of cotton gauge ball. A uniform film of ink was obtained on the tile with cotton gauge ball. Then with the help of same cotton gauge ball ink was spread uniformly on both hands. Complete palm impression including the hollow of palm was obtained over the paper. The same procedure was followed for recording the palm prints of left hand. Thus palm prints of both hands were obtained and recorded.

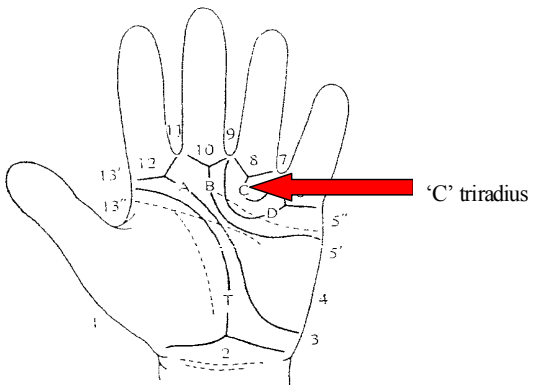
Following Palmar patterns were studied and analyzed in the present study (Galton, 1892)[3] – (Photograph no. 1 & 2).

'C' Line termination

This line represents proximal radiant of 'C' triradius. It is most commonly altered in various disorders. 'C' line may be directed to ulnar, radial, proximal direction or it may be abortive or absent. Accordingly it is designated as c-u, c-r, c-p, c- abortive or absent.

The palmar area may be divided into different sectors and given numbers starting from thumb side (1 to 13) as shown in the figure above. The 'c' line is traced and its termination

Figure 1: Showing 'C' triradius & numerical values used to designate termini of palmar main-line formula



is recorded in numerical value. (Henry ER. 1927).[7]

Thenar and First interdigital area (Th/I_1)

Anatomically these two areas are closely related. In dermatoglyphic analysis these two areas are considered as one area and it is labeled 'Thenar/first Interdigital' area (Th/I1). Usually, pattern is absent in this area. But sometimes 'a vestige' or 'a true' pattern can be present in either thenar or the I1 area or in each of the areas at the same time (Alter M. 1967).[8] A vestige is a pattern configuration, which occurs when an area of abruptly disarranged ridges disturbs the simple flow of ridges. Commonly patterns showing loops are present in 'Thenar / first Interdigital' area, but sometimes whorls also occur in this area.

Second, Third and Fourth Interdigital areas (I_2, I_3 and I_4)

These areas are located in the distal palm in the region of the heads of the metacarpal bones. Each Interdigital area is bordered laterally by digital triradii. The digital triradii are almost always located proximal to the base of digits II, III, IV, V. Digital triradii are labeled as 'a', 'b', 'c'& 'd' starting from the triradius located at the base of digit II (Index finger) moving towards the triradius associated with digit V (little finger). Thus, the second Interdigital (I_2) lies between triradii 'a' and 'b' the third Interdigital area (I_3) lies between triradii 'b' and 'c' and the four the Interdigital area (I_4) lies between triradii 'c' and 'd'.

In the event of digital triradius being absent, the midpoint of the base of the corresponding digit can be used to separate the Interdigital areas. In these Interdigital areas the commonly found pattern configurations are loops, whorls, vestiges and open fields. Loops are most commonly found patterns in the distal palm. Whorls are very rare in the Interdigital areas; while vestiges are relatively common, open fields are the most common ridge configuration found in the distal palm. Truly speaking, open fields are pattern less area formed by almost parallel ridges.

Hypothenar area (I_5)

True patterns are commonly present in the hypothenar area. The patterns usually found in this area are whorls, loops and tented arches. Sometimes simple arches, open fields, vestiges and ridge multiplication also occur. Whorls in the hypothenar area have three triradii.

Comparison of each study variable in patients and controls was done. Qualitative data was analyzed by using Chi-square test. The difference is said to be significant if

Figure 2: Diagram of palm showing the dermatoglyphic pattern areas. Th- thenar; I_1- I_4-first to fourth interdigital areas and Hy- hypothenar

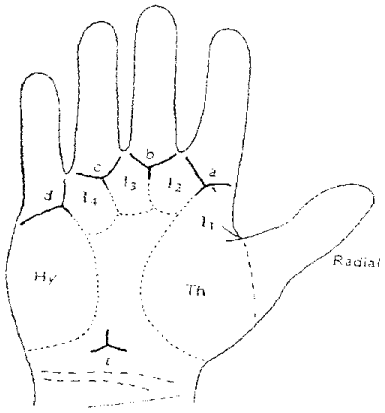
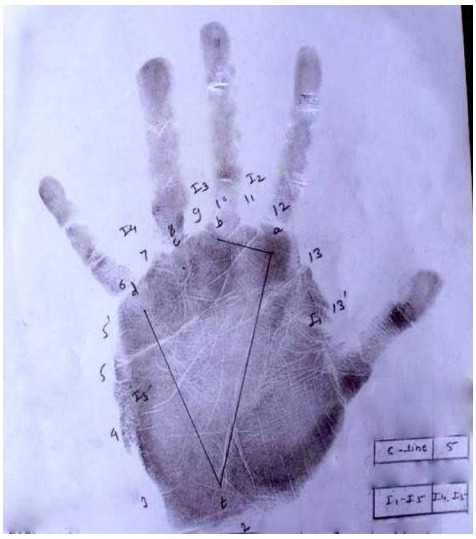


Figure 3: Showing the actual palm print taken



significance i.e. 'P' value is less than 0.05.

Table 1: Shows comparison of 'c' line termination in Right hands of Male Patients and Controls

'C' line termination towards	Total Value	MP %	Total Value	MC %
5	3	4.16	0	0
7	13	18.06	19	26.39
8	0	0	0	0
9	56	77.78	53	73.61

Table 2: Shows comparison of 'c' line termination in Left hands of Male Patients and Controls

'C' line termination towards	Total Value	MP %	Total Value	MC %
5	13	18.05	0	0
7	19	26.39	22	30.55
8	0	0	0	0
9	40	55.56	50	69.45

Table 3: Shows comparison of 'c' line termination in Right hands of Female Patients and Controls

'C' line termination towards	Total Value	FP %	Total Value	FC %
5	2	7.14	0	0
7	12	42.86	9	32.15
8	0	0	--	0
9	14	50	19	67.85

Table 4: Shows comparison of 'c' line termination in Left hands of Female Patients and Controls

'C' line termination towards	Total Value	FP (%)	Total Value	FC (%)
5	5	17.85	0	0
7	7	25	4	14.28
8	0	0	0	0
9	16	57.15	24	85.72

Table 5: Shows comparison of I_1 to I_5 patterns in right hands of Male Patients and Controls

Patterns	MP	MC	'chi-square' Value	Statistical Significance
I_1	2	2	--	Not Significant
I_2	7	5	0.364	Not Significant
I_3	39	41	0.112	Not Significant
I_4	35	31	0.448	Not Significant
I_5	22	14	2.370	Not Significant

X^2 =0.364, p (0.50) =0.46 X^2 =0.112 p (0.50) =0.46
X^2 =0.448 p (0.50) =0/46 X^2 =2.370 p (0.10) =2.37

Table 6: Shows comparison of I_1 to I_5 patterns in left hands of Male Patients and Controls

Patterns	MP	MC	'chi-square' Value	Statistical Significance
I_1	9	6	0.670	Not Significant
I_2	6	4	0.430	Not Significant
I_3	19	27	2.044	Not Significant
I_4	42	39	0.254	Not Significant
I_5	16	20	0.671	Not Significant

X^2=0.670,p(0.50)=0.46 X^2= 0.430,p(0.50)=0.46
X^2= 2.044,p(0.50)=0.46 X^2= 0.254,p(0.50)=0.46
X^2= 0.671,p(0.50)=0.46

Results and Discussion

Palmar pattern

'C' line termination

There is increase in number of hands in which 'c' line termination is towards '5' '8' '9' in right hands of male patients than controls. There is decrease in number of hands in which 'c' line termination is towards '7' in right hands of male patients than controls. There is increase in number of hands in which 'c' line termination is towards '5' in left hands of male patients than controls. There is decrease in number of hands in which 'c' line termination is towards '7' '8' '9' in left hands of male patients than controls. There is increase in number of hands in which 'c' line termination is towards '5' '7' '8' in right hands of female patients than controls. There is decrease in number of hands in which 'c' line termination is towards '9' in right hands of female patients than controls. There is increase in number of hands in which 'c' line termination is towards '5' '7' in left hands of female patients than controls. There is decrease in number of hands in which 'c' line termination is towards '9' in left hands of female patients than controls.

2. I_1 – I_5 pattern

Significant decrease in number of female patients having I_3 pattern in their right hands as compared to female controls.

Pulmonary tuberculosis is most important cause of mortality & morbidity in India. Dermatoglyphics variations are expected as it has some genetic background. There is very

little study done in Dermatoglyphics in diseases like pulmonary tuberculosis. Sidhu LS[9] in 1977 and Nechaeva OB et al[10], 1996 found statistical significant differences in distribution of various subtypes in index fingers of both hands and little finger of right hand. Sangita S Babu et al[11] in 2005 studied the whorl pattern significantly predominant with decrease in loop pattern. Dermatoglyphics has genetic basis in certain diseases like Bronchial asthma, Cervical cancer, Breast cancer. In the present study Dermatoglyphic parameters were studied and found to be statistically significant.

Conclusion

By above study it has been clear that any epidermal changes alternations in person have distinct dermatoglyphics feature. Genetic contribution is one of the causes of pulmonary tuberculosis. Some studies indicate that inherited susceptibility is important risk factor. Many Dermatoglyphic patterns seen in pulmonary tuberculosis patients are found to be statistically significant in comparison with controls. The result of this study establishes the fact that there is a random relation between palmar pattern and incidence of pulmonary tuberculosis. Advantage of this is simple, economical, ink method & material used is easily available & portable. We recommend for further quantitative study on large scale to use such screening tool as a diagnostic tool.

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Original Article

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Study of Fingertip Patterns in Idiopathic Epilepsy

Vibhute Archana Maruti, MBBS, MD (Anatomy)*, Wanje Shilpa, MBBS, MS (Anatomy), Kulkarni P.R., MBBS, MS (Anatomy)*****

Abstract

Idiopathic epilepsy is a tendancy to have seizure when there is no structural abnormality in brain. The cause could be genetic and number of genes have been mapped. These genetic factors are reflected as changes in dermatoglyphis pattern in patients of idiopathic epilepsy. Sophisticated investigations may not possible in all cases. The objective of this study is to investigate the relation between the dermatoglyphic patterns as an indication of genetic susceptibility in the idiopathic epilepsy. Dermatoglyphics has been well established as a diagnostic aid in a number of diseases having hereditary basis. Genetics plays an important role in idiopathis epilepsy, so a study was done on 135 cases of both sexes to find out variations in dermatoglyphysics of these patients. It was found that patients of idiopathic epilepsy have increase in radial loops & decrease in whorls. These genetic factors are reflected as changes in dermatoglyphic pattern in patients of idiopathic epilepsy.

Keywords: Dermatoglyphics; Idiopathic epilepsy; Palm print; Loops; Arches; Whorls.

Introduction

The fine ridge patterns of the fingers, palms and soles have attracted man since primitive times. There is evidence that finger prints were used for identification for more than 2000 years ago. Palmistry, an ancient art of fortune telling by studying the hand and predicting the future, has its origin in India.[1] Dermatoglyphics is the scientific study of epidermal ridges and their configurations on volar aspect of fingers, palms, toes and soles. The term 'Dermatoglyphics' was first introduced in 1926 by the Anatomist, Harold Cummins.[2] The biologic, embryologic, anthropologic, forensic, clinical and genetic implications of friction ridges have been folded into one scientific discipline called 'Dermatoglyphics'.

The importance of dermatoglyphics is based upon facts, (Penrose and Ohara[3] 1973)

1) Each dermatoglyphic configuration is unique, not same even in monozygotic twins.
2) These remains unchanged throughout life and survive superficial injury.
3) Recording of ridge pattern can be done rapidly, it does not require expensive equipments and procedure is safe and atraumatic.
4) Can be studied immediately after birth.
5) Useful for screening large population.

Ridge differentiation[4] takes place early in fetal life which is genetically determined and influenced by environmental factors. Once they formed, do not change throughout life. Genetically related medical disorders may be, studied with the help of dermatoglyphics.

Some clinical disorders in which dermatoglyphic studies have been carried out on a large scale are as follows,

Author's Affiliation: *Assistant Professor, Dept of Anatomy, YCMM & RDF's Dental College, Ahmednagar. **Assistant Professor, Dept of Anatomy, Govt Medical College, Aurangabad, ***Professor and Head of Dept of Anatomy, Govt Medical College, Latur.

Reprint's request: Dr Vibhute Archana Maruti, MBBS, MD (Anatomy), Assistant Professor, Dept of Anatomy, YCMM & RDF's Dental College, Ahmednagar. Contact No. 9370314077

Email: archuvibhute@gmail.com

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Major chromosomal aberrations

a) Autosomal syndromes (Cummins[5])
   1) Mongolism (Trisomy 21)
   2) Cri-du-Chat syndrome
   3) Trisomy E
   4) Trisomy D
b) Sex chromosome syndromes
   1) Klinefelter's syndrome (47 XXY)
   2) Turner's syndrome (45 X0)[6]
   3) XXYY syndrome (Uchida et al[7])

Inherited non-chromosomal disorders

1) Mental retardation (Smith et al[8])
2) Sickle cell anemia (Dejong[9])
3) Leukemia (Verbov[9])
4) Cerebral gigantism (Schaumann and Alter[8]
5) Congenital heart disease (Sanchez[10])

Epilepsy is one of the common neurological disorder affecting people across all nationalities. It presents an etiologic heterogenity and multifactorial pathogenesis. Genetic factors play an important role in determination of the idiopathic epilepsy, both partial and generalized.[11] Idiopathic epilepsy is a tendency to have seizure when there is no structural abnormality in the brain. The cause could be genetic and number of genes have been mapped. These genetic factors are reflected as changes in dermatoglyphic pattern in patients of idiopathic epilepsy. Sophisticated investigations may not be possible in all cases. Dermatoglyphics may be used as a screening test to select few cases showing abnormalities, expecting abnormal karyotype. In the present study a preliminary observation was made of the usefulness of finger tip patterns in serving as predictor for idiopathic epilepsy among individuals living in solapur district of Maharashtra.

Aims and Objectives

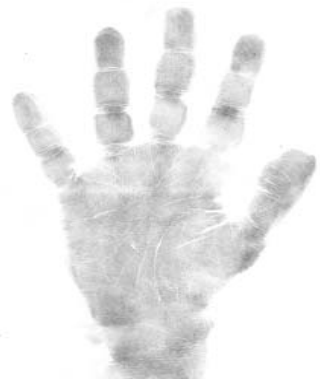
1) To study fingertip patterns in idiopathic epilepsy.
2) To compare the fingertip patterns in normal and patients with idiopathic epilepsy.
3) To study correlation between fingertip pattern in normal and idiopathic epilepsy patients.
4) To evaluate the significance of the above correlation by applying statistical methods.
5) To compare the result of the present study with that of previous study.

Materials and Methods

Materials used are wooden table of suitable height, porcelain tile, kores duplicating ink, sponge rubber pad, a rubber roller, white bond paper, spirit, soap, water and towel, magnifying lens.

The method used to collect the data for the present study was Standard ink method.[12] Patient was asked to wash hands with soap and water to remove oil, sweat and dirt from the skin. The porcelain tile was kept on table. A small amount of ink was placed on the slab and spread with roller into a thin, even film. The area to be printed was pressed against the slab, taking care that, the whole area to be printed was covered with ink.

Photograph of hand print



Palm Prints: A firm surface was used under the sheet of paper on which inked finger is pressed. Pressure is applied on interphalangeal joints, head of metacarpals and dorsum of hand. With the help of fingers or blunt end of the pencil little pressure is applied on the web space between the fingers. Complete palm impression including hallow of space was obtained over the paper. To ensure complete print and also to print the hollow of the palm, a sponge rubber pad was kept under the paper on which prints are made.[13] Thus prints of the both hands were obtained and recorded with care.

Fingertip Prints[14]: The distal phalanges of person's right hand were inked over the tile by firm pressure starting from thumb (ulnar to radial side). White bond paper was kept on the edge of the table for recording the fingerprint pattern. Rolled finger prints were obtained starting from the thumb to little finger. The same procedure was followed for recording the finger prints of the left hand. Thus rolled finger prints of the both hands were obtained and recorded with care.

Collection of data

With the help of standard ink method, prints of 135 diagnosed idiopathic epilepsy patients were obtained from Dept. of Medicine and Dept. of Pediatrics of Civil hospital, Solapur. Patients age was between 5-35 years and diagnosis of epilepsy was confirmed clinically and by investigations. Following criteria taken into consideration.

1) History of recurrent seizures.
2) No history of head trauma.
3) No history of infectious diseases.
4) No history of metabolic disorders.
5) Absence of any other genetic disorders.

The controls were having age group of 5 to 35 years. Criteria taken into consideration for controls:

1) No family history of epilepsy.
2) No history of febrile convulsions.
3) Absence of any other hereditary disorder.

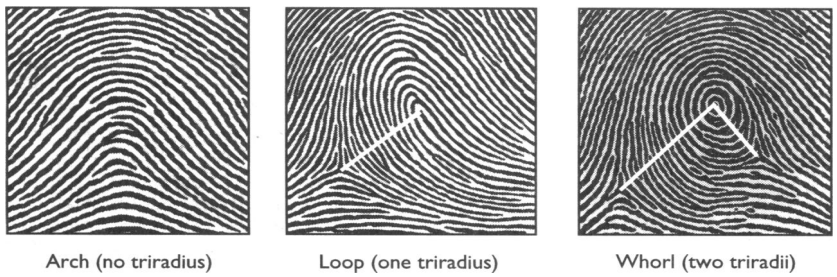
The following parameters were studied,

Finger tip patterns: The ridge patterns on the distal phalanges of the finger tip are divided into following types

1) *Arch:* It is formed by succession of more or less parallel ridges which traverse the pattern area and form a curve which is concave proximally. (As shown in Photograph No 1)
2) *Loop:* It is a series of ridges enter the pattern area on one side of the digit, recurves and leave the pattern area on the same side. If the ridge opens on the ulnar margin, the resulting loop is termed as ulnar loop. If the ridge opens towards the radial margin the resulting loop is termed as radial loop. (As shown in Photograph No 1)
3) *Whorl* - In this ridges are commonly arranged as a succession of concentric rings. (As shown in Photograph No 1)

The obtained data is tabulated separately for cases and controls and for males and females. The data is analyzed and compared statistically by applying 'z' test and then 'p'value is

Figure 1: Showing different finger tip patterns & TFRC



calculated. If 'p' value is less than 0.05, then results are considered significant.

Z test formula

$$Z = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}}$$

$\bar{X}_1$ = Mean (Cases)
$\bar{X}_2$ = Mean (Control)
σ_1 = S.D.Cases
σ_2 = S.D. Control
n_1 = Number of cases
n_2 = Number of Controls

Results and discussion

Table 1: Showing finger tip patterns in cases and controls

Finger tip pattern	Male				Female			
	Cases	controls	Z value	P value	Cases	controls	Z value	P value
Ulnar loop	376 (55.29%)	360 (53.73%)	0.576	**>0.05, not significant**	420 (62.68%)	411 (60.64%)	2.12	**>0.05, not significant**
Radial loop	45 (6.62%)	27 (4.02%)	2.115	<0.05, significant	7 (1.04%)	11 (1.62%)	0.917	>0.05, not significant
Whorls	230 (33.83%)	264 (39.41%)	-2.127	**<0.05, significant**	220 (32.84%)	224 (32.94%)	-0.041	**>0.05, not significant**
Arches	29 (4.26%)	19 (2.84%)	1.417	>0.05, not significant	123 (3.44%)	34 (5%)	-1.431	>0.05, not significant

Finger tip pattern

As per table No 1 in male cases, frequency of ulnar loops is 55.29% in idiopathic epilepsy cases and 53.73% in controls, radial loops is 6.62% in idiopathic epilepsy cases and 4.02% in controls, whorls is 33.83% in idiopathic epilepsy cases and 39.41% in controls, arches is 4.26% in idiopathic epilepsy cases and 2.84% in controls. So in male cases percentage of ulnar loops, radial loops and arches are increased, while whorls are seen decreased. In this result increased incidence of radial loops and decreased incidence of whorls are statistically significant.

In females, frequency of ulnar loops is 62.68% in idiopathic epilepsy cases and 60.64% in controls , radial loops is 1.04% in idiopathic epilepsy cases and 1.62% in controls , whorls is 32.84% in idiopathic epilepsy cases and 32.94% in controls , arches is 3.44% in idiopathic epilepsy cases and 5% in controls. Also in female cases percentage of ulnar loops are increased while radial loops, whorls and arches are seen decreased. In this increased incidence of ulnar loops and decreased incidence of radial loops, whorls and arches are statistically not significant.

The results of this study are compared with previous study by Blanka Schaumann and Assa Mayersdorf. As per their study, they found percentage of ulnar loops and radial loops increased and percentage of whorls and arches decreased in male.

Conclusions

Hence we conclude that the following parameters can be used as dermatoglyphic markers in case of idiopathic epilepsy.

Comparison of finger tip patterns in present and previous studies

Pattern	Previous study by Blanka Schaumann and Assa Mayersdorf[13]				Present study			
	Male		Female		Male		Female	
	Cases (%)	Controls (%)	Cases (%)	Controls (%)	Cases (%)	Controls (%)	Cases (%)	Controls (%)
Ulnar loops	63	59.9	63	59.9	55.29	53.73 (Not Significant)	62.68	60.44 (Not Significant)
Radial loops	6.6	5	6.6	5	6.62	4.02 (Significant)	1.04	1.62 (Not Significant)
Whorls	25.6	28.4	25.6	28.4	33.83	39.41 (Significant)	32.84	32.94 (Not Significant)
Arches	4.8	6.7	4.8	6.7	4.26	2.84 (Not Significant)	3.44	5 (Not Significant)

1. Increase in radial loops in males.
2. Decrease in whorls in males.

Ulnar loops and arches cannot be taken as dermatoglyphic markers in case of idiopathic epilepsy as they are not significant in our study. The result of this study establishes the fact that there is a random relation between fingertip pattern and incidence of idiopathic epilepsy. We recommend for further quantitative study to confirm the findings of present study.

Presence of above dermatoglyphic features will help us to predict the chances of development of idiopathic epilepsy, so that the individual can take precautions measures and early treatment to prevent complications.

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Dorsal Pancreatic Agenesis

Dope Santoshkumar A., MBBS, MS (Anatomy)*, Selukar Mangesh S., MBBS, MS (Anatomy), Kombde Balaji H., MBBS, MD (Radiology)***, P.R. Kulkarni, MBBS, MS (Anatomy)****

Abstract

Dorsal Pancreatic Agenesis (DPA) is a rare congenital anomaly ,agenesis that results from the embryological failure of the dorsal pancreatic bud to form the body and tail of the pancreas. Present case of dorsal pancreatic agenesis have been reported in GMC ,Latur. A 11-year-old girl presented with abdominal pain. Abdominal computed tomography (CT) revealed a normal-appearing pancreatic head, but the body and tail were not visualized. Endoscopic cholangiopancreatogram (ERCP) revealed a short pancreatic duct. Abdominal magnetic resonance imaging (MRI) findings were similar to the CT and ERCP results. The patient was diagnosed with agenesis of the dorsal pancreatic bud by CT, ERCP and MRI.

Key Words : Agenesis; Dorsal Pancreas;, ERCP; CT.

Introduction

Agenesis of pancreas is very rare anomaly. The pancreas owes its development from the endoderm of the duodenal segment of the foregut. It develops in two parts – dorsal and ventral. The ventral bud forms the lower part of the head and the uncinate process of the pancreas, while the upper part of head , the body and the tail are formed from the dorsal bud. Partial or complete agenesis of the dorsal pancreas is a rare congenital anomaly that results from embryologic failure of dorsal pancreatic budding in the developing fetus.[1,3]

Author's Affiliation: *Assistant Professor, Dept of Anatomy, Government Medical College, Latur-413512 (Maharashtra), **Associate Professor, Dept of Anatomy, Government Medical College, Latur-413512 (Maharashtra), ***Associate Professor, Dept of Radiology, Government Medical College, Latur-413512 (Maharashtra), ****Professor & HOD, Govt. Medical College, Latur.

Reprint's request: Dr Dope Santoshkumar A., MBBS, MS (Anatomy), Assistant Professor, Dept of Anatomy, Government Medical College, Latur-413512 (Maharashtra).

Email: drdopesantosh@yahoo.co.in

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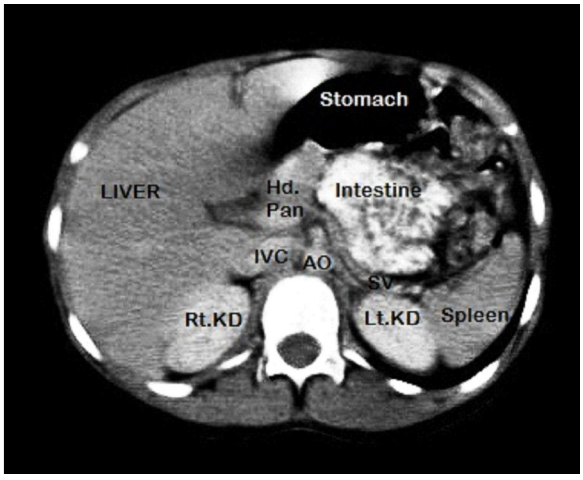
Case report

A 11-year-old girl presented with recurrent episodes of epigastric pain over a four month period. The pain was continuous and non-radiating in nature. Physical examination revealed epigastric tenderness. There was no history of diabetes mellitus. Investigations: elevated serum amylase and lipase levels [1200 U/L(normal values 0-200) and 920 U/L (normal values 0-190), respectively]. Ultrasonography showed only partial visualization of pancreas; the body and tail of the pancreas could not be visualized. CT scan revealed normal head of pancreas; the body and tail of pancreas were absent. Endoscopic retrograde cholangio-pancreatography (ERCP) demonstrated filling of the normal ventral duct only. The minor papilla was not visualized despite careful examination. The common bile duct was normal. The patient was treated conservatively; Absence of the dorsal pancreatic ductal system, accessory duct and minor papilla was documented. Lipid profile, serum calcium and renal function tests were normal. There was no family history . The patient did not have skeletal , dental or cardiac defects.

Discussion

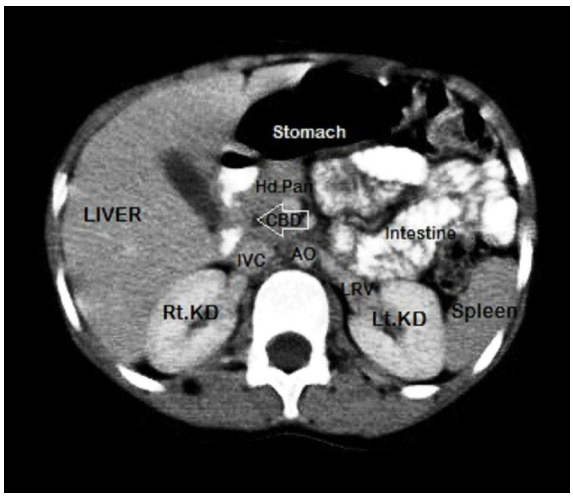
The human pancreas develops from the ventral and dorsal buds of the foregut endoderm.[1] The ventral bud forms the uncinate process and the posteroinferior part of the head. The Wirsung duct drains along with the bile duct through the major papilla. The dorsal bud forms the remaining ventrosuperior part of the head, the isthmus, the body and the tail of the pancreas and drains through the Santorini duct into the minor papilla. Agenesis of the dorsal pancreas is derived embryologically from the absence or regression of the dorsal bud.[1-4] This anomaly may be partial or complete. In partial agenesis of the dorsal pancreas, the minor papilla, duct of Santorini or the pancreatic body are present. In complete agenesis of the dorsal pancreas, the neck, the body and the tail of the pancreas, duct of Santorini and minor papilla are absent. Few cases of agenesis of the dorsal pancreas have been reported in the English literature.[2,3] Complete agenesis of the pancreas is incompatible with life.[5] Agenesis of the dorsal pancreatic bud results in complete absence of the dorsal ductal system. ERCP is necessary to differentiate DPA from "partial agenesis".[6] A diagnostic triad is required, documenting absence of the dorsal ductal system, the accessory duct (Santorini) and the minor papilla. The absence of the body and tail of the pancreas is best demonstrated on CT scan, MRI or MRCP. With increasing availability of MRCP, awareness of DPA is required. DPA condition is very rare; a total of 15 cases have been reported since 1913 till date.[2,7] Abdominal pain and diabetes mellitus are commonly reported. The association of DPA and pancreatitis is less well defined.[8] The possible mechanism contributing to pancreatitis are proposed , Sphincter of Oddi dysfunction may play a role in the pathophysiology of dorsal pancreatic hypoplasia and pancreaticobiliary diseases associated with it.[9] However, the role of genes in the pathogenesis of acute and chronic pancreatitis is increasingly recognized.[10] In southern India, genetic predisposition results in a high incidence of pancreatitis.[11,12] Agenesis of dorsal pancreas is a very rare congenital anomaly that may be associated with diabetes mellitus and abdominal pain. However, hereditary mechanisms may play a role in the development of this anomaly but remains to be further clarified. Wildling et al and Schnedl et al reported familial occurrence of agenesis of dorsal pancreas in the mother and her sons.[13,14] In these reports, the authors suggested that the genetic mode of transmission for this anomaly is most likely autosomal dominant or X-linked dominant. If

Fig 1: CT abdomen showing head of pancreas; body and tail are absent



(Where Hd.Pan is Head of pancreas,IVC is Inferior vena cava, AO is Aorta & SV is Spleenic Vein)

Fig 2: CT abdomen showing head of pancreas



(Where Hd.Pan is head of pancreas,IVC is Inferior vena cava, AO is Aorta,CBD is common bile duct & LRV is left renal vein.)

DPA is suspected, the combined use of CT and ERCP or MRCP is needed. However, ERCP is invasive procedure and operator-dependent for successful identification of opacity of the main and accessory pancreatic duct. By contrast, MR cholangiopancreatogram (MRCP) clearly demonstrates pancreatic duct morphology.[15-17] In cases where cannulating the pancreatic duct fails, MRCP may be helpful. Therefore, the combined use of CT and ERCP or MRCP is useful for confirmation of the diagnosis of agenesis of dorsal pancreatic bud.

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Rare Variant of Right Testicular Artery: A Case Report

Ambica Wadhwa*, Sandeep Soni**

Abstract

A sound knowledge of variations of blood vessels is important during operative diagnostic and endovascular procedures in the abdomen. This report describes the origin of right testicular artery from the renal artery and the origin of accessory right inferior suprarenal artery from the right testicular artery in a 60 year old male cadaver. A knowledge of the variant origin of the testicular artery is important during renal and testicular surgery. The origin and course must be carefully identified in order to preserve normal blood circulation and prevent testicular atrophy. A reduction in gonadal blood flow may lead to varicocele under circumstances. A knowledge of this variant anatomy may be of interest to radiologists and helpful in avoiding diagnostic errors.

Keywords: Renal artery; Suprarenal artery; Testicular artery; Varicocele.

Introduction

Variations in the origin of arteries in the abdomen are very common but with the invention of new operative techniques within the abdominal cavity, the anatomy of abdominal vessels has assumed much more clinical importance. The gonadal arteries arise from the front of the aorta, usually 1–2 inches (2.5–5 cm) below the renal arteries. These arteries are small and variable in their origin.[1] Each kidney receives blood supply form a single renal artery. This pattern presents in 70% of individuals. Accessory renal arteries are found in approximately 25–30%.[2]

In 14% of kidneys, the gonadal artery which usually arise from the aorta, originated from renal artery, either from main or accessory one.[3] Moreover, several variations of suprarenal artery have been reported.[4-8] A gonadal artery with origin from an inferior polar renal artery may be injured during the percutaneous treatment of the syndrome of pielo-ureteral junction, so it becomes a major contraindication. Also, this anatomical variation enhances the importance of the arteriography or Doppler ultrasound examination of the renal hilum.

Case report

During routine dissection, we found variations in a 60 year old male cadaver with no known unfavourable medical history. The right testicular artery originated from right renal artery 2 cms distal to its origin from the abdominal aorta. The right testicular artery gave an accessory inferior suprarenal artery 1cm distal to its origin, that supplied the right adrenal gland. The right testicular artery then progressed in an oblique course outwards and caudally, crossing anterior to the right renal artery. The right main inferior suprarenal artery arose normally from the renal artery 1.5 cm from its origin from the aorta. However, no variations of renal or testicular vein were observed. On the left side, the renal, testicular and suprarenal arteries were normal in origin.

Author's Affiliation: *Associate Professor, Deptt. Of Anatomy, Punjab Institute of Medical Sciences, Jalandhar, ** Deptt. Of Chest & TB, Punjab Institute of Medical Sciences, Jalandhar.

Reprint's request: Dr. Ambica Wadhwa, Associate Professor, Anatomy, Punjab Institute of Medical Sciences, Garha road, Jalandhar(Punjab) – 144006.

E-mail: ambicasoni02@yahoo.com

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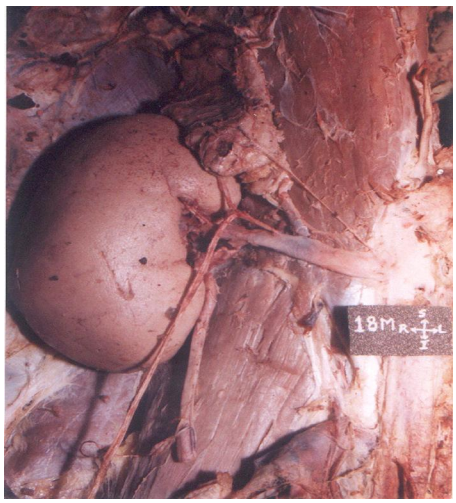
Fig-1: Origin of right testicular artery from right renal artery and the origin of accessory right inferior suprarenal artery from the right testicular artery



Discussion

Variations in the origin, course, and branches of the testicular arteries are attributed to their embryological origin[9]. The first note on the embryological origin of the gonadal artery was made by Felix W.[10] The embryo has three sets of lateral mesonephric arteries namely cranial, middle, and caudal. One of the caudal arteries usually persists and differentiates into the definitive gonadal artery. However, the persistence of a cranial lateral mesonephric artery may result in a high-origin of the gonadal artery.[10] Ciçekciba°i AE et al revealed that the middle group of lateral mesonephric arteries gave rise to a gonadal artery that originated from the renal artery, while that of the cranial group gave rise to a gonadal artery that originated from the suprarenal artery or from a more superior aortic level.[11] Knowledge concerning the variations of renal artery has increasing importance due to increasing rate of renal transplants, vascular reconstruction for both congenital anomalies and acquired lesions, and reconstructive surgery for abdominal aortic aneurysm[12]. Several combined variations of renal, testicular and suprarenal arteries have also been reported. Salve el al. reported right testicular artery arising from right aberrant renal artery.[13] Sylvia et al. reported bilateral variant testicular artery with double renal arteries in male cadaver. Right testicular artery originated from right upper renal artery while left testicular artery originated from left lower renal artery.[14] Brohi et al. reported a case with high origin of left testicular artery with unusual suprarenal branch from it.[8] Ozan et al reported two cases, in which gonadal arteries and accessory renal arteries arose from abdominal aorta at higher level than usual. In one of the cases, right middle suprarenal artery and parenchymal branch to the kidney originated from right testicular artery via a common trunk.[7] Variations in the gonadal vessels may influence the blood flow to the kidney and gonadal glands and cause some pathological conditions as varicocele.[15] With the advancement of new operative techniques within the abdominal cavity, the anatomy of gonadal vessels has assumed much more importance. The gonadal vessels must be preserved to avoid the possible complications following damage of these vessels. During laparoscopic surgery of the male abdomen and pelvis, many complications may arise, due to unfamiliar anatomy in the operative field.[16] The variant becomes more significant in light of the fact that testicular arterial blood flow was found to be significantly decreased in men with varicocele.[17] Additionally, anomalous Testicular artery origin may affect the testicular perfusion and testicular function. Since age-related disturbances in spermiogenesis are well described in the literature, it would be wise for the clinician to differentially diagnose age-related impaired spermiogenesis from perfusion-induced spermiogenesis.

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Amniotic Band: A Case Report

Gayatri S. Chakre, MD (Anatomy)*, S.U. Chakre, MD (Pediatrics), Ashwini S. Jadhav, MS (Anatomy)***, P.R. Kulkarni, MS (Anatomy)*****

Abstract

Amniotic bands are caused by tearing of amnion, which produces fiber like bands that may entrap the fetal parts in utero, a condition called Amniotic band syndrome (ABS). As the baby grows, the bands constrict or tighten, causing a reduction in blood supply and the extremities may develop abnormally or become amputated.

Keywords: Amniotic band syndrome; Ehler-Danlos Syndrome.

Embryological basis

ABS is not a hereditary disorder. It most often happens spontaneously, but can also occur if the woman experiences trauma to lower abdomen, except in case of Ehler-Danlos Syndrome, a connective tissue disorder. The exact cause of amnion tearing is often unknown and there are no preventive measures.[1]

Origin of the bands may be from infection or toxic insults that involve either the fetus or fetal membranes, or both. They may represent adhesion between the amnion and of affected structures in the fetus.[2]

According to the Amniotic band theory ABS occurs due to partial rupture of amnion but this does not explain the high incidence cleft palate and other malformations occurring together with ABS, this co-occurrence suggests an "intrinsic" defect of the blood circulation. [3]

Case report

A full term male child born of non-consanguineous marriage with birth weight of 2.5 kg was delivered vaginally to a 24 yrs old primigravida at Civil Hospital attached to Dr. V. M. Govt. Medical College, Solapur. After birth, the baby was referred to department of Paediatrics to rule out any other associated malformations in view of malformed index finger. The mother did not have any antenatal history of drug intake or any other complications. On examination the neonate [Fig 1 and 2] had a constriction ring over the proximal part of right index finger, the distal part of the finger was normal. No other associated anomailies were found.

Discussion

Amniotic banding affects approximately 1 in 1, 2000 live births. It is the cause of 178 in 10,000 miscarriages. Up to 50% of cases have other congenital anomalies including cleft lip, cleft palate, club foot deformity. Hand and finger anomalies occur in up to 80%.[3]

Other names for conditions include amniotic

Author's Affiliation: *Assistant Professor, Department of Anatomy, Dr VM Government Medical College, Solapur, (MS), **Assistant Professor, Department of Pediatrics, Dr VM Government Medical College, Solapur, (MS), ***Assistant Professor, Department of Anatomy, Dr VM Government Medical College, Solapur, (MS), ****Professor and Head of Department, Department of Anatomy, Dr VM Government Medical College, Solapur, (MS).

Reprint's request: Dr. Mrs. Gayatri S. Chakre, Department of Anatomy, Dr VM Government Medical College, In front of District Court, Solapur – 413 003 (MS).

E-mail: drgschakre@yahoo.co.in

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Fig 1

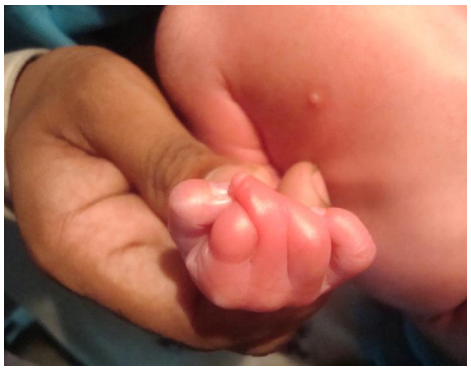
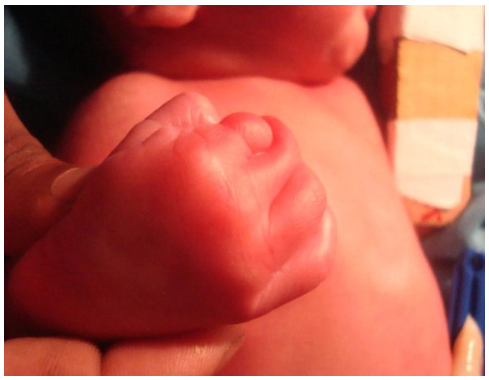


Fig 2



band disruption complex[4], streater dysplasia, congenital constriction bands or rings, amniotic deformity adhesions mutilations (ADAM)[1], pseudoainhum[3].

Sometimes ABS may cause limb-body wall complex (LBWC), where in addition to limb defects and craniofacial defects, exencephaly or encephalocele, anterior body well defects such as omphalocele or gastroschisis are present.[5] The most severe causes occur if the band becomes wrapped around the head or umbilical cord, which can result in fetal death.[2]

ABS is often difficult to detect before birth as the individual strands are small and hard to see on the ultrasound. Usually the bands are detected indirectly because of constrictions and swelling upon limbs, digits etc. 3D ultrasound and MRI can be used for more detailed and accurate diagnosis and the resulting damage to fetus.[2]

Treatment usually occurs after birth , where plastic and reconstictive surgery is considered to treat the resulting deformity. Physical and occupational therapy may be needed in few cases. In rare cases fetal surgery is done to save a limb which is in danger of amputation or other deformity, known as amniotic band release surgery.[2]

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Case Report

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Variant Termination of the Brachial Artery and its Clinical Importance

Sharadkumar Pralhad Sawant, Dope Santoshkumar A., MBBS, MS (Anatomy)**

Abstract

During routine dissection, of the right upper limb of a 70 years old donated embalmed male cadaver in the Department of Anatomy, K.J. Somaiya Medical College, Sion, Mumbai, India, we observed a trifurcation of the brachial artery into the radial, ulnar and common interosseous arteries. The brachial artery trifurcated above the cubital fossa in the lower part of the arm. The common interosseous artery was longer in length. The common interosseous artery divided at an unusual site in the cubital fossa into the anterior and posterior interosseous arteries. The radial artery travelled downward along the radial side of the forearm to the wrist. The course of the ulnar artery was normal. There were no associated altered anatomy of the nerves observed in the specimen. The variation was unilateral and the left upper limb was normal. The photographs of the trifurcation of brachial artery into radial, ulnar and common interosseous artery were taken for proper documentation.

Conclusion: Topographical anatomy of the normal and abnormal variations of the axillary artery are clinically important for surgeons, orthopaedicians operating on the supracondylar fracture of humerus and radiologists performing angiographic studies on the upper limb. The trifurcation of brachial artery in the lower part of arm may result in excessive haemorrhage during supracondylar fracture of the humerus. A lack of knowledge of such type of variations with different patterns may complicate the surgery and may cause unnecessary bleeding. Therefore both the normal and abnormal anatomy of the region should be well known for accurate diagnostic interpretation and therapeutic intervention.

Keywords : Brachial Artery; Trifurcation; Radial Artery; Ulnar Artery; Common Interosseous Artery; Surgeons; Orthopaedicians; Supracondylar Fracture; Radiologists; Angiographic Studies.

Introduction

The brachial artery ends in the cubital fossa by dividing into the radial and ulnar arteries. The ulnar artery, the deeper and the larger of the two terminal branches of the brachial artery, begins a little below the bend of the elbow, and, passing obliquely downward, reaches the flexor carpi ulnaris muscle in its middle third, whereas the ulnar nerve is covered by the muscle throughout its entire course running under the tendon in the wrist region. It then runs along the ulnar border upto the wrist, crosses the transverse carpal ligament on the radial side of the pisiform bone, and immediately beyond this bone divides into two branches, which enter into the formation of the superficial and deep palmar arches. The common interosseous artery is a short branch of the ulnar, about 1 cm in length, arises immediately below the tuberosity of the radius from the Ulnar artery. It passes back to the upper border of the interosseous membrane and divides into anterior and posterior interosseous arteries. Anterior interosseous artery descends on the anterior aspect of the interosseous membrane with the median nerve's anterior interosseous branch. Median artery, a slender branch from anterior

Author's Affiliation: *Associate Professor, Department of Anatomy, K. J. Somaiya Medical College, Somaiya Ayurvihar, Eastern Express Highway, Sion, Mumbai-400 022, **Assistant Professor, Dept of Anatomy, Government Medical College, Latur-413512 (Maharashtra).

Reprint's request: Dr. Sharadkumar Pralhad Sawant, 25/2, Samrat Ashok Nagar Society, Shell Colony Road, Chembur, Mumbai – 400 071, Maharashtra, India. Phone : 022-22936867, 09322061220, Fax No.: 022–24091855.

E-mail: drspsawant@gmail.com

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interosseous artery, accompanies and supplies the median nerve.[1] The radial artery appears, from its direction, to be the continuation of the brachial, but it is smaller in caliber than the ulnar. It commences at the bifurcation of the brachial, just below the bend of the elbow, and passes along the radial side of the forearm to the wrist and take part in the completion of the superficial and deep palmar arches.

Case Report

During routine dissection, of the right upper limb of a 70 years old donated embalmed male cadaver in the Department of Anatomy, K.J. Somaiya Medical College, Sion, Mumbai, India, we observed a trifurcation of the brachial artery into the radial, ulnar and common interosseous arteries. The brachial artery trifurcated above the cubital fossa in the lower part of the arm. The common interosseous artery was longer in length. The common interosseous artery divided at an unusual site in the cubital fossa into the anterior and posterior interosseous arteries. The radial artery travelled downward along the radial side of the forearm to the wrist. The course of the ulnar artery was normal. There were no associated altered anatomy of the nerves observed in the specimen. The variation was unilateral and the left upper limb was normal. The photographs of the trifurcation of brachial artery into radial, ulnar and common interosseous artery were taken for proper documentation.

Figure 1: The photographic presentation of trifurcation of brachial artery into radial, ulnar and common interosseous artery

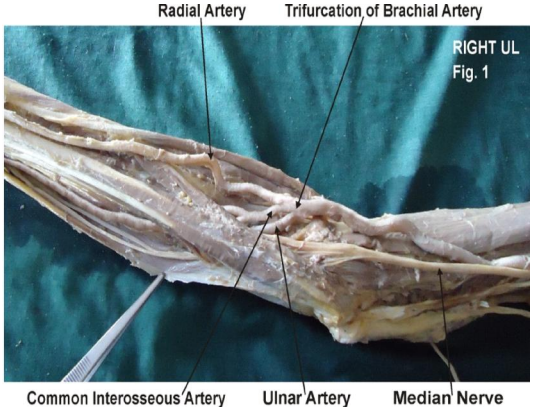
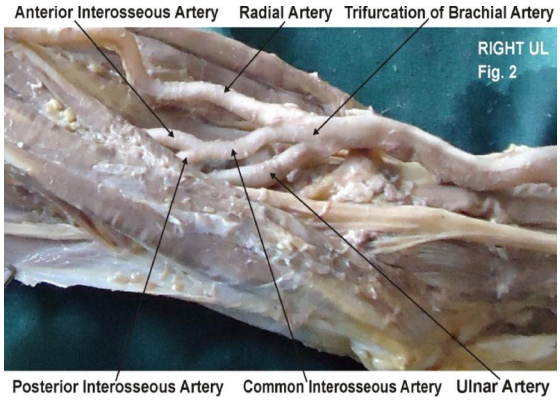


Figure 2: The photographic presentation of unusual termination of the common interosseous artery into the anterior and posterior interosseous arteries



Discussion

The brachial artery commonly terminates into radial and ulnar arteries proximal or distal to intercondylar line. But the trifurcation of the brachial artery into radial, ulnar and common interosseous arteries are not common.[1] In the present case the brachial artery trifurcates into the radial, ulnar and common interosseous arteries above the supracondylar line in the lower part of the arm. The supernumerary branches of brachial artery may be the radial recurrent artery or the median artery (**2**). Various authors have made studies on termination of brachial artery.[1,2, 3,4,5,6,7,8,9,10] It may bifurcate proximally and reunite to form single trunk. Sometimes ulnar artery arise proximally. Rarely there may be a communicating vessel connecting axillary artery and brachial artery.[1] The radial recurrent arising from the lower part of brachial artery separately but not as a one of the terminal branch is reported in literature.[2] The trifurcation of brachial artery into ulnar, radial, and radial recurrent arteries in a right superior extremity of fifty years old male cadaver during dissection is documented in literature. The third branch was radial recurrent artery and the common interosseous artery was given off from the ulnar artery, which divided into anterior and posterior interosseous arteries. The radial artery was

normal in that study.[10] In the present case, the brachial artery had trifurcated into ulnar, radial, and common interosseous arteries in the right upper limb. There were no communicating branches seen between radial and ulnar arteries. In high termination of brachial artery if one of the two arteries lies superficial to the superficial flexor group of muscles. The other artery is taking the usual course is crossed superficially by the median nerve.[11] In the present case the ulnar artery was present deep to the superficial flexor muscles of forearm and no aberrant artery was observed. The ulnar artery may take origin from the brachial artery proximally and then the brachial artery terminates into the radial artery and the common interrosseous artery in the cubital fossa.[16] The radial artery also may take origin proximally from the brachial artery running superficial to forearm flexors or deep fascia or rarely subcutaneous. The common interosseous artery may take origin proximally.[17] Sometimes the radial artery may be absent[18] and even the brachial artery may be absent.[19]

Developmental Basis

The seventh cervical intersegmental artery forms the axis artery of the upper limb and persists in the adult to form the axillary, brachial, and interosseous arteries. Transiently, the median artery arises as a branch of the interosseous artery, begins to regress and remains as a residual artery accompanying the median nerve.[13] The radial and the ulnar arteries are later additions to the axis artery. The ulnar artery and the median artery are branches of the axis artery.[12] The superficial brachial artery is a consistent embryonic vessel, coexisting or not with the brachial artery.[14] It has two terminal branches, lateral and medial. The lateral continues as a part of the definitive radial artery[15] and the medial i.e. superficial antebrachial artery, which divides into the median and ulnar artery branches, which are the trunks of origin of the median and ulnar arteries. The arterial pattern of the upper limb develops from an initial capillary plexus by a proximal and distal differentiation, due to maintenance, enlargement and differentiation of certain capillary vessels, and the regression of others. The number of upper limb arterial variations arise through the persistence, enlargement and differentiation of parts of the initial network which would normally remain as capillaries or even regress.[12,20,21,22]

Clinical significance

The knowledge of presence of the unusual high level trifurcation of brachial artery is clinically important for clinicians, surgeons, orthopaedicians and radiologists performing angiographic studies. Undoubtedly, such variations are important for diagnostic evaluation and surgical management of vascular diseases and injuries.

Conclusion

The trifurcation of brachial artery in the lower part of arm may result in excessive haemorrhage during supracondylar fracture of the humerus. A lack of knowledge of such type of variations with different patterns may complicate the surgery and may cause unnecessary bleeding. Therefore both the normal and abnormal anatomy of the region should be well known for accurate diagnostic interpretation and therapeutic intervention.

Competing interests

The author declare that he has no competing interests.

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An Elongated Styloid Process: A Case Report

B.R. Sontakke*, P. Bokariya *, J.E. Waghmare, A.M. Tarnekar***, M.R. Shende*****

Abstract

In the department of anatomy MGIMS Sevagram during routine osteology demonstration classes for undergraduate students, one adult dried human skull of students had abnormally long styloid processes approximately measuring 5 cm in length. The details of this case along with clinical implications are presented below.

Keywords: Styloid process; Skull; Reichert's cartilage.

Introduction

Elongated styloid process can cause recurrent throat pain along with foreign body sensation, dysphagia or facial pain. Additional symptoms may include neck or throat pain which may radiate to ipsilateral ear.[1] In adults the styloid process is approximately 2.5 cm in length and its tip is located between the external and internal carotid arteries on lateral aspect of the tonsillar fossa.[2]

Results

The length of the styloid process was measured with the help of Vernier Caliper.

Table 1: Measurements of styloid processes

Length in cm	
Right styloid process	Left styloid process
5 cm	4.9 cm

Author's Affiliation: *Assistant Professor, Department of Anatomy, MGIMS, Sevagram, **Associate Professor, Department of Anatomy, MGIMS, Sevagram, ***Professor, Department of Anatomy, MGIMS, Sevagram.

Reprint's request: B.R. Sontakke, Assistant Professor, Department of Anatomy, Mahatma Gandhi Institute of Medical sciences, Sevagram, Wardha (Maharashtra) India, Pin- 442102. Phone No.: Office- 07152- 284341 to 284355 (extension 261) Mobile: 09763462693

E-mail: drbharatsontakke@gmail.com

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Discussion

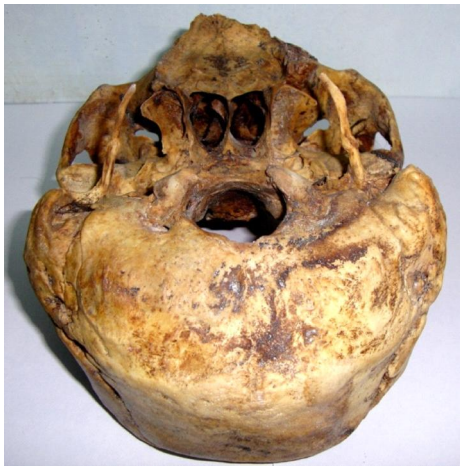
The styloid process is a slender bony projection extending downwards and forwards which lies anteromedial to the mastoid process. Its normal length is from 2 cm to 3 cm and a styloid process longer than 3 cms is found in 4 to 7 % of the population.[2] It gives attachments to three muscles and two ligaments. The styloglossus originates from anterior surface of tip, the stylohyoid from posterior surface midway between tip and base and the stylopharyngeus from medial surface of base. The facial nerve emerges from the stylomastoid foramen posteriorly. The stylohyoid ligament extends from the styloid process to the lesser cornu of the hyoid bone.[3]

Embryological explanation

The styloid process, stylohyoid ligament and lesser cornu of the hyoid bone are derived from Reichert's cartilage, which arises from the second branchial arch.[4] The cause of elongation of the styloid process has not been fully elucidated. Several theories have been proposed:

1. Congenital elongation of the process due to persistence of a cartilaginous anlage in the stylohyale.
2. Calcification of the stylohyoid ligament giving the appearance of an elongated

Fig 1: Showing elongated styloid process



styloid process.

3. Growth of osseous tissue at the insertion of the stylohyoid ligament.[5]

Regardless of the pathophysiology of elongation, the result is a rigid, abnormally long structure that can cause pain or discomfort by one or several mechanisms. It may develop inflammatory changes or impinge on the adjacent arteries, on sensory nerve endings leading to the symptoms like recurrent throat pain, dysphagia or facial pain. Diagnosis can usually be made on physical examination by digital palpation of the styloid process in the tonsillar fossa which exacerbates the pain. In addition relief of symptoms with injection of an anaesthetic solution in to the tonsillar fossa is highly suggestive of this diagnosis. Radiological diagnosis includes AP and lateral x rays of skull. The most satisfactory and effective treatment Eagles syndrome is surgical shortening of the styloid process via intraoral or external approach.[6]

Conclusion

Though the incidence of Elongated Styloid process is 4 to 7%, many times it remains under diagnosed. A complete clinical and radiological examination will help one to reach at a proper diagnosis. This will help to decide the line of management and the ultimate clinical out come.

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Type-E Brachydactylous Family: Autosomal Dominant Inheritance with Variable Expression and Non-Penetrance

N.P. Patil*, S.S. Dhapate**

Abstract

The word brachydactyly is used to describe the hands and feet with shortened digits. Autosomal dominant brachydactyly Type-E (BDE) is a congenital limb malformation characterized by shortened digits in hands and feet predominantly as a result of shortened metacarpals and metatarsals . A 45 yrs old female presented with shortened 4th toe bilaterally with no other complaints.The 4th metatarsals were shortened bilaterally, rest other metatarsals, tarsals and phalanges appeared normal on X-ray examination.On family history there was positive history of similar brachydactyly of 4th toe bilaterally in her paternal grandfather and unilateral brachydactyly of 4th toe in her son. These features match approximately with isolated Type-E Brachydactyly. Type-E brachydactyly always inherited as an autosomal dominant trait.In present study when pedigree was plotted it was found that though the brachydactylous trait inherited as autosomal dominant , IInd generation showed nonpenetrance of the concerned trait while same was appeared in the IIIrd generation and the same trait showed variable expression in IVth generation which is rarely observed. Isolated brachydactyly has excellent prognosis and the role of surgical correction is limited only for cosmetic purpose in the present case.

Keywords: Brachydactyly; Toes; Autosomal dominant; Non-penetrance; Variable expression.

Introduction

The word brachydactyly is used to describe the hands and feet associated with shortened digits or toes. (Brachy meaning "short" and dactylous meaning "digit") The digits themselves may be shorter than normal or they may appear small because of shortening of metacarpal and metatarsal bones in the hands or feet.[1] Most of the patients with brachydactyly do not require any specific treatment. When use of the hands is impaired, physiotherapy may improve their function. Corrective surgery can also be used to lengthen the hand or foot bones in some severe forms of brachydactyly. If brachydactyly is associated with other medical problems, such as hypertension, specific treatments for these problems may be indicated.[1,2] The various types of isolated brachydactyly are rare, except for types A3 and D, which are common, prevalence being around[3] 2%. In isolated brachydactyly, the inheritance is mostly autosomal dominant. In usual pedigree showing an autosomal dominant inheritance an affected person has affected either parent but with few exceptions those involve nonpenetrance of concerned trait. Though the trait was inherited as autosomal dominant not all characters are going to present in next generation and that is governed by many genetic and environmental factors leading to variable expression of that concerned trait. Isolated brachydactyly generally has an excellent prognosis.

Case report

A 45 yrs old female patient presented withshortened 4th toe bilaterally without functional deformity since birth. On

Author's Affiliation: *Assistant professor, **Prof. and H.O.D. , Department of Anatomy, SRTR Medical College, Ambajogai, Maharashtra, India.

Reprint's request: Dr. N. P. Patil, Assistant Professor, Department of Anatomy, SRTR Medical College, Ambajogai, Maharashtra, India.

Email: nilsudh@gmail.com

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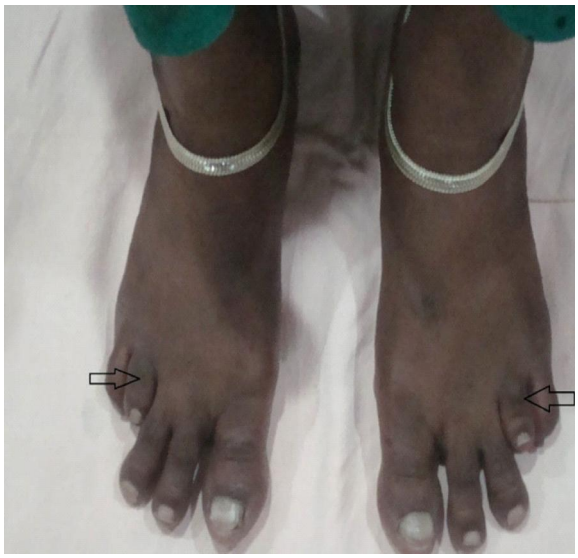
Fig 1a: Show bilateral 4th toe brachydactyly



examination it was found that the 4th toes were shortened bilaterally. No evidence of any lesions of nails. Both right and left hands were absolutely normal. Her height was 5ý2ýý. Rest general and systemic examinations were normal.

On family history her grandfather suffered from same 4th toe brachydactyly bilaterally. Details or photographs and radiograms were not available. Also there was family history of her son suffering from 4th toe brachydactyly of left foot only with right foot normal and

Fig 1b: Show bilateral shortening of fourth metatarsal

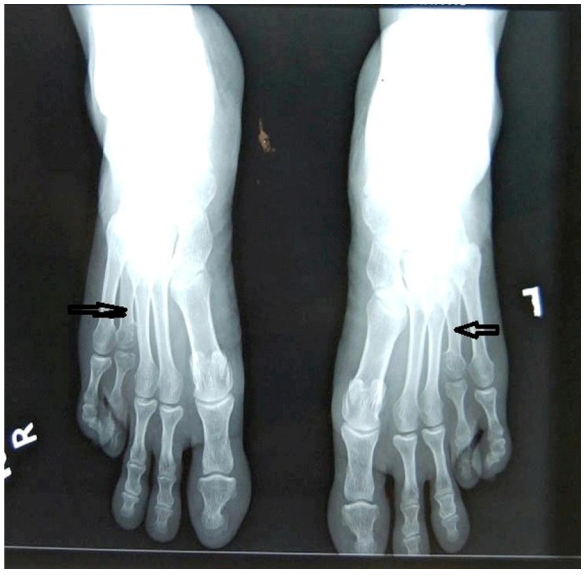
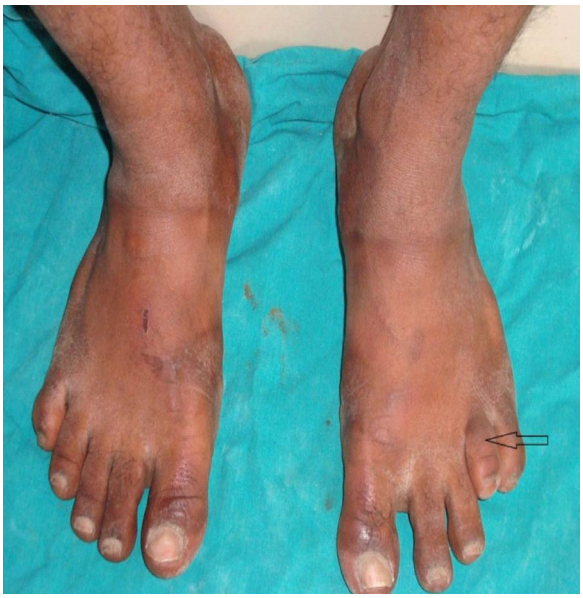


Fig 2a: Show left foot with 4th toe brachydactyly right foot normal

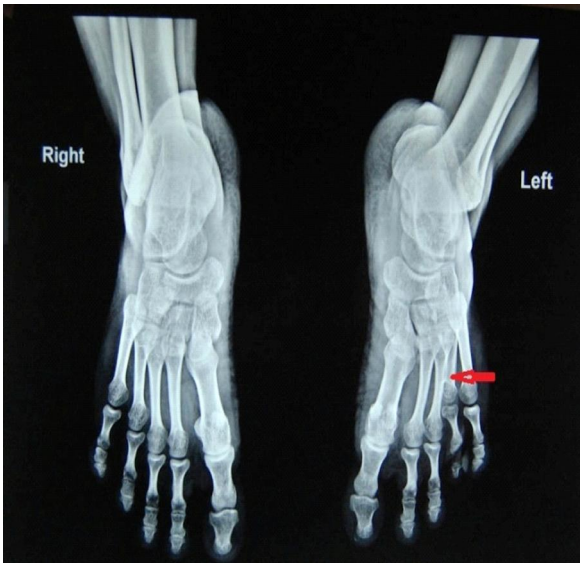


that appeared to be very rare occurrence. On general and systemic examination no other abnormality found (remove examination no other abnormality found).

From the fig 1a and fig 1b it is evident that the 4th toe appears shortened bilaterally because of Shortened 4th metatarsal. Rest all other bones in both feet were normal.

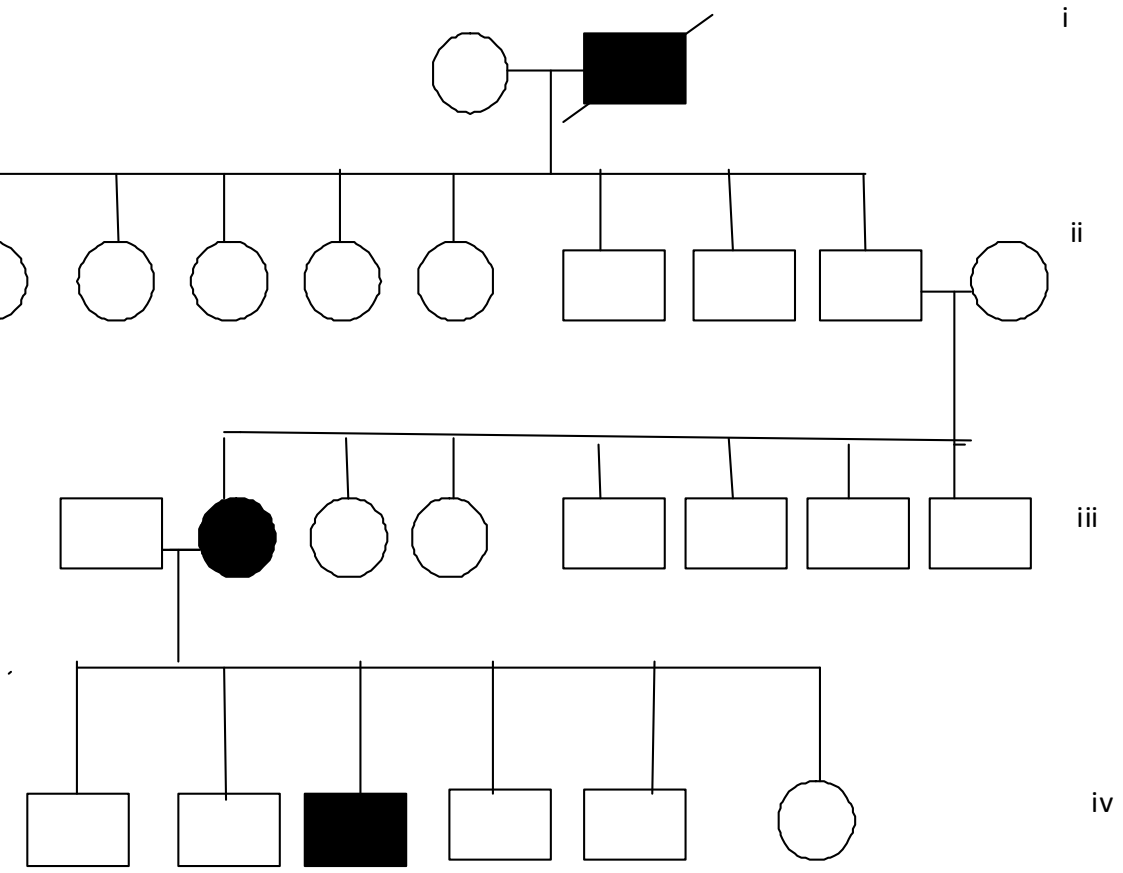
From fig 2a and fig 2b it is evident that the 4th toe appears shortened on left side because

Fig 2b: Show shortened 4th metatarsal. On right side no variation evident



of shortened 4th metatarsal on left side. Rest all other bones of left foot were normal. Also right foot appears absolutely normal in photograph as well as in radiogram.

The pedigree plotted as follows:



From above pedigree it is clear that in the first generation the Type–E brachydactylous trait in the grandfather of the patient. In the IInd generation no one suffered from the concerned trait indicating non-penetrance of the concerned trait. In the IIIrd generation 1st female child was suffered from the concerned trait bilaterally. In the IVth generation the IIIrd male child affected from the Type–E brachydactyly unilaterally indicating variable expression of the brachydactylous trait. Such a pedigree is more common with an autosomal dominant trait.

Discussion

Brachydactyly can involve any of the phalanges, metacarpals, metatarsals in many different combinations. The shortening of these bones may range from mild to severe. Sometimes certain bones are completely absent. Shortening of bones may occur in one or many or all the bones. For a particular digit or finger the entire digit may be short or the particular phalynx may be short. When brachyactyly involves the distal phalynx the fingernails or toe nails may be small or absent. Type-E brachydactyly is rare as an isolated anomaly. As an isolated anomaly it inherits as autosomal dominant trait with variable expressivity.[1] Trauma is the most common cause of this deformity.[4] It can also be seen in cases of Pseudopseudohypoparathyroidism (PPHP), neurofibromatosis and congenital adrenal hyperplasia due to 11-â hydroxylase deficiency. Pseudopseudohypoparathyroidism was excluded as the patients are not short statured, no evidence of cataracts. Moreover the phalanges of forth toes were not shorter as was the case with PPHP.[5,6,7] No e/o

neurofibromatosis was there.

In the present case report it is evident that this is a case of Type-E brachydactyly according to Bells classification.[8] It is clear from the above case report that there is positive family history of the same deformity inherited as autosomal dominant inheritance with non penetrance and variable expression of the trait. McKusick[1] reported a family with 17 affected members in three generations confirming autosomal dominant inheritance and variable expressivity. Non penetrance and variable expressivity are the major pitfalls in genetic counselling and so it is very necessary for the clinicians and counsellors to know the usual degree of penetrance and variable expressivity of the concerned autosomal dominant condition. Also non-penetrance and variable expressions are more conspicuous in humans than in animals and plants so the genetics must understand its importance when studying animal models of human diseases[9]. There are number of surgical techniques for correction of the brachydactyly including lengthening of the shortened metacarpal or the metatarsal[10,11], but in our case as the brachydactyly did not affect the function of those limbs the surgical role was limited for only cosmetic purpose.

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