Morphological Aspects of the Kidney: Can Normality Be Predicted?

Introduction and Objective: Our study aimed to assess the normal parameters of renal parenchyma and upper urinary tract from a contrast enhanced computed tomography assessment in order to create a mathematical model of normal kidney.
Materials and Methods: We conducted a retrospective observation study on 520 patients with a normal abdominal contrast enhanced CT scan in our Institute during November 2008–November 2010. All CT examinations were performed using 16 slices Siemens Emotion 2007 (Siemens Medical Solutions, Malvern, PA, USA). Two experienced radiologists evaluated all the evaluations and reformatted axial sections and after excluding patients with urinary tract pathology, the images were transferred to a separate workstation (eFilm Workstation™ 2.2.1, Merge Healthcare, Milwaukee, USA). Parameters measured were: the number of kidneys, craniocaudal diameter (CCD) in a coronar reconstruction, transverse diameter (TD) and anteroposterior diameter (APD) as the maximum diameter of the kidneys in the axial sections, parenchymal (PW) and cortical width (CW) in axial sections, kidney pyelon width (KPW), parenchymal index (PI), kidney rotation, measured in relation to the sagittal axial plane of reference (AR) and rotation of the kidney measured in the sagittal plane in relation to the coronary reference (SR). To identify factors that can influence the variables CCD, CW and PW, multivariate regression models were performed using SPSS software (SPSS 15, SPSS Inc., Chicago, Illinois, USA). We considered $p<0.05$ statistically significant.
Results: CCD remains high until the fifth decade of life ($p=0.0053$ on the right side, $p=0.0012$ on the left, ANOVA), PW values were found to be somewhat increased ($p=0.0293$ on the right side, $p=0.2924$ on the left, ANOVA). There are linear correlations between height and CCD, CW and PW, with statistical significance ($p<0.05$ each, Spearman ρ between 0.13 and 0.4). In multivariate analysis, only BMI, male gender and height had statistical significance.
Conclusions: There is a wide range in size kidney. Among factors that strongly influence the values of CCD, CW, and PW in adults, BMI, male gender and height are most important. Also, cranial and caudal position of the kidney influences renal size. As for the size of the renal cortex, the factor most influencing these values is the absence of a contralateral kidney.