Partial Nephrectomy Techniques for Renal Preservation: Historical and Modern Approaches

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Disclosures

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Renal Cell Carcinoma

- 50% of cases diagnosed incidentally
- pT1NxM0 stage associated with a 90% cumulative 5 year survival
- Minimally invasive techniques available for the majority of cases
- Lymph node status may be predictive of failure
- Targeted therapies may be evolving for high risk patients
Renal Cell Carcinoma

- Cancer control determined by T stage of primary tumor and lymph node status
- Uncommon to underestimate venous involvement
- Lymph node involvement predicts failure
- Lymph node size may be misleading
Partial vs Radical Nephrectomy

Cancer control for small tumors may be similar regardless of surgical approach.

Tumor location compared in series of small (<4 cm) cancers treated by radical nephrectomy or partial nephrectomy.

145 pts (mean f/u 4 yrs) T1N0M0 stage:

- Central: 94%
- Peripheral: 82%

(5.7% vs 4.5% recurrence rate)

Hafez, Novick, Butler J Urol 1998 159:1156
Radical Nephrectomy

- Principle of excision of fascia surrounding renal parenchyma and/or associated involved tissues
- Tumors > 4 cm optimal
- May be associated with local and distant disease
- Curative, palliative or cytoreductive
Radical Nephrectomy

Surgical Approach:

- Retroperitoneal
  - Retroperitoneal Flank
  - Dorsal Lumbotomy

- Transabdominal
  - Anterior subcostal
  - Bilateral anterior subcostal (Chevron)
  - Thoracoabdominal
  - Laparascopic (HAL or Laparoscopic)
Lymphadenectomy

- Lymph node status accurately assessed with regional node dissection
- Lymph drainage multidirectional
- Lymph node dissection is **not** therapeutic unless bulky nodes are painful and obstructive (bowel or ureter)
- Lymph node dissection above left renal hilum increases risk of chylous ascites
Bulky Renal Cell Carcinoma

- 5-20 cm dimensional range
- Local invasion may occur
- Inflammatory response may confuse
- Hepatic invasion difficult to exclude
- Colon invasion even with moderate tumors
- Duodenal invasion defines unresectability
- Splenic/pancreatic invasion manageable
Bulky RCC Staging

- Abdominal CT
- MRI
- Chest CT
- Bone Scan
- Brain CT/MRI
- Ultrasound
- Arteriogram
Radical Nephrectomy for Bulky RCC

- Surgical planning mandatory:
- Determine superior extent of tumor
- Plan for retroperitoneal node dissection
- Anticipate vascular exposure requirements
- Bowel prep anticipating bowel resection
- Recruit consultants for pancreatectomy, liver resection, duodenal resection, vena cavaotomy
Transabdominal Surgical Approach

- Bilateral anterior subcostal (Chevron)
  - Excellent abdominal exposure
- Ideal for vascular/bowel dissection
- May limit access to suprahepatic vena cava
- Ease of closure advantageous
- Less pain than thoracoabdominal incision
Thoracoabdominal Surgical Approach

Right side approach:
- Superior extent of right tumor accessible
- Liver displacement into chest
- Retroperitoneal node dissection

Left side approach:
- Superior extent of tumor/spleen/pancreas
- Limited exposure of liver/vena cava
Cytoreductive Surgery for RCC

- Metastatic RCC may be associated with small primary tumors.
- Bulky primary tumors are problematic for immunotherapy/chemotherapy.
- Preparative nephrectomy usually successful but may be associated with performance decline or tumor progression in 25-40% pts.
RCC Metastectomy

- Feasible removal of mass/nodes/mets
- Solitary pulmonary nodule: combined thoracoscopic resection
- Liver resection: adjacent capsule only
- Splenectomy in continuity
- Distal pancreatectomy
- Bowel resection in continuity
Summary

- Surgery is the primary treatment for RCC
- Large renal mass resection is feasible in a majority of cases
- Significant palliative benefit may be derived
- Careful planning mandatory
- Locally advanced disease does not preclude surgery for the symptomatic patient
Partial Nephrectomy for Renal Cell Carcinoma

- Czerny first described partial nephrectomy in 1890.
- In 1950 Vermooten proposed renal mass excision with a margin of normal kidney.
- Novick established criteria for patient selection in bilateral and unilateral renal masses.
Partial Nephrectomy

- Solitary kidney with renal mass
- Bilateral renal cell carcinoma
- Unilateral renal mass with contralateral renal abnormality or dysfunction
- Unilateral renal mass with risk for future renal dysfunction (calculus disease, diabetes)
Partial Nephrectomy

“Cancer control is equivalent to radical nephrectomy results”

- 4% unilateral recurrence rate
- 1% contralateral tumor development rate

- 485 pts Cleveland clinic population with 92% cancer specific survival

Partial Nephrectomy

- Recurrence may be local or distant:
- 327 pts Cleveland Clinic underwent partial nephrectomy
- 13(4%) developed local recurrence
- 25(7.6%) developed metastatic disease
- 0% local recurrence for T1N0M0 tumors
- 4.4% metastatic disease for T1N0M0 stage

- Hafez, Novick, Campbell J Urol 1997 157:2067
Partial Nephrectomy

- **Recurrence patterns by stage:**

<table>
<thead>
<tr>
<th>Stage</th>
<th>Local</th>
<th>Distant</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1N0M0</td>
<td>0%</td>
<td>4.4%</td>
</tr>
<tr>
<td>T2N0M0</td>
<td>2%</td>
<td>5.3%</td>
</tr>
<tr>
<td>T3aN0M0</td>
<td>8.2%</td>
<td>11.5%</td>
</tr>
<tr>
<td>T3bN0M0</td>
<td>10.6%</td>
<td>14.9%</td>
</tr>
</tbody>
</table>

- Hafez, Novick, Campbell J Urol 1997 157: 2067
Partial Nephrectomy

Surgical Approach:

- Flank
- Transabdominal
- Laparoscopic
Partial Nephrectomy

- **Flank Approach**
  - Supracostal 11\(^{th}\) rib optimal
  - Facilitates dissection of peripheral tumors
  - Anterior, Posterior and Central tumors accessible
  - Hilar dissection feasible
  - Renal artery perfusion feasible
  - Allows for mobilization and surface cooling with minimal disruption of abdominal contents
Partial Nephrectomy

Transabdominal Approach

- Deeper dissection
- Anterior dissection only
- Mobilization of renal attachments more difficult
- Bowel manipulation required
- NOT RECOMMENDED
Partial Nephrectomy

Laparoscopic Approach

- Transabdominal vs retroperitoneal
- Hand-assisted technique preferred
- Compression vs hilar clamping
- 3cm or less sized tumors
- Surface cooling problematic
- Renal artery perfusion challenging
Summary

- Moderate to small tumors (1-4 cm) may be well managed with partial nephrectomy.
- Equivalent cancer control is seen with partial vs radical nephrectomy in tumors < 4 cm.
- Choice of surgical approach for partial nephrectomy is determined by tumor location and size.
Partial Nephrectomy

Renal preservation techniques are variable and guided by location and size of tumors:

- Warm ischemia/compression < 30 min
- Surface renal hypothermia/temporary arterial occlusion < 60 min
- Renal arterial perfusion/surface renal hypothermia < 90 min
Partial Nephrectomy

- Renal ischemia may be cold or warm
- Off clamp dissection becoming more popular
- Micro-dissection required for off clamp partial nephrectomy for medial tumors
- Peripheral tumors ideally suited for off clamp technique.
Partial Nephrectomy

- Isolated perfusion via laparoscopic technique feasible but difficult
- Warm ischemia preferred with minimal clamp time
- Ischemia related to residual decline in renal function
- Re-clamping for hemostasis occasionally required
Partial Nephrectomy

- Combination approach of selective arterial dissection and temporary arterial occlusion permits decreased clamp time.
- Off clamp dissection technique may supplant hilar clamping in selected cases.
- Careful hilar dissection prevents arterial injury.
Summary

- Traditional techniques employ cold ischemia and parenchymal compression
- Modern techniques combine microdissection with off clamp approach
- Renal parenchymal repair remains variable but depends on adequate compression and vasculature control prior to unclamping
Summary

- Advances in minimally invasive surgery have changed traditional approaches to renal preservation. This will continue to be the major trend for the future.

- Further understanding of renal protective strategies will be centered on arterial dissection and hilar management improvements.