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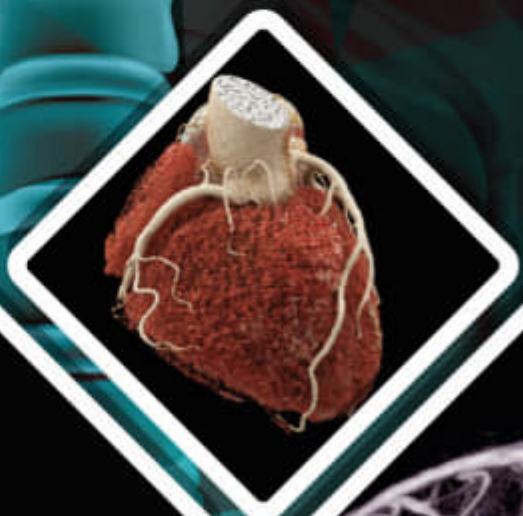

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Journal of Radiology in Medicine

Editorial

We are excited to publish the first issue of the our journal, Journal of Radiology in Medicine (JRM). Our Journal will be published as 4 issues per year. With the first issue of our journal, indexing will be made to Ulakbim TR-Index and some indexes. We want to be included in strong international indexes in the near future and become a journal that contributes to the international scientific literature on behalf of our country. In the longer term, we want to first enter valuable international indexes such as Scopus, ESCI, Pubmed, raise the quality of the articles to higher levels, and then take part in SCI-Expanded. During this process, we would like to thank the editors who worked in our journal, all the authors who submitted articles to our journal, and everyone who contributed to the publication, development and every stage of the journal.

Sincereley,

Assoc. Prof. Adnan ÖZDEMİR
Editor-in-Chief

Journal of Radiology in Medicine

Volume: 1 Issue: 1 Year: 2024

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Original Article

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Evaluation of pneumatized structures and osteoma frequency in the paranasal region

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ABSTRACT

Aims: The aim of our study was to evaluate the incidence of pneumatized structures in the paranasal region and the presence of osteomas.

Methods: Paranasal CT images obtained with Multislice (Philips) 64-slice computed tomography (CT) at Kırıkkale University Hospital in 2023 were retrospectively analyzed. Pneumatized variations and the presence of osteoma were evaluated.

Results: The images of 186 patients (93 female and 93 male) with paranasal CT were analyzed. The most common pneumatized variation was middle turbinate bullosa with 40.3%, and the least common was pneumatization of the nasal septum with 2.1%. Anterior clinoid pneumatization was observed in 23.1%, posterior clinoid pneumatization in 2.2%, pneumatization of the uncinate process in 4.9%, and crista galli pneumatization in 4.3%. The frequency of osteomas in the paranasal region was 3.2% (n=6).

Conclusion: Our study will provide a better understanding of paranasal anatomy by providing information about the frequency of pneumatized paranasal variations and the presence of osteomas. This will guide the surgeon in surgical planning and at the time of surgery.

Keywords: Paranasal region, osteoma, paranasal variation, pneumatized structures

INTRODUCTION

Anatomical variations in paranasal sinus structures are frequently encountered. These differences in anatomy make the sinus drainage channels narrow or get blocked, which makes it harder for mucociliary activity and less air flow to reach the paranasal sinuses. Thus, infections are predisposed.[1] Although it is accepted that most of the paranasal sinus variations predispose to the development of sinusitis, there are significant differences between studies.[2] Pneumatized paranasal structures have an important place among these variations.

Better understanding of the anatomy of the paranasal sinuses is now necessary because Functional Endoscopic Sinus Surgery (FESC) is becoming more common as a medical and surgical way to treat paranasal sinus diseases. Before FESC, coronal CT provides information about the patient's current anatomy and guides the surgeon.[3] In paranasal sinus surgery, anatomy and variations should be well known.

Osteomas are slow-growing benign bone tumors and frequently follow an asymptomatic course unless they increase in size or disrupt the sinus drainage system.[4] However, depending on the size and location of the osteoma, it may cause complaints of chronic sinusitis, mucocele, chronic headache, proptosis, or diplopia. The most common symptom is a frontal headache and facial pain.[5] Since it usually proceeds asymptomatically, the actual incidence is not clear, but according to some authors, it varies between 0.002% and 0.98%.

There are studies in the literature on the anatomy and variations of the paranasal sinuses. However, there are no studies on pneumatization variations in paranasal structures. In addition, the evaluation of the presence of osteoma will also contribute to the literature.

METHODS

This retrospective study was performed according to the principles of the Declaration of Helsinki, with paranasal CT images taken in 2023. Kırıkkale University Faculty of Medicine Local Ethics Committee approval was obtained (Date:10.01.2024, Decision No: 2023.12.18).

Patients younger than 18 years of age, patients older than 75 years, patients with nasal polyposis, patients with a history of trauma or surgery in the sinonasal region, and patients with benign or malignant tumors were excluded.

Routine paranasal CT imaging was performed without the use of contrast or sedation. Images were obtained using a 64-slice CT (MSCT; Brilliance 64, Philips Medical System, Best, The Netherlands).

All of the scans were obtained using the following parameters: effective mAs=350, tube voltage=120 kV, field of view (FOV)=180 mm, slice thickness=1.00 mm, and image matrix=768×768. After scanning, coronal, axial, and sagittal images were reconstructed with a slice thickness of 1.00 mm.

Anterior clinoid process (ACP) pneumatization, posterior clinoid process (PCP) pneumatization, middle turbinate bullosa, uncinate process pneumatization, crista galli pneumatization, and nasal septum pneumatization were evaluated. Osteomas detected in the paranasal region were also analyzed.

The diameters of the osteomas observed in our study ranged between 4 and 8 mm.

RESULTS

186 paranasal sinus CT images were analyzed. Of these, 93 were male (mean age 35.49-SD 15.24) and 93 were female (mean age 35.42-SD 13.97). The most common pneumatized variation was middle turbinate bullosa with 40.3% (right 11.3%, left 10.2%, and bilateral 18.8%) (**Figure 1**), and the least common was pneumatization of the nasal septum with 2.1% (**Figure 2**). ACP pneumatization was 23.1% (right 11.3%, left 7%, and bilateral 4.8%) (**Figure 3**), PCP pneumatization was 2.2% (right 1.6%, left 0.6%), uncinate process pneumatization was 4.9% (right 2.2%, left 2.2%, and bilateral 0.5%) (**Figure 1**), and crista galli pneumatization was 4.3% (**Figure 4**). The frequency of pneumatized variations is shown in **Table 1**.

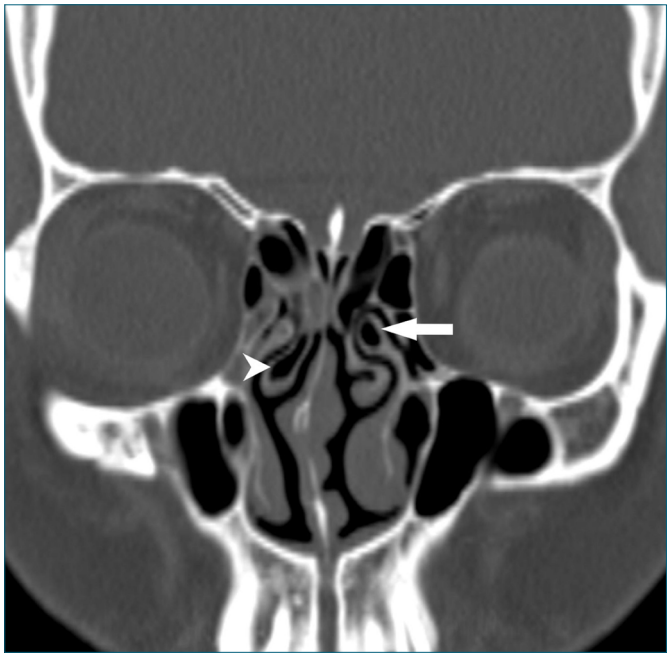

Figure 1. On coronal section CT, showing right middle turbinate bullosa (arrowhead) and left uncinate process pneumatization (white arrow)

Table 1. The incidence of pneumatized variations

Variation Type	Number (n)	Rate
Middle Concha Bullosa	75	40.3
Anterior Clinoid Process Pneumatization	43	23.1
Pneumatization of the Uncinate Process	9	4.9
Crista Galli Pneumatization	8	4.3
Posterior Clinoid Process Pneumatization	5	2.7
Nasal Septum Pneumatization	4	2.2

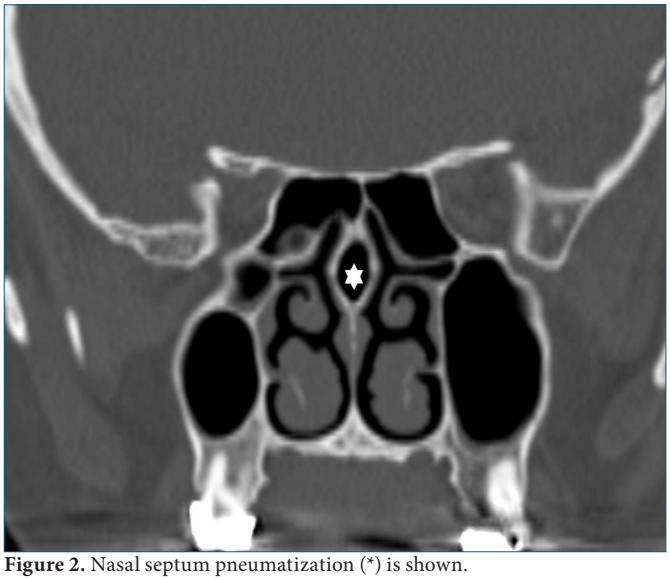

Figure 2. Nasal septum pneumatization (*) is shown.

Figure 3. Coronal section CT image of a 35-year-old male patient, showing anterior clinoid process pneumatization (*)

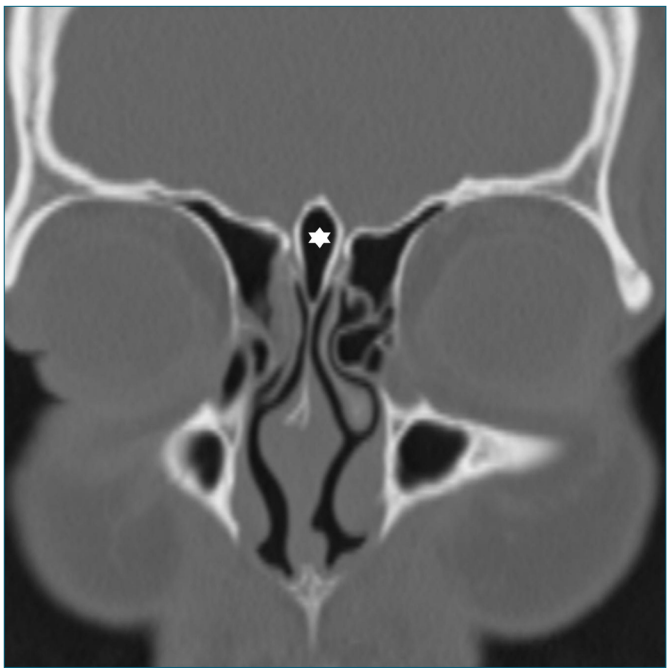

Figure 4. Coronal section CT image, crista galli pneumatization (*) is shown.

The frequency of osteomas in the paranasal region was 3.2% (n=6). Of those with osteomas, five were female and one was male. While 3 osteomas were found in the frontal sinus (**Figure 5**), 1 osteoma each was found in the sphenoid, maxillary and ethmoidal sinuses (**Figure 6**).

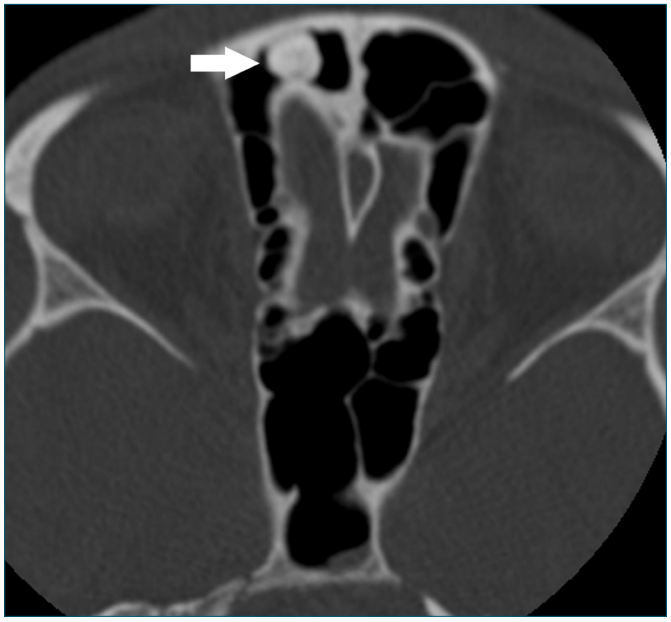

Figure 5. A 6 mm-diameter osteoma is seen in the frontal sinus (white arrow).

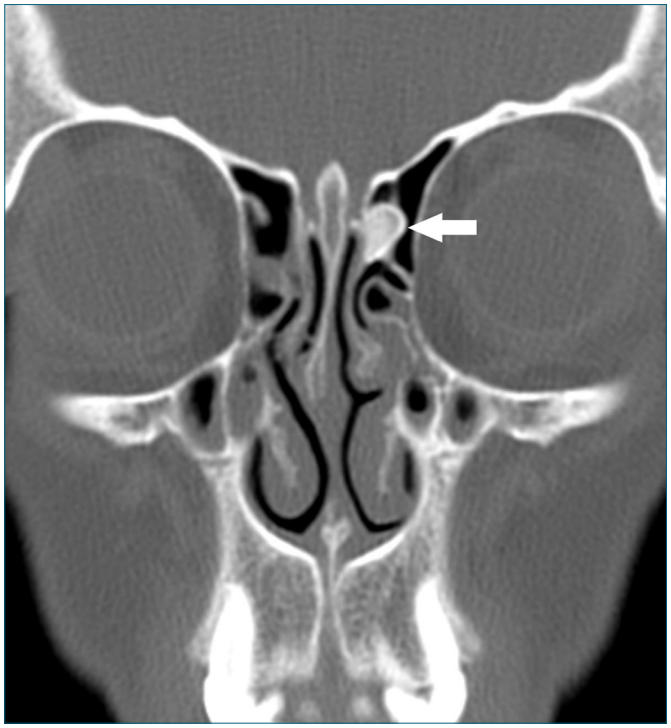

Figure 6. Coronal section CT image, showing anterior ethmoidal sinus osteom (white arrow).

DISCUSSION

There are numerous variations in the paranasal sinus region. Anatomical variations of the paranasal sinuses are one of the most important etiologic factors in the etiopathogenesis of chronic inflammatory paranasal sinus diseases with their obstruction in the ostiomeatal complex.[6,7]

The development of minimally invasive surgical techniques has necessitated a better knowledge of paranasal sinus anatomy. Anatomic variations should be well known to avoid complications that may occur during the operation and to perform the surgery safely. CT is the gold standard imaging method used in the evaluation of the patient before endoscopic sinus surgery.[8,9]

CT imaging is the imaging method that best demonstrates the relationship between chronic sinus infections and anatomic variations seen in the paranasal sinuses.

There are significant differences in the frequency of paranasal variations in most studies. Among the reasons for these differences is the fact that only the coronal plane is examined.

In the article by Mikami et al.[10] pneumatization of ACP was found in 55 of the 600 sides (9.2%) in 300 consecutive patients. In another study, this rate was found to be 26%.[11] In the study by Veysel et al.[12] this rate was found to be 33.3% in women and 37.5% in men. They stated that this difference may be related to genetic differences in subject populations or environmental exposure to different agents. In our study, the rate of ACP pneumatization was found to be 21.3%, which is in accordance with the literature.

Variations in PCPs are important in intracranial surgery. The PCP deepens the Sella turcica and provides a connection to the tentorium cerebelli. Therefore, any anomaly in the PCP may be responsible for the altered attachment of the tentorium cerebelli. In the study by Veysel et al.[13] PCP pneumatization was found in 20.7% of men and 11.5% of women. In addition, PCP pneumatization was found to be higher in men and young people. In our study, this rate was found to be lower and was 2.7% (n=5). Two of these patients were female, and three were male.

The frequency of Crista galli pneumatization was found to be 9.2-13.7% in various studies.[14-16] In our study, it was found to be 4.3%, which is lower than the literature.

The pneumatized uncinate process is a significant anatomical variation that can make it hard for the anterior ethmoid cells, infundibulum, and frontal recess to breathe. Its incidence varies between 0.4-6.1% in the literature.[14,17] In our series, this variation was observed at 4.9%.

The frequency of middle turbinate bullosa has been reported as 39.2% and 40.9% in some studies.[11,15] In our study, it was found to be 40.3%, in accordance with the literature.

Osteomas are the most common tumors of the paranasal sinuses.[5] Paranasal sinus osteomas are well-circumscribed, frequently asymptomatic tumors that are diagnosed incidentally.[5] In publications, clinical symptoms are observed in 4-10% of all osteomas.[18] Headache is reported as the most common symptom, with a rate of 71%.[19]

It is frequently detected in the 3rd and 4th decades, and its incidence is higher in men than in women.[20] In our study, osteomas were detected in 6 patients, and contrary to the literature, 5 were female and 1 was male. It can be detected in 0.43-1% of routine radiographic imaging and 3% of paranasal sinus CT.[21] In our study, the frequency of osteoma was found to be 3.2%.

Indications for surgery include rapid growth of the tumor, a symptomatic patient, chronic sinusitis due to tumor obstruction, bone erosion, facial deformity, osteoma occupying more than 50% of the frontal sinus, partial or complete blockage of the frontal recess due to osteoma, and the presence of complications.[22] The diameters of the osteomas observed in our study ranged between 4 and 8 mm. Since small osteomas were observed, the complications mentioned above were not observed.

CONCLUSION

Our study will provide a better understanding of paranasal anatomy by providing information about the frequency of pneumatized paranasal variations and the presence of osteomas. This will guide the surgeon in surgical planning and at the time of surgery.

ETHICAL DECLARATIONS

Ethics Committee Approval

The study was carried out with the permission of Kırıkkale University Faculty of Medicine Clinical Researches Ethics Committee (Date: 10.01.2024, Decision No: 2023.12.18).

Informed Consent

Because the study was designed retrospectively, no written informed consent form was obtained from patients.

Referee Evaluation Process

Externally peer-reviewed.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

Financial Disclosure

The authors declared that this study has received no financial support.

Author Contributions

All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

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Original Article

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Evaluation of high placed jugular bulbus density with multislice temporal computed tomography

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ABSTRACT

Aims: In this study, it is aimed to investigate the density of high placed jugular bulbus which is useful to know from a clinical and surgical perspective.

Methods: Between the dates of May and November 2023, temporal computed tomography scans which took place in the computed tomography (General Electric) were evaluated retrospectively.742 cases and 1484 ears were included in the study. Jugular bulbus was evaluated based on the internal acoustic canal.

Results: The age range of 742 cases was 18-72. Of the cases, 796 were women and 688 were men. High placed jugular bulbus was detected in 44 (3%) of 1484 ears. Of the 44 ears in which high placed jugular bulbus was detected, 26 (59%) were located on the right and 18 (41%) were located on the left. High placed jugular bulbus were monitored more frequently on the right side.

Conclusion: In this study, the density of high placed jugular bulbus was investigated. The density of high placed jugular bulbus is lower than the literature. Additionally, it was detected more frequently on the right side, consistent with the literature.

Keywords: Jugular bulbus, internal acoustic canal, skull base surgery

INTRODUCTION

Jugular bulbus (JB); is a formation located at the base of the middle ear, at the level of the hypotympanum, and provides the venous connection between the sigmoid sinus and the internal jugular vein (IJV). It is separated from the cavum tympani by a compact bone in its upper part. There are several variations of the JB that may be clinically important. JB location and size may vary between individuals. High placed jugular bulbus (HPJB) is a rare developmental variation, but it is the most common anomaly of the jugular vein in the temporal bone.[1] The definition and density of HPJB vary depending on the underlying anatomical formation. HPJB; in clinical practice, it is often asymptomatic and detected incidentally. It is mostly detected during computed tomography (CT) examination of the temporal bone for another reason. When HPJB is symptomatic, the most common symptom is venous tinnitus.[2] It is known that HPJB may cause conductive and mixed hearing loss.[3] Additionally, recognition of HPJB during skull base surgery planning is important to prevent morbidity and complications. For this purpose, in this study, temporal CT scans were evaluated retrospectively in terms of the density of HPJB according to the internal acoustic canal (IAC).

METHODS

The study was carried out with the permission of the Ankara Etlik City Hospital Scientific Researches Evaluation and Ethics Committee (Date: 20.12.2023, Decision No: AEŞH-EK1-2023-800). All procedures were carried out in accordance with the ethical rules and the principles of the Declaration of Helsinki.

742 temporal CT scans performed on CT (General Electric) were included in the study. The scans were evaluated retrospectively. Temporal CT protocol had Kv; 130, mAs; 130 FOV; 220 rotation time; 1 slice thickness; 1 mm values.

Evaluation according to IAC was performed on images obtained in the axial plane without contrast and with a section thickness of 1 mm. JB ending at the IAC lower limit and above was considered highly placed. In this study, the density of HPJB was investigated. Additionally, grading was performed in cases in which HPJB was detected; In images obtained with an axial section thickness of 1 mm, JB was evaluated as grade I if it was 0-2 mm above the lower limit of IAC, and grade II if it was >2 mm above the lower limit of IAC.

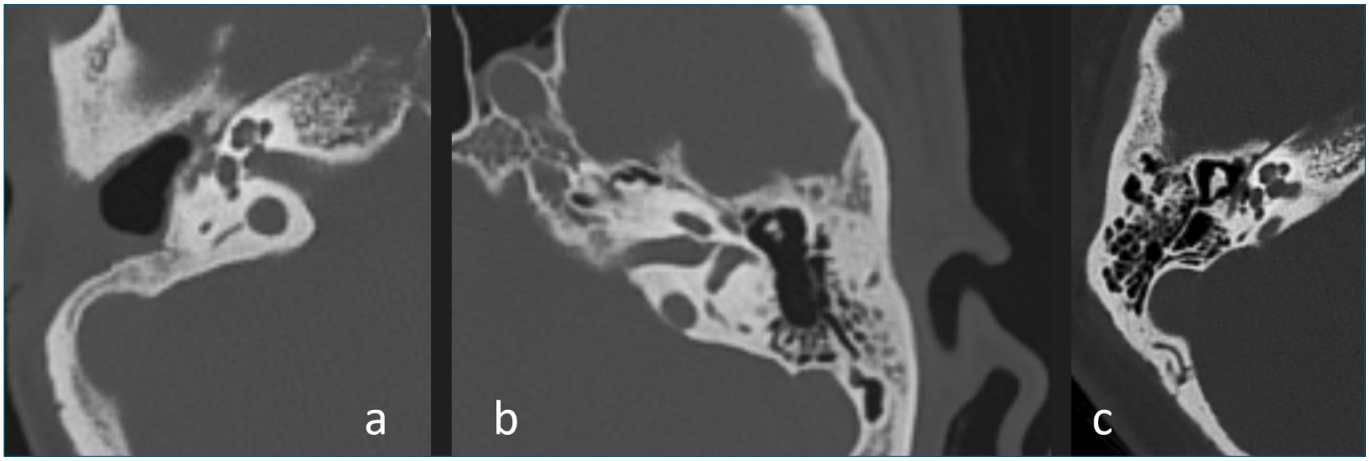

Figure 1. a, b; in the axial plane with a section thickness of 1 mm, jugular bulb on the right and left is observed along 3 sections starting from the level of the internal acoustic canal (grade 2). **c;** left jugular bulb is observed in 1 section at the base of the internal acoustic canal (grade 1).

RESULTS

742 cases with temporal CT scan, 1484 ears were included in this study. Of the cases, 796 were women and 688 were men. HPJB was evaluated according to IAC (**Figure 1**).

According to IAC; there were HPJB in the 44 out of 1484 ears (3%). Of the HPJB cases, 32 were women and 8 were men (**Table 1**). According to IAC, the age range of HPJB cases was 18-72, and the average age was 40. Of the 44 ears in which HPJB was detected, 26 (59%) were located on the right and 18 (41%) were located on the left. The number of bilateral HPJB cases was 4 (**Table 1**). Of the 44 ears with HPJB, 18 (41%) were evaluated as grade I and 26 (59%) as grade II (**Table 2**).

Table 1. Cases of HPJB according to position

	Men	Women
Right	2	20
Left	4	10
Bilateral	2	2

Table 2. Grades of HPJB cases according to IAC

	Men	Women	Total	Percantage
Right Grade 1	2	8	10	23%
Right Grade 2	2	14	16	36%
Left Grade 1	0	8	8	18%
Left Grade 2	6	4	10	23%

DISCUSSION

JB is the venous structure that provides the connection between the sigmoid sinus and IJV. Various studies are available in the literature evaluating JB-related pathologies such as HPJB, JB diverticulum, JB adjacent to the inner ear, JB-related inner ear dehiscence, JB dehiscence, and asymmetric JB.[4] In addition, JB diverticulum, which is detected more rarely, was observed in 2 ears in our study (**Figure 2**). Pathologies associated with JB are rare, and the most common is HPJB. The definition and density of HPJB varies depending on the reference point (6-65%).[5] For example, according to Wadin et al.[6] the diagnosis of HPJB is made based on the JB reaching the round window niche on radiological examination. Frequency of HPJB according to IAC; It was found to be 5.3% in the study of Asal et al.[7] and 10-15% in the study of Freidmann et al.[8] In this study, the frequency of HPJB compared to IAC was 3% and was found to be low compared to the literature.

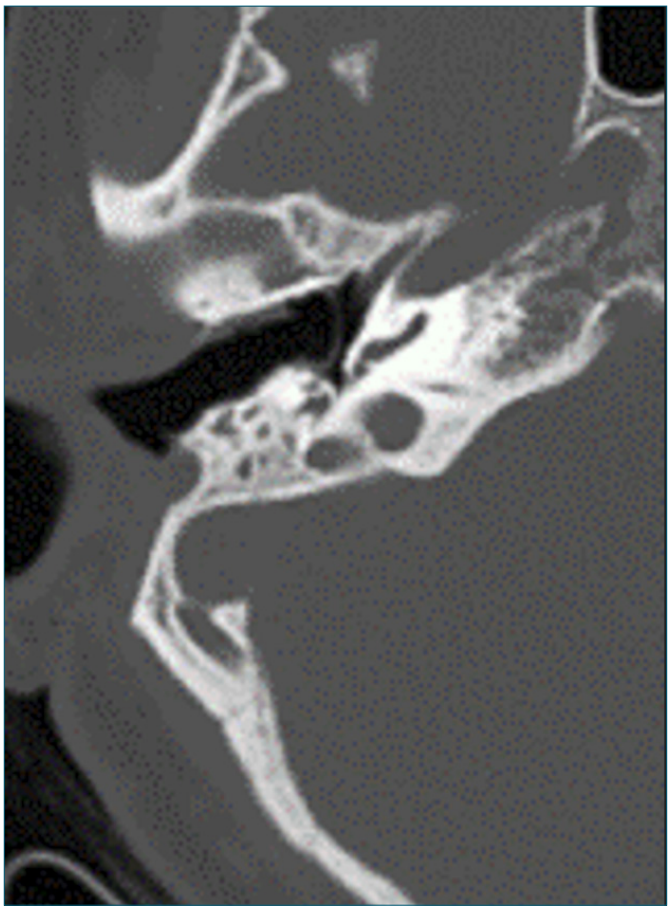

Figure 2. Grade 2 high placed jugular bulb on the right is accompanied by a jugular diverticulum.

Gejrot[9] reported in his study that HPJB is more common on the right side because the jugular vein and transverse sinus are wider on the right side. In this study, consistent with the literature, HPJB was detected on the right side in 59% and on the left side in 41%.

HPJB is usually asymptomatic. Tinnitus is the most common symptomatic complaint.[2] Vestibular dysfunction is less common, and it is thought that this condition may be caused by compression of the endolymphatic sac and distal aqueduct.[10] It has also been reported that HPJB causes conductive and mixed hearing loss.[3] HPJB should be considered in various otological findings whose cause cannot be determined.

In the anatomical and radiological study conducted by Orr and Todd, it was reported that the distance between

the internal acoustic canal and the jugular apex could be estimated accurately with CT.[11]

Depending on the level it reaches, HPJB may make labyrinthectomy difficult or prevent the determination of the boundaries of the mass in tumor surgeries, and may cause venous injuries.[12]

Before lateral skull base surgery, a possible HPJB should be detected with preoperative temporal CT scanning and necessary precautions should be taken.

Asymptomatic cases of HPJB are usually detected incidentally and these cases do not require treatment. Surgery may be considered in patients with persistent pulsatile tinnitus that causes cranial nerve involvement in HPJB. The rate of success and symptom relief after surgery is quite high.[13] In this study, the frequency of HPJB is 3%, which is lower than the literature. Additionally, it was detected more frequently on the right side, consistent with the literature. The limitations of this study are that the patients' symptoms were not known and otological examinations could not be performed.

CONCLUSION

HPJB should also be considered in patients whose etiology cannot be determined and who present with various otological symptoms, especially tinnitus; the risks posed by HPJB for lateral skull base and middle ear surgery should be known, to prevent complications, the possibility of HPJB should be examined. We believe that the results obtained in this study investigating the density of HPJB will benefit studies investigating otological findings of unknown etiology. We think that the results of this study will contribute to the literature.

ETHICAL DECLARATIONS

Ethics Committee Approval

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Informed Consent

Because the study was designed retrospectively, no written informed consent form was obtained from patients.

Referee Evaluation Process

Externally peer-reviewed.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

Financial Disclosure

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Author Contributions

All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

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Review

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Sonoelastography of the Achilles tendon: a review

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ABSTRACT

Sonoelastography (SE) is a method that evaluates the mechanical properties of tissue by detecting tissue displacement and strain after stress applied to the tissue. There are various sonoelastography techniques used in clinical practice. Strain elastography, which allows real-time visualization of the tissue elastography map, is the most widely used technique. There is increasing evidence that SE can be used to measure the mechanical properties of musculoskeletal tissue in clinical practice. It is thought to have the potential to guide both early diagnosis and treatment monitoring and therapy in the future. This review describes various Achilles tendon SE techniques and published evidence for clinical use and includes discussions on the use and limitations of SE in the musculoskeletal system and future perspectives.

Keywords: Ultrasound, elastography, shear wave, strain, Achilles tendon, tendinopathy

INTRODUCTION

Sonoelastography (SE) is a new and promising non-invasive method based on ultrasound that evaluates the elastic properties of tissues based on the physical principles produced by tissue compression. This technique was introduced in vitro in the early 1990s and has since been used in real-time in vivo. In addition to B-mode and Doppler imaging, which provide acoustic impedance and vascular flow information in diagnostic imaging, SE provides information about tissue stiffness, opening a new window.[1-5]

SE is based on showing the change in the elastic properties of the stressed tissue. Over the years, studies on elasticity have used different methods to measure the displacement of stressed tissue. Strain elastography is one of the most widely used techniques that allows real-time visualization of the image in different tissues and organs and can detect and characterize lesions.[1-3]

Changes in tissue and cell biomechanics occur because of many diseases. SE examination is currently used in the diagnosis of breast, thyroid, cervix, and liver pathologies.[6-9] In the musculoskeletal system, it is used to evaluate tendons, muscles, fascia, and subcutaneous tissue. The Achilles tendon is the first area to be evaluated using SE. Achilles tendon SE provides most of the clinical data in musculoskeletal applications available so far.[9-11]

The aim of this review is to describe the various published elastographic applications on the Achilles tendon and to discuss limitations and future perspectives.

ELASTOGRAPHY PHYSICS AND SONOELASTOGRAPHY METHODS

Elastography assesses tissue elasticity, which is the tendency of tissue to resist deformation by an applied force or to return to its original shape after removal of the force. Hooke's law is defined as the law of elasticity, where a material is completely elastic and its deformation does not depend on time. An equation for linear elastic materials ($\sigma=E \cdot \varepsilon$) was proposed by the English mathematician Robert Hooke (1653-1703) and is known as Hooke's Law. Under the effect of any pressure or stress, a shortening of the length of the object occurs. While the change in length is called deformation, the amount of length change per unit length is called strain (ε - epsilon). During this deformation, there is a direct proportional relationship between stress (σ) and strain (ε) ratio.[12] Strain imaging uses the direct Hooke's Law relationship where σ represents the externally applied stress and ε represents the strain.[13]

Elastography is a set of techniques in which tissue stiffness is estimated as a physical property called Young's modulus (E). Young's modulus is defined as the ratio of the stress (force per unit area) applied to the object and the resulting axial strain (displacement or deformation) in the linear elastic region of the material.

SE methods can be divided into two categories: strain-based (**Figure 1**) and shear-wave-based (**Figure 2**). In strain-based elastography, force is applied through the application of probe pressure or endogenous mechanical force (e.g., carotid pulsation). In shear wave-based elastography, the imaging system induces a tissue shear wave. In both approaches,

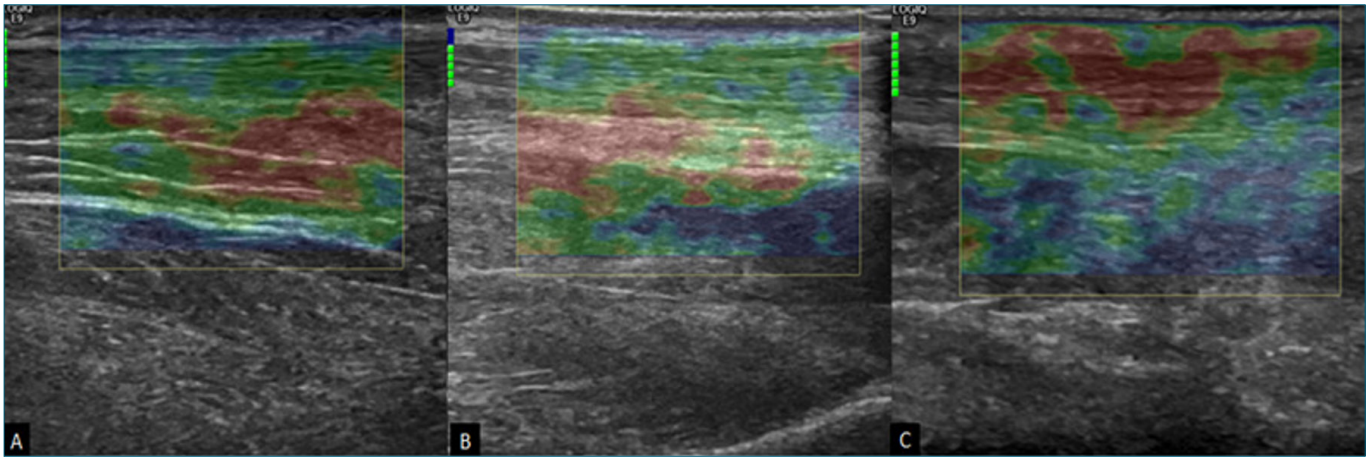

Figure 1. Strain elastography image of the Achilles tendon with different stiffness. Ultrasound probe was placed in a longitudinal scan at the level of the medial malleolus.

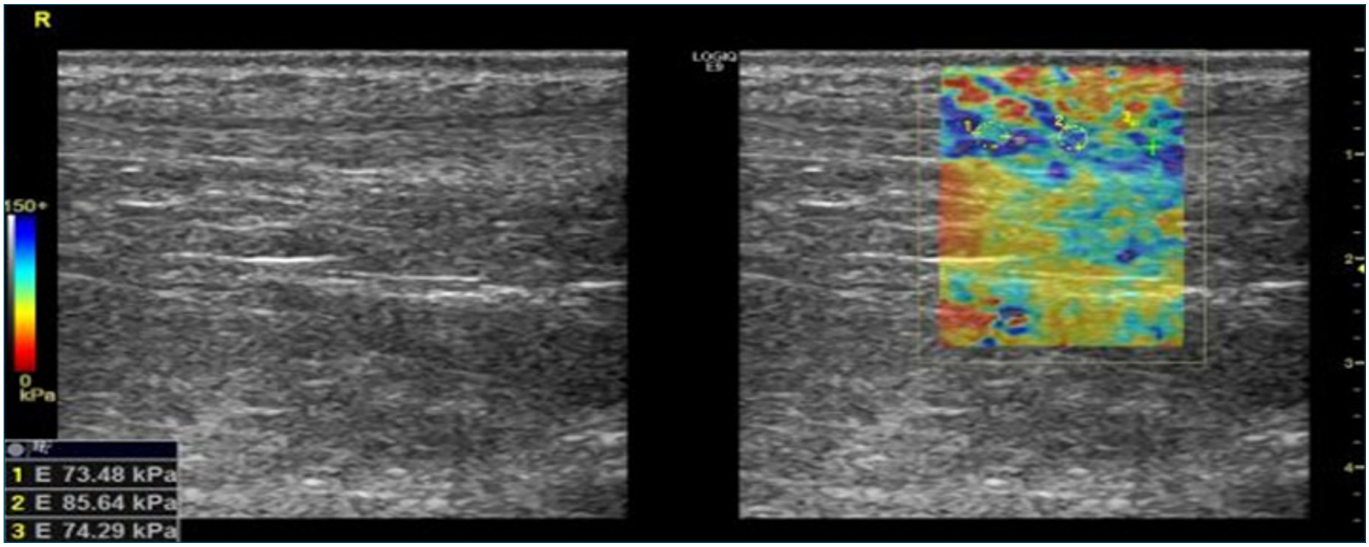

Figure 2. SWE measurements(kPa) of Achilles tendon in a longitudinal scan

the tissue response to these mechanical stimuli is used to estimate the mechanical properties of the tissue.[12]

Young's modulus is not calculated with clinical strain imaging systems, as the force applied to the tissue of interest is usually unknown. Shear wave imaging systems calculate Young's modulus using the relationship E=3ρcs2, where ρ represents the tissue density and cs represents the shear wave velocity.

The ultrasound operator can convert kPa to m/s and m/s to kPa. At the end of the US examination, most US systems display a table showing hardness values in both kPa and m/s.[13]

THE ROLE OF SONOELASTOGRAPHY IN TENDON EVALUATION

B-mode ultrasonography (US) is usually the first imaging modality used to evaluate tendon abnormalities because it is easily accessible, fast, safe, and inexpensive. With conventional B-mode US, the diagnosis of tendinopathy is often based on the presence of morphologic changes of the relevant tendon, such as focal or diffuse thickening, intra-tendon hypoechoic areas. Beyond the morphological information obtained with US, power doppler (PD) can show pathologically increased vascularization.[14-16] Currently, current imaging of tendon pathologies is mainly based on magnetic resonance imaging (MRI) in addition to traditional B-mode and PD sonography. However, it is well known that US and MRI show a "limited correlation between structural irregularity and pain," i.e., various tendons of asymptomatic patients may have abnormal imaging on MRI but not on B-US and PD-US. In addition, there is thought to be a lack of current imaging modalities (B-US, PD-US, and MRI) in defining the smooth transition process from "asymptomatic" to "symptomatic" (or vice versa) during the incipient disease or healing process in the tendon. Therefore, so far, the interpretation of tendon structure analyzed by B-US, PD-US, and MRI with additional examinations such as SE could benefit the clinic.[17,18]

Recently, shear wave elastography (SWE) has been recognized as a technique that provides quantitative information about tissue stiffness and thus the mechanical properties of a tendon. SWE is a real-time diagnostic imaging technique that provides quantitative information on tissue elasticity (in kilopascals (kPa) or meters per second (m/s). Real-time ultrafast SWE calculates the US pulse's generated shear wave velocity (in meters per second). Further studies are needed to fully correlate SWE with the reference standard. However, SWE provides diagnostic information complementary to B-mode US and PD-US. SWE has been shown to be able to detect and grade tendinopathies and can significantly improve diagnostic accuracy. Quantitative and semi-quantitative SWE measurements of Achilles, patellar, and wrist extensor tendons have been found to correlate better with patient symptoms than traditional ultrasound findings.[19,20] SWE allows repeated intra-individual as well as inter-individual measurements and comparisons and is therefore suitable for diagnosis and treatment monitoring.

In general, symptomatic tendons exhibit lower SWE values than asymptomatic tendons, but so far there are no universally accepted or applicable reference values for healthy Achilles tendons. Little is known about factors that influence tendon stiffness, such as patient age, weight, pre-existing diseases, or strengthening of a tendon due to exercise.

ACHILLES TENDON SONOELASTOGRAPHY

The Achilles tendon is the thickest, largest, and strongest tendon in the human body and is loaded 3.9 times the body weight during walking and 7.7 times the body weight during running. With these tensile loads, the tendon structure is exposed to the highest stress in the body. Especially if there is a biomechanical incompatibility, it is exposed to significant stress when running uphill and downhill.[21]

Many factors contribute to the development of tendinopathy in the general population and among athletes. The exact mechanisms leading to tendinopathy are complex and poorly understood. However, overuse of the tendon has an important role in the onset of tendinopathy. Tendinopathy can occur in any tendon, especially in the adhesion zone where the greatest stresses occur. Any activity or condition that increases the load to which the tendon is subjected (e.g., increased activity, weight gain, age) can lead to tendinopathy.[22]

Risk factors for tendinopathy can be divided into intrinsic and extrinsic factors; intrinsic factors originate from the body itself, such as age, gender, obesity, and genetics, while extrinsic factors originate from outside the body, such as excessive activity or intensity, occupation, footwear, and environmental conditions.[22] Although the etiology of tendinopathy is known to be multifactorial, there are many studies in the literature on risk factors.

In a study by Timm Dirrichs et al.[23] Achilles tendon SWE was assessed by taking measurements of both Achilles tendons from 33 semi-professional athletes and 35 non-athletes, totaling 68 individuals with a training history of at least 5 years of weekly running. Two radiologists with 6 and 7 years of experience took the measurements without knowing whether the participants were "athletes" or "non-athletes." The mean SWE value in athletes was 187.2 kPa (±45.2 kPa) on the right and 180.4 kPa (±39.7 kPa) on the left; in non-athletes, it was 105.4 kPa (±34.9 kPa) on the right and 101.8 kPa (±28.9) on the left. Dirrichs found a significant increase in tendon stiffness in athletes compared to non-athletes.

Coombes et al.[24] In a study of 40 patients (33 study patients and 7 control patients), they investigated the effects of diabetes on tendons. In their study, they also evaluated Achilles tendon thickness with B-mode US and tendon elasticity with shear wave velocity (SWV) in patients with and without statin use. They found lower SWV values and increased thickness values in the Achilles tendon of participants with diabetes on statins compared to participants without statins. They found that SWV of the Achilles tendon was moderately negatively correlated with total cholesterol and LDL cholesterol in statin-treated diabetic patients, whereas no correlation was found with serum lipids in non-statin-treated patients. The relationship between Achilles tendon thickness, elasticity, and body mass index (BMI) was also evaluated in this study by Coombes et al.[24] A negative correlation was observed between SWV of the Achilles tendon and BMI. A minimal positive correlation was observed between Achilles tendon thickness and BMI. They thought that this was due to the pathologic effects of lipids and cholesterol causing subcutaneous fat accumulation in and around the tendon. Long-term statin use was thought to cause microdamage to the tendon and decrease tendon elasticity. It is thought that these changes in the extracellular matrix of tendons after treatment with statins probably cause microdamage and micro ruptures in the tendon, and that these factors are the pathophysiology causing the loss of elasticity in the tendon.

Wen Cao et al.[25] conducted a large multicenter study with a total of 1165 adult participants in 17 Chinese hospitals using SE to determine Achilles tendon visco-elasticity in healthy humans and to determine normal values. Measurements were made in the middle 1/3 of the Achilles tendon with the foot in a relaxed, neutral position. Tendon circumference measurements were taken simultaneously from the section where tendon thickness measurements were taken. The data were obtained using these two measurements, the SWE value, and the elastic modulus (Young's modulus), which is the resistance of a substance to elastic deformation. In the study, BMI values were calculated from the height and weight data of the patients. The mean BMI value was found to be 22.75 (±3.22). In another study conducted in Chinese patients, both Achilles tendon thicknesses were found to be 0.48 cm (±0.27 cm) on the left and 0.47 cm (±0.07 cm) on the right. Wen Cao et al.[25] obtained Young's modulus SWE kPa values with tendon circumference, diameter, and SWE multiplier when the Achilles tendon was in its natural position and found 381.41 kPa (±106.50 kPa) on the right and 374.24 kPa (±106.12 kPa) on the left for both Achilles tendons.

Alessandro Schneebeli et al.[26] used elastography to look at the Achilles tendon's mechanical properties and elasticity while it was being stretched isometrically. 20 healthy participants underwent repeated measurements with SE and SWE by 2 radiologists with 7 years of musculoskeletal SE experience. The examination was performed longitudinally along the Achilles tendon by evaluating B mode, SE, and SWE. Measurements were taken at the level of the medial malleus and not at the Achilles tendon calcaneal attachment to avoid the effect of stiffening artifacts that may occur near the bone. Participants were instructed to perform contractions of different intensities (0 kg, 0.5 kg, 1 kg, 2 kg, 5 kg, and 10 kg) from the plantar flexion position using a wrist ergometer. Measurements were made on each tendon each time. Both practitioners obtained similar results in SE evaluations. They found a decrease in the strain rate in the Achilles tendon as the contraction intensity increased. However, in SWE measurements with increasing contraction intensity, the first practitioner found a decrease in the strain value, while the other practitioner's measurement showed an increase in the strain value with increasing contraction intensity.

SE probably represents the most important technical development in the field of ultrasonography since Doppler imaging. It has many advantages over other tissue elasticity estimation methods, such as MR elastography, as it is a low-cost, non-invasive, and rapid system and has the potential for wider clinical availability. The evidence so far seems very promising that SE can be used to assess the mechanical properties of musculoskeletal tissues in a clinical setting. It suggests that SE may be even more sensitive than MRI or gray-scale ultrasound in detecting subclinical changes in muscle and tendon and may therefore be valuable in early diagnosis

and rehabilitation. SE can be used as a research tool to provide information on the biomechanics and pathophysiology of musculotendinous diseases. However, despite the great interest in the technique, published literature information is still very limited and is mainly based on case reports or studies with small study populations using various EUS techniques and scoring systems. The lack of measurement methods, which limits the reproducibility of the method, and various technical issues, such as artifacts and differences in the application of the technique by different users, cast doubt on its potential clinical utility. In addition, it has been found that in most pathologic conditions, the changes detected on SE are those that are evident on B-mode US and PD examinations. The clinical significance of changes that are not seen in conventional B-mode US and PD but can be seen in SE is controversial.

For all these reasons, it is obvious that there is a need for standardization and consensus for elastogram window size, adapter/pad/gel usage, and scoring in soft tissue applications for SE. It is very important to ensure this consistency in the future, and this will only be possible by applying the technique to many studies performed today and making comparisons between studies.

CONCLUSION

SE in its current form remains highly subjective due to a lack of standardization and limited research data in terms of its clinical value. With more research and appropriate standardization, SE could become a valuable complementary tool in the study of musculoskeletal disorders.

ETHICAL DECLARATIONS

Referee Evaluation Process

Externally peer-reviewed.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

Financial Disclosure

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Author Contributions

All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

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Journal of Radiology Medicine in

Case Report

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Percutaneous interventional removal of the broken catheter during angiography

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ABSTRACT

Catheter breakage during coronary angiography is very rare complication. Generally, this broken catheter piece can be removed with a snareloop, but sometimes in cases where the broken piece is large in diameter, it may not be caught with a snareloop. In this case, the catheter piece that could not be caught with a snare loop was removed by catching it with a manual snare using a 0.014 inch guide wire.

Keywords: Coronary angiography, complication, breakage of catheter

INTRODUCTION

Coronary artery disease is the most common cause of death all over the world. Diagnosis is often made by coronary angiography and provides important information for planning treatment. breakage of the catheters used during angiography is a rare complication. The broken catheter piece must be removed percutaneously or surgically. Percutaneous removal is the preferred method because it is less traumatic. If the broken catheter piece cannot be removed from the artery being attempted, it can be captured and removed by the snareloop by placing a sheath on another artery. If it cannot be caught with a Snareloop, the 0.014 inch guide wire can be turned into a larger snare and removed.[1-3]

In this article, a case of removing the broken catheter tip during coronary angiography by placing a sheath on another artery and using a 0.014 inch wire as a snare is presented.

CASE

A 71-year-old male patient underwent coronary angiography due to exertional chest pain that had been present for the last 1 month. Angiography was performed by placing a 6F femoral sheath into the left femoral artery. In coronary angiography, the left system was first imaged using the left Judkins 4 catheter. Then, the right coronary artery was visualized using the right Judkins 4 catheter. No serious stenosis was detected in the coronary arteries.

While the right Judkins catheter was being removed from the sheath, it was noticed that the tip of the catheter was stuck on the edge of the sheath and trying to remove the catheter, it was observed that the tip of the catheter broke off at the femoral artery at the end of the sheath. In order to remove the broken end of the catheter, a snare loop was sent into the sheath to catch the piece, but it could not be caught. Since the fragment could not be captured from this side, a new sheath was placed on the right femoral artery and the right catheter was passed from the right femoral to the left femoral artery as a crossover. The broken piece was tried to be caught again with a snareloop, but it could not be caught again after repeated attempts. Thereupon, a 0.014 inch floppy wire was turned into a large lasso into the right Judkins catheter and sent to the femoral artery (**Figure 1**). In this way, the broken piece was caught and put into the sheath and taken out.

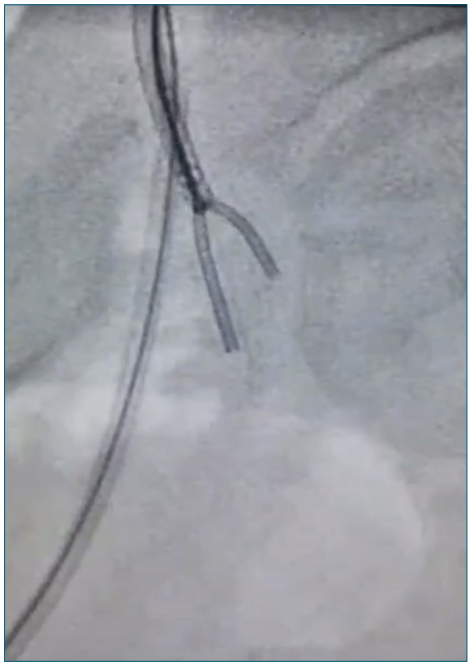

Figure 1. View of the patient's broken catheter tip caught with a snare under fluoroscopy

DISCUSSION

Clinically significant complications are encountered at a rate of 0.3-1% in coronary angiography.[1] Some of these complications include broken guide wires, stuck balloons or wires, and stripped stents.[2,3] However, intravascular catheter breakage is a very rare complication.[4] Catheter reuse, vessel tortuosity, aggressive manipulation of the catheter by the operator, and removal of the catheter without a guidewire may result in catheter breakage. If the broken catheter tip remains in the intravascular space, it must be removed percutaneously or surgically, as it will cause dissection, thrombosis or limb loss.[5] The snareloop method has been used for a long time for percutaneous removal of intravascular foreign bodies. If the foreign body in the intravascular space is large in diameter, curved, or does not have a large intravascular space, these foreign bodies may not be caught with the snareloop.[6] In such cases, 0.014 inch wires used during interventional procedures and larger tipped snares can be made manually and foreign objects can be captured with the help of a catheter. Thus, in this case, the foreign object that the snareloop could not catch was easily caught with the help of a catheter by manually creating a larger diameter snare. The broken catheter tip in the left femoral artery could be removed percutaneously without the need for surgery.

CONCLUSION

As the frequency of coronary angiography increases, the incidence of complications also increases. In this context, it is important that special cases are performed by experienced operators and that a guide wire is used when removing the catheter.

ETHICAL DECLARATIONS

Informed Consent

All patients signed and free and informed consent form.

Referee Evaluation Process

Externally peer-reviewed.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

Financial Disclosure

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Author Contributions

All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

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Case Report

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A rare case: chondral delamination in the knee

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ABSTRACT

We aimed to present the clinical and radiological features of a case of large-sized, discrete chondral delamination in the lateral femoral condyle of an 11-year-old girl, following trauma caused by inward rotation of her right knee.

Keywords: Cartilage, knee injuries, MRI

This case was presented as a poster presentation at the 44th National Radiology Congress (TÜRKRAD 2023). Apart from this, it has not been published anywhere else and has not been sent for publication elsewhere at the same time.

INTRODUCTION

Chondral delamination is the separation or debonding of the articular cartilage from the underlying subchondral bone at the tidemark forming an unstable cartilage flap that is at risk for complete detachment from the adjacent cartilage, causing full-thickness defects and intra-articular loose bodies.[1-4] We present the clinical and radiological features of a case of large-sized, discrete chondral delamination in the lateral femoral condyle after trauma.

CASE

An 11-year-old girl was referred to our department with complaints of knee pain and limitation of movement following trauma caused by inward rotation of her right knee. On physical examination, he had limited knee movements and severe pain. Plain x-ray examination was performed. No fracture was observed on the plain x-ray, and the patella appeared to be lateral subluxated (**Figure 1**).

Figure 1. Knee x-rays, subluxation of the patella

Knee magnetic resonance imaging (MRI) was planned. In knee MRI; Bone marrow edema compatible with contusion was observed in a focal area distal to the lateral condyle of the femur and a 2.5 cm loss of integrity in the cartilage at this level (**Figure 2**). The amount of intra-articular fluid in the knee increased and there was a free cartilage fragment within the joint (**Figure 3**). In the lateral subluxation of the patella, subchondral local bone marrow edema was observed in the medial part of the patella, thickening and increased signal in the medial retinaculum adjacent to this area, and occasional loss of integrity in some fibers was noted (**Figure 3**).

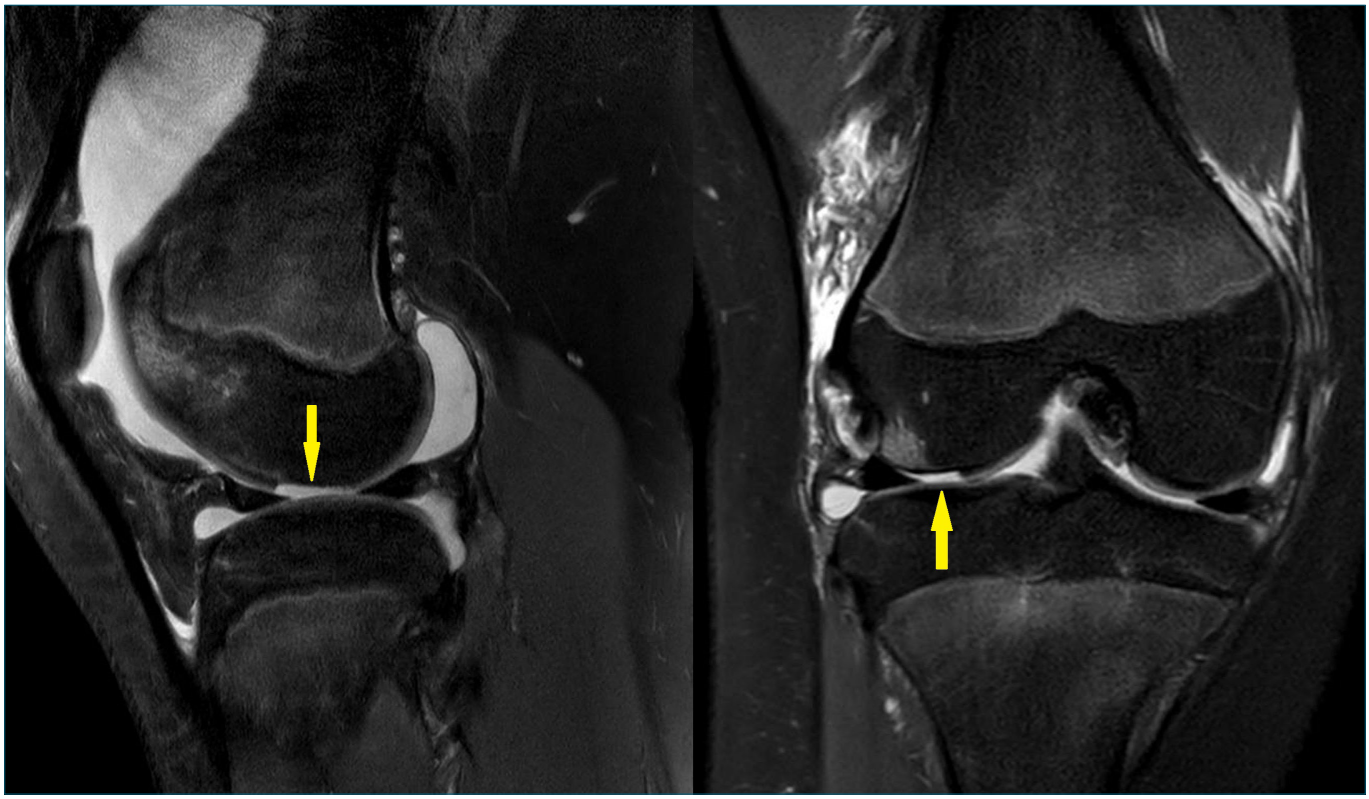

Figure 2. T2-weighted sagittal and coronal images; femoral lateral condyle bone marrow edema and loss of integrity in cartilage at this level (yellow arrows)

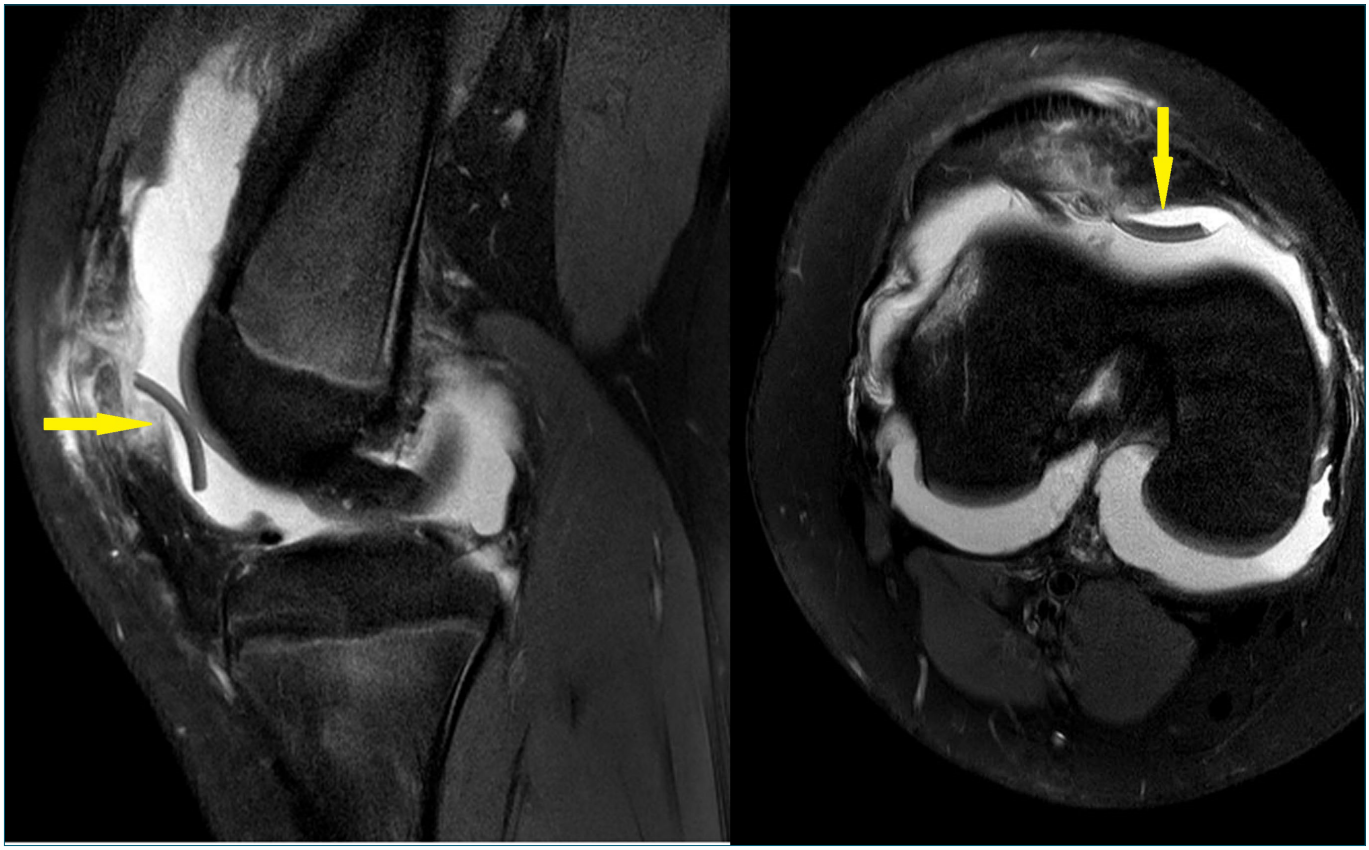

Figure 3. T2-weighted sagittal and axial images; femoral lateral condyle bone marrow edema and loss of integrity in cartilage at this level (yellow arrows)

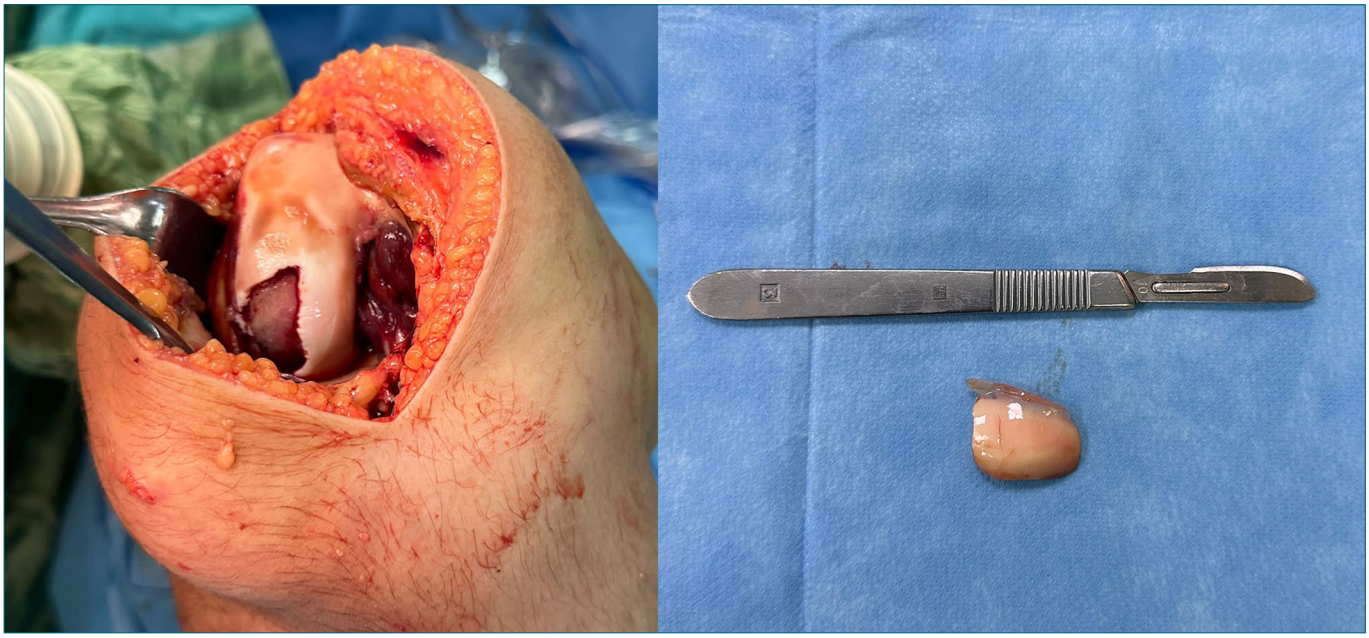

Figure 4. Operation images, 2.5 cm chondral fracture

Cruciate ligaments and menisci were observed naturally. The patient was taken into operation with the diagnosis of chondral delamination. During the operation, it was determined that there was a 2.5 cm chondral fracture and it was repaired (**Figure 4**).

DISCUSSION

Chondral injuries in the knee have been reported mostly in association with meniscus tears and ligament injuries.[1,5,6] Diagnosis is based primarily on clinical suspicion, such as the presence of discomfort associated with effusion and swelling during or after physical activity. Sometimes accurate diagnosis can be difficult as it may resemble other pathologies such as meniscus lesions.[5,6] Plain x-rays are usually normal. An MRI study is essential in the evaluation and is mandatory to confirm the diagnosis and assist in preoperative planning. This case was related to patellar subluxation. Additionally, there was patellar subluxation in this case.[1,2,4,5,7]

CONCLUSION

Identifying and appropriately treating these injuries results in a better prognosis for patients with chondral delamination.

ETHICAL DECLARATIONS

Informed Consent

All patients signed and free and informed consent form.

Referee Evaluation Process

Externally peer-reviewed.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

Financial Disclosure

The authors declared that this study has received no financial support.

Author Contributions

All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

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