

Distribution and Pattern of Sesamoid Bones of the Hand in Saudi Arabia- a Retrospective Study

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Abstract Background: Injuries or inflammation of the sesamoid bones can be very painful. In order to properly diagnose and treat problems affecting the hand, it is necessary to have a thorough grasp of the number and location of sesamoid bones in the hand. This study was carried out with an objective to study the distribution and pattern of sesamoid bones of the hand in the Saudi population. **Materials and Methods:** This three-month retrospective study was conducted from May 2023 to July 2023 in orthopedics and radiology department of Saudi Arabia's Medical Centre, Majmaah University's. The study analyzed 200 patient who had sesamoid bone in hand by radiographs. Patients had two radiological examinations. All patients had posteroanterior (PA) and oblique direct hand radiographs. The radiologist and orthopedic surgeon examined hand sesamoid bones, including at the metacarpophalangeal (MCP) and interphalangeal (IP) joints. Radiologist analyzed X-rays of hand injury patients using demographic data and imaging tests. The patients' sesamoid bone distributions and locations were meticulously recorded. Data was analysed in SPSS Version 23, and Chi-square test was applied to test the statistical significance. A p-value of <0.05 was considered significant. **Results:** Total 200 patients had sesamoid bone examined in their first radiological examination of MCP. Among them 72 (36%) patients had 1st, 2nd and 5th MCP followed by 1st MCP in 58 (29%), 1st and 5th MCP in 45 (22.5%), 1st and 2nd MCP in 43 (21.5%) with average age of sesamoid bone at MCP joint as 47.71±17.09, 41.76±18.08, 48.16±15.76 and 42±14.77 respectively. Sesamoid bone was reported 1st, 2nd and 3rd MCP in 1 (0.5%) and 1st, 2nd, 4th and 5th MCP 1 (0.5%) patients in first radiological examination. Second radiological examination in same patients showed, 64 (32%) patients had 1st, 2nd and 5th MCP followed by 1st MCP in 47 (23.5%), 1st and 5th MCP in 43 (21.5%), 1st and 2nd MCP in 17 (8.5%) with average age of 48.38±17.13, 41.09±16.72, 49.02±16.59 and 38.24±14.59 respectively at MCP joint. The association between first radiological examination and second radiological examination of sesamoid bone at MCP was statistically significant (chi square 623.73, p value <0.001). **Conclusion:** This is the first radiological assessment with two imaging evaluations in the same 200 patients who had sesamoid bone in hand. In the first and second imaging evaluations, we recorded 7 and 9 sesamoid bone distribution patterns respectively. 1st, 2nd and 5th metacarpophalangeal (MCP) sesamoid bones pattern was seen in patient. Trauma victims rarely have hand sesamoid bones, which are typically misdiagnosed when they appear elsewhere. This study provides orthopedic surgeons with anatomical data to help diagnose and treat patients.

Key Words bone, distribution, hand, interphalangeal, metacarpophalangeal, pattern, sesamoid bone

1. Introduction

Galen of Pergamum was the first to use the term sesamoid, which comes from the Latin sesamum, to describe the little, spherical bones located near the joints. The bones were given

the name because they resembled the flat, oval-shaped seeds of "Sesamum Indicum," an ancient East Indian plant that the Greeks used for purification [1], [2]. Sesamoid bones are tiny, ovoid or circular bones that reside in the joint capsule or

beneath tendons in the hands and feet [3]. Sesamoid bones are typically found in the hands and feet. They can also be found in the knee (patella) and wrist (pisiform bone). The placement and number of sesamoid bones in the hand vary greatly, despite the fact that some sesamoids, such as the pisiform bone and patella, are found in all individuals. The occurrence of sesamoid bones at various metacarpophalangeal (MCP) and interphalangeal (IP) joints varies greatly, although practically all adults have one at the first metacarpophalangeal (MCP) joint [1], [4]. It is still unclear what role the hand's sesamoid bones serve in the body [5]. Sesamoids are thought to serve a variety of functions, the most notable of which are to reduce tendon friction, protect the tendon, lower pressure, and hold the flexor pollicis longus in place [5], [6].

In order to correctly diagnose hand diseases, it is crucial to understand where the sesamoid is located. Particularly in comminuted articular fractures, the sesamoid bone can be easily misinterpreted as an avulsion fracture fragment. In addition, after a fracture-dislocation, sesamoid bones themselves may fracture or become imprisoned inside the joint [7], [8]. Clinical characteristics mentioned included inflammation, arthritic changes, and painful clicking [9]–[11]. Along with the sesamoid bone, trigger thumb was seen, simulating stenosing tendinopathy [12], [13].

Sesamoid bones are known to occur more or less frequently in some populations than others, depending on their geographic origin [14], [15]. According to a study, Caucasians have a 100% sesamoid bone incidence rate for the thumb and a 35% to 70% incidence rate for MP joints in the index and little fingers, respectively [16]. In Saudi Arabia population, Sesamoid bones observed in MCP I (100%), MCP V (53%), MCP II (46%), MCP III (2%), MCP IV (2%) and IP I (53%) [17]. Only 2.3% and 1.5% of hands showed sesamoids at the MCP joints of the middle and ring fingers respectively in Arab population [15]. Documentation of occurrences of sesamoids in the 3rd and 4th MCP is very rare [5], [17].

Previous research on the form and prevalence of hand sesamoid bones employed plain radiographs, postmortem investigations, ultrasonography (USG) and digital tomosynthesis (DTS) [4], [5], [17]. It is easy to count many subjects using a plain radiograph, but correct counting may be challenging because to the superimposition of complex tiny bones, such as nearby metacarpal and phalangeal bones. User-dependent and not the best method for evaluating bone structures, ultrasound. Digital tomosynthesis is not always available and does not yield images of the similar quality as computed tomography (CT). Despite having a small number of participants, cadaveric investigations have certain advantages for morphological examination.

The sesamoid bones can cause pain and discomfort if they are injured or become inflamed. Understanding the presence and distribution of sesamoid bones in the hand is critical for accurately diagnosing and treating hand-related disorders. The purpose of this study was to use radiographs to analyse the distribution and pattern of sesamoid bones of the hand in

the Saudi Arabian population.

2. Methodology

This retrospective study was conducted in Medical Center, Majmaah University in Saudi Arabia for 3 months, from May 2023 to July 2023 in the department of orthopedics and radiology.

Majmaah University's ethics committee approved the study with IRB number HA-01-R-088 dated 30.4.2023. Participants provided informed consent, and all acquired data was kept confidential and utilised solely for the purpose of this study. The sample size was estimated using the EPI info programme. Based on a 95% confidence interval, 5% margin of error, and the entire population. The sample size was estimated using the EPI info programme. Based on a 95% confidence interval, 5% margin of error, and the entire population. The predicted sample size was 200. Therefore 200 patients were taken as sample size for the study and Two radiology examination were analyzed for same patients.

A. Inclusion Criteria

The patients from Saudi Arabia who had sesamoid bone in hand and required hand radiographs for any reason, such as for the diagnosis of a hand-related condition or for pre-employment screening and above than 10 years of age were included in this study.

B. Exclusion Criteria

Patients less than 10 years and images not had all MCP joint and IP joints were excluded in this study. Any adult male or female who had acute Trauma, congenital anomalies (e.g. Coalition), joint disease (e.g. Osteoarthritis).

All the radiographs were assessed by an experienced radiologist and orthopedic surgeon. The radiologist and orthopedic surgeon assessed the presence and distribution of sesamoid bones in the hand, including at the MCP and IP joints. All the demographic data of patients, imaging studies, collaborate with radiologists to analyze imaging X-rays of individuals with hand injuries or conditions. Sesamoid bone and distributions of the patients were recorded systematically that provided the detailed information on the location and number of sesamoid bones was present in their hands.

C. Statistical Analysis

The statistical analysis was performed using SPSS version 26 (Armonk, NY: IBM Corp., USA). Descriptive and inferential statistics were used. The statistical significance was assessed using a p-value of 0.05 at 95% confidence interval. Descriptive statistics show numerical and percentage representations of all categorical variables, while mean and standard deviation summaries are supplied for all continuous variables. The independent factors were compared to the dependent variable using the Chi-square test. A p-value of <0.05 indicated statistical significance.



Figure 1: Anterior-Posterior hand radiograph of skeletally immature patient demonstrates sesamoid bones seen at the 1st MCP joint

3. Results

Total 200 patients who had sesamoid bone in hand were included in this study all of them were between 10 years to 84 years. Age distribution of all 200 patients shown in line chart of the patients. 41 (20.5%) patients were from age group of 30-39 years followed by 50-59 years 36 (18%), 60-69 years 35 (17.5%). Among all patients 77 (38.5%) were male and 123 (61.5%) were female with average (mean \pm SD) age of 43.03 ± 16.84 and 47.17 ± 16.64 respectively. Average age of all patients was 45.57 ± 16.84 (Table 1). No statistical significance was seen between age and gender among the included patients (p-value 0.29) shown in Table 1.

Total 200 patients were had sesamoid bone examined in their first radiological examination of MCP. The X ray images of the hands were shown in Table / Figure (1-3). Among them 72 (36%) patients had 1st, 2nd and 5th MCP followed by 1st MCP 58 (29%), 1st and 5th MCP 45 (22.5%), 1st and 2nd MCP 43 (21.5%) with average age of 47.71 ± 17.09 , 41.76 ± 18.08 , 48.16 ± 15.76 and 42 ± 14.77 respectively reported sesamoid bone at MCP joint (Table 2). The least sesamoid bone was reported 1st, 2nd and 3rd MCP 1 (0.5%) and 1st, 2nd, 4th and 5th MCP 1 (0.5%). In female sesamoid bone were investigated in 1st, 2nd and 5th MPC 54 (27%) followed by 1st MCP 27 (13.5%), 1st and 5th MCP 24 (12%), 1st and 2nd MCP 12 (6%) with average age of 47.96 ± 17.02 , 45.15 ± 18.08 , 48.17 ± 16.41 and 43.67 ± 16.20 respectively. In males most prevalent sesamoid 1st MCP 31 (55.5%) followed by 1st and 5th MCP 21 (10.5%), 1st, 2nd and 5th MCP 18 (9%), 1st and 2nd MCP 5 (2.5%) and 1st, 2nd, 3rd and 5th MCP 2 (1%) with mean age of 38.81 ± 17.55 , 48.14 ± 14.98 , 46.94 ± 17.30 , 38.0 ± 9.44 and 32 years respectively (Table 2).



Figure 2: Bilateral oblique hand radiograph of skeletally mature patient demonstrates sesamoid bones seen at the 1st, 2nd and 5th MCP joints

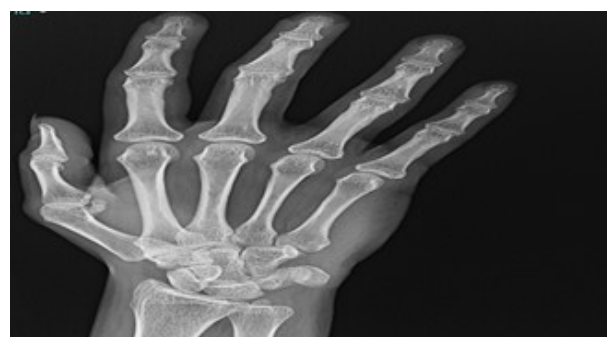


Figure 3: Anterior-Posterior hand radiograph of skeletally mature patient demonstrates sesamoid bones seen at the 1st and 2nd MCP joints

Age (Years)	Male	Female	Total Patients	Percentage (%)
10 -19 years	5	8	13	6.5
20-29 years	16	13	29	14.5
30- 39 Years	17	24	41	20.5
40- 49 years	11	18	29	14.5
50 -59 years	12	24	36	18
60-69 years	10	25	35	17.5
70- 79 Years	6	10	16	8
80- 84 years	0	1	1	0.5
Total	77	123	200	100
Mean	43.03	47.17	45.57	-
Standard Deviation	16.84	16.64	16.84	-
Significance (P value)	0.29			

Table 1: Demographic distribution of patients included in this study

Sesamoid Bone	Male	Percentage	Mean Age (Male)	Standard Deviation (Male)	Female	Percentage	Mean Age (Female)	Standard Deviation (Female)	Total	Percentage	Mean Age	Standard Deviation	Significance (P value)	Chi square	P-value
1 st MCP	31	15.5	38.81	17.55	27	13.5	45.15	18.08	58	29	41.76	18.08	0.16	14.2	0.028
1 st and 2 nd MCP	05	2.5	38	9.44	12	06	43.67	16.20	43	21.5	42	14.77	0.088		
1 st , 2 nd and 3 rd MCP	0	0	-	-	01	0.5	54	-	01	0.5	54	-	0.10		
1 st and 5 th MCP	21	10.5	48.14	14.98	24	12	48.17	16.41	45	22.5	48.16	15.76	0.63		
1 st , 2 nd and 5 th MCP	18	09	46.94	17.30	54	27	47.96	17.02	72	36	47.71	17.09	0.002		
1 st , 2 nd , 3 rd and 5 th MCP	02	01	32	-	04	02	53.75	11.49	06	3	46.5	13.90	0.39		
1 st , 2 nd , 4 th and 5 th MCP	0	0	-	-	01	0.5	54	-	01	0.5	54	-	0.10		
Total	77	38.5	43.03	16.84	123	61.5	47.16	16.64	200	100	45.57	16.84	0.028		

Table 2: Sesamoid bone reading by first radiology examination

Sesamoid Bone	Male	Percentage	Mean Age (Male)	Standard Deviation (Male)	Female	Percentage	Mean Age (Female)	Standard Deviation (Female)	Total	Percentage	Mean Age	Standard Deviation	Significance (P value)	Chi square	P value
1 MCP	25	12.5	36.08	15.11	22	11	46.77	16.65	47	23.5	41.09	16.72	0.678	14.93	0.62
1 AND 2 MCP	7	3.5	39.14	10.73	10	5	37.6	16.75	17	8.5	38.24	14.59	0.366		
1 AND 5 MCP	20	10	49.05	17.89	23	11.5	49	15.38	43	21.5	49.02	16.59	0.678		
1,2 AND 5 MCP	16	8	46.88	17.14	48	24	48.88	17.1	64	32	48.38	17.13	0.006		
1,2,3 AND 5 MCP	2	1	32	-	3	1.5	55.2	12.38	7	3.5	48.37	14.81	0.913		
BILATERAL 1 MCP	3	1.5	56.33	10.4	3	1.5	31.67	16.51	6	3	44	18.51	0.913		
BILATERAL 1 AND 2 MCP	0	0	0	-	2	1	46.5	3.5	2	1	46.5	3.5	0.996		
BILATERAL 1 AND 5 MCP	3	1.5	35.67	7.4	3	1.5	45.67	19.39	6	3	40.67	15.5	0.878		
BILATERAL 1,2 AND 5 MCP	1	0.5	66	-	7	3.5	46	10.25	8	4	48.5	11.65	0.72		
Total	77	38.5	43.03	16.84	123	61.5	47.16	16.64	200	100	45.57	16.84	0.62		

Table 3: Sesamoid bone reading by Second radiology examination

Sesamoid bone at MCP by second radiological examination													623.73	P<0.001	
Sesamoid bone at MCP by first radiological examination		1 MCP	1 and 5 MCP	1, 2, and 5 MCP	Bilateral 1 and 2 MCP	Bilateral 1 and 5 MCP	1 and 2 MCP	Bilateral 1 MCP	Bilateral 1,2 and 5 MCP	1, 2, 3 and 5 MCP	Total	Chi square			P value
	1 st	47	3	0	0	2	1	5	0	0	58				
	1 st , 5 th	0	39	0	0	4	1	0	0	45					
	1 st , 2 nd , 5 th	0	1	60	1	0	0	8	1	72					
	1 st , 2 nd	0	0	2	1	0	14	0	0	0	17				
	1 st , 2 nd , 4 th , 5 th	0	0	1	0	0	0	0	0	0	1				
	1 st , 2 nd , 3 rd , 5 th	0	0	1	0	0	0	0	0	5	6				
	1 st , 2 nd , 3 rd	0	0	0	0	0	0	0	0	1	1				
	Total	47	43	64	2	6	17	8	7	7	200				

Table 4: Association between first and second radiological examination of sesamoid bone in same patients

Second radiological examination in same patients, 64 (32%) patients had 1st, 2nd and 5th MCP followed by 1st MCP 47 (23.5%), 1st and 5th MCP 43 (21.5%), 1st and 2nd MCP 17 (8.5%) with average age of 48.38±17.13, 41.09±16.72, 49.02±16.59 and 38.24±14.59 respectively reported sesamoid bone at MCP joint (Table 3). The least sesamoid bone was reported bilateral 1st MCP 6 (3.0%) and bilateral 1st and 2nd MCP 2 (1%) with mean age of 44±18.51 and 46.5±3.5. Second radiological examination in female sesamoid bone at MCP were investigated in 1st, 2nd and 5th MCP 48 (24%) followed by 1st and 5th MCP 23 (11.5%), 1st MCP 22 (11%), 1st and 2nd MCP 10 (5%) with average age of 48.88±17.1, 49±15.38, 46.77±16.65 and 37.6±16.75 respectively (Table 3). In males most prevalent sesamoid bone was at 1st MCP 25 (12.5%) followed by 1st and 5th MCP 20 (10.0%), 1st, 2nd and 5th MCP 16 (8.0%), 1st and 2nd MCP 7 (3.5%), bilateral 1st MCP 3 (1.5%), bilateral 1st and 5th MCP 3 (1.5%), 1st, 2nd, 3rd and 5th MCP 2 (1%) and bilateral 1st, 2nd and 5th MCP 1 (0.5%) with mean age of 36.08±15.11, 49.05±17.89, 46.88±17.14, 39.14±10.73, 56.33±10.4, 35.67±7.4, 32±0 and 66±0 years respectively (Table 4). Sesamoid bone at Bilateral 1st and 2nd MCP was not reported in male but reported in female. The statistical significance p value 0.62 were analyzed (Table 3). The correlation between first radiological examination and second radiological examination of sesamoid bone at MCP were analyzed statistically significant (chi square 623.73, p value <0.001) shown in Table 4.

4. Discussion:

Sesamoid bones are frequently seen in the hand, especially in the thumb and little finger. The study looked extensively at the distribution of sesamoid bones in the hand. Using radiographs, we sought to determine the distribution and pattern of sesamoid bones of the hand in the Saudi population. The sesamoid bone was analyzed in the initial radiological evaluation of 200 patients with MCP. Average ages were 47.71±17.09, 41.76±18.08, 48.16±15.76, and 42±14.77 for patients with 1st, 2nd, and 5th MCP, 1st MCP, 1st and 5th MCP, and 1st and 2nd MCP sesamoid bones, respectively. Sesamoid bone incidence was lowest for MCP levels 1st, 2nd, 4th and 5th MCP 1 (0.5%).

Many studies were undertaken to determine the distribution and prevalence of sesamoid bone in the hand. Al khabori H et al reported a significant incidence of sesamoid bones at the fifth metacarpophalangeal joint (64%), as well as the interphalangeal joint of the thumb (49.7%) [18]. Sesamoid bones were more prevalent in elderly adults at the fifth metacarpophalangeal joint (p = 0.03). Sesamoid bones appear to be more prevalent in the fifth metacarpophalangeal joint and the interphalangeal joint of the thumb in Omani patients than in other Middle Eastern populations [18]. Similar findings were reported in this investigation, with sesamoid bones most commonly found at the fifth metacarpophalangeal joint. This finding is similar with Ozkan Kose's studies in Turkey, where he identified identical levels of

sesamoid bone in the first and second metacarpophalangeal joints [19].

Sesamoid bones in the hand have also been investigated to determine their distribution. The total number of sesamoid bones discovered in a Chinese population study was 1,641. The prevalence of sesamoid bones was 100% at the first metacarpophalangeal joint (MCPJ), 59.0% at the second MCPJ, 2.93% at the third MCPJ, 0 at the fourth MCPJ, 47.6% at the fifth MCPJ, and 28.0% at the first IPJ. Radiographs of both hands indicated the same number of sesamoid bones [20].

A second study from China found that the prevalence of sesamoid bones was 60.8% for the MCP joint in the index finger and 59.1% for the MCP joint in the little finger. Only 15.9% of hands possessed sesamoid bones in their thumb IP joints. Aside from the thumb MCP joints, two sesamoid bones were rarely found in other hand joints [4].

In this investigation, the sesamoid bones were evaluated using two radiological examinations, an accurate approach for assessing bone positions and three-dimensional pictures for quality studies. In this study we reported correlation between first radiological examination and second radiological examination of sesamoid bone at MCP were analyzed statistically significant (chi square 623.73, p value <0.001). But in previous studies they reported no statistically significant correlation between two investigations [15], [21].

5. Limitation of the Study

Radiologists and orthopedic surgeons may be affected clinically by the existence and placement of sesamoid bones. Sesamoids can be misdiagnosed on radiographs as fractures or other diseases, resulting in needless procedures. Furthermore, sesamoids may have a role in a number of diseases, including osteoarthritis, tendinopathy, and ligament injuries.

6. Conclusion

The study concluded that this is the first radiological examination were study having two imaging evaluation in same patients. The most prevalent sesamoid bone was reported at 1st, 2nd and 5th MCP followed by 1st MCP. This study also reported 7 and 9 different patterns of the sesamoid bone distribution in different two radiological evaluations. Hand sesamoid bones are not common in trauma patients and are often misdiagnosed when they occur in another location on the hand. Therefore, the findings of this study are significant because they provide orthopedic surgeon with anatomical data that may assist in the diagnosis and treatment of patients.

Conflict of interest

The authors declare no conflict of interests. All authors read and approved final version of the paper.

Authors Contribution

All authors contributed equally in this paper.

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