Exclusively ultrasound guided Extracorporeal Shock Wave Lithotripsy (ESWL): a feasible, effective and guideline conformable concept for stone treatment

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Introduction

ESWL is occasionally debatable in competition to endoscopic stone removal. Till now stone localization for ESWL is almost exclusively based on X-ray despite matured ultrasound techniques. This is to evaluate solely ultrasound guided ESWL in a newly established ESWL unit as part of a modular stone treatment concept under particular consideration of economic aspects.

Methods

A lithotripter (electromagnetic Modulith SLK, Storz Medical AG, Switzerland) combining inline real time sonography was newly established in a public General hospital in which ESWL was not available before. Cost effectiveness and in particular the accomplishment of a simple modular stone treatment concept were strictly followed. Mobile ESWL without X-ray and special table was required to accomplish a most flexible room concept, 5 – 8 ESWL/week were pre-estimated. Indications for ESWL were mainly kidney and upper ureter stones. The EAU guidelines were strictly followed. Data of the first 150 consecutive patients were followed. These parameters were obtained:

1. Stone size
2. Desintegration rate
3. Retreatment rate
4. Complication rate
5. Hematoma rate
6. Time for positioning
7. Type of positioning

The following questions were to answer:

1. Localisation possible under all conditions?
2. Desintegration results?
3. Cost situation?
4. Development of a “stone concept”

All parameters were investigated retrospectively

ESWL was exclusively done in sedoanalgesia (max. 3,000 SW/Energy level 1 mJ/mm²). All steps (positioning, arrogation, ultrasound localization, ESWL treatment) were solely done by one urologist. All data were collected in a commercially available database.

Results

ESWL could be performed in all cases in supine position. Stone localization by ultrasound was easy and conclusive after short learning curve (< 30 ESWL). 83% (n = 124) were kidney and 17% (n=26) upper ureter stones. Stone size was 5 – 10 mm (n=14) 11-15mm (n=36). Desintegration could be achieved in all cases. Retreatment rate depended in particular in stone size and was overall 17%. Sedoanalgesia was sufficient in all cases for ESWL at maximum energy level each. Inline real time ultrasound provided excellent visibility of the concrement during the entire ESWL procedure. Major side effects/hematoma did not occur at all.

Subsidiary measurements were necessary in < 10% following ESWL. Positioning time was <5 min. in 83%.

Stone size (diameter)
5-6 mm 33%
7-8 mm 31%
9-10 mm 24%
10-15 mm 10%
>15 mm 1%

(after PCNL)

Procedure

1. Ultrasound targeting with 3.5MHz INLINE transducer
2. Patient positioning in supine position (max. 60° rotation)
3. ESWL unit flexibly adjusted to patients’ anatomy and stone localization (> device adapts to patient)

Conclusion & cost analysis

Inline real time sonography was excellently suitable for stone localization and intraoperative observance.

Results are comparable to X-ray based ESWL. All intended stone localizations could be reached by sonographically guided ESWL. According to our modular stone treatment concept mid/lower ureter stones (for which X-ray would be compulsively necessary) were a priori not scheduled for ESWL but for endoscopy.

Giving up X-ray led to a highly flexible lithotripter concept without specific room/structural requirements.

Sono-ESWL: Advantages…
1. easy handling/positioning of patients
2. good patient comfort
3. less pain and therefore stable positioning
4. better tolerated ESWL
5. continuous real time desintegration effect control
6. continuous real time positioning control
7. higher total energy application to the stone
8. flexible room concept
9. short availability of the ESWL unit (“roll on – roll off”)
10. easy interdisciplinary use
11. less fix costs
12. no X ray radiation for patient and user

Sono-ESWL: “Disadvantages”…
1. Learning curve
2. “Burden on users” (“press and go” not possible)
3. exercise necessary

Compared to it is highly cost effective due to less investment/operating and staff expenses.

At the same time Sono-ESWL can be integrated into a modern modular stone concept in accordance to guidelines.

For low to mid volume ESWL units (e. g. <500 ESWL/year) it could be an ideal economic and specialized option.