Renal Tumor Structured Reporting Including Nephrometry Score and Beyond: What the Urologist Needs to Know

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Goals

- Describe the morphologic parameters that urologists and interventional radiologists need to know in pre-procedural planning, which might impact the management

- Review the commonly used terms and descriptors of those parameters

- Suggest a comprehensive reporting system for detected renal masses on contrast enhanced CT
Target Audience

- Diagnostic Radiologists
- Interventional Radiologists
- Urologists

No financial disclosures
Contents

- Background
- Renal tumor complexity measures
- Variant anatomy
- Parameters pertinent to surgical intervention
- Parameters pertinent to percutaneous ablation
- Suggested reporting system
- Summary
Background

- Incidence of detected renal masses has increased in the last decades
- More than 50% of all diagnosed RCCs are in a localized stage

- Many radiologic reports lack important parameters/factors that impact management decision

Management decision is based on:

- Cancer stage
- Tumor complexity
- Patient anatomy
- Contralateral kidney function
- Patient functional status and comorbidities
- Surgeon preference

For Radiologists, the question has always been: Is it an RCC?
For Urologists on the other hand; Should it be managed with total or partial nephrectomy, ablation, or to be followed up?

Some current practices obtain tumor biopsy, but this is not the purpose of this presentation.
The Nephrometry Score

- Widely used by urologists in guiding management
- Correlates with perioperative vascular and urinary complications as well as local tumor extension

Figure A: Left renal moderately complex mass- (A 3 cm mass; mostly endophytic, <4 mm from renal sinus in between the polar lines, is neither anterior nor posterior to the renal sinus in the sagittal plane; receives the nephrometry score of 9x)

Figure B: Post partial nephrectomy- CTA shows vascular complication with an arterial pseudoaneurysm at the surgical site
Scoring

- Based on:
  R - Radius: Tumor maximal dimension
  E - Exophytic/Endophytic property
  N - Nearness to the collecting system
  A - Anterior/posterior aspect of the kidney
  L - Location relative to the polar lines

- Tumors are stratified into:
  Low complexity (<7 points)
  Moderate complexity (7-9 points)
  High complexity (>9 points)
Maximum tumor dimension is **physical** not **projectional**

Mass measured on standard axial (A), sagittal (B), and coronal (C) projections; Largest measured diameter is 3.5 cm (B)

(D) Same tumor measured 3.8 cm on coronal oblique projection

**Standard projections are not reliable!**
**Exophytic / Endophytic**

Whether the tumor is outside the kidney (Exophytic) or inside (Endophytic)

- 1 point: mostly exophytic
- 2 points: mostly but not completely, endophytic
- 3 points: completely endophytic

Mostly exophytic 1 point

Mostly endophytic 2 points

Completely endophytic 3 points
**Nearness to the Collecting System**

- Tumor’s edge to the collecting system/renal sinus in millimeters
  - **1 point:** 7 mm or beyond
  - **2 points:** between 7-4 mm
  - **3 points:** closer than 4 mm

![Images of medical scans with measurements](https://example.com/medical-scans)

- 8.5 mm: 1 point
- 5 mm: 2 points
- Reaching the sinus: 3 points
**Anterior/posterior**

- Descriptor given for whether the tumor is located along the anterior or posterior aspects of the kidney

- **A**: Anterior
- **P**: Posterior
- **X**: not applicable

- Can’t be described as anterior or posterior

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![Anterior Image](image1)

**Anterior**

![Posterior Image](image2)

**Posterior**

![Can’t be described as anterior or posterior Image](image3)
Location Relative to the Polar Lines

- **Entirely below lower polar or above upper polar lines**
- **Mass crosses polar lines**
- **50% of mass is across polar line, mass entirely between polar lines, or mass crosses the axial midline**
Location Relative to the Polar Lines

Polar lines and axial renal midline are best imaged on oblique reformats; in the plane of the renal sinus.

**Figure 1:** A 3.5 cm mass abutting the sinus, above the upper polar line, mostly endophytic, not anterior or posterior to the sinus; score of 7x (Moderate complexity). The patient underwent successful partial nephrectomy.

**Figure 2:** A 5.5 cm mass extending posterior to and involving the sinus, crossing the axial renal midline (white dotted line), mostly endophytic; score of 10x (High complexity). The patient underwent total nephrectomy.
<table>
<thead>
<tr>
<th>Component</th>
<th>1 Point</th>
<th>2 Points</th>
<th>3 Points</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>R</strong> (radius; maximum dimension in cm)</td>
<td>=&gt;4</td>
<td>&gt;4 but &lt;7</td>
<td>=&gt;7</td>
</tr>
<tr>
<td><strong>E</strong>(exophytic/endophytic)</td>
<td>=&gt; 50% exophytic</td>
<td>&lt; 50% exophytic</td>
<td>Completely endophytic</td>
</tr>
<tr>
<td><strong>N</strong>(nearness to collecting system / sinus in mm)</td>
<td>=&gt;7</td>
<td>&gt;4 but &lt;7</td>
<td>=&gt;4</td>
</tr>
<tr>
<td><strong>A</strong>(anterior/posterior)</td>
<td>Mass location gets a letter added to the score; “A” for masses anterior to the sinus, “P” posterior, and “X” for not applicable.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>L</strong>(location relative to polar lines)</td>
<td>Entirely below lower polar or above upper polar lines</td>
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Centrality Index

- Distance of tumor center to renal center (c) divided by tumor radius (r)

- Gross measure to predict post partial nephrectomy GFR decline
Parameters Pertinent to Surgical Intervention; *Kidney Location*[^1]

- Surgical approach is mostly based on surgeon’s preference
- One major factor is the kidney location relative to the ribs

**High kidney is a challenge for posterior extraperitoneal approach**

The rib overlying middle of the lateral cortex sometimes used to mark the site of flank incisions

Tumor in a low-abdominal kidney
Note splenomegaly and levoscoliosis
Parameters Pertinent to Surgical Intervention; *Perinephric Fat*\(^5\)

Perinephric fat stranding can predict adhesiveness of renal capsule to the surrounding fat within Gerota’s fascia.

*Adherent fat* is associated with adverse peri-operative outcomes including longer operating time and greater blood loss.

It is also associated with renal malignancy on final pathology.
Nephrectomy (total and partial) requires full mobilization of the kidney with dissection of the perinephric fat.

Increased amount of perinephric fat (yellow arrows) is associated with perioperative complications in robotic partial nephrectomies. Less fat is associated with better surgical outcome.
Parameters Pertinent to Surgical Intervention; *Renal Vessels*

Most partial nephrectomies are performed with transient clamping of the main renal artery.

Knowledge of the distance of the *first arterial branching from the renal sinus*, and presence of accessory arteries, is essential to predict the degree of required perinephric dissection.
Main renal artery length to first branching point and to renal hilum

Main renal vein length from IVC to renal hilum, and from aortic edge to the renal hilum for the left kidney
Renal mass extending to the renal vein (white arrow) and to a lumbar vein (yellow arrow)

Duplicated IVC- Tumor thrombus (white arrows) and bland thrombus (yellow arrow) in left IVC
Note venous bridge connecting the IVCs (orange arrow)
Variant Vessel Anatomy

Right renal upper pole tumor
Two renal arteries

Anterocaval right main renal artery

Right renal upper pole tumor
Two renal veins

Upper pole tumor with renal vein bland thrombus and perinephric collaterals
Parameters Pertinent to Percutaneous ablation

- Tumor size
- Tumor location
- Tumor surroundings:
  - Proximity to hilar structures
  - Adjacent bowel, organs, vessels and nerves

Ideal tumor for ablation (cannot tolerate surgical resection):
Small (<3 cm)
Partially exophytic
Posteriorly located

Ablation zone must extend at least 3 mm beyond the tumor, and the goal should be of at least 5 mm to avoid residual or untreated tumor.
Parameters Pertinent to Percutaneous ablation;
The under-recognized nerves\textsuperscript{8,9}

- Nerve injury can lead to postablative neuralgia and paresthesias

- Intercostal, \textit{genitofemoral}, and lateral femoral cutaneous nerves

- The ablation of posterior masses located close to major psoas muscle can damage the genitofemoral nerve, resulting in chronic pain, and diminished sensitivity within the skin area of the ipsilateral groin

\textit{Displacement techniques (e.g. hydrodissection) can be used to lower the risks of nerve injuries}
Variant Anatomy and Benign Pathology

- Renal Parenchyma (Dromedary hump, Column of Bertin, fetal lobulation, renal clefts, congenital fusion or malrotation)
- Collecting system
- Arteries
- Veins
- Cysts
- Stones / parenchymal calcifications
- Scars
- Benign tumors such as Angiomyolipoma

Different renal morphologies might necessitate different surgical approaches
Suggested Reporting system

**Involved Kidney:**
- Location: *Standard, high, low, ectopic*
- Length
- Lesion complexity:
  - Radius
  - Exophytic/endophytic property
  - Nearness to the collecting system
  - Anterior/posterior Location
- Collecting system
- Arteries: anomalies, patency, main renal artery length to first branching point and to renal hilum
- Veins: anomalies (including IVC anomalies and large varices), patency, length from IVC to renal hilum, and from aortic edge to the left renal hilum
- Parenchymal variant anatomy: *Dromedary hump, Fetal lobulation, Column of Bertin, Renal cleft, congenital fusion / rotation*
- Benign pathology: cysts, stones / calcifications, scars, AML
- Perinephric fat stranding and amount of fat
- Extra-renal structures adjacent to the lesion: varices, bowel, muscle, …

**Contralateral Kidney:**
- Length
- Enhancement
- Pathology
The Nephrometry Score is a widely used tumor complexity score, which correlates with post-operative complications and local tumor extension.

Renal arterial anatomy, and distance of the first branching to the renal sinus, is essential in preoperative planning.

Predicting perinephric fat adhesiveness and fat quantity, easily assessed on imaging, adds valuable preoperative information.

Structured reporting allows recognition of potential factors of surgical complexity and might influence the surgical or interventional approach.
References


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