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Case Report

Parry-Romberg syndrome: A case report and literature review☆,☆☆,★,★★

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ABSTRACT

Parry-Romberg syndrome (PRS) is a rare neurocutaneous and craniofacial disorder characterized by progressive hemifacial wasting and atrophy that predominantly affects children and young adults, with an estimated prevalence of 1 in 700,000 individuals. Despite its rarity, PRS poses significant challenges for patients, their families, and healthcare providers due to its unpredictable course and potential functional and aesthetic impairments. The main aim is to provide a comprehensive overview of PRS, encompassing its clinical features, pathogenesis, and management techniques. We present a case of PRS in a 9-year-old female with pronounced facial asymmetry, with marked wasting and atrophy involving the entire right side of the face. CT scan revealed right sided hypoplasia of maxilla, mandible, and zygomatic arch with enophthalmos of right eye. MRI showed right temporalis, medial and lateral pterygoid, masseter, risorius, buccinator, zygomaticus major and minor, levator labii superioris, levatorangulioris and orbicularis oris muscles atrophy. The clinical presentation of PRS typically involves progressive facial atrophy, predominantly affecting the subcutaneous tissues, muscles and bones. Patients may experience various symptoms as the condition advances, including facial asymmetry, hemifacial pain, dental and ocular abnormalities and neurological manifestations. The exact etiology of PRS remains unknown, although autoimmune, genetic and vascular factors are likely contributors. Treatment of PRS needs a multidisciplinary approach involving dermatologists, plastic surgeons, neurologists, ophthalmologists, and dental specialists. Treatment options aim to alleviate symptoms, im-

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prove function and address cosmetic concerns. Surgical interventions such as autologous fat grafting, facial reconstructive procedures and orthognathic surgery have restored facial symmetry and function. Additionally, nonsurgical modalities, including botulinum toxin injections, prosthetic devices and dental interventions, may offer symptomatic relief and enhance overall quality of life.

Introduction

Parry-Romberg syndrome (PRS) is a rare sporadic neurocutaneous and craniofacial disorder characterized by progressive hemifacial wasting and atrophy of the skin, muscles and bone, sometimes involving the central nervous system [1] and sometimes manifests as focal scleroderma. It was first described independently by Caleb Hillier Parry in 1825 and Moritz Heinrich Romberg in 1846 [2,3]. PRS predominantly affects children and young adults, with an estimated occurrence rate of 1 in 700,000 individuals. PRS is characterized by the gradual and unilateral loss of subcutaneous fat, muscle tissue and bone on one side of the face. The atrophy typically begins in the prepubertal period, progressing slowly over months to years and stabilizing after reaching a variable degree of severity. Facial asymmetry is the hallmark feature of PRS, leading to aesthetic concerns and potential functional impairments. The pathophysiology of PRS is the hypothesis of meningoencephalitis with vasculitis and chronic vasomotor disorder causing sympathetic nervous system hyperactivity. The clinical presentation of PRS extends beyond facial changes, as patients may experience a wide range of symptoms. A significant proportion of individuals report hemifacial pain, which can be chronic and debilitating.

Additionally, dental abnormalities such as malocclusion, tooth eruption disturbances and periodontal disease were observed in PRS. Ocular manifestations, including enophthalmos, ptosis and uveitis, may also be present, further contributing to the complexity of the syndrome. Neurological manifestations, such as seizures, migraine-like headaches and cognitive impairments have been reported in some cases, suggesting a potential central nervous system involvement. Understanding the etiology of PRS is critical for developing targeted therapeutic approaches and effective management strategies. By consolidating current knowledge and identifying gaps in understanding, we aim to enhance awareness and promote further research into this rare and enigmatic syndrome. Improved insights into PRS will ultimately contribute to more accurate diagnosis, appropriate treatment interventions and enhanced quality of life for affected individuals.

Case presentation

A 9-year-old female child presenting with right hemifacial alteration characterized by progressive hemifacial atrophy and deformity for the past 6 years. Past medical history is overall good health until the age of three years. At that time, her parents noticed a blackish discoloration on her right cheek, which gradually progressed over time. By age 6 years, the atrophy had encompassed the entire right side of her face, reaching a stable phase where further progression ceased (burnt-out phase).

Physical examination of the patient revealed pronounced facial asymmetry, with marked wasting and atrophy involving the entire right side of the face.

We proceeded with Computed tomography (CT) Face with Multi-planar reformatted (MPR) images, Three-dimensional (3D) Volume rendered (VR) images, and Three-dimensional (3D) Surface shaded display (SSD), which showed (Figs. 1–3) facial asymmetry with underdeveloped right hemifacial bony and soft tissue structures:

- **Zygoma and Zygomatic Arch:** Right zygoma malformed, hypoplasia. Right zygomatic arch hypoplasia.
- **Maxilla:** Right maxilla, maxillary antrum, medial and lateral pterygoid plates hypoplasia. Right hemi-maxillary dental crowding.
- **Mandibular:** Hemi-mandibular hypoplasia (condylar, coronoid processes, ramus, body and para-symphysis mentis). Right deviation of the chin.
- **Ocular:** The right eye/globe is posteriorly displaced with intraconal fat atrophy, causing enophthalmos.
- **Oral cavity and Oropharynx:** The right hemi-tongue exhibited mild atrophic changes and dental crowding in the maxillary and mandibular regions.
- **Salivary glands:** Right parotid and submandibular salivary glands not visualized – the possibility of agenesis or hypoplasia.
- **Otic:** Right external auditory canal bony wall (anterior) hypoplasia.
- **Soft tissue:** Right, temporalis, medial and lateral pterygoid, masseter, risorius, buccinator, zygomaticus major and minor, levator labii superiors, levatorangulioris and orbicularis oris muscles atrophy. Right facial subcutaneous fat volume loss and skin thinning. Right frontotemporal scalp thinning.

Pre-operative Magnetic resonance imaging (MRI) Face was done which showed (Fig. 4) ipsilateral right hemi-facial atrophy (skin, subcutaneous tissues, cartilaginous, and bony structures) causing facial asymmetry. Brain parenchyma appeared normal with no signs of altered signal intensity. No evidence of brain atrophy.

Given the extensive skeletal and soft tissue abnormalities identified in this case, the patient's condition aligns with the characteristic features of Parry-Romberg syndrome (PRS). The complex nature of the syndrome, affecting both bone and soft tissue structures, necessitates a multidisciplinary approach

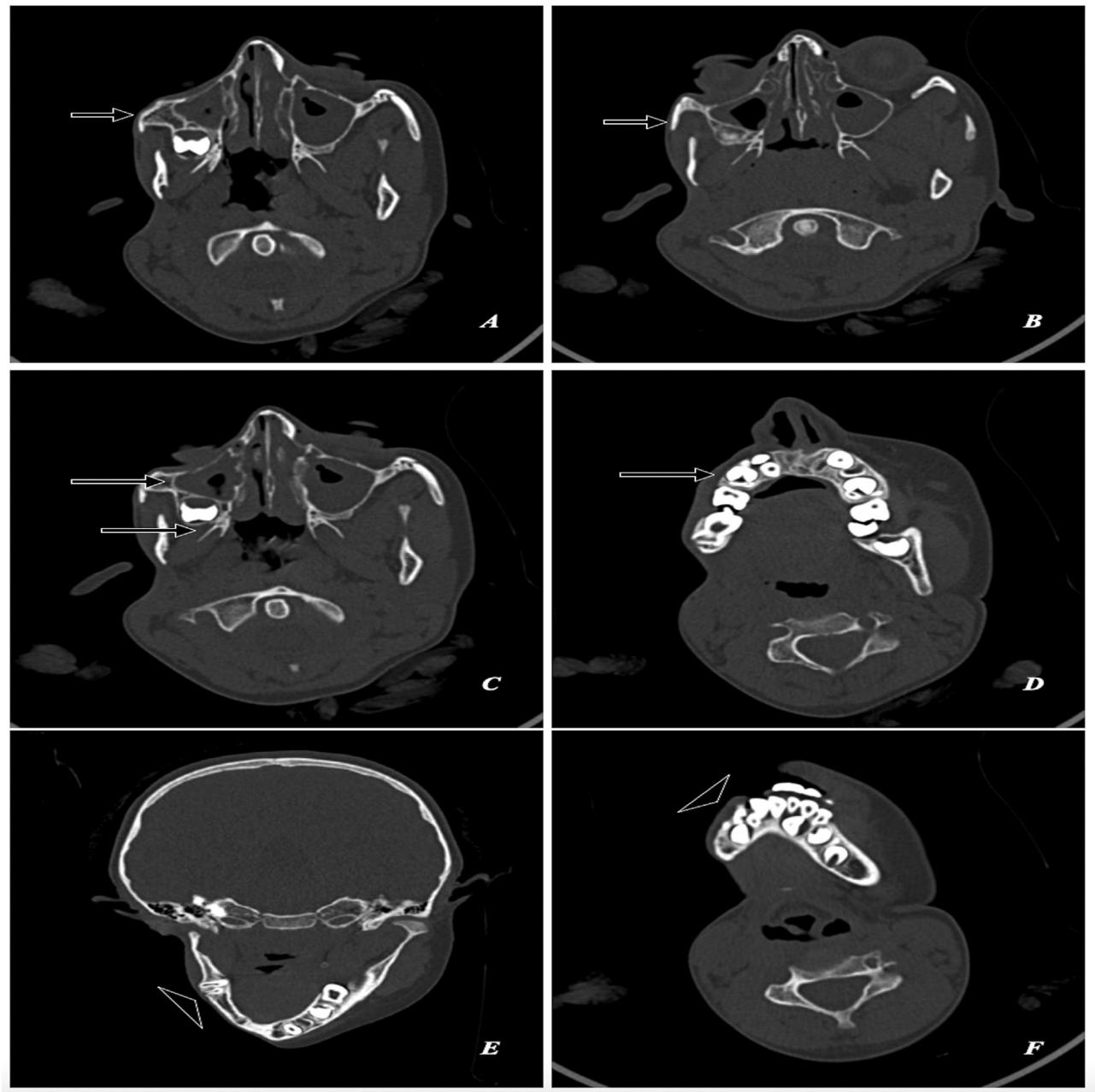

Fig. 1 – (A, B, C, D, E, F): Pre-operative computed tomography (CT) Face: Multi-Planar Reformatted (MPR) images (A, B, C, D - Axial, E - Coronal, F - Axial sections in bone window) *show right zygoma, zygomatic arch malformed, hypoplasia* (short black arrows), *right maxilla, maxillary antrum, medial and lateral pterygoid plates hypoplasia, right hemi-maxillary dental crowding* (long black arrows), *right hemi-mandibular hypoplasia (condylar, coronoid processes, ramus, body, and para-symphysis mentis), and right deviation of the chin* (large black arrowheads) *causing facial asymmetry.*

involving dermatologists, plastic surgeons, orthodontists, and other specialists to provide comprehensive management.

Surgical interventions, such as the previously described free differential thickness adipose-fascial anterolateral thigh flap for soft tissue augmentation, followed by autologous fat grafting, was done to address the soft tissue deficiencies and restore facial volume. Post procedure patient was shifted to pediatric intensive care unit and placed under observation. Post operative period was uneventful. Oral feeds were started for the patient on POD 8. Then we proceded with Computed tomography (CT) Face with Three-dimensional (3D) Surface shaded display (SSD) which showed (Fig. 5) adipo-fascial flap or graft in the post-operative bed of the right hemiface extending from the right temporal or pre-auricular region (10 mm in thickness), the right pre-maxillary region (15 mm in thickness), and the right pre-mandibular region (13 mm in thick-

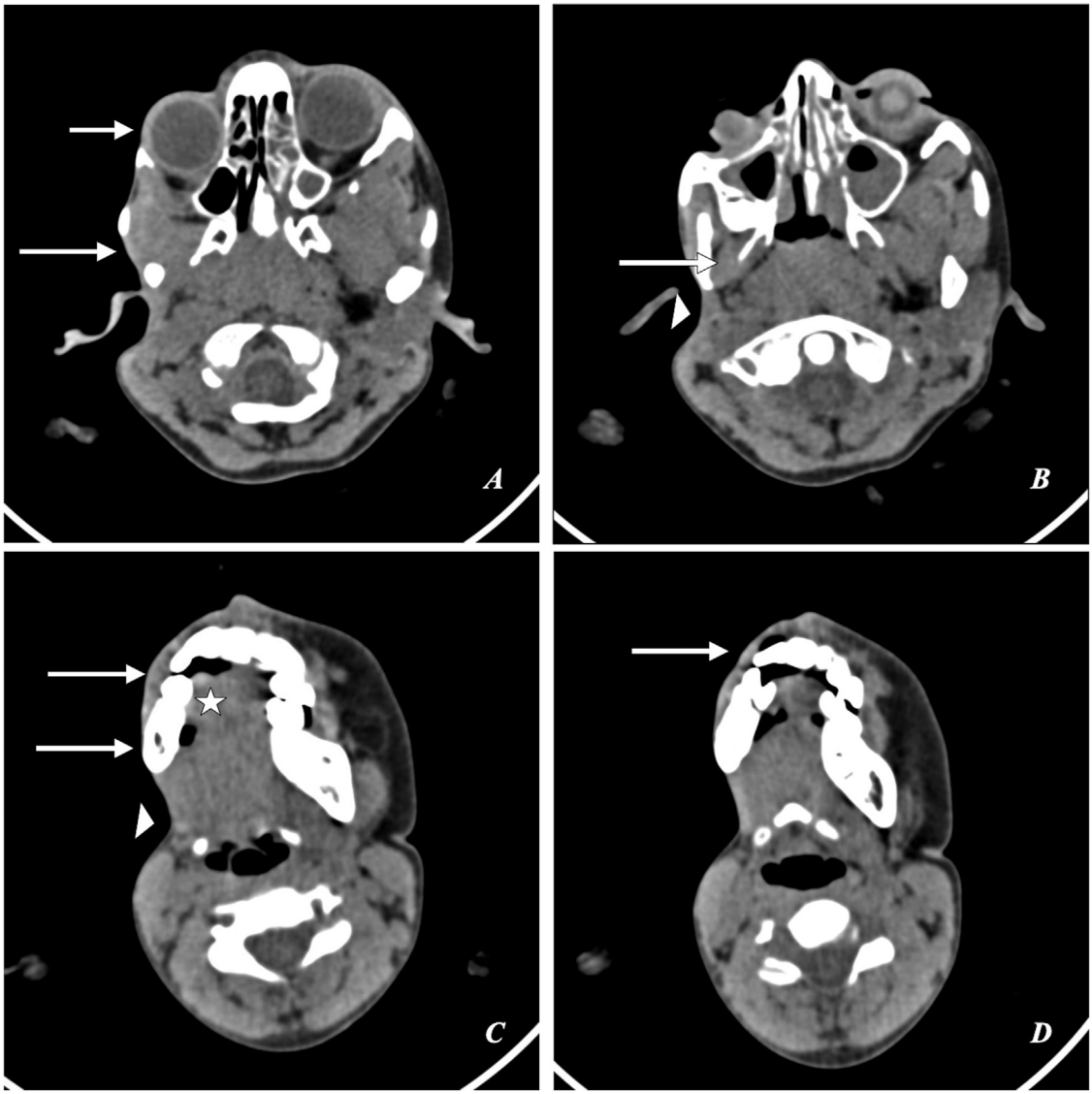

Fig. 2 – (A, B, C, D): Pre-operative computed tomography (CT) Face: (A, B, C, D - Axial sections in soft tissue window) shows *posteriorly displaced right eye/globe with intraconal fat atrophy causing enophthalmos* (short white arrow), *right parotid gland and sub-mandibular gland agenesis* (small white arrowheads), *right temporalis, medial and lateral pterygoid, masseter, risorius, buccinator, zygomaticus major and minor, levator labii superioris and levator anguli oris and orbicularis oris muscles atrophy, right facial subcutaneous fat volume loss, and skin thinning, right fronto-temporal scalp thinning* (long white arrows), and *right hemi-tongue exhibited mild atrophic changes* (white asterisk) *causing facial asymmetry.*

ness). Multiple linear radio-opaque areas (sutures) were noted in the right submandibular region (deep to the adipo-fascial flap). The subcutaneous plane bulk in the right hemiface appeared relatively symmetrical compared with the contralateral side.

Then postoperative Magnetic resonance imaging (MRI) Face was done which showed (Fig. 6) adipo-fascial flap or graft in the postoperative bed of the right hemiface extending from the right temporal or pre-auricular region (10 mm in thickness), the right premaxillary region (15 mm in thickness), and the right premandibular region (13 mm in thickness). T1W and T2W - Multiple linear small hypointensities/areas (sutures) were noted in the right submandibular region (deep to the adipo-fascial flap). The subcutaneous plane bulk in the right hemiface appeared relatively symmetrical compared with the contralateral side.

In conclusion, this case highlights a nine-year-old female with Parry-Romberg syndrome in the burnt-out phase, presenting with extensive skeletal and soft tissue abnormalities involving the right side of her face.

The multidisciplinary management approach aims to address the functional and aesthetic concerns associated with the syndrome, with surgical and orthodontic interventions tailored to the patient's specific needs. Regular follow-up and

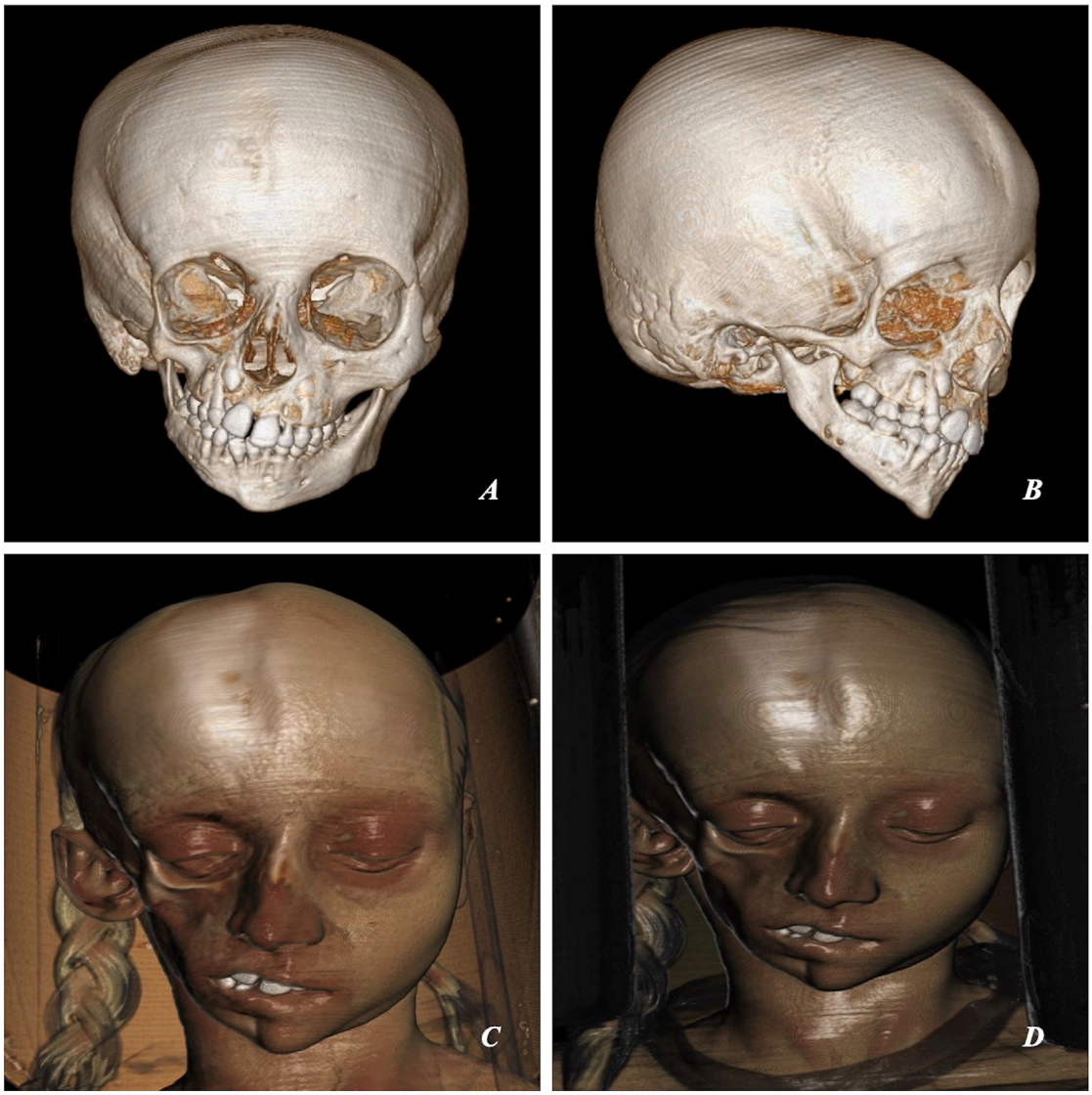

Fig. 3 – (A, B, C, D): Pre-operative computed tomography (CT) Face: Three-Dimensional (3D) Volume Rendered (VR) images: (A - Coronal, B - Right Para-Sagittal) *shows right hemi-facial bones hypoplasia causing facial asymmetry.* Pre-operative Computed Tomography (CT) Face: Three-Dimensional (3D) Surface Shaded Display (SSD) images (C, D - Coronal) *show right hemi-facial soft tissue atrophy causing facial asymmetry.*

long-term monitoring will be necessary to evaluate the outcomes of the interventions and provide ongoing support to the patient.

Discussion

Etiology and demographics

Parry Romberg syndrome (PRS) is an uncommon sporadic condition more common in females with no ethnic or geographic predilection [4]. PRS occurs during the first to second decades of life [5], resulting in slow and progressive facial hemiatrophy, predominantly on the left side [6]. The progression of PRS abruptly arrests and stabilizes and reaches to "burned-out" phase [7]. Diagnosis of PRS mostly depends on the clinical history with imaging studies and histopathology correlation [8].

The etiology of PRS is unknown; it was also postulated that PRS falls in the localized scleroderma spectrum. Many theories have developed over the years to explain the peculiar disease; however, no single approach has been adequate in fully describing and forecasting PRS, and understanding of the underlying pathophysiology remains limited. Causes of PRS include genetic predisposition, embryonic developmental dysfunction, infection, radiation, trauma, metabolic and endocrinologic disorders, and sympathetic cervical ganglion dysfunction. Other include histologic evidence of an inflammatory autoimmune disorder with or without vasculopathy. Clinical improvement with immunosuppressive therapy

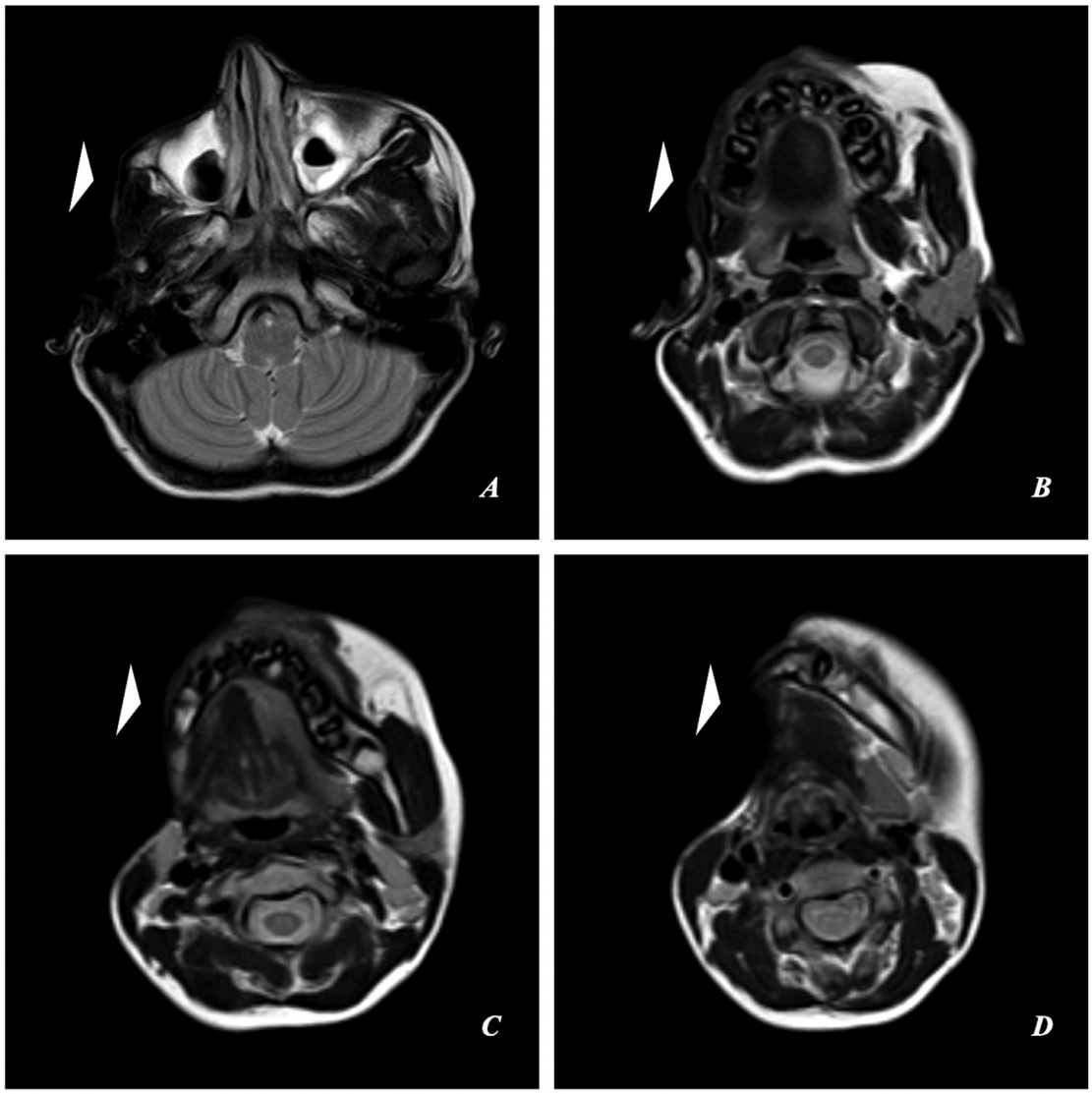

Fig. 4 – (A, B, C, D): Pre-operative magnetic resonance imaging (MRI) - Face: (A, B, C, D - Axial sections of T2 weighted images) *shows ipsilateral right hemi-facial atrophy (skin, subcutaneous tissues, cartilaginous and bony structures)* (large white arrowheads) *causing facial asymmetry.*

during active disease supports an underlying immunologic-mediated process [9].

Clinical findings

About 15%-20% of PRS presents neurologic symptoms that include migraine headaches, facial pain/trigeminal neuritis, focal epilepsy and seizures, facial paresthesia, cranial nerve dysfunction, hemiparesis, and cognitive impairment. Other include facial skin, subcutaneous tissues, muscles, cartilaginous, bony and glandular structures atrophy [10]. PRS affects the maxillary region, perioral region, forehead, teeth, jaw and neck. About 10%-35% of PRS presents ophthalmologic symptoms that usually involve the ipsilateral orbit (enophthalmos, uveitis and retinal or optic nerve alterations). PRS is generally limited to unilateral head and neck, but bilateral diseases reported and involving the trunk and extremities are even rarer. PRS also causes skin discoloration and alopecia [11]. In PRS, teeth involvement is unclear, with smaller teeth with short roots [12].

Imaging findings

The most common Computed tomography (CT) and Magnetic resonance imaging (MRI) facial findings of PRS include varying degrees of hemiatrophy by fat plane obliteration, ipsilateral deviation of the aerodigestive tract and enophthalmos.

The most common CT and MRI intracranial findings of PRS include ipsilateral subcortical calcifications, white matter changes, and ipsilateral focal or diffuse brain atrophy. Less common findings include cortical gyration loss, ventricular dilation, corpus callosum infarct, leptomeningeal thickening and enhancement and hamartomas [13]. Vascular abnormal-

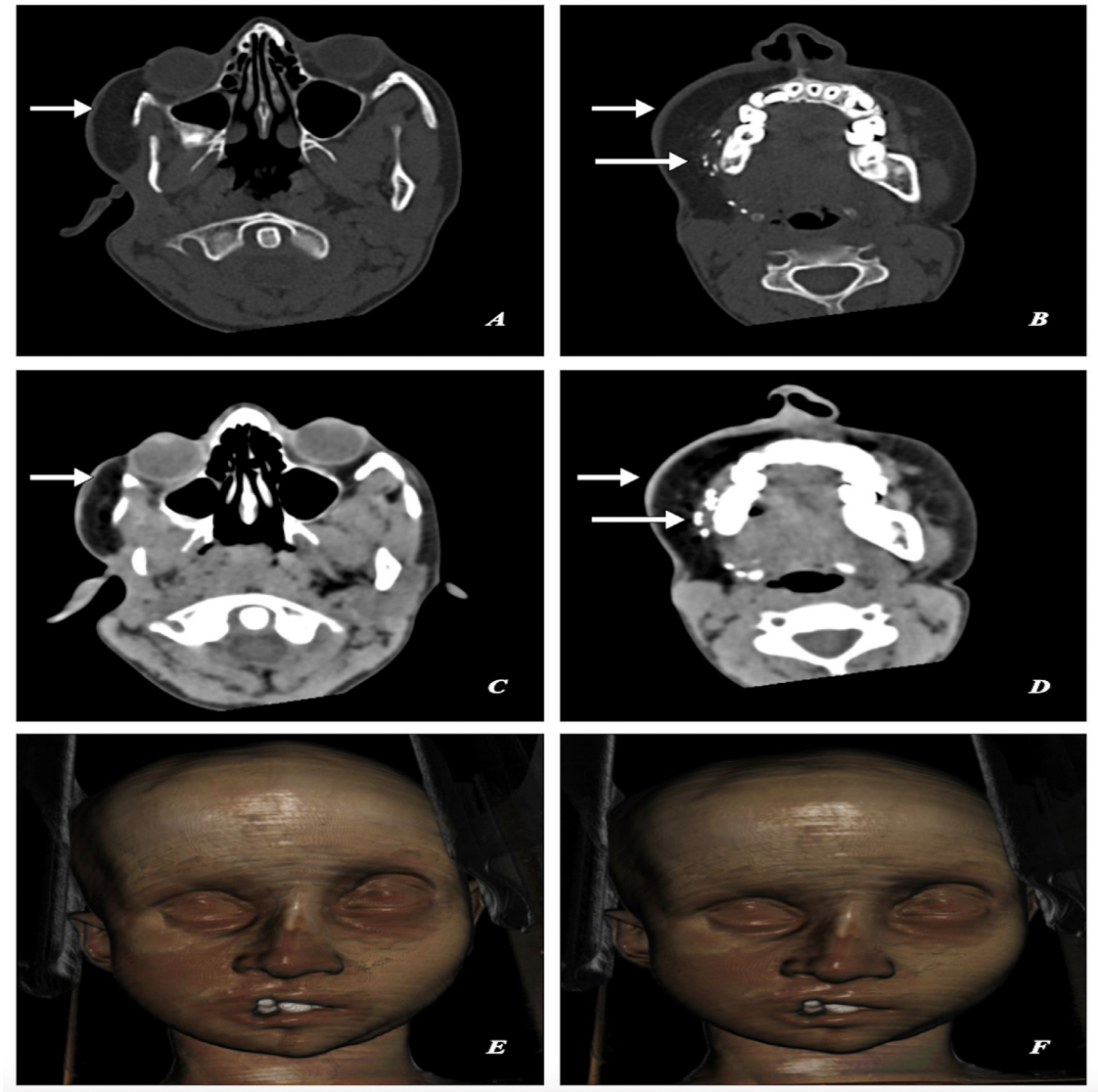

Fig. 5 – (A, B, C, D, E, F): A nine-year-old female child presents with right hemifacial alteration characterized by progressive hemifacial atrophy and deformity for the past 6 years. Post-operative Computed Tomography (CT) Face: (A, B - Axial sections in bone window, C, D - Axial sections in soft tissue window) show an adipofascial flap or graft in the post-operative bed of the right hemiface extending from the right temporal or pre-auricular region, the right pre-maxillary region, and the right pre-mandibular region (small thick white arrow) and multiple linear radio-opaques areas (sutures) in the right submandibular region (deep to the adipo-fascial flap) (large thick white arrow). Post-operative Computed Tomography (CT) Face: Three-Dimensional (3D) Surface Shaded Display (SSD) (E, F - Coronal) shows the subcutaneous plane bulk in the right hemiface appears relatively symmetrical compared with the contralateral side.

ities of PRS such as micro or macro-hemorrhages, malformations, stenoses and aneurysms.

Management

PRS requires a multidisciplinary approach, including physicians, dentists, psychologists, speech and hearing therapists [14]. PRS-related seizures are managed with anticonvulsive therapy and lobectomy. PRS-related scleroderma is treated with immunosuppressive therapies, topical and systemic corticosteroids, immunomodulators and plasmapheresis. Antimalarials, antibiotics, vitamin D3 analogs and penicillamine are treatment options that have demonstrated variable responses [15]. Other aesthetic management methods include cosmetic therapies, including pulse dye lasers, dermal fat grafts, autologous fat grafts, muscle flap grafts, free silicone injections and bone augmentations [16].

Cerebral amyloid angiopathy and chronic systemic hypertension are the differentials.

Differential diagnosis

The differential diagnosis of PRS includes diseases with facial hemiatrophy, such as localized scleroderma, hemifa-

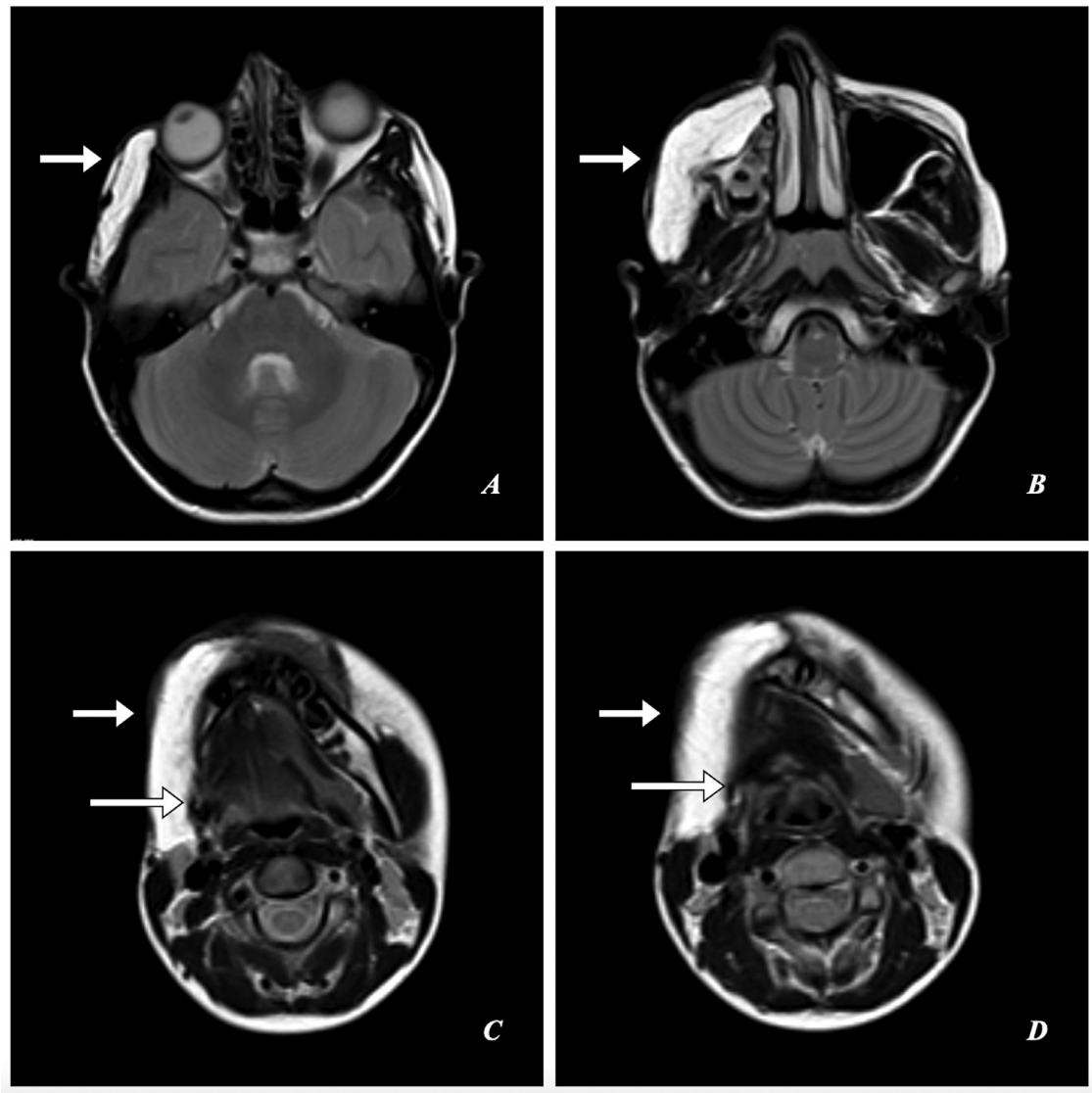

Fig. 6 – (A, B, C, D): Post-operative Magnetic Resonance Imaging (MRI) - Face: (A, B, C, D - Axial sections of T2 weighted images) shows an adipofascial flap or graft in the post-operative bed of the right hemiface extending from the right temporal or pre-auricular region, the right pre-maxillary region, and the right pre-mandibular region (small thick white arrow) and multiple linear radio-opaques areas (sutures) in the right submandibular region (deep to the adipo-fascial flap) (large thick white arrow). The subcutaneous plane bulk in the right hemiface appears relatively symmetrical compared with the contralateral side.

cial microsomia, Goldenhar syndrome and cerebral hemiatrophy, such as Rasmussen encephalitis and Sturge-Weber syndrome [17].

Conclusion

In conclusion, Parry-Romberg syndrome (PRS) is a progressive disorder associated with a broad spectrum of changes ranging from mild to severe involving the skin, subcutaneous fat, muscles, cartilage and bones, neurologic, ophthalmologic and cutaneous manifestations associated with aesthetic, functional and psychological problems. Imaging assessments also facilitate the exclusion of other differential considerations, help monitor disease progression and evaluate post-treatment responses.

Literature review

Some authors have raised the hypothesis of a meningoencephalic inflammation associated with vasculitis associated with PRS. Some authors have postulated that PRS is due to a chronic vasomotor disorder related to sympathetic nervous system hyperactivity, leading to myelin destruction due to associated metabolic lipid alterations [13].

Okumura et al. [18] demonstrated a typical imaging pattern at proton spectroscopy, perfusion imaging, and diffusion ten-

sor imaging, showing lipid elevation, decreased perfusion and a decrease in fractional anisotropy values in the white matter of the affected areas respectively.

Diffusion tractography shows reduced white matter fibers in the affected area due to decreased myelination [19].

DeFelipeet al. [20] reported a PRS case with temporal lobe epilepsy and decreased perfusion in the parietooccipital lobe on the SPECT.

Limitations

- Limited generalizability due to the focus on a single case.
- The retrospective nature of the literature review may introduce selection bias.

Learning points

- Clinical Awareness: Healthcare practitioners must be aware of the various presentations.
- Imaging Importance: Accurate diagnosis and evaluation depend on CT and MRI.
- Multidisciplinary Approach: For complete patient care, cooperation between radiologists, dermatologists, plastic surgeons, neurologists, ophthalmologists, psychologists, physiotherapists and occupational therapists, comprehensive patient education and long-term management is crucial.

Authors contributions

1st author – Dr. Praveen K Sharma, **2nd author** –Dr. Aadithiyan Sekar, **3rd author and Corresponding author** –Dr. Aashika Parveen Amir, **4th author** – Dr. Ajay Lucas Rubben Prabhu.

Patient consent

The authors certify that they have obtained all appropriate patients consent.

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