CONDITION

Pfeiffer syndrome type I

Pfeiffer syndrome type I is a genetic condition affecting skull growth, facial shape, thumbs, and great toes.

WHAT IT IS
Genetic condition affecting skull, face, hands, and feet

BODY SYSTEM
Skull, face, hands, feet, hearing, vision, and breathing

MAIN SYMPTOMS
Unusual head shape, flat midface, broad thumbs, broad great toes

WHAT CAUSES IT
Inherited or new FGFR1 or FGFR2 gene change

HOW IT IS DIAGNOSED
Examination, skull imaging, and genetic testing

MAIN TREATMENT
Craniofacial surgery and coordinated supportive care

CAN IT BE CURED?
No - genetic change remains lifelong

IS IT AN EMERGENCY?
Sometimes - severe breathing trouble or sudden vision change

LONG-TERM OUTLOOK
Often favorable with early, coordinated care

Overview

Pfeiffer syndrome type I is a genetic condition that affects how certain bones develop. It is sometimes called classic Pfeiffer syndrome.

The main feature is craniosynostosis . This means one or more of the flexible joints between a baby's skull bones close earlier than expected. These joints are called sutures. Early closure changes the shape of the head and can limit the space available for the growing brain.

The condition also affects the middle of the face, thumbs, and great toes. The thumbs and great toes are usually broad and may angle away from the other digits. These differences are often visible at birth.

Type I is generally milder than Pfeiffer syndrome types II and III. Children with type I usually do

not have the cloverleaf-shaped skull or severe neurological problems associated with the other types. Intellectual development is often typical, although learning or developmental difficulties can occur.

Early specialist care matters because craniosynostosis may lead to pressure inside the skull, breathing problems, hearing loss, or vision problems. Surgery can create more room for the brain and improve skull or facial structure. The underlying genetic change remains lifelong.

Symptoms

Features may differ between people, including relatives with the same genetic change. Some are clear at birth, while concerns such as snoring, hearing loss, or headaches may become noticeable later.

Common physical features include:

A shallow eye socket can make the eyes appear to bulge. The eyelids may not fully protect the eye surface, which can cause dryness or irritation. In some cases, pressure inside the skull can affect the optic nerves that carry visual information to the brain.

The underdeveloped middle face can narrow the nose and upper airway. This may cause noisy breathing, mouth breathing, snoring, or obstructive sleep apnoea. Sleep apnoea means breathing repeatedly pauses or becomes shallow during sleep.

Fluid behind the eardrum, repeated ear infections, or differences in the ear structures can cause hearing loss. Reduced hearing may affect speech development if it is not recognised and managed.

Headaches, vomiting, unusual sleepiness, declining school performance, or changes in vision can sometimes be signs of raised pressure inside the skull. These symptoms need medical assessment, but they can also have other causes.

- An unusually short, wide, or tall head shape
- A high or prominent forehead
- A flat or underdeveloped middle part of the face
- Eyes that appear prominent or widely spaced
- A small upper jaw, sometimes causing dental crowding
- Broad thumbs and great toes that angle outward
- Partial joining of fingers or toes in some people

Causes and risk factors

Pfeiffer syndrome is caused by a change in a gene involved in bone growth. Most cases involve the FGFR2 gene. Some people with type I have a change in the FGFR1 gene.

These genes provide instructions for fibroblast growth factor receptors. The receptors help control how cells grow and mature into bone. A gene change can make the signal too active, causing skull bones to join too early and affecting bone development elsewhere.

Pfeiffer syndrome follows an autosomal dominant inheritance pattern. This means one changed copy of the gene is enough to cause the condition. A parent with Pfeiffer syndrome has a 1 in 2 chance of passing the gene change on in each pregnancy.

The condition can also result from a new genetic change in an egg, sperm, or early embryo. In that situation, neither parent has the condition. A new change is not caused by anything someone did during pregnancy.

Features can differ even within one family. A genetic result cannot always predict exactly which symptoms a child will have or which treatments will be needed.

Diagnosis

Pfeiffer syndrome type I may be suspected from the shape of a baby's skull and face, along with broad, outward-angled thumbs and great toes. A clinical genetics or craniofacial team will consider these features together rather than relying on one finding.

Skull imaging shows which sutures have closed and helps plan treatment. A low-dose CT scan with three-dimensional reconstruction may be used when detailed images are needed. The clinical team balances the information gained against radiation exposure.

Genetic testing can identify a change in FGFR1 or FGFR2 and confirm the molecular cause. Testing may use a panel that examines several genes linked to craniosynostosis because different genetic conditions can have overlapping features. A negative result does not always rule out a genetic cause.

Assessment also looks for effects beyond skull shape. This may include hearing tests, eye examinations, airway and sleep assessment, developmental review, dental checks, and measurements of head growth. Further brain imaging may be recommended if there are signs of raised pressure, fluid build-up, or other concerns.

During pregnancy, ultrasound may identify an unusual skull shape, but it cannot always determine the exact condition. If a family's genetic change is already known, prenatal diagnostic testing can test specifically for that change.

Treatment and management

Care is usually coordinated through a specialist craniofacial team. The team may include craniofacial and neurosurgeons, geneticists, ear specialists, eye specialists, respiratory or sleep teams, dentists, orthodontists, speech therapists, and psychologists.

Most children need surgery for craniosynostosis. Skull surgery creates space for the growing brain and reshapes the head. The technique and timing depend on the sutures involved, the child's age, skull growth, pressure inside the skull, and the experience of the treating centre.

Some children have a less invasive operation early in infancy, sometimes followed by helmet therapy. Others need open skull reconstruction. Further surgery may be considered as the child grows if pressure rises again or the skull and face require additional correction.

A significantly underdeveloped midface may later be moved forward. This can improve the airway, protect the eyes, and help the upper and lower teeth meet more normally. Not everyone with type I needs this procedure.

Other treatment may include hearing aids or ear procedures, glasses, eye-surface care, treatment for sleep apnoea, orthodontic treatment, and speech or developmental support. Hand or foot surgery is not routinely needed when the broad digits function well.

There is no treatment that removes the genetic change. Management focuses on protecting brain, vision, hearing, breathing, and development while supporting appearance, comfort, and daily function.

Complications

Raised pressure inside the skull is an important possible complication. It may result from limited skull growth, obstructed blood flow, sleep-related breathing problems, or excess fluid around the brain. It can threaten vision or brain function if it is not treated.

Other possible complications include:

Hydrocephalus, which is an abnormal build-up of fluid within the brain, is less typical of type I than of more severe Pfeiffer syndrome, but it can occur.

Medical procedures and anaesthesia may require careful airway planning because of facial and airway structure. Specialist teams take this into account when arranging surgery or other procedures.

Visible facial differences and repeated treatment can also affect confidence, relationships, and emotional wellbeing. Psychological and peer support can be useful at different ages.

- Obstructive sleep apnoea or ongoing airway narrowing
- Eye dryness, corneal injury, or damage to the optic nerves
- Conductive hearing loss from poor movement of sound through the middle ear
- Dental crowding or an uneven bite
- Speech or learning difficulties, sometimes related to hearing
- A return of skull-growth restriction after earlier surgery

Prevention

Pfeiffer syndrome type I cannot be prevented through diet, medicines, or changes made during pregnancy. It results from an inherited or new genetic change.

Genetic counselling can explain inheritance and reproductive options. When the family's gene change is known, options may include testing during pregnancy or testing embryos created through in vitro fertilisation. These are personal choices rather than required steps.

The condition itself cannot be prevented, but regular monitoring can reduce the risk of secondary harm. Hearing checks, eye examinations, sleep assessment, and monitoring for pressure inside the skull can identify treatable problems before they cause lasting effects.

Living with it and what to expect

Childhood often involves regular appointments and at least one skull operation. Some children need several procedures as the skull and face grow, while others need fewer interventions. Follow-up usually continues through growth because airway, vision, hearing, dental alignment, and pressure inside the skull can change over time.

Most children with type I have typical intelligence and attend mainstream school. Some need support for hearing, speech, attention, or specific learning difficulties. Early hearing and developmental assessment can help identify the right support.

Broad thumbs and great toes usually remain throughout life. They often do not prevent walking, writing, sports, or other daily activities. Facial and skull differences may change with growth and treatment but may not disappear completely.

Adults may continue to need hearing care, dental or orthodontic treatment, eye reviews, or assessment for snoring and sleep apnoea. New or worsening symptoms should not be assumed to be part of the condition without assessment.

Many people with type I study, work, build relationships, and live independently. Individual experiences are shaped by the features present, access to specialist care, treatment effects, and emotional support. No single childhood appearance or genetic result can predict a person's full course.

When to get medical help

Keep routine craniofacial follow-up even when things seem stable. Arrange a non-emergency review for persistent snoring, mouth breathing, hearing changes, eye irritation, dental problems, frequent headaches, developmental concerns, or changes in school performance.

Seek urgent medical advice for worsening headaches with vomiting, unusual sleepiness, new balance problems, increasing eye prominence, inability to close an eye, or repeated pauses in breathing during sleep. These symptoms may need prompt assessment for pressure, eye injury, or airway obstruction.

Call emergency services for:

A mild headache, ordinary cold, or stable snoring is not automatically an emergency. What matters is a marked change, severe symptoms, or signs that breathing, vision, or consciousness are affected.

- Severe difficulty breathing, gasping, or blue or grey lips
- Sudden loss of vision
- A seizure, especially a first seizure or one that does not stop
- Collapse, unresponsiveness, or extreme difficulty waking

Common questions

Is Pfeiffer syndrome type I a mild condition?

Type I is usually milder than types II and III, but it still requires specialist care. Craniosynostosis can affect pressure inside the skull, and facial growth can affect breathing, hearing, eyes, and teeth. The term "mild" should not be taken to mean that monitoring or treatment is unnecessary.

Does Pfeiffer syndrome type I affect intelligence?

Intellectual development is often typical in type I. Some children have developmental or learning difficulties, and hearing loss or disrupted sleep can affect speech, attention, and

school progress. Development should be assessed individually.

Will my child need surgery?

Most children with Pfeiffer syndrome type I need surgery for craniosynostosis. The number and type of operations cannot be predicted from the diagnosis alone. Decisions are based on skull growth, pressure, airway and eye protection, age, and the sutures involved.

Is Pfeiffer syndrome inherited from a parent?

It can be. A parent with the condition has a 1 in 2 chance of passing the gene change on in each pregnancy. It can also begin with a new gene change in a child whose parents do not have Pfeiffer syndrome.

What is the difference between Pfeiffer syndrome types I, II, and III?

Type I is the classic and generally less severe form. Types II and III are associated with more serious skull, brain, airway, and neurological problems. Type II includes a cloverleaf-shaped skull. The types describe patterns, but individual features still differ.

Does Pfeiffer syndrome shorten life expectancy?

Type I is often compatible with a typical lifespan, especially when breathing, skull pressure, vision, and hearing problems are recognised and treated. A person's outlook depends on their specific complications and response to care.

Sources

- MedlinePlus Genetics. Pfeiffer syndrome . US National Library of Medicine
- GeneReviews. FGFR Craniosynostosis Syndromes Overview . University of Washington and NCBI Bookshelf
- Mathijssen IMJ, Working Group on Craniosynostosis. Updated Guideline on Treatment and Management of Craniosynostosis . Journal of Craniofacial Surgery . 2020;31(8):e843-e876
- Dias MS, Samson T, Rizk EB, Governale LS. Identifying the Misshapen Head: Craniosynostosis and Related Disorders . Pediatrics . 2020;146(3):e2020015511