ABOUT
MENKES

You know your baby best

BUT WOULD YOU BE ABLE TO SPOT **THE SIGNS AND SYMPTOMS OF MENKES DISEASE?**

Recognizing the signs and symptoms is the first step toward diagnosis

Menkes disease is a rare genetic disease caused by defective copper transport through the body.[1] Although Menkes disease is rare, learning to recognize the signs and symptoms can help you get to an accurate diagnosis faster. Please alert your child's doctor if your child is experiencing any combination of the following signs and symptoms[1-3,*]:

Males, who represent more than 90% of affected children
Early birth, with fluctuating temperature or low blood sugar
Not meeting milestones after 2 months
Kinky hair and/or steely colored hair
Evidence of a positive family history
Seizures and/or low muscle tone that cannot be explained

*Presentation of possible signs and symptoms may vary.

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EARLY DIAGNOSIS IS KEY

Menkes disease is a fatal genetic disorder with death usually occurring between 6 months and 3 years of age.[1] However, early diagnosis and intervention may lead to better treatment outcomes and quality of life.

It takes a team to care for a patient with Menkes disease[1]

Depending on their symptoms, patients with Menkes disease may be diagnosed and cared for by different healthcare professionals[1,4,*]:

Pregnancy › **Birth** › **Infancy and childhood**

When to talk to your child's doctor:

Pregnancy

Talk to your doctor about genetic testing if you have a family history on the mother's side of males with:

- Seizures
- Developmental delay
- Extensive medical care (such as feeding tubes, wheelchairs, or breathing equipment)
- Death at a very young age

Birth

Talk to your child's doctor or nurse if shortly after birth your child experiences multiple early symptoms of Menkes disease, including:

- Kinky hair that is light-colored, coarse, and breaks easily
- Persistent jaundice (yellowish skin and eyes)
- Low blood sugar
- Difficulty keeping warm or fluctuating body temperature
- Feeding difficulties
- Low muscle tone or "floppiness"
- Fractures or large bruises on the baby's head at birth
- Distinctive facial features

Infancy and childhood

Talk to your child's pediatrician or specialist if your child has any of the following symptoms of Menkes disease:

- Kinky hair that is light-colored, coarse, and breaks easily
- Seizures, which can look like unusual:
  - sudden stiffening of arms or legs or the whole body
  - eye movements (eyelid fluttering, eyes rolling up)
  - mouth movements (chewing movements, sticking out tongue)
- Loose skin on the body or saggy facial features
- Not meeting developmental milestones, such as not lifting head, rolling over, sitting at an appropriate age, or cognitive (thinking) problems that worsen over time
- Feeding difficulties
- Slow growth and weight gain

Your child's healthcare team:

OB-GYN
An OB-GYN may recommend prenatal screening (genetic testing) for Menkes disease.

Medical geneticist
Your care team during pregnancy may also refer you to a medical geneticist or genetic counselor for prenatal screening.

Doctors and nurses at the hospital
Doctors and nurses at the hospital may recognize your child's subtle early signs and symptoms and have an essential role in making an earlier diagnosis.

Pediatrician
Pediatricians may recognize early signs and symptoms that were not present at birth, as well as observe the development of later symptoms, advise special testing, or recommend you speak to a specialist.

Pediatric neurologist
Neurological symptoms such as floppiness, movements that look abnormal, or other unusual signs may prompt referral to a neurologist.

Urologist
Urinary tract infections (UTIs), which can be caused by bladder diverticula (a pouch, pocket, or sac that protrudes out of the bladder wall), may initiate a referral to a urologist.

Pulmonologist
You may be referred to a pulmonologist if your child is experiencing respiratory infections or has trouble breathing.

Gastroenterologist
Slow growth and weight gain or feeding problems may lead to a referral to a gastroenterologist.

*Signs and symptoms may vary from person to person

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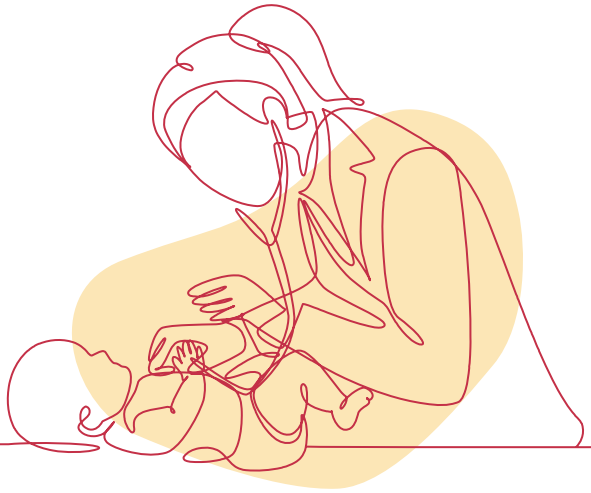
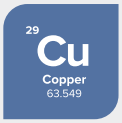
If there is suspicion that your child has Menkes disease,

YOUR CHILD'S DOCTOR **MAY WANT TO RUN SOME ADDITIONAL TESTS**



Your child's doctor may use the following tests to help make a diagnosis of Menkes disease:



Copper

Decreased copper levels are seen in patients with Menkes disease, but may not be specific in very young infants, who sometimes have low copper levels even when healthy

Ceruloplasmin

Decreased ceruloplasmin, a protein that stores and carries copper through your body, is often seen in patients with Menkes disease

Catecholamines

Patients with Menkes disease don't have normal levels of catecholamines (substances that help the nervous system work), which can be detected in blood or urine

Genetic testing

Determining if the *ATP7A* gene doesn't work correctly through genetic testing is definitive diagnostic proof of Menkes disease

Talk to your doctor about which tests they feel are appropriate for your child and if you'll need a referral to a specialist for genetic testing

Every child with Menkes disease has unique opportunities for a diagnosis

Depending on the signs and symptoms and your family history, your child's doctor may suggest different tests or use only some of the tests listed above. However, the first step toward reaching diagnosis is recognizing the signs and symptoms of Menkes disease and telling your doctor about them right away. Consider keeping a journal of your child's signs and symptoms, or use the checklist on the next page to show to your child's doctor.

Notes: _____

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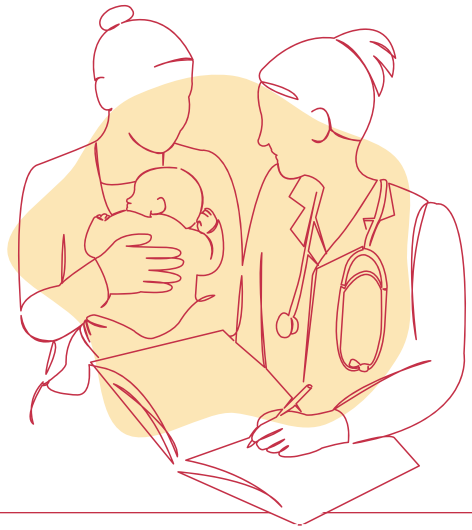
TIPS FOR TALKING WITH **YOUR CHILD'S DOCTOR**



You can start the conversation with your child's doctor at any time if you have a family history suggestive of Menkes disease or you suspect your child may be having symptoms. Here are a few topics that may help you and your doctor have a conversation about how to diagnose and treat Menkes disease.

1. My child has been experiencing signs and symptoms common in Menkes disease, such as:
(check those that apply)

0-1 month old

- ☐ Difficulty keeping warm or fluctuating body temperature
- ☐ Fractures or large bruises on the baby's head at birth
- ☐ Persistent jaundice (yellowish skin and eyes)
- ☐ Low blood sugar
- ☐ Feeding difficulties
- ☐ Lacking facial expressions

1 month old or more

- ☐ Feeding problems
- ☐ Kinky hair that is light-colored, coarse, and breaks easily
- ☐ Loose skin on the body or saggy facial features
- ☐ Seizures, which can look like unusual:
  - sudden stiffening of arms or legs or the whole body
  - eye movements (eyelid fluttering, eyes rolling up)
  - mouth movements (chewing movements, sticking out tongue)
- ☐ Low muscle tone/not moving around well/floppiness
- ☐ Not meeting developmental milestones
- ☐ Urinary tract infections

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2. What are the next steps if Menkes disease is suspected? Which lab tests should be run? Are there other specialists we should be in contact with?

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3. If my child has Menkes disease, what are the next steps in creating their care and treatment plan?

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4. Are there additional care team members available in your office, like a dietician, nutritionist, or social worker? If my child requires the care of other specialists (like a neurologist, pulmonologist, gastroenterologist, or urologist), how will we coordinate care as a team?

Notes: _____

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To learn more about available resources and support, visit aboutmenkes.com or scan here.

References: 1. Ojha R, Prasad AN. Menkes disease: what a multidisciplinary approach can do. *J Multidiscip Healthc*. 2016;9:371-385. **2.** Kaler SG. ATP7A-related copper transport diseases–emerging concepts and future trends. *Nat Rev Neurol*. 2011;7(1):15-29. **3.** Tümer Z, Klomp L. Clinical utility gene card for: Menkes disease. *Eur J Hum Genet*. 2011;19(10). doi:10.1038/ejhg.2011.56. **4.** Kaler SG. Inherited disorders of human copper metabolism. In: Pyeritz RE, Korf BR, Grody WW, eds. *Emery and Rimoin's Principles and Practice of Medical Genetics and Genomics: Metabolic Disorders*. 7th ed. Academic Press; 2021:413-443.

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