A LOW COST PORTABLE SMARTPHONE DIGITAL MICROSCOPE TO ACCURATELY PREDICT KIDNEY BIOPSY ADEQUACY

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INTRODUCTION

On kidney biopsies, at least 8-10 glomeruli are conventionally required to reach a final diagnosis (1). When the tissue is scarce, the correct allocation of the sample for light microscopy, immunofluorescence and electronic microscopy can be troublesome. Without intraoperative assessment, the risk of an inadequate sample increases to nearly 4 times (2). New portable smartphone microscopes represent promising tools, albeit still requiring validation (3).

METHODS

We conducted a prospective cohort study on kidney biopsies performed in our Department in the University Hospital of Parma between June 2020 and April 2021. We compared the number of visible glomeruli by a digital microscope (Bodelin ProScope, **Figure 1**) with the total number by LM, IF and EM. All biopsies were ultrasound-guided. Pearson's correlation analysis was used to explore the relationship between the two counts. ROC curve analysis was performed to evaluate the ability of our tool to predict specimen adequacy (a total sum ≥10 glomeruli observed by LM, IF and EM).

RESULTS

We analysed 83 specimens of both allograft (73%) and native kidney biopsies (27%) [**Table 1**]. The mean glomerular yield was 25. A final diagnosis was reached in all cases. There was a strong positive linear correlation between the number of glomeruli assessed at the bedside and the sum of glomeruli observed by LM, IF and EM (Pearson's coefficient r=0.825, p <0.001). The area under the ROC curve was 1.0, indicating high accuracy of the method. The most sensitive and specific threshold of the Bodelin Proscope count to predict specimen adequacy was of ≥9 glomeruli, with both a sensitivity and specificity of 100%.

CONCLUSIONS

The Bodelin ProScope grants a low-cost tool to intraoperatively assess kidney biopsy adequacy with high grade confidence. Larger scale studies in which the number of biopsy cores is guided by the threshold we identified are warranted, potentially leading to a decrease in the number of passages and therefore bleeding risk.

Table 1. Biopsy details

Number of biopsies	83
Biopsy type, n (%)	
Native kidney biopsy	22 (27)
Transplant biopsy	61 (73)
Total number of cores, n	129
Number of cores per patient, n (SD)	1.5 (0.5)
Final pathology results	
Glomeruli obtained per patient, n (SD)	25 (11.5)
Able to make diagnosis, n (%)	83 (100)

Figure 1. Picture of a kidney biopsy core taken with the Bodelin Proscope. Glomeruli are identified as small red circles in clear contrast with the rest of the cortical parenchyma.

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(2)Syed Gilani, MD, Hong Qu, MD, Daniel Ockner, MD, Role of On-site Microscopic Evaluation of the Kidney Biopsy for the Adequacy and Allocation of the Glomeruli: Comparison of Renal Biopsies With and Without On-site Microscopic Evaluation, American Journal of Clinical Pathology, Volume 138, Issue suppl_1, July 2012, Page A343, https://doi.org/10.1093/ajcp/138.suppl1.319
(3)Singh, Gurmukteshwar1; Massak, Mark2; Czaplicki, Michael2; Young, Evan2; Sharma, Shree3; Chang, Alex1; Bhanushali, Ashok2; Anand, Prince1. Use of a Smartphone Camera at the Bedside to Assess Adequacy of Kidney Biopsies. JASN 32(12):p 3024-3026, December 2021. | DOI: 10.1681/ASN.2021070898