

# **Medical Articles Representing the Safety and Efficacy of BiPolar EHL Associated with both Urologic and Biliary Lithotripsy Procedures**

- **[Combined Electrohydraulic and Holmium: YAG Laser ureteroscopic nephrolithotripsy for 20 to 40 mm renal calculi](#)**

Albert J. Mariani M.D.

The Journal of Urology, Vol. 172, 170-174, July 2004

**Summary:**

Combined EHL and Ho:YAG laser flexible ureteroscopic lithotripsy can be an effective treatment with low morbidity. As such, it provides an attractive, minimally invasive alternative to PCNL or open surgery in patients with 2 to 4 cm renal calculi.

In this series the bulk of the calculus was disintegrated using EHL. In 2 patients with hard stones resistant to EHL, the stones were pre-drilled with a 200  $\mu$  Ho:YAG laser and then the EHL probe was placed into the defect. After the stone was initially fractured, EHL lithotripsy completed the fragmentation.

- **[Combined Electrohydraulic and Holmium: YAG Laser ureteroscopic nephrolithotripsy of large \(>2 cm\) renal calculi](#)**

Albert J. Mariani M.D.

Indian Journal of Urology 2008 Oct-Dec; 24(4): 521-525

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**Summary:**

Because of the longer effective range (1-3 mm vs. 0.5 mm) the EHL fragments much larger volumes of stone per unit of time than the Ho:YAG laser thus shortening operative time. Another advantage is flexibility. The 1.9-Fr. EHL probe permits greater ureteroscope deflection improving access to all parts of the collecting system. Unlike a HO:YAG laser fiber, a 1.9-Fr. EHL probe can be gently passed down a prepositioned, flexed ureteroscope with minimal risk to the working channel further improving access. While the Ho:YAG laser easily cuts through a guidewire or basket, this is unlikely with EHL. Eye protection is not required with EHL. Finally, because of the simplicity of the technology, the cost and maintenance of EHL is much less than for the Ho:YAG laser.

Medical articles representing the safety and efficacy of bipolar electrohydraulic lithotripsy associated with both urologic and biliary stone fragmentation procedures, con't.

- [Ureteroscopic Treatment of larger renal calculi \(>2 cm\)](#)

Demetrius Bagley, Kelly Healy, Nir Kleimann

Department of Urology, Thomas Jefferson University, Philadelphia, PA  
Arab Journal of Urology (2012) **10**, 296-300

**Objectives:** To evaluate the current status of ureteroscopic lithotripsy (UL) for treating renal calculi of >2 cm, as advances in flexible ureteroscope design, accessory instrumentation and lithotrites have revolutionised the treatment of urinary calculi. While previously reserved for ureteric and small renal calculi, UL has gained an increasing role in the selective management of larger renal stone burdens.

**Summary:** UL is safe and effective for treating large renal calculi. While several procedures might be required for total stone clearance, UL should be considered a standard approach in the urologist's options treating renal calculi of > 2 cm.

The electrohydraulic lithotripter (EHL) has probes as small as 1.7-1.9 F, which are extremely flexible and do not limit endoscope deflection. EHL yields excellent fragmentation and does not require direct contact with the stone.

- [Efficacy of Electrohydraulic and Laser Lithotripsy in the Ureter](#)

Thomas W. Schoborg M.D.

Journal of Endourology. Winter 1989, 3(4): 361-365. doi:10.1089/end.1989.3.361.  
Published in Volume: 3 Issue 4: March 31, 2009

**Summary:**

“Important advantages of EHL are the simplicity and rapidly performed technique, whereas laser lithotripsy involves the use of a much more complex and cumbersome piece of equipment. A substantial service fee is necessary to support the laser, whereas no service contract is required for the electrohydraulic lithotripter.”

“EHL in the ureter via the rigid ureteroscope was initiated in 1982 at Georgia Baptist Hospital. For the purpose of this report, 62 cases of ureteral calculi treated since that time have been reviewed. Of the 62 cases, success was achieved in 60 (97%). The two treatment failures consisted of one in which the stone was never adequately reached with the ureteroscope and another in which retrograde ureterscopic attempts with both EHL and laser lithotripsy failed.”

“EHL and laser are equally successful and safe in managing ureteral calculi.”

Medical articles representing the safety and efficacy of bipolar electrohydraulic lithotripsy associated with both urologic and biliary stone fragmentation procedures, con't.

- [Morphological change in the urothelium after electrohydraulic versus pulsed dye laser lithotripsy](#)

T.T. WU MD, T.H. HSU MD, A.F. LI MD, PhD, M.T. CHEN MD, L.S. CHANG MD

Article first published online: 21 NOV 2008

British Journal of Urology: Volume 74, Issue 6, pages 685–689, December 1994

**Summary:**

“In conclusion, both electrohydraulic and pulsed dye laser lithotripsy can cause urothelial injury when the electric spark or laser beam is applied directly to the mucosa. To avoid inadvertent tissue injury, both of these two fragmentation techniques should be performed under direct vision only.”

- [Electrohydraulic lithotripsy of renal and ureteral calculi.](#)

J. Denstedt M.D., R. Clayman M.D.

Division of Urologic Surgery, Washington University School of Medicine, St Louis, Missouri.

The Journal of Urology [1990, 143(1):13-17]

**Summary:**

“Electrohydraulic lithotripsy was used to manage 45 upper tract calculi (23 renal and 22 ureteral stones) in 40 patients. Electrohydraulic lithotripsy successfully fragmented 91% of the calculi. All ureteral fragments cleared; in 2 patients with renal calculi solitary 4 mm. stone fragments remained. There were no intraoperative or long-term complications directly related to the use of electrohydraulic lithotripsy in the upper urinary tract. We conclude that intrarenal and intraureteral electrohydraulic lithotripsy is a safe, effective, inexpensive means to perform intracorporeal lithotripsy.”

- [Ex Vivo Comparison of Four Lithotripters Commonly Used in the Ureter: What Does It Take to Perforate?](#)

Robert W. Santa-Cruz, Raymond J. Levelliee, and Arnon Krongrad.

Journal of Endourology. October 1998, 12(5): 417-422. Journal of Urology, Volume: 12 Issue 5: March 30, 2009

**Summary:**

The Holmium laser with 2100nm output, has the power to perforate the ureter easily. It consistently produced a full-thickness injury within 1 second at its lowest power setting of 1W when fixed at 90° in contrast to EHL which produced perforation with an average of 24.4 seconds.

• [Ureteroscopic Management of Ureteral Calculi: Electrohydraulic versus Holmium: YAG Lithotripsy](#)

Joel M.H. Teichman, Ramesh D. Rao, Vince J. Rogenes, Mansel J. Harris

From the Division of Urology, University of Texas Health Science Center, San Antonio, Texas.

The Journal of Urology, Volume 158, Issue 4, October 1997, Pages 1357–1361

**Summary:**

Two cohorts of consecutive patients with ureteral calculi treated with ureteroscopic electrohydraulic or holmium:YAG lithotripsy were retrospectively compared. Electrohydraulic lithotripsy was done using a 1.9F fiber at energy settings between 50 and 100 v. Holmium YAG lithotripsy was done using a 365 micro m. fiber at energy settings of 0.6 to 1.5 J.

A total of 23 and 47 consecutive patients underwent electrohydraulic and holmium YAG lithotripsy, respectively. For preoperative calculi less than 15 mm. mean stone size plus or minus standard deviation was 9 +/- 3 versus 9 +/- 3 mm (p = 0.5), mean operative time was 72 +/- 21 versus 102 +/- 38 minutes (p = 0.004), stone-free rate at the end of ureteroscopy was 65 versus 97 (p <0.01) and 3-month stone-free rate was 94 versus 97% (p = 0.4) for electrohydraulic versus holmium YAG lithotripsy. For preoperative calculi 15 mm. or greater stone size was 19 +/- 5 versus 19 +/- 4 mm. (p = 0.9), operative time was 159 +/- 61 versus 108 +/- 27 minutes (p = 0.01), stone-free rate at the end of ureteroscopy was 33 versus 87% (p = 0.001) and 3-month stone-free rate was 67 versus 100% (p = 0.02). Complications were not significantly different in either comparison.

For ureteral calculi less than 15 mm, electrohydraulic lithotripsy was more rapid than the holmium:YAG procedure but for ureteral calculi 15 mm or greater the holmium YAG technique was more rapid than electrohydraulic lithotripsy. The outcomes differences may have resulted from the different mechanisms of electrohydraulic and holmium YAG lithotripsy.

• [Intracorporeal Electrohydraulic Lithotripsy of ureteral and renal calculi using small caliber \(1.9Fr\) Electrohydraulic Lithotripsy probes.](#)

Osama M. Elashry, Robert B. DiMeglio, Stephan Y. Nakada, Elspeth M. McDougall and Ralph V. Clayman

The Journal of Urology, Vol. 156, 1581-1585, November 1996

**Summary:**

“The current cost of basic electrohydraulic lithotripsy equipment is approximately \$11,350 in contrast to \$90,000 or \$160,000 for a holmium or tunable dye laser respectively. In addition, unlike the laser, the electrohydraulic lithotripsy unit requires no service contract. While the holmium and tunable dye laser can be used many times, laser units have \$10,000 and \$23,000 annual service contracts respectively.”

“The development of 1.9Fr. electrohydraulic lithotripsy probes provides urologists with a uniquely safe, effective and economical method for performing Intracorporeal lithotripsy using rigid or flexible endoscopes throughout the entire upper urinary tract. For the ureteroscopic treatment of the lower pole renal calculi, electrohydraulic lithotripsy is the only form of intracorporeal lithotripsy sufficiently malleable to combine effective access with successful fragmentation. In 37% of our cases the targeted stone was in the lower pole. Thus in these patients successful electrohydraulic lithotripsy precluded a much more invasive and expensive percutaneous procedure. With ureteroscopic electrohydraulic lithotripsy we salvaged 10 ESWL and 5 laser failures. We encourage other urologists to consider performing EHL as a first line or salvage therapy for ureteral and renal calculi.”

Medical articles representing the safety and efficacy of bipolar electrohydraulic lithotripsy associated with both urologic and biliary stone fragmentation procedures, con't.

- [Features and Acoustic Output of Five Electrohydraulic Lithotripters for Endoureteral Stone Treatment](#)

Roland Vorreuther, M.D. and Ruediger Enelking, M.D.  
Journal of Endourology, Volume 6, Number 1, 1992

**Summary:**

"Minimally invasive ureteroscopy with small semi-rigid endoscopes is gaining more importance. Thus, electrohydraulic lithotripsy (EHL) becomes more attractive as a cost-efficient alternative to laser lithotripsy."

- [Electrohydraulic lithotripsy: an effective and economical modality of endoscopic ureteric lithotripsy.](#)

See AC, Ng FC, Ch'ng HC.  
Source: Department of Surgery, Toa Payoh Hospital, Singapore.  
Aust N Z J Surg. 1997 Aug;67(8):551-3.

**Summary:**

Electrohydraulic lithotripsy (EHL) has been available for endoscopic treatment of urinary calculi since 1960, but the large probe size and concerns regarding safety had previously restricted its use to the treatment of bladder calculi. However, recent refinements have made it particularly suitable for the treatment of ureteric calculi.

The authors report their initial experience using EHL in conjunction with mini-ureteroscopy in the treatment of 94 ureteric calculi in 89 patients. The size of the calculi ranged from 3 to 19 mm in diameter, with a mean of 8.2 mm. The mean operating time was 29 min, ranging from 10 to 120 min.

A complete fragmentation rate of 91.5% of the calculi was achieved. There were no major complications and a low incidence of minor complications: haematuria (2.2%), urinary tract infection (3.4%) and postoperative ureteric colic (2.2%). There were four cases of minor ureteric perforations (4.5%); all were successfully treated using conservative measures.

It is concluded that EHL is a safe and effective method of treating ureteric calculi.

- [Intracorporeal Biliary Lithotripsy](#)

Picus D. M.D.  
Radiologic Clinics of North America. 1990 Nov; 28 (6):1241-1249  
Source: Mallinckrodt Institute of Radiology, Washington University School of Medicine, St. Louis, Missouri.

**Summary:**

"Most bile duct calculi can be removed with standard percutaneous or endoscopic techniques. Very large stones are the most common cause for failure. Intracorporeal lithotripsy, and EHL in particular, can be used safely in either the biliary tree or gallbladder to fragment these large stones and allow percutaneous removal or passage. Intracorporeal EHL requires direct vision to prevent damage to the bile duct mucosa. Intracorporeal laser lithotripsy may offer some safety advantages, but the laser requires much more expensive equipment than intracorporeal EHL."

- [Fragmentation of Biliary Calculi in 71 Patients by Use of Intracorporeal Electrohydraulic Lithotripsy](#)

Kevin E. Burton, M.D., Daniel Picus, M.D., Marshall E. Hicks, M.D., Michael D. Darcy, M.D., Thomas M. Vesely, M.D., Michael A. Kleinhoffer, R.T., Giuseppe P. Allperti, M.D., Steven A. Edmundowicz, M.D.  
Journal of Vascular and Interventional Radiology March-April 1993 (4):251-256

**Summary:**

“In these difficult cases, Intracorporeal electrohydraulic lithotripsy (EHL) is a method that allows larger stones to be fragmented and removed percutaneously or endoscopically.”

“EHL lithotripsy was effective in fragmenting all biliary stones in 69 of the 71 patients (97%). All of the stone fragments were removed in 67 of these 69 patients (94%). Major complications, including bile peritonitis and gallbladder necrosis, occurred in five patients; however, all major complications were related to the initial percutaneous drainage or tract dilation. No significant complications were directly attributable to the EHL procedure.”

“We recommend that EHL be adopted by anyone doing a substantial number of these procedures.”

- [Role of Percutaneous Intracorporeal EHL in the Treatment of Biliary Tract Calculi](#)

Daniel Picus, M.D., Philip J. Weyman, M.D., M. Victoria Marx, M.D.  
Radiology-SCVIR, Vol.170, No.3, Pages 989-993, March 1989.

**Summary:**

“The stones in all 11 patients were successfully fragmented and removed. There were no complications. Intracorporeal electrohydraulic lithotripsy (EHL) is an effective alternative therapy for the treatment of biliary tract calculi when standard methods fail.”

- [Nonmechanical Treatment of Common Bile Duct Stones](#)

Kenneth F. Binmoeller, M.D.  
UCSD Medical Center, San Diego,CA 1999

**Summary:**

“EHL is preferable to the pulsed laser for intra-ductal lithotripsy”

“Electrohydraulic lithotripsy seems to provide the best combination of technical success, low costs, and practicality”.

Medical articles representing the safety and efficacy of bipolar electrohydraulic lithotripsy associated with both urologic and biliary stone fragmentation procedures, con't.

• [\*\*Are Modified Procedures Significantly Better than Conventional Procedures in Percutaneous Transhepatic Treatment for Complicated Right Hepatolithiasis with Intrahepatic Biliary Strictures?\*\*](#)

K. Jeng, I. Sheen,

Scandinavian Journal of Gastroenterology, May 2002 Vol.37, Nr.5 p.597-601

**Summary:**

"We believe that the modified methods using EHL are superior to conventional treatment in that they effectively decrease procedural complications and cost, and significantly improve treatment results."

• [\*\*The Management of Treatment-Resistant Biliary Calculi using Percutaneous Endourologic Techniques\*\*](#)

A. Andrew Ray, M.D., Edward T. Davies, M.D., Mordechai Duvdevani, M.D., Hassan Razvi, M.D., and John D. Denstedt, MD Departments of Surgery, Divisions of Urology and of General Surgery, Schulich School of Medicine and Dentistry, University of Western Ontario, London, Ontario Canada

Dr. J.D. Denstedt, Department of Surgery, Schulich School of Medicine and Dentistry, 268 Grosvenor St., London ON N6A Canadian Journal of Surgery. 2009 October; 52(5): 407–412.

**Summary:**

"There were no intraoperative complications and no patients required blood transfusions. Postoperatively, 1 patient experienced acute coronary syndrome (ACS) and another prolonged biliary drainage. Both had successful endoscopic treatment of their calculi. There were no cases of treatment-related sepsis, and we observed no other complications."

"Electrohydraulic lithotripsy is a useful adjunct in the endoscopic treatment of calculi."

• [\*\*Electrohydraulic Lithotripsy in 111 Patients: A safe and Effective Therapy for Difficult Bile Duct Stones\*\*](#)

Naveen Arya, M.D., Sandra E. Nelles, M.D., Gregory B. Haber, M.D., Young-In Kim, M.D., and Paul K. Kortan M.D.

American Journal of Gastroenterology 2004; 2330-2334

**Summary:**

"Peroral EHL has been compared to extracorporeal shockwave lithotripsy in a number of open trials. It has been shown to have similar stone-free rates as ESWL; however, the advantage of EHL was that fewer lithotripsy sessions were required. Also, in these same studies 92-24% of patients successfully treated with ESWL, required additional endoscopic removal of stone fragments. In our study, 57% of patients successfully treated with EHL required no further endoscopic procedures. A study by Neuhaus et al., compared ESWL to EHL in a total of 60 patients. The study found that ESWL was 73% effective compared to EHL, which was 97% effective in stone clearance. EHL had fewer complications and required fewer sessions than ESWL."

"Peroral fragmentation of difficult bile duct stones using EHL in our study has shown to be a successful and safe procedure and should be the first option to other treatment modalities."