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Case Report

A GIANT CELL TUMOR OF RIB: A RARE PRESENTATION IN LOCATION AND SHAPE WITH LITERATURE REVIEW

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ABSTRACT

Giant cell tumors (GCT), which are also known as "osteoclastomas" of the bone, are generally benign tumors of the bone, although they can be in the vicinity of insidious characteristics. Patients with GCT are naturally between 20 and 40 years of age and present with ache and bulge of the joints. There is a possibility that the tumor may be benign, malignant degeneration, metastasis, or other complications. Here, we present a case of a 36-year-old male who presented with slight pain at the right superior-posterior chest wall for 3 months. On physical examination, there was nothing signat right superior-posterior chest wall. Hematological and biochemical test results were in normal limits. Chest X-ray showed a large spherical shaped radiopaque opacity at the right superior-posterior chest wall. Computed tomography (CT) of the chest revealed an expansile soft tissue mass arising from the right fourth posterior rib extending into the thoracic cavity with a sclerotic margin and fluid level suggestive of GCT of the fourth posterior rib. Ninety percent of the tumor was resected, excluding the continuous part of the fourth rib. The histopathological examination of the resected tumor revealed sheets of osteoclast-like giant cells embedded between mononuclear cells. This tumor's exceptional position in the superior posterior aspect of the fourth rib, as well as its growth to an almost round shape, has rarely been reported.

Keywords: Osteoclastomas, Giant cell tumors, Ribs, Bone tumors and Computed tomography

INTRODUCTION

Giant cell tumors (GCT) of the bone are normally benign but locally highly invasive tumors that usually affect the epiphysis of long bones [1]. GCT of the bone accounts for approximately less than 5% of all primary bone tumors, and occurrence in the ribs is extremely rare[2]. Generally, GCT consists of mononuclear cells, neoplastic stromal cells, and reactive multinucleated giant cells [3]. Giant cell tumors (GCT) of ribs are extremely rare and are seen in approximately 0.07% of all cases of GCT [1]. In this case report, we present the case of a GCT arising from the right fourth posterior rib extending into the thoracic cavity with a sclerotic margin and fluid level that was not treated at the time of diagnosis. Excisional biopsy was performed, and 90% of the tumor was resected, excluding part of the fourth rib.

Case presentation:

Here, a 36-year-old male presented with mild chest pain at the right superior-posterior chest wall for 3 months. The patient visited local primary health care centers to have a check-up. At the primary health care center, he advised having one chest X-ray. Chest X-ray showed a large almost round radiopaque opacity at the right superior-posterior chest wall suggestive of a soft tissue mediastinal mass. After that, the patient was referred to the cancer hospital for further evaluation. At the Cancer Hospital, the patient underwent a computed tomography (CT) scan of the chest, magnetic resonance imaging (MRI) of the chest, and 99 m-Tc-MDP whole-body bone scan and required laboratory test examination. On physical examination, there was nothing sign at the right superior-posterior outer chest wall. Hematological and biochemical test results were in normal limits. A CT scan of the chest revealed an expansile soft tissue mass measuring 7.8 X 7.8 X 7.9 cm arising from the right fourth posterior rib extending into the thoracic cavity with a sclerotic margin and fluid level suggestive of GCT of the fourth posterior rib (Figure 1).

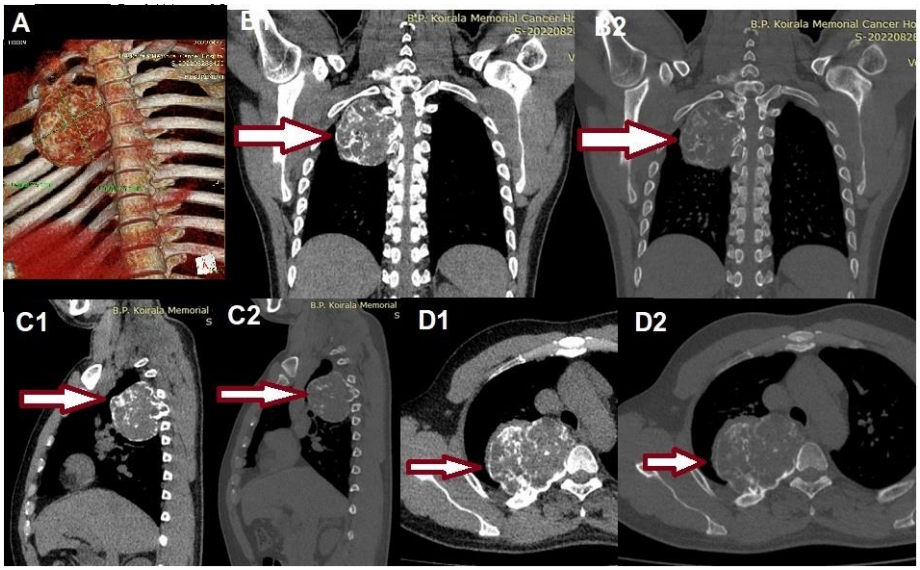

Figure 1: Computed tomography scan of chest (Fig 1-A) 3D image (Fig 1-B) Coronal section with soft tissue (B_1) and bone window (B_2), (Fig 1-C) Sagittal section with soft tissue (C_1) and bone window (C_2), and (Fig 1-

D) Transverse section with soft tissue (D_1) and bone window (D_2), showed expansile soft tissue mass measuring 7.8 X 7.8 X 7.9 cm arising from the right fourth posterior rib extending into the thoracic cavity with a sclerotic margin and fluid level suggestive of GCT of the fourth posterior rib

In magnetic resonance imaging (MRI) of the chest, T1-weighted with short TE and TR times, T2-weighted with longer TE and TR times, short-TI inversion recovery (STIR), diffusion-weighted imaging (DWI) and T1-weighted imaging with contrast media infusing gadolinium (Gad) MRI sequencing were performed at all planes, i.e., axial, coronal and sagittal (Fig 2). MRI shows an expansile chest wall mass measuring 7.8 X 7.8 X 7.9 cm arising from the fourth rib. It was isointense on T1-weighted transverse and sagittal images (Fig 2-A), heterogeneously hyperintense on T2-weighted transverse and sagittal images (Fig 2-B), heterogeneously hyperintense on short-TI inversion recovery (STIR) coronal, transverse and sagittal images (Fig 2-C) and somewhat heterogeneously hyperintense on T1-weighted imaging with contrast media infused with gadolinium (Gad) (Fig 2-D). In the ^{99m}Tc-MDP whole-body bone scan, both anteroposterior (AP) and posteroanterior (PA) whole-body scans with chest anteroposterior and posteroanterior chest spot views were taken (Fig 3). There was intense radioactivity uptake in the right posterior apical region of the lung extending into the thoracic cavity with a clear margin suggestive of a bone tumor of the fourth posterior rib D/D giant cell tumor.

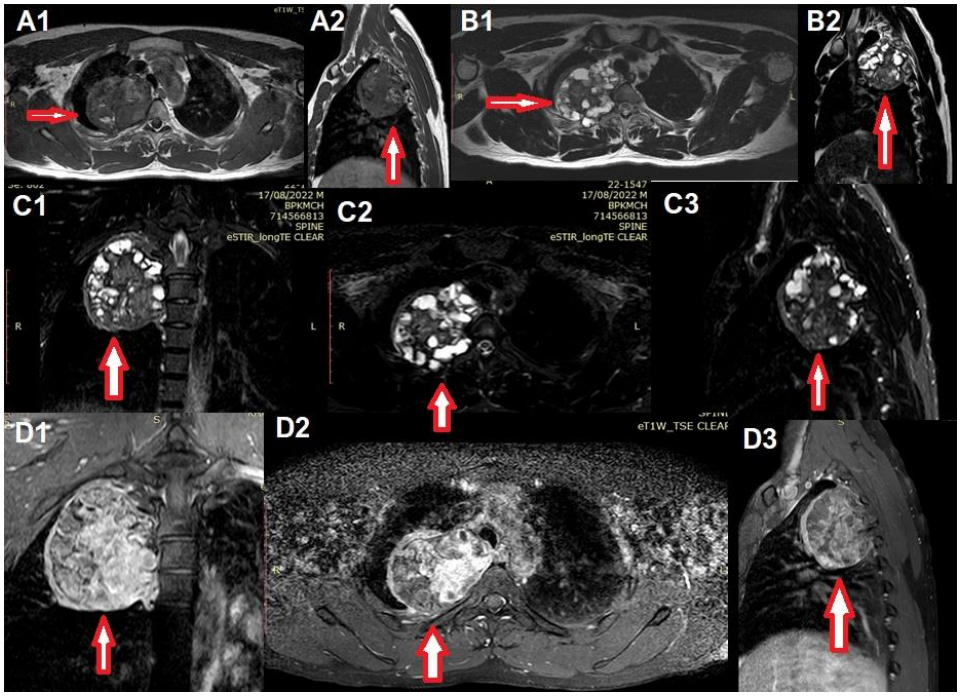

Figure 2: Magnetic resonance imaging (MRI) of chest (Fig 2-A) showed T1-weighted TSE transverse section (A_1) and sagittal section (A2), (Fig 2-B) showed T2-weighted images transverse section (B_1) and sagittal section (B_2), (Fig 2-C) showed Short-TI Inversion Recovery (STIR) images coronal section (C_1), transverse section (C_2) and sagittal section (C_3), and (Fig 2-D) T1-weighted imaging with contrast media infusing Gadolinium (Gad) images coronal section (D_1), transverse section (D_2) and sagittal section (D_3)

showed T1 weighted isointense soft tissue and T2 weighted, STIR and Gadolinium enhance heterogeneously hyperintense mass measuring 7.8 X 7.8 X 7.9 cm arising from the right fourth posterior rib extending into the thoracic cavity with a sclerotic margin and fluid level suggestive of GCT of the fourth posterior rib.

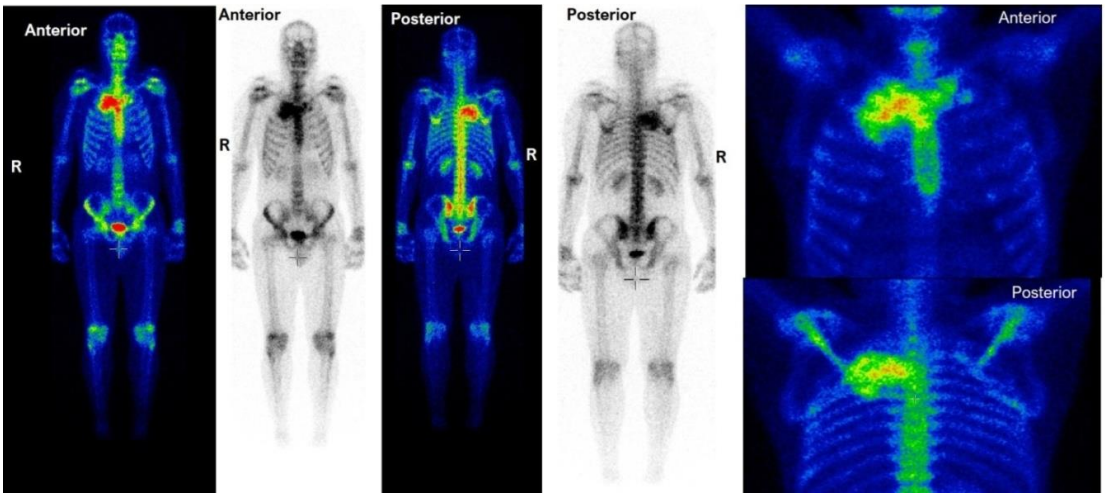

Figure 3: ^{99m}Tc-MDP whole-body bone scan, both anteroposterior (AP) and posteroanterior (PA) whole-body scans with chest anteroposterior and posteroanterior chest spot views were taken. There was intense radioactivity uptake in the right posterior apical region of the lung extending into the thoracic cavity with a clear margin suggestive of a bone tumor of the fourth posterior rib D/D giant cell tumor.

After that, excisional biopsy was performed, and 90% of the tumor was resected, excluding part of the fourth rib (Fig 4). Single hard tissue mass measuring 7.8 X 7.8 X 7.5 cm was resected and sent for histopathological examination (Fig 5). For the histopathology examination, multiple fragmented gray–white to brown, firm to hard tissues measured 7.9 X 8 X 1.5 and separate single hard tissue mass measuring 7.8 X 7.8 X 7.5 cm sample were received. C/S showed a solid gray–white, gritty mass with myxoid areas and multiple cystic spaces filled with gray–white to brown material (R/S/S). Histopathology of excisional biopsy sections revealed sheets of osteoclast-like giant cells embedded between mononuclear cells. The mononuclear cells had a moderate amount of pale cytoplasm, an ill-defined cell membrane, round nuclei showing fine chromatin and few mitoses. No significant cytological atypia was noted. Areas of cystic change with hemorrhage, hemosiderin-laden macrophages and fibrosis are seen. The report was concluded to be suggestive of a giant cell tumor (GCT).

Chest wall reconstruction was performed, and in a follow-up visit six months later, there was no evidence of recurrence. After one and a half years of surgery, the patient was asked to undergo a computed tomography (CT) scan of the chest, which revealed no recurrence of GCT until that time (Fig 6). There was slight pleural effusion at the right costophrenic (CP) angle that may be a chest infection. Antibiotic treatment was given for the recommended duration. Otherwise, all biochemical examinations were normal.

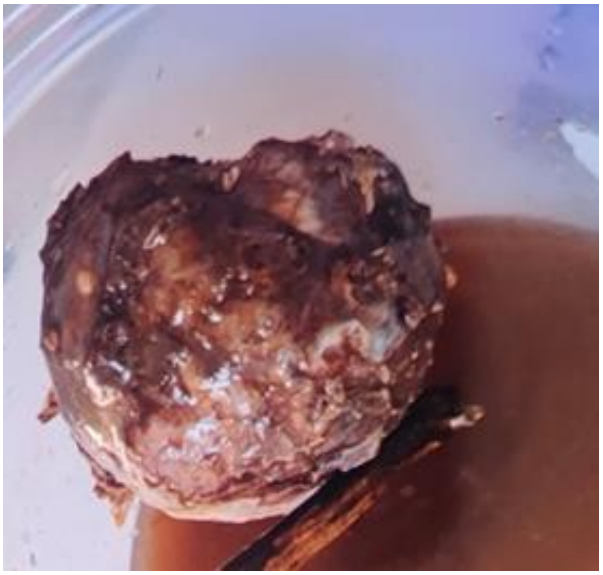

Figure 4: Resected tumor solid gray–white, gritty mass with myxoid areas and multiple cystic spaces filled with gray–white to brown material

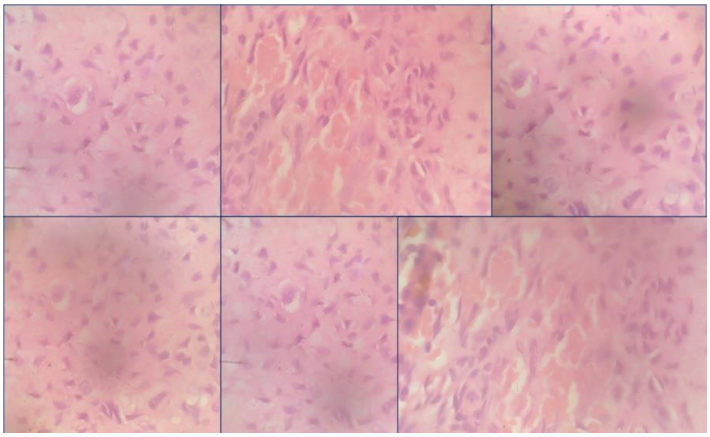

Figure 5: Tumors composed of diffusely dispersed osteoclast-like giant cells embedded between mononuclear cells

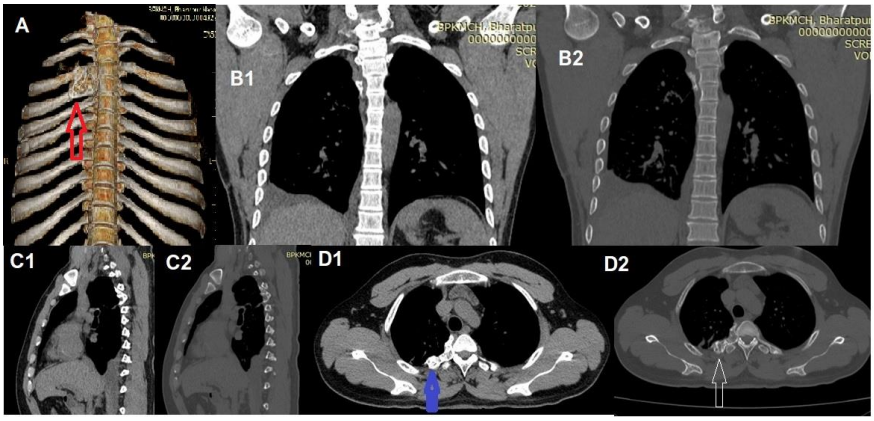

Figure 6: Computed tomography scan of chest (Fig 1-A) 3D image (Fig 1-B) Coronal section with soft tissue

(B_1) and bone window (B_2), (Fig 1-C) Sagittal section with soft tissue (C_1) and bone window (C_2), and (Fig 1-D) Transverse section with soft tissue (D_1) and bone window (D_2) revealed no recurrence of GCT until that time (Fig 5). There was slight pleural effusion at the right costophrenic (CP) angle that may be a chest infection.

DISCUSSION

Giant cell tumor (GCT) of bone is a rare condition that includes less than 5% of primary bone tumors in adults. According to one research article, the majority of GCTs occur in the distal femur or proximal tibia [3], with a rare location in the ribs occurring in less than 1% of cases [1]. Of those that do begin from the ribs, the posterior aspect is a relatively rare location. We performed a literature review of recent five-year case studies from 2018 to the present in PubMed, Google, Research Gate, Scopus, Publons and Orcid. We found 12 case study articles during the last 5 years, which are summarized in Table 1. Among all 12 case studies, 10 presented GCT from the anterior rib, one presented GCT from the posterolateral rib, and only one presented GCT from the posterior rib. Therefore, our review concluded that GCT arising from the posterior rib is extremely rare. In our case study, we presented an almost round-shaped GCT arising from the posterior rib.

Author/Year	Age/Sex	Size	Location	Treatment
Chen et al 2022 [5]	22/F	5 cm Diameter	Right Anterior 6th rib	Surgery
Özyüksel et al 2022 [6]	12/F	7 X 10 X 10 cm	Left Anterior 7th rib	Surgery
Shastri M et al 2022 [7]	9/F	NA	Anterior rib	Surgery
Matsunobu et al 2021 [8]	27/F	5.2×4.8×4.5 cm	Left Anterior 1st rib	Denosumab and Surgery
Jain et al 2021 [9]	28/F	Huge Mass	Left Anterior 3rd rib	NA
Cabañas et al 2021 [10]	40 /F	15 X 16 X 13 cm	Right Anteriorrib	Surgery
Pradana et al 2021 [11]	7/F	3 cm Diameter	Right Posterolateral 9thrib	Surgery
Ellen Y et al 2021 [12]	41/F	16 × 12 x 12 cm	Right Anterior 5thrib	Surgery
Kabir et al 2021 [13]	31/F	5 cm Diameter	LeftPosterior 1strib	Surgery
Takata et al 2018 [14]	33/M	8 cm in Diameter	Right Anterior 7thrib	Surgery
Blanco et al 2018 [15]	28/M	11 × 4 × 13 cm	LeftPosterior 8thrib	Surgery and Chemotherapy
Alexandre S et al 2018 [16]	33/F	5.4 cm	LeftAnterior 8thrib	Denosumab and Surgery

Table 1: Literature Review of Giant Cell Tumor of ribs since 2018 to 2023 (Recent Five Year)

In addition, GCT does not usually grow to very large sizes. A review of the literature by Sharma and Armstrong [4] of 13 cases revealed that only a few consisted of large tumors, such as the one in our report.

General symptoms include pain, swelling, and limited range of motion when the tumor occupies joint spaces [17]. GCT in the ribs most often presents with symptoms such as feelings of pain or heaviness in the chest that can radiate, shortness of breath (SOB) or no symptoms that affect activities of daily life. Our patient's presentation of mild pain may be common in other reported cases.

In our case study, the patient was previously misdiagnosed with metastatic tumors at a rural primary health center. The confirmed diagnosis of GCT in bone can be made based on history and physical, radiological and histological findings.

A majority of efforts have been made to grade and classify GCT in bone based on radiological and histological features. The Jaffe histological classification system classified tumors as benign, aggressive, or malignant [18], but the system was found to be an unreliable prognostic factor. Campanacci et al. [19] used a radiological feature-based approach, with grades 1 through 3, based on tumor margins and cortical involvement as seen on radiological imaging. The Enneking grading system is comparable to Campanacci's and believes radiological as well as clinical findings [18]. Between the two, the Campanacci classification system is more extensively used, although, ultimately, either of the proposed classification systems have significant value in predicting prognosis or recurrence or in taking into account various risk factors to help guide intervention. The standard of care at our patient's hospital applies the Campanacci scale only to GCT in bone found in the long bones of the extremities, the most typical locations of GCT in bone. Additionally, our patient's tumor size and location necessitated wide resection, a decision unlikely to be changed based on tumor staging. GCT of bone is generally treated with curettage followed by bone cement filling [3]. Large bone GCT tumors can be resected using a wide resection technique [3], as in our case, or amputation if necessary [3]. Curettage has been linked to up to 40% rates of recurrence. Wide resection has been found to have little to no recurrence, although rates of postoperative complications are significantly higher than in curettage [20]. Adjuvants to curettage therapy have helped decrease recurrence rates, and modalities include cryosurgery, high-speed burring, phenol, and more [20]. Although surgery remains the mainstay of treatment, chemotherapy options are available as well. Bisphosphonates are one of the most favored agents due to their anti-osteoclastic action; in particular, nitrogen-containing bisphosphonates such as zoledronic acid are especially cytotoxic to osteoclasts [21]. Denosumab, a relatively newer anti-osteoclastic agent that acts via the RANK-L pathway, may also be a good option, especially as a neoadjuvant to surgical intervention or in unresectable tumors. It has been shown to reduce morbidity and improve outcomes in such settings [22].

As recurrence is not uncommon, clinicians should be diligent in monitoring for it. There are no official guidelines, although Boriani et al. [23] suggested monitoring regularly with CT or MRI in the first 5 years post-surgery - every 3 months for the first 2 years and then every 6 months for the following 3 years. We also followed up our case for one and a half years, and we did not find any significant evidence of recurrence.

CONCLUSION

We report a case of a bulky, almost round-shaped GCT arising from the right 4th posterior ribs. This case is unique in its location, shape, and lack of severe presentation. It shows a case where the tumor was thought to be a large posterior mediastinal mass; however, through CT scan, MRI, and ^{99m}Tc-whole body bone scan, it was diagnosed as a bone tumor extending into the thoracic cavity, likely GCT, and was confirmed histopathologically as well. Left to progress for a long span of time (seven years), it caused significant impairment to the patient's life. Earlier intervention for such tumors greatly reduces the burden of disease. The tumor was resected, the chest wall was reconstructed, and the patient has not shown recurrence thus far. Any lung mass should also be suspected to have a primary origin from bone.

Declarations:

Ethics approval and consent to participate: Consent from participate was already taken and Ethics approval is not applicable

Consent for publication: No patient nametag or any form of confidential personal information is compromised in this manuscript; a copy of the approval letter is available on demand by the editor.

Availability of data and material: Figures of this case report are available as part of the article and no additional image files are required.

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Study planning: YSK, YAK, SN

Case report: SN, YSK, SS, YAK

Follow up: MSK, GS

Interpretation: YAK, SS, MSK

Manuscript writing: AKY, SS, AGD.

Manuscript revision: YAK, YSK.

Final approval: YSK, YAK, SN, MSK.

Agreement to be accountable for all aspects of the work: YSK, YAK, SN, MSK, GS

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REFERENCES

1. V. Gupta, R. Mittal, Giant cell tumor of rib--rare location on the anterior aspect Arch. Orthop. Trauma Surg., 120 (3–4) (2000), pp. 231-232, DOI : 10.1007/s004020050053

2. Dehghan A, Moaddab AH, Eskandarlou M, Moeeni A. Anterior chest wall giant cell tumor. GenThoracCardiovascSurg 2010; 58: 39-41 [PMID: 20058142 DOI: 10.1007/s11748-009-0463-8
3. M. Balke, L. Schremper, C. Gebert, et al. Giant cell tumor of bone: treatment and outcome of 214 cases, J. Canc. Res. Clin. Oncol., 134 (9) (2008), pp. 969-978, DOI : 10.1007/s00432-008-0370-x
4. A. Sharma, A.E. Armstrong, Giant cell tumor of rib arising anteriorly as a large inframammary mass: a case report and review of the literature, Case Rep Med, 2012 (2012), p. 850509, 10.1155/2012/850509
5. Chen YS, Kao HW, Huang HY, Huang TW. Traumatic giant cell tumor of rib: A case report. World J Clin Cases 2022; 10(24): 8662-8666, doi: 10.12998/wjcc.v10.i24.8662
6. Özyüksel G, Ardıçlı B, Özcan HN, Gedikoğlu G, Varan A, Karnak İ. Giant cell tumor arising from the anterior arc of the rib: an extremely rare site in an adolescent girl. *Turk J Pediatr*. 2022;64(5):940-945. doi:10.24953/turkjped.2021.4588
7. Shastri M, Kaur J, Dey P. Cytodiagnosis of giantcelltumourpresentingatunusualage and site withreview of literature. Cytopathology. 2022 May;33(3):393-396. doi: 10.1111/cyt.13081. Epub 2021 Dec 7. PMID: 34821424.
8. Matsunobu T, Maekawa A, Nabeshima A, et al. Giant Cell Tumor of Bone of the First Rib Successfully Treated with Combined Preoperative Denosumab Therapy and Surgery via a Transmanubrial Approach. *Am J Case Rep*. 2021;22:e931796. Published 2021 Jun 1. doi:10.12659/AJCR.931796
9. Jain, R., S H, C., &Mridha, A. R. (2021). Giant cell tumor in queer location with lung metastasis!. *Journal of clinical orthopedics and trauma*, *21*, 101554. https://doi.org/10.1016/j.jcot.2021.101554
10. Cabañas, Rolando & Salas, Blanca &Fernández, Ares & Endo Milan, Jesús. (2022). Giant Cell Tumor originating in the anterior portion of a costal arch. Case report and literature review. 37. 163-166. 10.3306/AJHS.2022.37.01.163.
11. Pradana IPGP, Edward M. Giant Cell Tumor Of The Ribs: A Case Report. Joints. 2021 Apr. 29 [cited 2023 Feb. 12];10(1):32-8. Available from: https://e-journal.unair.ac.id/JOINTS/article/view/25151
12. Ellen Yang, Tianyang Li, Ariel Katz,A giant cell tumor of the bone in the rib cage left to proliferate unfettered for seven years to an extensive size, Respiratory Medicine Case Reports, Volume 33, 2021, 101419, ISSN 2213-0071,doi:10.1016/j.rmcr.2021.101419.
13. Kabir EM, Aghrib F, Belgadir H, Amriss O, Merzem A, Moussali N, El Benna N. Unusual Location of a Giant Cell Tumor. Eur J Case Rep Intern Med. 2021 Mar 1;8(3):002329. doi: 10.12890/2021_002329. PMID: 33869093; PMCID: PMC8046279
14. Takata, Masahiko & Miyamoto, Yoshifumi &Maniwa, Yoshimasa. (2018). Giant Cell Tumor of the Rib;Report of a Case. Kyobugeka. The Japanese journal of thoracic surgery. 71. 156-159.
15. Blanco, J.F., Jiménez, M., Rendón, D. et al. Giant-cell tumor of the rib cage extending to the spine. *Orthopäde* **47**, 437–441 (2018). https://doi.org/10.1007/s00132-018-3554-3
16. AlexandreSemionov, John Kosiuk, Giant cell tumor of a rib following denosumab treatment, Radiology Case Reports, Volume 13, Issue 5, 2018, Pages 1018-1020, ISSN 1930-

0433,https://doi.org/10.1016/j.radcr.2018.04.005.

17. W. Heo, D.K. Kang, H.K. Min, H.J. Jun, Y.H. Hwang, Giant cell tumor arising from anterior arc of the rib, Korean J ThoracCardiovascSurg, 46 (5) (2013), pp. 377-379, 10.5090/kjtcs.2013.46.5.377
18. A.F. Mavrogenis, V.G. Igoumenou, P.D. Megaloikonomos, G.N. Panagopoulos, P.J. Papagelopoulos, P.N. Soucacos, Giant cell tumor of bone revisited,SICOT J, 3 (2017), p. 54, 10.1051/sicotj/2017041
19. M. Campanacci, N. Baldini, S. Boriani, A. Sudanese, Giant-cell tumor of bone, J Bone Joint Surg Am, 69 (1) (1987), pp. 106-114
20. J. Ke, S. Cheng, M.Y. Yao, et al., ovel strategy of curettage and adjuvant microwave therapy for the treatment of giant cell tumor of bone in extremities: a preliminary study, Orthop. Surg., 13 (1) (2021), pp. 185-195, 10.1111/os.12865
21. A.F. Mavrogenis, V.G. Igoumenou, P.D. Megaloikonomos, G.N. Panagopoulos, P.J. Papagelopoulos, P.N. Soucacos, Giant cell tumor of bone revisited, SICOT J, 3 (2017), p. 54, 10.1051/sicotj/2017041
22. D.T. Miles, R.T. Voskuil, W. Dale, J.L. Mayerson, T.J. Scharschmidt, Integration of denosumab therapy in the management of giant cell tumors of bone, J. Orthop., 22 (2020), pp. 38-47, 10.1016/j.jor.2020.03.020
23. S. Boriani, S. Bandiera, R. Casadei, et al., Giant cell tumor of the mobile spine: a review of 49 cases, Spine (Phila Pa 1976, 37 (1) (2012), pp. E37-E45, 10.1097/BRS.0b013e3182233 ccd