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KLIPPEL-FEIL SYNDROME

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SUMMARY

Introduction

Klippel-Feil Syndrome is a complex condition, characterized by fusion of cervical vertebrae 2 and 3; however, it has been shown in several studies that fusion of the vertebrae also affects different cervical vertebrae. It is caused by a failure of the normal division or segmentation of the cervical vertebrae in early fetal development. This anatomical variant can lead to chronic headaches, limitation of neck movement and pain in the neck muscles. In addition, it may manifest neurological symptomatology (1)(2).

The aim of this literature review is to consider this malformation as one of the main differential diagnoses in patients who present neurological symptoms or a history of trauma; since, as has been shown, the presence of this malformation can be confused with the presence of a cervical fracture; therefore, patients who present with clinical or imaging alterations need to be carefully evaluated to confirm or rule out the presence of this pathology.

Conclusions

Klippel-Feil, being a very rare pathology, is often forgotten, so the doctor must remember the most important clinical-epidemiological characteristics, since this pathology can be considered as a differential diagnosis in patients with a pathological condition located in the cervical region; in addition, this pathology should be considered when the patient has systemic pathologies, especially of the renal type.

KEY WORDS: *Klippel-Feil syndrome, cervical spine, congenital spinal fusion, radiological abnormalities.*

INTRODUCTION

This pathology occurs due to defective segmentation, occurring between the 3rd and 8th week of embryonic development at gestation, caused by failure of normal segmentation or formation of the cervical somites. Interestingly, approximately 50% of patients with Klippel-Feil

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will have concurrent scoliosis. Fifty percent may have atlanto-axial instability, 30% will have renal disease and 30% will be deaf (3)(4).

AETIOLOGY

It has been hypothesized that vascular abnormality, global fetal insult, primary neural tube complications or related genetic factors may lead to the development of this condition. In addition, mutations in the GDF6, GDF3 and MEOX1 genes may cause this pathology; for example, GDF6 properly forms bone, while GDF3 is necessary for bone development. MEOX1 regulates the separation of the vertebrae. Therefore, GDF6 and GDF3 abnormalities are inherited in an autosomal dominant pattern, and MEOX1 mutations are autosomal recessive (5).

EPIDEMIOLOGY

This syndrome occurs in approximately 1 in 40,000 to 42,000 newborns, with a slight preference for females. It should be mentioned that asymptomatic pediatric patients, who do not undergo radiological imaging of the neck and have no obvious physical deformity, are likely to grow into adulthood unaware of their condition (6).

CLINICAL MANIFESTATIONS

This includes a clinical history, physical examination and a detailed family genetic history. It should be remembered that this syndrome may predispose to congenital spinal stenosis, whereby a relatively low impact or low energy injury can lead to significant neurological deficits (7).

Physical examination usually demonstrates a shorter neck stature and a lower hairline. Neurological symptoms that may manifest are radiculopathy and myelopathy (8). There is a classic clinical triad present in up to 40-50%: low hairline, short neck and restricted neck movement; however, this is only present in 50% of patients with Klippel-Feil syndrome. (9)

Laboratory tests are used to rule out other conditions and assess organ dysfunction. These include tests for cardiac, gastrointestinal and urinary disorders; along with this, an echocardiogram, renal ultrasound and intravenous pyelogram, respectively, may be performed. An audiological evaluation is also important (10).

Imaging evaluation of the cervical spine is performed with X-ray, computed tomography and magnetic resonance imaging. A thorough evaluation of the cervical spine is important before proceeding with procedures in the cervical region due to the risk of atlanto-axial subluxation and cranio-vertebral dislocation to avoid spinal cord injury (10).

X-Rays

This study demonstrates fusion of the vertebral bodies, facets and even the spinous processes. The examination should include anteroposterior, lateral and odontoid projections in flexion and extension. These studies assess the stability of the atlanto-axial, atlanto-occipital and sub-axial joints. Imaging of the thoracic and lumbar spine should be performed, as these may illustrate scoliosis, spina bifida or hemi-vertebrae (10).

Magnetic Resonance Imaging

It is useful to assess the integrity of the spinal cord, disc space, nerve tracts, ligaments and other soft tissue structures or when neurological deficits are present; or to rule out other spinal cord anomalies such as Chiari malformations and diastematomyelia (10).

Computed Axial Tomography

Diagnosis by tomography is very good, especially when used with 3D reconstruction, as it allows the characteristics of Klippel-Feil Syndrome to be highlighted and manifested, among which are mainly the anomalies of the vertebrae and ribs (11).

TREATMENT

Non-operative management consists of symptom management. For patients with 1 or 2 level fusions below C3, monitoring and conservative treatment is sufficient. When there is fusion above C3, especially at the occiput, contact sports should be avoided and are more likely to be symptomatic and prone to risk of spinal injury. Operative management is only performed in patients with persistent neurological symptomatology, myelopathy, new onset muscle group weakness and documented spinal instability are candidates for surgery. Spinal deformities and instability drive surgical decisions (12) (13).

The prognosis of the disease depends on the Samartzis classification:

- Type I: congenital single level fusion of the cervical segment
- Type II: multiple congenitally fused, non-contiguous, congenitally fused segments
- Type III: multiple congenitally fused contiguous segments in the cervical region.

Samartzis et al. noted that, over an eight-year period, approximately two-thirds of patients with Klippel-Feil syndrome had no symptoms. Those with a type I deformity had more axial symptoms, and with type II and type III were the patients who developed myelopathy and radiculopathy (13) (14).

SOME CLINICAL STUDIES AND CASES TO CONSIDER

In a retrospective, linear, descriptive and observational study of patients with Klippel-Feil syndrome, it was found that, of the 46 patients, 24 were female and 22 male, with an average age between 1 month of birth and 14 years, and all cases were sporadic. As for the relationship with heart disease, after performing an echocardiogram, it was found that the most frequent were: Atrial Septal Defect, Ventricular Septal Defect and Pulmonary Stenosis. No patients were found to have died as a result of this pathology (15).

A clinical case reports a 5-year-old female patient with a physical examination showing a short neck, low posterior hairline, limitation of lateralisation movements, for which a cervical X-ray was performed showing fusion blocks between C1-2-3, C4-5 and C6-7; the study was complemented by a computerized axial tomography of the thorax showing multiple hemi-vertebrae in the upper third of the thoracic vertebrae corresponding to ribs I-IV (14).

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The clinical case report of a 26 year old female patient with a history of hypothyroidism and hiatal hernia, with the following symptoms: retronasal mucous secretion and swallowing problems, with a physical examination showing: low posterior hairline, short neck and some limitation

The patient was suspected of having Klippel-Feil syndrome. A simple lateral neck X-ray was performed, where fusion of the vertebral bodies and posterior cervical arches at the level of C5-C6 was identified. The diagnosis was confirmed with a computed axial tomography of the neck and skull, which showed fusion of the cervical vertebrae and a left Haller's cell was identified as an anatomical variant, respectively. In addition, cardiac, pulmonary, nervous and renal malformations were ruled out (16).

Another clinical case report of a 52-year-old woman with a history of arterial hypertension and recurrent episodes of cervicalgia, with no history of trauma, with the following symptoms: cervicalgia of one month's evolution with mechanical characteristics, non-radiating, which improved with rest and associated dizziness. Physical examination revealed: short neck and pain on palpation of the cervical paravertebral musculature, without cervico-dorsal apophysalgia on palpation. Limitation of cervical hyperextension and rotation. A simple X-ray of the cervical spine was requested, showing synostosis at C6-C7, confirming the diagnosis of Klippel-Feil syndrome. Magnetic resonance imaging confirmed the diagnosis and showed the absence of neurological complications secondary to the anatomical alterations due to this syndrome (17).

CONCLUSIONS

Although Klippel-Feil syndrome is a very infrequent pathology, it is necessary to always keep it in mind and take it into account, because it is characterized by being a differential diagnosis of several entities that a patient may present. In most cases, this cervical alteration is usually diagnosed occasionally, sporadically and independently of the reason for the patient's admission and treatment. However, the patient may develop symptoms related to this syndrome, which is why the corresponding speciality (traumatology, cardiology and neurosurgery) must always be consulted for its control and management.

FINAL STATEMENT

This review is based on an article by Santiago Vintimilla and María Antonieta Flores called “Síndrome de Klippel-Feil. Revisión Bibliográfica”, whose authors authorized the translation and rewriting from the Spanish language version to the english language version.

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