Histopathological Validation of the Surface-Intermediate-Base Margin Score for Standardized Reporting of Resection Technique during Nephron Sparing Surgery

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Abbreviations and Acronyms

HRM = healthy renal margin

NSS = nephron sparing surgery

ORS = operative resection strategy

PC = pseudocapsule

RT = resection technique

SIB = surface-intermediate-base

SSA = score specific area

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Study received institutional review board approval.

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Purpose: The surface-intermediate-base margin score is a novel standardized reporting system of resection techniques during nephron sparing surgery. We validated the surgeon assessed surface-intermediate-base score with microscopic histopathological assessment of partial nephrectomy specimens.

Materials and Methods: Between June and August 2014 data were prospectively collected from 40 consecutive patients undergoing nephron sparing surgery. The surface-intermediate-base score was assigned to all cases. The score specific areas were color coded with tissue margin ink and sectioned for histological evaluation of healthy renal margin thickness. Maximum, minimum and mean thickness of healthy renal margin for each score specific area grade (surface [S] = 0, S = 1 ; intermediate [I] or base [B] = 0, I or B = 1, I or B = 2) was reported. The Mann-Whitney U and Kruskal-Wallis tests were used to compare the thickness of healthy renal margin in S = 0 vs 1 and I or B = 0 vs 1 vs 2 grades, respectively.

Results: Maximum, minimum and mean thickness of healthy renal margin was significantly different among score specific area grades S = 0 vs 1, and I or B = 0 vs 1, 0 vs 2 and 1 vs 2 ($p < 0.001$). The main limitations of the study are the low number of the I or B = 1 and I or B = 2 samples and the assumption that each microscopic slide reflects the entire score specific area for histological analysis.

Conclusions: The surface-intermediate-base scoring method can be readily harnessed in real-world clinical practice and accurately mirrors histopathological analysis for quantification and reporting of healthy renal margin thickness removed during tumor excision.

Key Words: carcinoma, renal cell; pathology; validation studies

Partial nephrectomy resection techniques vary. Surgical approaches differ not only between institutions and surgeons, but also depend on each particular tumor location and anatomical complexity.[1] Indeed, the amount of normal renal parenchyma that is excised with each tumor affects complication rates, preserved parenchymal volume, surgical margin status and potentially oncological outcomes.[2–7] Yet the urological literature historically has largely avoided the detailed reporting of RT used during NSS.[8]

Recently the SIB margin score was proposed as a novel reporting system to classify and communicate tumor

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RT during NSS.[1] The SIB model is based on a visual analysis of the intrarenal side of the specimen (fig. 1), and proposes a structured classification system to quantify and report RT in a standardized fashion across published series (fig. 2).[1,9] In the current study we evaluated the feasibility of the SIB score assessment in a real-world clinical setting and provided definitive histopathological corroboration of the scoring system's validity (histopathological validation).

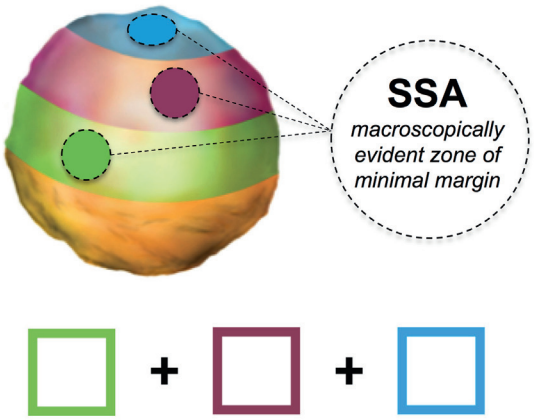
MATERIALS AND METHODS

After institutional review board approval was obtained, between June and August 2014 data were prospectively collected from a cohort of 40 consecutive patients undergoing NSS for localized renal tumors at our institution. NSS was performed by 4 experienced surgeons. The ORS for tumor excision was to search and carefully develop by blunt dissection the natural cleavage plane between the PC and normal parenchyma.

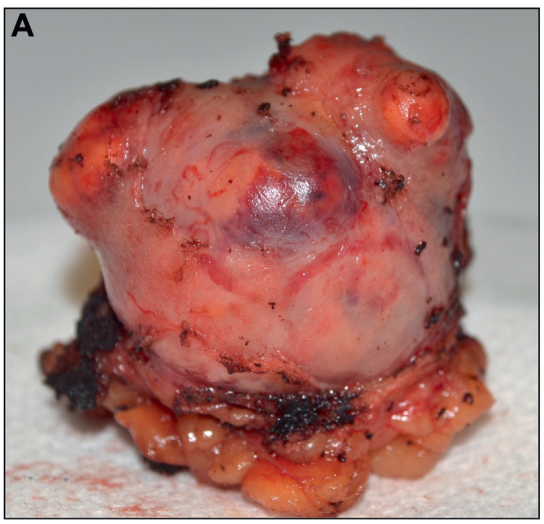
SIB Score Assignment

A detailed, step-by step overview of SIB score assignment is shown in figure 1. After surgery the specimen was oriented in the operating theater and visually analyzed as mutually agreed by 2 surgeons (AM, RC) according to the SIB scoring system.[1,9] Discrepancies were resolved by open discussion.

For SIB score assignment the intrarenal portion of the specimen was divided into 3 approximately equivalent circumferential macro areas (step 1—delineation of the surface, intermediate and base macro areas). Then, the 3 critical areas for SIB score assignment (SSAs), defined as the macroscopically evident zones of minimal margin within each macro area (SSA-Surface, SSA-Intermediate and SSA-Base) were visually defined on the specimen (step 2—delineation of the SSAs, fig. 1). Then a visual analysis of each SSA was made by the surgeon to



Resection technique in the SSA	Visual definition	SIB SCORE		
		Surface	Intermediate	Base
Enucleation	*Only the pseudocapsule is seen, no additional overlying tissue*	0	0	0
Enucleoresection	*Minimal margin of parenchyma with tumor contour readily visible*	1	1	1
Resection	*Tumor contour cannot be appreciated through resected parenchyma*	1	2	2



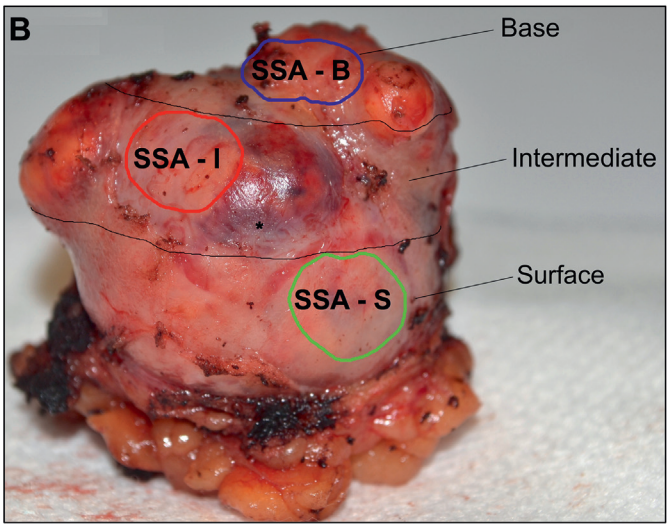


Figure 1. Identification and grading of SSA for SIB score assignment. *A*, intrarenal portion of specimen is divided into surface, intermediate and base areas. *B*, SSAs are visually assigned and defined as enucleation, enucleoresection or resection according to careful assessment of tumor contours and PC visibility.[9] In case thickness of healthy renal margin is homogeneous in given macro area (S, I or B), then every zone of minimal margin in that macro area can be identified as SSA.