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CUSUM Methodology for the analysis of the efficacy of the laser fragmentation in one session RIRS during the learning curve

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Introduction & Objectives: A way to analyze the learning curve during lithiasis surgery is to analyze the efficacy of the fragmentation regarding the number of procedures completed. The objective is the evaluation of the efficacy of the laser fragmentation of the lithiasis like a parameter in the learning curve.

Materials & Methods: Retrospective revision of all our cases treated with RIRS during three years. We only included for the analysis cases in which we achieved complete fragmentation of the lithiasis in one session, being RIRS the primary procedure. Analysis of demographics variables, lithiasis and intraoperative parameters was done. The evaluation of the variation of the efficacy of the láser fragmentación over time was performed with the formula: fragmented lithiasis volumen (mm3)/ operative time (min). We used Holmium Laser (Stone Light AMS) as fragmentation source The analysis of the improvement of the fragmentation rate was performed with the cumulative sum (CUSUM) analysis. CUSUM analysis is a test that relies on the comparison between computed values and a limit, used for detecting tendencies around the learning curve, allowing quantitative and individual assessment of the procedure. The graphs shows for each observation(x_i), its deviation from the objective mean(μ) and calculates deviations(x_i-μ) from the beginning of the LC. It is a pondered method, so it considerer the accumulative. We particularly evaluated CUSUM for the fragmentation rate related to the operative time.

Results: We had analysed 115 surgeries in our Service, only 53 were the first procedure and resolved the lithisis in one session. The mean age was 51,79 years (15-75), 31 males (58,5%) and 22 females (41,5%). the most frequent lithiasis localization was renal pelvis and lower calyx. The mean surface of the treated lithiasis was 517 mm3. The mean fragmentation rate for lithiasis lower than 1 centimeter is 25 mm3/min, without evidencing differences along the consecutives cases for this size. For lithiasis between 1 - 1,5 cm, we observed an increase above the mean after 25 cases. With >1,5 cm for the initial size of the lithiasis we did not observed any tendency in the increasing of the fragmentation rate, probably due to a small number of cases. We assumed like a study limitation the possible bias of the time spent for the previous steps to the fragmentation (meatal dilatation, pielography, sheath`s ascend…).

Conclusions: The efficacy of the laser fragmentation in relation to the operative time during the learning curve seems to increase with the number of cases. For lithiasis between 1-1,5 cm we observed an increase in the fragmentation rate above 25 cases. It can be interesting for the planification of the surgeries.