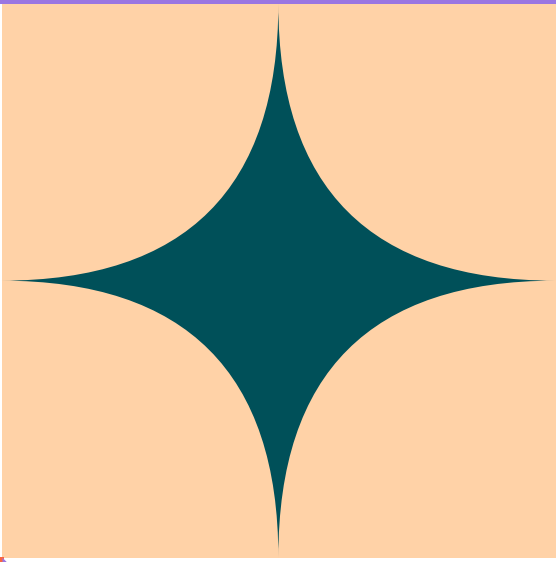


# OSTEOGENESIS IMPERFECTA

The pocket guide for  
adults living with OI



Chloe Morgan  
Dr Laura Wilkinson  
Dr Darren Edwards  
Professor Joy Merrell



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# WHAT IS THIS GUIDE FOR?

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This guide was made to ensure people with OI have access to information about their condition.

The aim of the guide is to allow people with OI to make informed decisions about their care and manage their condition.

## WHO IS THIS GUIDE FOR?

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Although this is mainly aimed at adults with OI this could be used by anyone who wants to learn more about the condition.

You could refer to this in appointments with your healthcare professionals.



## HOW TO USE THIS GUIDE?

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Throughout this guide you will see numbers inside brackets like this (1), these numbers correspond to the hyperlinks included on the References pages. You can use these to read more into topics that are interesting and / or relevant to you.



## WHAT IS OI?

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Osteogenesis imperfecta / Brittle Bone Disease is a genetic condition which results in your body making weaker collagen or not producing enough collagen. (1)

# GENERAL OI INFORMATION

## WHAT DOES COLLAGEN DO?

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Collagen provides the structure to many of the tissues in your body. When it is weak or there is not enough, those tissues are weaker than they should be. (2)

## HOW COMMON IS OI?

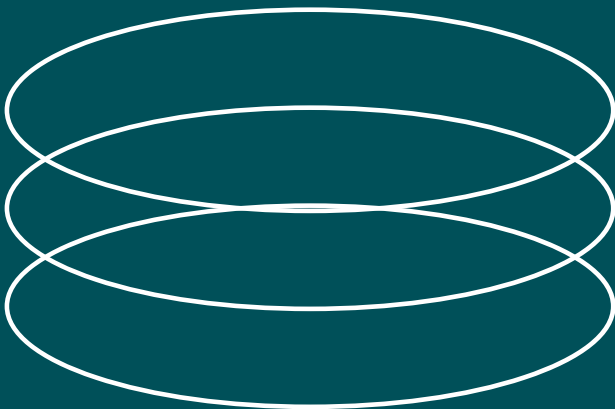
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OI is estimated to affect one in 15,000 people in the UK. This means almost 5,000 people in the UK have OI. (3)

## IS THERE A CURE?

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There is no cure for OI but with treatment people with OI can live very productive lives and be successful. (4)



# OI TYPES

Thanks to genetic testing, more types of OI have been identified in recent years. There are currently 21 identified OI types (5), these range in severity, some cases are very mild and others can be very severe and sometimes fatal. Types I, II, III and IV are the most common and account for 85-90% cases of OI.

This table shows the known types of OI as of January 2023. The severity for each type is shown but this varies for everyone and should be used as a guide only. This also shows the inheritance pattern for each of the types. These patterns of inheritance are explained on the following page of the guide (Genetics - page 6).

Type	Severity	Inheritance	Gene
I	Mild	Dominant	COL1A1/2
II	Fatal	Dominant	COL1A1/2
III	Severe	Dominant	COL1A1/2
IV	Moderate	Dominant	COL1A1/2
V	Moderate	Dominant	IFITM5
VI	Moderate	Recessive	SERPINF1
VII	Severe	Recessive	CRTAP
VIII	Severe	Recessive	P3H1
IX	Severe	Recessive	PPIB
X	Varies	Recessive	SERPINH1
XI	Varies	Recessive	FKBP10
XII	Moderate	Recessive	SP7
XIII	Severe	Recessive	BMP1
XIV	Varies	Recessive	TMEM38B
XV	Moderate	Recessive	WNT1
XVI	Severe	Recessive	CREB3L1
XVII	Varies	Recessive	SPARC
XVIII	Severe	Recessive	TENT5A
XIX	Severe	X-Linked	MBTPS2
XX	Varies	Recessive	MESD
XXI	Varies	Recessive	KDEL2

# GENETICS

Many discoveries have been made in genetics in the last few decades. More is known about OI now as a result of developments in the field of genetics. This brief summary includes some of the key information regarding genetics and OI.

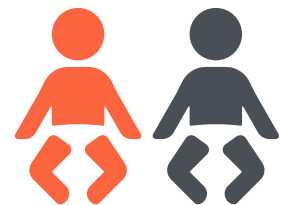
## **CAN OI BE PASSED ON TO CHILDREN?**

OI can be passed on to children. The likelihood of it being passed on depends on the type of gene which it affects.

If you have OI and are pregnant or are considering whether you want to have children, you can be referred for genetic counselling by your GP or by the OI team managing. They will be able to advise you on the options and explain the chances of your child having OI.

## **DOMINANT GENES**

Most cases, 85-90% occur in dominant genes. (6)  
Dominant genes are more common in OI. Only one copy of the gene is needed in order for the person to have OI. Therefore, there is a 50% chance of inheriting it from a parent who has OI. (7)



## **RECESSIVE GENES**

Only 10-15% of OI mutations occur in recessive genes. Two copies of the faulty gene are needed to have a recessive form of OI. This means it would need to be passed on by both parents in order for the person to have OI. If both parents have one recessive OI gene, there is a 25% chance that the child will have OI. (8)

However, people with only one copy of the recessive gene for OI may never know as they would not have OI. This is because they have a healthy version of the gene which cancels out the negative effects of the faulty gene.



## **X-LINKED GENES**

X-linked means the gene is found on the X chromosome. The X and Y chromosomes determine the sex of the person, women have two X chromosomes and men have an X and a Y. Having a mutation on an X chromosome is more likely to affect men than women. Women will likely have a healthy version of the gene on one of the X chromosomes which will prevent the mutated gene from causing disease.

As men only have one X chromosome, they will not have a healthy version of the gene and will therefore have the condition.

# **FRACTURES**

Fractures/ Breaks are common for people with OI and often occur without trauma. Around 25% of lifetime fractures occur during adulthood for people with OI. (9)

## **TYPES OF FRACTURES**

These are some of the types of fractures you might be diagnosed with and what they mean. (10)

<b>Non-displaced</b>	The bone is still in the correct position
<b>Displaced</b>	The bone has moved and is not in the correct position
<b>Closed</b>	The skin is not broken
<b>Open/ Compound</b>	The bone has come through the skin
<b>Comminuted</b>	The bone has broken into small fragments
<b>Hairline/ Stress</b>	A small fracture, may be called a crack in the bone
<b>Greenstick</b>	The bone is broken but not all the way through the bone and may be bent. These are more common in children.
<b>Avulsion</b>	A ligament or tendon has pulled a piece a bone out of the correct position
<b>Pathological</b>	Caused by a disease which weakens the bones

Fractures in people with OI are often missed due to the low bone density and fractures may not be seen until healing begins.

## **HOW ARE FRACTURES TREATED?**

How your fracture is treated will depend on what type of fracture it is. Some fractures won't need any treatment and will be able to heal on their own, some may require the use of a plaster cast or splint to keep the fracture stable. Some severe fractures may need surgery. (11) (12)

Vertebral (spine) fractures are common in OI. More information on how these can be managed and treated can be found on Page 16.

## **WHERE SHOULD I GO FOR TREATMENT?**

NHS advises that;

Minor injury units or urgent care centres deal with fractures in fingers or toes

A&E departments should deal with fractured arms or legs

Call 999 for fractures in the spine or neck, open fractures, pelvic or femur fractures or unstable tibia fractures

# **SURGERY**

Surgery is often part of life for people with OI. Either to resolve fractures, or to correct deformities of the limbs such as bowing. Surgery can improve mobility and prevent fractures. (13)

## **WHAT IS RODDING?**

Rodding surgery involves placing metal rods, often titanium or steel, in the middle of the bone (the medulla) this surgery can also be referred to as intramedullary rodding.

There are many different kinds of rods which can be used, and this will depend on the size and shape of the bone. Most rods will fit into one of two categories: stable rods or telescopic rods. (14)

### **STABLE RODS**

The rods are a fixed length.

Used more in adults as they are no longer growing.

### **TELESCOPIC RODS**

These rods will extend as the bone grows.

Good for children who are still growing but are not used in adults.

Children can still outgrow these rods as they have a maximum length they can extend to.

These rods are susceptible to failure and cannot be left in permanently.

## **HOW LONG DO RODS LAST?**

Unlike replacement joints, rods are not under mechanical stress and do not degrade over time. They can be left in for as long as is needed unless there are complications such as fractures or infections.

There is also a risk rods migrating out of the bone and they can also bend or break.

## **OTHER METALWORK**

Metal plates and screws may also be used in the event of fracturing. There is a risk of stress fracturing around screws in OI bones.

## **OSTEOTOMIES**

An osteotomy involves cutting and reshaping a bone. This can be done to straighten a bone and correct bowing.

Osteotomies may need to be performed before metalwork can be placed if there is bowing in the bone.

# **PAIN MANAGEMENT**

Pain can be either acute or chronic and both types of pain are common for people with OI and there are many ways to deal with it. Acute pain is short term pain which might be from an injury. Chronic pain is when pain lasts for more than six months. Your GP can offer help and advice for chronic pain and there are a number of things they can offer.

## **PAIN MEDICATIONS**

There a number of different medications that are used to treat pain. This table shows the different categories of medications and some examples. This is not exhaustive and not all medications are suitable for everyone. (15)

Non-opioid	Paracetamol	
NSAID's	Ibuprofen	Naproxen
Opioids	Codeine	Morphine
Adjuvant analgesics	Lidocaine	Benzodiazepine

## **WHAT IS A PAIN CLINIC?**

Pain clinics are specialist services which deal with chronic pain. They can offer different medications, injections and therapies such as physical therapies and/or complementary therapies.

Some people who attend pain clinics can be offered a place on a pain management programme. (16)

## **PAIN MANAGEMENT PROGRAMMES**

Pain management programmes teach you how to live with chronic pain. These would be useful for people who do not benefit from the use of pain medications.

The function of these programmes is to teach you coping strategies and how to prevent pain flare ups by better understanding your pain and it's triggers.

The aim of these programmes is to improve quality of life and allow you to take control of your situation and get the most out of life. (17)

# **BISPHOSPHONATES**

Bisphosphonates increase bone mineral density (BMD) and make bones stronger. Possible outcomes of bisphosphonate therapy are reduced pain, fewer fractures and increased mobility but these are not guaranteed. (18)

## **HOW DO BISPHOSPHONATES WORK?**

Bisphosphonates work by reducing how quickly bone is broken down, the reduction in bone breakdown increases bone density and reduces bone fragility.

## **WHO CAN HAVE BISPHOSPHONATES?**

Bisphosphonates are given when bone mineral density is lower than it should be. People with OI often have lower bone density and if it is found that the bones have osteopenia or osteoporosis in addition to osteogenesis imperfecta, then there is an increased risk of fracturing, and you might be offered bisphosphonates.

Not everyone with OI can be given bisphosphonates and you will need to have your bone density checked with a DEXA scan before it can be prescribed. Your bone density will need to be monitored while you are having bisphosphonates.

## **ARE THERE DIFFERENT BISPHOSPHONATES?**

There are a number of different bisphosphonates that you might be prescribed. Some are given orally (tablet form) and some are given intravenously as infusions (directly into veins through a drip).

This table shows some examples of bisphosphonates. This is not exhaustive and not all medications are suitable for everyone. (19)

Oral	Risedronate	Alendronate
Intravenous	Pamidronate	Zoledronic Acid

## **ARE THERE RISKS?**

There are some risks with the use of bisphosphonates, especially in adults. (20) In adults, the risk of side effects increase overtime and often if bisphosphonate therapy is given, it is for a limited time (often 5 years).

Flu like symptoms are common 48 hours after beginning treatment, such as muscle aches, fever or an upset stomach, these symptoms do not typically recur.

Some of the less common and more serious side effects include;  
Osteonecrosis of the jaw - this is when the cells in the jaw bone die, which can lead to problems with healing. The risk of this increases over time and the risk is higher for intravenous bisphosphonates than oral bisphosphonates  
Atypical femoral fractures - the risk of this increases over time

# **COMPLEMENTARY AND ALTERNATIVE MEDICINE (CAM)**

## **WHAT IS CAM?**

Complementary and alternative medicine (CAM) falls outside mainstream medicine. Some CAM treatments are based on principles and an evidence base that are not recognised by the majority of independent scientists. (21)

## **EXAMPLES OF CAM?**

These are just some CAM therapies with some evidence to support their suggested uses, this list is not exhaustive.

Acupuncture - may help with migraines and back pain (22)

Chiropractic - found to improve acute back pain and acute neck pain (23)

Aromatherapy - may improve sleep quality and help with stress (24)

Meditation - can improve chronic pain (25)

These are more CAM therapies without strong evidence to support their suggested uses, this list is not exhaustive.

Naturopathy

Reiki

Homeopathy

Herbal Medicines

## **CAN I TRY CAM?**

**Always** speak to your doctor before changing your treatment plans, they will be able to advise you on which ones are best for you. They will also need to ensure any CAM treatments you want to try will not interact with existing prescriptions.

The NHS does not offer most CAM treatments.

## **WHERE CAN I FIND A CAM PRACTITIONER?**

All Chiropractors must register with;

Chiropractor - General Chiropractic Council <https://www.gcc-uk.org/>

The following have accreditation from Professional Standards Authority for Health and Social Care (PSA);

Acupuncture - British Acupuncture Council <https://acupuncture.org.uk/>

Aromatherapist - International Federation of Aromatherapists

[https://ifaroma.org/en\\_GB/home](https://ifaroma.org/en_GB/home)

Complementary and Natural Healthcare Council

<https://www.cnhc.org.uk/>

# **PHYSICAL THERAPIES**

Physical therapies include physiotherapy, hydrotherapy and occupational therapy. These therapies are important to build muscle mass and bone mass. Both of which can allow for more mobility and can decrease the risk of fractures.

Therapies should be chosen based on the needs and abilities of each person. OI can vary greatly and so can the abilities.

Joint laxity and hypermobility are common in OI and may affect what physical therapies can be undertaken.

## **PHYSIOTHERAPY**

Physiotherapists consider the body as a whole and do not just focus on an injury or illness. They can offer advice on everyday activities or actions such as posture, pacing and lifting or moving things. They can recommend tailored exercises designed to build muscle and improve mobility. Physiotherapists can also give manual therapy to relieve stiffness, pain and encourage better movement.

Physiotherapy may also be used for rehabilitation after a fracture or surgery. For OI, it is beneficial as a way to offset the effects of immobilization such as decreased muscle mass, weakness and fear of movement. (26)

Physiotherapy referrals can be made by GPs and many health boards offer self-referral to physiotherapy services.

## **HYDROTHERAPY**

Also known as water therapy, usually takes place in a heated pool. Hydrotherapy is similar to physiotherapy as it involves performing exercises under the supervision of a physiotherapist who will support and guide the session.

Hydrotherapy can build mass and possibly allow for the person to learn to swim can allow for them to take up swimming on a more regular basis (not just in hydrotherapy pools), swimming is very low impact and is a very effective form of cardiovascular exercise. (27)

## **OCCUPATIONAL THERAPY**

Occupational therapists can offer advice and guidance to allow people to live more independently. They are involved in the provision of wheelchairs and may be able to assist in referrals to wheelchair services. (28)

Occupational therapists often work in the community, you can contact your local social services or your GP to get a referral to an occupational therapist.

# **TEETH**

There are a number of differences that may be seen in the teeth of people with OI. The teeth are likely to be smaller and the oral cavity is also likely to be smaller which may result in overcrowding of the teeth.

## **DENTINOGENESIS IMPERFECTA**

Dentinogenesis imperfecta (DI) results in weak teeth which are at risk of breaking. There are different types of DI, the type associated with OI is type I (Syndrome-Associated).

DI is more common in OI types III and IV but can occur in any type. (29)

## **SYMPTOMS**

There are a number of symptoms with DI, these are some of the symptoms but this list is not exhaustive. (30)

- Discoloured or translucent teeth
- Brittle teeth which wear and break more easily
- Small holes (pitting) in enamel
- Tooth loss
- Speech difficulties (due to teeth being in incorrect positions)

## **DIAGNOSIS**

Usually by a dentist during a clinical exam and may be confirmed using a dental x-ray but this is not always necessary in people with OI as DI is common in people with OI.

## **TREATMENT**

Treatment for teeth with DI would depend on the severity and treatment plans would be tailored to meet the individual's needs. (31)

Treatments could include;

- Crowns, or caps
- Fillings (including preventative fillings to strengthen the teeth)
- Dental implants (this will depend on whether the bone is strong enough to support the implant and may not be possible for some people with OI)
- Dentures

Have regular check-ups with a dentist are very important for DI.

# **HEARING**

Hearing loss is common in people with OI.

It is estimated to affect up to 50% of people with OI but most cases reported are mild. (32)

## **WHY IS HEARING LOSS COMMON IN OI?**

There are two types of hearing loss and both can occur in all different types of OI.

### **CONDUCTIVE HEARING LOSS**

This type is the result of physical problems in the middle ear or externally. Some causes include, fracturing of the bones in the ear, infections or blockages. (33)

### **SENSORINEURAL HEARING LOSS**

This type occurs when the nerves from the ear are no longer able to transmit signals to the brain. (34)

### **MIXED HEARING LOSS**

A combination of conductive hearing loss and sensorineural hearing loss where there is damage to the outer and middle ear's ability to conduct sound and damage to the nerves.

## **WHEN DOES IT HAPPEN?**

It can start at any age but it has been suggested that the risk of hearing loss reduces after the age of 40. (35)

Conductive hearing loss will often occur between ages 20 and 30 but can happen at any age.

## **WHAT TO DO?**

Hearing tests should be sought if you are worried about your hearing.

## **WHAT IS THE TREATMENT?**

Standard in-ear hearing aids would be used first. If these were not working for you or you had complications from using them, such as recurrent ear infections, bone anchored hearing aids or cochlear implants might be an option. (36)

A stapedectomy may also be considered. This involves the removal of part or all of the original stapes bone and replacing it with an artificial device. This procedure restores the transmission of sound waves to the inner ear for hearing.

# HEART AND LUNGS

## HEART

People with OI have a higher risk of developing cardiovascular (heart) disease than people without OI. (37)

These are some of the heart problems which have been associated with OI through research but this is not an exhaustive list. If you have concerns or a family history of heart disease, you should speak to your GP.

## **VALVE REGURGITATION**

This is when the valves in the heart are weakened and begin to leak.

Some symptoms of valve regurgitation are dizziness, breathlessness, tiredness and chest pain. Valve regurgitation may be treated with medications or in serious cases, with valve repair or replacement surgery. (38)

## **ATRIAL FIBRILLATION**

Atrial fibrillation is when your heart has an irregular or abnormally fast heartbeat. It is not usually life threatening but can be uncomfortable and may require treatment. Some symptoms include dizziness, shortness of breath and tiredness. This increases the risk of blood clots which can cause heart attacks or strokes. People with atrial fibrillation would likely be given anti-coagulant medications to prevent blood clots.

It may be treated with medications to control the heart rhythm, catheter ablation to destroy the area causing the abnormal rhythm or cardioversion which gives a controlled shock to the heart to restore the normal heart rhythm. (39)

## LUNGS

People with OI are more likely to have reduced lung function. (40)

COVID-19 : There was no reported issue for those with OI during the covid pandemic.

The following are some of the issues people with OI can experience, this list is not exhaustive. If you experience difficulty breathing or you are concerned, you should see your GP.

## **BRONCHIAL THICKENING**

The walls of the airways become thicker which limits the airflow in the lungs, this also means mucus builds up in the lungs and can make chest infections more likely.

Symptoms include persistent cough and shortness of breath. Treatment may include exercises to clear the mucus, medications to improve airflow and antibiotics to treat infections. (41)

## **EMPHYSEMA**

Emphysema is a type of chronic obstructive pulmonary disease (COPD). Symptoms include breathlessness, persistent cough or frequent chest infections. Diagnosis would be made using spirometry tests, chest x-rays or blood tests. You may be offered an inhaler or other medications, or lung rehabilitation. Surgery is only required in very serious cases. (42)

# **SPINE**

There are a number of common issues with the spine in people with OI. These are some of the more common complications and how they can be managed. However, this is not an exhaustive list and management of these issues will vary depending on OI severity and whether there are other health issues which have to be taken into consideration.

## **VERTEBRAL COMPRESSION FRACTURES**

Fractures in the spine are common and the vertebrae can become compressed over time. (43) Compression fractures can cause significant pain, reduced mobility, decreased height, poor posture and weakness/ tingling sensation in the legs. They can be diagnosed with x-rays or CTs. Treatment includes pain medications, physical therapy or surgery to fuse the affected vertebrae in severe cases.

## **SCOLIOSIS**

Curvature of the spine, often seen as an 'S' shape on an x-ray. This can cause back pain. If untreated, scoliosis can also compromise pulmonary function and affect balance.

Treatment will depend on the severity of the curve. Some treatments include the use of a back brace or surgical correction of the curve. Bracing or surgery may not always be possible in OI as the bones may not tolerate these treatments. Some may be offered steroid injections to control pain caused by scoliosis. (44)

Treatment will be individualised, and your consultant will be able to suggest the best treatments for you.

## **KYPHOSIS**

Kyphosis is the abnormal curvature at the top of the spine. This can cause back pain, stiffness and tenderness in the spine.

Mild cases may not require treatment. Surgery may be used for severe cases; this would involve spinal fusion. This involves straightening the spine and joining together the vertebrae responsible for the curve. However, this may not be possible in OI. (45)

## **BASILAR INVAGINATION**

An uncommon but serious complication of OI, where the vertebrae intrude into the skull and put pressure on the brain. Some of the symptoms include headache or pain in the back of the head, feeling dizzy or lightheaded, confusion, or tingling or numbness in hands or feet. You should seek advice from your GP and a referral to neurology if you are experiencing these symptoms.

Treatment could involve physical therapy, the use of a neck brace or surgery to stabilise the spine and prevent the spine from compressing the brain. (46)

# **PREGNANCY**

Pregnancy is possible for people with OI, OI is not known to affect fertility. However, there are many risks associated with pregnancy in general. For those with OI there are some increased risks. (47) You will be seen by obstetrics who will help you to decide on a birth plan. You and the baby will be monitored closely.

## **NATURAL BIRTH VS CAESAREAN SECTION**

Method of birth for women with OI will be dependent on the type of OI the mother has. It will also depend on whether the baby has OI. OI babies are more likely to present in the breech position which will make a caesarean more likely. More severe types of OI make a caesarean section more likely.

## **PRE AND POST NATAL COMPLICATIONS**

These are some of the possible complications, this list is not exhaustive and not everyone will experience these complications.

### **FRACTURES**

There is a risk of fractures during in pregnancy and during birth. (48)

### **GESTATIONAL DIABETES**

Gestational diabetes is a form of diabetes which develops during pregnancy and usually disappears after birth. This is found to be more common in women with OI.

It can cause increased thirst, a dry mouth and tiredness. It may be controlled by changing diet and exercise or through medication or insulin injections. (49)

### **PRE-ECLAMPSIA**

Pre-eclampsia causes high blood pressure, headaches, disturbs vision, vomiting, swelling of feet and ankles and can cause pain below the ribs. The cause is not known and it is more common in women with OI.

Pre-eclampsia can only be cured by delivering the baby. Once it is diagnosed you will be monitored closely and the baby will be delivered when it is safe. You may need to be induced. (50)

### **HAEMORRHAGE/ BLEEDING**

There is a higher risk of bleeding during birth. This may result in the need for a blood transfusion. (51)

### **PREMATURE DELIVERY AND LOW BIRTH WEIGHT**

Women with OI are more likely to deliver early, and the babies have a higher risk of having a low weight at birth. (52)

# **SPECIALISTS**

## **OI CHARITIES**

There are a number of charities worldwide who support people with OI. In the UK, the charity is the Brittle Bone Society (BBS). They support people with OI and their families. They offer lots of information, run events and share OI research studies.

## **CHILDREN'S SERVICES**

There are four highly specialised services (HSS) for children with OI in the UK. These centres provide multi-disciplinary care where you may see a variety of specialists during your visit. They are also able to offer specialist advice and information to your local hospital team.

There are also a number of regional centres throughout the UK and Ireland.

### **Highly Specialised Services (HSS)**

Birmingham Children's Hospital  
Bristol Royal Hospital for Children  
Great Ormond Street Hospital, London  
Sheffield Children's Hospital

### **Regional Centres**

Royal Manchester Children's Hospital  
Royal Hospital for Children, Glasgow  
Royal Hospital for Children and Young People, Edinburgh  
Musgrave Park Hospital, Belfast  
Temple Street Children's University Hospital, Dublin  
Noah's Ark Children's Hospital for Wales, Cardiff

## **ADULT'S SERVICES**

There are currently no specialist centres for adults with OI in the UK. Many people with OI are seen by consultants who have a special interest in rare conditions such as OI. These may be consultants in Rheumatology, Metabolic Bone Diseases or Orthopaedics.

The Brittle Bone Society has close links with many centres and clinicians in the UK and lists the following centres on their website.

To be seen at any of these centres, you must be referred by your GP.

### **England**

Addenbrooke's Hospital, Cambridge  
Bristol Royal Infirmary  
Manchester Royal Infirmary  
Newcastle upon Tyne Hospitals  
Northern General Hospital, Sheffield  
Nuffield Orthopaedic Centre, Oxford  
Royal National Orthopaedic Hospital, London  
Queen Elizabeth Hospital Birmingham

### **Northern Ireland**

Belfast Health and Social Care Trust

### **The Republic of Ireland**

St Vincent's University Hospital, Dublin

### **Wales**

University Hospital Llandough (UHL)

### **Scotland**

Queen Elizabeth University Hospital, Glasgow  
Western General Hospital, Edinburgh

# REFERENCES

This list of references includes the hyperlinks to websites used to inform the development of this guide. These can be used to read further on the topics included in this guide.

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# GLOSSARY

## BREAK THROUGH THE JARGON

**ANALGESICS** - Medications used to control pain, more commonly known as pain killers

**BISPHOSPHONATES** - A type of medication used to increase bone mineral density

**DENTINOGENESIS IMPERFECTA** - Extremely brittle and weakened teeth

**HYPERLORDOSIS** - More prominent forward curvature of the lower spine

**INTRAMEDULLARY NAIL / ROD** - A rod/ nail which is placed in the medulla of the bone

**KYPHOSIS** - Front or backward curvature of the spine

**KYPHOSCOLIOSIS** - Combination of scoliosis and kyphosis where the spine curves in both sideways and front/backwards directions

**MEDULLA** - Cavity in the centre of bones

**NSAIDs** - Non Steroidal Anti Inflammatory Drugs

**OSTEOGENESIS IMPERFECTA** - Brittle Bone Disease

**OSTEOPENIA** - Bone mineral density which is lower than normal

**OSTEOPOROSIS** - Very low bone mineral density

**OSTEOTOMY / OSTEOTOMIES** - A surgical cut made in the bone in order to correct a deformity

**SCOLIOSIS** - Sideways curvature of the spine

**SPIROMETRY** - test used to measure the lung function and to diagnose lung conditions





# CHLOE MORGAN

PhD Candidate in Public Health  
MSc Long Term and Chronic Conditions Management  
BSc (Hons) Medical Sciences and Humanities

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