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Case Report

Gorlin-Goltz syndrome: Multidisciplinary approach for early diagnosis of rare disease for better patient outcome ☆

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ABSTRACT

Gorlin-Goltz syndrome, also known as nevoid basal cell carcinoma syndrome (NBCCS), is an infrequent, autosomal dominant, multi-systemic disease characterized by odontogenic keratocysts (OKC) in the jaw, multiple basal cell carcinomas (BCC), ectopic calcifications of the falx and tentorium, and various other skeletal abnormalities. The syndrome can be recognized early in life during dental and dermatology visits or on routine radiographic studies, opening the door for further screening and follow-up of affected individuals and their offspring. We report a case of Gorlin syndrome diagnosed in a 37-year-old female patient with features of hypertelorism after presenting with jaw swelling of 6 months. The diagnosis was made after identifying multiple OKCs, bilamellar calcification of falx and tentorium, bifid spinous process, and bridging sella seen on head computed tomography (CT) scan, fulfilling the diagnostic criteria set for the syndrome. This case highlights the important role radiology has in diagnosing NBCCS and the importance of a multidisciplinary approach to provide a better prognosis for the patient.

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Abbreviations: GGS, Gorlin-Goltz syndrome; BCC, basal cell carcinoma; NBCCS, Nevoid basal cell carcinoma; OKC, odontogenic keratocyst; CT, Computed Tomography; OPG, Orthopantomogram.

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Introduction

Gorlin-Goltz syndrome (GGS), or nevoid basal cell carcinoma syndrome, is an autosomal dominant genetic disease with an estimated prevalence of 1:57,000 to 1:256,000 and a high level of penetrance with variable expressiveness [1–3]. Gorlin and Goltz, in 1960, established the classical triad of this syndrome, characterized by multiple epitheliomas, keratocysts in the jaws, and bifid rib. Later on in 1993, *Evans et al* formulated a diagnostic criterion for the syndrome, which required the presence of 2 major or 1 major and 2 minor criteria for the diagnosis [4,5]. The underlying pathophysiology is a mutation in the patched-1 (*PTCH-1*) gene, a tumor suppressor gene found on the long arm of chromosome 9 [6,7].

The clinical features arise in the first, second, or third decades of life. This syndrome includes a wide spectrum of defects encompassing the skin, eyes, central nervous and, endocrine system, and bones. The main characteristic features of GGS are multiple odontogenic keratocysts (OKCs) (75%), BCC (50%-97%), bifid ribs (40%), palmar and plantar pits (60%-90%), and ectopic calcification of falx cerebri (37%-79%). For this syndrome, early diagnosis and treatment, as well as genetic counseling, are of utmost importance. We encountered 1 such case with mainly maxillofacial and intracranial manifestations on CT scan. The diagnosis was made with 2 major and additional minor criteria [6,8]. With our report, we intend to emphasize the high index of suspicion radiologists need to make early diagnosis of unrecognized cases of GGS and the multidisciplinary approach to management and follow-up of this rare condition.

Case presentation

A 37-year-old female patient presented to our outpatient clinic with a complaint of painless swelling of the left lower jaw. It was initially noticed 6 months back, and it steadily increased in size until it reached the current size, causing fascial asymmetry. Before that, she completed 6 months of treatment for the diagnosis of pulmonary tuberculosis. She recalls no history of prior skin lesions. She is from a rural village with no access to regular dental visits, but has no known chronic medical illness and no known family member with similar complaints.

On physical examination, she has normal vital signs. There is nontender swelling on the left mandible. On intra-oral examination, the 36 and 37 teeth are lingually displaced. She also has frontal bossing and hypertelorism. No skin lesion was identified. The complete blood count (CBC) was normal.

A CT scan of the head was done for better evaluation of the jaw lesion. On CT, there are multiple well-defined, lytic, expansile cysts with endosteal scalloping seen involving bilateral mandibular body and rami as well as the anterior part of the maxillary bone (Fig. 1, A-E). Some of the lesions have displaced roots of mandibular tooth. The mandibular lesions have areas of cortical breach both on the outer aspect and on the lingual side. There is also lamellar or sheet-like calcification of both the falx and the tentorium (Fig. 2, A-D). Bridging sella turcica is also evident by the calcified dura connecting the anterior and posterior clinoid processes on both sides of the sella. There is also a bifid spinous process of the C7 vertebrae (Fig. 3, A-D).

Odontogenic cysts such as ameloblastoma and OKC are potential radiologic differential diagnoses for the jaw findings. The presence of a unilocular predominant growth pattern along the length (long axis) of the mandibular bone with minimal expansion, a Corticated and scalloped border, with displacement of developing teeth are radiologic findings more suggestive of OKC. Multiple OKCs can be nonsyndromic. More often, it is reported with syndromes like GGS, orofacial digital syndrome, Ehler-Danlos syndrome, and Noonan syndrome. The constellation of physical, radiologic, and molecular findings helps to suggest the likely diagnosis [9].

In our patient, the combination of the aforementioned radiologic and physical findings suggested a more probable syndromic cause. Alongside the facial features observed during the physical examination (hypertelorism and frontal bossing), the diagnostic criteria for Gorlin syndrome were met, fulfilling 2 major and more than 3 minor criteria. The patient then began treatment, along with multidisciplinary screening and follow-up at the maxillofacial surgery department.

Discussion

In 1960, Robert W. Goltz, a dermatologist, and Robert J. Gorlin, a pathologist, described a distinct syndrome characterized by the triad of multiple nevoid basal cell epitheliomas, jaw cysts, and bifid rib. Today, this syndrome, widely known as Gorlin syndrome, is also called Gorlin-Goltz syndrome (GGS) or "basal cell nevus syndrome", or the "nevoid basal cell carcinoma syndrome". Since then, multiple other characteristic features of the syndrome have been described in the literature. It occurs 1/60,000 live births with no sex predilection. Affected individuals usually present for the first time between the ages of 17 and 35 years [4,10].

It is a hereditary disease associated with mutation of the tumor suppressor gene, the human patched gene (PTCH1 gene), located on chromosome 9q22·3- q31. This gene is involved in the regulation of cell growth in all 3 germ layers of the embryo, including organogenesis, carcinogenesis, and odontogenesis. Hence, the various clinical features are seen from malformations of all 3 germ cell lines [6,7].

The hallmark of cutaneous manifestations in this syndrome is multiple BCCs. It occurs in 90% of patients, first appearing in the late teens and early adulthood. These brownish, pink, or orange basal cell nevi can be detected during routine dermatology visits. Palmar and plantar pitting can also be seen due to defects of basal cell maturation [6,7]. Our patient did not have these dermatologic findings.

A large head with frontal bossing, hypertelorism, and cleft lip and palate are among the prominent facial features. In our case, frontal bossing and hypertelorism are noted upon physical examination. Painless jaw swelling can occur due to multiple OKCs, which are observed in 75% of affected individuals by the age of 30 and can be detected using panoramic radiograph, skull X-ray, and CT scan. On CT, these cysts present as uniloc-

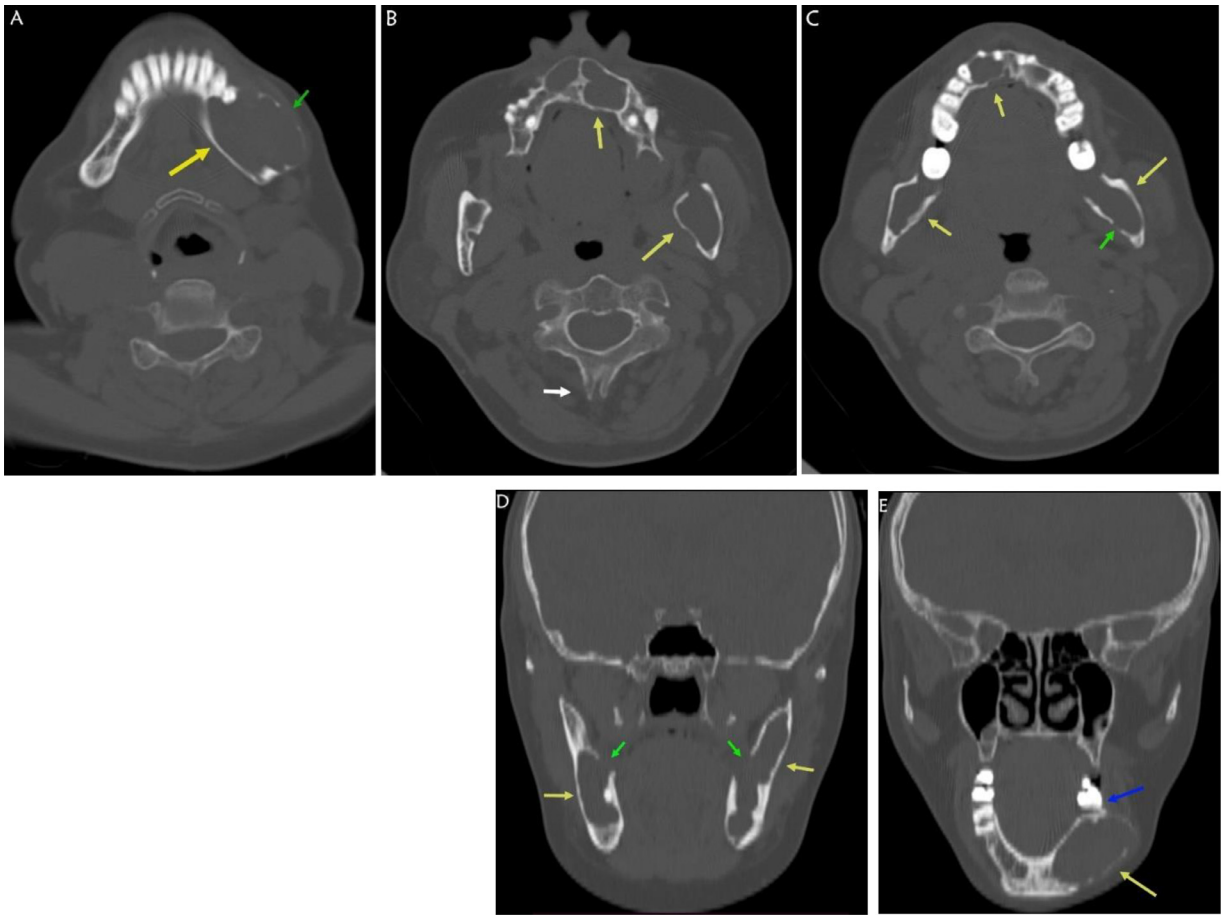


Fig. 1 – (A-E) - Axial (A-C) and coronal (D and E) bone window images showing lytic expansile lesions involving bilateral mandibular body and rami as well as anterior part of maxillary bone with (yellow arrows). The lesions on the mandibular body extend more along its long axis. There is endosteal scalloping, areas of cortical breach (Green arrows). Lingual displaced left mandibular teeth is also seen (blue arrow in E). A bifid spinous process is also seen (white arrow in B).

ular or multilocular, expansile lytic lesions in the mandible or maxilla, characterized by scalloped borders and preferential growth along the long axis of the mandibular body, as seen in our case. CT can also identify lamellar or sheet-like calcification of the falx and the tentorium, which should raise suspicion when detected in individuals under 20 years of age. Another CT finding is bridging of the sella turcica, which occurs due to ossification of the dura mater extending between the anterior and posterior clinoid processes. Both of these findings are observed in our case. The dura shares a similar embryologic origin with structures derived from the neural crest, such as the palate and teeth, hence the association. Early occurrence of medulloblastoma at an average age of 1 to 2 years is also reported in approximately 5% of patients with NBCCS [6,11,12].

Our patient also has a bifid vertebra, which is among several skeletal features of the syndrome, including bifid ribs and wedge-shaped vertebrae. Cardiac fibromas, ovarian fibromas, and medulloblastoma are malignancies associated with the syndrome. X-ray, ultrasound, and CT can easily identify these findings. Compared with nonsyndromic OKC, OKC in GGS is usually multiple, located in the maxilla, occurs in the first 2-3 decades, and has a higher risk of recurrence [13]. Even though our patient presented in the fourth decade of her life, the nature of the cysts, the pattern of ectopic calcifications of the falx, and other additional findings support an unrecognized syndromic cause.

The diagnosis of Gorlin syndrome relies on the presence of a multitude of these findings. Evans et al. proposed major and minor diagnostic criteria to assist in early diagnosis, as well as in possible genetic screening and follow-up of affected individuals and their offspring (see Table 1) [5,14]. Based on these diagnostic criteria, our case meets 2 of the major criteria (sheet-like calcification of the falx and tentorium and multiple cysts in the mandible and maxilla) and 3 of the minor criteria (bifid spinous process, bridging Sella, and hypertelorism).

Conservative management of OKC involves simple enucleation and surgical options, including peripheral ostectomy, chemical curettage with Carnoy's solution, and resection, all of which are viable treatment options for OKC [10]. Complications associated with GGS include oromaxillofacial deformation, destruction, and an increased risk of malignancy. Early diagnosis, treatment, and regular follow-up can reduce the morbidity related to such long-term complications. [6,15].

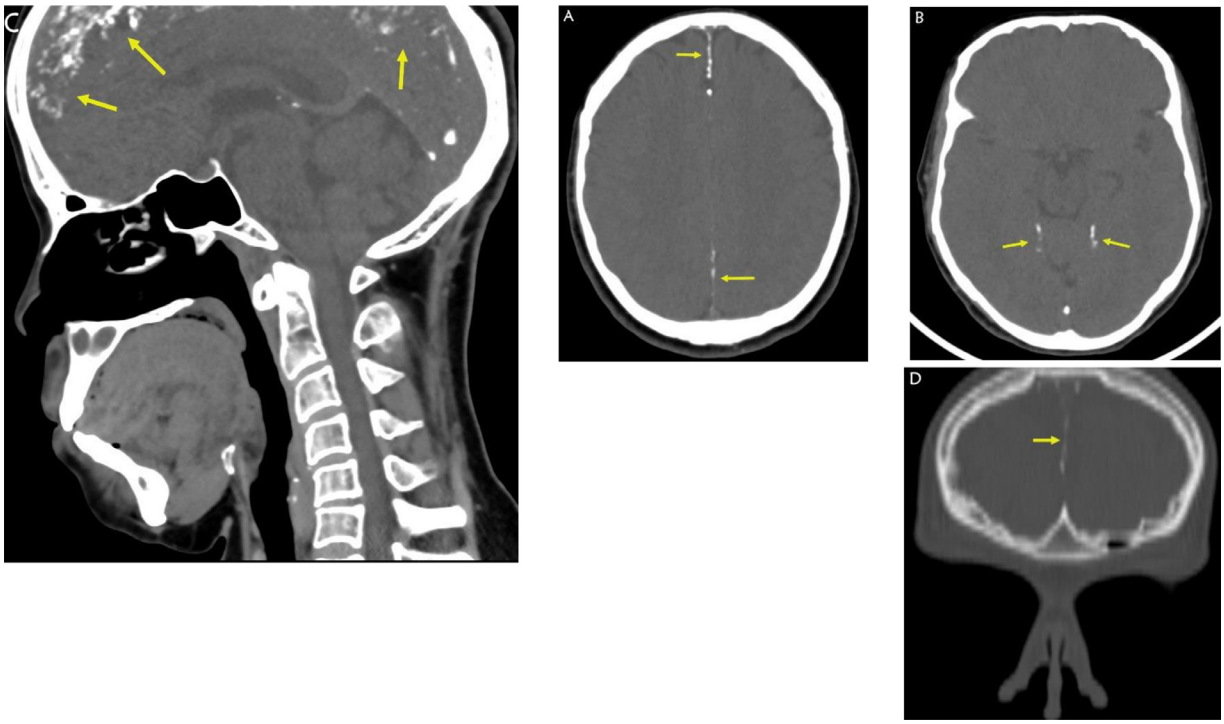


Fig. 2 – (A-D) - Brain CT in soft tissue window axial (A and B), sagittal (C) and coronal (D) images showing sheet like bilaminar calcification of the falx (arrows in A-D) and tentorium cerebellum (arrows in B).

Table 1 – Diagnostic criteria for nevoid basal cell carcinoma syndrome (NBCCS).

Major criteria
1. Multiple (>2) basal cell carcinomas (BCC) or 1 under 30 years, or > 10 basal cell naevi.
2. Any odontogenic keratocyst (proven on histology), or polyostotic bone cyst.
3. Palmar or plantar pits (3 or more).
4. Ectopic calcification: lamellar or early (< 20 years) falx calcification.
5. Family history of NBCCS.
Minor criteria
1. Congenital skeletal anomaly: bifid, fused, splayed, or missing rib, or bifid, wedged, or fused vertebra.
2. OFC > 97th centile, with frontal bossing.
3. Cardiac or ovarian fibroma
4. Medulloblastoma.
5. Lymphomesenteric cysts
6. Congenital malformation: cleft lip and/or palate, polydactyly, eye anomaly (cataract, coloboma, microphthalmia)
A diagnosis can be made when 2 major or 1 major and 2 minor criteria are fulfilled.
Our case fulfils 2 major and 3 minor criteria.

The diagnosis, management, and follow-up of such patients involves multiple disciplines, including Radiology, Oral and Maxillofacial surgery, primary care physicians, and dermatology. Patients with GGS should have dermatological evaluation every 3-6 months to look for BCC and an orthopantomogram (OPG) study every year to look for new or recurrent OKCs. Neurological examination is recommended every 6 months for children with NBCCS as they are at a higher risk of developing medulloblastoma [6,15].

Since the PTCH gene mutation is inherited in an autosomal dominant manner, offspring of an affected individual have a 50% risk of inheriting NBCCS. Hence, genetic counseling should be part of the multidisciplinary management. Nowadays, antenatal diagnosis of PTCH gene mutation can be made from analysis of DNA extracted from fetal cells. Due to the resource-limited nature of our setup, the lack of genetic testing to confirm the PTCH1 mutation, which is a key diagnostic feature of GGS, is a limitation of our case report [6,15].

Radiological manifestations of the disorder can permit early diagnosis of unrecognized cases, allowing optimal surveillance and screening for neoplasms and other disorders associated with the syndrome. The presence of OKC at a very young age, multiple OKCs, incidental finding of lamellar calcification of the falx and tentorium, especially in individuals younger <30 years old, should prompt the radiologist to consider syndromic causes and suggest confirmatory genetic

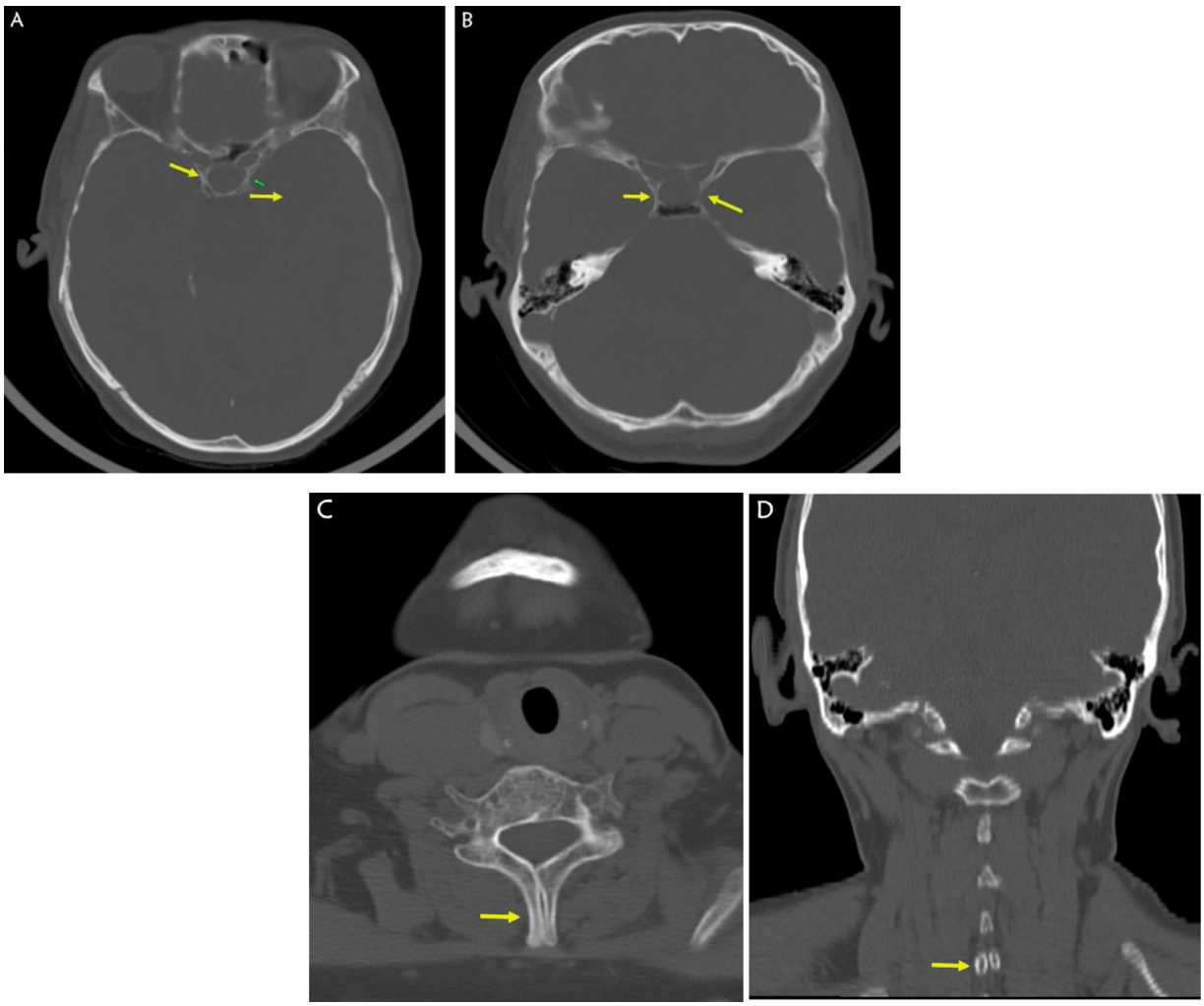


Fig. 3 – (A-D) - axial (A and B) bone window images showing the calcified dura connecting anterior and posterior clinoid processes in bridging Sella (yellow arrows in A and B). Also, axial (C) and coronal (D) bone window images showing the bifid spinous process of C7 (arrows in C and D).

tests. Hence, awareness and a high index of suspicion among the radiology and maxillofacial community are essential [5–7,15].

Ethical consideration

Written informed consent has been obtained from the patient for the use of pictures and other clinical data for the publication.

Patient consent

After a thorough explanation of the case report and its publication process, written informed consent for the inclusion of their medical information was obtained from the patient. This ensures their understanding and authorization for the anonymized presentation of this case for educational purposes.

REFERENCES

[1] Lo Muzio L. Nevoid basal cell carcinoma syndrome (Gorlin syndrome). Orphanet J Rare Dis 2008;3:32. doi:10.1186/1750-1172-3-32.
[2] Kiran NK, Tilak Raj TN, Mukunda KS, Rajashekar Reddy V. Nevoid basal cell carcinoma syndrome (Gorlin-Goltz syndrome). Contemp Clin Dent 2012;3(4):514–18. doi:10.4103/0976-237X.107459.
[3] Jawa DS, Sircar K, Somani R, Grover N, Jaidka S, Singh S. Gorlin-Goltz syndrome. J Oral Maxillofac Pathol 2009;13(2):89–92. doi:10.4103/0973-029X.57677.
[4] Gorlin RJ, Goltz RW. Multiple nevoid basal-cell epithelioma, jaw cysts and bifid rib: a syndrome. N Engl J Med 1960;262:908–12. doi:10.1056/NEJM196005052621803.
[5] Kimonis VE, Mehta SG, Digiovanna JJ, Bale SJ, Pastakia B. Radiological features in 82 patients with nevoid basal cell

carcinoma (NBCC or Gorlin) syndrome. Genet Med 2004;6(6):495–502. doi:10.1097/01.gim.0000145045.17711.1c.
[6] Chandran S, Marudhamuthu K, Riaz R, Balasubramaniam S. Odontogenic keratocysts in Gorlin-Goltz Syndrome: a case report. J Int Oral Health 2015;7(Suppl 1):76–9.
[7] Farndon PA, Del Mastro RG, Evans DG, Kilpatrick MW. Location of gene for Gorlin syndrome. Lancet 1992;339(8793):581–2. doi:10.1016/0140-6736(92)90868-4.
[8] Shobha C, Bijjaragi A, Suragimath V, Ajit S, Veerendra SP. Gorlin Goltz syndrome: a clinicopathological case report. J Indian Acad Oral Med Radiol 2014;26(1). doi:10.4103/0972-1363.141868.
[9] Rai S, Rana AS, Kalra P, Gupta D, Goel S. Multiple keratocystic odontogenic tumors in a non-syndromic minor patient: report of an unusual case. J Orofac Sci 2013;5(1):61–6. doi:10.4103/0975-8844.113708.
[10] Ramesh M, Krishnan R, Chalakkal P, Paul G. Gorlin-Goltz Syndrome: case report and literature review. J Oral Maxillofac Pathol 2015;19(2):267. doi:10.4103/0973-029X.164557.
[11] Evans DG, Farndon PA, et al. Nevoid basal cell carcinoma syndrome GeneReviews®. Adam MP, Ardinger HH, Pagon RA, et al., editors. Seattle (WA): University of Washington, Seattle; 2002.
[12] Bronoosh P, Shakibafar AR, Houshyar M, Nafarzade S. Imaging findings in a case of Gorlin-Goltz syndrome: a survey using advanced modalities. Imaging Sci Dent 2011;41(4):171–5. doi:10.5624/isd.2011.41.4.171.
[13] Kumar NN, Padmashree S, Jyotsna TR, Shastry SP. Gorlin-Goltz syndrome: a rare case report. Contemp Clin Dent 2018;9(3):478–83. doi:10.4103/ccd.ccd_96_18.
[14] Evans DG, Ladusans EJ, Rimmer S, Burnell LD, Thakker N, Farndon PA. Complications of the naevoid basal cell carcinoma syndrome: results of a population based study. J Med Genet 1993;30(6):460–4. doi:10.1136/jmg.30.6.460.
[15] Richa R, Kumar V, Ayushree A. A rare case report of Gorlin-Goltz's syndrome: a multisystemic disorder of otolaryngological domain. Egypt J Otolaryngol 2023;39:175. doi:10.1186/s43163-023-00539-4.