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## Glomerular Density and Volume in Renal Biopsy Specimens of Children with Proteinuria Relative to Preterm Birth and Gestational Age

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### Abstract

**Background and objectives** A low total nephron number, which is associated with low birth weight (LBW), may indicate increased susceptibility to early-onset renal diseases in children. However, few studies have assessed renal biopsy findings in LBW children. We examined the relationship between LBW and glomerular density (GD) and/or glomerular volume (GV) in renal biopsy samples as a surrogate for total nephron number.

**Design, setting, participants, & measurements** Renal biopsy findings of children of LBW were compared with those of age-matched control subjects of normal birth weight (NBW) who were histopathologically diagnosed with FSGS or minimal change nephrotic syndrome (MCNS) from 1995 to 2011. The GD and GV were estimated on the basis of measurements obtained by computerized image analysis.

**Results** A total of 31 subjects (mean age 11 years; eight with low birth weight-FSGS [LBW-FSGS], 10 with normal birth weight-FSGS [NBW-FSGS], and 13 with normal birth weight-minimal change nephrotic syndrome [NBW-MCNS]) were analyzed. The mean birth weight of each group was 777 g (629–1000), 3110 g (2888–3358), and 3120 g (2748–3398), respectively (median [25th–75th percentile]). Age, body mass index, BP, and degrees of globally sclerotic glomeruli at biopsy were comparable between the groups. The GD was lower (LBW-FSGS,  $1.4 \pm 0.6/\text{mm}^2$ ; NBW-FSGS,  $3.3 \pm 1.2/\text{mm}^2$ ; and NBW-MCNS,  $3.6 \pm 1.1/\text{mm}^2$ ;  $P < 0.05$ ) and the GV was greater (LBW-FSGS,  $4.1 [3.1-5.1] \times 10^6 \mu\text{m}^3$ ; NBW-FSGS,  $1.6 [1.5-2.1] \times 10^6 \mu\text{m}^3$ ; and NBW-MCNS,  $1.3 [1.1-1.8] \times 10^6 \mu\text{m}^3$  [median, (25th–75th percentile)];  $P < 0.05$ ) in patients with LBW-FSGS than in the other patient groups. The GD showed close positive correlations with birth weight ( $r = 0.48$ ) and gestational age ( $r = 0.54$ ), independent of renal function and degree of global glomerular sclerosis.

**Conclusions** A low GD together with marked glomerular enlargement characterizes renal biopsy samples of children born with a LBW at an early stage of gestation.

premature birth   biopsy   kidney glomerulus   birth weight  
blood pressure   body mass index   child   female   gestational age  
glomerulosclerosis, focal segmental   humans   infant, low birth weight  
infant, newborn   kidney   kidney glomerulus   nephrons  
nephrosis, lipid   pregnancy   premature birth   proteinuria   sclerosis  
segmental glomerulosclerosis

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