Patient Information Sheet
Renal agenesis

You have recently learned that your baby has renal agenesis. We expect that you may have questions about what this could mean for your developing baby. Hopefully, this information will address some of your concerns; however, we encourage you to speak to your genetic counselor or healthcare provider for more information. It is important to remember that anyone can have a baby with a birth defect. Birth defects occur in 2-5% of all births and are rarely caused by something that the parents did or did not do before or during pregnancy. Currently, there are no tests available to detect all health problems.

What is renal agenesis?

Renal agenesis is a condition where one or both of the kidneys do not develop while the baby is in the womb and are missing on ultrasound. Generally people should have two kidneys that filter the blood and remove waste products out of the body via urine. Renal agenesis is called *unilateral* if only one kidney is missing and *bilateral* if both kidneys are missing. At least one healthy kidney is needed for normal development.

How many babies are found with renal agenesis?

It is not known exactly how many babies are born with renal agenesis. It is thought that approximately 1 in 450 to 1 in 1,300 babies have unilateral renal agenesis, however, most people with one kidney are healthy and may not even know they have one kidney missing. Bilateral renal agenesis is less common and happens in approximately 1 in 3,000 to 1 in 4,000 births.

What causes renal agenesis?

In majority of babies with renal agenesis, the exact cause is not known. For these babies, renal agenesis is thought to be a "multifactorial" condition, meaning that multiple factors (including genetics and the environment) influence the development of the kidneys.

Although many babies only have renal agenesis and no other problems (isolated), it is thought that about half of children with renal genesis may have additional birth defects. Some of these include other problems with the urinary tract, heart, gastrointestinal, and skeletal problems. If your baby has additional birth defects, it could be because your baby has a chromosome problem or a genetic condition. If the renal agenesis is isolated (no other problems found), then it is more likely to be multifactorial.

In order to understand a possible chromosomal cause or genetic syndrome cause, it is helpful to know a little about chromosomes. Chromosomes are packages of genetic information that carry the instructions (genes) necessary for our growth and development. Typically, there are 23 pairs of chromosomes in each cell of our bodies. One copy of each pair is from our mother and one copy of each is from our father. The first 22 pairs of chromosomes are the same in males and females. The last pair is known as the sex chromosomes and they determine our gender. Females typically have two X chromosomes and males usually have one X and one Y. It is important to have the correct amount of genetic material to have typical development. Sometimes there is an imbalance of genetic material that may cause birth defects. The imbalance may be caused by an extra or missing whole chromosome or sometimes only by extra or missing pieces of chromosomes. Some genetic conditions are caused by changes in one or more genes in our genetic make-up that result in a particular set of characteristics or features (also called a syndrome). A genetic imbalance or genetic syndrome can produce birth defects and physical changes such as renal agenesis.

Rarely, certain medications, other exposures, or an underlying maternal medical condition during early pregnancy may cause renal agenesis. There have also been reports of families with multiple family members having renal agenesis or other kidney problems, suggesting that some cases are "hereditary", or passed down from generation to generation.

What problems could be associated with renal agenesis for my baby and how are they treated?

Starting at about 14 to 18 weeks of pregnancy the baby's kidneys start producing the urine that makes up most of the amniotic fluid around the baby. The amniotic fluid helps cushion the baby inside your belly and allows the baby to move. Amniotic fluid is also swallowed by the baby which helps the baby's lungs grow and develop.

Typically babies that have isolated *unilateral* renal agenesis have normal amniotic fluid and do not have serious problems. Most people can live normal lives with only one working kidney. They may be an increased risk of kidney infections, kidney stones, hypertension (high blood pressure), and/or kidney failure later in life.

Babies with *bilateral* renal agenesis have more severe problems. In most cases the kidneys do not produce enough amniotic fluid leading to something called oligohydramnios (low fluid) or anhydramnios (no fluid). Since amniotic fluid is needed for the baby's lungs to grow, low or no amniotic fluid causes underdeveloped lungs. Unfortunately, this is usually not compatible with life outside the womb and most babies pass away at birth or shortly after birth.

In general, there is no treatment that can help produce amniotic fluid or help lungs grow if both of the kidneys are missing. There may be some investigational therapies to increase amniotic fluid to help the lungs grow and are only offered at a few hospitals in the country. However, the lungs are still likely to be underdeveloped. Babies with bilateral renal agenesis who survive the pregnancy or after birth typically require dialysis and kidney transplant for long-term survival. Some parents may choose to end a pregnancy that has been diagnosed with bilateral renal agenesis.

What further testing may be offered and what will it tell me?

Depending on how far along you are in pregnancy, a number of additional tests may be offered to you. If the renal agenesis is found during a routine ultrasound, a more detailed ultrasound will usually be performed to look more carefully at the baby's body parts. In some cases a fetal echocardiogram (an ultrasound of the baby's heart) and/or a fetal MRI may also be recommended. You may be referred to a high risk maternal-fetal-medicine (MFM) doctor or a fetal center, which is a high risk center where various specialists may gather to review the health problems identified in your baby, as well as the potential causes and prognosis.

You may also be offered different types of genetic tests. There are two types of prenatal tests, diagnostic and screening:

<u>Diagnostic Tests</u>

Depending on your gestational age and the amount of amniotic fluid around the baby, two diagnostic testing options may be available including chorionic villus sampling (CVS) or amniocentesis. These are diagnostic tests in which a small sample of placenta or amniotic fluid is obtained to examine the baby's chromosomes. Because these procedures are considered invasive procedures, there is a risk, likely less than 1%, for complications that can lead to miscarriage.

If you choose to pursue a CVS or amniocentesis, you may be offered an additional test called a chromosome microarray (CMA). It is used to identify small missing or extra pieces of the baby's chromosomes that may be associated with genetic conditions. CMA cannot detect all genetic conditions and may detect variations in the chromosomes that have uncertain clinical significance. Parental blood samples may help to clarify the meaning of a variation, but effects of these changes may not be known until after the baby is born. CMA may also detect information such as non-paternity and close relationships between parents. In addition to CMA, you may also be offered testing for specific genetic syndromes to look for changes in one or more genes.

<u>Screening Tests</u>

There are multiple screening tests to determine the chances for a baby to have a chromosome condition. These screening tests cannot diagnose or rule out the presence of a chromosome condition but may be used to help you decide whether or not you would like to pursue a diagnostic test.

Cell-free DNA (cfDNA), also referred to as Non-Invasive Prenatal Testing (NIPT) or Non-Invasive Prenatal Screening (NIPS), is a screening test for certain chromosome conditions. During pregnancy, some of your baby's placenta's chromosome material is in your blood, along with your own chromosome material. Cell-free DNA screen is a blood test that measures the amount of chromosome material in your blood to determine if your baby could have an extra chromosome. This test screens for Down syndrome, trisomy 18, trisomy 13 and may also screen for some less severe conditions that are caused by different numbers of the X or Y chromosome. Cell-free DNA screen may also screen for several conditions caused by small missing pieces of chromosomes. While cell-free DNA screen is a good screen, it is not a diagnostic test, like the amniocentesis. The detection rate for these chromosome conditions is typically between 90-99%. Other screening blood tests (often called a triple, quad, penta, or first trimester screen) may also be offered.

The risks, benefits, and limitations of screening and diagnostic testing options should be discussed with you by your genetic counselor or other health care provider. Follow-up counseling and referrals for support can be made if a chromosome condition is detected prenatally. As with all situations in which prenatal testing is discussed, it is your decision whether or not this test is done.

It is important to remember that prenatal screening and testing cannot detect or rule out all genetic conditions. After the baby is born, if additional birth defects or developmental delays are noted, an examination by a pediatric geneticist may be recommended. The geneticist may recommend that a small amount of blood be taken from the baby to evaluate for a chromosome or genetic problem. In cases of bilateral renal agenesis where the baby passes away an autopsy may also be recommended. This examination and possible additional tests are important, since an accurate diagnosis will provide you with the best information regarding the

prognosis for your baby, the cause of the birth defect, the risks to future children and that of other family members, as well as to determine appropriate tests to be offered to you in future pregnancies.

The decision to have one or more of these tests or to do no additional testing is a difficult and personal one. There is no one right decision. Some people will decide to have no further testing because they do not feel they need to know if their baby will have any of these chromosome or genetic conditions before delivery. Other people feel that they want more information as soon as possible. After gathering all of the information you need about renal agenesis and available testing, you should make the decision that is right for you and your family

What is the chance for this to happen again?

Parents of a baby with renal agenesis are often worried about the chance for it to happen in another pregnancy. If the renal agenesis is isolated and not part of a genetic condition and there is no other family history, this chance is 3-4%. If there is family history of kidney problems in parents or other family member, the chance for it to happen again may be as high as 50%.

What do I do now?

This information is only intended as an introduction to some of the terms and tests that you have already heard or will be hearing about from your genetic counselor and healthcare provider. We hope that this information sheet will be helpful as you begin to understand more about renal agenesis. We understand that any time something of concern is found through prenatal screening and testing, parents are going to be worried. Please don't hesitate to contact your genetic counselor with any questions or concerns you have. We are here to help you and your baby.

You may also find it useful to have a consultation with a maternal-fetal medicine physician (physician that specializes in high-risk obstetrical care), a nephrologist (kidney doctor), a urologist (urinary tract doctor), and/or neonatologist (NICU doctor) prior to delivery. However, depending on your specific case and what hospital you are seen at, your health care provider may recommend additional consultations and tests that are not discussed here. Support groups, either online or in person, can provide comfort for families facing this diagnosis. We encourage you to talk to your genetic counselor or healthcare provider to learn more about what might be helpful for you.