

# Endourology: A Basic Science and Clinical Update

*Highlights from the 23rd World Congress on Endourology and the Shockwave Lithotripsy 21st Basic Research Symposium, August 23–26, 2005, Amsterdam, The Netherlands*

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There were a number of innovative papers presented at this meeting held in Amsterdam on August 23–26, 2005. I will highlight what I consider the important papers in the domains of oncology, ureteral physiology and stents, nephrolithiasis, and laparoscopy.

### Oncology

More patients are currently being treated with minimally invasive ablative procedures. Two important issues to consider with these approaches are difficulties with diagnostic accuracy from limited tissue sampling and whether the treatment itself has any

other beneficial or negative systemic effects. Barocas and colleagues<sup>1</sup> (New York Presbyterian Hospital–Weill Cornell Medical Center, New York, NY) obtained 2 core needle biopsies from tumors in radical and partial nephrectomy specimens. One core was subjected to routine histologic analysis and the other to a molecular diagnostic algorithm whereby the expression of carbonic anhydrase IX, racemase, parvalbumin, and kidney-specific chloride channel was measured with a quantitative real-time polymerase chain reaction (RTPCR) technique. The latter technique correctly categorized all 13 renal cell carcinomas assessed, whereas histology correctly classified 11 such tumors. This demonstrates that a molecular diagnostic algorithm using an RTPCR approach could provide an accurate pretreatment diagnosis in those renal cell carcinoma

patients who are candidates for ablative therapy.

Cryotherapy has been used to ablate renal tumors. Hedican and associates<sup>2</sup> (University of Wisconsin, Madison, WI) assessed the impact of cryoablation in a murine renal cancer model (Renca cells) in nude mice and in mice with an intact immune system. The animals were subjected to either nephrectomy of the tumor-bearing kidney, cryoablation of the lesion, or a sham procedure. Survival in the mice with intact immune systems was significantly longer in the cryotherapy group as compared with the other 2 cohorts. This survival benefit was not present in the athymic mice. This suggests that cryotherapy in this animal model provides both local tumor control and an immune-mediated systemic response that enhances survival.

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Reviewed by Dean G. Assimos, MD, Department of Urology, Wake Forest University School of Medicine, Winston-Salem, NC

### Ureteral Physiology

Better insight into ureteral physiology has fostered the development of medical expulsive therapy to facilitate stone passage. Madeb and associates<sup>3</sup> (University of Rochester Medical Center, Rochester, NY) performed immunohistochemical studies and a molecular analysis of  $\alpha$ -1 receptors in human ureter and found A, B, and D subtypes throughout, with the D subtype being most prevalent. Sakamoto and Rajasekaran<sup>4</sup> (University of Cali-

fornia San Diego, San Diego, CA) characterized muscarinic receptors in human ureter and found that all 5 subtypes are present, with the M3 subtype predominating.

### Ureteral Stents

Novel concepts in ureteral stent design and composition were presented

during this session. Ureteral stents provide bacterial pathogens with a binding surface that might act as a nidus for urinary tract infection. Chew and associates<sup>9</sup> (University of Western Ontario, London, Ontario, Canada) reported that coating ureteral stents with triclosan, an antibacterial agent, inhibited the growth of several bacterial species in vitro.

Center, Albert Einstein College of Medicine, Bronx, NY) described a novel 7-F double-lumen stent that provided better drainage than a standard 7-F double-J stent in a porcine model.

### Nephrolithiasis

The efficacy of the aforementioned stents will need to be established in clinical trials.

Advances in understanding the pathophysiology of kidney stone formation and methods for more effective stone removal were reported at this meeting. Approximately 50% of the urinary oxalate pool is derived from endogenous synthesis occurring in the liver. The terminal step in this process is the oxidation of glyoxylate to oxalate, which is catalyzed by lactate dehydrogenase. Cell culture studies have demonstrated that the metabolism of hydroxyproline in the mitochondrial compartment is a source of glyoxylate. Assimos and associates<sup>12</sup> (Wake Forest University School of Medicine, Winston-Salem, NC) administered gelatin, a rich

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source of hydroxyproline, to normal humans, which resulted in significant increases in both urinary glycolate and oxalate excretion. These findings suggest that hydroxyproline is involved in endogenous oxalate excretion in humans.

Sur and colleagues<sup>13</sup> (Duke University Medical Center, Durham, NC) reported information suggesting that the gender ratio of stone formers is changing. They noted that the proportion of women discharged for stone disease increased from 38.5% in 1997 to 44.3% in 2002, according to the Nation Inpatient Sample database.

Stent patency can be influenced by extrinsic pressure, especially in patients with retroperitoneal malignancies. Monga and colleagues<sup>10</sup> (University of Minnesota, Minneapolis, MN) performed a study in which the resistance to radial compression was assessed in vitro in 10 different types of ureteral stents. Among the stents tested, the Cook C-Flex and the Cook EndoSof (Cook Urological, Spencer, IN) were found to be the most resistant to extrinsic compressive forces.

Ost and associates<sup>11</sup> (Long Island Jewish Medical Center, New Hyde Park, NY, and Montefiore Medical

Kim and associates<sup>14</sup> (Methodist Hospital Institute for Kidney Stone Disease and Indiana University, Indianapolis, IN) performed an in vitro study using an artificial stone made of gypsum to test the effectiveness of a new intracorporeal lithotripter, the Cyberwand (Cybersonics, Erie, PA). This device incorporates 2 concentric probes driven at different frequencies by a single ultrasonic handpiece. They found that the stone penetration time for this device was less than that of the Lithoclast Ultra device (Boston Scientific, Natick, MA), an instrument that was demonstrated in previous in vitro studies to be the most efficient commercially available intracorporeal lithotripter.

The holmium:YAG (yttrium-aluminum-garnet) laser is commonly used for intracorporeal lithotripsy. Laser energy might cause some degree of stone retropulsion, which might increase procedural times. Kalra and colleagues<sup>15</sup> (Thomas Jefferson University, Philadelphia, PA) reported that retropulsion was less in an in vitro model when a longer pulse width was used.

### Laparoscopy

Laparoscopic partial nephrectomy is now being widely performed. Two things that continue to make this

procedure more difficult than the open surgical approach are hemostasis and effective renal protection. Humphreys and colleagues<sup>16</sup> (Mayo Clinic, Rochester, MN) reported that the application of microporous polysaccharide hemospheres (MPH®; Medafor, Minneapolis, MN) provided a rapid and effective means of hemostasis in a porcine laparoscopic renal injury model. This product, which is engineered from purified plant starch, accelerates the natural clotting cascade by concentrating clotting factors and proteins on its surface while also absorbing aqueous and low-molecular-weight proteins to form a hemostatic plug. It might prove to be a useful agent for both laparoscopic and open surgical renal surgery.

Lyon and associates<sup>17</sup> (University of Chicago, Chicago, IL) described a novel and effective method of achieving 90 minutes of laparoscopic renal ischemic hypothermia by delivering micro-particulate ice slurry in a porcine model.

Humphreys and colleagues<sup>18</sup> (Mayo Clinic, Rochester, MN) reported that the retrograde delivery of an oxygenated perfluorocarbon emulsion, Oxygent™ (Alliance Pharmaceutical, San Diego, CA), resulted in excellent renal protection in a 40-minute rabbit model of renal ischemia. This alterna-

tive oxygen carrier also increased venous systemic oxygenation.

Although these innovative technologies seem promising, their efficacy will need to be proven in carefully performed clinical trials.

The presentations profiled in this review represent many of the novel and innovative advances being made in the areas of stone disease, endourology, laparoscopy, and other forms of minimally invasive surgery. Some provide better insight into the pathophysiology of diseases that urologists are asked to treat. Others are harbingers of more effective therapy. The amalgamation of these advances will, we hope, result in better treatment outcomes for our patients. ■

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### Main Points

- A molecular diagnostic algorithm using a real-time polymerase chain reaction approach could provide an accurate pretreatment diagnosis in those renal cell carcinoma patients who are candidates for ablative therapy.
- Coating ureteral stents with triclosan, an antibacterial agent, inhibited the growth of several bacterial species in vitro.
- Among 10 tested stents, the Cook C-Flex and the Cook EndoSof (Cook Urological) were found to be the most resistant to extrinsic compressive forces.
- Stone penetration time for the Cyberwand device (Cybersonics), which incorporates 2 concentric probes driven at different frequencies by a single ultrasonic handpiece, was less than that of the Lithoclast Ultra device (Boston Scientific).
- The application of microporous polysaccharide hemospheres (Medafor) provided a rapid and effective means of hemostasis in a porcine laparoscopic renal injury model.
- The retrograde delivery of an oxygenated perfluorocarbon emulsion, Oxygent (Alliance Pharmaceutical), resulted in excellent renal protection in a 40-minute rabbit model of renal ischemia.

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