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FETAL HYDRONEPHROSIS

Due to the widespread use of ultrasound screening in pregnancy, the number of children with urinary tract abnormalities who are diagnosed prenatally is increasing. Approximately 20% of fetal anomalies discovered on ultrasound involve the urinary tract. Because the diagnosis of fetal hydronephrosis is being made more frequently, the need for a coherent approach to the diagnosis and management of these patients is readily apparent.

Etiology

Fetal hydronephrosis encompasses a wide variety of urinary tract abnormalities. Although hydronephrosis may initially be thought of as an obstructive phenomenon, it also may be secondary to nonobstructive entities. The most common cause of obstructive hydronephrosis would be the ureteropelvic junction obstruction which may be unilateral or bilateral. The most severe form of obstruction would be complete ureteral atresia which leads to the development of a multicystic kidney. Other less common obstructive entities leading to various presentations of hydronephrosis include ectopic ureters and ectopic ureteroceles which are usually associated with duplex collecting systems. Ureterovesical junction obstruction leads to the development of an obstructive megaureter.

Severe cases of vesicoureteral reflux lead to hydronephrosis in the absence of obstruction. Prune belly syndrome also presents with severe urinary tract dilation but in most cases, obstruction is absent. Posterior urethral valves and neurogenic bladders may cause either upper urinary tract dilation or vesicoureteral reflux secondary to bladder outlet obstruction.

Prenatal Diagnosis

The kidneys are usually visualized with ultrasound by the eighteenth week of gestation. The unobstructed fetal ureter is usually not identified, and the bladder may be seen to fill and empty in a normal cyclical pattern. After 18 weeks, the amount of amniotic fluid is a reflection of fetal urine output.

Fetal obstructive uropathies are identified by demonstrating a dilated renal pelvis or calices, ureter or bladder. An abnormal urinary tract is found on postnatal evaluation in only 85% of cases diagnosed prenatally. The other 15% of cases can be described as having physiologic hydronephrosis which resolved. This finding demonstrates the problem we have in determining what is significant renal pelvic dilation. From one series, 94% of fetuses with caliceal dilation greater than 1.5 cms. were found to have a postnatal abnormality requiring surgery. However, only 3% of patients with a dilated renal pelvis less than 1 cm. in diameter were found to be normal.

Once fetal hydronephrosis has been identified, attempts are made to assess renal function. After 20 weeks, oligohydramnios is an indicator of possible poor renal function.

Prenatal Management

Harrison and co-workers performed bilateral cutaneous ureterostomies via hysterotomy in a 21 week fetus with posterior urethral valves in 1982. Since that time, in utero intervention has been undertaken in a number of centers across the country, mainly utilizing different types of internal shunts between the amniotic sac and urinary tract. Although the technical expertise in doing these procedures has improved, there is much controversy concerning whether there is any positive effect on ultimate renal function. There is general agreement that in certain cases with oligohydramnios, pulmonary hypoplasia can be prevented by restoring adequate levels of amniotic fluid.

In utero interventions are not without complications which include premature labor and chorioamnionitis. As expected, since the prenatal ultrasound diagnosis is often unreliable, there are numerous reports of in utero intervention for obstructive uropathies which were not actually present.

Unilateral hydronephrosis secondary to ureteropelvic junction obstruction or an obstructive megaureter does not require in utero intervention or early delivery. Most of these patients will have a normal contralateral kidney and normal amniotic fluid volumes and, therefore, renal function should be adequate. In fetuses with bilateral ureteropelvic junction obstruction who have normal amniotic fluid volume, in utero intervention is not indicated and early delivery is not recommended. In fetuses with nonobstructive hydronephrosis secondary to reflux, in utero intervention is not beneficial.

In cases of severe oligohydramnios where there is indication of severe renal dysplasia on ultrasound, in utero intervention will be unsuccessful in reversing ultimate renal failure. The number of fetuses who are candidates for intervention is extremely small and would include the fetuses with evidence of posterior urethral valves who has displayed some capacity for making adequate urine. Prior to placing a vesicoamniotic shunt or performing a vesicostomy through an open hysterotomy, the fetal urine is analyzed for sodium and chloride concentration and osmolality which are sometimes predictive of satisfactory renal function.

Postnatal Diagnosis and Treatment

Ultrasonography should be the initial examination in a newborn who carries an antenatal diagnosis of hydronephrosis. The ultrasound findings may be able to confirm the diagnosis, but usually further imaging studies are required in order to identify the etiology of the hydronephrosis. All children with antenatal hydronephrosis should undergo a voiding cystogram in order to rule out vesicoureteral reflux. Even though 15% of fetuses will have physiologic hydronephrosis, which may have resolved completely by the postnatal ultrasound, intermittent hydronephrosis can be caused by vesicoureteral reflux. In children whose postnatal ultrasound is normal shortly after delivery, a follow-up ultrasound should be obtained 4 to 6 weeks after birth to ensure that the absence of the hydronephrosis is a permanent finding. In some patients with significant obstruction, the ultrasound in the immediate newborn period will be normal due to transient oliguria.

In those children whose ultrasound is consistent with a ureteropelvic junction obstruction, the next imaging study is usually a MAG 3/DTPA renal scan with Lasix washout which can confirm the level of obstruction, as well as quantitate the degree of obstruction. A number of children will have dilation without obstruction which is documented by adequate washout of isotope from the renal pelvis after Lasix. Children with this presentation require close observation during infancy since some will subsequently develop an obstruction which requires surgery. In those children whose scans confirm a high-grade obstruction, surgery to correct

the obstruction is indicated. Even when function is poor, the neonatal kidney has the capacity for significant improvement in function following pyeloplasty.

In children with obstructive megaureters, an intravenous pyelogram will sometimes be indicated in order to better define the anatomy of the renal unit including outlining ureterocele. Children presenting with posterior urethral valves confirmed on voiding cystogram, should undergo primary valve ablation in the newborn period.

Certain newborns presenting with a history of antenatal hydronephrosis will benefit from prophylactic antibiotics until their definitive surgery is completed or their urinary tract is shown to be free of abnormality.

Conclusion

The detection of hydronephrosis in utero is increasing because of the widespread use of prenatal ultrasound screening. Consequently, the diagnosis of an obstructive uropathy is being made much earlier in life than in the past. Earlier diagnosis allows for earlier reconstructive surgery, thereby maximizing renal function. Although in utero intervention is indicated in only a very small percentage of cases, prenatal counseling concerning the prenatal ultrasound findings is an integral part of maternal care.