

Application of Novel Break Wave Lithotripsy and Ultrasonic Propulsion Technology for the Treatment of Ureteral Calculi in a Bottlenose Dolphin (*Tursiops truncatus*)

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Abstract

Marine mammals may develop obstructing urinary calculi (stones) that are challenging to treat and can result in life threatening renal disease.¹⁻⁵ We describe the use of burst wave lithotripsy (BWL) and ultrasonic propulsion to treat ureteral calculi in a 48-year-old female bottlenose dolphin (*Tursiops truncatus*) that had chronic urinary tract and respiratory infections from multiple organisms.

BWL and ultrasonic propulsion were delivered transcutaneously in sinusoidal ultrasound bursts to fragment and reposition the obstructing stones.^{6,7} The dolphin was provided oral sedation and was placed on waterproof foam padding, out of the water, on her side. Targeting and monitoring were performed with real-time imaging using traditional diagnostic ultrasound integrated with the BWL and ultrasonic propulsion system in addition to an electrocardiogram heart monitor during the procedures. Four dolphin stones were obtained and fragmented *ex vivo* the first procedure. The dolphin received a 10-minute and a 20-minute treatment with BWL and ultrasonic propulsion conducted approximately 24 hours apart to treat two 8-10 mm partially obstructing right mid-ureteral stones under oral sedation. Intravenous fluids were administered using a ventral fluke venous access point throughout the procedure.

All 4 *ex vivo* stones fragmented to < 2 millimeters in < 20 minutes. In the dolphin, the ureteral stones appeared to fragment, spread apart, and move with ultrasonic propulsion. On post-treatment days 1 and 9 the ureteral calculi fragments shifted caudally and then to the ureteral orifice, respectively. On day 10, the calculi fragments passed and were not identified in the urinary bladder on diagnostic ultrasound. On day 11 there was a marked reduction in right ureter and renal collecting duct dilation. The animal's appetite improved, and she was introduced to other dolphins. However, complete resolution of the azotemia was not attained, and she passed away about 5 weeks post-procedure from various causes. In conclusion, BWL and ultrasonic propulsion successfully relieved ureteral stone obstruction in a geriatric dolphin.

Acknowledgments

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