

The Journal of UROLOGY®

FOUNDED IN 1917 BY HUGH HAMPTON YOUNG

Official Journal of the American Urological Association, Inc.

752-10

CONTENTS

CLINICAL UROLOGY

Review Article

- Renal Perfusion/Reperfusion Injuries. *W. S. McDougal* 1325

State of the Art Article

- Electrical Stimulation in Clinical Management of Neurogenic Bladder. *E. A. Tanagho and R. A. Schmidt* 1331

Original Articles

- Incidental Carcinoma of Prostate: Analysis of Predictors of Progression. *B. A. Lowe and M. B. Listrom* ... 1340
Management of Stage A Prostate Cancer With High Probability of Progression. *B. A. Lowe and M. B. Listrom* 1345
Catecholamine Metabolism in Pheochromocytoma and Normal Adrenal Medullae. *T. Nakada, H. Furuta and T. Katayama* 1348
3-Dimensional and Radiological Pelvicaliceal Anatomy for Endourology. *F. J. B. Sampaio and C. A. Mandarin-de-Lacerda* 1352
Complex Struvite Calculi Treated by Primary Extracorporeal Shock Wave Lithotripsy and Chemolysis With Hemiacidrin Irrigation. *J. P. Spirnak, B. P. DeBaz, H. Y. Green and M. I. Resnick* 1356
Current Operative Management of Urinary Calculi After Renal Transplantation. *T. C. Caldwell and J. R. Burns* 1360
Outpatient Angiographic Evaluation of Living Renal Donors. *W. Spencer, S. B. Stroom, M. A. Geisinger, A. C. Novick, D. R. Steinmuller, M. G. Zelch and B. Risius* 1364
Early Hydronephrosis Following Aortic Bifurcation Graft Surgery: Prospective Study. *S. L. Goldenberg, P. B. Gordon, P. L. Cooperberg and M. G. McLoughlin* 1367
Use of Caval-Atrial Shunt for Resection of Caval Tumor Thrombus in Renal Cell Carcinoma. *R. S. Foster, Y. Mahomed, R. Bihrlle and S. Strup* 1370
Management of Iatrogenic Ureteral Strictures After Urologic Procedures. *A. D. Smith* 1372
Urinary Diversion to Augmented and Valved Rectum: Preliminary Results With Novel Surgical Procedure. *N. G. Kock, M. A. Ghoneim, K. G. Lycke and M. R. Mahran* 1375
Hemi-Kock Augmentation Ileocystoplasty: Low Pressure Anti-Refluxing System. *A. C. Weinberg, S. D. Boyd, G. Lieskovsky, T. E. Ahlering and D. G. Skinner* 1380
Interstitial Cystitis is Associated With Intraurothelial Tamm-Horsfall Protein. *J. E. Fowler, Jr., W. L. Lynes, J. L. T. Lau, L. Ghosh and A. Mounzer* 1385
Intravesical Thiotepa Versus Mitomycin C in Patients With T_a, T₁ and T_{is} Transitional Cell Carcinoma of Bladder: Phase III Prospective Randomized Study. *N. M. Heney, W. W. Koontz, B. Barton, M. Soloway, D. L. Trump, T. Hazra and R. S. Weinstein for National Bladder Cancer Group* (Editorial Comments by H. W. Herr and D. L. Lamm) 1390

Contents continued on page A8

Flow Cytometry and Cytology as Response Indicators to M-VAC (Methotrexate, Vinblastine, Doxorubicin and Cisplatin). <i>D. K. Hermansen, V. E. Reuter, W. F. Whitmore, Jr., W. R. Fair and M. R. Melamed</i>	1394
Management of Adult Sarcomas of Bladder and Prostate. <i>T. E. Ahlering, P. Weintraub and D. G. Skinner</i> (Editorial Comment by M. M. Lieber)	1397
Potency-Sparing Radical Cystectomy: Does it Compromise Completeness of Cancer Resection? <i>T. R. Pritchett, W. M. Schiff, E. Klatt, G. Lieskovsky and D. G. Skinner</i> (Editorial Comments by J. E. Montie, P. C. Walsh and W. F. Whitmore, Jr.)	1400
Sonographic Urethrogram: Comparison to Roentgenographic Techniques in 22 Patients. <i>C. D. Gluck, A. L. Bundy, C. Fine, K. R. Loughlin and J. P. Richie</i>	1404
Sonography of Distal Male Urethra—New Diagnostic Procedure for Urethral Strictures: Results of Retrospective Study. <i>W. Merkle and W. Wagner</i>	1409
Spinal Cord Lesions at Different Levels Affect Either Adrenergic or Vasoactive Intestinal Polypeptide-Immunoreactive Nerves in Human Urethra. <i>R. Crowe, G. Burnstock and J. K. Light</i>	1412
Erectile Responses to Intracavernous Papaverine and Phentolamine: Comparison of Single and Combined Delivery. <i>C. G. Stief and U. Wetterauer</i>	1415
Experience in Management of Erectile Dysfunction Using Intracavernosal Self-Injection of Vasoactive Drugs. <i>G. R. Watters, E. J. Keogh, C. M. Earle, C. J. Carati, Z. S. Wisniewski, A. G. S. Tulloch and D. J. Lord</i> (Editorial Comment by G. S. Benson)	1417
Use of CX Cylinders in Association With AMS700 Inflatable Penile Prosthesis. <i>J. J. Mulcahy</i>	1420
Hydroflex Self-Contained Inflatable Prosthesis: Experience With 100 Patients. <i>J. J. Mulcahy</i>	1422
Clinical Experience With Mentor Inflatable Penile Prosthesis in 301 Patients. <i>D. C. Merrill</i> (Editorial Comments by R. L. Fein and J. G. Gregory)	1424
Five-Year Followup of Scott Inflatable Penile Prosthesis and Comparison With Semirigid Penile Prosthesis. <i>J. N. Kabalin and R. Kessler</i>	1428
Subclinical Human Papillomavirus Infections in Male Sexual Partners of Female Carriers. <i>A. Schneider, R. Kirchmayr, E.-M. De Villiers and L. Gissmann</i>	1431
Bilateral Testicular Injury From External Trauma. <i>A. S. Cass, L. Ferrara, J. Wolpert and J. Lee</i>	1435
Stage II Nonseminomatous Germ Cell Tumors of Testis: Analysis of Treatment Options in Patients With Low Volume Retroperitoneal Disease. <i>M. A. Socinski, M. B. Garnick, P. C. Stomper, C. Y. Fung and J. P. Richie</i> (Editorial Comment by J. P. Donohue)	1437
Combined Retropubic Prostatectomy and Preperitoneal Inguinal Herniorrhaphy. <i>J. Abarbanel and D. Kimche</i>	1442
Evaluation of Serial Digital Rectal Examinations in Screening for Prostate Cancer. <i>E. J. Mueller, T. W. Crain, I. M. Thompson and F. R. Rodriguez</i>	1445
Benefits of Combining Early Radionuclide Renal Scintigraphy With Routine Bone Scans in Patients With Prostate Cancer. <i>P. Narayan, D. Lillian, W. Hellstrom, M. Hedgcock, P. B. Jajodia and E. A. Tanagho</i>	1448
Natural Course of Prostatic Carcinoma in Relation to Initial Cytological Grade. <i>J. Adolfsson and B. Fåhræus</i> (Editorial Comments by D. F. Paulson and W. M. Murphy)	1452
Radical Prostatectomy After Radiation Therapy for Cancer of Prostate: Feasibility and Prognosis. <i>L. M. Rainwater and H. Zincke</i>	1455
Combination of Cyproterone Acetate and Low Dose Diethylstilbestrol in Treatment of Advanced Prostatic Carcinoma. <i>S. L. Goldenberg, N. Bruchovsky, P. S. Rennie and C. M. Coppin</i>	1460
Urokinase-Type Plasminogen Activator as Marker for Formation of Distant Metastases in Prostatic Carcinomas. <i>G. Hienert, J. C. Kirchheimer, H. Pflüger and B. R. Binder</i>	1466
Distribution of Patients With 2,8-Dihydroxyadenine Urolithiasis and Adenine Phosphoribosyltransferase Deficiency in Japan. <i>N. Kamatani, T. Sonoda and K. Nishioka</i>	1470
Excretory Urogram Bowel Preparation—Is It Necessary? <i>A. P. Roberge-Wade, D. H. Hosking, D. W. MacEwan and E. W. Ramsey</i>	1473
Malpractice Claims for Urogenital Injuries. <i>A. F. Morey, H. T. Foley, D. G. McLeod and T. L. Pendergrass</i>	1475

Urologists At Work

Clam-Shell Technique for Right Renal Vein Extension in Cadaver Kidney Transplantation. <i>J. M. Barry, T. R. Hefty and T. Sasaki</i>	1479
Transplantation Using Inverted Renal Unit and Donor Vena Cava-Iliac Vein Conduit to Bypass Recipient Distal Vena Cava and Iliac Venous Systems. <i>L. J. Gibel, M. Chakerian, A. Harford and W. Sterling</i>	1480

Urological Neurology and Urodynamics

Simple Versus Multichannel Cystometry in Evaluation of Bladder Function in Incontinent Geriatric Population. <i>J. Ouslander, G. Leach, S. Abelson, D. Staskin, J. Blaustein and S. Raz</i>	1482
Urodynamic and Histological Correlates of Benign Prostatic Hyperplasia. <i>T. Dørflinger, D. M. England, P. O. Madsen and R. C. Bruskewitz</i>	1487

Pediatric Articles

Outcome of Renal Transplantation in Children With Posterior Urethral Valves. <i>Y. Reinberg, R. Gonzalez, D. Fryd, S. M. Mauer and J. S. Najarian</i> (Editorial Comment by A. I. Sagalowsky)	1491
Ileocecal Ureterosigmoidostomy: Alternative to Conventional Ureterosigmoidostomy. <i>K. S. Kim, M. R. Susskind and L. R. King</i>	1494

Bladder Pressure Management System for Myelodysplasia—Clinical Outcome. S. C. Wang, E. J. McGuire and D. A. Bloom	1499
Cavernous Hemangiomas of Bladder in Pediatric Age Group. M. P. Leonard, J. C. Nickel and A. Morales ..	1503
Simple Cysts of Testis in Children: Preoperative Diagnosis by Ultrasound and Excision With Testicular Preservation. V. Altadonna, H. M. Snyder, III, H. K. Rosenberg and J. W. Duckett (Editorial Comment by G. W. Kaplan)	1505
Fibrous Hamartoma of Infancy. E. O. Abara, B. M. Churchill, G. A. McLorie and K. Mancer	1508

Case Reports

Extracorporeal Shock Wave Lithotripsy Performed on Woman With Cardiac Pacemaker. M. L. Stoller, W. Stackl, J. J. Langberg and J. C. Griffin	1510
Xanthogranulomatous Pyelonephritis in Renal Allograft. S. Ribot, A. Y. Campbell and H. Esлами	1512
Lymphorrhhea as Postoperative Complication of Living Donor Nephrectomy. A. Fernandez, L. Orte, J. M. Rodriguez Luna, F. Lovaco, A. Berenguer, F. Liaño, R. Matesanz and I. Ortuño	1514
Coincidental Angiomyolipoma and Renal Cell Carcinoma—Report of 1 Case and Review of Literature. J.-K. Huang, D. M. Ho, J.-H. Wang, Y.-H. Chou, M.-T. Chen and S.-S. Chang	1516
Thoracic Ureter. J. M. Garat, J. M. Viladoms and A. Palacios	1519
Radiolucent Seed Calculi in Orthotopic Ureterocele. W. S. Wong and M. K. Li	1521
Bilateral Ureteral Necrosis and Obliteration Secondary to Pancreatic Pseudocyst. S. Meller, N. N. Stone, J. S. Waxman and A. Goodman	1523
Ureteral Leak Around Aortic Bifurcation Graft: Complication of Ureteral Stenting. D. Sacks and J. Miller	1526
Mitrofanoff Principle: Alternative Form of Continent Urinary Diversion. J. L. Weingarten and W. J. Cromie	1529
Nodular Fasciitis of Bladder. S. Das, J. D. Upton and A. D. Amar	1532
Actinomycosis of Urachal Remnants. S. Gotoh, N. Kura, K. Nagahama, Y. Higashi, I. Fukui, K. Takagi, T. Terada, T. Kao, R. Kamiyama and H. Oshima	1534
Localized Amyloidosis of Urethra: Diagnostic Implications and Management. R. D. Brown, J. A. Mulhollan, J. H. Childers and G. M. Preminger	1536
Vascular Complications of Transurethral Incision of Post-Traumatic Urethral Strictures. R. Gary, A. S. Cass and G. Koos	1539
Candida Albicans Corpora Abscess Following Penile Prosthesis Placement. D. S. Peppas, J. W. Moul and D. G. McLeod	1541
Nonpenetrating Gunshot Injury as Cause of Testicular Rupture. D. L. Willis, A. E. Finkbeiner and J. F. Redman	1543
Transvasovasostomy—Alternative Operation for Obstructive Azoospermia. A. Hamidinia	1545
Normal Expression of Serologically Defined H-Y Antigen in Leydig Cell Hypoplasia. I. J. P. Arnhold, B. B. Mendonça, H. Bisi, F. O. Russo, W. Nicolau, W. Bloise and C. A. Moreira-Filho	1549

Letters to the Editors

Re: En Bloc Kidney and Bladder Transplantation From Anencephalic Donor Into Adult Recipient, by J. L. Gutierrez Calzada, J. L. Martinez, V. Baena, G. Laguna, J. Arrieta, J. Rodriguez and A. Moncada. F. J. Gómez-Campderá, J. Albertos, F. Anaya and M. A. Rengel-Aranda	1553
Re: Predictive Criteria for Failed Sphincterotomy in Spinal Cord Injury Patients, by J. K. Light, A. Beric and P. G. Wise. E. J. Zeidman	1554
Re: Urological Complications of Sickle Cell Disease in Pediatric Population, by W. F. Tarry, J. W. Duckett, Jr. and H. McC. Snyder, III. H. N. Noe and G. R. Jerkins	1554
Re: Venous-Occlusive Mechanism of Canine Corpus Cavernosum: Angiographic and Pharmacologic Studies, by K. Valji and J. J. Bookstein. A. M. B. Goldstein, J. P. Meehan, R. Zakhary, P. A. Buckley and F. A. Rogers	1555
Re: Effects of Prostaglandin E1 on Penile Erection and Erectile Failure, by R. Virag and P. G. Adaikan. J. Y. Jeremy, D. P. Mikhailidis and P. Dandona	1556
Re: Laparoscopy in Management of Nonpalpable Testis, by R. M. Weiss and J. H. Seashore. S. Das	1556
Re: Cardiovascular Side Effects of Diethylstilbestrol, Cyproterone Acetate, Medroxyprogesterone Acetate and Estramustine Phosphate Used for Treatment of Advanced Prostatic Cancer: Results From European Organization for Research on Treatment of Cancer Trials 30761 and 30762, by H. J. deVoogt, P. H. Smith, M. Pavone-Macaluso, M. de Pauw, S. Suciu and Members of European Organization for Research on Treatment of Cancer Urological Group and Re: Comparison of Diethylstilbestrol, Cyproterone Acetate and Medroxyprogesterone Acetate in Treatment of Advanced Prostatic Cancer: Final Analysis of Randomized Phase III Trial of European Organization for Research on Treatment of Cancer Urological Group, by M. Pavone-Macaluso, H. J. deVoogt, G. Viggiano, E. Barasolo, B. Lardennois, M. de Pauw and R. Sylvester. H. J. deVoogt, M. Pavone-Macaluso, R. Sylvester and F. H. Schröder	1557
Re: Radioimmunological Imaging of Metastatic Prostatic Cancer With ¹¹¹ Indium-Labeled Monoclonal Antibody PAY 276, by R. J. Babaian, J. L. Murray, L. M. Lamki, T. P. Haynie, E. M. Hersh, M. G. Rosenblum, H. J. Glenn, M. W. Unger, D. J. Carlo and A. C. von Eschenbach. T. Yoshiki	1557
Re: Evaluation of Microscopic Hematuria: Population-Based Study, by I. M. Thompson. D. N. Mohr, K. P. Offord and L. J. Melton, III	1557
Re: Suppression and Treatment of Urinary Tract Infection in Patients With Intermittently Catheterized Neurogenic Bladder, by J. L. Mohler, D. L. Cowen and R. C. Flanigan. J. P. Kilbourn	1558

Errata

Prostatic Aspiration Biopsy 1558
 Diagnosis of Neoplasia 1558

INVESTIGATIVE UROLOGY

This Month in Investigative Urology: Venous Impotence. *R. Lewis* 1560
 Diagnosis of Venogenic Impotence: Dynamic or Pharmacologic Caverosometry? *C. G. Stief, W. Diederichs, F. Benard, R. Bosch, T. F. Lue and E. A. Tanagho* 1561
 Rationale for Pharmacologic Caverosography. *C. G. Stief, F. Benard, W. Diederichs, R. Bosch, T. F. Lue and E. A. Tanagho* 1564
 Dynamic Study of Nervous Control on Prostatic Contraction and Fluid Excretion in Dog. *H. Watanabe, M. Shima, M. Kojima and H. Ohe* 1567
 Promotive Effect of Urine From Patients With Primary Hyperparathyroidism on Calcium Oxalate Crystal Aggregation in In Vitro Whole Urine System. *T. Koide, T. Yoshioka, T. Oka and T. Sonoda* 1571
 Characterization of Heparin-Binding Growth Factor From Adenocarcinoma of Kidney. *J. H. Mydlo, W. D. W. Heston and W. R. Fair* 1575
 Expression of Transfected v-Harvey-Ras Oncogene in Dunning Rat Prostate Adenocarcinoma and Development of High Metastatic Ability. *B. Treiger and J. Isaacs* 1580
 Cavitation Microjets as Contributory Mechanism for Renal Calculi Disintegration in ESWL. *L. A. Crum* 1587
 New Test to Predict Reversibility of Hydronephrotic Atrophy After Stable Partial Unilateral Ureteral Obstruction. *H. Huland, D. Gonnermann, B. Werner and U. Possin* 1591

UROLOGICAL SURVEY

Author Index to Abstracts in Volume 140 1596

Vesicoureteral Reflux in Primate. IV. Infection as Cause of Prolonged High-Grade Reflux. *J. A. Roberts, M. B. Kaack and A. B. Morvant* 1599
 Novel Modes of Action of Aminoglycoside Antibiotics Against *Pseudomonas Aeruginosa*. *G. Morris and M. R. W. Brown* 1599
 Guidelines for Improving Use of Antimicrobial Agents in Hospitals: Statement by Infectious Diseases Society of America. *J. J. Marr, H. L. Moffet and C. M. Kunin* 1599
 Renal Cell Carcinoma: Surgical Management of Regional Lymph Nodes and Inferior Vena-Caval Tumor Thrombus. *F. F. Marshall* 1599
 Organ-Preserving Surgery for Renal Cell Carcinoma in Patients With Solitary Kidney or Bilateral Tumors. *G. Hubmer and P. H. Petritsch* 1600
 Urological Aspects of Surgical Management for Metastatic Renal Cell Cancer. *G. Hienert, D. Latal and S. Rummelhardt* 1600
 Orthopaedic Management of Bony Metastases of Renal Cancer. *N. Pongracz, R. Zimmerman and R. Kotz* 1600
 Pathology of Renal Cancer and its Metastases. *W. Ulrich, P. Buxbaum and J. H. Holzner* 1600
 Bladder Cancer: Pelvic Lymphadenectomy Revisited. *H. W. Herr* 1601
 Pyridoxine: Potential Local Antidote for Mitomycin-C Extravasation. *R. Rentschler and D. Wilbur* 1601
 Odyssey of Sailor's Diagnosis Since 1795 AD. *M. R. Shetty* 1601
 Germ Cell Tumors in Indian Children. *S. Khanna, N. C. Arya, I. M. Gupta, S. Gupta and G. D. Singhal* 1601
 Uses and Limitations of Prostate-Specific Antigen in Laboratory Diagnosis of Prostate Cancer. *D. J. Wells, B. D. Bennett and W. A. Gardner* 1602
 Treatment of Metastatic Prostate Carcinoma With Depot LRH Analog Zoladex. *I. M. Holdaway, H. K. Ibbertson, M. S. Croxson, V. Harvey, J. Boulton, A. List, M. Rutland and B. S. Knox* 1602
 Tamoxifen in Advanced Prostate Cancer: ECOG Pilot Study. *J. Horton, C. Rosenbaum and F. J. Cummings* 1602
 Natural History of Localised Prostatic Cancer Managed by Conservative Therapy Alone. *N. J. R. George* 1602
 Case-Control Study of Prostatic Cancer With Reference to Dietary Habits. *K. Oishi, K. Okada, O. Yoshida, H. Yamabe, Y. Ohno, R. B. Hayes and F. H. Schroeder* 1603
 Pelvic Exenteration for Carcinoma of Cervix: Analysis of 252 Cases. *H. R. Cuevas, A. Torres, M. De La Garza, D. Hernandez and L. Herrera* 1603
 Primary Fallopian Tube Carcinoma: Treatment and Spread Pattern. *M. Yoonessi, J. P. Leberer and K. Crickard* 1603
 Resection of Fixed Pelvic Tumors Using Nd:YAG Laser. *E. Brand, M. E. Wade and L. D. LaGasse* 1603
 Anorectal Region Malignant Melanoma. *A. Kantarovsky, Z. Kaufman, M. Zager, S. Lew and A. Dinbar* 1604
 Evaluation of N-Acetylneuraminic Acid, Carcinoembryonic Antigen, and Alpha-Fetoprotein as Markers for Advanced Carcinoma. *U. Khanderia and H. B. Grossman* 1604
 Comparison of Growth and Drug Response of Human Tumor Cells in Serum-Free and Serum-Supplemented Media in Tumor-Clonogenic Assay. *K. A. Zirvi and G. J. Hill* 1604
 Evaluation of Role of Surgery in Metastatic Neuroblastoma. *M. Matsumura, J. B. Atkinson, D. M. Hays, G. D. Hammond, S. E. Siegel, H. Sather, J. Grosfeld and G. Haase* 1604
 Coordinating Cancer Care Using Weekly Patient-Oriented Conference. *P. H. Sugarbaker* 1605
 Experimental Continent Diversion. *J. R. Drago, J. A. Nesbitt, G. McDowell, C. Cirulli, E. Geraniotis and J. Smith* 1605

New Treatment for Urethral Strictures. <i>E. J. G. Milroy, C. R. Chapple, J. E. Cooper, A. Eldin, H. Wallsten, A. M. Seddon and P. M. Rowles</i>	1605
Technique for Placement of Totally Implantable Venous Access Device. <i>E. S. Kondi, J. J. Pietrafitta and J. A. Barriola</i>	1605
Pulmonary Embolectomy: Its Place in Management of Pulmonary Embolism. <i>H. H. Gray, G. A. H. Miller and M. Paneth</i>	1606
Worldwide Experience in Newborn Screening for Classical Congenital Adrenal Hyperplasia Due to 21-Hydroxylase Deficiency. <i>S. Pang, M. A. Wallace, L. Hofman, H. C. Thuline, C. Dorche, I. C. T. Lyon, R. H. Dobbins, S. Kling, K. Fujieda and S. Suwa</i>	1606
Demonstration of Both Primary and Secondary Reninsim in Renal Tumors in Children. <i>K. Yokomori, T. Hori, T. Takemura and Y. Tsuchida</i>	1606
Extrarenal Wilm's Tumor—Case Report. <i>H.-S. Lai, W.-T. Hung and S.-W. How</i>	1606
Follow-Up of Infants With Bilateral Renal Disease Detected In Utero. Growth and Renal Function. <i>V. M. Reznik, G. W. Kaplan, J. L. Murphy, M. G. Packer, D. Boychuck, W. R. Griswold, G. R. Leopold and S. A. Mendoza</i>	1607
Growth and Development of Infants With End-Stage Renal Disease Receiving Long-Term Peritoneal Dialysis. <i>B. A. Warady, M. Kriley, H. Lovell, S. E. Farrell and S. Hellerstein</i>	1607
Renal Function Correlates of Postnatal Diuresis in Preterm Infants. <i>K. S. Bidiwala, J. M. Lorenz and L. I. Kleinman</i>	1607
Bladder Fungus Ball: Reversible Cause of Neonatal Obstructive Uropathy. <i>B. Baertz-Greenwalt, B. Debaz and M. L. Kumar</i>	1608
Morphologic Effects of Unilateral Cryptorchidism on Contralateral Descended Testis. <i>F. T. Salman, E. S. Adkins and E. W. Fonkalsrud</i>	1608
Crossed Testicular Ectopia With Bilateral Duplication of Vasa Deferentia: Unusual Finding in Cryptorchidism. <i>F. Tolete-Velcek, M. O. Bernstein and F. Hansbrough</i>	1608
Prognostic Factors in 281 Children With Nonmetastatic Rhabdomyosarcoma (RMS) at Diagnosis. <i>C. Rodary, A. Rey, D. Olive, F. Flamant, E. Quintana, M. Brunat-Mentigny, J. Otten and P. A. Voute</i>	1608
Second Genetic Locus for Autosomal Dominant Polycystic Kidney Disease. <i>G. Romeo, M. Devoto, G. Costa, L. Roncuzzi, L. Catizone, P. Zucchelli, T. Keith, D. J. Weatherall and S. T. Reeders</i>	1609
Predicting Postoperative Urinary Incontinence Development in Women Undergoing Operation for Genitourinary Prolapse. <i>A. Bergman, P. P. Koonings and C. A. Ballard</i>	1609
Immunoglobulin-Producing Cells in Human Prostate. <i>M. C. Bene, A. Studer and G. Faure</i>	1609
Focal Intestinal Heating With Regional Abdominal Hyperthermia. <i>W. J. Spanos, Jr., T. Thrasher, J. Thompson and R. R. Torrey, Jr.</i>	1610
Genitourinary Trauma, by A. S. Cass. <i>J. W. McAninch</i>	1610
Clinical Manual of Urology, by P. M. Hanno and A. J. Wein. <i>M. J. Schacht</i>	1610
Current Literature	1611
Volume Index and Contents	
Index, Volume 140	1613
Table of Contents, Volume 140	iii

PROPRIETARY NAMES

Many of the words appearing in the JOURNAL OF UROLOGY are proprietary names even though no reference to this fact is made in the text. The appearance of any name without designation as proprietary is, therefore, not to be regarded as a representation by the editorial committee or publisher that it is not the subject of proprietary rights.

THE DIAGNOSIS OF VENOGENIC IMPOTENCE: DYNAMIC OR PHARMACOLOGIC CAVERNOSOMETRY?

CHRISTIAN G. STIEF, WOLFGANG DIEDERICHS, FRANCOIS BENARD, RUUD BOSCH, TOM F. LUE* AND EMIL A. TANAGHO

From the Department of Urology, University of California, San Francisco, California and the Department of Urology, University Clinics, Freiburg, FRG

ABSTRACT

In an attempt to refine the diagnosis of venogenic impotence, we evaluated different techniques of cavernosometry in 10 dogs. Saline was perfused intracavernously in five dogs to induce erection. Regardless of the amount required for induction, a mean flow rate of 23.4 ml./min. was necessary to maintain an intracavernous pressure level of 110 cm. H₂O. In seven dogs, a leak was created by intracavernous insertion of a 19-gauge needle. When erection was induced by either cavernous nerve stimulation or a combination of papaverine injection and saline perfusion, the mean flow through the needle was significantly less than when erection was induced by saline perfusion alone (1.73, 1.78, and 8.77 ml./min., respectively). Sympathetic trunk stimulation at the level of L5 could reduce the intracavernous pressure by 90% in erections induced by neural stimulation or papaverine plus perfusion but had no effect on erection induced by saline perfusion alone. Our findings show that cavernosometry after intracavernous injection of papaverine will provide more valuable information in patients in whom venogenic impotence is suspected. (*J. Urol.*, 140: 1561-1563, 1988)

During erection, penile rigidity can be prevented by excessive cavernous vein outflow, to which numerous factors may contribute: pathological changes of the cavernous smooth muscles;¹ abnormal local venous drainage;² insufficient neurotransmitter release; and alteration of the cavernous endothelium.³

In 1978, Virag et al. introduced dynamic cavernosography.⁴ Saline was infused at increasing rates of flow until the intracavernous pressure plateaued at the full erection stage, 80 mm. Hg (at which point it was assumed that saline perfusion had effected closure of the venous channels). The lowest rate needed to induce erection was called the induction flow. The lowest rate needed to maintain erection was named the maintenance flow. The ratio of induction flow to maintenance flow, the maintenance index, was suggested as a diagnostic parameter for venogenic impotence. The penis was then perfused with contrast medium to opacify the abnormally draining veins. In 1986, Lue et al.⁵ suggested that cavernosometry be done after intracavernous injection of papaverine (pharmacocavernosometry) because the resultant erection more closely mimics the normal physiologic event.

We undertook this study to determine which method of cavernosometry would provide the most useful diagnostic information. The dog was chosen as the experimental model because canine erection lacks the tumescent phase and the pressure increase from flaccidity to rigidity can be readily quantified.

MATERIALS AND METHODS

Ten dogs, weighing 32 to 41 kg., were used. In dogs 1 to 5, two 21-gauge needles were inserted into the right corpus cavernosum. One was connected to a Harvard perfusion pump (Mod. 903), the other to a Statham transducer (mod. P 23 AC) for pressure recording (Grass mod. 7 polygraph) (fig. 1). An artificial erection with an intracavernous pressure of 110 cm. H₂O was induced by intracavernous perfusion of saline. Three different perfusion modes were used (fig. 2). First, the rate was

gradually increased by 3.82-ml./min. increments after the pressure had plateaued. The maximal rate was 45.8 ml./min. We then used the same incremental rise but stopped the perfusion and waited for the intracavernous pressure to return to baseline before increasing the flow rate. Thirdly, we perfused saline at an initially high rate of 26.7 ml./min. All measurements were repeated twice to verify reproducibility.

In dogs 4 to 10, a 19-gauge needle was inserted into the right corpus cavernosum to create an artificial leak. Two 21-gauge needles were inserted and connected as above. After a full erection was obtained by electrical stimulation of the cavernous nerve⁶ or saline perfusion, the flow through the needle and the drop in intracavernous pressure were recorded. Erection was again induced, this time by intracavernous injection of two mg. papaverine and saline perfusion, and the cavernous leakage and intracavernous pressure drop were again measured.

In dogs 4 to 10, cuff electrodes were also placed around the sympathetic trunk at the level of L5.⁷ After inducing a full erection by cavernous nerve stimulation, saline perfusion, or papaverine injection plus saline perfusion, electrical stimulation was applied (20 Hz, 3V). Sympathetic stimulation was also applied 30 seconds before and then during saline perfusion to determine whether it can influence the intracavernous pressure change induced by saline perfusion alone.

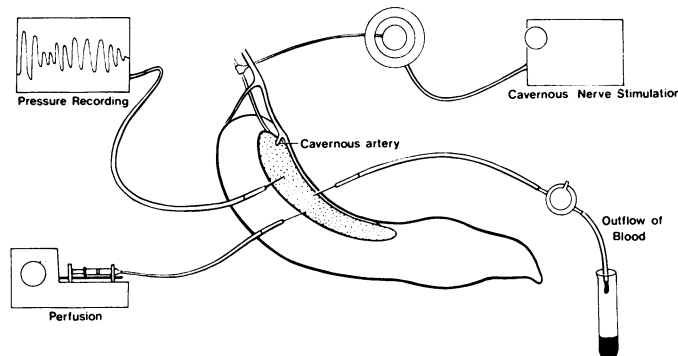


FIG. 1. Canine corpus cavernosum with placement of needles for cavernosometry.

Accepted for publication June 23, 1988.

Requests for reprints: Dept. of Urology, U-518, University of California, San Francisco CA 94143.

Supported by a grant from the Deutsche Forschungsgemeinschaft.

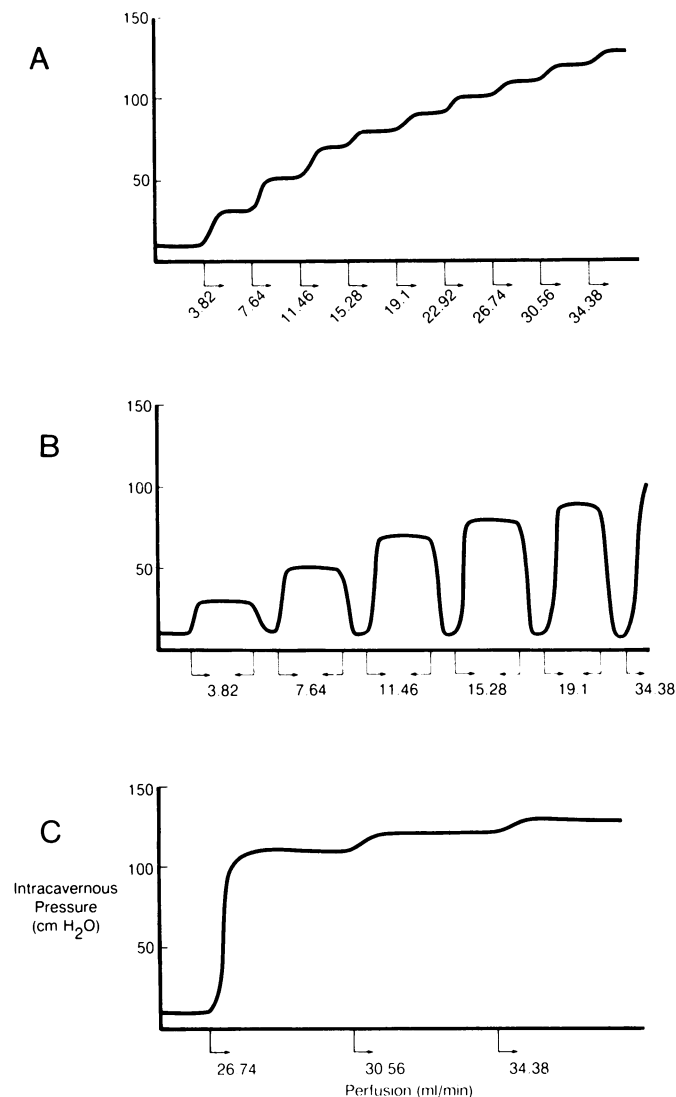


FIG. 2. Intracavernous pressures induced by A, perfusion rates increased by 3.82-ml./min. increments after pressure had plateaued; B, perfusion rates increased by same increment after pressure had returned to baseline; and C, initially high perfusion rate (26.74 ml./min.) followed by same incremental increases as in A and B.

RESULTS

The intracavernous pressure levels induced by saline perfusion were identical at a given perfusion rate, regardless of whether we continuously increased the flow rate or waited for the pressure to return to baseline before so doing (fig. 2). The pressure rose off the scale (>200 cm. H_2O) only when the initial perfusion rate was 34.4 ml./min. or higher (fig. 2C). However, when the perfusion rate was increased gradually (fig. 2A and B), it was possible to perfuse at a rate higher than 34.4 ml./min. without provoking a pressure level >200 cm. H_2O . These findings were reproducible twice in the same animals.

Creation of the artificial leakage resulted in a mean pressure drop of 65 cm. H_2O , regardless of mode of induction. When erection was induced by cavernous nerve stimulation, the mean rate of flow through the leak was 1.73 ml./min.; with erection induced by saline perfusion alone, the mean rate was 8.77 ml./min. Within 60 seconds after intracavernous injection of two mg. papaverine, cavernous smooth muscle relaxation was obtained with a mean intracavernous pressure of 40 cm. H_2O . Only one dog (#8) did not respond to papaverine. In the six that did respond to papaverine, a mean saline perfusion rate of 4.3 ml./min. was necessary to maintain full erection, and the

mean rate of flow through the leak was 1.78 ml./min., much lower than with saline perfusion alone (table 1).

Electrical stimulation of the sympathetic trunk reduced the intracavernous pressure by 90% in erections induced by either cavernous nerve stimulation or by two mg. papaverine plus saline perfusion (fig. 3A, B). Sympathetic trunk stimulation did not influence the intracavernous pressure of an erection induced by saline perfusion alone. It could neither abolish nor significantly reduce the erection induced by saline perfusion when sympathetic stimulation was applied 30 seconds before perfusion (fig. 3C).

TABLE 1. Rate of drainage through the artificial cavernous leak in canine erection induced by various means

Dog No.	Saline Perfusion	Cavernous Stimulation	Papaverine + Perfusion
4	22.0*	2.4	2.9
5	5.8	1.3	0.6
6	12.0	1.8	1.4
7	3.3	0.9	0.9
8	3.5	0.9	No reaction to papaverine
9	7.0	2.8	2.5
10	7.8	2.0	2.4

* All values are ml./min.

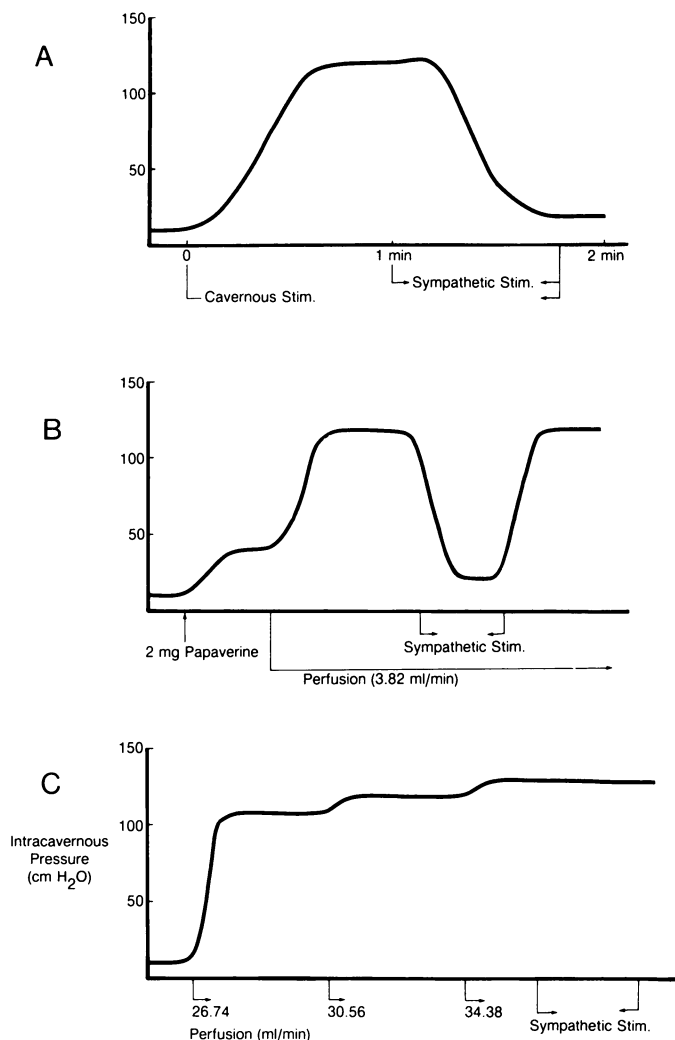


FIG. 3. Effect of sympathetic trunk stimulation (L5) on intracavernous pressure increases induced by A, electrical stimulation of the cavernous nerve; B, two mg. papaverine plus saline perfusion; and C saline perfusion alone.

DISCUSSION

The mode of saline perfusion, whether by continuous incremental increases or by interrupted increases with a return to baseline between increments, did not influence the level of intracavernous pressure provoked by a given perfusion rate. Only in response to an initially high perfusion rate did the pressure rise acutely, presumably by surpassing the compliance of the cavernous tissue and the venous system. By gradually increasing the flow rate, the venous channels may remain open and perfusion rates far in excess of 34.4 ml./min. can be accommodated.

Because the penile venous drainage capacity during erection is determined quantitatively by the maintenance flow, tumescence will result if a rate higher than the maintenance flow rate is used to induce an erection. Thus, the flow rate required to induce an erection depends on the size of the penis and the maintenance flow rate. The induction flow therefore has no diagnostic usefulness in the evaluation of venous leakage.

The amount of flow through the artificial leak was similar in erection induced by neurostimulation or by papaverine and saline (1.73 and 1.78 ml./min., respectively). However, in erection induced by saline perfusion alone, the flow was five times higher (8.77 ml./min.). This can be explained by the fact that the smooth muscles remain contracted in saline-induced erection and permit a free flow from the perfusion needle to the leak. In contrast, the relaxation of the cavernous smooth muscles with neurostimulation or papaverine injection results in outflow resistance and does not permit this high rate of trans-cavernous flow.

Similarly, the divergent responses to stimulation of the sympathetic trunk can likewise be explained: erection induced by cavernous nerve stimulation or papaverine injection more closely mimics the normal physiologic event, and the resultant smooth-muscle relaxation is susceptible to suppression by sympathetic stimulation; erection induced by saline perfusion cannot be influenced because the cavernous smooth muscles have remained contracted.

In human erectile dysfunction, venous leakage is diagnosed and quantified during cavernosometry by measuring the maintenance flow^{4,5,8-12} and the intracavernous pressure drop after cessation of the saline perfusion.^{13,14} The findings of Diederichs et al.⁷ and our results show that these parameters can be significantly influenced by sympathetic stimulation, which seems to increase the intracavernous adrenergic level that causes smooth muscle contraction.¹⁵ Carati and coworkers found that the cavernous smooth muscle contraction induced by sympathetic chain stimulation could be partially reduced by intracavernous injection of phentolamine.¹⁶ These findings suggest that the intracavernous injection of papaverine and phentolamine may reduce psychological inhibition during pharmacocavernosometry. Nevertheless, our clinical experience has

shown that even when high doses of papaverine and phentolamine are injected intracavernously, full erectile response can still be inhibited by nervousness or anxiety of the patient. Thus, pharmacocavernosometry should be performed only in a relaxed setting after the physician has gained the patient's confidence. Any remaining nervousness or anxiety must be taken into account in the interpretation of the cavernosometric results.

REFERENCES

- Persson, C., Diederichs, W., Lue, T. F., Yen, B. and Tanagho, E. A.: Correlation of altered penile ultrastructure with clinical arterial evaluation. *J. Urol.*, **139**: 401A, 1988.
- Stief, C. G., Gall, H., Scherb, W. and Baehren, W.: Erectile dysfunction due to an ectopic vein. *Urology*, in press.
- Goldstein, I.: What controls erection? Presented at the 1987 Postgraduate Course on Erectile Dysfunction. October 16-17, 1987; San Francisco, California.
- Virag, R., Legman, M., Zwang, G. and Dermange, H.: L' utilisation de l' erection passive dans l' exploration de l' impuissance d' origine vasculaire. *Contraception, Fertilité, Sexualité*, **7**: 707, 1978.
- Lue, T. F., Hricak, H., Schmidt, R. A. and Tanagho, E. A.: Functional evaluation of penile veins by cavernosography in papaverine-induced erection. *J. Urol.*, **135**: 479, 1986.
- Lue, T. F.: The mechanism of penile erection in the monkey. *Sem. Urol.*, **4**: 217, 1986.
- Diederichs, W., Stief, C. G., Bosch, R., Benard, F., Lue, T. F. and Tanagho, E. A.: Sympathetic effect on erection in monkeys and dogs. *J. Urol.*, **139**: 253A, 1988.
- Wespes, E. and Schulman, C. C.: Parameters of erection. *Brit. J. Urol.*, **56**: 416, 1984.
- Porst, H., van Ahlen, H. and Vahlensieck, W.: Relevance of dynamic cavernosography to the diagnosis of venous incompetence in erectile dysfunction. *J. Urol.*, **137**: 1163, 1987.
- Wespes, E., Delcour, C., Struyven, J. and Schulman, C. C.: Pharmacocavernosometry-cavernosography in impotence. *Br. J. Urol.*, **58**: 429, 1986.
- Delcour, C., Wespes, E., Vandebosch, G., Schulman, C. C. and Struyven, J.: Impotence: evaluation with cavernosography. *Radiology*, **161**: 803, 1987.
- Bookstein, J. J., Valji, K., Parsons, L. and Kessler, W.: Penile pharmacocavernosography and cavernosometry in the evaluation of impotence. *J. Urol.*, **137**: 772, 1987.
- Padma-Nathan, H. and Goldstein, I.: Corporal leakage syndrome: the role of dynamic infusion cavernosometry and cavernosography. *J. Urol.*, **137**: 184 A, abstract 321, 1986.
- Freidenberg, D. H., Berger, R. E., Chew, D. E., Ireton, R., Ansell, J. S. and Schwartz, A. W.: Quantitation of corporal venous outflow resistance in man by corporal pressure flow evaluation. *J. Urol.*, **138**: 533, 1987.
- Benson, G. S., Mc Connell, J., Lipshultz, L. I., Corriere, J. N. and Wood, J.: Neuromorphology and neuropharmacology of the human penis: an in vitro study. *J. Clin. Invest.*, **65**: 506, 1980.
- Carati, C. J., Creed, K. E. and Keogh, E. J.: Autonomic control of penile erection in the dog. *J. Physiol.*, **384**: 525, 1987.