Minimally-Invasive PCNL in contemporary management of Nephrolithiasis

Dr Madhu S Agrawal
Prof & Head, Dept of Urology
Global Rainbow Healthcare
Agra, India

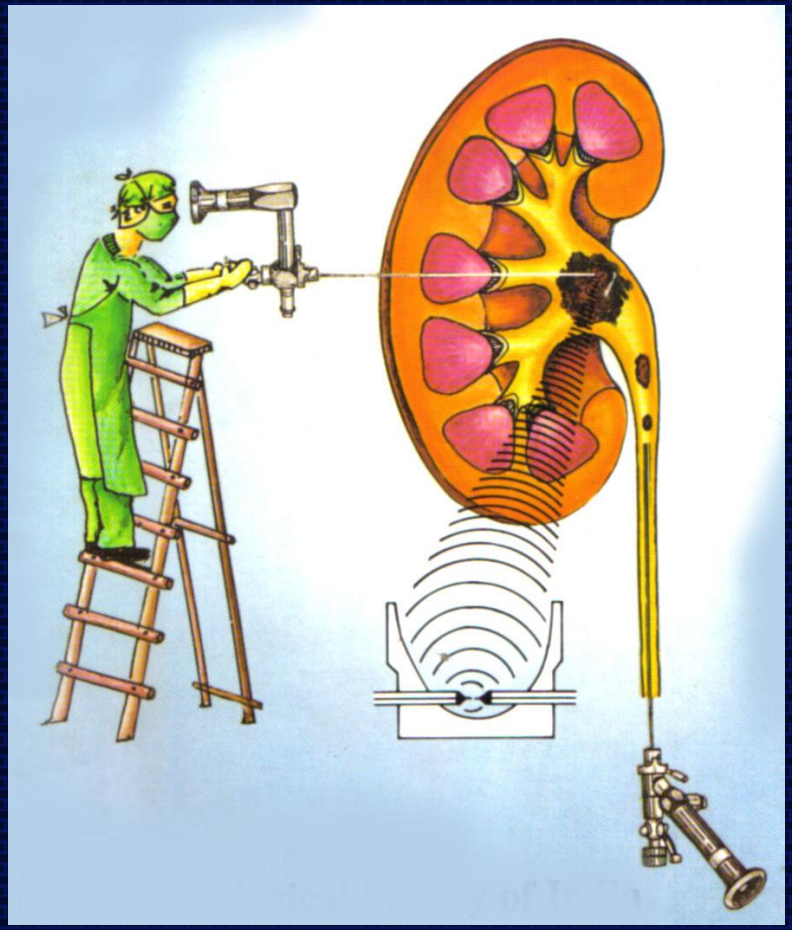
Management of small and medium volume Nephrolithiasis

- **ESWL**

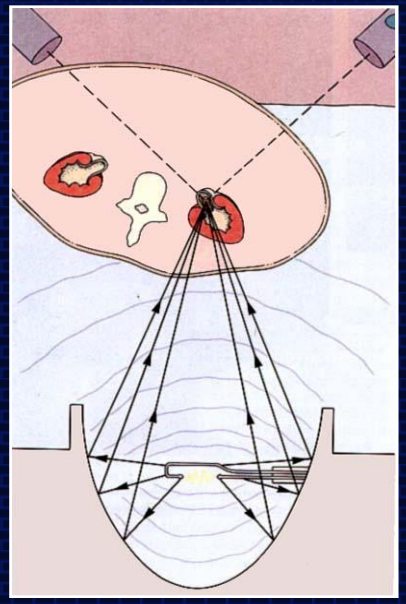
  (Extra-corporeal shock wave lithotripsy)
- **PCNL**

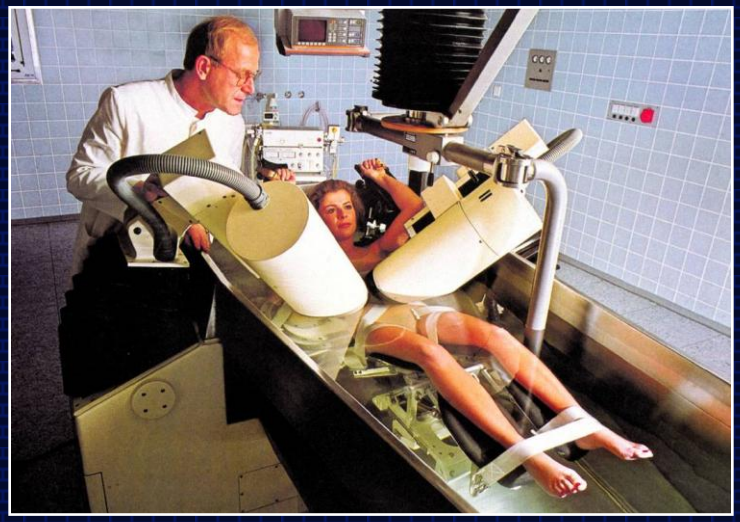
  (Perc Nephro lithotripsy)
- **RIRS**

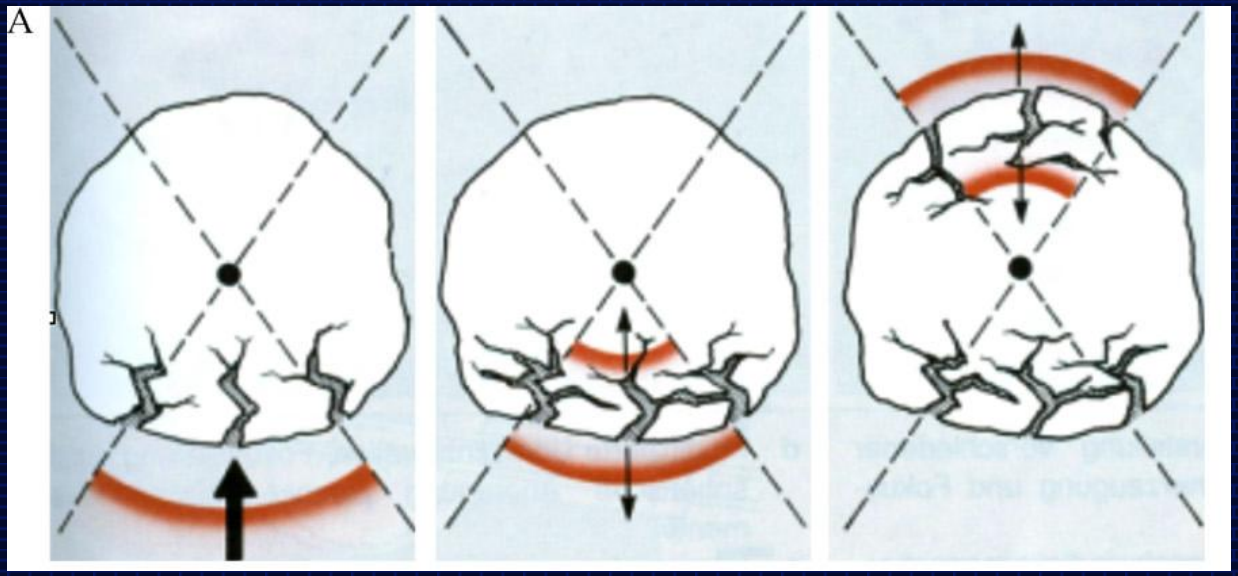
  (Retrograde intra-renal Surgery)



Extra-Corporeal Shock wave Lithotripsy (ESWL)



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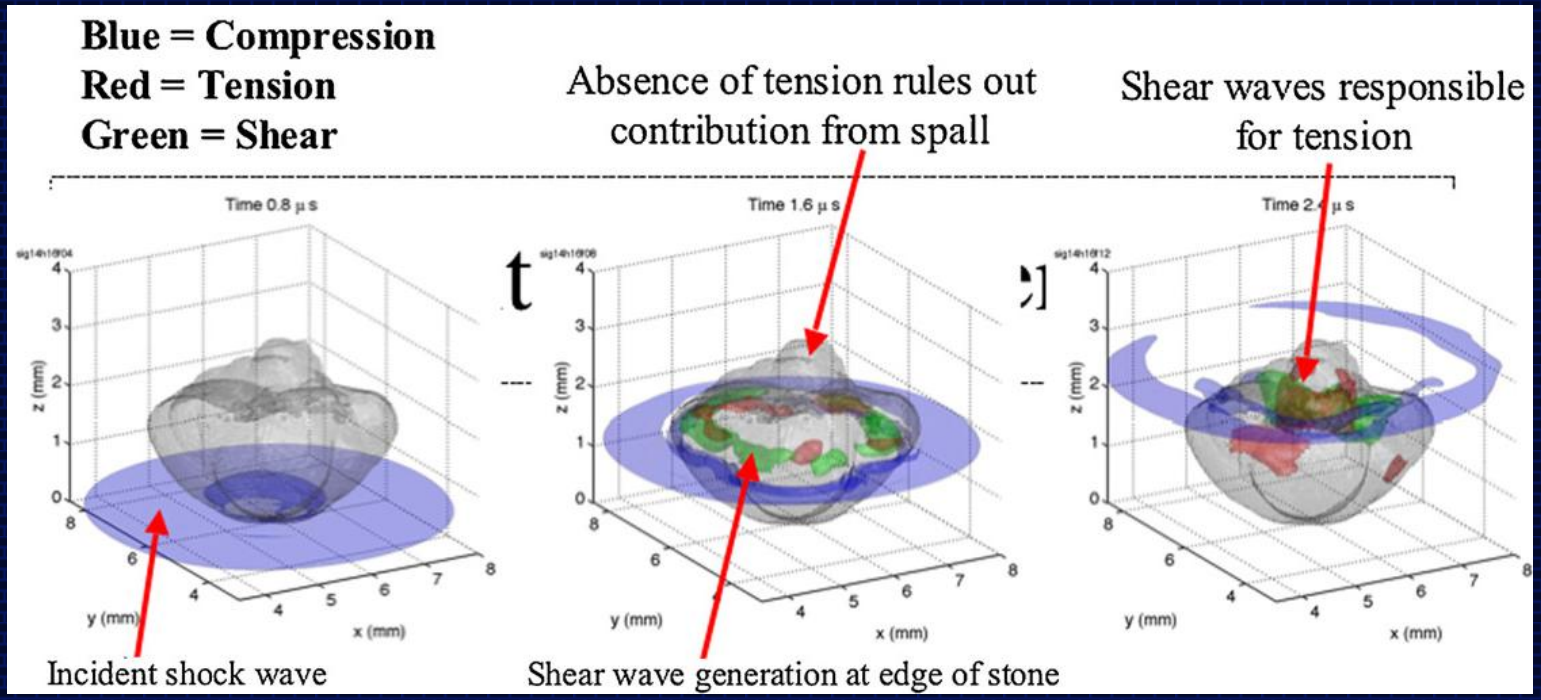
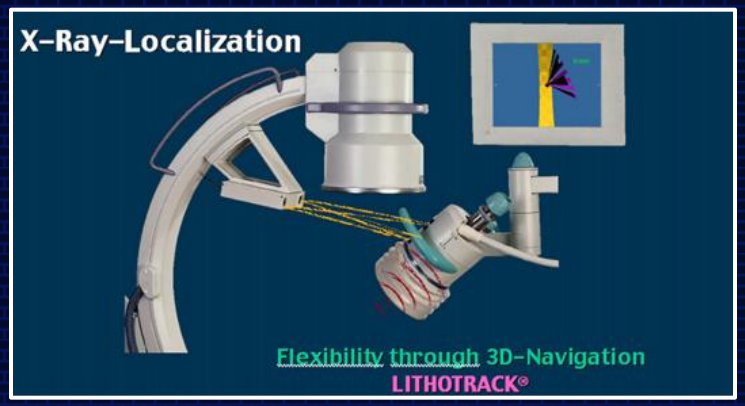
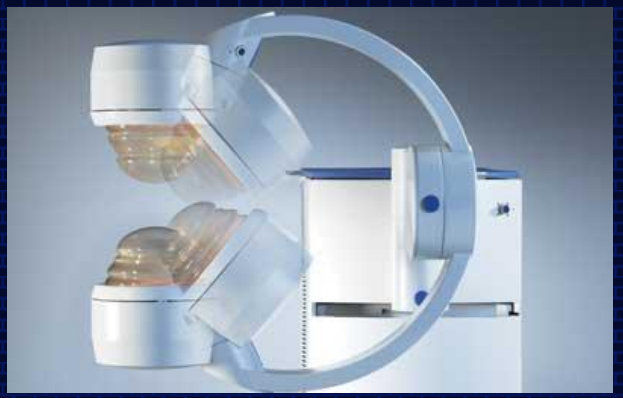

Blue = Compression
Red = Tension
Green = Shear
Absence of tension rules out contribution from spall
Shear waves responsible for tension
Time 0.8 μs
Time 1.6 μs
Time 2.4 μs
z (mm)
y (mm)
x (mm)
Incident shock wave
Shear wave generation at edge of stone

ESWL : New concepts

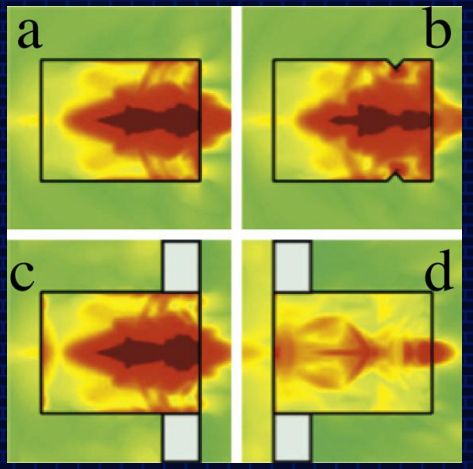


Optical tracking



Dual flexible shock-heads

Acoustic tracking



Alterations in ‘stress-fields’

ESWL: Optimizing parameters

Stone characteristics:

- Stone size : 1-1.5 cm calculi
- SSD: Skin-to-stone distance : < 9 cm
- Stone density : < 900 Hounsfield units

New treatment concepts:

- Acoustic coupling
- Shock wave frequency : ≤ 60 per minute
- Power ramping
- Larger focal zone : 18-20 mm

Success Factors of Extracorporeal Shock Wave Lithotripsy (ESWL) for Renal & Ureteric Calculi in Adult

Download as PDF (Size:521KB) HTML PP. 26-32

DOI: 10.4236/oju.2014.43005 510 Downloads 1,809 Views

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Ammar Fadil Abid

Affiliation(s)

Medical College, Al-Mustansirya University, Al-Yarmouk Teaching Hospital, Baghdad, Iraq.

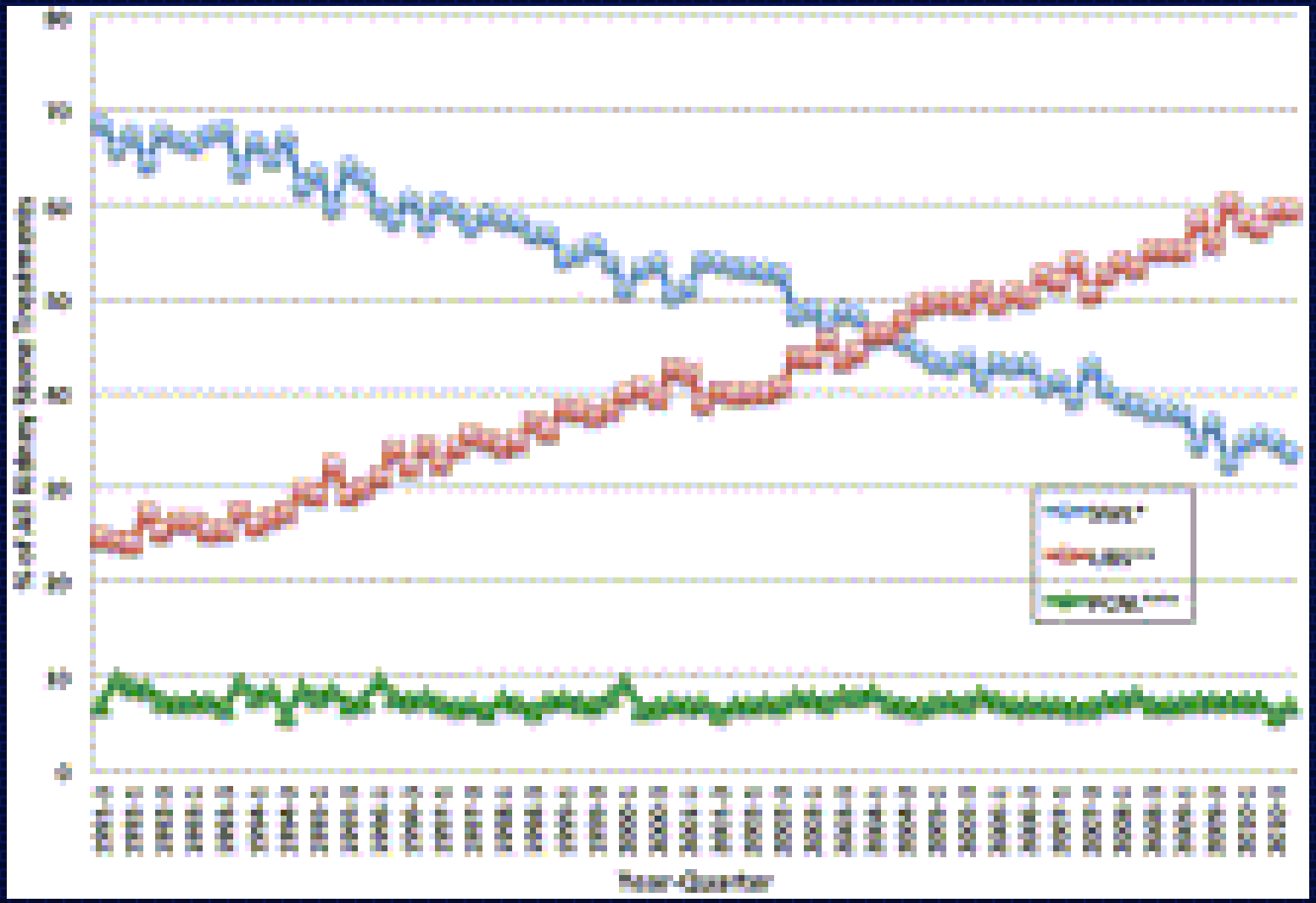
ABSTRACT

The purpose of this study was to define factors that have a significant impact on the stone-free rate after ESWL. Methods: A total of 417 patients harboring renal or ureteral stones underwent extracorporeal shock wave lithotripsy (ESWL) between October 2008 and July 2012. Eighty five patients were lost on follow up. The remaining (n = 332). All patients were >18 yr of age. Siemens and SLX-F2 electromagnetic machines were used

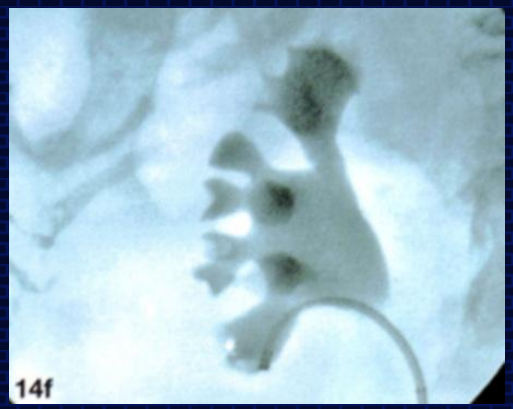
10 - 20 mm, and >20 mm). Result: The overall success rate was 251/332 (75.6%) Repeated ESWL sessions were needed in 258 (61.9%). Of eleven variables were

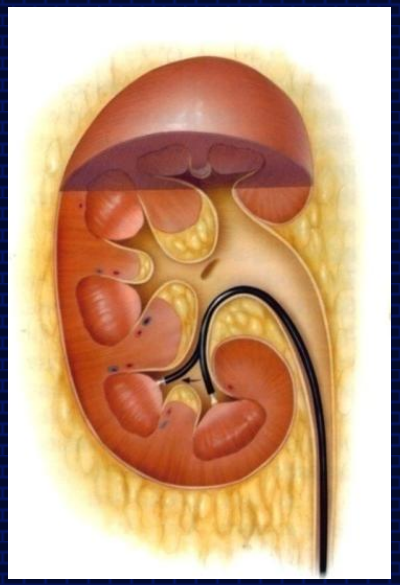
number of shock waves, opacity of stone, renal system state, and type of lithotripter, three variables were significantly affect the success rate namely stone size, number of shock waves and location of stone. Conclusions: ESWL remains one of the most commonly utilized treatments for patients with upper urinary tract calculi; Stone diameter, location, and number of shock waves, are the most important predictors determining stone clearance after ESWL of renal and ureteric calculi. To optimize treatment outcomes with ESWL the presence of treating urologist is essential to optimize the final result.

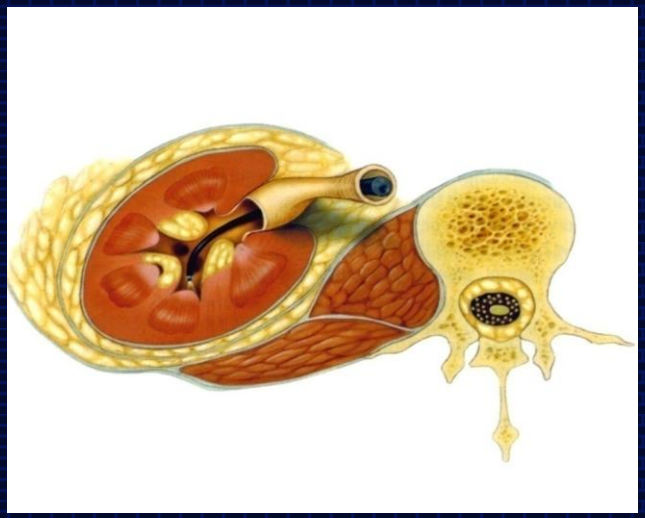
Decline of ESWL



Flexible Ureteroscopy





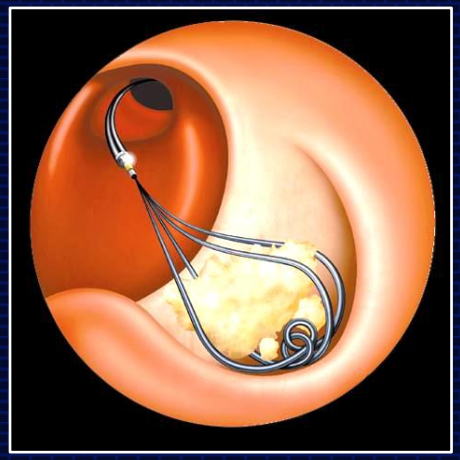


RIRS :

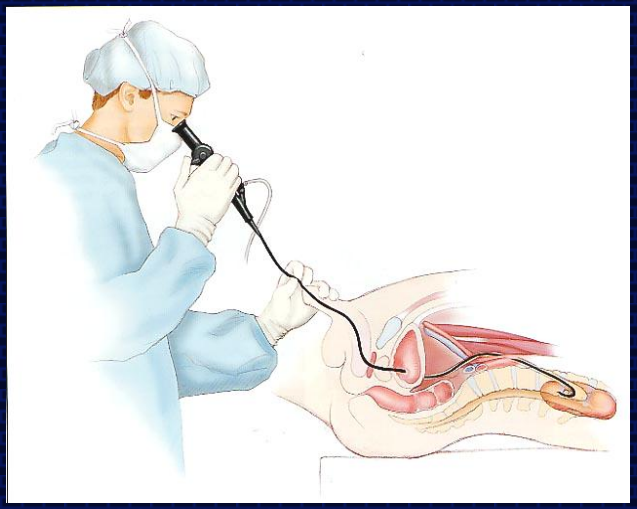
Costs ?

A. Armamentarium :
   Flexible ureteroscope
   (lasts for limited no. of cases only)

B. Disposables :
   Ureteral access sheath,
   Baskets, Balloons, Bi wire and other guide wires



RIRS: Limitations



- High Costs
- Prolonged operating time
- High intra-renal pressure during procedure
- Need for pre-stenting in a percentage of patients
- Need for post-operative stent and secondary procedure
- Long overall treatment (‘freedom-from-stone’) time

J Endourol. 2014 Sep 9. [Epub ahead of print]

A prospective randomized comparison between shock wave lithotripsy and flexible ureterorenoscopy for lower calyceal stones ≤ 2 cm

Kumar A[1], Vasudeva P, Nanda B, Kumar N, das MK, Jha SK.

Materials and Methods:

195 patients with single lower calyceal calculi ≤ 2 cm

Group A: SWL using electromagnetic lithotripter (Dornier compact delta)

Group B: RIRS was performed using 6/7.5 F flexible ureteroscope

Results:

Mean stone size was 12.1 mm in group A vs. 12.3 mm in group B (p= 0.52).

Overall 3 month stone free rate: 82.2% for group A vs. 86.6% for group B

for stones <10 mm: 84.9% for group A vs. 87.7% for group B

For stones 10-20 mm: 78.4% for group A vs. 85.4% for group B

Conclusions:

Both SWL and RIRS are safe and efficacious for lower calyceal calculi ≤ 20mm. For stones < 10 mm, SWL was less invasive and safer than RIRS. For 10-20 mm stones, RIRS was more effective, with lesser retreatment rate.

THE JOURNAL of UROLOGY®

Is Ureteroscopy as Good as We Think?

Margaret S. Pearle
Department of Urology, University of Texas Southwestern Medical Center, Dallas, Texas

However, closer scrutiny of URS using computerized tomography (CT) to ascertain stone clearance has yielded disappointing results. Macejko et al reviewed 113 ureteroscopic stone procedures for which patients were imaged by CT within 3 months of the procedure and found a stone-free rate of only 50%.[3] Likewise, Rippel et al detected residual fragments in 38% of 232 patients undergoing URS and imaged with CT within 30 to 90 days after the procedure.[4] Finally, Portis et al prospectively evaluated 45 patients with 5 to 15 mm renal calculi treated ureteroscopically.[5] In all cases nonupper pole stones were displaced to the upper pole before treatment, ureteral access sheaths were used and all fragments were actively manually retrieved. Yet despite this concerted effort to clear all stones, the stone-free rate was only 54% by CT criteria.[5]

THE JOURNAL of UROLOGY®
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Is Ureteroscopy as Good as We Think?

Margaret S. Pearle
Department of Urology, University of Texas Southwestern Medical Center, Dallas, Texas

These data suggest that URS may not be quite as effective as we like to believe in terms of rendering patients free of stones. Furthermore, despite its widespread and increasing use and the perception that it is a well tolerated, low risk procedure, several recent reports indicate a higher than expected unplanned ED visit or hospital admission rate after URS. Scales et al used the MarketScan® data set from 2003 to 2011 and found a 15% rate of unplanned ED visits or hospital admissions within 30 days of the procedure,[9] and Tan et al reported a 3.9% rate of immediate unplanned admission in their series of 1,798 consecutive outpatient URS procedures.[10]

World J Urol. 2016 Oct 13. [Epub ahead of print]
Uncovering the real outcomes of active renal stone treatment by utilizing non-contrast computer tomography: a systematic review.
Tokas T, Habicher M, Junker D, Herrmann T, Jessen JP, Knoll T, Nagele U; (T.R.U.S.T.)-Group.

RESULTS:

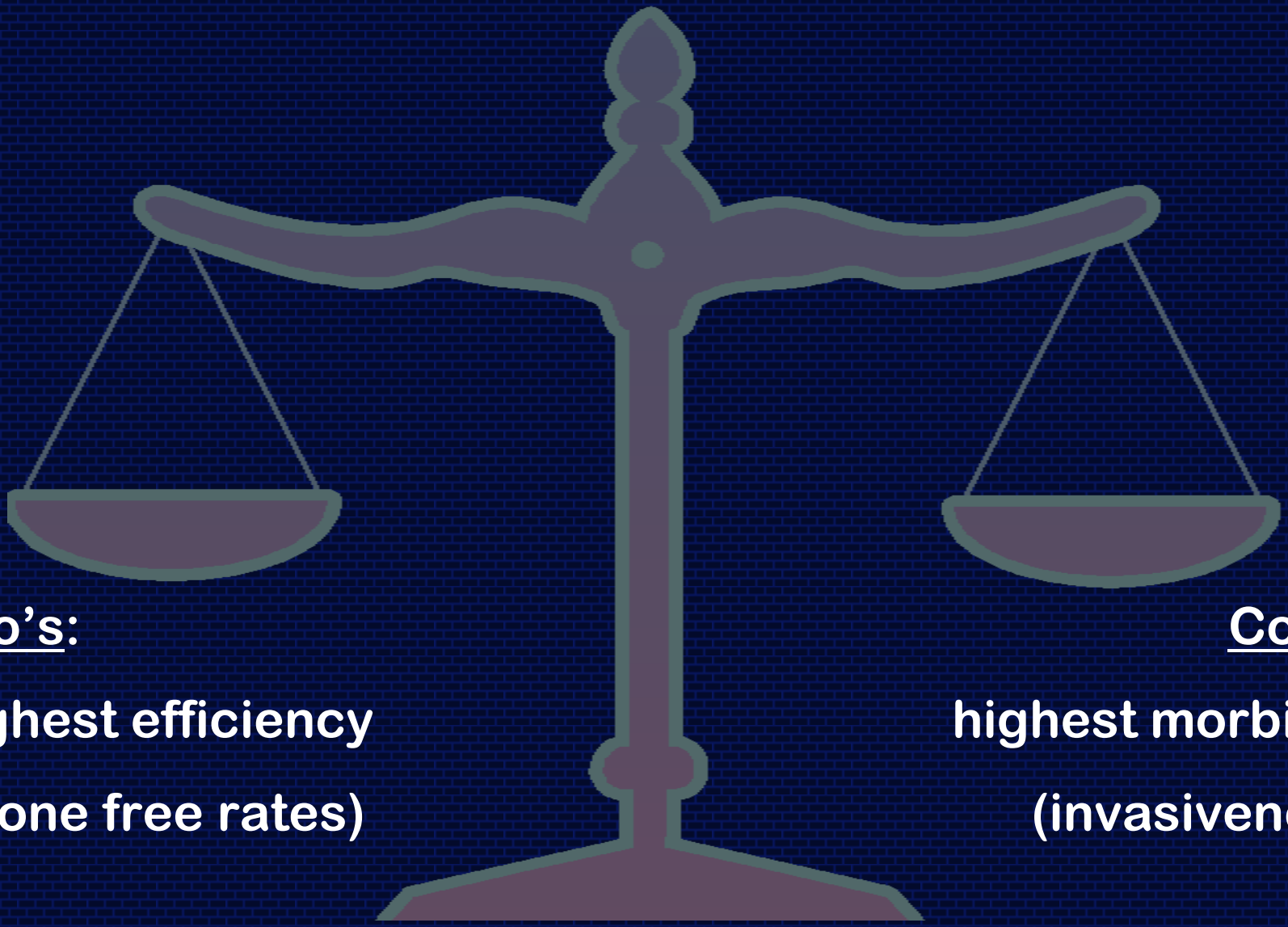
- Twenty-three studies with 2494 cases were included in the review.
- According to the comparative studies, SFRs are 17-61.3 % for SWL, 50 % for RIRS, and 95-100 % for PCNL.

CONCLUSIONS:

- According to NCCT findings, it seems that PCNL provides better SFRs than ESWL and RIRS.

May be it is time to subject flexible ureteroscopy to the same level of scrutiny as we did to SWL in the previous decade

PCNL in small volume nephrolithiasis



Pro's:

highest efficiency

(stone free rates)

Con's:

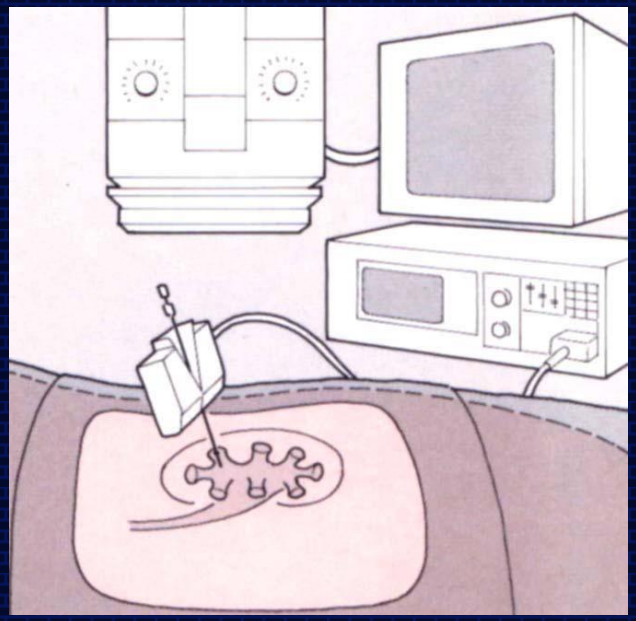
highest morbidity

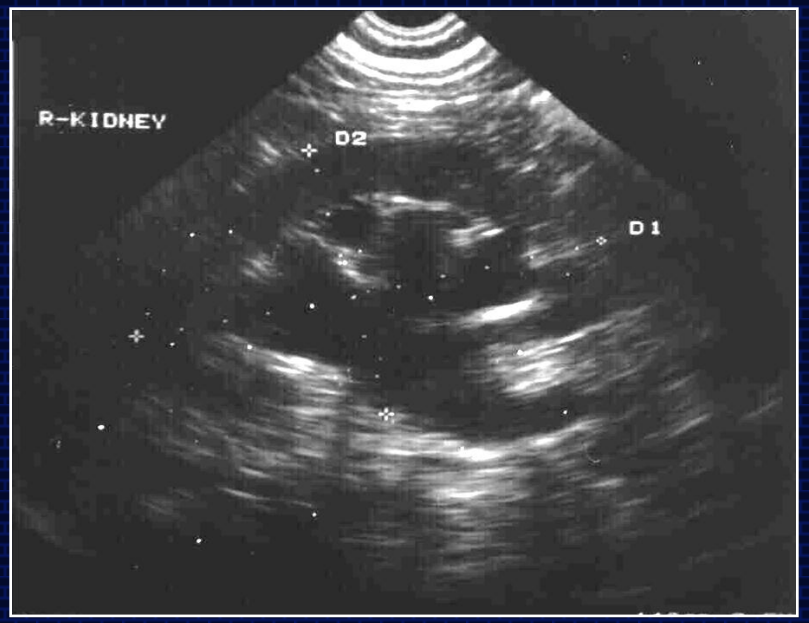
(invasiveness)

Minimizing morbidity of PCNL:

- Ultrasound-Guided Puncture
- Laser in PCNL
- ‘Mini’- PCNL (MIP)
- Flexible Nephroscope

Ultrasound-guided Puncture

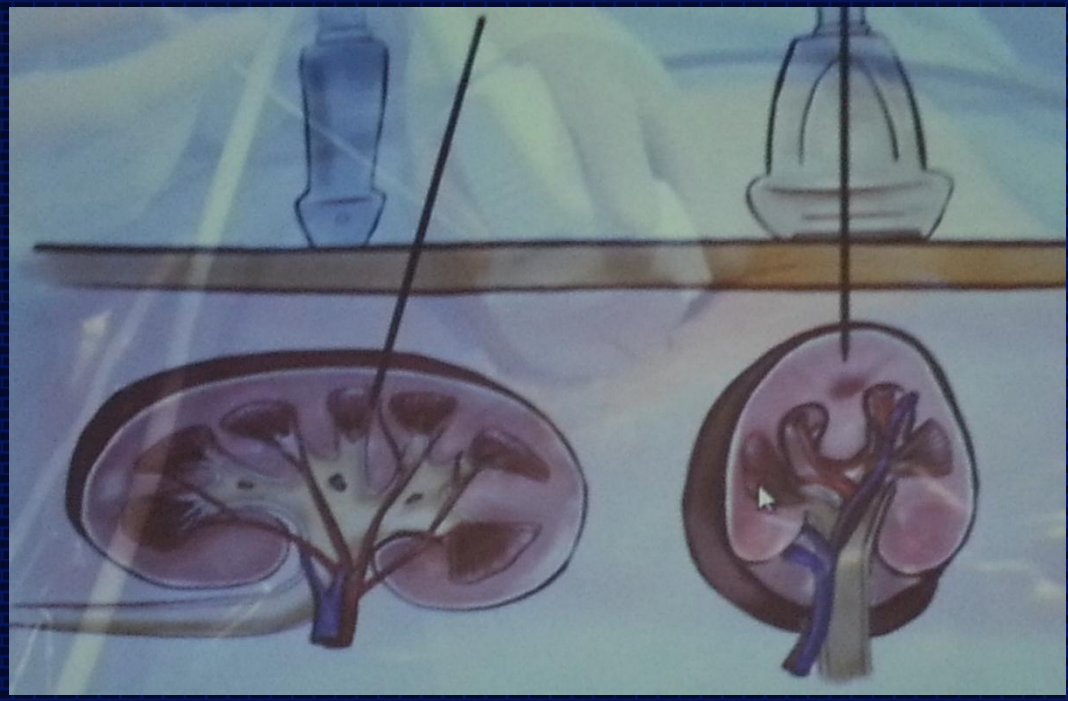




Advantages

- Better assessment of plane & depth of puncture
- Provides the 'third dimension' for puncture
- Easy identification of targeted calix (Ant. vs Post.)
- Reduced radiation exposure to patient & surgeon

Ultrasound-guided Puncture



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Safety and efficacy of ultrasonography as an adjunct to fluoroscopy for renal access in percutaneous nephrolithotomy (PCNL)

Mayank Agarwal, Madhu S. Agrawal, Abhinav Jaiswal, Deepak Kumar, Himanshu Yadav and Prashant Lavania

Department of Surgery, SN Medical College, Agra, India

Accepted for publication 8 October 2010

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Study Type – Therapy (case series)
Level of Evidence 4

OBJECTIVE

- To evaluate the safety and efficacy of ultrasonography (US)-guided renal access in percutaneous nephrolithotomy (PCNL), as compared with conventional fluoroscopy-guided renal access in a prospective randomized trial.

PATIENTS AND METHODS

- From January 2008 to October 2009, 224 patients with renal calculi undergoing PCNL were randomized into two groups.
- Group 1 (112 patients) underwent PCNL using only fluoroscopy-guided renal access; while in group 2 (112 patients), US guidance for puncture was used in addition to fluoroscopy.
- The inclusion criteria were: normal renal functions, American Society of Anesthesiology scores 1 or 2, absence of congenital abnormalities, aged 15–70 years, and anticipated single-tract procedure. The patients in both groups were matched for age, sex, and stone characteristics.
- The Student *t*-test was used for statistical analysis with an allowable error of 5%.

RESULTS

- The mean time to successful puncture was 3.2 min and 1.8 min in group 1 and group 2, respectively ($P < 0.01$).
- The mean duration of radiation exposure to successful puncture was 28.6 s in group 1 and 14.4 s in group 2 ($P < 0.01$).
- The mean numbers of attempts for successful puncture in the desired calyx was 3.3 in group 1 as compared with 1.5 in group 2 ($P < 0.01$).
- The meantime taken for tract formation in group 1 was 7.4 min with radiation exposure of 82 s, while in group 2 it took 4.8 min with radiation exposure of 58 s ($P < 0.01$).
- Successful access was achieved in all patients. All patients were stone-free at the end of the operation. The hospital stay (2–3 days) was same in both groups. There was no incidence of significant bleeding requiring transfusion during or after surgery. All the patients were followed-up for a ≥6 months.

CONCLUSION

- US-guided puncture in PCNL helps in increasing accuracy of puncture and decreasing radiation exposure for the surgical team and the patients.

KEYWORDS

percutaneous nephrolithotomy (PCNL), kidney stone, ultrasonography, flouroscopy

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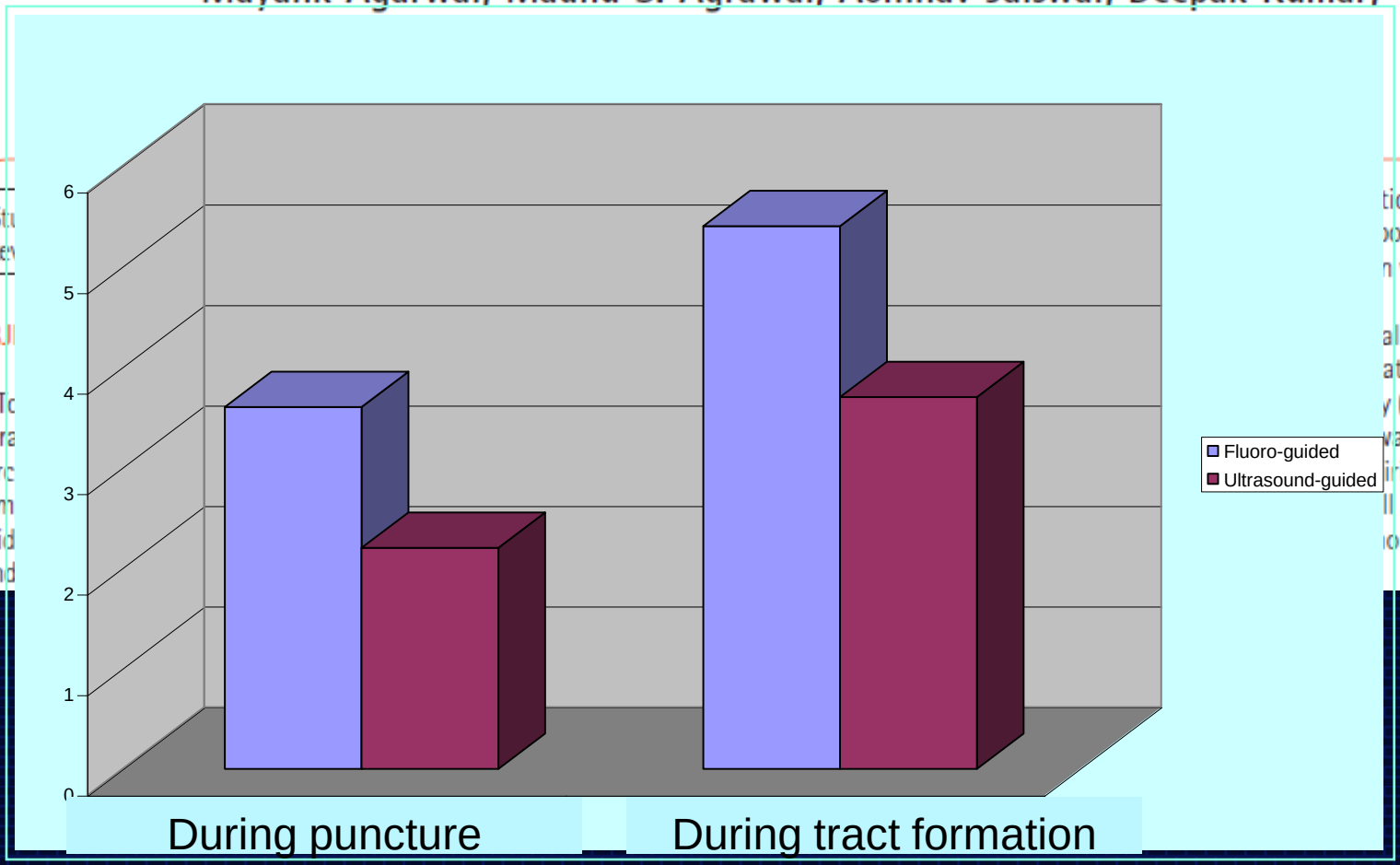

Operating Time (minutes)

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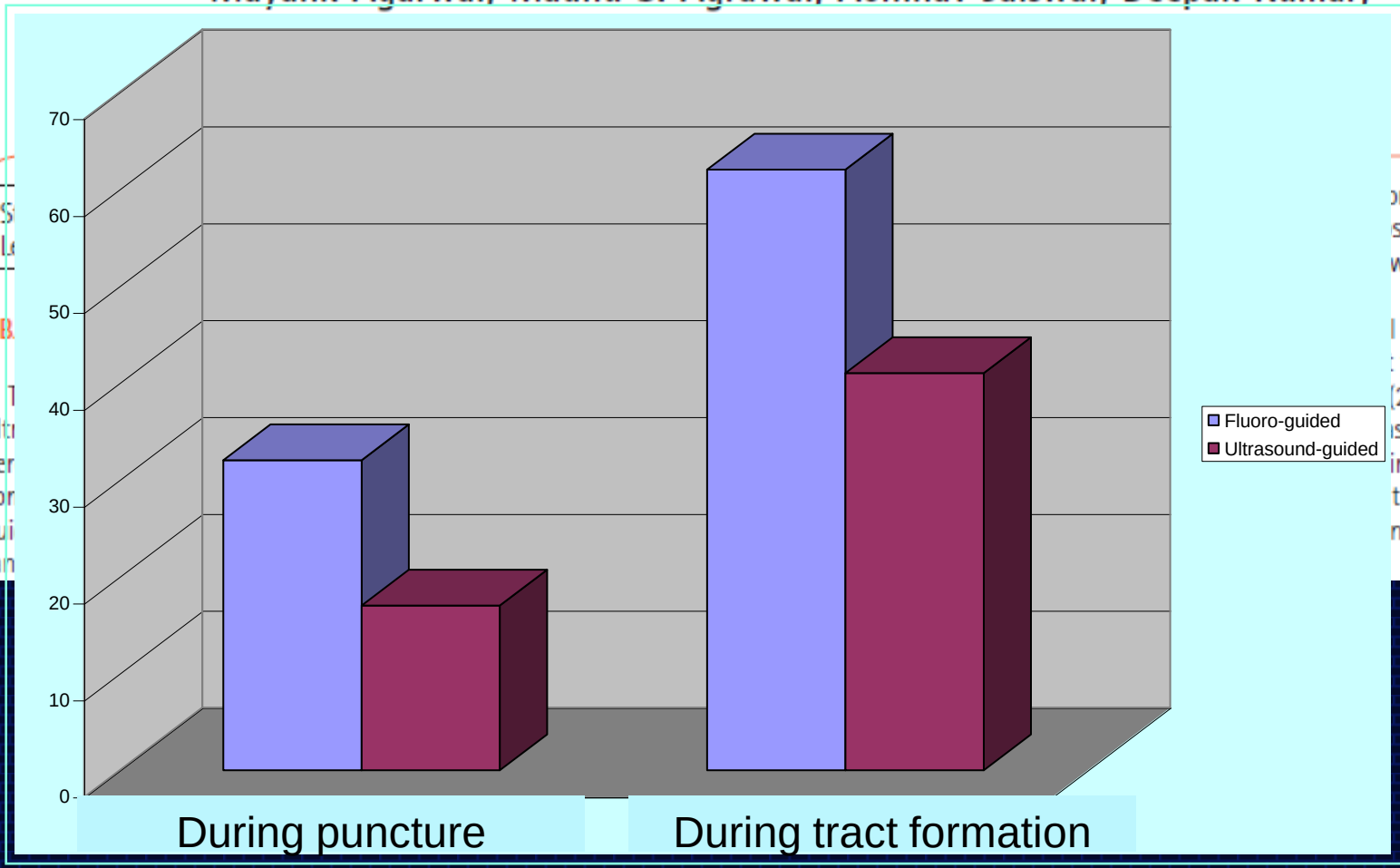


Radiation Exposure (seconds)

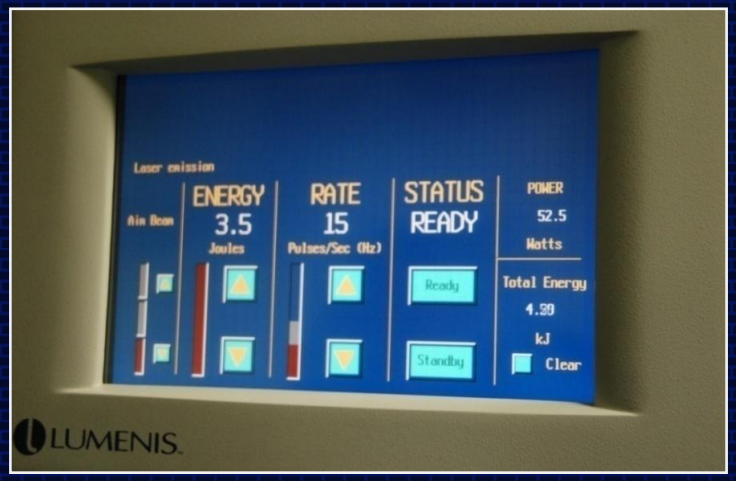
Lithotripsy with Holmium Laser

Why LASER in PCNL?

- No displacement, migration of stone
- Does not ‘push’ the stone against tissue
- Works well on hard and soft stones
- Can use for infundibulotomy, endopyelotomy
- Hemostasis of the tract with ‘tubeless’ PCNL
- Use with flexible instruments
- Use with mini- and micro- instruments

PCNL with LASER

Low-power



High-power

<u>Combinations</u> :

- Low joules + high frequency : dusting effect
- High joules + low frequency : blasting effect

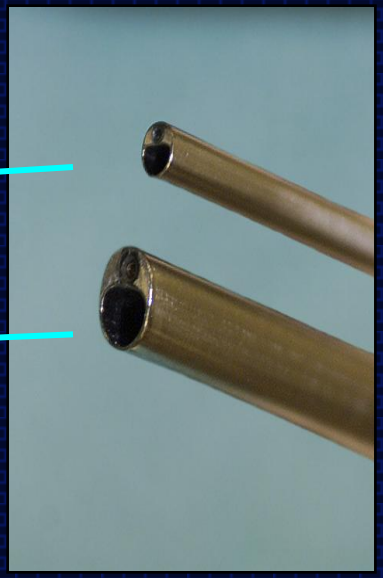
PCNL

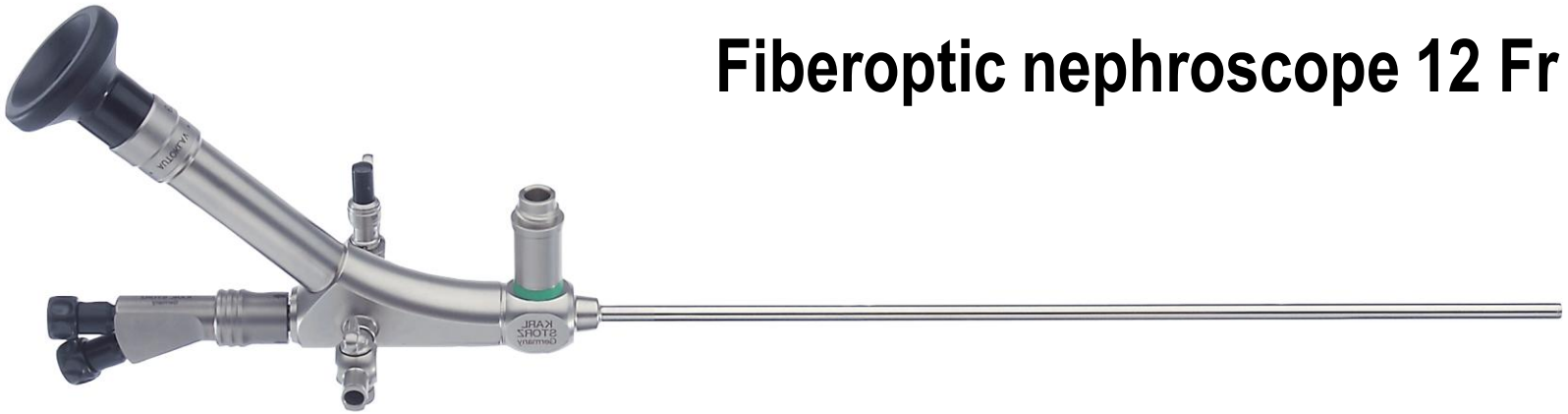
Complications: can we reduce them?

- Bleeding
- Infundibular and calyceal tear
- Persistent urine leak
- Nephron loss
- 0.6 to 1.4% require angio- embolisation for intractable bleeding.

- The larger the track size the higher the greater the risk of parenchymal damage and bleeding

Mini-PCNL





Fiberoptic nephroscope 12 Fr

Ultra-mini PCNL (LUT)

Telescope diameter : 1 mm (3 F)

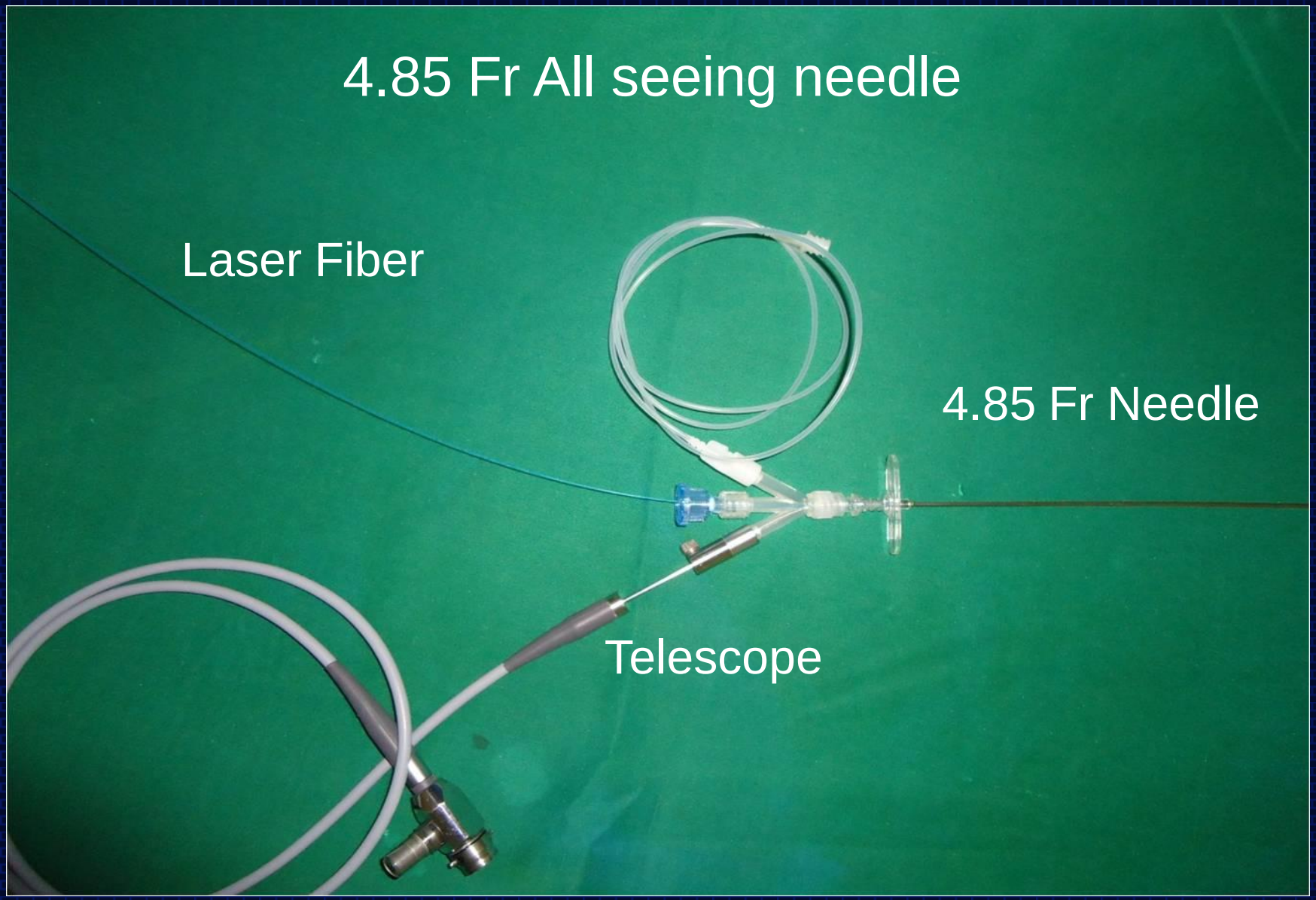
Standard
Amplatz 30F

Mini Perc
Sheath 15F

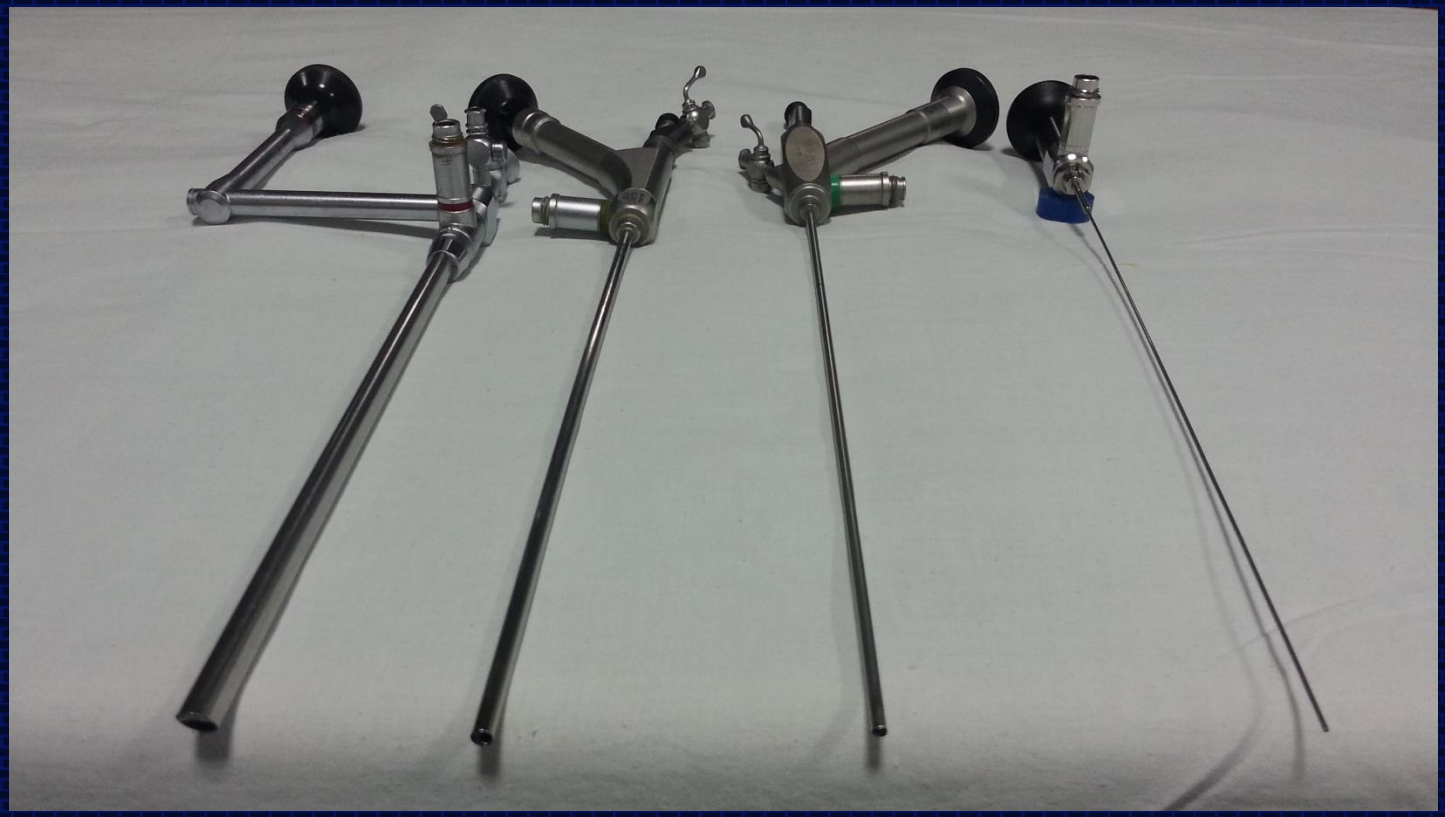
MIP XS Sheath
8.5 F

MIP Equipment

Micro-PCNL


4.85 Fr All seeing needle
Laser Fiber
4.85 Fr Needle
Telescope

Minimally Invasive PCNL (MIP)



How small is small enough?

Minimally Invasive PCNL (MIP)

Minimally Invasive PCNL (MIP)

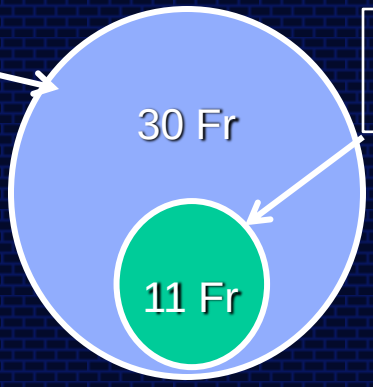
Definitions

- Standard PCNL 24 F – 30 F
- Mini PCNL 15 F – 18 F
- Ultra-Mini PCNL 11 F – 13 F
- Micro PCNL 4.8 F - 8 F

Minimally Invasive PCNL (MIP)

Standard
Amplatz sheath

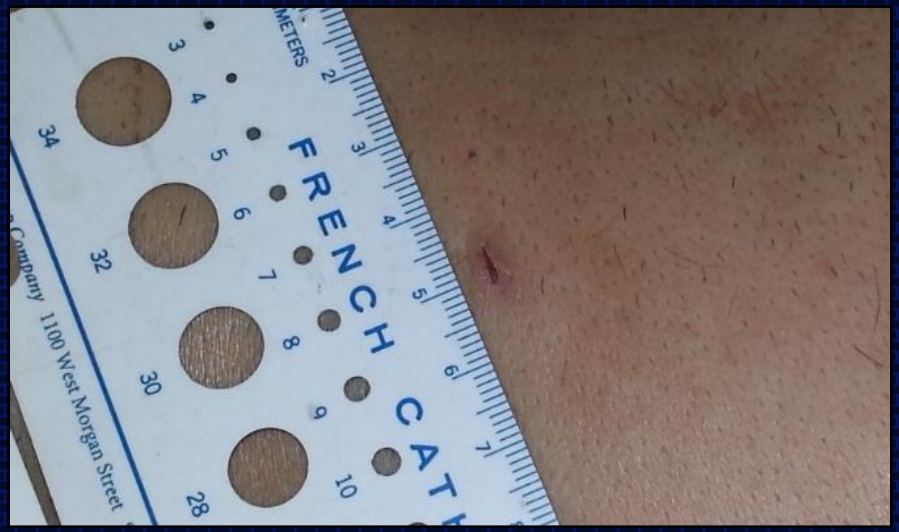
Ultra-Mini
PCNL sheath



Minimally Invasive PCNL (MIP)

Mini-PCNL

Ultra-mini PCNL



Best Paper Award

The Scientific Committee of WCE 2014
extends its recognition to

Madhu S Agrawal, Ketan Agarwal, Manoj Sharma, Anurag Gupta

for the work

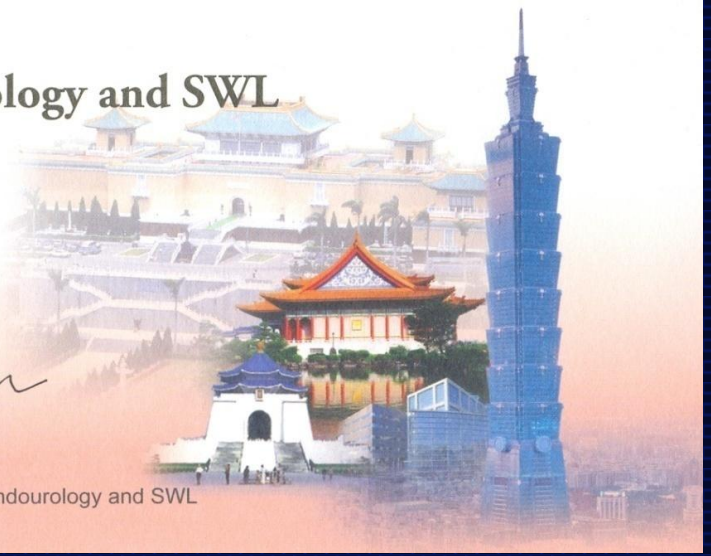
ULTRA MINI PCNL: A MINIMALLY INVASIVE PERCUANEOUS APPROACH

presented at

The 32nd World Congress of Endourology and SWL (WCE 2014)

Taipei, Taiwan

September 3-7, 2014



Allen W. Chiu

Allen W. Chiu, M.D., Ph.D.
Congress President
The 32nd World Congress of Endourology and SWL

Saint S. Chen

Saint S. Chen, M.D., Ph.D.
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PMCID: PMC4831502

Ultra-mini-percutaneous nephrolithotomy: A minimally-invasive option for percutaneous stone removal

Madhu Sudan Agrawal, Ketan Agarwal,[1] Tarun Jindal, and Manoj Sharma

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Abstract

Go to:

Introduction:

Percutaneous nephrolithotomy (PCNL) has witnessed rapid advancements, the latest being ultra-mini-percutaneous nephrolithotomy (UMP), which makes the use of 11–13F sheaths as compared to 24–30F sizes used in conventional PCNL. This miniaturization aims to reduce morbidity and improve patient outcomes. We evaluated the safety and efficacy of UMP and report our ourtcomes.

MP24-04:

Minimally-invasive PCNL versus RIRS for treatment of medium sized (10-20 mm) renal calculi- A prospective study.

Madhu S Agrawal, Dilip K Mishra; Agra, India

Methods:

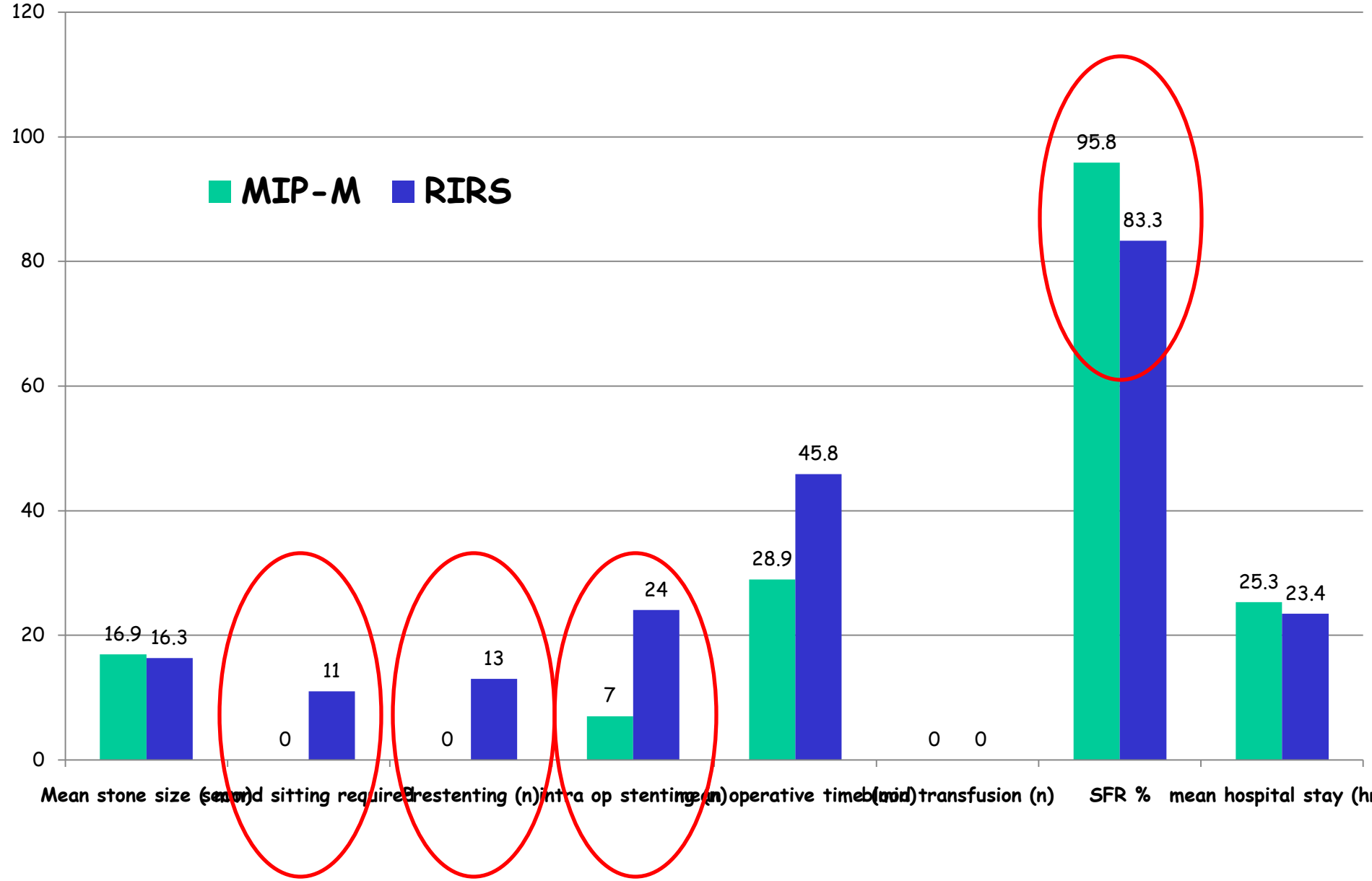
- Prospective randomized study (April 2015 – March 2016)
- 48 patients with renal calculi (10-20 mm), into 2 groups:

  Gr A–MIP, Gr B–RIRS (24 pts each)
- Stone clearance was assessed by post-operative CT scan at 1 month in all cases.

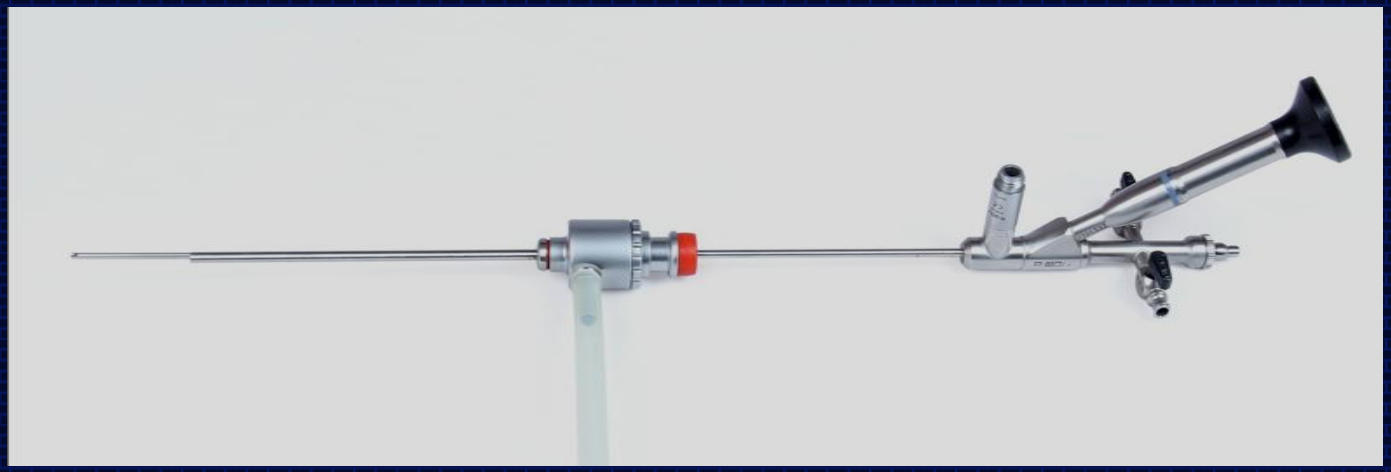
Results

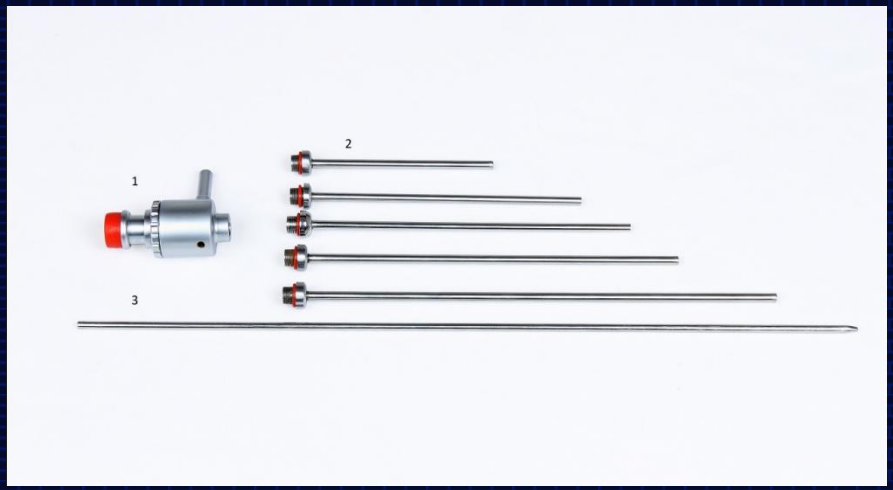
Variable	MIP group	RIRS group
Number	24	24
Age(range)	46.8(22-76)	43.2(19-64)
Male/Female	14/10	15/9
Stone size	16.9 mm	16.3 mm
First sitting/second	24/0	13/11
Pre stenting	0	13
Post stenting	7	24
Mean operative time	28.9 min	45.8 min
Stone clearance rate	95.8%	83.3%
Mean hospital stay	25.3 hours	23.4 hours
Post op Complications (Clavien grade 1)	2	2

Results

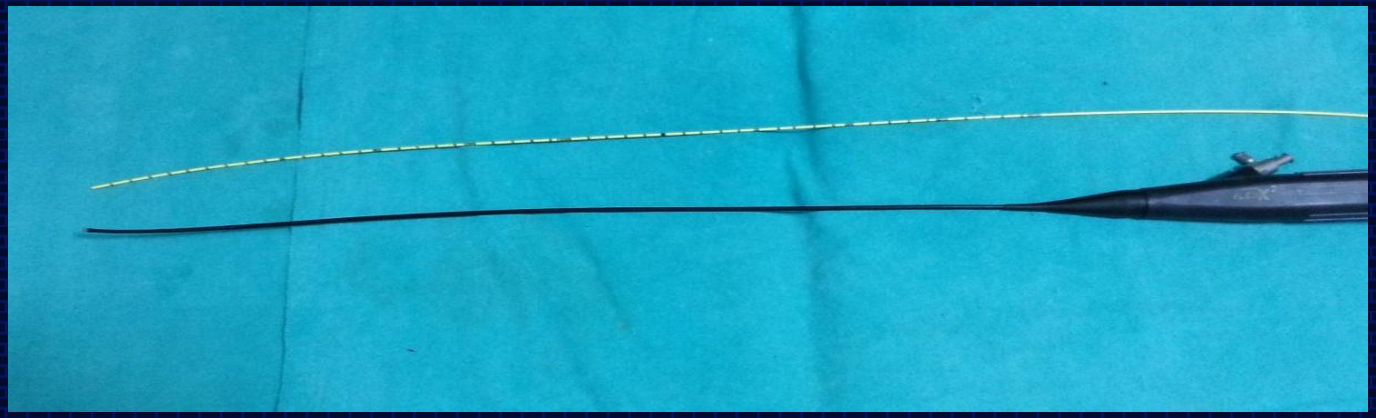

120
100
80
60
40
20
0
MIP-M
RIRS
16.9
16.3
0
11
0
13
7
24
28.9
45.8
0
0
95.8
83.3
25.3
23.4
Mean stone size (mm)
Second sitting required
Prestenting (n)
intra op stenting (n)
operative time (min)
blood transfusion (n)
SFR %
mean hospital stay (hrs

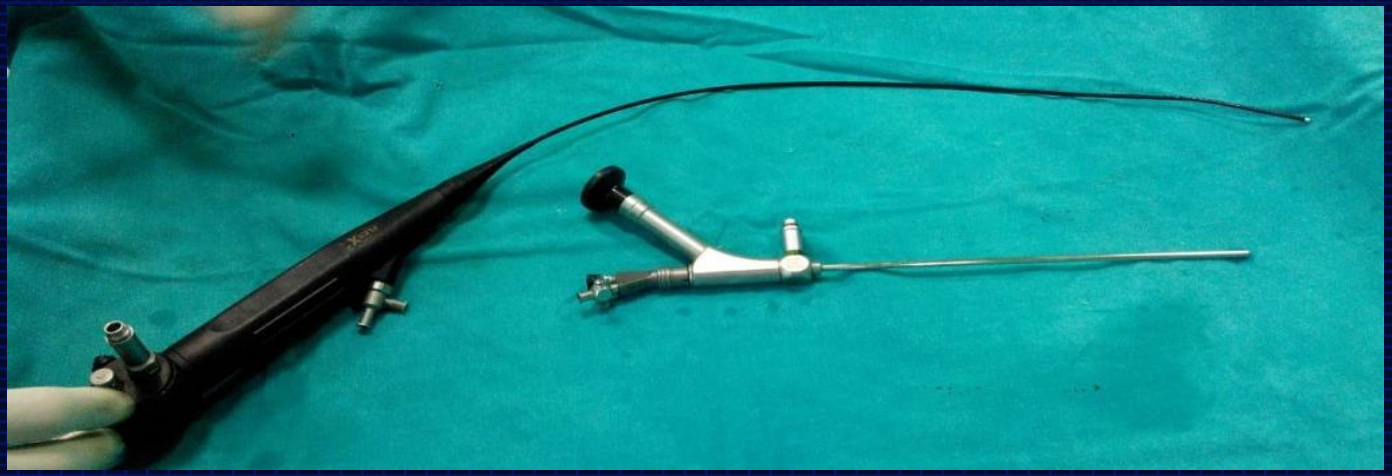
Superperc-PCNL



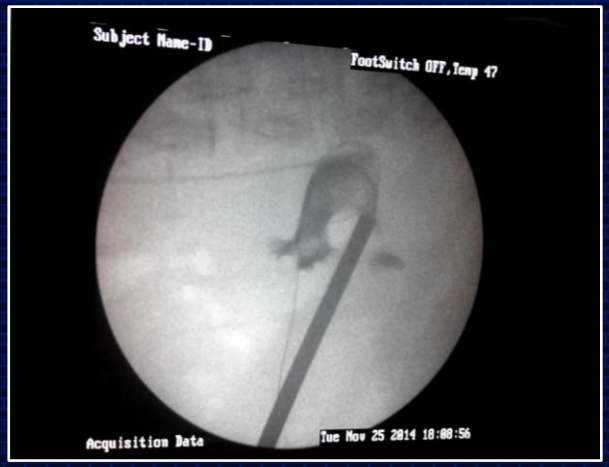


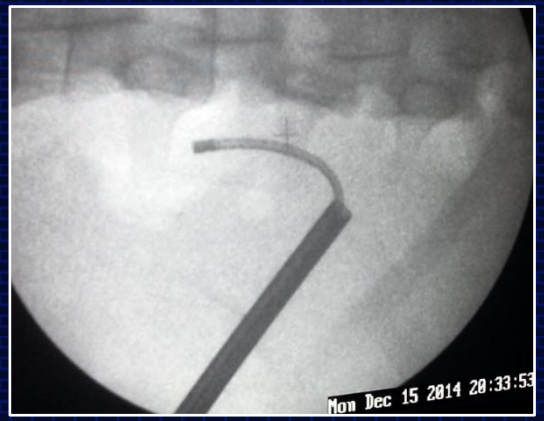
Flexible Mini-Nephroscopy





Flexible Mini-Nephroscope





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Use of a Novel Flexible Mini-nephroscope in Minimally Invasive Percutaneous Nephrolithotomy.

Mishra DK[1], Agrawal MS[2].

Author information

Abstract

OBJECTIVE: To assess the feasibility and safety of a novel flexible mini-nephroscope in minimally invasive percutaneous nephrolithotomy (PCNL). Presumably, limiting the size and number of tracts during PCNL has the potential of decreasing the morbidity of the procedure. We present our experience with this new technique.

MATERIALS AND METHODS: A retrospective analysis of patients with multiple kidney stones treated with mini-PCNL combined with a novel flexible mini-nephroscope was performed. Minimally invasive PCNL was done with rigid 12 F MIP-M nephroscope, followed by flexible mini-nephroscopy for smaller stones in other inaccessible calyces. Record was made of the operating time, stone-free rates, postoperative pain, morbidity, hospital stay, time to recovery, complication rates, and ancillary procedures. Matched-pair analysis was done with cases operated by flexible ureteroscopy performed with Flex X-2 or Flex X-c scope.

RESULTS: Twenty-five patients in the study group were matched with 25 cases from the flexible ureteroscopy group. Both groups were comparable in terms of age, laterality, and mean composite stone burden. The mean operating time was 40.1 ± 10.6 minutes in the mini-PCNL group and 51.2 ± 8.8 minutes in the flexible ureteroscopy group. Mean hospital stay was similar in both groups. The primary stone clearance rate of 92% (23 of 25) in the mini-PCNL group was better than the clearance rate of 80% (20 of 25) in the flexible ureteroscopy group. Eight percent in the mini-PCNL group required ancillary procedures as compared with 20% of cases in the flexible ureteroscopy group. Postoperative pain and analgesia requirement in these patients was minimal. There were no significant complications.

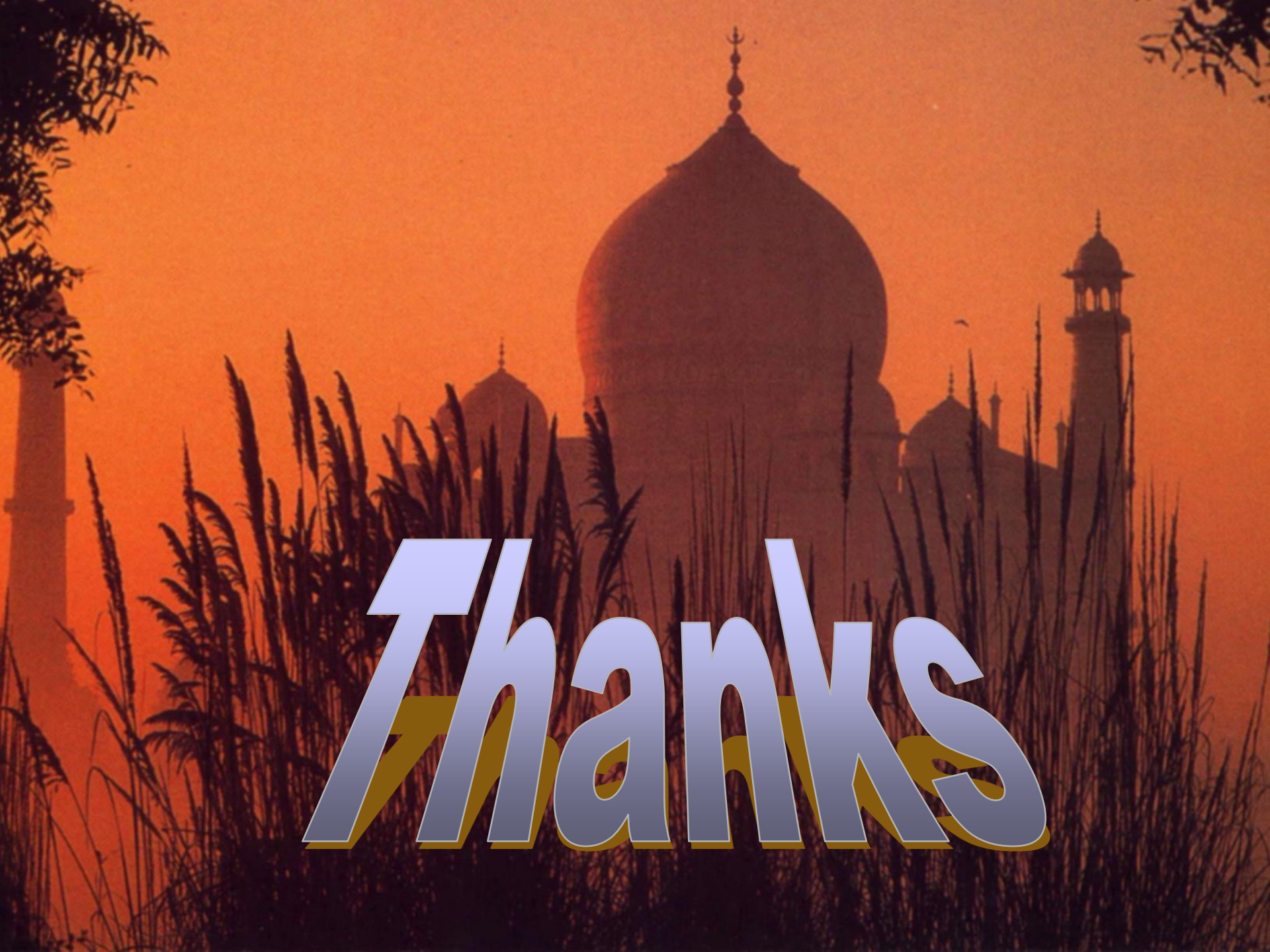
CONCLUSION: Flexible mini-nephroscope is an effective adjuvant to minimally invasive PCNL in achieving high clearance rate with minimum morbidity.

Minimally Invasive PCNL (MIP)

Advantages

- No Tubes – 'Truly Tubeless' in majority of cases
- Short hospital stay (around 24 hours)
- Low intra-renal pressure due to free drainage
- Complete stone clearance on table in most cases
- Higher stone-free rates compared to other procedures
- Lower need for secondary procedures
- Lower costs of maintenance, disposables

Compares favorably against both ESWL and RIRS


Thanks