

# Waardenburg Syndrome – A Rare Case with Facial Paralysis and Chronic Otitis Media

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**Abstract:** *Waardenburg syndrome is a rare inherited disease characterized by a varying degree of deafness, heterochromia of the iris, depigmentation of the skin and a white hair forelock. To our knowledge there are a few reports in the literature about the association of Waardenburg syndrome and facial paralysis. We present a case of 8 years old boy with a clinical history of chronic otitis media and facial paralysis.*

**Keywords:** Waardenburg syndrome, facial paralysis, chronic otitis media, clinical case

## 1. Introduction

Waardenburg syndrome (WS) is an inherited autosomal dominant or autosomal recessive disease, named after the Dutch ophthalmologist Petrus Johannes Waardenburg. In 1951 he described a patient with hearing loss, lateral displacement of the inner canthi of the eyes and pigmentary anomalies of the iris<sup>1</sup>. The prevalence of the WS is estimated about 1:42000 among the general population, representing one of the most frequent (2-5%) etiological factors for inherited sensorineural hearing loss<sup>2</sup>. WS affects all races, without any sex predilection. The disease is characterized by a variable clinical presentation due to the different gene penetration and expression, defining 4 major types and 10 subtypes<sup>3</sup>. WS type 1 and WS type 2 are the most frequently encountered types of the disease, WS type 4 is less common and the WS type 3 is registered extremely rare<sup>4</sup>.

## 2. Case Presentation

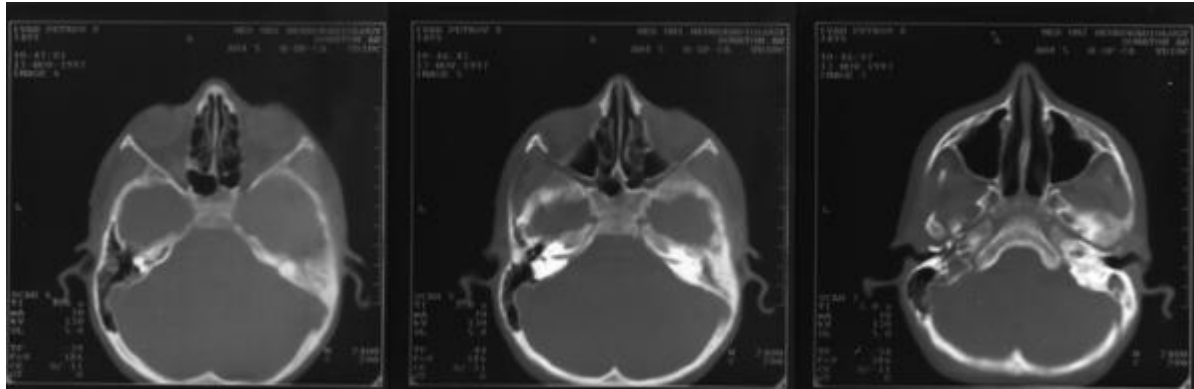
An 8 years old boy was referred to the ENT outpatient clinic with a history of purulent secretion from his right ear since one month, without pain and temperature. A year ago a peripheral paralysis of the right facial nerve was diagnosed and treated conservatively without full recovery. The physical examination reveals the typical clinical features of Waardenburg syndrome. The child has white forelock in the frontal area and zones of depigmentation on the trunk and extremities. We diagnose hypoplasia of the nasal alar cartilage, broad nasal bridge and an increased intercanthal distance (dystopia canthorum). The other family members (parents and siblings) bear also the clinical signs of the disease (Fig. 1)



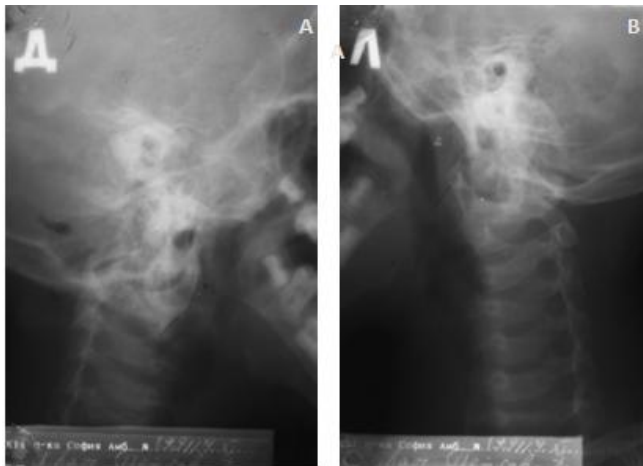
**Figure 1:** The patient (A), his mother (B) and his sister (C) present with the typical facial characteristics of Waardenburg syndrome.

The otomicroscopic exam reveals a purulent secretion in the external auditory canal, infiltrated tympanic membrane and presence of a soft tissue mass, eroding the posterior canal wall and invading the external ear canal lumen. The imaging of the temporal bone, conducted by both computer tomography (axial scan) (Fig. 2) and conventional x-ray

(Schuller projection) (Fig. 3), shows radiological signs of poorly-pneumatized right mastoid bone, bone erosion and demineralization of the mastoid trabeculae. The presence of rounded soft tissue mass inside the right mastoid was demonstrated, accompanied by otosclerotic changes.



**Figure 2:** CT axial scan (A) and conventional Schuller projection of the right (B) and left (C) temporal bones.



**Figure 3:** Conventional Schuller projection of the right (A) and left (B) temporal bone.



**Figure 4:** Photographs of the eyes of the patient (A), his mother (B) and his sister (C) with dystopia canthorum.

There were no laboratory signs of an acute infection (leukocyte number and erythrocyte sedimentation rate in normal references). The urine analysis showed solitary crystals of uric acid and few erythrocytes. Surgery was performed under general anesthesia using transmeatal approach. After elevating the tympano-meatal flap, a standard attico-antrotomy was conducted exploring the tympanic cavity filled with cholesteatoma and granulation tissue with increased density, extending backwards and invading the mastoid antrum. The stapes suprastructures, as well as the long process of the incus were melted. Only the short process and the body of incus were preserved and encapsulated by granulations. The Fallopian canal was eroded at the level of the 2<sup>nd</sup> genu of the facial nerve along a 1 cm length. All pathological tissue and eroded structures were eliminated from the tympanic cavity and mastoid

antrum, followed by plastic recovery of the canal wall. After a smooth postoperative period the patient was discharged from hospital with an improvement.

### 3. Discussion

The diagnosis of Waardenburg syndrome is based on a clinical evaluation of specific signs, which are subdivided into two groups – major and minor<sup>5</sup>. Major criteria are – congenital hearing loss, pigmentary disturbances of the iris, white forelock, dystopia canthorum and affected first degree relative. Minor criteria are respectively – hypopigmentation of the skin, synophrys (eyebrows which meet), broad nasal bridge, hypoplasia of the nasal alar cartilage and premature graying hair. Usually the diagnosis of WS type 1 requires 2 major or 1 major with 2 minor criteria<sup>6</sup>. For WS type 2 diagnostic are 2 major criteria (excluding dystopia canthorum). Waardenburg type 3 (Klien-Waardenburg) fulfills the same diagnostic criteria as WS type 1 but including musculoskeletal abnormalities<sup>7</sup>, while in WS type 4 (Waardenburg-Shah) typical type 1 features coexist with Hirschsprung disease (autosomal recessive inheritance). Different types are associated with different mutations affecting distinctive genes, defining different clinical presentations. WS type 1 and type 3 are related to PAX 3 gene mutation, responsible for pigmentation of the skin and proper craniofacial and musculoskeletal development<sup>3</sup>. WS type 2 is associated with MITF gene mutation that controls function of melanocytes and WS type 4 is connected with SOX10 gene defect which control neural crest cells functioning and formation of enteric nerves<sup>8</sup>. The sensorineural hearing loss is one of the most frequent, but not mandatory diagnostic criteria. It has been reported up to 69% in WS type 1 cases and encountered in approximately 87% of WS type 2<sup>2</sup>. For determination of dystopia canthorum an estimation of Waardenburg index (W index) has been implemented. If the total score exceeds 1.95 the result is consistent with the diagnosis of Waardenburg syndrome. To calculate the W index, a measurement of the inner canthal distance (a), the interpupillary distance (b) and the outer canthal distance has been made. We digitalized the photographs using scanner and submit them for further processing with the UTHSCSA Image Tool 3 – a freeware for image analysis. The results have been used for further calculation using the following formulations:

$$X = (2a - 0.2119c - 3.909) / c; Y = (2a - 0.2479b - 3.909) / b; W = X + Y + a/b, \text{ where } W \text{ is final } W \text{ index. For our patient the}$$

score was 2.75, 2.69 for his mother and 2.62 for his sister respectively, all exceeded the cut-off value of 1.95. The combination of more than 2 major criteria (white forelock, dystopia canthorum and affected first degree relative) and 2 minor criteria (broad nasal bridge, hypoplasia of the nasal alar cartilage) is certain clinical evidence for WS type 1 diagnosis. To our knowledge there are few reports in the literature demonstrating coexistence of Waardenburg syndrome and facial paralysis<sup>9 10 11 12</sup>. We couldn't find any reported clinical case of WS with chronic otitis media.

#### 4. Conclusion

Following the strict Waardenburg Syndrome Consortium Criteria, a proper diagnosis of the WS is reliable and conveniently implemented into daily clinical practice of the otorhinolaryngologists. The close interdisciplinary collaboration between representatives of different clinical specialties is essential for effective and opportune diagnosis of the Waardenburg syndrome.

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