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Recurrent Sacral Chordoma Treated by Radiotherapy: A Case Report

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Abstract **Case Report**

Chordoma is a rare and locally aggressive tumor that arises from the notochordal remnants that corresponds to 1 to 4 % of all malignant bone tumors in the axial skeleton, and has an incidence of 0.1/100000 per year. It consists of a silent and slow-growing mass that requires radical treatment due to its high potential for local and metastatic invasion. It is typically managed with surgery in combination with radiation therapy. The risk of recurrence is very high due to the infiltrating nature of the tumor. A favorable outcome depends on early diagnosis and surgical resection with tumor-free margins. It can arise along the ventromedial aspect of the sacrum, mobile spine, and clivus, with most cases occurring in the sacrum or skull base. We report a case of a 56-years male who complained of pain over his sacral region for the past three years and constipation with no neurological signs. Eighteen months after undergoing large surgery resection for his sacral chordoma with no adjuvant treatment. He was then diagnosed with recurrent sacral chordoma and planned for radiotherapy given the possible complications after surgery.

Keywords: Chordoma, metastatic invasion, radiation therapy.

INTRODUCTION

Chordoma is a rare malignant tumor of musculoskeletal system and it only accounts for 1-4% of primary bone tumors and 20% of spine tumours. It originates from the remnants of notochord [1, 2]. Furthermore, 50-60% of the tumors occur in the sacrococcygeal region, 25-35% at the skull base and 10-15% in the mobile spine [3]. It has male predominance (2:1), with the most common age group between 50 and 60 year-old. Metastases of sacral chordoma occur late in the disease or even many years after surgical resection. The literature reports secondaries found in lung, bone, liver, lymph nodes, softs tissus and skin.

Chordomas are slow growing tumors and are resistant to chemotherapy or radiation [4]. The first line of treatment is usually wide surgical resection.

Inadequate surgical resection due to anatomical limitations and wound infiltration by seeding tumor cells from pseudo-capsule results in recurrence generally after four years [5-7].

Chordomas are divided into three histological subtypes including conventional, dedifferentiated, and poorly differentiated [8].

The role of radiation therapy is controversial and there are no level 1 data to guide decision making. As such, the optimal radiation technique and sequencing remain unclear and may consist of proton, photon, or heavy ion therapy using either conventional fractionation or hypofractionated stereotactic radiosurgery [9].

CASE PRESENTATION

We present a case of a 55-year-old man who presented with a recurrent sacral chordoma treated with radiotherapy. He initially had a chronic sacro-coccygeal pain for two years prior to the diagnosis, with recent onset of constipation, without deterioration of general condition. He underwent an MRI that demonstrated lobulated mass arising from the sacrum, which extends posteriorly to the left gluteus maximus muscle, and extends anteriorly to the endopelvic region coming into contact with the lower rectum with loss of the fatty separation line in places. On T1-weighted images, the signal in the mass was predominantly isointense relative to that in muscle, with scattered areas of hyperintensity, On T2-weighted images, the mass had heterogeneous

high signal intensity. On the diffusion sequence, the mass was in hypersignal without significant restriction of the ADC, with moderate, heterogeneous and late enhancement after injection of Gadolinium (figure 1). The patient underwent gross total resection of the mass with partial sacrectomy. Pathology confirmed the diagnosis (Fig. 2). Post-operative MRI showed no tumor residue. Post-operative radiotherapy was not indicated given the delayed scarring of the surgical wound.

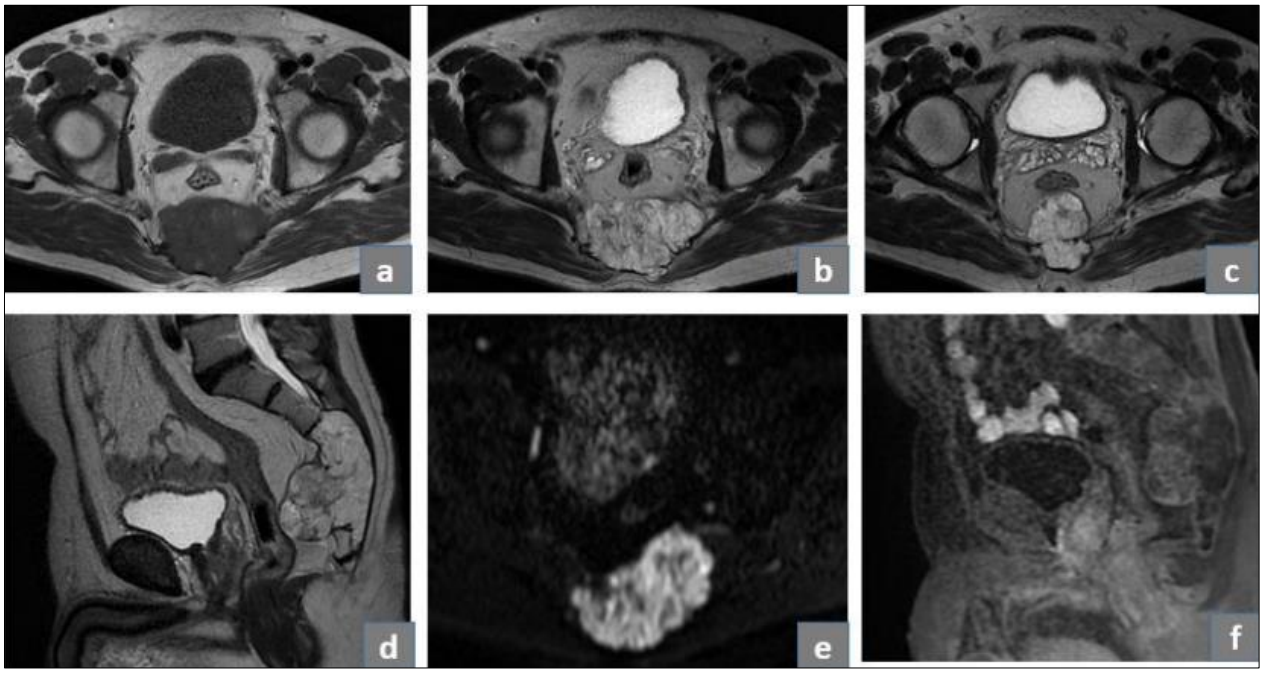


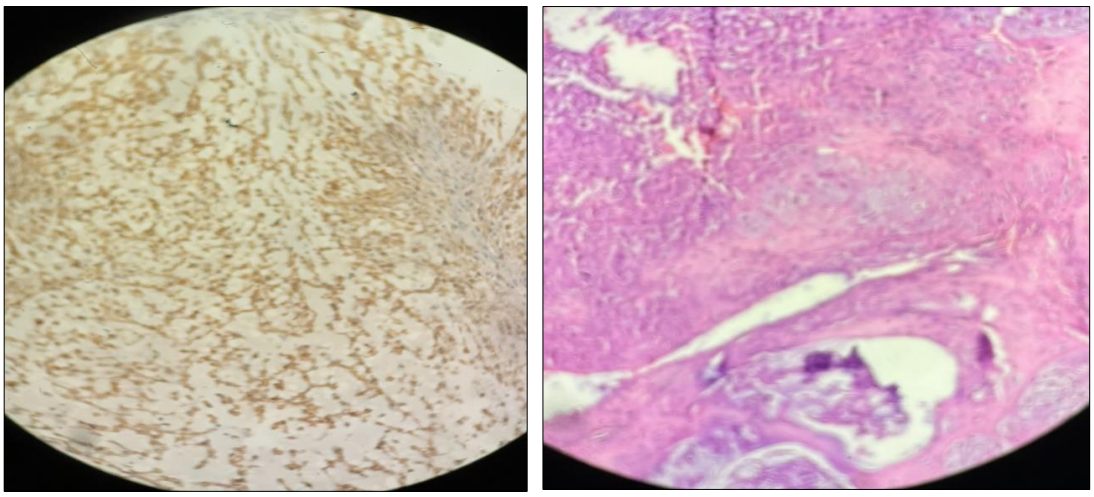
Figure 1: MRI demonstrated lobulated mass arising from the sacrum, which is isointense relative to that in muscle on T1 with scattered areas of hyperintensity (a), On T2-weighted images, the mass had heterogeneous high signal intensity (b,c,d); on the diffusion sequence the mass had high signal (e), with moderate, heterogeneous and late enhancement after injection of Gadolinium (f).

Twenty months later, a pelvic MRI was requested following the reappearance of sacral pain, it was in favour of the appearance opposite the last three sacral vertebrae and the coccyx of a polylobed mass, close to the sacrum, extending transversely.

It was hypersignal on T2, hyposignal on T1, enhanced after injection of contrast medium. It measured 95 x 44 in transversal diameters and 50 mm in height.

Surgical revision was not possible due to delayed scarring and superinfection of the surgical site. The patient received external radiotherapy at a dose of 70 Gy and 35 fractions of 2 Gy by IMRT.

A control MRI performed 3 months after the end of radiotherapy showed a stable tumor process.



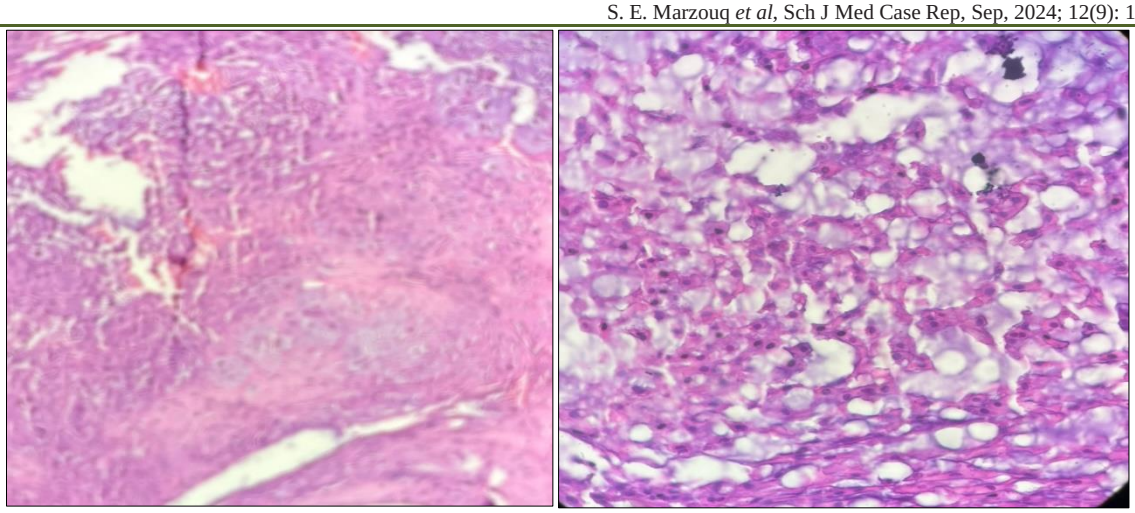


Figure 2: Microscopic analysis reveals conjunctivo-adipose tissue occupied by a tumoral proliferation of lobules and plages composed of fairly large cells, sometimes with round, often regular nuclei with a small nucleolus. Cell cytoplasm is abundant, sometimes eosinophilic, sometimes clarified. These lobules tend to cystize with the presence of a basophilic Alcian Blue and PAS-positive substance. This proliferation dissociates oedematous conjunctive tissue in the center and fibrous conjunctive tissue in the periphery, and dissociates bone tissue without neoplastic vascular emboli. AE1/AE3 and EMA are positive.

DISCUSSION

Chordomas are slow-growing, low-to-intermediate-grade tumors that are often diagnosed at an advanced stage with significant bone destruction and soft tissue invasion [10, 11].

The origin of the chordoma is not clear, it is proposed that it comes from cells of the notochord leaving some vestiges in the bones of the spine, the base of the skull and the nucleus pulposus of the intervertebral discs [12, 13]. The first description of chordoma clinically was made in 1857 by Virchow, who histologically describes a lesion with unique intracellular "bubble-like" vacuoles, later in 1985, Ribbert associated the lesion with notochord cells in 0.4 to 2% of the autopsies performed finding the tumor as a mass of less than 1 centimeter located behind the clivus [13, 14]. The types of chordoma according to their histology are: conventional or classic which is the most common, poorly differentiated that is an aggressive and fast-growing type related to the loss of the INI-1 gene in pediatric patients and young adults, dedifferentiated or sarcomatous and chondroid (presence of the brachyury gene, which is expressed in almost all conventional chordomas and makes the difference with chondrosarcoma) [15].

A frequent referral presenting to the neurosurgeon is lower back pain and quite commonly these patients are in the 5th and 6th decade. The vague symptoms produced by sacral chordoma thus poses a challenge for early diagnosis. Pain and radiculopathy due to compression of the sciatic nerve or iliolumbar trunk were reported in up to one third of these patients. A few cases with tumor presenting in the S1- S2 region had weakness or total loss of L5-S1 function unilaterally. Up to one third of patients presented with symptoms of urinary tract infections and 10 % had constipation or cauda equina symptoms. Many of these patients had been treated for years for the above symptoms with NSAIDs, antibiotics, laxatives as well as steroid injections by general practitioners before the pathology necessitated further investigations [16].

CT can be very useful for defining the extent of bone involvement, It shows bone destruction with an associated lobulated midline soft-tissue mass. MRI is considered superior to other imaging modalities, the most striking feature of a chordoma is the high signal intensity seen on T2-weighted images. High T2 signal intensity is a non specific feature, however, the combination of high T2 signal intensity and a lobulated sacral mass that contains areas of hemorrhage and calcification is strongly suggestive of a chordoma. Chordomas tend to show hypointense or isointense signal relative to that in muscle on T1-weighted images, and contrast-enhanced images show a modest heterogeneous enhancement in the soft-tissue components of the tumor [17].

The treatment of chordoma corresponds to an interdisciplinary approach, surgery is the mainstay of treatment while other options include radiotherapy and medical therapy. Surgery can be done via the anterior and/or posterior approach, however an adequate surgical margin can be achieved in only about 50% of cases of sacral chordoma due to the anatomical constraints and technical limitations [1-19]. En-bloc resection with sacrectomy provides good long-term tumor control but at the expense of substantial perioperative morbidity including impairment of bowel, bladder and motor functions [18].

Radiotherapy can be used either as adjuvant therapy after surgery, or exclusively in cases of local recurrence, or even when surgery is not possible [20]. In view of the high relapse rates obtained after exclusive surgery, adjuvant photon irradiation was initially proposed, but progression-free survival was always less than 40%. The proximity of organs at risk to the tumor and the ballistic properties of photons often prevented the delivery of doses in excess of 60 Gy to the tumor, which had a direct impact on local control [21]. Chordomas vary in radiosensitivity, but in most cases they are radioresistant tumors [22]. This raises the question of whether adjuvant radiotherapy is indicated, after R1 and R2 surgery, at a dose of 50 to 60 Gy over 5 to 6 weeks. Radiotherapy is sometimes indicated exclusively and palliatively, in the case of very large tumors that cannot be operated on. An initial series of external irradiation for decompressive and analgesic purposes is delivered up to a dose of 50 Gy over 5 weeks. In the event of a good objective tumor response on a follow-up CT scan, a further 20 GY of external irradiation can be administered over 2 weeks. Exclusive external irradiation only exceptionally leads to complete tumor destruction, but it often provides good comfort and above all a good analgesic effect.

Given the possibility of metastasis, chemotherapy combinations have unfortunately been tried without success [23]. Thanks to the ballistic characteristics of protons, proton therapy increases the dose to the tumor and spares nearby critical organs as much as possible [21]. This physical feature is fundamental in explaining the dose gradient that can be obtained close to a critical organ. The dose varies from 10 to 15% per millimeter of tissue crossed [24]. It was then shown that local control was improved and the risk of toxicity was acceptable in a large number of series. This is why, for several years now, proton irradiation has become the reference irradiation technique for the treatment of skull base chordomas after surgery [24]. The use of carbon ions represent an interesting modality. Indeed, they have the physical advantages of protons (Bragg peak) and a relatively superior biological efficacy, which is interesting for radio-resistant tumors. Promising results have been obtained in Japan and Germany in terms of both efficacy and toxicity [22-25].

Experience with chemotherapy has been disappointing in most cases, but it does seem useful to use it in secondary localizations of the disease [21]. In practice, the chemoresistance of these tumours is well recognized, although positive and isolated results have been reported with anthracyclines, alkylating agents, cisplatin and thalidomide [21-26]. Imatinib alone or in combination with sirolimus has also shown some efficacy in terms of local control in PDGF-expressing chordomas [27, 28]. The prognosis of sacral chordomas depends above all on the quality of surgical resection. Apart from complications related to the surgical procedure itself, secondary complications may arise, such as local recurrence, which is a pejorative event significantly reducing overall patient survival [21]. The value of radiotherapy remains debated, as the majority of case series have shown no major effect on survival [23].

To date, radiotherapy is suitable for local tumor control, but the actual ability of adjuvant radiotherapy to improve recurrence-free and overall survival remains unknown. In Erikson's series, mean survival was 6.6 years for the radiosurgery group, compared with 5.7 years for surgery alone and 5.4 years for radiotherapy alone [29].

In our case, the patient didn’t respond well to radiotherapy. Multiple factors would suggest a negative prognosis, such as a high sacral location, large tumor size, and delayed scarring. Several studies support that high sacral location (above S2) is a statistically significant negative prognostic factor. Additionally, chordomas of 10 cm or larger are associated with higher local recurrence and complication rates. Therefore, the length of survival in the present patient cannot be attributed to favorable prognostication [30].

CONCLUSION

Chordoma is the most common primary malignant tumor of the sacrum, MRI is the gold standard in imaging, it shows a destructive sacral mass with lobular growth, high water content (high T2 signal intensity), and foci of hemorrhage and calcification. At present, en bloc resection with possible radiation therapy remains the only effective treatment option, and there is significant morbidity associated with the tumor. There is optimism regarding development of standardized therapies, however, that will require more funding and internal collaborations that are carried out on a larger scale.

REFERENCE

1. Pillai, S., & Govender, S. (2018). Sacral chordoma: a review of literature. *Journal of orthopaedics*, *15*(2), 679-684.
2. Meng, T., Jin, J., Jiang, C., Huang, R., Yin, H., Song, D., & Cheng, L. (2019). Molecular targeted therapy in the treatment of chordoma: a systematic review. *Frontiers in oncology*, *9*, 30.
3. Chugh, R., Tawbi, H., Lucas, D. R., Biermann, J. S., Schuetze, S. M., & Baker, L. H. (2007). Chordoma: the nonsarcoma primary bone tumor. *The oncologist*, *12*(11), 1344-1350.
4. Park, L., DeLaney, T. F., Liebsch, N. J., Hornicek, F. J., Goldberg, S., Mankin, H., ... & Suit, H. D. (2006). Sacral chordomas: impact of high-dose proton/photon-beam radiation therapy combined with or without surgery for primary versus recurrent tumor. *International Journal of Radiation Oncology* Biology* Physics*, *65*(5), 1514-1521.

5. Pillai, S., & Govender, S. (2018). Sacral chordoma: a review of literature. *Journal of orthopaedics*, *15*(2), 679-684.
6. Walcott, B. P., Nahed, B. V., Mohyeldin, A., Coumans, J. V., Kahle, K. T., & Ferreira, M. J. (2012). Chordoma: current concepts, management, and future directions. *The lancet oncology*, *13*(2), e69-e76.
7. van Wulfften Palthe, O. D., Tromp, I., Ferreira, A., Fiore, A., Bramer, J. A., van Dijk, N. C., ... & Hornicek, F. J. (2019). Sacral chordoma: a clinical review of 101 cases with 30-year experience in a single institution. *The Spine Journal*, *19*(5), 869-879.
8. Chugh, R., Tawbi, H., Lucas, D. R., Biermann, J. S., Schuetze, S. M., & Baker, L. H. (2007). Chordoma: the nonsarcoma primary bone tumor. *The oncologist*, *12*(11), 1344-1350.
9. Redmond, K. J., Schaub, S. K., Lo, S. F. L., Khan, M., Lubelski, D., Bilsky, M., ... & Lo, S. S. (2023). Radiotherapy for mobile spine and sacral chordoma: a critical review and practical guide from the spine tumor academy. *Cancers*, *15*(8), 2359.
10. Walcott, B. P., Nahed, B. V., Mohyeldin, A., Coumans, J. V., Kahle, K. T., & Ferreira, M. J. (2012). Chordoma: current concepts, management, and future directions. *The lancet oncology*, *13*(2), e69-e76.
11. Sciubba, D. M., Chi, J. H., Rhines, L. D., & Gokaslan, Z. L. (2008). Chordoma of the spinal column. *Neurosurgery Clinics of North America*, *19*(1), 5-15.
12. Understanding Chordoma-Chordoma Foundation. (5th edn) (2018).
13. George, B., Bresson, D., Herman, P., & Froelich, S. (2015). Chordomas: a review. *Neurosurgery Clinics*, *26*(3), 437-452.
14. Walcott, B. P., Nahed, B. V., Mohyeldin, A., Coumans, J. V., Kahle, K. T., & Ferreira, M. J. (2012). Chordoma: current concepts, management, and future directions. *The lancet oncology*, *13*(2), e69-e76.
15. Solángel, R. M., & Carlos, S., & Montero, S. (2021). *Sacral Chordoma*: A Case Report.
16. Pillai, S., & Govender, S. (2018). Sacral chordoma: a review of literature. *Journal of orthopaedics*, *15*(2), 679-684.
17. Ouassil, S., Benzalim, M., & ALJ, S. (2022). Sacral Chordoma: Report of Two Cases and Review of the Literature. *Sch J Med Case Rep*, *4*, 405-408.
18. Stacchiotti, S., & Sommer, J. (2015). Building a global consensus approach to chordoma: a position paper from the medical and patient community. *The Lancet Oncology*, *16*(2), e71-e83.
19. Casali, P. G., Stacchiotti, S., Sangalli, C., Olmi, P., & Gronchi, A. (2007). Chordoma. *Current opinion in oncology*, *19*(4), 367-370.
20. Clarke, M. J., Dasenbrock, H., Bydon, A., Sciubba, D. M., McGirt, M. J., Hsieh, P. C., ... & Wolinsky, J. P. (2012). Posterior-only approach for en bloc sacrectomy: clinical outcomes in 36 consecutive patients. *Neurosurgery*, *71*(2), 357-364.
21. Georgea, B., Bresson, B., Bouazza, S., Froelich, S., Mandonnet, E., & Hamdi, S. (2014). Les chordomes. Neurochirurgie, 60(3), 63-140.
22. Preda, L., Stoppa, D., Fiore, M. R., Fontana, G., Camisa, S., Sacchi, R., ... & Orecchia, R. (2018). MRI evaluation of sacral chordoma treated with carbon ion radiotherapy alone. *Radiotherapy and Oncology*, *128*(2), 203-208.
23. Catton, C., O'Sullivan, B., Bell, R., Laperriere, N., Cummings, B., Fornasier, V., & Wunder, J. (1996). Chordoma: long-term follow-up after radical photon irradiation. *Radiotherapy and Oncology*, *41*(1), 67-72.
24. Brada, M., Pijls-Johannesma, M., & De Ruysscher, D. (2007). Proton therapy in clinical practice: current clinical evidence. *Journal of clinical oncology*, *25*(8), 965-970.
25. Schulz-Ertner, D., Karger, C. P., Feuerhake, A., Nikoghosyan, A., Combs, S. E., Jäkel, O., ... & Debus, J. (2007). Effectiveness of carbon ion radiotherapy in the treatment of skull-base chordomas. *International Journal of Radiation Oncology* Biology* Physics*, *68*(2), 449-457.
26. Scimeca, P. G., James-Herry, A. G., Black, K. S., Kahn, E., & Weinblatt, M. E. (1996). Chemotherapeutic treatment of malignant chordoma in children. *Journal of pediatric hematology/oncology*, *18*(2), 237-240.
27. Stacchiotti, S., Longhi, A., Ferraresi, V., Grignani, G., Comandone, A., Stupp, R., ... & Casali, P. G. (2012). Phase II study of imatinib in advanced chordoma. *Journal of Clinical Oncology*, *30*(9), 914-920.
28. Stacchiotti, S., Marrari, A., Tamborini, E., Palassini, E., Virdis, E., Messina, A., ... & Casali, P. G. (2009). Response to imatinib plus sirolimus in advanced chordoma. *Annals of Oncology*, *20*(11), 1886-1894.
29. Moukhlissi, M., Sghier, A. B., Bensaid, M., & Mezouar, L. (2021). Le chordome sacrococcygien: à propos d'un cas. *The Pan African Medical Journal*, *40*.
30. Kennamer, B. T., Gridley, D. G., Rhines, L. D., Nair, G. R., Lettieri, S. C., Davis, K. M., & Feiz-Erfan, I. (2020). Natural history of a patient with sacral chordoma: case report and literature review. *World Neurosurgery*, *139*, 132-135.