Understanding Chromosome & Gene Disorders

Prenatal Genetic Testing and Diagnosis

rarechromo.org

Introduction

This guide aims to provide support and information to families whose unborn baby has been diagnosed with a rare chromosome or gene disorder during their pregnancy.

There will also be links throughout the guide and at the end of the guide that should help direct you to further sources of information you might find helpful.

Lots of different aspects are covered in this guide. These include: what the chromosome or gene change may mean for your baby, and whether the decision is right for you to continue with your pregnancy, or to consider having a termination.

Information and support needed will differ from person to person during pregnancy, so do please just read the parts of this guide that are relevant to your situation.

Everyone's decision and the pathway they decide to follow at this point, are very personal and individual. There are no right or wrong answers, or choices.

This guide aims to help you in some way along your journey, with this process, at what is potentially a very stressful time for you and your family.

AND please remember there is always a 'listening ear' available at Unique if you just need someone to talk to:

Unique Helpline: Monday – Friday 9am-5pm (GMT) +44 (0) 1883 723356
Or Email us at: info@rarechromo.org

Contents

Prenatal genetic diagnosis

Prenatal genetic diagnosis describes when an unborn baby has been diagnosed with a chromosome or gene condition. It is not unusual to experience a whole range of emotions at this point. You may feel shock, guilt, sadness, anger, denial and loss. You may also feel very scared, and you may be wondering:

“Why is this happening to me? What did I do wrong?”

The answer is: NOTHING! Genetic changes happen naturally and are not due to any lifestyle, dietary or environmental factors. There was nothing you did to cause this and there is nothing you could have done to prevent it.

You will have many questions about what the diagnosis might mean for your baby, yourself and the future of your family life. These may include:

- Will my baby die?
- Will my baby be in pain?
- Will my baby be able to walk and talk?
- Who will help me care for my baby/child?
- How can I get help for my child’s development?
- Where will they go to school?
- Will I have to give up my job to look after my child?
- Will I be able to claim financial support to help care for my child?
- Will my child be able to live independently as an adult?
- Do I have the option to terminate my pregnancy?

..... and you may have many more questions.

If an unexpected finding is identified during a pregnancy ultrasound or blood test, you may be referred to a specialist department, such as an antenatal screening team, and/or a fetal medicine centre, and offered further testing in order to try and find the cause and provide you with more information.

What does prenatal testing involve?

If you have received an unexpected test result during your pregnancy, there are other tests available that might help to find out more about what could be causing these results. You may, or may not, wish to have these tests, the choice is yours. The following tests are currently available in the UK and many other countries:

Invasive testing

There are two types of invasive prenatal diagnostic testing currently offered that partly depend on how far along you are in your pregnancy:

Chorionic Villus Sampling (CVS)

A CVS is an invasive procedure whereby a small sample of placental tissue is taken and tested for any genetic or chromosomal changes. To obtain the sample, a small needle is usually inserted through the mother's abdominal wall into the placenta where the sample is then collected. Ultrasound scanning is used to ensure the correct position of the needle. A CVS is usually performed between weeks 11 to 14 of pregnancy.

Amniocentesis

An amniocentesis (also known as 'amnio') is an invasive procedure whereby a small sample of the amniotic fluid surrounding the baby is taken and tested. This fluid contains cells which have been shed from the baby and is a very accurate reflection of the baby's genetic make-up. To obtain the sample, a needle is passed through the mother's abdominal wall and into the fluid-filled space around the baby. The procedure is performed under ultrasound guidance to ensure the needle is inserted into the desired location and away from the baby. An amniocentesis can be performed after week 15 of pregnancy.

Non-invasive prenatal testing/diagnosis

In some cases, it is now possible to offer a non-invasive prenatal blood test. This can be a screening test for additional chromosomes, called NIPT, or a diagnostic test for a specific genetic condition, called NIPD.

Both tests involve taking a blood sample from the mother only, no sample is taken directly from the fetus. The DNA found in the mother's blood is tested since it also contains a small amount of 'cell free' DNA from the placenta.

These tests can be carried out any time from 10 weeks onwards in pregnancy but are not always routinely available on the NHS. Positive results would need to be followed up by an invasive test such as CVS or amniocentesis (as described on the previous page). This type of non-invasive testing is not currently available for most of the rare chromosome or gene disorders that affect Unique families.

NIPT (non-invasive prenatal testing)

Also known under several brand names including SAFE test or Harmony test.

This technique can be used to look for changes in number of chromosomes in the baby. It can be used to identify the more common trisomies (when an additional chromosome is present) such as trisomy 13, 18 and 21, which cause Patau's, Edwards and Down's syndrome, respectively. It is also able to detect other chromosome trisomies, but with less accuracy.

NIPD (non-invasive prenatal diagnosis)

This type of test can identify changes in single genes and is most well-developed for gene changes that are found in the father but not the mother. This technique is currently useful for those with a risk of a single gene disorder rather than a chromosomal change. This test is now also increasingly being used to make a diagnosis in babies whose unusual findings on an ultrasound scan point towards a specific diagnosis that neither parent has.

Further information about these tests and what they involve are detailed on pages 7-11 of the Unique 'planning your next child guide':

https://rarechromo.org/media/information/Other%20Topics/Planning%20your%20next%20child%20FTNW.pdf

Pathway when something unexpected is discovered

Once a chromosome or gene change has been identified, you should be referred as soon as possible to appropriate specialists. You may have lots of appointments and be given a lot of medical information. You should be told about the options for your pregnancy, in order for you to make a decision on how you want to move forward. People you may see at this point are:

- **Obstetric consultants** - these are experienced doctors who specialise in pregnancy.
- **Fetal medicine team** – this is a team of medical professionals who specialise in pregnancies that may require additional care. This team may be based at a different hospital from where you began your antenatal pregnancy care.
- **Genetic counsellor** – these are healthcare professionals with training in genetics/genomics and counselling skills.
- **Clinical geneticist** – these are doctors who are experts in genetics, and explain your options, so that you can make a plan that is right for you and your pregnancy. They can also help decide on the best tests to make an accurate diagnosis.

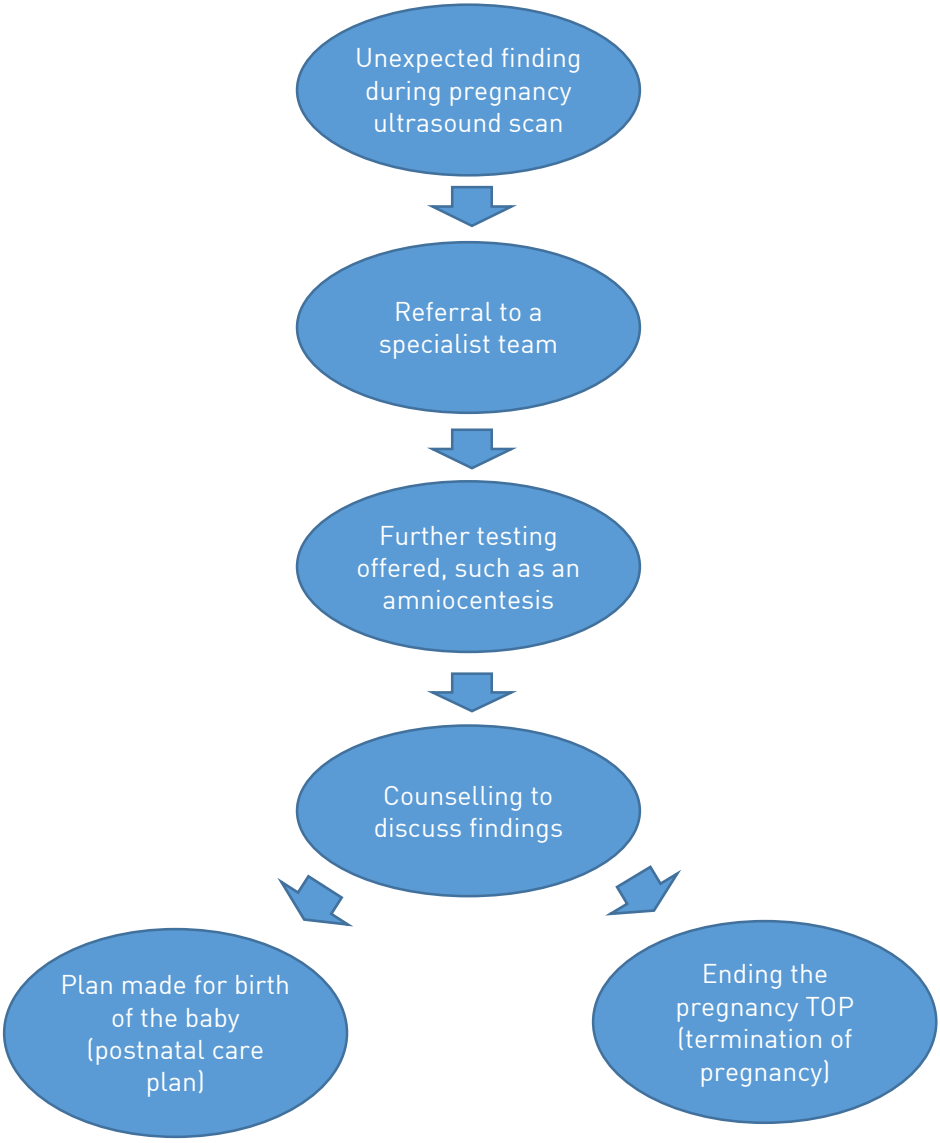
Many pregnant women and couples feel lost and overwhelmed by their situation and the rollercoaster of emotions that they are dealing with. Your friends and family might find it difficult to understand and not know what to say. You may decide not to share results with other people. Many couples in this situation feel guilt, especially when discussing whether to carry on with a pregnancy or to terminate the pregnancy.

“ I never dreamed this was a decision I would ever have to make when I first became pregnant. ”

Some chromosome and gene disorders are so rare, that most people will not have heard of them. Many genetic conditions don’t have a name, but instead are made up of a series of numbers and letters (relating to the gene or chromosome involved) which can be difficult to understand or remember.

The diagram below summarises the process that happens when an unexpected finding is identified during a pregnancy ultrasound:

What happens when something unexpected is found during a pregnancy ultrasound:



What are chromosome or gene changes?

When sperm and egg cells join, they form a single cell and this cell must continuously make copies of itself (and all its genetic material) in order to produce the trillions of cells that are necessary for human growth and development. Sometimes during the formation of the egg or sperm cells or during this complicated replication process, parts of chromosomes and genes are lost, duplicated and/or become rearranged or changed. Sometimes entire chromosomes are involved. The effect of any chromosome or gene change varies according to how much genetic material has been altered, and more specifically, which genes or regions that control genes are involved.

Why do genetic changes happen?

We all have differences in our chromosomes, it's only when an important gene or section of chromosome is involved, that features and symptoms can occur. Some genetic changes are inherited from a parent and others are *de novo*, this means that they have occurred in the fetus and are not passed on by either parent.

As mentioned earlier, these genetic changes happen naturally and are not due to any lifestyle, dietary or environmental factors. No one is to blame and nobody is at fault.

General Genetic terms

Listed below are some common genetic terms you may come across after you have received your prenatal genetic diagnosis.

Chromosome: these are structures made from genetic material called DNA. We usually have 46 chromosomes (23 pairs) in the cells of our bodies. Eggs and sperm cells, however, only have 23 chromosomes (one half of each pair). When a baby is conceived, the egg and sperm join, so each parent contributes one half of their chromosomes to the child.

Deletion (or copy number loss): this is when a piece of genetic material is missing. Deletions can vary in size. Those too small to be seen under a microscope are known as microdeletions.

Duplication (or copy number gain): this is when there is an extra copy of a piece of genetic material. Duplications can vary in size. Those too small to be seen under a microscope are known as microduplications.

Single gene disorder (SGD): this is where a change in one gene causes a genetic condition. An example of this is cystic fibrosis. An SGD can occur in a new pregnancy or can be passed down in families.

Translocation: this is when part of one chromosome is broken off and moved to another chromosome. A balanced translocation is when two pieces of chromosomes have swapped places and no genetic information has been lost or gained. An unbalanced translocation, is when two pieces of chromosomes have swapped places, but genetic information has been lost or gained.

Variant: This is a change in genetic information. This is sometimes called mutation.

Mosaicism: this is when a genetic alteration has occurred in some of the cells in the body but not all of them. The type and number of genetically altered cells determine how much a child is affected.

A more extensive list of glossary terms can be found on the Unique website: https://rarechromo.org/glossary/

Medical terminology in pregnancy

It can be overwhelming when you find out your baby has a problem in pregnancy and you are faced with lots of medical jargon. Do ask your health care team to explain any medical terms that you are unsure of.

Some of the medical terms you may hear can be found in this glossary:

https://www.arc-uk.org/tests-explained/glossary-of-terms/

Understanding your diagnosis and what support is available

Genetic counselling

If you have received a prenatal genetic diagnosis (a genetic diagnosis found while you are still pregnant), you may be referred to a clinical geneticist or genetic counsellor for advice. Some genetic diagnoses are received just after 20 weeks of pregnancy when something unusual is identified on the 20-week scan. Sometimes an unusual finding may be detected as early as the 12-week scan.

Genetic counsellors can provide information and explain the facts as clearly as possible, to help you understand which genetic test has been carried out and what the results mean for you and your unborn baby.

The genetic specialist and the fetal medicine team will also explain your options, so that you can make a plan that is right for you and your pregnancy. You may also see other medical professionals who specialise in particular physical conditions (if one of these is detected in your baby).

It is important that you understand the information you are told by the genetics team. It is always recommended to take someone with you to an appointment, not only for moral support, but also to ensure you are able to take on board and remember the information you are given. You may find it helpful to take notes.

Before you leave the genetic appointment, try to make sure you have an understanding of the information you have been told. You may be very anxious and distressed and medical jargon can often be confusing. If you don't understand something, PLEASE ask for it to be explained again. No one will mind, and it is important to take the time to understand the information you have been given. You may well be given a contact number for any questions you think of when you go home. At the end of the appointment a follow up plan or appointment should be in place.

During your genetics appointment, you and the father of the baby (if possible) may be asked to give a blood sample to help interpret any genetic variants found. The results can also help to find out if the condition is inherited or happened out of the blue (often called *de novo*).

You will also have a discussion about the chances of the same genetic change happening again in your family.

After the appointment you will receive a summary letter of your appointment and a copy of any relevant information leaflets. It may also be possible for the clinical genetics team to put you in touch with other families with the same condition or with a specific support group, or a general support group such as Unique.

Unique has a separate guide on genetic appointments if you would like further details:

https://rarechromo.org/media/information/Other%20Topics/A%20Clinical%20Genetics%20Appointment%20FTNW.pdf

Other support

If you are pregnant with a baby that has a chromosome or gene disorder, or any disability, this can put a huge strain on your life and relationships.

Your midwife and other members of your antenatal team can be a good source of support at this time. It is not uncommon for parents to have different views about the next steps in pregnancy. It is important to keep talking to each other and other people. Please remember, even though you may feel it at times, you are never alone...

Antenatal Results and Choices (ARC) are an excellent support for pregnant women and couples at this time. They provide non-directive information and support before, during and after antenatal testing. You can contact them on their helpline, staffed by a very experienced, professional team or email them for help and/or to arrange a call.

https://www.arc-uk.org/

What might the diagnosis mean for my baby?

Every parent wants to know if their baby is going to be OK, and how the diagnosis is going to affect their baby's life. With rare chromosome and gene disorders, information is often very limited. The answer often is:

“ No one knows for sure ”

A Unique member shared their opinion:

“ I am glad the medical team were brutally honest and told me they didn't know what to expect, as there was so little information. Honesty is very important at this time ”

Unique have a list of guides that cover many different types of rare chromosome and single gene disorders, but still there is very limited information on many conditions.

https://rarechromo.org/disorder-guides/

It is important to remember that, while predictions can be made about how a genetic change might affect a baby, the effects can be very variable. Even within a family some people can be much more or less severely affected by the same genetic change.

What are the effects of a genetic change?

When a genetic change has been identified, unless it is associated with a well-known genetic condition, it is sometimes very difficult to give precise information about what effects the change could have on a child's health and development.

Rare genetic findings are commonly called variants and are classified into different categories:

- Pathogenic - will cause a condition
- Likely pathogenic - very likely to cause a condition
- Variant of uncertain significance (VUS) - not enough information is available to classify this genetic change
  (not all countries or laboratories in the same country report VUS)
- Likely benign - very unlikely to cause a condition
- Benign - will not cause a condition
  (benign variants are not usually included in genetic test results)

We all have lots of genetic changes that are not seen in other people. It can be very difficult to determine if a genetic variant would have an effect on health and development, or if it's just a benign change. It is for this reason that parental DNA is often tested to determine if the genetic change found in a baby is a harmless variant that has been passed on by a parent. This is called trio analysis since three DNA samples are compared.

Genetic variants are carefully analyzed using evidence from research studies, databases, computerised prediction tools, scientific literature and professional knowledge of gene function. But even with all of this information, it can still be difficult to determine what possible effects certain genetic changes can have.

Families experiences with prenatal diagnoses

A number of families have shared some comments on their experience of prenatal genetic diagnosis. Some parents found out about their child's diagnosis during pregnancy and some found out after. These comments may help you feel less alone and help you to realise other people have been where you are now.

One member mentioned she felt '*pressured*' by health professionals during pregnancy to have a termination and that a very gloomy picture of her baby's outcome was given to her. Doctors do have to include the worst case scenarios, but many children do end up surpassing expectations. Her son is now 20 months old and has reached many of his milestones and she is loving being a mum.

One couple shared that they felt the team at the hospital were amazing. They explained all the different tests in detail and everyone was very kind and patient.

"They took the time to make sure we understood all the information we were told and everyone showed great care and empathy at a time when we felt massively overwhelmed"

Every family should be able to make a personal choice on whether to carry on with a pregnancy. There are no right or wrong answers.

Another member mentioned how she felt her prenatal diagnosis overshadowed the whole of her pregnancy and she was 'unable to bond with her baby' when pregnant. She now has a beautiful 'Unique boy' who she loves very much!

Prenatal diagnosis is about gaining knowledge to help prepare you for what might happen after the birth of your baby or to help you make the decision to terminate the pregnancy.

Decision making after diagnosis:

Take your time .....

Just take a moment to think about what is important to you and your family. Many people will need time to think about the information they have been given before they make any decisions. It's important to take the time you need and it can help to have people to talk to.

Talk .....

Keep talking if you need to; friends, family, medical professionals, support organisations, anyone you feel comfortable with... you are not alone. Your health care team will give you as much information as they can about the diagnosis, but you may also want to contact organisations that might be able to describe what life with a particular condition can be like.

Next steps .....

Often a good place to start is to make a list of what is important to you. This may help you to make a decision on the way forward for your pregnancy. i.e.:

- Do I have enough good support for myself and my baby, such as close friends and family?
- Is my baby going to need surgery after it is born?
- Will my baby need lifelong support?
- How will a child with extra needs impact on our family (including children you may already have)?
- How would my religious and moral beliefs affect my decision?

It might help to make a list of anything, no matter how big or small, about things that matter to YOU and your family. Having any baby is a 'unique' and life changing experience, but the path of your child will be a different path to what other families may experience.

Everyone's view on how to go forward with a pregnancy is individual and personal. Some families want to carry on with the pregnancy and some families choose to terminate their pregnancy. Neither decision is wrong and no one has the right to judge. The medical profession and support groups are all about imparting what knowledge they have on conditions, to allow families to reach their own choice on a way forward.

THE GUIDE WILL NOW SPLIT INTO TWO SECTIONS SO YOU CAN CHOOSE WHICH INFORMATIN YOU WISH TO CONSIDER:

■ Section One

This section contains information if you are considering continuing with your pregnancy.

■ Section Two

This section contains information if you are considering terminating your pregnancy.

Section One: This section contains information if you are considering continuing with your pregnancy.

What to expect at the birth of your baby

In this section you will find some information about what extra care and support your baby may possibly need initially after the birth if you choose to continue with your pregnancy.

It might help to be well prepared for what could happen after the birth if your new-born baby needs lots of extra medical support initially.

If your baby needs extra help with feeding, keeping warm, or breathing, they may go to a neonatal unit (NNU) which is sometimes called a special care baby unit (SCBU). This is a specialist ward for new-born babies.

Some babies only need extra support for a few hours, other babies may need to spend a lot longer on a neonatal unit. The link below is a video of what to expect in a neonatal unit:

https://www.gwh.nhs.uk/wards-and-services/children-s-services/neonatal-unit/what-happens-if-your-baby-is-sick-or-premature/

Here are some helpful tips from Unique members

- Expect the unexpected! Some babies do better than predicted when they are born and other babies do not do as well as expected. *Not all babies do go to the SCBU, but it is good to be prepared!*

- It is always a good idea to look around the SCBU where you are having your baby, so it is familiar. If your baby is known to have a physical anomaly from a scan (such as a heart condition), your plan may involve giving birth at a larger and/or more specialist hospital.

- Pack bags for you and your baby for at least a 2 week stay. That way you are prepared for all events, if you do need to stay longer than average in the hospital.

- At the birth of your baby you will probably have extra doctors in the room. The paediatricians (doctors who specialise in taking care of babies) may be at the delivery, so that care can be given to your baby as soon as it is born, if it is needed.

- Have as much skin to skin contact as possible when your baby is born. It is a lovely way to bond with your new baby and it keeps your baby safe and warm (partners can do this too). You can still have lots of skin to skin contact with your baby regardless of whether you end up breast or bottle feeding, or even if your baby has a tube to be fed initially.

- Ask your midwife about harvesting colostrum in the later stages of pregnancy if you would like to breast feed. This can be very useful if your baby does end up needing a stay in a special care baby unit.

Neonatal units

You will hear people refer to the Neonatal unit (NNU) as different names. Often the NNU is divided into three areas:

High care **NICU** (neonatal intensive care unit) - this unit is for babies who need a lot of extra support when they are first born, including a tube to help them breath.

Low care **SCBU** (special care baby unit) – this unit is for babies who need some extra help when first born.

Transitional care: this unit is where your baby is well enough to stay with you, but under the watchful eye of the neonatal unit.

The link below goes into more detail about the different types of care your baby may need and equipment you may see on a neonatal unit.

https://www.bliss.org.uk/parents/in-hospital/about-neonatal-care/how-does-neonatal-care-work

Useful resources if you are deciding whether to carry on with your pregnancy

Antenatal Results and Choices (ARC)

Offers excellent support and advice when facing pregnancy options
https://www.arc-uk.org/for-parents/decision-making/
helpline: 0207 713 7486
Email: info@arc-uk.org

SOFT

Support organisation for trisomy 13 and trisomy 18
https://www.soft.org.uk/
helpline: 03001027638
Email: support@soft.org.uk

Down's Syndrome Association

Support organisation for trisomy 21
https://www.downs-syndrome.org.uk/
helpline: 03331212300
Email: info@downs-syndrome.org.uk

Section Two: This section contains information if you are considering terminating your pregnancy.

Terminating your pregnancy

If you have reached the decision to end your pregnancy, there is lots of support available for you. Please keep talking to people if you need to. You don't have to manage on your own. ALL of the organisations listed below in the resources offer amazing support, and ALL are non-judgemental.

The NHS link below goes through the steps of terminating a pregnancy if you decide this is the right choice for you and your family:

https://www.nhs.uk/pregnancy/support/termination-for-foetal-anomaly/

Ending a pregnancy after a prenatal diagnosis can lead to complicated grief emotions – as often the pregnancy was planned and wanted. There is support for you available, please make sure you ask for it if you need it.

Many of the support organisations available are also for any friends or extended family members that are affected by the loss, not just the parents. Some of the groups offer support for children as well.

Unique also has a separate bereavement guide which has other links to support groups:

https://rarechromo.org/media/familyguides/English/Bereavement%20and%20loss%20FTNW.pdf

Useful resources if you are considering a termination

Antenatal Results and Choices (ARC)

Offers excellent support and advice when facing pregnancy options:

Website: https://www.arc-uk.org/for-parents/decision-making/
Helpline: 0207 713 7486
Email: info@arc-uk.org

BPAS (British Pregnancy Advisory Services)

Offers advice and support about termination and has specific information and a care pathway for people ending a wanted pregnancy following a prenatal diagnosis:

Website: https://www.bpas.org/more-services-information/fetal-anomaly-care/
Helpline: 03457 30 40 30
Email: info@bpas.org

SANDS (Stillbirth and Neonatal Death Society)

This helpline is for anyone who has been affected by the death of a baby and wants to talk to someone about their experience. The helpline team are there to listen and give support, and can advise you about finding local help, whether from a Sands group or other counselling services, or information about other relevant support organisations:

Website: https://www.sands.org.uk/
Helpline: 0808 164 3332 (Sands National Helpline)
Email: helpline@sands.org.uk

Aching Arms

Aching Arms supports parents through pregnancy and baby loss. This includes termination for medical reasons. They offer a befriending service to help you to feel less alone at this time. This service also includes an online support group for dads:

Website: https://achingarms.co.uk/
Helpline: 07464508994 (befriending service)
Email: support@achingarms.co.uk

Inform Network Support

Rare Chromosome Disorder Support Group,
The Stables, Station Rd West, Oxted, Surrey. RH8 9EE, UK
Tel: +44(0)1883 723356
info@rarechromo.org I www.rarechromo.org

Join Unique for family links, information and support.
Unique is a charity without government funding, existing entirely on donations and grants. If you can please make a donation via our website at: www.rarechromo.org/donate Please help us to help you!

This leaflet is not a substitute for personal medical advice. Families should consult a medically qualified clinician in all matters relating to genetic diagnosis, management and health. The information is believed to be the best available at the time of publication. It was compiled by Unique (AD) and reviewed by Dr Dagmar Tapon, genetic counsellor at Queen Charlotte's and Chelsea Hospital's Centre for Fetal Care, Imperial College Healthcare NHS Trust and Jane Fisher, Director of Antenatal Results and Choices (ARC), UK.

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