IN VITRO STUDY OF THE REVISED ULTRASOUND BASED REAL-TIME TRACKING OF RENAL STONES FOR SHOCK WAVE LITHOTRIPSY: PART 1

Abstract

Purpose: Extracorporeal Shock Wave Lithotripsy has been popular since 1980s. Of all the conventional lithotriptors, only 30% to 50% of shock waves are focused on stones. We developed an ultrasound based real-time stone tracking system (1st version) to improve accuracy and treatment efficiency. Yet, some problems remained. We have now revised the existing system and tested its reliability and performance.

Materials & Methods: We revised the system by adding more algorithms to reduce misidentification of renal stones (2nd version). We verified the advanced system with two tests. In each test, non-tracking and tracking with the 1st and 2nd versions were conducted by using thirteen stone trajectories.
1. Coincidence Test: Evaluating the accuracy of targeting the stone within the effective focal area.
2. Stone Fragmentation Efficiency Test: Clarifying the decrease in number of shocks for stone fragmentation.
3. Results: In the Coincidence Test, the results (Mean ± S.D.) of the non-tracking, 1st, and 2nd version of tracking systems are 68.8±18.8%, 89.9±5.2% and 94.3±4.5%, respectively. Statistically, the 2nd version is significantly better than the 1st version (p=1.5×10^-4). In the Stone Fragmentation Efficiency Test, the results (Mean±S.D.) of the non-tracking, 1st and 2nd version are 49.5±14.2%, 85.1±4.5% and 89.5±4.2%, respectively. Statistically, the 2nd version is significantly better than the 1st version as well (p=1.9×10^-8).
4. Conclusions: The results show that the revised tracking system is better than the 1st one. It not only improves the efficiency of treatment, decreases the misidentification of stones, but also has the ability to shorten the treatment time.