CONDITION

Osteopenia - premature infants

Osteopenia of prematurity is reduced bone mineral content in a baby born before the bones have stored enough calcium and phosphorus.

WHAT IT IS
Low bone mineral content in babies born too early

BODY SYSTEM
Bones and mineral metabolism

MAIN SYMPTOMS
Often none, poor growth, fractures, reduced limb movement

WHAT CAUSES IT
Missed third-trimester mineral transfer plus illness and nutrition

HOW IT IS DIAGNOSED
Serial blood tests and sometimes X-rays

MAIN TREATMENT
Mineral-rich feeding, supplements, monitoring, and gentle movement

CAN IT BE CURED?
Sometimes: usually improves as babies grow and mineralize bones

IS IT AN EMERGENCY?
Sometimes: breathing difficulty or signs of fracture

LONG-TERM OUTLOOK
Most improve; some have lower bone density later

Overview

Osteopenia of prematurity means that a baby born early has less mineral in their bones than expected. It is often called metabolic bone disease of prematurity . The condition is most likely in babies born very early or at a very low birth weight.

Calcium and phosphorus give bones much of their strength. A fetus receives large amounts of these minerals from the placenta during the last three months of pregnancy. When a baby is born early, this transfer stops before the bones have stored as much mineral as they normally would.

After birth, it can be difficult to replace those minerals quickly enough. Premature babies may need intravenous nutrition, have trouble tolerating milk feeds, or need treatment for other health problems. Their bones are also growing rapidly, which increases their mineral needs.

Most affected babies do not look unwell because of their bones. The condition is often found through routine blood tests in a neonatal unit. Early recognition allows the care team to adjust nutrition and reduce the risk of fractures and other complications.

Symptoms

Osteopenia of prematurity often causes no clear symptoms at first. Changes in blood test results usually appear before changes can be seen on an X-ray.

Possible signs include:

Fractures can sometimes happen during routine care without a major injury. They may affect the ribs, arms, or legs. However, most premature babies with abnormal bone blood tests do not develop a fracture.

Some findings, such as a soft area of skull bone, can occur in healthy newborns as well. A single physical sign does not confirm osteopenia.

- Slower-than-expected growth
- Tenderness or swelling over a bone
- Moving one arm or leg less than usual
- Crying during handling because of a fracture
- A change in the shape of the chest, wrist, or ribs
- Breathing difficulty in severe cases involving the ribs

Causes and risk factors

The main cause is interrupted mineral transfer from the placenta. The earlier a baby is born, the less time there has been to build calcium and phosphorus stores.

A premature baby's mineral needs may also be greater than the amount initially provided through milk or intravenous nutrition. Human milk has important benefits for premature babies, but by itself it may not provide enough calcium and phosphorus for a very premature baby's rapid growth. This is why neonatal teams often use human milk fortifier or a preterm formula.

Factors that can increase the risk include:

Diuretics help the body remove extra fluid. Some types can also increase mineral loss in urine. These medicines may still be necessary, so the neonatal team balances their benefits with

their possible effects on bone health.

The condition is not caused by ordinary cuddling, feeding choices made by parents, or something a parent did during pregnancy.

- Very early birth or very low birth weight
- Delayed establishment of full milk feeds
- A long period of intravenous nutrition
- Difficulty absorbing nutrients from the intestine
- Liver disease that reduces bile flow, called cholestasis
- Long-term lung disease related to prematurity
- Serious infection or repeated illness
- Limited physical movement during a prolonged hospital stay
- Some medicines, including prolonged corticosteroid treatment or certain diuretics like furosemide or hydrochlorothiazide

Diagnosis

There is no single blood test that confirms osteopenia of prematurity in every baby. Diagnosis usually comes from the baby's history, growth, physical examination, and a pattern of test results over time.

Blood tests commonly include phosphorus and alkaline phosphatase , often shortened to ALP. ALP is an enzyme that can rise when bones are working hard to grow and mineralize. A low phosphorus level combined with a rising or high ALP level may suggest inadequate bone mineralization.

A normal blood calcium result does not rule out the condition. The body can keep blood calcium within its usual range by removing calcium from bone.

Depending on the results, the care team may also check:

Blood tests are often repeated because the trend can be more useful than one result.

X-rays may show thinning bones, changes near the ends of growing bones, or fractures. However, considerable mineral loss can occur before an X-ray looks abnormal. X-rays are therefore more useful when disease is advanced or a fracture is suspected than as an early screening test.

Special bone-density scans can measure bone mineral content, but they are not routinely

practical for small or medically fragile premature babies.

- Calcium, magnesium, and vitamin D
- Parathyroid hormone, which helps control calcium and phosphorus
- Kidney and liver function
- Calcium and phosphorus lost in urine

Treatment and management

Treatment focuses on providing enough calcium, phosphorus, vitamin D, protein, and energy for bone growth. The exact approach is based on the baby's age, weight, feeding method, medical conditions, and test results.

Management may include:

Fortification does not mean that human milk is inadequate or should be stopped. It adds nutrients needed for the unusually rapid growth of a premature baby.

The care team calculates mineral and vitamin intake carefully. Giving more is not always better. An unsuitable balance can affect the kidneys, cause mineral deposits, or interfere with the absorption of other nutrients. Supplements should therefore be used according to the neonatal or follow-up team's plan.

Gentle physical activity may support bone development in some stable premature babies. This can involve carefully guided movements of the arms and legs. It should be taught and supervised by trained neonatal staff rather than started independently.

When a fracture occurs, treatment usually includes careful positioning, pain relief, and limiting movement of the affected area. Premature bones can heal, and surgery is not needed for most uncomplicated fractures.

- Fortifying expressed human milk
- Using a formula designed for premature babies
- Adjusting calcium and phosphorus in intravenous nutrition
- Giving mineral or vitamin supplements when needed
- Monitoring growth and blood test trends
- Reviewing medicines that may affect mineral balance
- Treating feeding, liver, kidney, or absorption problems

Complications

The main short-term complication is fracture. Because premature bones are small and may be poorly mineralized, a fracture can occur with little force. Some fractures are found only on an X-ray taken for another reason.

Severe loss of bone mineral may affect the ribs and chest wall. This can make breathing less efficient, particularly in a baby who already has lung disease.

Other possible complications include reduced growth in length, bone shape changes, and kidney problems related to an imbalance of minerals or supplements. Monitoring is intended to identify these concerns before they become severe.

Babies born very prematurely may have lower bone mineral content during childhood than babies born at term. Research has not shown that every affected baby will develop osteoporosis or frequent fractures later in life. Long-term bone health is influenced by growth, nutrition, physical activity, other medical conditions, and medicines as well as prematurity.

Prevention

Osteopenia of prematurity cannot always be prevented. Early birth stops the normal transfer of minerals through the placenta, and some babies are too unwell to receive full nutrition straight away.

Neonatal care can reduce the risk and severity. This includes providing appropriate calcium and phosphorus in intravenous nutrition, establishing fortified milk feeds when possible, supporting adequate vitamin D intake, and monitoring babies at higher risk.

Care teams may also review medicines that affect bone mineral balance. A necessary medicine should not be stopped simply because it can affect bones.

Parents do not need to avoid normal, gentle contact. Skin-to-skin care and cuddling can usually continue when the neonatal team says the baby is stable. Staff can show you how to lift, hold, dress, and position your baby safely.

Living with it and what to expect

For many premature babies, bone mineralization improves as feeding becomes established, growth continues, and the underlying illnesses of prematurity settle. Blood test abnormalities may improve over weeks or months. Changes seen on an X-ray can take longer to recover.

Some babies leave hospital while still taking a prescribed supplement or receiving fortified milk. The discharge plan should explain what to give, how long to continue it, and when blood tests or growth checks are due. Do not continue, stop, or change supplements without advice, because nutritional needs change as a baby grows.

Follow-up may include measurements of weight, length, and head growth. Some babies need repeat blood tests. Imaging is generally reserved for ongoing concerns, abnormal examination findings, or suspected fractures.

Normal gentle play and movement become important as the baby matures. Once medically safe, age-appropriate activity helps muscles and bones develop together. Children with other movement or growth difficulties may receive support from a physiotherapist or dietitian.

Most children do not have obvious day-to-day bone symptoms after infancy. Some may remain smaller or have lower bone density than peers, especially after extremely premature birth or prolonged serious illness. This does not by itself mean that fractures or osteoporosis are inevitable.

When to get medical help

Arrange routine follow-up if your baby is due for growth checks, blood tests, or a review of milk fortification and supplements. Contact the healthcare team if feeds or supplements are repeatedly missed, difficult to give, or causing concern. These issues usually need planned advice rather than emergency care.

Seek prompt medical assessment if your baby:

Call emergency services if your baby has severe or rapidly worsening breathing difficulty, becomes blue or unusually unresponsive, or appears seriously unwell. These signs can have many causes and require immediate assessment.

If a fracture is suspected, support the limb in the position you found it and avoid repeatedly checking its movement.

- Develops unexplained swelling or tenderness over an arm, leg, or rib
- Stops moving one limb as much as usual
- Cries consistently when a particular area is touched or moved
- Develops a new bend, lump, or change in bone shape
- Has an unexpected setback in feeding or growth

Common questions

Is osteopenia of prematurity the same as osteoporosis?

No. Both involve reduced bone strength, but osteopenia of prematurity happens while a premature baby's bones are growing and have not received enough mineral. Osteoporosis is usually used for a longer-term skeletal condition associated with fragile bones and fractures.

Will my baby's bones become normal?

Many babies build bone mineral as they grow and receive adequate nutrition. Recovery is influenced by how early the baby was born, medical complications, feeding progress, and whether fractures or severe mineral loss occurred. Follow-up checks show how an individual baby's bones and growth are progressing.

Can my baby still have breast milk?

Yes. Human milk remains valuable for premature babies. Very premature babies commonly need a human milk fortifier to add calcium, phosphorus, protein, and other nutrients. The neonatal team can adjust fortification as feeding and growth change.

Does osteopenia hurt my baby?

Low bone mineral itself usually causes no obvious pain. A fracture can cause pain, swelling, crying during care, or reduced movement of a limb. Premature babies may show discomfort in subtle ways, so a new change in behaviour or movement should be assessed.

Is it safe to pick up and cuddle my baby?

Usually, yes. Gentle handling and skin-to-skin care are often encouraged when a baby is medically stable. Neonatal staff can demonstrate supportive lifting and positioning, especially if the bones are very fragile or a fracture has occurred.

Will this affect my child as an adult?

Some people born very prematurely have lower bone mineral density later in life, but the outcome is not the same for everyone. Childhood growth, nutrition, physical activity, health conditions, and medicines all contribute to adult bone health.

Sources

- American Academy of Pediatrics Committee on Nutrition. Abrams SA. "Calcium and Vitamin D Requirements of Enterally Fed Preterm Infants." Pediatrics . 2013;131(5):e1676-e1683.

- Embleton ND, Moltu SJ, Lapillonne A, and colleagues. "Enteral Nutrition in Preterm Infants: A Position Paper From the ESPGHAN Committee on Nutrition and Invited Experts." Journal of Pediatric Gastroenterology and Nutrition . 2023;76(2):248-268.
- Faienza MF, D'Amato E, Natale MP, and colleagues. "Metabolic Bone Disease of Prematurity: Diagnosis and Management." Frontiers in Pediatrics . 2019;7:143.
- Rustico SE, Calabria AC, Garber SJ. "Metabolic Bone Disease of Prematurity." Journal of Clinical and Translational Endocrinology . 2014;1(3):85-91.
- National Institute for Health and Care Excellence. Neonatal Parenteral Nutrition . NICE guideline NG154. Published 2020.