



Original Article

A Study on Prevalence and Characteristics of Fabella among the Patients Attending a Tertiary Care Centre of Purba Medinipur, West Bengal: A Radiograph-Based Cross-Sectional Study

Dr. Shamsh Tabrez Alam¹, Dr. Naresh Kumar Munda²

¹Assistant Professor, Department of Radiodiagnosis, Faculty of Icare Institute of Medical Sciences and Research and Dr. B C Roy Hospital, Haldia, India.

²Associate Professor, Department of Community Medicine, Faculty of Icare Institute of Medical Sciences and Research and Dr. B C Roy Hospital, Haldia, India.

OPEN ACCESS

Corresponding Author:

Dr. Shamsh Tabrez Alam

Assistant Professor, Department of Radiodiagnosis, Faculty of Icare Institute of Medical Sciences and Research and Dr. B C Roy Hospital, Haldia, India.

Received: 04-05-2026

Accepted: 28-05-2026

Available online: 25-06-2026

Copyright © International Journal of
Medical and Pharmaceutical Research

ABSTRACT

Background: The fabella is a small sesamoid bone lying in the lateral head of the gastrocnemius muscle, behind the lateral femoral condyle. Its prevalence differs among populations, and it has been linked with posterolateral knee pain and knee osteoarthritis. Data from eastern India are scarce. **Objectives:** To estimate the prevalence of fabella and describe its characteristics in patients attending a tertiary care centre of Purba Medinipur, and to assess its association with risk factors and posterolateral knee pain. **Methods:** A hospital-based, cross-sectional, radiograph-based study was conducted on 96 adults. Sample size was calculated using the formula $n = Z^2P(1-P)/d^2$ with an expected prevalence of 37% and 10% absolute precision. Participants were selected by systematic random sampling. Standard anteroposterior and lateral knee radiographs were reviewed for fabella, and its size, shape and laterality were noted. Data were analysed using descriptive statistics, chi-square test, independent t-test and odds ratios with 95% confidence intervals. **Results:** Fabella was present in 35 of 96 patients (36.5%; 95% CI 26.9–46.1%). Prevalence rose from 21.4% in the 18–30-year group to 44.4% above 60 years, and it was higher in males (40.4%) than in females (31.8%). Bilateral fabellae were seen in 62.9% of positive cases. Mean fabellar length was 12.4 ± 2.6 mm in males and 10.6 ± 2.3 mm in females ($p = 0.043$). Posterolateral knee pain was significantly associated with fabella (OR 4.04; 95% CI 1.68–9.74; $p = 0.001$). Knee osteoarthritis (OR 3.88) and BMI ≥ 25 kg/m² (OR 2.36) were also associated. **Conclusion:** Fabella is a fairly common finding in this population and is associated with posterolateral knee pain. Radiologists and clinicians should look for it routinely in unexplained posterolateral knee pain.

Keywords: Fabella; sesamoid bone; knee; posterolateral knee pain; radiograph; prevalence; West Bengal.

INTRODUCTION

The fabella (Latin for “little bean”) is a small sesamoid bone embedded in the tendon of the lateral head of the gastrocnemius, in close relation to the posterior aspect of the lateral femoral condyle [1,2]. It articulates with the condyle through a small facet and is stabilised by the fabellofibular, oblique popliteal and arcuate ligaments, which together form part of the posterolateral corner of the knee [3,4]. The common peroneal nerve runs close to this region, which explains why an enlarged or displaced fabella can produce neurological as well as mechanical symptoms [5].

Sesamoid bones develop to protect tendons from compressive stress and to change the direction of muscle pull [6]. The fabella ossifies late, usually in adolescence, and its development depends on mechanical loading as well as genetic factors [7,8]. It may be absent, unilateral or bilateral, and bony, cartilaginous or fibrous. A systematic review of more than 21,000

knees reported a global prevalence of nearly 37%, and found that the rate has increased over the last 150 years [1]. Regional rates vary widely [2,9,10].

Clinically, the fabella is often an incidental radiographic finding. However, it may cause “fabella syndrome”, with localised posterolateral knee pain on extension, squatting or climbing stairs [11,12]. It may be mistaken for a loose body or fracture fragment, and it may be affected by osteoarthritis, fracture, dislocation or impingement after knee arthroplasty [13]. Pritchett found more fabellae in osteoarthritic knees, suggesting a link with degenerative disease [14].

Knee pain and osteoarthritis are major causes of disability, and their burden is rising worldwide [25,26,28,29,30]. In India, rural labourers and farmers, who squat and sit cross-legged for long hours, are particularly at risk [15,16]. In Purba Medinipur, where agriculture and fishing are the main occupations, the fabella may therefore be clinically relevant.

OBJECTIVES

2.1 Primary objective

- To determine the prevalence of fabella on knee radiographs among patients attending a tertiary care centre of Purba Medinipur, West Bengal.

2.2 Secondary objectives

- To describe the characteristics of fabella, namely laterality, shape and size (length and width) in males and females.
- To find the prevalence of fabella in different age groups.
- To identify the risk factors associated with the presence of fabella.
- To assess the relationship between posterolateral knee pain and the presence of fabella.

METHODOLOGY

3.1 Study design, setting and period

This was a hospital-based, observational, cross-sectional study conducted in the Departments of Radiodiagnosis and Orthopaedics of a tertiary care centre in Purba Medinipur, West Bengal, India. The study was carried out over six months, from October 2025 to April 2026.

3.2 Study population

Patients aged 18 years and above, who were advised knee radiographs for any clinical reason during the study period, formed the study population.

Inclusion criteria: (i) age 18 years or more; (ii) availability of good-quality standard anteroposterior (AP) and lateral radiographs of one or both knees; (iii) willingness to give written informed consent.

Exclusion criteria: (i) history of knee fracture, major knee surgery or total knee arthroplasty; (ii) congenital or developmental skeletal deformity of the lower limb; (iii) tumour, infection or inflammatory arthritis of the knee; (iv) poor-quality or incomplete radiographs; (v) pregnancy.

3.3 Sample size calculation

The sample size for a single proportion in a descriptive study was calculated using the formula [18,19]:

$$n = Z^2 \times P \times (1 - P) / d^2$$

where $Z = 1.96$ (standard normal value at 95% confidence level), P = expected prevalence and d = absolute precision. The expected prevalence was taken as 37% (0.37) from the global pooled estimate of Berthoume et al. [1], and the absolute precision was fixed at 10% (0.10).

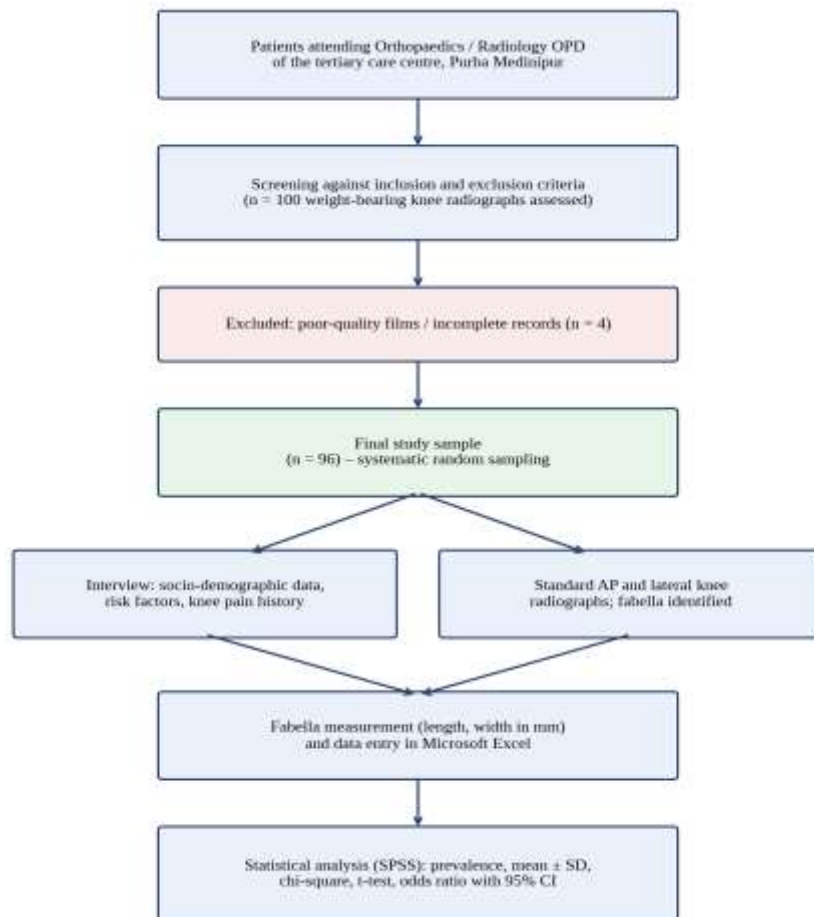
$$n = (1.96)^2 \times 0.37 \times 0.63 / (0.10)^2 = 3.8416 \times 0.2331 / 0.01 = 89.5, \text{ rounded to } 90.$$

To allow for about 7% loss due to poor-quality films or incomplete records, the sample was increased to $90 + 6 = 96$. Hence, the final sample size was 96.

3.4 Method of sampling

Systematic random sampling was done in this study. All eligible patients who underwent knee radiography during the study period were listed in the order of their radiology registration number. The sampling interval (k) was obtained by dividing the expected number of eligible patients by the sample size. The first participant was chosen by the lottery method from the first k patients, and every k -th patient thereafter was included until 96 participants were enrolled. A patient who refused consent or failed to meet the criteria was replaced by the next eligible patient on the list. The process of selection is shown in Figure 1.

Figure 1. Flow chart showing the methodology of the study



3.5 Data collection and radiographic technique

After consent, each participant was interviewed with a pre-tested proforma covering age, sex, residence, occupation, height, weight and history of knee pain. Body mass index (BMI) was calculated as weight (kg) divided by height squared (m^2). Posterolateral knee pain was defined as pain at the back and outer side of the knee, present for at least four weeks and aggravated by extension, squatting or climbing stairs.

Standard weight-bearing AP and true lateral knee radiographs were taken with a digital radiography unit at a focus–film distance of 100 cm. Two observers (a radiologist and an orthopaedic surgeon), blinded to clinical details, independently reviewed all images. A fabella was recorded as present when a well-defined, round to oval bony density was seen behind the lateral femoral condyle on the lateral view. Its maximum craniocaudal length and mediolateral width were measured in millimetres with electronic calipers, and shape (oval, round or irregular/bipartite) and laterality were noted. In bilateral cases, the larger fabella was used for size analysis. Knee osteoarthritis was graded by the Kellgren–Lawrence scale, and grade 2 or more was considered osteoarthritis. Disagreements were settled by consensus, and agreement was measured by Cohen's kappa.

3.6 Statistical analysis

Data were entered in Microsoft Excel and analysed with SPSS software. Categorical variables were expressed as numbers and percentages, and continuous variables as mean $\pm$ standard deviation (SD). Prevalence was reported with its 95% confidence interval (CI). The chi-square test (or Fisher's exact test when expected cell counts were below 5), the chi-square test for trend and the independent samples t-test were used as appropriate. Odds ratios (OR) with 95% CI were calculated to measure the strength of association. A p-value below 0.05 was taken as statistically significant.

RESULTS

4.1 Socio-demographic profile

A total of 100 patients were screened, and 4 were excluded because of poor-quality radiographs, leaving 96 participants for the final analysis. The mean age was 47.8 ± 14.2 years (range 19–78 years). Males formed 54.2% of the sample, and

about two-thirds of the participants came from rural areas. Farmers and labourers were the largest occupational group, and 43.8% of the participants were overweight or obese (Table 1).

Table 1. Socio-demographic characteristics of the study participants (N = 96)

Variable	Category	n (%)
Age group (years)	18–30	14 (14.6)
	31–40	18 (18.8)
	41–50	22 (22.9)
	51–60	24 (25.0)
	>60	18 (18.8)
Sex	Male	52 (54.2)
	Female	44 (45.8)
Residence	Rural	63 (65.6)
	Urban	33 (34.4)
Occupation	Farmer / labourer / fisherman	31 (32.3)
	Homemaker	24 (25.0)
	Service / business	22 (22.9)
	Retired	19 (19.8)
BMI (kg/m ²)	<18.5 (underweight)	6 (6.3)
	18.5–24.9 (normal)	48 (50.0)
	25.0–29.9 (overweight)	30 (31.3)
	≥30 (obese)	12 (12.5)

4.2 Overall prevalence and characteristics of fabella

Fabella was seen in 35 of the 96 patients, giving an overall prevalence of 36.5% (95% CI 26.9–46.1%). Among the 35 positive patients, 22 (62.9%) had bilateral fabellae and 13 (37.1%) had a unilateral fabella (right side in 7 and left side in 6), so that a total of 57 fabellae were identified. Regarding shape, 18 (51.4%) were oval, 10 (28.6%) were round, and 7 (20.0%) were irregular or bipartite. All fabellae were located in the lateral head of gastrocnemius behind the lateral femoral condyle. Inter-observer agreement for the identification of fabella was almost perfect (kappa = 0.91).

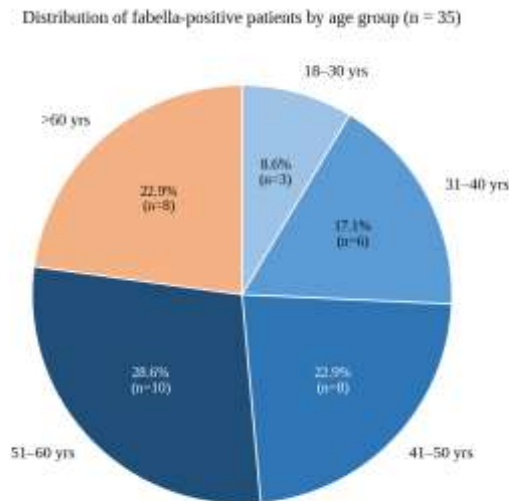
4.3 Prevalence of fabella in different age groups

The prevalence of fabella showed a rising trend with age, from 21.4% in the youngest group to 44.4% in those above 60 years (Table 2). However, this trend was not statistically significant (chi-square for trend = 2.03, p = 0.15). The pie chart in Figure 2 shows how the 35 fabella-positive patients were distributed across the age groups. The largest share (28.6%) belonged to the 51–60-year group, whereas only 8.6% were in the 18–30-year group.

Table 2. Prevalence of fabella in various age groups

Age group (years)	Patients examined (n)	Fabella present (n)	Prevalence (%)
18–30	14	3	21.4
31–40	18	6	33.3
41–50	22	8	36.4
51–60	24	10	41.7
>60	18	8	44.4
Total	96	35	36.5

Figure 2. Pie chart showing distribution of fabella-positive patients across age groups



4.4 Prevalence and size of fabella according to sex

The prevalence of fabella was 40.4% (21 of 52) in males and 31.8% (14 of 44) in females, but the difference was not significant ($p = 0.39$). Among the fabella-positive patients, the fabellae in males were larger than those in females. The mean length was significantly greater in males, while the difference in width approached but did not reach significance (Table 3).

Table 3. Mean and standard deviation of fabella size in males and females

Parameter (mm)	Male (n = 21) Mean $\pm$ SD	Female (n = 14) Mean $\pm$ SD	t-value	p-value
Length (craniocaudal)	12.4 $\pm$ 2.6	10.6 $\pm$ 2.3	2.10	0.043*
Width (mediolateral)	8.1 $\pm$ 1.9	7.0 $\pm$ 1.6	1.78	0.084

*Statistically significant ($p < 0.05$); independent samples t-test. The overall mean length was 11.7 mm.

4.5 Risk factors for fabella

Table 4 compares the risk factors between patients with and without fabella. A higher proportion of fabella-positive patients were above 50 years of age, male, overweight or obese, engaged in manual work, and had radiographic knee osteoarthritis. Of these factors, knee osteoarthritis (60.0% versus 27.9%, $p = 0.002$) and BMI ≥ 25 kg/m² (57.1% versus 36.1%, $p = 0.047$) showed a statistically significant difference. Manual occupation showed a near-significant trend ($p = 0.096$), while age and sex did not differ significantly.

Table 4. Distribution of risk factors among patients with and without fabella

Risk factor	Fabella present (n = 35) n (%)	Fabella absent (n = 61) n (%)	p-value
Age >50 years	18 (51.4)	24 (39.3)	0.25
Male sex	21 (60.0)	31 (50.8)	0.39
BMI ≥ 25 kg/m ²	20 (57.1)	22 (36.1)	0.047*
Manual occupation (squatting / heavy work)	15 (42.9)	16 (26.2)	0.096
Radiographic knee osteoarthritis	21 (60.0)	17 (27.9)	0.002*
Posterolateral knee pain	22 (62.9)	18 (29.5)	0.001*

*Statistically significant ($p < 0.05$).

In simple words, heavier patients and those with osteoarthritis were more likely to show a fabella. This agrees with the idea that greater mechanical load on the posterior knee may favour its formation or visibility. The associations with age and sex were in the expected direction but could not be proved with the present sample size.

4.6 Relationship of posterolateral knee pain with the presence of fabella

Forty of the 96 participants (41.7%) had posterolateral knee pain. Pain was reported by 22 of the 35 patients with fabella (62.9%) but by only 18 of the 61 patients without it (29.5%). The difference was highly significant (chi-square = 10.18, df = 1, p = 0.001), as shown in Table 5.

Table 5. Relationship of posterolateral knee pain with presence of fabella on radiographs

Radiographic finding	Pain present n (%)	Pain absent n (%)	Total n
Fabella present	22 (62.9)	13 (37.1)	35
Fabella absent	18 (29.5)	43 (70.5)	61
Total	40 (41.7)	56 (58.3)	96

Chi-square = 10.18; df = 1; p = 0.001.

4.7 Odds ratio analysis

The odds ratio tells us how many times higher the odds of having fabella are in people with a given factor, compared with those without it. An OR of 1 means no association, an OR above 1 means a positive association, and the association is significant when the 95% confidence interval does not include 1. The results are shown in Table 6.

Table 6. Odds ratio of factors associated with the presence of fabella

Factor	Odds ratio	95% CI	p-value	Interpretation
Posterolateral knee pain	4.04	1.68 – 9.74	0.001	Significant
Knee osteoarthritis	3.88	1.61 – 9.34	0.002	Significant
BMI ≥ 25 kg/m ²	2.36	1.01 – 5.52	0.047	Significant
Manual occupation	2.11	0.88 – 5.08	0.096	Not significant
Age >50 years	1.63	0.71 – 3.78	0.25	Not significant
Male sex	1.45	0.63 – 3.37	0.39	Not significant

Patients with posterolateral knee pain had about four times higher odds of showing a fabella than those without pain (OR 4.04). Similarly, osteoarthritic knees had nearly four times the odds, and overweight or obese persons had more than twice the odds. The confidence intervals for manual occupation, age and sex included 1, so no firm conclusion can be drawn for these factors from this study. The wide confidence intervals reflect the modest sample size.

4.8 Clinical management of symptomatic fabella

Most fabellae are asymptomatic and need no treatment. As 22 of our 35 fabella-positive patients had posterolateral pain, a stepwise approach is suggested.

- **Step 1:** Clinical diagnosis. Record the site, duration and aggravating factors of pain. Localised tenderness over the lateral head of gastrocnemius behind the lateral femoral condyle, pain on active extension or resisted plantar flexion, and a palpable bony prominence are suggestive. Exclude popliteus tendinopathy, lateral meniscal tear, biceps femoris or iliotibial band problems, Baker's cyst and common peroneal nerve irritation.
- **Step 2:** Imaging. Lateral and AP radiographs usually confirm the diagnosis. Ultrasonography assesses adjacent soft tissue and guides injections. MRI is advised when the diagnosis is uncertain, as it shows marrow oedema, cartilage damage at the fabellofemoral facet, or associated meniscal and ligament injury.
- **Step 3:** Conservative treatment (first line). Advise rest and activity modification (avoid repeated deep squatting), oral NSAIDs or paracetamol for two to three weeks, cold or heat application, and weight reduction. A supervised physiotherapy programme should include stretching of the gastrocnemius–soleus complex, quadriceps and hamstring strengthening, and manual therapy. Many patients improve within six to twelve weeks.
- **Step 4:** Injection therapy. If symptoms persist, an ultrasound-guided injection of local anaesthetic with corticosteroid around the fabella can be tried; it is both diagnostic and therapeutic. Repeated steroid injections should be avoided.
- **Step 5:** Surgery (fabellectomy). Excision is reserved for pain not responding to three to six months of proper conservative treatment, and for fracture, painful non-union or definite impingement. It is done through a posterolateral approach, protecting the common peroneal nerve, with repair of the gastrocnemius tendon and early mobilisation. Outcomes are generally good.

- **Step 6: Counselling.** Patients should be told that the fabella is a normal variant and not a disease, which reduces anxiety. A prominent fabella should also be remembered during total knee arthroplasty, as it may cause posterior impingement.

DISCUSSION

This radiograph-based study found a fabella prevalence of 36.5% among patients of a tertiary care centre in Purba Medinipur. This is almost the same as the global pooled prevalence of 36.8% reported by Berthoume et al. [1], and close to the radiographic prevalence of about 38% in Turkish subjects [9]. Lower rates have been reported in cadaveric studies [2,10]. Such variation may be due to ethnicity, study design, image quality, age profile and the rising secular trend in recent generations, possibly linked to better nutrition and body size [1].

Prevalence rose with age, from 21.4% to 44.4%, though not significantly. A previously cartilaginous fabella may become visible on plain films only after calcification, and degenerative change may further increase its visibility [5,6]. Small numbers in each age stratum may explain the lack of significance.

Males had a higher prevalence than females (40.4% versus 31.8%), and larger fabellae (length $p = 0.043$). Most earlier studies found no clear sex difference in prevalence, but larger fabellar size in males is consistent, in keeping with greater bone dimensions in men [2,10].

Bilateral occurrence in 62.9% of positive patients agrees with the literature, where bilaterality is the rule [1,2]. The irregular or bipartite variety is worth recognising, since it may be confused with a fracture fragment.

The most important finding was the significant association between fabella and posterolateral knee pain (OR 4.04; 95% CI 1.68–9.74). Driessen et al. and Dalip et al. have noted that the fabella is a recognised but probably under-diagnosed cause of posterolateral knee pain [5,11]. The mechanism may be friction against the lateral femoral condyle, irritation of the common peroneal nerve, or tension in the lateral head of gastrocnemius. This is a cross-sectional association and does not prove causation. Many fabella-positive patients (37.1%) had no pain, so pain should be attributed to the fabella only after other causes are ruled out.

Knee osteoarthritis was strongly associated with fabella (OR 3.88), as Pritchett also reported [14]. A fabella may increase posterior compartment load and contribute to degeneration, or both may share risk factors such as age, weight and mechanical stress. The association with BMI ≥ 25 kg/m² (OR 2.36) supports the load-related explanation. Manual workers, who squat and sit cross-legged, showed a non-significant trend, which is relevant for rural West Bengal [15,16].

The strengths of this study include a standard radiographic protocol, two blinded observers with high agreement, a calculated sample size and random sampling. It provides baseline data for a region where little has been published.

5.1 Limitations

The study was hospital-based and cross-sectional, so selection bias is possible and causality cannot be established. The sample size was small and was powered to estimate prevalence, not to detect all associations; confidence intervals were wide. Plain radiographs cannot detect a purely cartilaginous fabella, so prevalence may be slightly underestimated. Pain was self-reported and no MRI or ultrasound correlation was done. Multivariable adjustment was not performed.

CONCLUSION

The prevalence of fabella among the patients of this tertiary care centre in Purba Medinipur was 36.5%, which is comparable with the global estimate. It was commonly bilateral and oval in shape, tended to increase with age, and was larger in males than in females. Posterolateral knee pain, knee osteoarthritis and higher BMI were significantly associated with its presence. Although mostly an incidental and harmless variant, the fabella should be considered in the differential diagnosis of posterolateral knee pain, and most symptomatic cases can be managed successfully without surgery.

RECOMMENDATIONS

- Radiologists should routinely comment on the presence, size and shape of the fabella in lateral knee radiographs.
- Clinicians should consider fabella syndrome in patients with unexplained posterolateral knee pain, after excluding other common causes.
- Conservative treatment should be tried first; fabellectomy should be reserved for carefully selected, refractory cases.
- Orthopaedic surgeons should look for the fabella during pre-operative planning of knee arthroplasty and posterolateral corner surgery.

Larger multicentre studies with CT or MRI correlation and multivariable analysis are recommended to establish the true burden and clinical significance of fabella in eastern India.

DECLARATIONS

Conflict of interest: The authors declare that they have no conflict of interest regarding the publication of this article.

Funding: No funding was received for this study.

Ethical approval: Obtained from the Institutional Ethics Committee. Informed consent was obtained from all participants.

Acknowledgements: The authors thank the staff of the Radiodiagnosis and Orthopaedics departments and all the patients who participated.

Submission declaration: We declare that this work is original, has not been published previously, and is not under consideration elsewhere. Its publication is approved by all authors, and, if accepted, it will not be published elsewhere in the same form without the written consent of the copyright holder. All authors have read and approved the final manuscript.

REFERENCES

1. Berthoume MA, Di Federico E, Bull AMJ. Fabella prevalence rate increases over 150 years, and rates of other sesamoid bones remain constant: a systematic review. *J Anat.* 2019;235(1):67–79.
2. Zeng SX, Dong XL, Dang RS, et al. Anatomic study of fabella and its surrounding structures in a Chinese population. *Surg Radiol Anat.* 2012;34:65–70.
3. Minowa T, Murakami G, Kura H, Suzuki D, Han SH, Yamashita T. Does the fabella contribute to the reinforcement of the posterolateral corner of the knee by inducing development of associated ligaments? *J Orthop Sci.* 2004;9(1):59–65.
4. Standring S, editor. *Gray's Anatomy: The Anatomical Basis of Clinical Practice.* 41st ed. London: Elsevier; 2016.
5. Dalip D, Iwanaga J, Oskouian RJ, Tubbs RS. A comprehensive review of the fabella bone. *Cureus.* 2018;10(6):e2736.
6. Sarin VK, Erickson GR, Giori NJ, Bergman AG, Carter DR. Coincident development of sesamoid bones and clues to their evolution. *Anat Rec.* 1999;257(5):174–180.
7. Eyal S, Rubin S, Krief S, Levin L, Zelzer E. Common cellular origin and diverging developmental programs for different sesamoid bones. *Development.* 2019;146(7):dev167452.
8. Berthoume MA, Bull AMJ. Human biological variation in sesamoid bone prevalence: the curious case of the fabella. *J Anat.* 2020;236(2):228–242.
9. Egerci OF, Kose O, Turan A, Kilicaslan OF, Sekerci R, Keles-Celik N. Prevalence and distribution of the fabella: a radiographic study in Turkish subjects. *Folia Morphol (Warsz).* 2017;76(4):713–718.
10. Phukubye P, Oyedele O. The incidence and structure of the fabella in a South African cadaver sample. *Clin Anat.* 2011;24(1):84–87.
11. Driessen A, Balke M, Offerhaus C, et al. The fabella syndrome: a rare cause of posterolateral knee pain. A review of the literature and two case reports. *BMC Musculoskelet Disord.* 2014;15:100.
12. Weiner DS, Macnab I. The “fabella syndrome”: an update. *J Pediatr Orthop.* 1982;2(4):405–408.
13. Kuur E. Painful fabella. *Acta Orthop Scand.* 1986;57(5):453–454.
14. Pritchett JW. The incidence of fabellae in osteoarthritis of the knee. *J Bone Joint Surg Am.* 1984;66(9):1379–1380.
15. Pal CP, Singh P, Chaturvedi S, Pruthi KK, Vij A. Epidemiology of knee osteoarthritis in India and related factors. *Indian J Orthop.* 2016;50(5):518–522.
16. Mahajan A, Verma S, Tandon V. Osteoarthritis. *J Assoc Physicians India.* 2005;53:634–641.
17. von Elm E, Altman DG, Egger M, et al. The Strengthening of Reporting of Observational Studies in Epidemiology (STROBE) statement: guidelines for reporting observational studies. *Lancet.* 2007;370:1453–1457.
18. Lwanga SK, Lemeshow S. *Sample Size Determination in Health Studies: A Practical Manual.* Geneva: World Health Organization; 1991.
19. Cochran WG. *Sampling Techniques.* 3rd ed. New York: John Wiley & Sons; 1977.
20. Kellgren JH, Lawrence JS. Radiological assessment of osteo-arthritis. *Ann Rheum Dis.* 1957;16(4):494–502.
21. Landis JR, Koch GG. The measurement of observer agreement for categorical data. *Biometrics.* 1977;33(1):159–174.
22. Altman DG. *Practical Statistics for Medical Research.* London: Chapman & Hall; 1991.
23. Hosmer DW, Lemeshow S. *Applied Logistic Regression.* 2nd ed. New York: John Wiley & Sons; 2000.
24. World Medical Association. Declaration of Helsinki: ethical principles for medical research involving human subjects. *JAMA.* 2013;310(20):2191–2194.
25. Felson DT. Osteoarthritis of the knee. *N Engl J Med.* 2006;354(8):841–848.
26. Hunter DJ, Bierma-Zeinstra S. Osteoarthritis. *Lancet.* 2019;393(10182):1745–1759.
27. Zippelle JT, Hammer RL, Loubert PV. Treatment of fabella syndrome with manual therapy: a case report. *J Orthop Sports Phys Ther.* 2003;33(1):33–39.
28. Cross M, Smith E, Hoy D, et al. The global burden of hip and knee osteoarthritis: estimates from the Global Burden of Disease 2010 study. *Ann Rheum Dis.* 2014;73(7):1323–1330.

29. Nguyen US, Zhang Y, Zhu Y, Niu J, Zhang B, Felson DT. Increasing prevalence of knee pain and symptomatic knee osteoarthritis. *Ann Intern Med.* 2011;154(11):725–731.
30. Peat G, McCarney R, Croft P. Knee pain and osteoarthritis in older adults: a review of community burden and current use of primary health care. *Ann Rheum Dis.* 2001;60(2):91–97.