R.C.P.U. NEWSLETTER

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Trisomy 13 and Trisomy 18

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Introduction

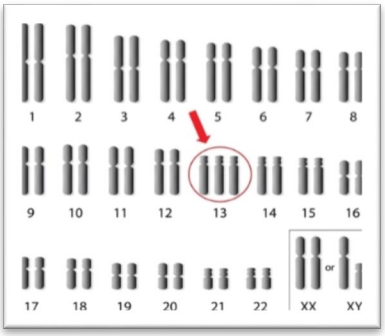
Trisomy 13 and Trisomy 18 are rare genetic disorders that occur when infants have extra chromosomal material in their cells. This article will provide a brief history of these disorders as well as describe the clinical symptoms, diagnostic methods, and new information that may be helpful for parents and clinicians.

History

In 1656, Thomas Bartholin, a Danish physician, ccurately described the clinical findings of a patient with Trisomy 13. However, it was not until 1960 that Klaus Patau, a German-born American geneticist, correctly identified an extra copy of chromosome 13 (three copies instead of the usual two - see Figure 1) as the cause of those clinical findings. That same year another geneticist, John Edwards from the United Kingdom, identified an extra copy of chromosome 18 as the cause of another disorder, Trisomy 18. In the past, these conditions were referred to as Patau syndrome and Edwards' syndrome, but in recent years, they are more often referred to as Trisomy 13 and Trisomy 18, respectively.

In most instances, these conditions result when an extra copy of a chromosome is included during the formation of the sperm or the egg. In rare cases, Trisomy 13 or Trisomy 18 occur when an extra copy attaches to another chromosome in the cells (translocation trisomy), when only some of the body's cells have an extra copy of the chromosome (mosaic trisomy), or when only a portion of the extra copy is present in the cells (partial trisomy). Regardless of how the genetic change occurs, the extra copy usually leads to a range of serious medical and developmental problems in the developing fetus.

Figure 1: Cytogenetic Trisomy 13



Source: NIH - https://ghr.nlm.nih.gov/condition/trisomy-13

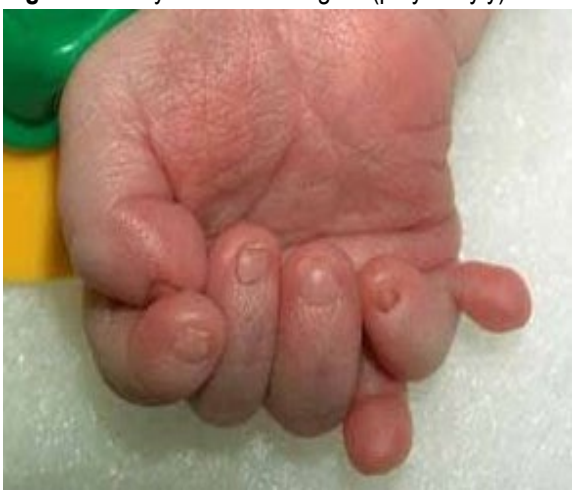
Clinical Symptoms

The clinical findings associated with Trisomy 13 and Trisomy 18 are usually very serious (see Table 1). Newborns affected with these disorders often have severe intellectual disabilities and other complications, such as heart defects, kidney malformation or malfunction, growth deficiency, and feeding and breathing problems. Because of these health issues, most babies with Trisomy 13 or Trisomy 18 often do not survive past the age of one year.

Table 1. Clinical Features of Trisomy 13 and 18

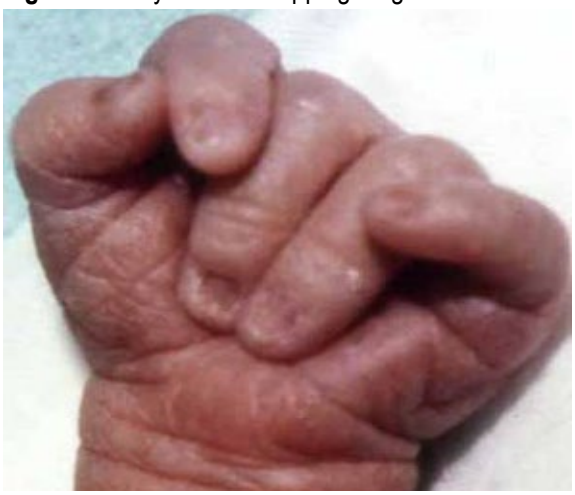
Trisomy 13	Trisomy 18
Low birthweight	Failure to thrive
Small head with sloping forehead	Problems with feeding
Structural abnormalities of the brain	Small size
Close-set eyes	Small head
Nose or nostrils not well developed	Low-set ears
Cleft lip and cleft palate	Small mouth and jaw
Low-set abnormal ears	Short sternum
Scalp abnormalities	Heart defects
Heart defects	Spina bifida
Extra fingers and toes (Figure 2)	Clenched fists with overlapping fingers (Figure 3)
Feet with prominent heels	Feet in a curved position
Intellectual disability (often severe)	Intellectual disability (often severe)

Figure 2. Baby with Extra Fingers (polydactyly)



Source: NHGRI – https://elementsofmorphology.nih.gov/index.ci?tid=6d82cc5a5f23eb61

Figure 3. Baby with Overlapping Fingers



Source: NHGRI – https://elementsofmorphology.nih.gov/index.cgi?tid=6d82cc5a5f23eb61

Diagnostic Methods

According to the CDC, Trisomy 13 occurs in one out of 7,906 live births and Trisomy 18 occurs in one out of 3,762 live births. This means that over 500 babies with Trisomy 13 and over 1,100 babies with Trisomy 18 are born in the United States each year. To help determine if a baby is at increased risk for these conditions, health care providers use studies during pregnancy, including ultrasound, which can reveal physical abnormalities in the growing fetus, and non-invasive prenatal screening, which can reveal abnormalities in the fetus's DNA. If these conditions are suspected on screening tests, further studies are needed (either chorionic villus sampling or amniocentesis during pregnancy or blood testing after birth) to confirm the diagnosis.

New Information

Trisomy 13 and 18 have often been described as lethal conditions, but in recent years, a significant number of patients have lived longer than previously reported. One multi-state study showed that nearly 10 percent of children with Trisomy 13 and over 12 percent of children with Trisomy 18 survived to the age of five years, a significant increase in survival from those previously reported in the literature (Meyer et al., 2016). Many individuals with these conditions are now reported to have survival into adulthood. Later gestational age, female sex, and being born to a non-Hispanic black mother were all associated with longer survival.

Family Support

Family support groups are vital to providing mental, emotional, and financial support to parents who have a child with Trisomy 13 or Trisomy 18. The following is a list of the largest and most active family support groups available:

- **Support Organization for Trisomy 18, 13, and Related Disorders (SOFT)** is a family support network started by the mother of a young girl with Trisomy 18. It provides support to parents both during and after the life of children with Trisomy 13 and 18 as well as informs parents about treatment options available:

https://trisomy.org

- **Hope for Trisomy 13 and 18** is a nonprofit organization that raises awareness, promotes education, and funds research for these disorders:

https://www.hopefortrisomy13and18.org/

- **Unique: Understanding rare chromosome or gene disorders**
  https://www.rarechromo.org/

Selected Resources

- American Academy of Pediatrics - Trisomies: https://pedsinreview.aappublications.org/content/pedsinreview/39/2/104.full.pdf
- Centers for Disease Control and Prevention – Data and Statistics on Birth Defects: https://www.cdc.gov/ncbddd/birthdefects/data.html
- National Institutes of Health – Trisomy 13: https://rarediseases.info.nih.gov/diseases/7341/trisomy-13
- National Institutes of Health – Trisomy 18: https://rarediseases.info.nih.gov/diseases/6321/trisomy-18
- National Institutes of Health – Non-Invasive Prenatal Testing: https://ghr.nlm.nih.gov/primer/testing/nipt
- National Institutes of Health – Newborn Screening Procedures https://ghr.nlm.nih.gov/primer/newbornscreening/nbsprocedure
- Mayo Clinic – Amniocentesis: https://www.mayoclinic.org/tests-procedures/amniocentesis/about/pac-20392914

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About the RCPU
The R.C. Philips Unit is a resource for all Floridians interested in the diagnosis, treatment and prevention of intellectual disability. Staff members are available for consultation and for educational programs for health.

Acknowledgments:

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The Raymond C. Philips Research and Education Unit began in 1978 when the legislature established section 393.20, F.S., of what is now known as the "prevention" legislation. It is named after Raymond C. Philips, who was the Superintendent of Gainesville's Tacachale (formerly Sunland) Center for 38 years, and was an acknowledged state and national leader in services for mentally retarded persons. The Unit is located on the Tacachale campus and is funded through a contract with the Department of Children and Families and the Department of Health.

The purpose of the R.C.P.U. is to treat, prevent, and/or ameliorate intellectual disability through medical evaluations, education and research. The unit provides direct evaluations and counseling to families and promotes service, education, and prevention projects.
Some of the conditions currently under study at the RCPU involve Angelman, Velo-Cardio-Facial, Prader-Willi, Fragile X, Williams and Smith-Lemli-Opitz syndromes.

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