A malformation is defined as a morphological defect of an organ, part of an organ, or a larger region of the body resulting from an intrinsically abnormal developmental process [1].

Inheritance of malformations can be classified in several ways. For the purposes of this chapter, we follow the classical genetic modes of inheritance: autosomal dominant, autosomal recessive, and X-linked recessive. Sporadic malformations for which information regarding inheritance is lacking are listed on a table (table 17-4). The renal lesions found in chromosomal defects are listed separately because their inheritance pattern is variable: most trisomies are sporadic, due to nondisjunction; translocation abnormalities may be transmitted through a balanced translocation-parent carrier. Functional abnormalities without obvious structural malformations are described in other sections of this volume.

Specific renal malformations are relatively rare in dysmorphic syndromes. Examples include the common association of horseshoe kidney in gonadal dysgenesis (Turner syndrome) and chromosome 18 trisomy, and hypoplasia of the kidney in obstruction sequences. However, variable renal anomalies and renal malfunction are integral parts of many syndromes, including those with clearly defined modes of inheritance. Some of these conditions, such as obstructive uropathy [2, 3] can be identified in utero by ultrasonography, while those associated with enzymatic or chromosomal defects can be diagnosed by examination of the amniotic fluid or chorionic villi.

RENAL DYSPLASIA

Dysplastic kidneys are the result of an abnormal differentiation of the metanephros. Typical dysplastic features are the presence of metaplastic cartilage, primitive ducts, and lobar disorganization [4, 5]. Metaplastic cartilage appears within the cortex as bars and nests of hyaline cartilage. Primitive metanephric ducts, which may be cystic, are lined with undifferentiated epithelium and surrounded by fibromuscular collars. Abnormal corticomedullary relationships and rudimentary medullary development constitute lobar disorganization. These abnormalities bear a strong relationship to urinary tract malformations [6, 7], including ureteral atresia and urethral valves, suggesting that urinary obstruction or urinary reflux during metanephric development leads to renal dysplasia [4].

Dysplastic kidneys are often cystic; the most common variety perhaps is the multicystic dysplastic kidney [8]. The enlarged misshapen, irregularly cystic kidney is closely related to aplastic dysplasia—the small, barely recognizable, rudimentary, solid nubbin. The difference is in the degree of cyst formation. All degrees intermediate between the two prototypes exist. Some multicystic kidneys contain masses of undifferentiated cells, which have been referred to as nodular blastema [8, 9]. Nodular blastema may be related to the rare development of Wilms’ tumors [9] or renal cell carcinoma [10, 11].

The multicystic dysplastic kidney is usually detected in the newborn as a flank mass, and sonography shows large, spherical cysts with nondelineation of the renal sinus [12, 13]; frequently there are renal and urinary tract abnormalities contralaterally [14, 15]. Malformations of other systems, especially congenital heart disease and esophageal or intestinal atresia, are common.

Diffusely cystic dysplastic kidneys with patent urinary tracts occur principally in malformation syndromes. They should not be confused with multicystic kidneys, since the clinical and genetic implications are different. The cysts in diffuse cystic dysplasia typically arise within primitive collecting ducts. There may be a striking paucity of nephrons. Clusters of glomeruli and convoluted tubules are present among the cysts. Cartilage is seldom present. Diffuse cystic dysplasia occurs with regularity in Meckel syndrome [16, 17], and less often in a group of disorders that includes several forms of short-limbed chondrodysplasia, Zellweger syndrome, glutaric aciduria type 2, and renal-hepatic-pancreatic dysplasia [18]. In all these syndromes, the liver contains a biliary abnormality very similar to that of autosomal recessive polycystic kidney disease and congenital hepatic fibrosis. Specific diagnosis depends on recognition of the syndrome, since the renal abnormality is similar in all of them.

The risk of inheritance of renal dysplasia is very small [20]. Multicystic and aplastic kidneys are inherited, usually in a dominant pattern, in the hereditary renal adysplasia syndrome, which includes unilateral dysplasia and unilateral agenesis [20–22]. There is also a small risk of obstructive dysplasia due to the familial occurrence of posterior urethral valves [23]. The risk of recurrence of