



# Reducing Intra-Operative Fluoroscopy Time in Percutaneous Nephrolithotomy

Bodo E. Knudsen, MD, FRCSC

Henry A. Wise II Endowed Chair in Urology

Associate Professor, Vice Chair Clinical Affairs

Department of Urology



**THE OHIO STATE  
UNIVERSITY**

WEXNER MEDICAL CENTER



# Introduction

- PCNL with fluoroscopic guidance is associated with highest amount of radiation of any endourological procedure
- Mean radiation dose
  - Patient: 7.3 mSv
  - Physician: 12.7 mSv





THE OHIO STATE  
UNIVERSITY

WEXNER MEDICAL CENTER

# Introduction

- Internally our goal was to challenge ourselves to determine how low we could reduce radiation exposure during PCNL in a tertiary care academic medical center where residents and fellows are involved in procedures





# Methods

- We prospectively set the goal to actively reduce amount of radiation used during PCNL (surgeon guided access)
- We retrospectively collected data:
  - Group 1: Pre-dose reduction
  - Group 2: Post-dose reduction
- All consecutive cases to avoid selection bias



# Methods

- Measures implemented to reduce radiation dose
  - Spot checking rather than continuous live fluoroscopy
  - Low-dose setting on GE 9900 OEC C-arm (50% reduction in milliamperage and variable reduced KVP)
  - Pulsed-mode used extensively (4 fps)
  - Last image hold
  - Increased reliance on tactile feedback
  - Active communication with xray technologist

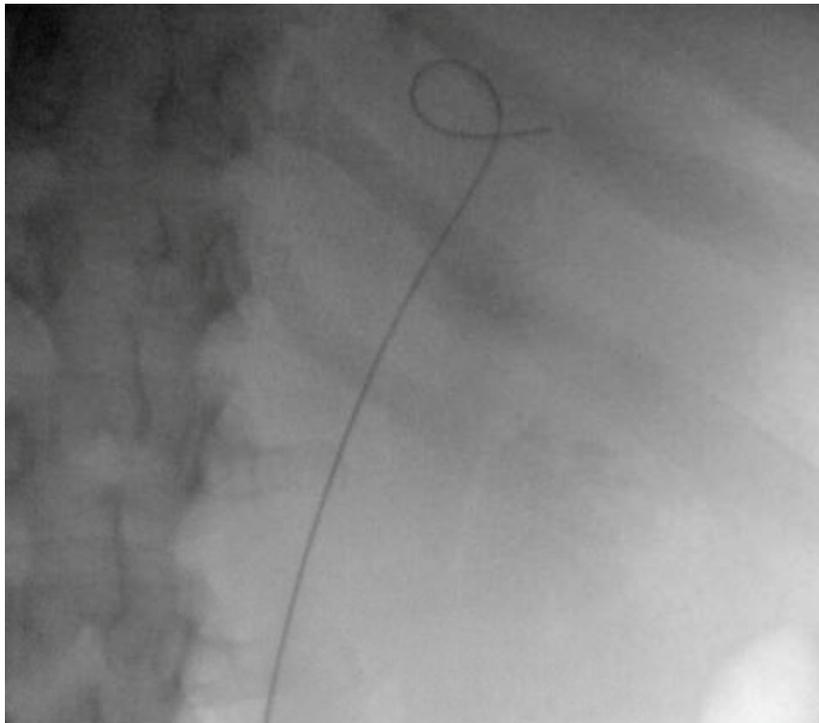


# Specific Examples

Step	Technique
Initial needle placement	Small segments of live fluoro used; imaging stopped as soon as needle thought to be in calyx
Wire Access	Spot images primarily used with small live segments if wire manipulation difficult
Balloon / Sheath Placement	Spot images only used with balloon inflation and sheath advancement
Flexible nephroscopy / Eval of calyces	Images used only if visualization difficult
Stent / NT Placement	Spot images only



# Standard vs Low-Dose



**Standard dose**



**Low dose**



# Results

Characteristics	Pre-intervention	Post-intervention
<b>Patient Number</b>	48	48
<b>Median Age (range)</b>	55 (30 - 80)	32 (21 - 75)
<b>Median Stone burden (largest axial x coronal diameter)</b>	27.3 x 29.2 mm	29.4 x 33.6 mm
<b>Median BMI</b>	32 kg/m <sup>2</sup>	30 kg/m <sup>2</sup>
<b>Median/Mean Fluoroscopy Time (range)</b>	240/281 sec (56.0 - 916.0)	65.5/128 sec* (13.0 - 561.0)
<b>Stone Free Rate</b>	62.2%**	65.9%**
<b>Ancillary Procedures</b>	5	7
<b>Complications (Clavien 3a+)</b>	2	4

\*p < 0.001

\*\*Based on completely stone-free – ie. No residual fragments of any size.



# Discussion

- Factors associated with increased radiation dose
  - ↑ BMI, stone burden, # of access tracts
  - Non-branched configuration



# Monga: Endo-Guided Access Dose Reduction

- Compared a series of patients undergoing traditional fluoroscopic guidance vs endo-guided access
- Complication rates similar between the groups

Reduced fluoroscopy time  
from

**16.8 minutes to  
3.2 minutes**



# Baldwin: Reduced Fluoro Protocol

- Visual and tactile cues
- Fixed lowered mAs and kVp
- Laser guide on C-arm
- Designated fluoroscopy technician
- Surgeon foot pedal control
- Single pulse per second fluoroscopy
- 80.9% reduction in fluoroscopy time

Reduced fluoroscopy  
time from

**175.6 sec to  
33.7 sec**



# Learning Curve for Ultrasound Access

- Fellowship trained surgeon expert in fluoroscopic access
- *Hands on hands* mentored by surgeon expert in ultrasound access
- Improvement noted by 20 cases but continued improvement over 100 cases
- Fluoroscopy time reduced from average of **157.5 sec** to **33.4 sec**

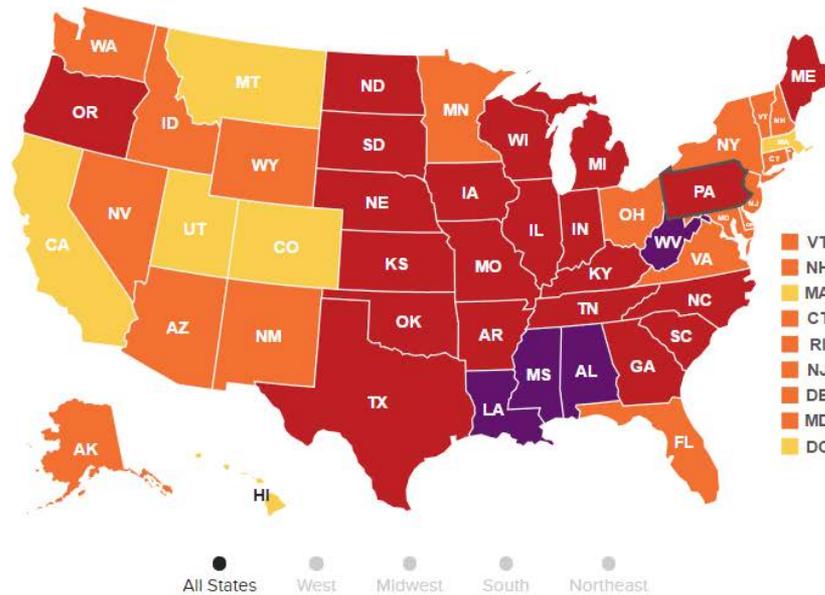
Adopting ultrasound guidance for prone PCNL: Evaluating the learning curve for the experienced surgeon. Chi *et al.*, J Endo, 2016

## Adult Obesity Rate by State, 2015

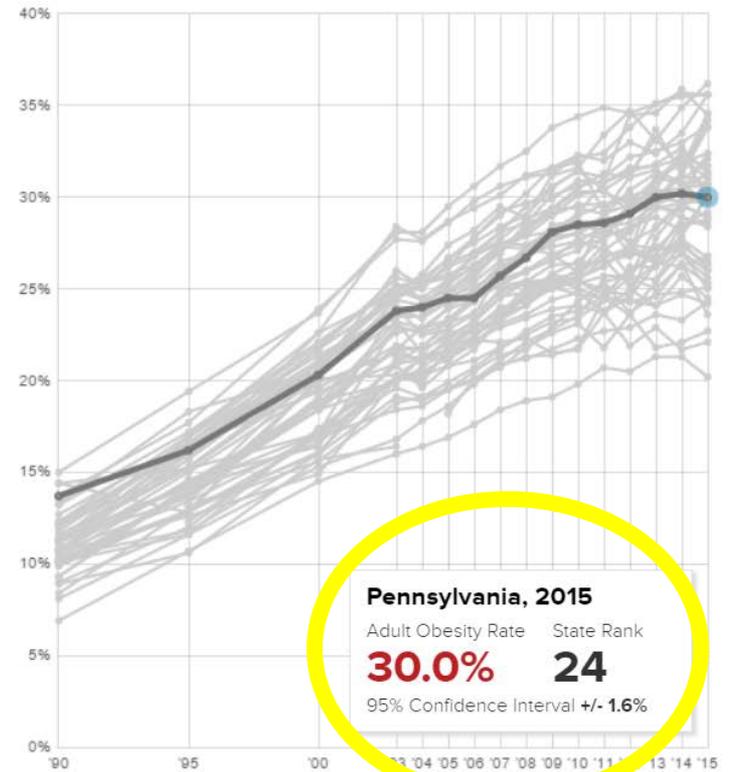
Select years with the slider to see historical data. Hover over states for more information. Click a state to lock the selection. Click again to unlock.

### Percent of obese adults (Body Mass Index of 30+)

0 - 9.9%   10 - 14.9%   15 - 19.9%   20 - 24.9%   25 - 29.9%   30 - 34.9%   35%+

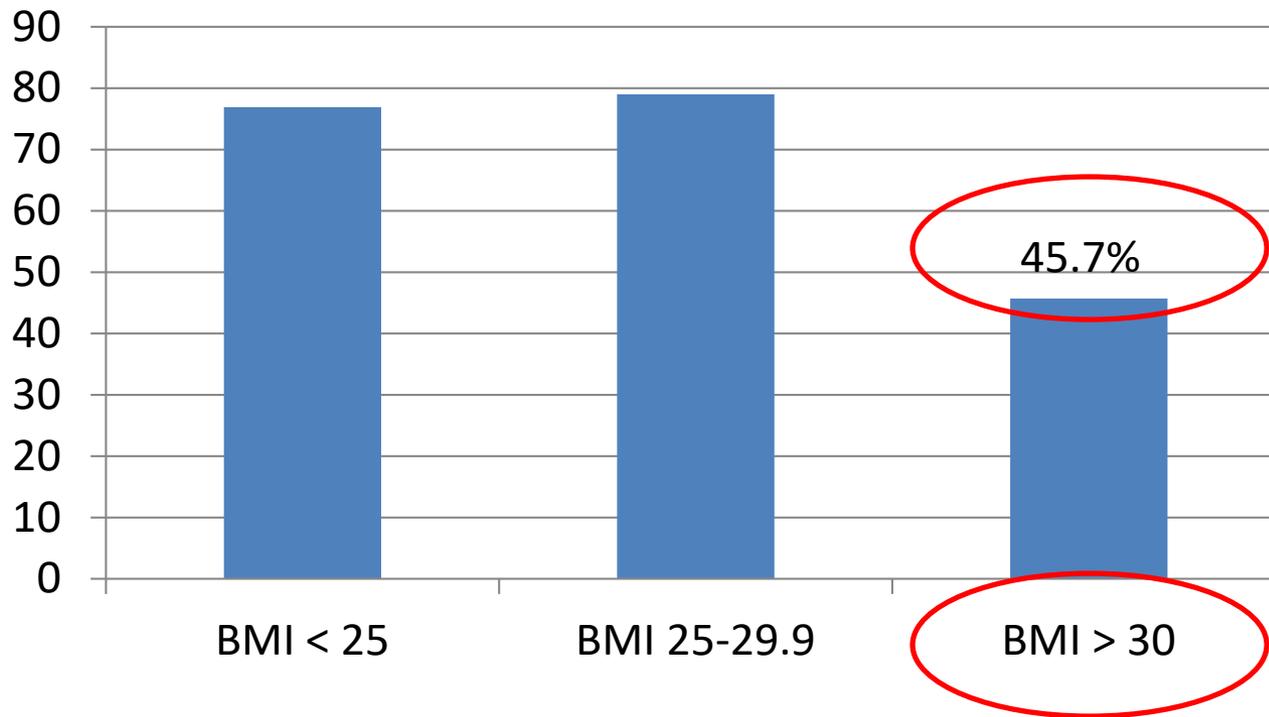


## Adult obesity rates, 1990 to 2015





## Successful Ultrasound Guide Access





# Conclusions

- Fluoroscopy time can be significantly reduced by adopting simple techniques and having active communication with xray technologist
- 72.7% reduction in median fluoroscopy time with current protocol
- Ultrasound guided access remains best choice for ultimate radiation dose reduction,
  - Both resident training in the U.S. and high BMI of patient population are challenges to widespread adoption