Kidney biopsy is still the gold standard in renal disease to provide diagnosis and prognosis, and to guide treatment. Like any invasive procedure, it has complications (4%–5%), mainly related to bleeding or development of arteriovenous fistulas.

All staff required to perform a percutaneous renal biopsy (PRB) should receive formal technique training to improve skills and competency outcomes. Simulation-based education has recently become a crucial part of procedural and surgical training to complement learning.

However, and despite being recommended, formal simulation of the biopsy procedure prior to performing the technique is not a common routine practice in nephrology.

In 71 (13.5%) of cases, the SimPRB modified the standard puncture site. From the NK biopsied, in 312 (91.2%) the puncture site selected was the left NK (Figure 1), and in 27 (9.4%) of cases, the SimPRB modified the target site: 2 patients underwent biopsy in the middle area of the left kidney instead of the lower pole and 25 (8.8%) in the right kidney because of anatomical abnormalities of the left kidney (cysts), left NK hydronephrosis, or a thinned cortex of the left NK. From the KTs biopsied, in 37 patients (19.8%) the SimPRB modified the usual target (upper pole, Figure 2) and were biopsied in other areas, mostly because of collections around the upper pole, extreme depth, or arteriovenous fistula.

### RESULTS

In the study period, 531 simulated percutaneous renal biopsies (SimPRBs) were done by an experienced nephrologist, with 59 patients deemed not suitable for biopsy after the SimPRBs, which accounts for 11.1%. Of the 531 SimPRBs, 342 (64.4%) were native kidney (NK). The indications for biopsy are summarized in Table 1. No kidney transplant protocol biopsies were done.

### Table 1. Biopsy indications

| Indication          | Native kidney (%) | Kidney transplant (%) |
|---------------------|-------------------|-----------------------|
| Impaired renal function | 23.8              | 64.0                  |
| Proteinuria         | 21.1              | 15.8                  |
| Hematuria           | 5.6               | —                     |
| Proteinuria and hematuria | 19.0              | 1.1                   |
| Nephrotic syndrome  | 23.1              | 1.1                   |
| Nephritic syndrome  | 7.6               | —                     |
| Suspected Rejection | —                 | 18.0                  |
Of the 59 patients who did not undergo a biopsy, reasons to preclude it were risk–benefit disbalance in 23 patients (39.0%), intolerance to technique in 11 patients (18.6%), low diagnostic potential in 14 patients (23.7%), diagnostic SimPRB in 9 patients (15.3%), and patient refusal in 2 patients (3.4%). Risk–benefit disbalance was as per treating physician and interventional nephrologist criteria, based on excessive bleeding risk, proteinuria, and/or renal function improvement. Low diagnostic potential was considered when SimPRB findings showed 1 or more of the following characteristics: echogenic, thinned, or calcified kidney cortex, and reduced kidney size.

The diagnostic SimPRB findings precluding the biopsy are summarized in Table 2.

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The diagnostic SimPRB findings precluding the biopsy are summarized in Table 2.

Table 2. SimPRB findings contraindicating biopsy

| SimPRB result     | Findings                   |
|-------------------|----------------------------|
| Unsuitable        | Severe scoliosis           |
|                   | Inaccessible KT pole       |
|                   | Patient refused/apnea intolerant |
|                   | Prone position intolerant  |
| Anomalies         | Cysts (hilar and cortical) |
|                   | Hydronephrosis             |
|                   | Thinned parenchyma         |
|                   | Bladder mass               |
|                   | Altered perfusion on Doppler ultrasound |
| KT, kidney transplant; SimPRB, simulated percutaneous renal biopsy.

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional review board at which the studies were conducted (Institutional Review Board approval number 034/19) and with the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards. As data were retrospectively collected and derived from routine clinical practice, further consents were waived.

Questionnaire

Of 89 SimPRBs done in 2018, a total of 50 patients responded to the questionnaire (56.1%). In all, 18 (36%) of the surveyed patients referred a reduction in anxiety after the SimPRB, and only 4% (2 patients) considered that the information provided was not at all helpful in resolving their doubts. When asked to rate their satisfaction level postprocedure on a scale of 1 to 10, it was rated 9.3 (range, 7–10), with 66.6% of the respondents considering the SimPRB very helpful to them (response options: not at all, somewhat helpful, very helpful). Responses are summarized in Table 3.

Table 3. Questionnaire results

| Questionnaire result | Prescreen questionnaire | Post-screen questionnaire: prescreen utility |
|----------------------|-------------------------|------------------------------------------|
| Clinic PRB information enough | 72% Yes                  | 66.6% Very helpful 33.4% Somewhat helpful 0% Not at all |
| Doubts sorted during prescreen | 96% Yes                  | N/A                                      |
| Anxiety levels >7 (scale 1 [less anxious] – 10 [more anxious]) | 38% Yes                  | 22%                                      |

N/A, not applicable; PRB, percutaneous renal biopsy.

DISCUSSION

Simulation in health care has been an increasingly used tool due to its utility and effectiveness in improving outcomes. As a result, simulation learning approaches have been introduced in most specialties.
In nephrology, several procedures are included in the specialty portfolio worldwide, such as kidney biopsies and hemodialysis line insertion, and simulation is widely used as a learning tool. However, a formal renal biopsy prescreen done by the nephrologist prior to the real procedure has not been routinely established despite being recommended. It can provide important information and even preclude the technique. Furthermore, certain findings during SimPRB can provide a diagnosis and guide clinical decisions, speeding up patient care. This contributes to boost management and continuity of care, providing optimal and safe care for patients, enhancing success rates, and increasing patients’ cooperation, confidence, and satisfaction.

In our series, we found that SimPRB precluded the biopsy in 59 patients (11.1%) and modified the biopsy entry site and targeted area in another 64 patients (13.5%). This also results in a reduction of unnecessary hospital stays, sanitary costs, and waiting times. As per the Madrid Community Standard Public prices, a hospitalization for PRB costs around 6080 euros. As most nephrology units nowadays have an ultrasound device already available within their units, it would not add any cost, thus contributing to health system sustainability.

The questionnaire provided some insight from the patient perspective: for the patients, it was an opportunity to familiarize themselves with the technique and physician doing the procedure, to clarify any questions, and to gain more confidence, thereby reducing uncertainty and apprehension.

From our point of view, a SimPRB by an expert nephrologist should be done before a biopsy procedure to ensure adequate visualization and to provide input on the best puncture site to obtain an optimal biopsy yield while minimizing risks. The SimPRB also helps patients by reducing concerns and improves their cooperation.

On the other hand, in the last decades, there has been an attempt to shift from provider- and organization-oriented care to patient-centered care. Its aim is to increase patient engagement, to offer a comprehensive approach, and to improve communication, continuity, and shared decision making.

Our view is that a structured SimPRB could be a strategy for a patient-centered approach to promote collaboration, to achieve better communication, and to improve patient satisfaction, while avoiding gratuitous hospital stays, with subsequent savings for the health care system.

CONCLUSION

A structured prescreen of the percutaneous renal biopsy technique prior to the real procedure by the nephrologist permits an optimal puncture site selection, and may even preclude the biopsy, improving patient safety and avoiding needless admissions. It also improves patient confidence and increases cooperation, while minimizing risks and uncertainty.

We suggest that SimPRB be included as a routine part of pre-PRB protocols.

DISCLOSURE

All the authors declared no competing interests.

SUPPLEMENTARY MATERIAL

Supplementary File (Word)
Supplementary Methods.

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