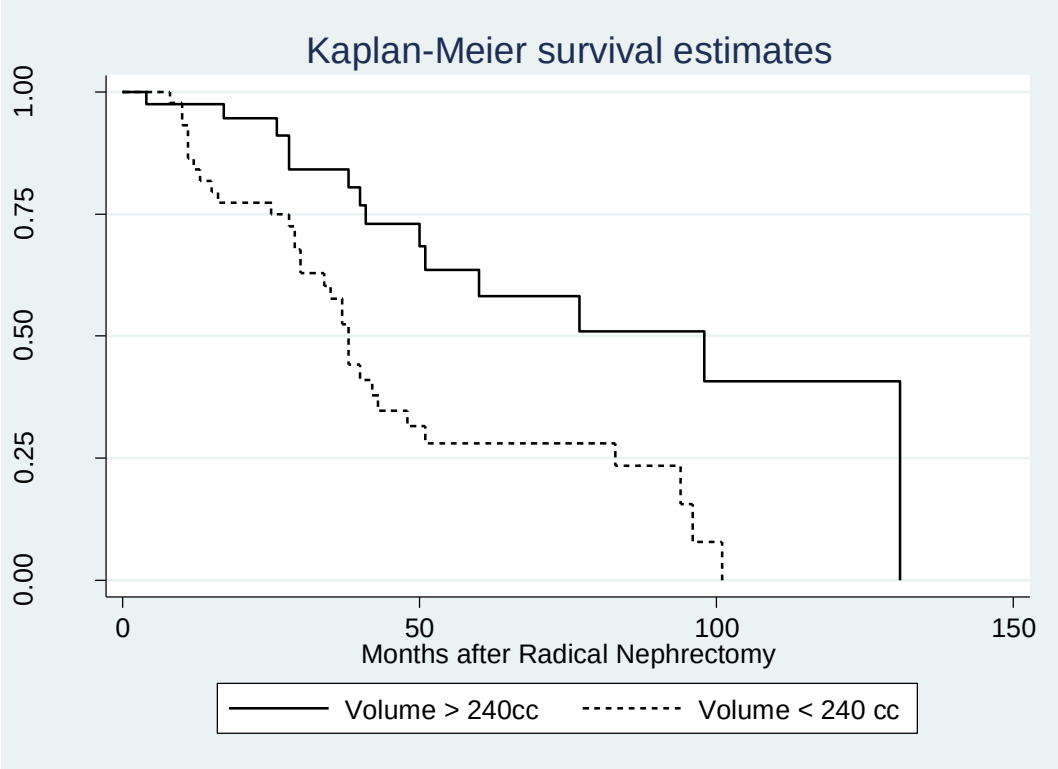
Baseline Total Renal Volume Predicts Risk of Chronic Kidney Disease (CKD) after Radical Nephrectomy

Introduction and Objective: We used ImageJ to measure pre-operative kidney volume on CT scans for patients undergoing radical nephrectomy and studied its association with kidney function post-operation.
Materials and Method: A retrospective review of 98 consecutive patients (% Females), who underwent radical nephrectomy (2000-2008) was performed. Each patient's CT scans were opened in ImageJ and bilateral kidney parenchyma and tumor were manually outlined in each transverse slice. The area of normal kidney tissue segmented in each slice, excluding the tumor mass, renal vessels and central sinus fat, was multiplied by slice thickness to calculate volume. Estimated glomerular filtration rate (eGFR) was determined using the Modification of Diet in Renal Disease (MDRD) equation pre and post operatively during follow-up. CKD was defined as an eGFR<60ml/min/1.73 m^2 according to KDOQI guidelines. Cox regression analyses were then used to determine the impact of predictors on the development of CKD post surgery.
Results: Mean total kidney volume for this population (Mean age 57.7±12.9) was 245.0 ± 61.3 (SD) cc. Pre operative eGFR was 76.4 ±22 ml/min/1.73 m^2. Kidney volume was correlated with preoperative eGFR by linear regression (r=0.20, P=0.049). At baseline, 21% (n=21) of patients have CKD. Over a median follow-up of 2.6 years, progression to CKD occurred in 53% (n=52) patients. Cancer-specific and overall survival was 97%. Cox regression analysis showed that renal volume<240cc ((P=0.005, OR 2.6(95% CI 1.3-5.0)), male gender (P=0.02, OR 2.2(95% CI 1.1-4.3)) and diabetes (P<0.001, OR 3.0(95% CI 1.9-4.7)) were independent predictors of post operative CKD. KM analysis shows the median time to CKD after nephrectomy is 3.3 vs 8.3 months respectively for renal volume less or more than 240cc.
Conclusion: Total renal volume as measured using proprietary image analysis software before radical nephrectomy correlates with baseline renal function as measured by MDRD equation. In the above population, a total volume of less than 240 cc is a significant predictor of CKD after radical nephrectomy.


Kaplan-Meier survival estimates
1.00
0.75
0.50
0.25
0.00
0
50
100
150
Months after Radical Nephrectomy
Volume > 240cc
Volume < 240 cc