Clinical cases

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Genu valgum and arachnodactyly: a rare presentation in Wildervanck syndrome

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Background: *Cervico-Oculo-acoustic syndrome, also known as Wildervanck syndrome, is a rare inherited disorder that causes congenital hearing loss, Klippel-Feil abnormalities, and Duane retraction syndrome. Females are more likely to have Wildervanck syndrome and associated skeletal and cranial anomalies. This illness's distinctive symptoms must be accurately documented to advance clinical knowledge and therapeutic strategies.*

Case Presentation: *An eleven-year-old girl from a blood line had restricted neck movement and left eye abduction since birth. She had genu valgum, arachnodactyly, micrognathia, and other notable cranial anomalies.*

Interventions: *Supportive treatment included neck mobility and scoliosis therapy, hearing aids for her conductive hearing loss, and genu valgum assessments. Genetic consultation assisted with family planning and inheritance patterns.*

Conclusion: *As this example shows a rare phenotype, patients with Wildervanck syndrome may have more symptoms than previously considered. This patient's limb malformations underscore the need for thorough clinical examination and genetic research. This paper provides a good starting point for comprehensive Wildervanck syndrome diagnosis, treatment, and genetic counseling.*

Keywords:

Wildervanck syndrome, genu valgum, arachnodactyly, Klippel-Feil abnormalities, Duane retraction syndrome

Introduction

X-linked dominant inheritance is a characteristic of Wildervanck syndrome, also known as cervico-Oculo-acoustic syndrome [1]. Approximately 10 to 1 more females than males have Klippl-Feil abnormalities, Duane retraction syndrome, and congenital hearing loss. A microdeletion in the Xp26.3 region affects the FGF13 gene, which affects the nervous system, cranial nerves, and cervical vertebrae [2]. The condition is genetic. Craniofacial, musculoskeletal, and auditory abnormalities may be present [3]. These are a few manifestations. Cases with all three features are rare, but they illuminate the genetic and developmental processes of craniovertebral and neuromuscular abnormalities.

Case Presentation

The patient was an 11-year-old girl born as a product of consanguineous marriage and none of her four siblings had symptoms or typical growth. This was an informal pregnancy with an eventful full-term normal vaginal delivery. She complained of limited neck movement and eye movement since early childhood, and recently, she was noted to have a short stature, scoliosis, knock knee and pointed long fingers. The patient's clinical evaluation revealed some Wildervanck syndrome-related traits and some odd results (table 1, Figures 1, 2, 3). These clinical findings are crucial for diagnosing and understanding syndrome phenotypes.

Table 1. Clinical findings of the patient

Clinical Feature	Observation
Cervical Spine Anomalies	Klippel-Feil anomaly (C1-C4 fusion)
Ocular Findings	Left eye abduction restriction (Duane retraction syndrome Type I)
Auditory Findings	Bilateral mild conductive hearing loss
Limb Abnormalities	Genu valgum, arachnodactyly
Craniofacial Features	Micrognathia, low-set ears, microstomia

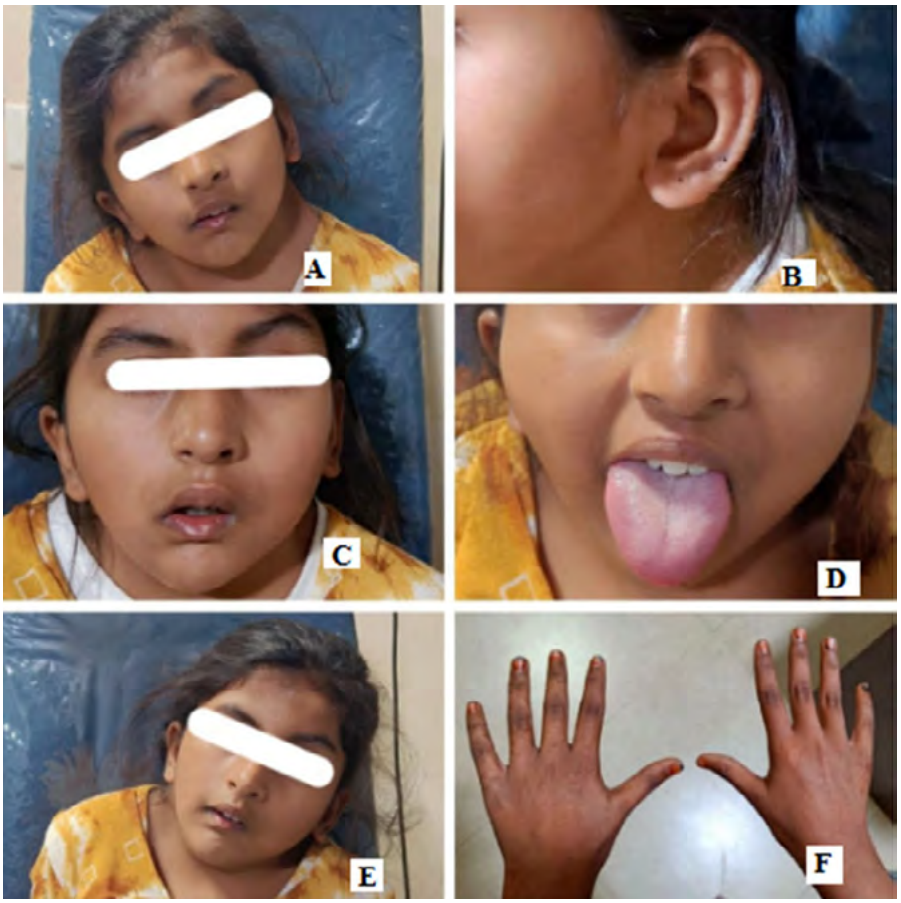

Figure 1. (a) and (e) Restricted neck movement, (b) low-set ear, (c) microsomia, (d) fissure tongue, (f) arachnodactyly

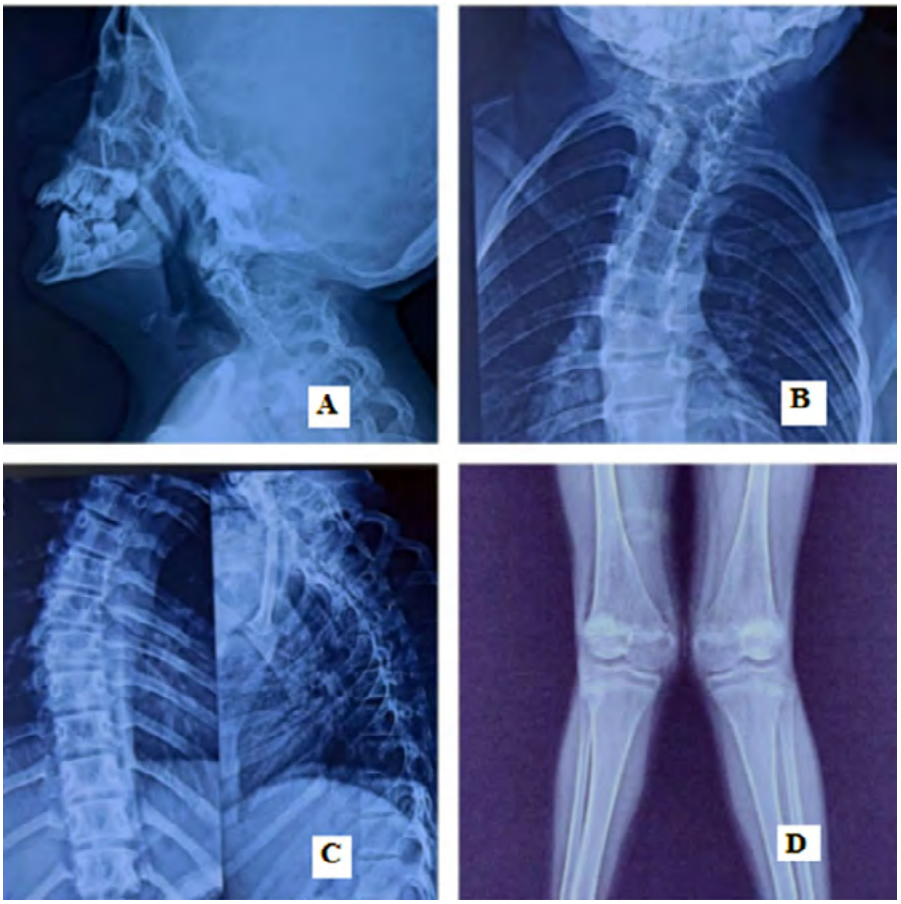

Figure 2. (a) C1–C4 cervical fusion and gingival hypoplasia, (b) and (c) scoliosis, (d) genu valgum

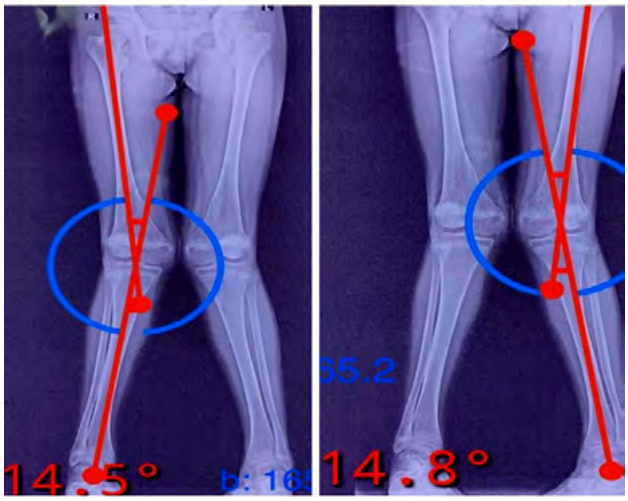

Figure 3. Genu value (14.5 degrees on the right and 14.8 degrees on the left side)

Ocular findings

A +1.25D Sphere prescription improved the patient's vision from 20/50 to 20/20 (P)in both eye. There was no deviation in the primary position, and the head posture was erect. The motility examination revealed left eye abduction limitation with primary and secondary deviation. There was no globe retraction during adduction, upshoot, or downshoot, and pattern strabismus was not observed. In some cases, this condition caused compensatory head postures due to impaired lateral eye movement. (figure 4). Rest of anterior and posterior segment examination was unremarkable. Ocular examination of the right eye was within normal limits.

Discussion

Wildervanck syndrome, or Cervico-Oculo-Acoustic syndrome, is an extremely rare genetic disorder characterized by the triad of Klippel-Feil anomaly, Duane retraction syndrome, and congenital hearing loss. While these fea-

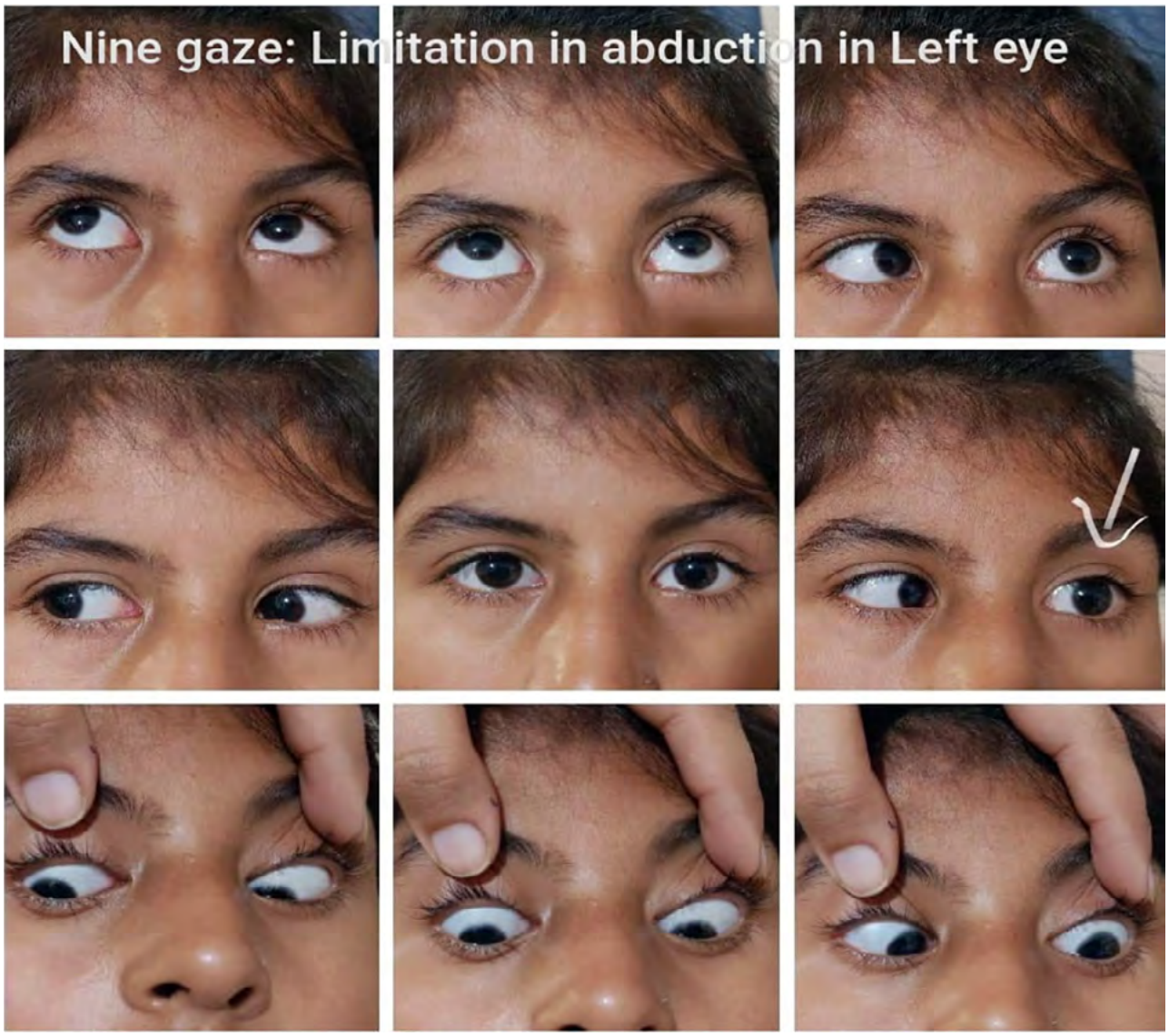

Figure 4. Nine gazes with limitations in abduction (left eye)

tures are considered hallmark symptoms, the phenotypic variability in Wildervanck syndrome is vast, and the addition of limb deformities, as observed in this case, highlights an expanded clinical profile. This case report documents an 11-year-old female presenting with a unique constellation of symptoms, including arachnodactyly (long, slender fingers) and a genu valgum of 14.5 degrees on the right side and 14.8 degrees on the left side, micrognathia, low-set ears, and microstomia along with the classic triad of symptoms associated with Wildervanck syndrome, i.e., Klippel–Feil anomaly (C1–C4 fusion), Duane retraction syndrome type I), and bilateral mild conductive hearing loss.

The genu valgum is a coronal plane deformity of the lower limbs in which the knee bends inward (the distance between two knees decreases) and the ankle is separated outward, also known as a knock knee deformity (a patient's knee knocks while walking, a knock knee gait), associated with a flat foot. Generally, a child is born with varus deformity that persists for up to 2--3 years (appears when the child starts walking). The presence of genu varum after 3 years is pathological. The most common cause of bilateral genu valgum is nutritional, i.e., rickets, followed by skeletal dysplasia, lysosomal storage disorders, and metabolic disorders, and the causes of unilateral valgum are trauma, infection, and tumors. Clinically, we observed knee gait, inward deviation of the knee and outward deviation of the ankle with an intermalleolar distance greater than 10 cm, associated flat foot deformity, medial joint line tenderness, and signs of metabolic disease/nutritional deficiency. At 3–7 years of age, varus converts into valgum (physiologically 5–7 degrees).

In this case, we found a genu valgum (knock knees) of 14.5 degrees on the right side and 14.8 degrees on the left side.

These findings are significant, as they suggest the potential for more extensive musculoskeletal involvement than previously recognized in this condition. Arachnodactyly and genu valgum are uncommon in patients with Wildervanck syndrome and have not been reported previously. These findings raise questions about the broader impact of the genetic mutation associated with Wildervanck syndrome, particularly on skeletal development. Arachnodactyly is a feature commonly linked to connective tissue disorders such as Marfan syndrome, whereas genu valgum can occur in conditions involving skeletal dysplasia or metabolic abnormalities [3]. The presence of these features in Wildervanck syndrome may indicate shared developmental pathways or genetic interactions that have not been fully explored [4]. The limb anomalies in this case contributed to the growing recognition of Wildervanck syndrome as a multisystem disorder rather than one confined to craniofacial, cervical, and auditory features [5].

Genetically, Wildervanck syndrome is believed to follow an X-linked dominant inheritance pattern, with a higher prevalence in females due to male lethality [6]. A microdeletion in the Xp26.3 region, affecting the FGF13 gene, is implicated in its pathogenesis. This gene is critical for neural and skeletal development, cranial nerve formation, and vertebral segmentation [7]. The addition of limb deformities in this case suggests that the FGF13 mutation may have downstream effects on other genes or signaling pathways involved in musculoskeletal differentiation [8]. Further genetic studies, such as whole-genome sequencing or targeted gene panels, are warranted to uncover potential modifiers or secondary mutations that could explain this unique phenotype.

The diagnosis of Wildervanck syndrome requires a comprehensive clinical evaluation due to the variability of its presentation [9]. In this case, the diagnosis was supported by the classic triad of features and radiographic findings, including cervical spine fusion (C1--C4), which is characteristic of the Klippel-Feil anomaly [10]. However, the presence of limb anomalies requires careful differentiation from other syndromic conditions. Goldenhar syndrome, for example, shares some craniofacial and spinal abnormalities but was ruled out because of the absence of facial dermoid cysts and external ear malformations. The meticulous evaluation of phenotypic features underscores the importance of multidisciplinary assessment in complex syndromes.

Bermudez et al. (2019) [11] investigated gastrointestinal disorders in Down syndrome, providing insight into the multisystem involvement that may appear in syndromic conditions such as Wildervanck syndrome. This study highlights the importance of a comprehensive approach for managing coexisting anomalies such as gastrointestinal issues, which can also cooccur in rare genetic syndromes.

Ostermaier (2019) [12] detailed the clinical features and diagnosis of Down syndrome in UpToDate, which provides a foundation for identifying and managing congenital abnormalities in rare syndromes. While focused on Down syndrome, Ostermaier's work offers a framework for recognizing phenotypic variations across syndromic disorders, including genotypic and phenotypic expressions such as those seen in Wildervanck syndrome.

Ostermaier & Drutz (2021) [13] discuss management approaches for Down syndrome, which could apply in part to Wildervanck syndrome, particularly in addressing multisystemic involvement and early intervention strategies. Their emphasis on monitoring developmental and orthopedic abnormalities highlights the value of regular follow-up in conditions with a risk of skeletal abnormalities, such as genu valgum.

Management and Outcomes

Since the underlying genetic abnormality is incurable, the primary goal of Wildervanck syndrome management is to alleviate the symptoms experienced by patients. Strabismus surgery is indicated if patient has abnormal head posture, globe retraction with or without upshoot and downshoot. Medial rectus recession is adviced in type 1 DRS. Orthopedic intervention may be necessary to preserve neck mobility and avoid additional musculoskeletal problems for individuals with substantial cervical verte-

bral fusion, such as the patient in the current study. Physical therapy aims to improve neck mobility and manage scoliosis. Hearing aids suggested for bilateral conductive hearing loss. Monitoring of genu valgum for potential future surgery to be done along with genetic counseling and inheritance patterns and implications for family planning.

Future Directions and Research Opportunities

This case highlights the need for expanded research into the genetic and developmental basis of Wildervanck syndrome. Key areas for future investigations include the following:

Genetic analysis: Comprehensive studies using next-generation sequencing could identify additional mutations or genetic modifiers associated with atypical phenotypes.

Phenotypic studies: Systematic documentation of rare features of Wildervanck syndrome, including limb anomalies, could help refine diagnostic criteria and expand the known clinical spectrum.

Developmental Pathways: Research on the role of FGF13 and related pathways in skeletal and connective tissue development could provide insights into the mechanisms underlying limb anomalies.

Longitudinal studies: Tracking the progression of musculoskeletal disorders and other symptoms in individuals with Wildervanck syndrome could inform management strategies and improve patient outcomes.

Conclusion

An 11-year-old female patient with arachnodactyly, genu valgum, Klippel-Feil anomaly, Duane retraction syndrome, and bilateral conductive hearing loss presented with a novel variant of Wildervanck syndrome, as described in this case report. Wildervanck syndrome is known to have a wide range of symptoms, but these unusual limb anomalies add to that list and may indicate further genetic or developmental pathways that impact musculoskeletal outcomes in people with this condition. To ensure comprehensive therapy for atypical symptoms, a comprehensive physical examination and multidisciplinary evaluation are crucial in patients with uncommon genetic disorders, as demonstrated in this case. Our hope is that by recording this case, we will help shed light on Wildervanck syndrome and offer guidance to clinicians dealing with similar instances.

References

1. Williams ML, Dobbs MB. Congenital Foot Deformities. In: Pediatric Lower Limb Deformities: Principles and Techniques of Management. 2024. p. 307-35.
2. Mir B, Gaber K, Ghali D, Merabia BG, Lin C, Kishta W. Developmental foot deformities in patients with connective tissue disorders. JBJS Rev. 2023;11(2):e22.
3. Rampal V, Giuliano F. Forefoot malformations, deformities and other congenital defects in children. Orthop Traumatol Surg Res. 2020;106(1):S115-23.
4. Butterworth ML, Marcoux JT, editors. The pediatric foot and ankle: diagnosis and management. Cham: Springer Nature; 2019.
5. Shah A, Bohn DC, Heest AE, Hu CH. Congenital Upper Limb Differences: Current Concepts over 5 Years of Literature. J Bone Joint Surg Am. 2023;10-2106.
6. Petit L. Malpositions et malformations congénitales du pied chez le nourrisson. Sages-Femmes. 2024.
7. Zakrzewski A, Jain VV, Robbins C. Etiology of Lower Limb Deformity. In: Pediatric Lower Limb Deformities: Principles and Techniques of Management. Cham: Springer International Publishing; 2024. p. 3-17.
8. Shah A, Bohn DC, Van Heest AE, Hu CH. Congenital upper-limb differences: a 6-year literature review. J Bone Joint Surg Am. 2023;105(19):1537-49.
9. Ramachandran M, Firth GB. Normal Lower Limb Variants in Children. In: Postgraduate Pediatric Orthopedics: The Candidate's Guide to the FRCS (Tr&Orth) Examination. 2024. p. 15-24.
10. Tan TSE, Teo ELHJ, Peh WC. Congenital and Developmental Disorders of the Foot and Ankle. In: Imaging of the Foot and Ankle: Techniques and Applications. Cham: Springer International Publishing; 2023. p. 91-131.
11. Bermudez BE, de Oliveira CM, de Lima Cat MN, Magdalena NI, Celli A. Gastrointestinal disorders in Down syndrome. Am J Med Genet A. 2019;179(8):1426-31.
12. Ostermaier KK. Down syndrome: Clinical features and diagnosis. UpToDate. Waltham (MA): UpToDate Inc.; 2019 [cited 2018 Feb 4].
13. Ostermaier KK, Drutz JE. Down syndrome: management. UpToDate. Waltham (MA): UpToDate Inc.; 2021.

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Informed consent. *Since child is less than 18 yr old and can not give consent, the assent has been obtained from patient's mother. Other requirements for original articles are not applicable since this is a case report .*

Data availability statement. *Data sharing not applicable to this article as no datasets were generated or analyzed during the current study.*

Abbreviation. *FGF – Fibroblast growth factor, DRS – Duane retraction syndrome.*