Modern approach to urolithiasis

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Geert G. Tailly

Department of Urology
(J.A. Baert, M. Claessens, K. R. Hente, G. G. Tailly)
AZ KLINA, Augustijnslei 100, B - 2930 Brasschaat

Management of URETERAL stones

Spontaneous passage

- Overall :
  - 60-70%
  - ureteral stones < 5mm : 98%
- Proximal ureter : 25%
  Mid-ureter : 45%
  Distal ureter : 70%

Management of URETERAL stones

Spontaneous passage

- location and size
- severity of renal colic
- degree of obstruction / renal function
- presence of UTI
- special conditions : pregnancy, solitary or transplant kidney, …
- professional activity of patient
- ……

Management of URETERAL stones

Active treatment

ESWL + URS
=
First line treatment of any ureteral calculus

ESWL or URS ?
ESWL

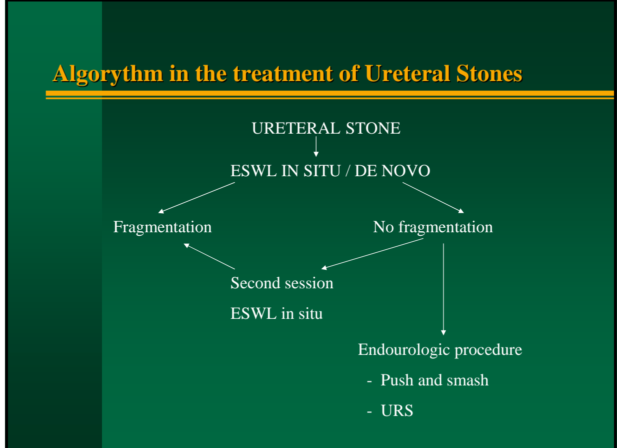
+	-
• Least invasive	• Multiple treatments
• Excellent stone free rates	• Salvage URS

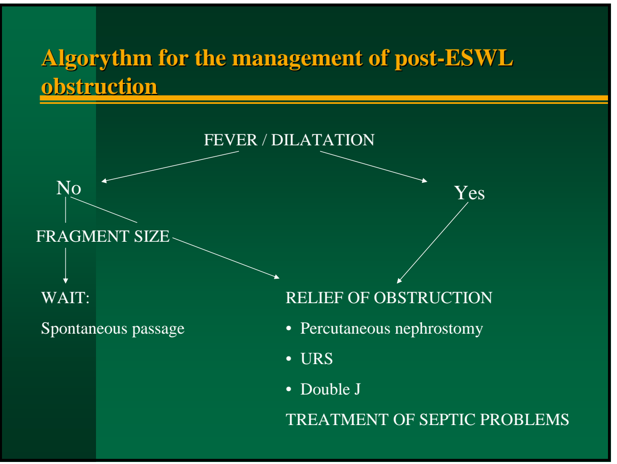
ESWL or URS ?
URS

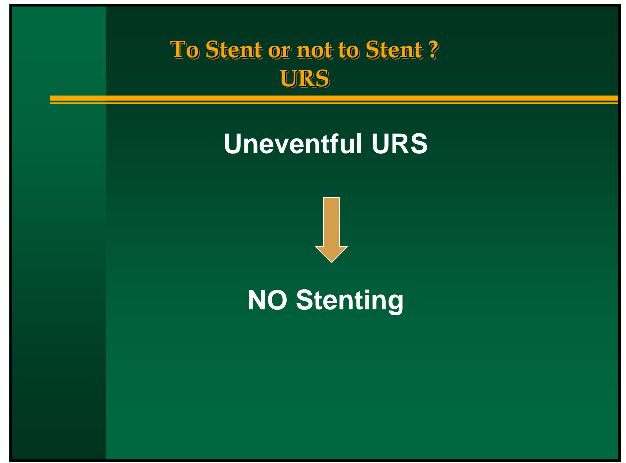
+	-
• Minimally invasive	• Higher morbidity
• Excellent stone free rates	• Higher complication rate
• More cost effective (?)	• Skill

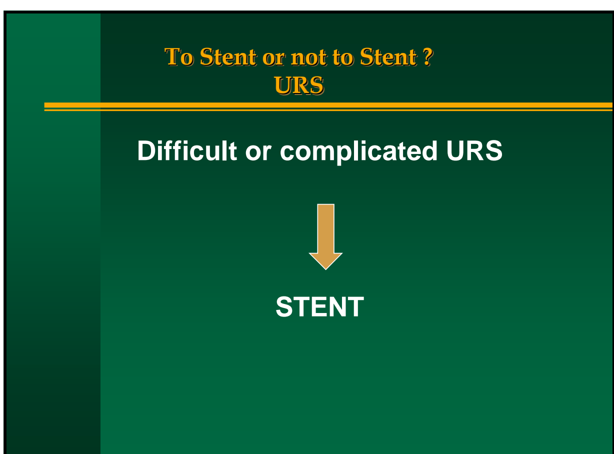
ESWL or URS ?

- Availability and type of lithotriptor
- Type, size and location of stone
- Presence of UTI
- Endourologic equipment and skill
- Experience with ESWL and/or URS
- Patient's preference
- Cost
- ……









To Stent or not to Stent ?
URS

Difficult or complicated URS

- Narrow distal ureter with difficult access
- Long term impaction of stone treated
- Long term obstruction
- UTI
- Perforation of the ureter
- ……

Integrated management of RENAL stones

The basis of modern stone management remains
a judicious combination
of both
ESWL and endourology (PNL, URS, RIRS),
each individual treatment tailored to
the stone and the patient

Integrated management of Renal Stones

1. Stones in the CALYX
- Solitary: ESWL
- Multiple: ESWL
- Special conditions:
  - LOWER POLE CALYX
    - evacuation may be delayed
    - PNL to be considered: de novo or post-ESWL
  - NARROW CALYCEAL NECK:
    - evacuation may be delayed
    - PNL to be considered: de novo or post-ESWL
  - SOLITARY KIDNEY
    - double J
    - PNL ?

Integrated management of Renal Stones

2. Stones in the RENAL PELVIS
- Stone surface $\leq 500\ mm^2$: ESWL-monotherapy
  - multiple sessions may be necessary
  - cave Steinstraße!
- Stone surface $> 500\ mm^2$:
  - ESWL monotherapy:
    - multiple sessions
    - cave Steinstraβe!
  - PNL:
    - monotherapy
    - PNL + ESWL
- Special conditions:
  - Solitary kidney:
    - double J
    - PNL ?

Integrated management of Renal Stones

3. STAGHORNS
- PARTIAL
  Cfr. Stones in renal pelvis > 500 mm²
- COMPLETE: PNL (+ESWL)

Integrated management of RENAL stones

Stones in the LOWER POLE CALYX (LPC)

Results for ESWL of LPC-stones significantly are poorer than results for other calyceal or renal pelvis stones of similar size and composition :

Poorer clearance of fragments

Integrated management of RENAL stones

Stones in the LOWER POLE CALYX (LPC)

Factors in poorer clearance :

1. Gravity-dependent position of LPC
2. Anatomy of lower pole collecting system
   - angle between LPC infundibulum and renal pelvis
   - diameter of LPC infundibulum
   - spatial distribution of the calyx
   - infundibular length
3. Stone size

Integrated management of RENAL stones

Stones in the LOWER POLE CALYX (LPC)

Alternative treatment modalities

1. PNL
2. RIRS : Retrograde IntraRenal Surgery

Integrated management of RENAL stones

Stones in the LOWER POLE CALYX (LPC)

Alternative treatment modalities : PNL

1. Stone Size :
   -stones <10 mm : no significant difference between ESWL and PNL
   -stones >10mm : Lower Pole Study Group favors PNL

Integrated management of RENAL stones

Stones in the LOWER POLE CALYX (LPC)

Alternative treatment modalities : PNL

2. Cost-effectiveness :
   - stones < 20 mm : ESWL more cost effective
   - stones > 20 mm : PNL more cost effective

3. PNL : higher morbidity

Integrated management of RENAL stones

Stones in the LOWER POLE CALYX (LPC)

Alternative treatment modalities : RIRS

Limiting factors :

1. Stone burden
2. Anatomy of the lower pole calyceal group

Integrated management of RENAL stones

Stones in the LOWER POLE CALYX (LPC)

Suggested management :

-LPC-stone < 10 mm :	ESWL
-LPC-stone 10-20 mm :	ESWL/PNL/RIRS
-LPC-stone > 20 mm :	PNL

ESWL vs PNL in renal stones

Results of ESWL dependent of :

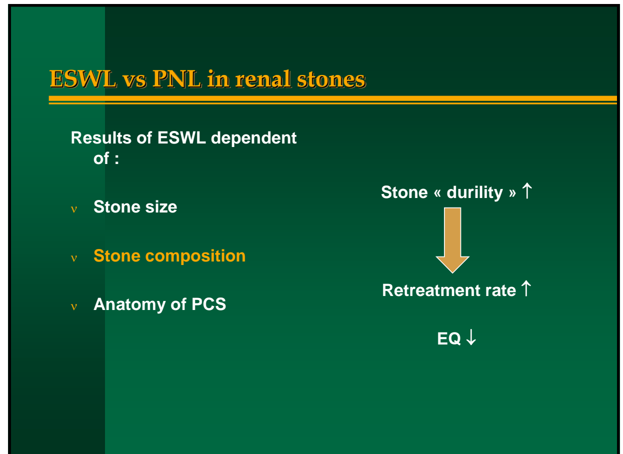
- Stone size
- Stone composition
- Anatomy of PCS

Stone size ↑

↓

Retreatment rate ↑

Stone Free Rate ↓



ESWL vs PNL in renal stones

Results of ESWL dependent of :

- Stone size
- Stone composition
- Anatomy of PCS

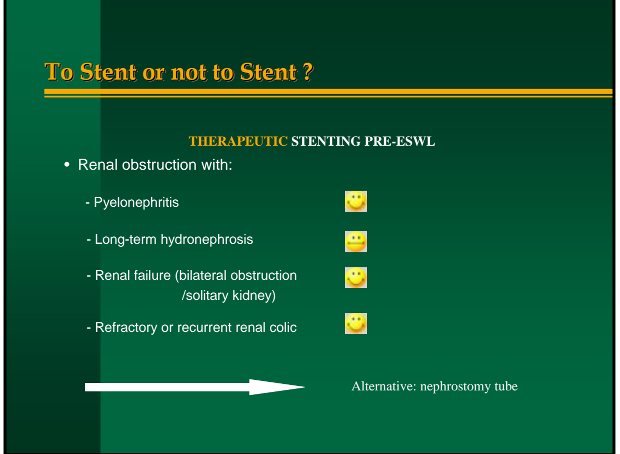
Anatomy of PCS
Influences
Stone clearance
And thus
Stone Free Rate

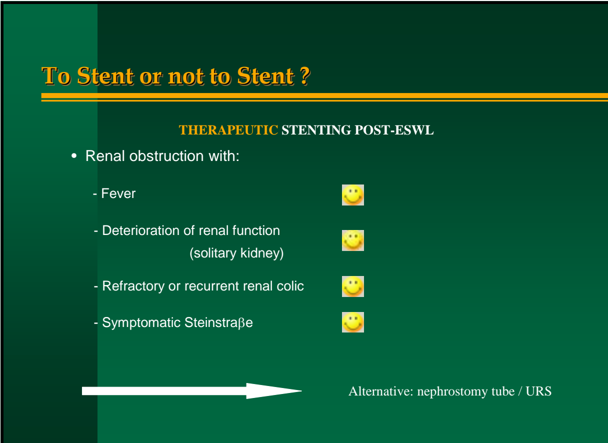
ESWL vs PNL in renal stones

PNL offers higher success rate in :

- Larger stones
- Harder stones
- Anatomical abnormalities

But :
Higher morbidity than ESWL





To Stent or not to Stent ?

PREVENTIVE STENTING

- **Stone burden ≥ 2 cm**
- Solitary kidney
- UTI prior to ESWL (struvite stone)
- Delayed ureteral outflow
- Delayed ESWL
- Facilitation of fragment passage
- Facilitation of targeting (ureteral stones)

- No difference between stented / non stented groups in:
  - Stone free rate
  - Auxiliary procedure rate
  - Retreatment rate
- Complication rate:
  - lower incidence of renal colic, Steinstraβe, fever, …
  - stent induced complications

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Prevention of Steinstraβe

- Incidence of Steinstraβe:
  - ~ stone size
  - significantly reduced by stenting in stone burden > 2.5 cm
- Outcome: No difference in
  - retreatment rate
  - auxiliary procedure rate
  - stone free rate

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Alternatives

- “phased” ESWL: in 1 session only fragment that portion that is likely to pass easily
- PNL for stones ≥ 2.5 cm (in combination with ESWL)

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No stent unless obstructed

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- **UTI prior to ESWL (struvite stone)**
- Delayed ureteral outflow
- Delayed ESWL
- Facilitation of fragment passage
- Facilitation of targeting (ureteral stones)

- Adequate treatment of UTI prior to ESWL
- No stent unless obstructed

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- Stone burden ≥ 2 cm
- Solitary kidney
- UTI prior to ESWL (struvite stone)
- Delayed ureteral outflow
- Delayed ESWL
- **Facilitation of fragment passage**
- Facilitation of targeting (ureteral stones)

- No improvement in passage of fragments
- Fragment passage may even be delayed
- No difference in
  - stone free rate
  - auxiliary procedure rate
  - retreatment rate

DISCUSSION

PREVENTIVE

- Stone burden ≥ 2 cm
- Solitary kidney
- UTI prior to ESWL (struvite stone)
- Delayed ureteral outflow
- Delayed ESWL
- Facilitation of fragment passage
- **Facilitation of targeting (ureteral stones)**

- Invasive
- No positive effect on outcome post-ESWL
- Alternatives: IV contrast / URS

To Stent or not to Stent ?

COMPLICATIONS OF STENTS

RARE

- Perforation
- Migration
- Stent occlusion
- Long term stenting:
  - Breakage
  - Encrustation
  - "Forgotten" stent

FREQUENT

- Patient discomfort: 50 - 80 %
- Invasive procedures for insertion / removal
- Cost of insertion / removal

To Stent or not to Stent ?

Therapeutic indications

Preventive indications

Complications of stents

Routine stenting

ESWL in modern stone management

- Complexity of SW-administration is generally underestimated, especially by new users
- HM3-users extensively trained prior to certification
- Newer machines are too often misjudged as "plug-and-play"
- Lack of background & training in SWL is often cause of poorer results with modern machines

ESWL in modern stone management

- ESWL remains the least invasive treatment modality for urinary calculi at all levels of the tract
- Given proper treatment strategies and experience results of ESWL are good with a very low complication rate

ESWL in modern stone management

Stone fragmentation is the result of four mechanisms :

1. Tensile and shear stress
2. Cavitation
3. Quasistatic squeezing
4. Dynamic fatigue

Acute complications post-ESWL

CAVITATION :

- one of the key mechanisms in stone fragmentation
- the single most important factor in the occurrence of acute post-ESWL complications

Acute complications post-ESWL

Cavitation → injury to small vessels and renal parenchyma

High energy SW → generalized renal vasoconstriction

injury to small vessels and renal parenchyma + generalized renal vasoconstriction → Formation of free radicals

Formation of free radicals → Injury to renal tissue

Cavitation / High energy SW → Injury to renal tissue

How to improve results and/or reduce complications?

- Reduce SW-rate (60-80 SW/min according to energy level) :
  Energy level ↗ = SW-rate ↘
- Use "Voltage stepping" : a gradual increase of the power output
- Start with a low voltage dose of ± 200 SW before starting voltage stepping
- A good analgesia regimen during ESWL improves outcome
- The quality of coupling of the SW-source to the patient is one of the most important factors in energy transfer
- A low dose of α_1-blockers can enhance the clearance of fragments post-ESWL

How to improve results and/or reduce complications?

- Lithotriptor manufacturers are also directing extensive research towards improvements in focal geometry and energy to improve stone disintegration and reduce collateral damage to the surrounding tissue

Special conditions

1. UTI or INFECTED STONES
2. RADIOLUCENT STONES
3. PREGNANCY
4. OPEN SURGERY

Special conditions

1. UTI or INFECTED STONES

- Antibiotics
- Avoid obstruction :

  - PREVENTIVE drainage
  - TIMELY relief of obstruction

Special conditions

2. RADIOLUCENT stones (Uric acid/Cystine)

A. Ureter :

- ESWL :
  - IV contrast
  - stent
  - oral chemolysis
- URS :
  - stent
  - oral chemolysis

Special conditions

2. RADIOLUCENT stones (Uric acid/Cystine)

B. Kidney :

- ESWL :
  - stent
  - oral chemolysis
- PNL

Special conditions

3. PREGNANCY

Management of ureteral calculi in pregnancy

is

CONSERVATIVE

- Rest
- Relative fluid restriction
- Analgetics

ACTIVE treatment : indications

- colic refractory to conservative treatment
- solitary kidney
- (threat of) urosepsis
- (threat of) premature labor that does not respond to tocolytic treatment

ACTIVE treatment

- ESWL contraindicated:
  potential disruptive effects of SW on the fetus
- PNL contraindicated:
  ·positioning of the patient
  ·possibly prolonged anaesthesia
  ·fluoroscopy

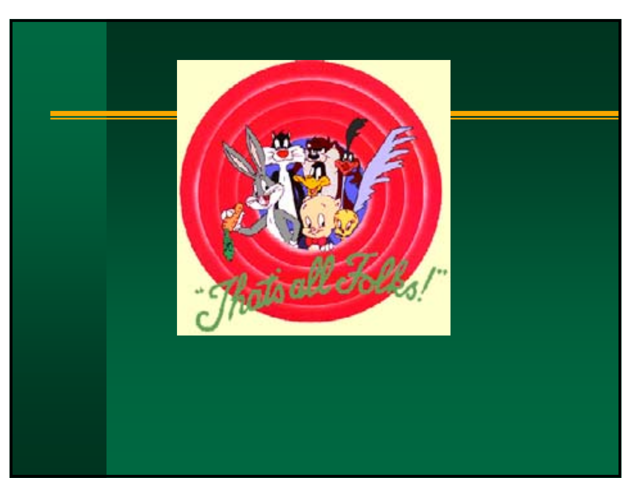
ACTIVE treatment

1. Temporary diversion
   - Percutaneous nephrostomy
   - Double-J-catheter
2. URS reserved for:
   - centers with all the best equipment
   - the most experienced of endourologists

Special conditions

4. OPEN SURGERY

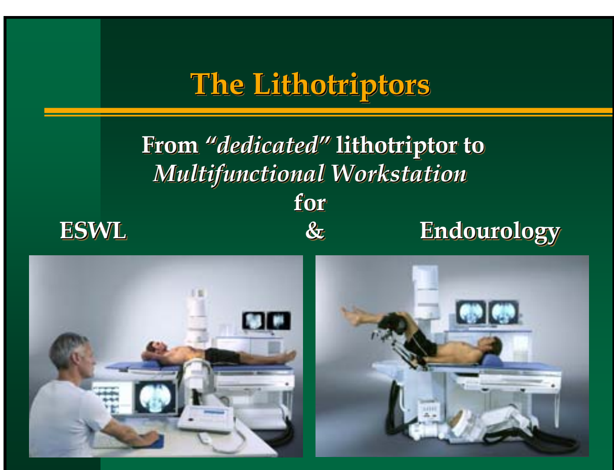
- Indications extremely rare (< 5%)
- To be replaced by laparoscopic surgery where indicated



That's All Folks

"That's all Folks!"

The Lithotriptors
From *"dedicated"* lithotriptor to
Multifunctional Workstation
for
ESWL
&
Endourology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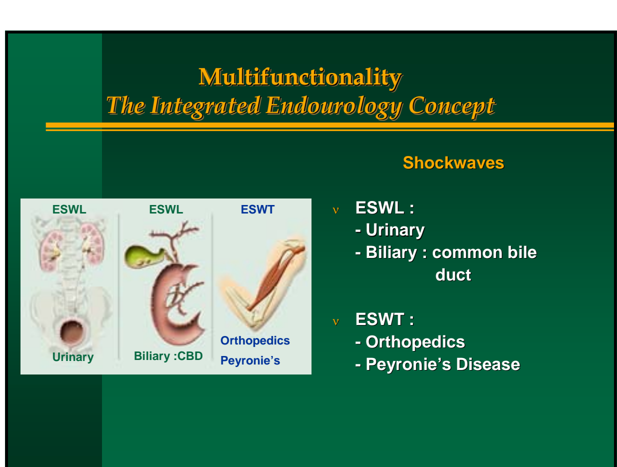
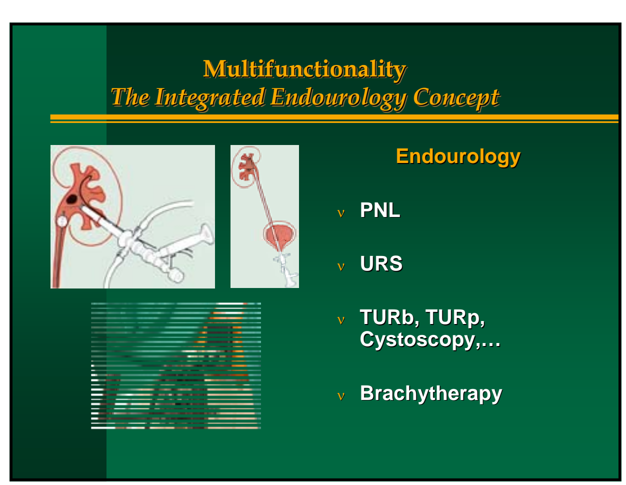
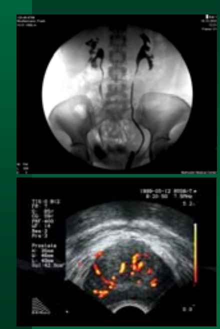

Multifunctionality
The Integrated Endourology Concept
Shockwaves
ESWL
ESWL
ESWT
Urinary
Biliary :CBD
Orthopedics
Peyronie's
ESWL :
- Urinary
- Biliary : common bile duct
ESWT :
- Orthopedics
- Peyronie's Disease


Multifunctionality
The Integrated Endourology Concept
Endourology
PNL
URS
TURb, TURp, Cystoscopy,…
Brachytherapy

Multifunctionality
The Integrated Endourology Concept



Diagnostics

- Fluoroscopy
- Ultrasound

The Integrated Endourology Concept at AZ Klina

1. Functions 5 days/week : 08.00-18.00
2. Workload per year : ± 3000 patients
   - ± 600 ESWL
   - ± 2400 EndoUrology
3. Policy in Stone Management :
   any acute stone problem should be adequately solved within 24 hrs of admission, preferably
   on an outpatient basis

Historic perspective

- HM3 (1983) :
  the myth of spark gap supremacy
- New EMSE 220F-XXP outperforms the HM3 or any other spark gap source

Historic perspective

- HM3 (1983) :
  a "dedicated" lithotripsy device

- Multifunctionality of great value :
  Integrated Endourology Concept