



Intracranial chondromas: A retrospective cross sectional analysis of this rare tumor in tertiary hospital, Coimbatore

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Abstract

Background: Chondromas are benign tumors that may be found in any part of the body. Tumors of cartilaginous origin presenting as an intracranial neoplasm, are very rare, [0.2-0.3%]. There are many hypotheses regarding its origin in the intracranial location. Diagnosing this tumor is mandatory as treatment and follow up depends upon the exact diagnosis. A retrospective cross sectional study

Aim: To diagnose intracranial chondroma and to calculate the incidence, mean age, sex predilection and site predilection of this rare tumor in our hospital set up.

Method: All central nervous tumor cases that were diagnosed during May 2011- May 2014 in our hospital was evaluated. From that, cases diagnosed as Intracranial chondromas was reevaluated. The incidence of this tumor among the central nervous system tumors was calculated. From this, the rarity of this tumor in our setup is established. Along with that the differential diagnosis and treatment options were also studied.

Results: Of all the two hundred eighty Central nervous system tumors reported during our study period, only two cases of intracranial chondroma was reported in our hospital. The incidence of Central nervous tumor in our hospital was 2.4% per year. The calculated incidence of Intra cranial Chondroma was 0.2% during our study period. This correlated with the study of Chorobski et al. The mean age was calculated as 41 years. There was an equal gender distribution and site from which the tumor arose was also analyzed.

Conclusion: In this cross sectional study, the diagnostic approach and the methods to rule out each differentials are analyzed. The incidence of intracranial chondromas among the central nervous system tumor was calculated and the rarity established. Equal gender distribution, mean age of occurrence of this tumor and the site predilection correlated with other studies.

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Introduction

Chondromas are benign tumors that may be found in any part of the body. Tumors of cartilaginous origin presenting as an intracranial neoplasm, are very rare [0.2-0.3%], [1]. Intracranial chondromas mostly involve the base of the skull with a predilection for the sphenothmoidal region. Less commonly it can occur in falx, choroid plexus, Leptomeninges, dura, within the ventricles and brain parenchyma, [2, 3, 4]. Intracranial chondroma that arises from duramater constitutes around 15% of all intracranial chondroma, [5]. This study was done to calculate the incidence of intracranial Chondroma in our hospital setup among the central nervous tumors and to establish the rarity of this disease in our setup.

Materials and Methods

During the three year period, May 2011 to May 2014, all the central nervous tumors reported in our hospital was evaluated.

Inclusion criteria: All the CNS tumors that were sent for histopathological evaluation to our department. The tissue that was accompanied by proper clinical history and radiological findings

Exclusion criteria: Specimens that do not have a proper clinical history or radiological findings.

Only two cases were diagnosed as intracranial chondroma among all the CNS tumor specimens that were received during the three year study period.

Case 1: A 25 year old male was admitted with a complaint of recurrent episodes of seizures and vomiting of three months duration. Family history, general and neurological examination were unremarkable. Routine laboratory investigations were within normal limits. An Electroencephalogram showed focal slow waves in the temporo-parietal areas. Skull roentgenogram showed hyperostosis in the left temporo-parietal region. CT and MRI imaging showed a large well defined lobulated, dural based extra axial mass lesion with mixed signal intensity, heterogeneous enhancement and dense calcification along left cerebral convexity causing mass effect over underlying brain and midline shift [Fig1&2].

The provisional diagnosis given by the radiologist was meningioma. The patient underwent craniotomy. The dural incision revealed a well-defined, firm to hard, whitish-gray tumor, measuring 8x6 cm. The tumor was found attached to the dura mater of the left temporo-parietal region. Calcification was noted on the surface of the tumor. There was no adhesion between the tumor and the brain. We received the specimen fixed in formalin and measuring 8x6x3cm in size. The tumor was pearl white in color, firm to hard in consistency and covered with a thin membranous structure and was submitted for histopathological examination [Fig3].



Fig 1: Show a CT image of the dura based tumor [Black arrow]

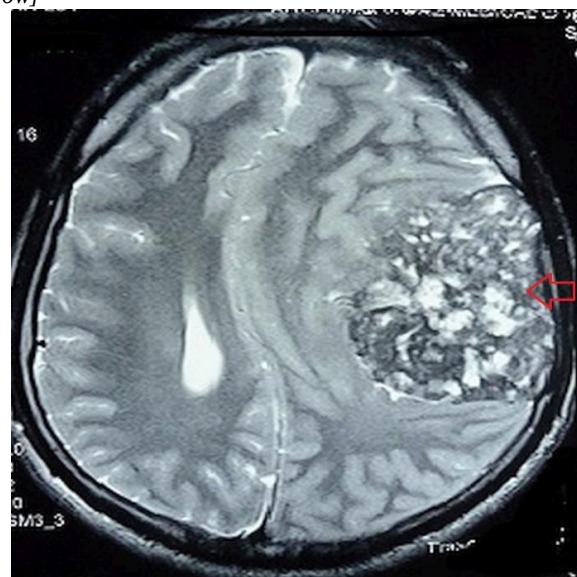


Fig 2: MRI image showing a dural based extra axial mass lesion with mixed signal intensity with heterogeneous enhancement [Red arrow]



Fig 3: Show a pearl white tumor [Red arrow] attached to the membrane [Black arrow]

Case 2: The second patient was 57 year old female patient, who presented with blurring of vision, headache and giddiness on and off for about a month duration. General examination, ENT and eye examinations were normal. CT and MRI skull, T2 axial image showed large lobulated, hyperintense extra axial mass lesion at the base of the skull involving the right middle cranial fossa extending to suprasellar and prepontine regions. The lesion was causing mass effect over the adjacent neuroparenchyma and encasing supraclinoid segment of right ICA and M1 segment of the right MCA and the diagnosis suggested by radiologist was extra axial lesion probably meningioma/schwannoma. Multiple pearl white, firm tumor bits in aggregate measuring 11x7x6cm, fixed in formalin were received [Fig4].



Fig4: Shows multiple pearl white cartilaginous bits

The diagnosis was established based on histopathological examination, which included processing, section cutting and staining with haematoxylin and eosin. Further confirmation was done by immunohistochemistry. Total number of CNS cases that were referred to our department was computed from the records. Total number cases reported as Intracranial Chondroma was enumerated. The incidence, age, sex ratio was calculated from that.

Result

In this cross sectional study first the diagnosis of Intracranial chondroma was established among the differentials. Histopathological examination of both the cases revealed a well-encapsulated cellular mass arranged in lobules composed of well-differentiated chondrocytes in the lacunae. There was no evidence of nuclear pleomorphism, increased mitotic activity or multinucleation. Meningothelial cells were not seen. No hemorrhage nor necrosis were noted [Fig5 & 6]. The diagnosis of Intracranial chondroma was established ruling out Chordoid meningioma, Chondrosarcoma, Chordoma and Chordoid glioma.

Chondromas of the duramater and the falx are difficult to distinguish from Chordoid meningiomas. However, in the CT scan, meningiomas usually display intense, homogeneous contrast enhancement, whereas chondromas are heterogenous and shows calcification. Early contrast

enhancement is suggestive of meningioma, whereas marked delayed contrast enhancement is suggestive of chondroma, [4,6,7]. In cerebral angiography meningiomas are vascular, while chondromas are avascular, [5]. Histologically, chordoid meningioma can be differentiated, by the presence of foci of meningothelial cells. Chordoid meningiomas are positive for EMA and vimentin but negative for cytokeratin and GFAP.

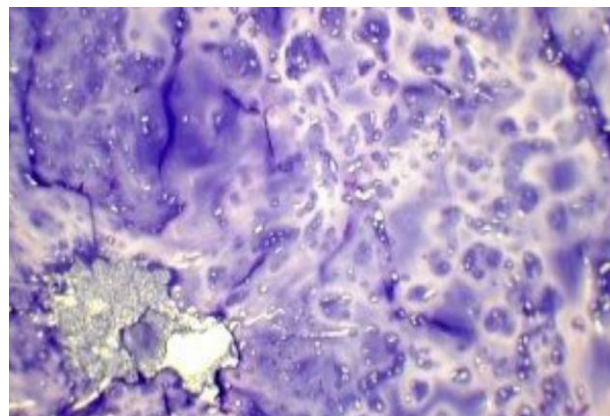


Fig5: Show lobules of benign chondrocytes [4x,H&E]

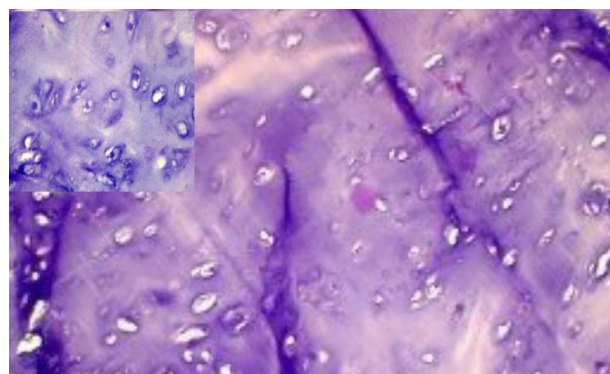


Fig 6: Shows benign chondrocytes arranged in pairs located in the lacunae [10xH&E]. Inset shows benign chondrocytes [40xH&E]

Chondrosarcoma – low grade another differential, sometimes show very well differentiated cartilaginous areas, but can be differentiated by the presence of nuclear pleomorphism and brisk mitotic activity. There was no pleomorphism or atypia in our case. The other differential is Chordoma when it arises from the clivus both clinically and radiologically. Although the cells are arranged in a lobular pattern on a basophilic background which may resemble chondroma, it is diagnosed mainly by the presence of vacuolated psaliferous cells. Chordoma usually has a short history. Chordoma is consistently immune positive for cytokeratins and EMA and is usually located in the midline. In our case the tumor was in the temporo-parietal region and there were no psaliferous cells microscopically.

Chordoid glioma is a rare GFAP-immunopositive tumor limited to the third ventricle. The location goes against our case and the absence of chordoid element supplemented in establishing the diagnosis.

What our eyes see may not be always correct. So, to prove further, we did immunochemistry. S100, positivity

[Fig7], Vimentin positivity [Fig8] and EMA negativity [Fig9] further ruled out the closest differential diagnosis of chordoid meningioma and Chordoma. Thus the diagnosis, Chondroma of the meninges was established.

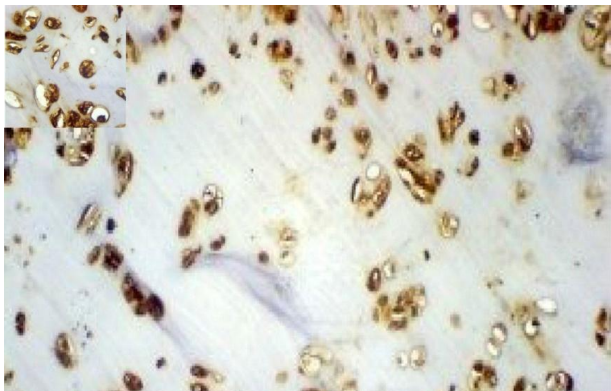


Fig 7: Shows S100 Positivity[10x]

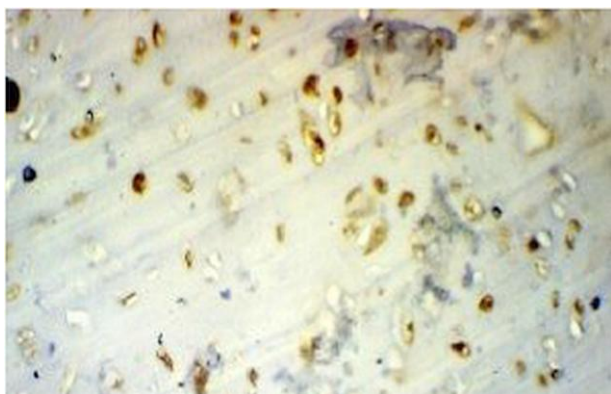


Fig8: Shows Vimentin Postivity[10x]

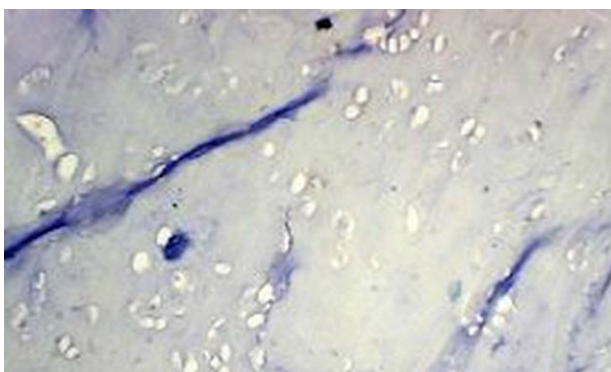


Fig 9: Shows EMA negativity[10x]

Out of 280 CNS cases reported from our department during our study period, two cases were reported as Intracranial Chondroma. The incidence of central nervous system is 2.4% per year. The incidence of Intracranial Chondroma was calculated and it was 0.2%. This is in accordance with the study by Chorobski et al, who observed the incidence as 0.2-0.3% in their study [1]. The age in which the tumor was reported was analyzed. The age incidence was 25 years and 57 years. The mean age calculated was 41 years. According to Richard et al, [4] and Beatrice De Coene et al, [5] the age incidence is 20-60 years with a peak in the third decade. This is in compliance with our study.

The sex ratio was calculated. One case in our study was a male and the other was a female. There is no sex predilection for this tumor in our study. Female predominance is noted in the study by Ata Abbasi et al, [3]. The site of the tumor was analyzed. One tumor was located in the base of the skull and the other was a dura based tumor in the temporo-parietal region. William Q. Wu And Angelo Lapi. J, [8] in their study had categorized the tumor into four based on the site. Our cases fall into the first and the last group [Table 1].

Table 1: Clinical Summary

	Case1	Case2
Age	25	57
Sex	Male	Female
Clinical Symptoms	Recurrent episodes of seizures and vomiting of three months duration	Blurring of vision, head ache and giddiness on and off for about a month duration
X ray	Hyperostosis in the left temporo-parietal region	-
CT and MRI imaging	A large well defined lobulated, dural based extra axial mass lesion with mixed signal intensity, heterogeneous enhancement	A large lobulated, hyperintense extra axial mass lesion in the base of the skull involving the right middle cranial fossa region extending to suprasellar and prepontine regions
Calcification	+	-
Treatment	Complete excision	Complete excision
Associated syndromes	Nil	Nil

Discussion

In the year 1851, Hirschfield was probably the first to report an intracranial cartilaginous tumor specifically chondromas, [5]. The first operative resection was published by Nixon in 1982. Primary intracranial chondromas that do not arise from the bone are rare WHO has classified it as ICD 9220. They constitute less than 1% of all the CNS tumors. The incidence is 0.2 to 0.3%, according to Chorobski et al, [1], Li T, Chen Yet al, [2], Uddin et al, [6], Maheshwari V et al, [7] and Jae-Hyun Park, [9]. Bwent Boyar et al, [10] in their report had mentioned that intracranial Chondroma had an incidence of less than 0.2% of all the intracranial tumors. Pauranik A et al, [11] and Abbasi A et al, [3] in their reports had cited 0.5% as the incidence of Intracranial Chondroma. Sharafeddine H et al, [12] in their report had quoted 0.2-0.5% as the incidence of Intracranial Chondroma. Abbasi A et al, [3] in their report had mentioned that only 30 cases had been reported so far. These reports account for the rarity of the tumor. The incidence calculated in our study was 0.2% which correlated with other's study.

The majority of the patients are between 20 and 60 years of age, with a peak incidence in the third decade, according to Li T, ChenYet al, [2], Uddin et al, [6] and Sharafeddine H et al, [12]. According to Brownlee Ret al, [4] and Fatma Oz Atalay et al, [13] age incidence was between 15 months and 60 years. According to Wu W, et al,[8] the age of occurrence lies between 18 years to 65 years. Coene B, et al,[5] in their report had mentioned that it occurs at any age. But all the above reports had mentioned the peak incidence as third decade. In our study the mean age calculated was 41 years. There is no gender predominance according to Maheshwari V, et al,[7], although a slight female preference has been proposed by Li T, ChenYet al, [2] Abbasi A et al,[3] Brownlee Ret al, [4] Uddin et al, [6], Bwent Boyar et al, [10], Sharafeddine H et al, [12] and Fatma Oz Atalay et al, [13]. There was no gender predominance in our study too.

It can be solitary or multiple. Solitary intracranial chondromas are most commonly seen the base of the skull or in the paranasal sinuses and it may extend into the cranial cavity according to Coene B, et al, [5]. They grow with expansion and do not infiltrate the brain parenchyma according to Coene B, et al, [5]. Symptomatology include an asymptomatic presentation to headache, seizures and compressive symptoms, according to Brownlee Ret al, [4] Uddin et al, [6] Wu W, et al,[8], Bwent Boyar et al, [10], Pauranik A et al,[11], Fatma Oz Atalay et al,[13] and Mohammad Sarwar et al,[14] like in our case. Bone destruction [50%] with hyperostosis of skull's inner table and calcifications[60%] are observed with these tumors, according to Coene B, et al,[5]. Rarely, it is associated with Ollier's multiple enchondromatosis, Maffucci's syndrome or choroid plexus papilloma according to Li T, ChenYet al,[2], Abbasi A et al,[3], Coene B, et al,[5], Uddin et al,[6], Maheshwari V, et al,[7], Jae-Hyun Park,[9], Bwent Boyar et al,[10] and Sharafeddine H et al,[12]. Sharafeddine H, et al,[12] and Delgado-López PD et al,[15] in their report had mentioned a case of Intracranial Chondroma with Noonan's syndrome. Sharafeddine H, et al,[12] and Mohammad Sarwar et al,[14] in their reports had mentioned about increase in the malignancy risk when Intracranial Chondroma is associated with these syndromes.

Intracranial chondromas can be classified into four groups based on the location according to Bwent Boyar et al,[10] and Palacios E,[16]. The first group of tumor arises from the skull base, particularly in the sphenoid-occipital region. The second group localizes in the paranasal sinuses and extends into the cranial cavity. The third group is the tumor arising from the choroid plexus. The fourth group prefers the dura with dural attachment. Our cases belong to the first and last group. The tumors that arise from the falx are supposed to be larger because of the late presentation as noted by Wu W, et al,[8] in their presentation. Delgado-López PD et al,[15] had mentioned in their report that only 25 cases of dura based Chondroma were mentioned in the literature.

When considering the histiogenesis of intracranial chondromas, sphenoid-ethmoidal tumors mainly develop from the embryonal cartilaginous rests along the basilar synchondroses,[5,16,17]. Although tumor from the base of the skull can be explained as to have originated from the cartilage, the tumor arising from the membranous parts of the brain like dura is an enigma and several theories were put forward according to Palacios E,[16]. Metaplasia of meningeal fibroblasts or migrate from the blood vessels,[9] or displacement and migration caused by trauma or an inflammatory process,[4] are proposed according to Li T, ChenYet al,[2], Abbasi A et al,[3], Uddin et al,[6], Maheshwari V, et al,[7], Pauranik A et al,[11], Sharafeddine H, et al,[12], Fatma Oz Atalay et al,[13], Delgado-López PD et al,[15], Palacios E,[16] and Fountas KN et al,[18]. They are ensheathed within the dura or arise from sub-dural surface,[3,17]. However, the origin of chondromas arising from other locations is unclear.

Diagnostic approach includes histopathology which is the gold standard and it is done in correlation with the imaging studies. Microscopically the tumor cells are arranged in a lobular pattern. They are composed of mature benign chondrocytes within lacunae in a chondroid matrix with no pleomorphism, mitosis, multinucleation or myxoid degeneration, according to Brownlee Ret al,[4], Coene B, et al,[5], Bwent Boyar et al,[10], Pauranik A et al,[11], Sharafeddine H, et al,[12] and Fatma Oz Atalay et al,[13]. Abbasi A et al, [3] and Sebbag M, et al,[19] had mentioned meningioma as a differential diagnosis in their study. Meningioma and chondrosarcoma are the differentials according to Maheshwari et al,[7]. Mohammad Sarwar et al,[14] in their report based on the radiological findings had mentioned meningioma, craniopharyngioma, chordoma, acoustic neuroma, epidermoid cyst and metastasis as the differentials. Coene B, et al,[5] in their write up had mentioned meningioma and calcified hematoma as the differentials based on the radiological findings. Fountas KN, et al,[18] had mentioned meningioma and glial tumors as a differential for Intracranial Chondroma.

All the histopathological findings need immunohistochemical [IHC] endorsement. IHC that is useful in the diagnosis of Chondroma is diffuse S100 positivity according to Fatma Oz Atalay et al,[13]. And Ki67 is the additional marker to rule out malignancy, according to them. Imaging studies such as CT or MRI are useful along with the histopathology in the diagnosis of Intracranial Chondroma. Usually Chondroma show a well-circumscribed, extra axial lesion, with variable heterogeneities and have delayed slight-to-moderate enhancement,[15]. Irregular and mottled areas of calcification are seen in 60% of the cases,[4,11,19]. In this case radiological imaging revealed a well-defined lobulated extra axial mass lesion with mixed signal intensity. Heterogeneous enhancement and calcification were also noted. Cerebral angiography complements the diagnosis. In cerebral angiography, chondromas present as avascular, extracerebral, space-occupying lesions which cause displacement of the arteries in the vicinity of the tumors,[11,20,21]. This and delayed enhancement in CT

and MRI helps in differentiating chondromas from meningioma. Since dural chondromas are well demarcated and have minimal adherence to surrounding tissues, the treatment of choice for these tumors is total excision with removal of attached duramater,[21]. The long-term prognosis is good after total excision of the tumor and tumor recurrence is exceptional. Malignant transformation into a chondrosarcoma is associated with Maffucci syndrome, inadvertent radiotherapy and after partial resection of chondroma. Local invasion or recurrence may suggest malignant transformation into chondrosarcoma [1,15]. Therefore, in cases with subtotal resection of chondroma, syndrome associated Chondroma and those who were given radiotherapy, long-term imaging follow up may be necessary. Patel A, [22] in their report had mentioned that a patient had survived with a giant intracranial Chondroma, 48 years after partial debulking. Overall, the prognosis is good [23,24,25].

Conclusion

In our three year study period, out of CNS tumors, two cases of Intracranial Chondroma were reported in our retrospective cross sectional study. The rarity of this tumor in our setup [Incidence 0.2%] was established. The mean age of occurrence was 41 years with no sex predilection. Both the cases in our study had a disease free interval in their follow up.

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Competing Interests

None declared.

References

- Chorobski J, Jarzynski J, Ferens E. Intracranial solid Chondroma. *Surg Gynecol Obstet.* 1939;68:677-686.
- Li T, Chen Y, Lin S, Tseng S. Chondroma of the Falx: Case Report. *Tzu Chi Med J* 2005. 2015; 17(4):269-272.
- Abbasi A, Ardalan F, Miri S, Shahriarian S, Tajik F. Chondroma of Falx: Case Report of a Rare Condition. *Acta Medica Iranica*. 2012;50(3):222-224.
- Brownlee R, Sevic R, Rewcastle N, Tranmer d. Radiologic-Pathologic Correlation Intracranial Chondroma. *AJNR*. 1997;18:889-893.
- Coene B, Gilliard C, Grandin C, Nisolle J, Trigaux J, Lahdou J. Unusual Location of an Intracranial Chondroma. *AJNR*. 1997;18:573-575.
- Uddin et al.: Intracranial cystic chondroma: a case report. *Journal of Medical Case Reports* 2012 6:432.
- Maheshwari V, Mehdi G, Varshney M, Jain A, Vashishtha S, Gaur K, Srivastava VK. Intracranial chondroma: a rare entity. *BMJ Case Reports* 2011; 10.1136/bcr.03.2011.4047
- Wu W, Lapi A. Primary non-skeletal intracranial cartilaginous neoplasms: report of a chondroma and a mesenchymal chondrosarcoma. *Journal of Neurology, Neurosurgery & Psychiatry*. 1970;33: 469-475.
- Park J, Jeun S. An Intracranial Chondroma with Intratumoral Hemorrhage: A Case Report and Review of the Literature. *Brain Tumor Research and Treatment*. 2013;1(1):42.
- Boyar B, Killr C, Akalan N, Giirsoy F, Sekerci Z, Sav A. Intradural solitary chondroma A Case Report. *Turkish Neurosurgery*. 1990;1:143-145.
- Pauranik A, Mahore A, Kataria NG. Giant chondroma of the falx. *Neurol India [serial online]* 2012 [cited 2015 Sep 20];60:364-6.
- Sharafeddine H, Elias E, Jabbour M, Najjar MW. Giant Convexity Chondroma of the Dura Matter Presenting with Epilepsy. *Austin J Neurol Disord Epilepsy*. 2014;1(1): 3
- Oz Atalay F, Ozgun G, Tolunay S, Bekar A. Intracranial Extra-axial Chondroma: A Case Report. *Journal of Nippon Medical School*. 2014;81:35-39.
- Mohammad Sarwar, Leonard E. Swischuk, 2 And Mannie M. Schechte. Intracranial chondromas. *Am J Roentgenol* 1976;127:973-977.
- Delgado-López P, Martín-Velasco V, Galacho-Harriero A, Castilla-Díez J, Rodríguez-Salazar A, Echevarría-Iturbe C. Large chondroma of the dural convexity in a patient with Noonan's syndrome: Case report and review of the literature. *Neurocirugía*. 2007;18(3).
- Palacios E. Intracranial Solitary Chondroma Of Dural Origin. *American Journal of Roentgenology*. 1970;110(1):67-70.
- Çolpan E, Attar A, Ereku S, Araslı E. Convexity dural chondroma: a case report and review of the literature. *Journal of Clinical Neuroscience*. 2003;10(1):106-108.
- Fountas K, Stamatiou S, Barbanis S, Kourtopoulos H. Intracranial falx chondroma: Literature review and a case report. *Clinical Neurology and Neurosurgery*. 2008;110(1):8-13.
- Sebbag M, Schmidt V, Leboucq N, Bitoun J, Castan P, Frerebeau P. Dura mater chondroma. A case report and review of the literature. *Journal de radiologie [Internet]*. 1989 [cited 26 September 2015] ;71(8-9):495-498.
- Aoki T, Tashiro Y, Fujita K, Kajiura M. A case report of the chondroma arising from the falx cerebri. No shinkei geka Neurological surgery [Internet]. 2005 [cited 26 September 2015];33:979-984.
- Khosrovi H, Sadrolhefazi A, el-Kadi H, Bloomfield S, Schochet S. Intradural convexity chondroma: a case report and review of diagnostic features. *The west virginia Medical journal*. 2000;96:612-616.
- Patel A, Munthali L, Bodi I. Giant cystic intracranial chondroma of the falx with review of literature. *Neuropathology*. 2009;29(3):315-317.
- Kozłowska K, Bień D, Niemczyk K. Chondroma of the skull base. *Otolaryngologia polska The Polish otolaryngology [Internet]*. 2003 [cited 26 September 2015];58(5):995-998.
- Nakazawa T, Inoue T, Suzuki F, Nakasu S, Handa J. Solitary intracranial chondroma of the convexity dura: case report. *Surgical Neurology*. 1993;40(6):495-498.
- Kurt E, Beute G, Sluzewski M, van Rooij W, Teepen J. Giant chondroma of the falx. *Journal of Neurosurgery*. 1996;85(6):1161-1164.