ENDOSCOPIC LITHOTRIPSY- WHAT’S NEW IN SOURCES OF ENERGY

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Electrohydraulic lithotripsy was the first modality of intracorporeal lithotripsy used in the clinical setting\textsuperscript{1}. Since then, other types of energy have been developed and used for stone treatment\textsuperscript{1-4}. Currently, the most commonly used modalities of energy for intracorporeal lithotripsy are ultrasonic, ballistic and laser\textsuperscript{2,5,6} and all can be used either through the percutaneous or ureteral approach.

Although, new devices for intracorporeal lithotripsy are being developed, to date there is no ideal device that, incorporates a high margin of safety and efficiency, flexibility, optimal power setting, and low costs. Herein, we briefly describe the newest devices and sources of energy for intracorporeal lithotripsy.

**Rigid devices:**

*Ultrasonic energy (Olympus LUS-2 and Richard Wolf model 2271.004).* Both devices use the piezoelectric principle to generate vibrational energy. A drilling effect is created at the tip of the probe that when in direct contact with the stone, causes fragmentation. The probes are hollow allowing for simultaneous aspiration. Recently, we assess the *in vitro* efficiencies of these new generators and compared them to currently available devices\textsuperscript{7}. Using 100\% power settings, times for complete penetration through stone phantoms were evaluated. The Olympus LUS-2 was considered the fastest (29.6 sec), followed by the Circon-ACMI USL-2000 (36.9 sec), Olympus LUS-1 (61.7 sec) and Wolf 2271.004 (103.1 sec). Each generator was significantly faster than the following units (p<0.05).
Swiss Lithoclast Master. This new device combines a pneumatic lithotripter with an ultrasonic lithotripter, which can be operated simultaneously. Haupt et al reported 100% stone disintegration regardless the stone composition. The fragments were quickly and efficiently removed in all renal stones. For bladder stone fragments, removal was aided by forceps. Two treatments had to be interrupted because of severe blocking of the ultrasonic handpiece lumen. We assessed the optimal setting of this device in vitro. The best setting for stone mass removal was 100% (ultrasonic) associated with 8 Hz (pneumatic). The pneumatic component was efficient for initial stone fragmentation, but clearance of small fragments was difficult due to the retropulsion effect. The ultrasonic component provided efficient removal for small particles, but not for big fragments. As a result, the authors recommended removing big fragments with grasper, reserving the ultrasonic part to remove small particles.

Flexible devices:

VersaPulse PowerSuite 20 Watt Ho:YAG Laser (Lumenis Ltd. Yokneam, Israel). Recently, this new device was approved by the FDA for clinical use. This laser is an attractive alternative when compared with more powerful lasers, because of its lower cost. Ho:YAG operates at wavelength of 2,120 nm. The energy delivered is highly absorbed in water with minimal effect beyond the tip of the fiber. Consequently, its safety margin is higher when compared with electrohydraulic lithotripsy. The unique advantages of Ho:YAG laser is its ability to fragment any stone and its use through flexible instruments.

Erbium:YAG laser (Er:YAG). This laser is a potential new energy source for intracorporeal lithotripsy. Currently, it is still in the developmental stage. Er:YAG laser
operates at wavelength of 2,940 nm and pulse duration of 275 microseconds. Recently, Teichman et al \textsuperscript{10} compared the Er:YAG with the Holmium:YAG laser \textit{in vitro} and noted an increased fragmentation efficacy for calcium oxalate monohydrate and cystine stones with the Er:YAG energy source. The Erbium and Holmium:YAG lasers share similar mechanisms of action, differing basically in the amount of optical energy absorbed by the stone. As a result, the Er:YAG and Ho:YAG laser produces a torpedo shaped and a pear shaped vapor bubble, respectively. Drawbacks associated with the Er:YAG laser are the lack of a practical delivery system of the optical fibers (this laser requires a 425 micrometer sapphire fiber at $700 per 1.5 meter), and, the stone fragments are larger than those obtained with the Ho:YAG laser.

The decision of which new device to purchase is difficult and requires a through evaluation of both the urologists needs and the main products available. Reliable clinical and experimental data about new devices often lags their availability on the market. Because the “ideal equipment” still does not exist, we suggest that urologists have in their urology suites an “ideal combination” of equipment comprised by a flexible low power Ho:YAG laser and a rigid device, combining the ultrasonic and pneumatic lithotripters.

REFERENCES


