

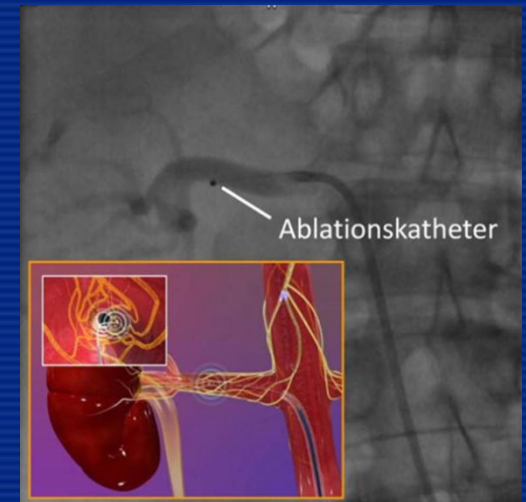
Renal Denervation for Resistant Hypertension : SMC experience

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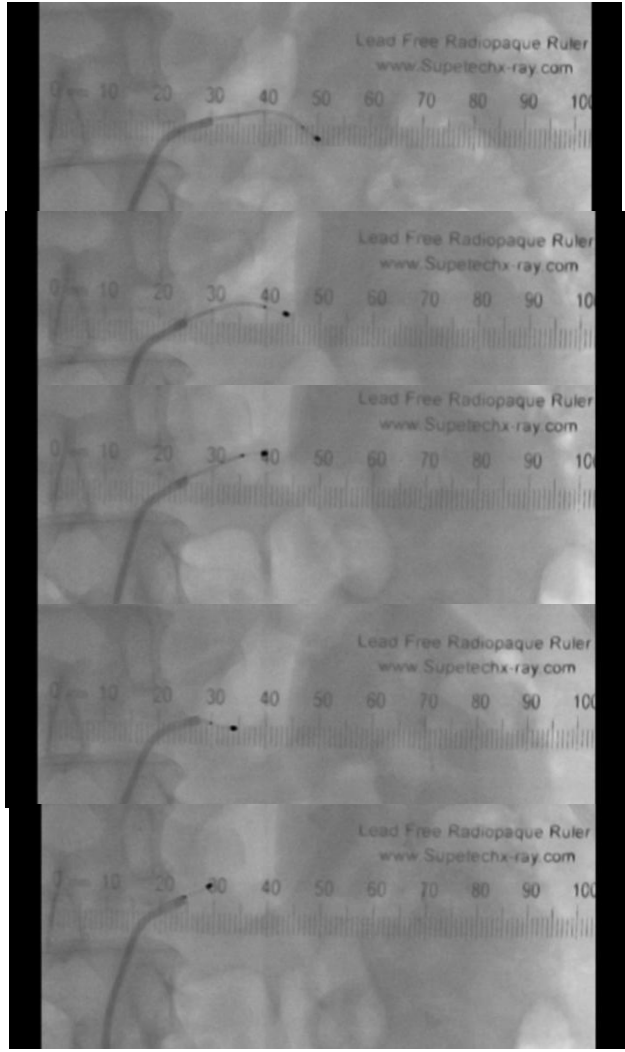
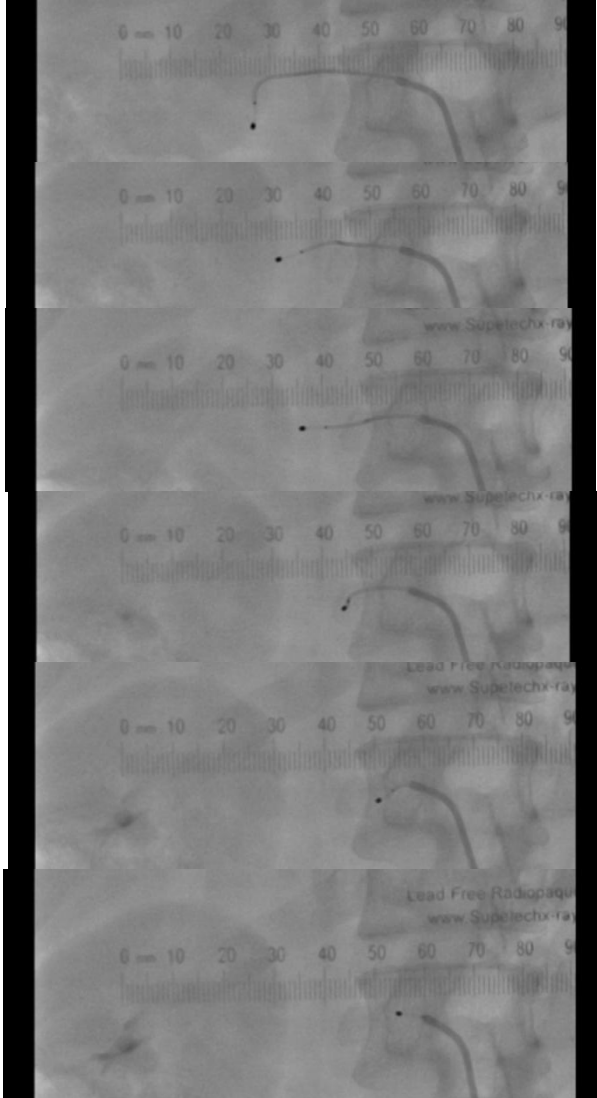
Case 1



- **M/45**
- **Office BP : 170/115 mmHg HR: 88/min**
- **171cm, 94 kg, policeman**
- **Hypertension for 5 year**
- **Medication Chart**

| Office BP | 170/115mmHg |
|--------------------|--------------------|
| Felodipine | 5 mg |
| Carvedilol | 50mg |
| Valsartan | 320mg |
| Hydrochlorothizide | 12.5mg |

Case : Renal denervation



Blood Pressure F/U



Weight gain : 5 kg

Hyper-responder

| Months | Initial (3/12/12) | 1 | 6 | 9 | 12 (4/1/13) |
|--------------------|------------------------------|---------------|---------------|---------------|------------------------|
| BP mmHg | 170/115 | 144/90 | 130/85 | 110/75 | 105/70 |

Medication

Felodipine 5mg
Carvedilol 50mg
Valsartan 320mg
Hydrothiazide 12.5mg

dizziness

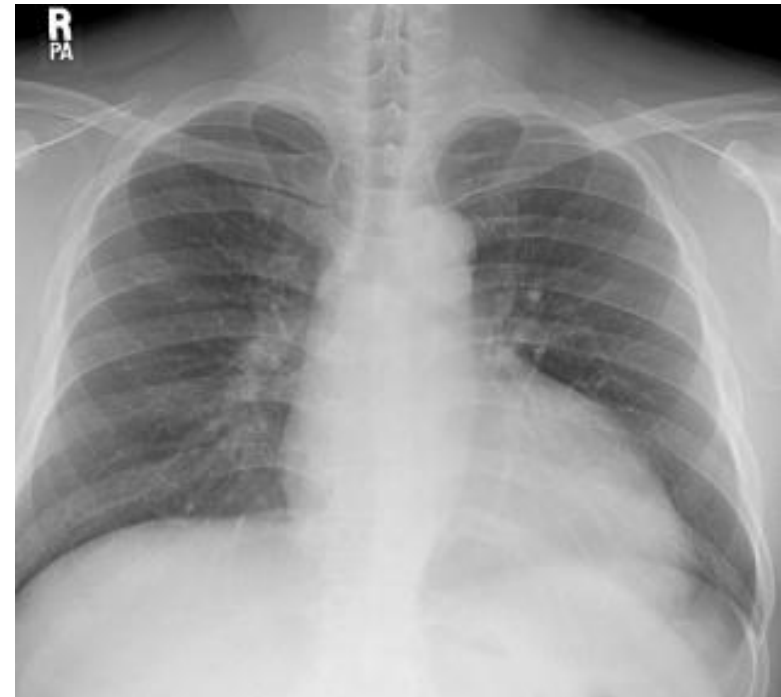
→ 160mg ↓

Case 2

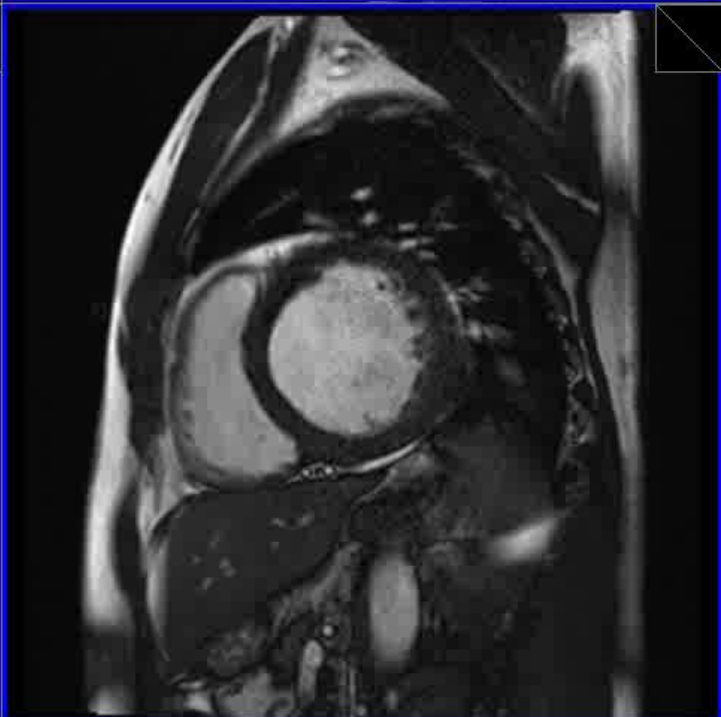
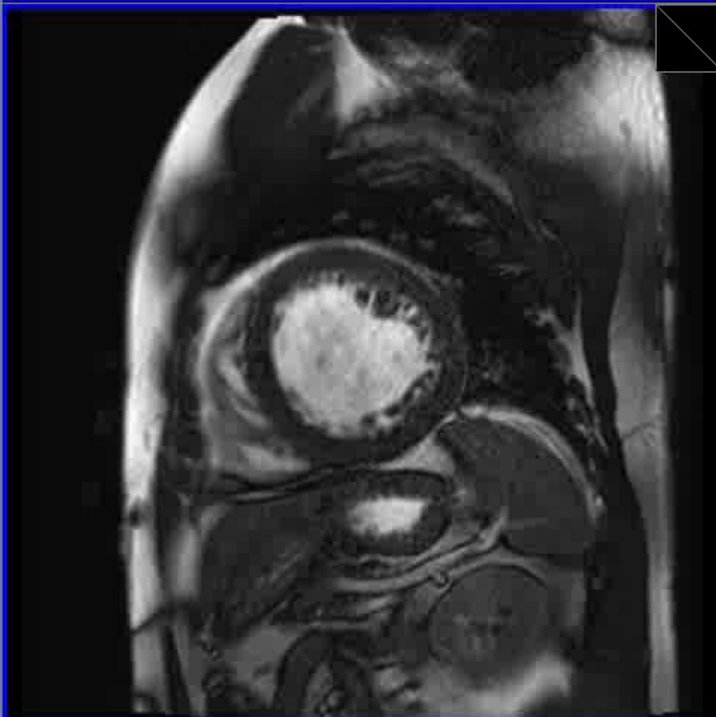
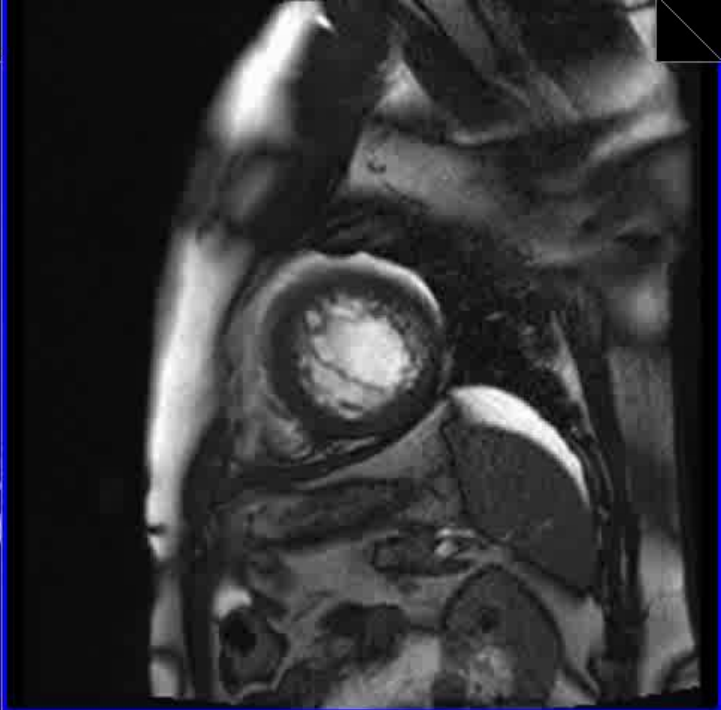
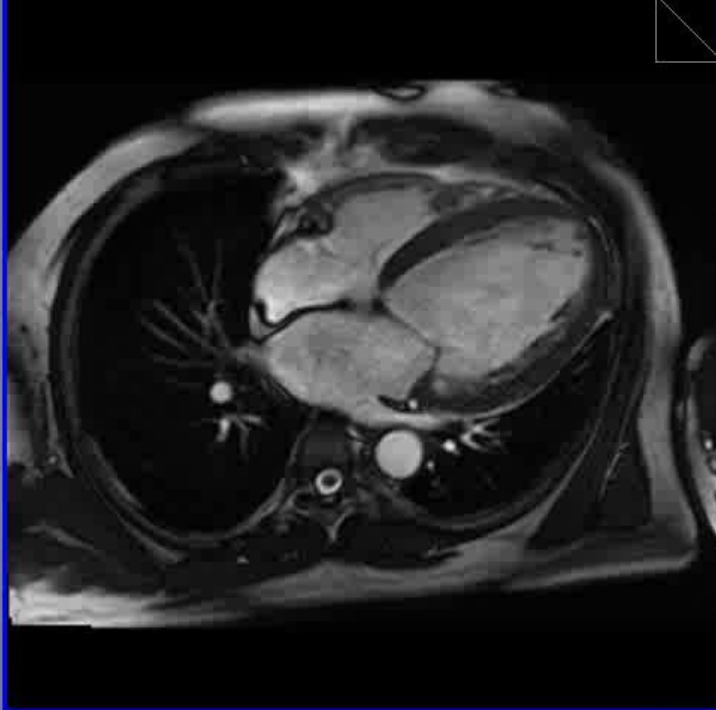


- **M/42**
- **Office BP : 160/120 mmHg HR: 83/min**
- **177cm, 104 kg**
- **Hypertension for 2 year**
- **Medication Chart**

| Office BP | 160/120 mmHg |
|--------------------|---------------------|
| Amlodipine | 5 mg |
| Bisoprolol | 10 mg |
| Losartan | 100 mg |
| Hydrochlorothizide | 12.5 mg |



2012.03.29



Blood Pressure F/U



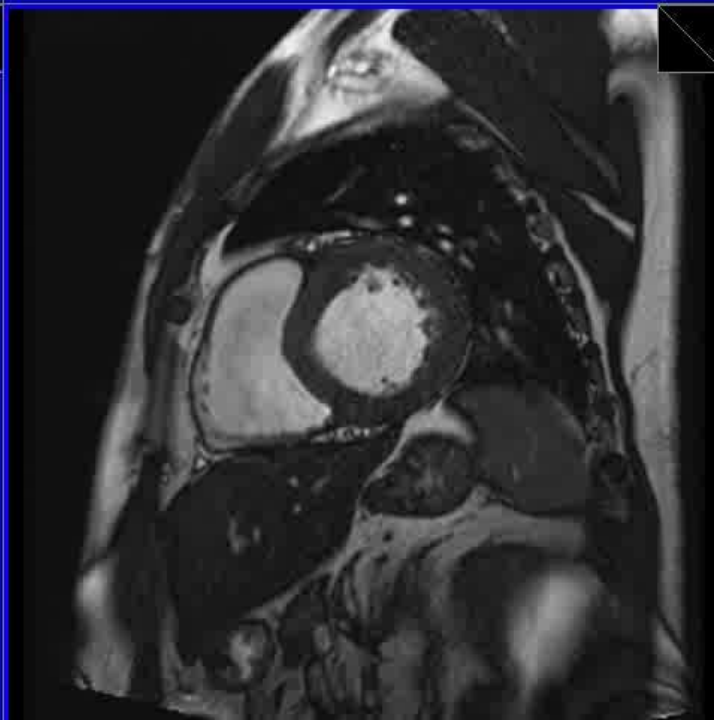
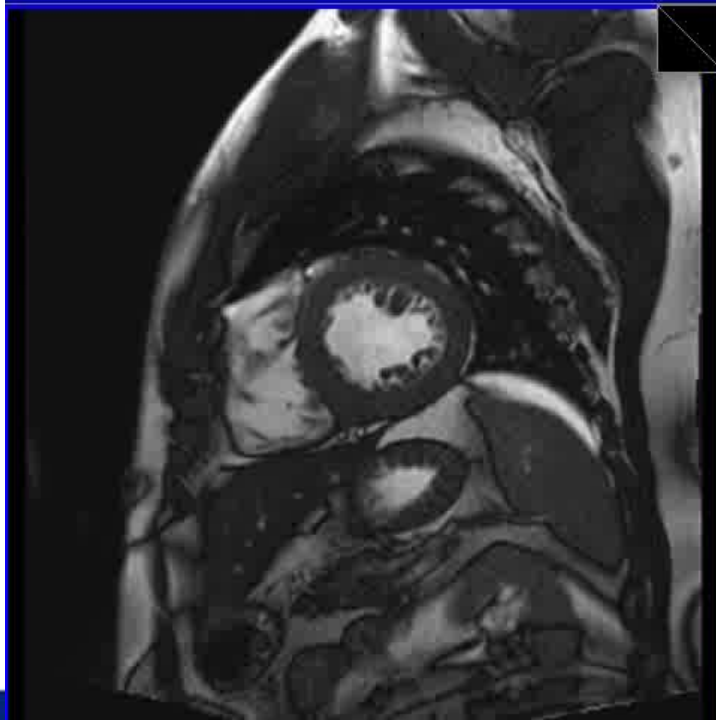
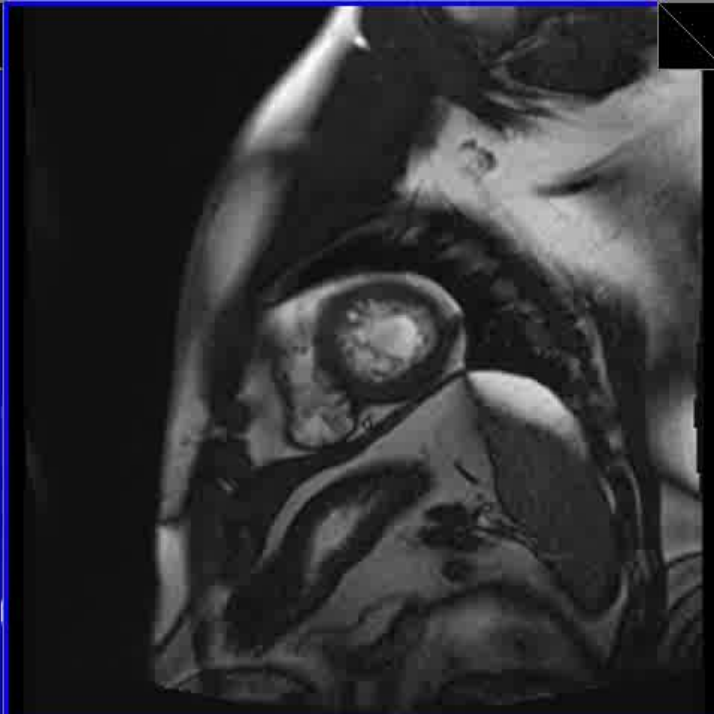
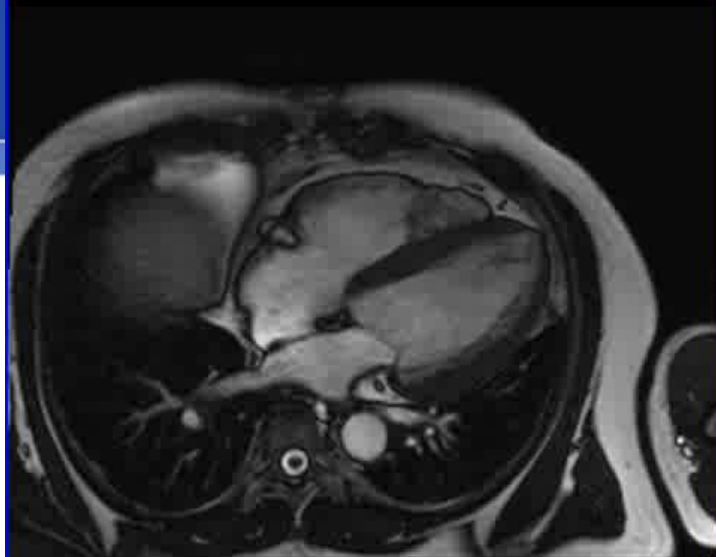
After the successful renal denervation

| Months | Initial (4/6/12) | 1 | 6 | 9 | 12 (4/22/13) |
|------------|---------------------|---------|--------|---------|-----------------|
| BP mmHg | 160/120 | 150/105 | 151/98 | 150/115 | 150/110 |

Medication

Amlodipine 5 mg
Bisoprolol 10 mg
losartan 100 mg
Hydrothiazide 12.5mg

2013.04.12



SMC registry



- **Key inclusion criteria**
 - Office blood pressure **≥ 140 mmHg** despite ≥ 3 anti-hypertensive medications
 - eGFR (MDRD) ≥ 45 mL/min/1.73m²
- **Key exclusion criteria**
 - known secondary cause of hypertension
 - Type I diabetes mellitus
 - renovascular abnormalities: significant renal artery stenosis, prior renal stenting or angioplasty

Total SMC RDN (n=36)



| | | |
|-----------------------|---------------------------------------|------------------------|
| Demographics | Age (years) | 52.6 ± 13 |
| | Gender (% female) | 20.0% |
| Co-morbidities | Diabetes Mellitus II (%) | 25.7% |
| | CAD (%) | 19.2% |
| | Hyperlipidemia (%) | 54.3% |
| | eGFR (mL/min/1.73m ²) | 78.1 ± 16.7 |
| Blood Pressure | Baseline BP (mmHg) | 164/101 ± 19/19 |
| | Number of anti-HTN meds (mean) | 4.0 ± 1.3 |
| | ACE/ARB (%) | 94.3% |
| | Beta-blocker (%) | 74.3% |
| | Calcium channel blocker (%) | 77.1% |
| | Vasodilator (%) | 2.9% |
| | Diuretic (%) | 77.1% |
| | Spirolactone (%) | 14.3% |
| | Alpha-blocker(%) | 2.9% |

Procedural data



Total 36 case

| | Right | Left |
|-------------------------------------|-------------------|------------------|
| Number of denervation | 5.9 (5-11) | 5.3 (3-8) |
| RDC 1 | 26 (72%) | 25 (69%) |
| IMA | 10 | 11 |
| Accessory vessel denervation | 2 | 1 |
| Wire guided procedure | 6 | 7 |

- **Mean procedure time : 56 minutes**
- **Contrast media : around 50 cc**

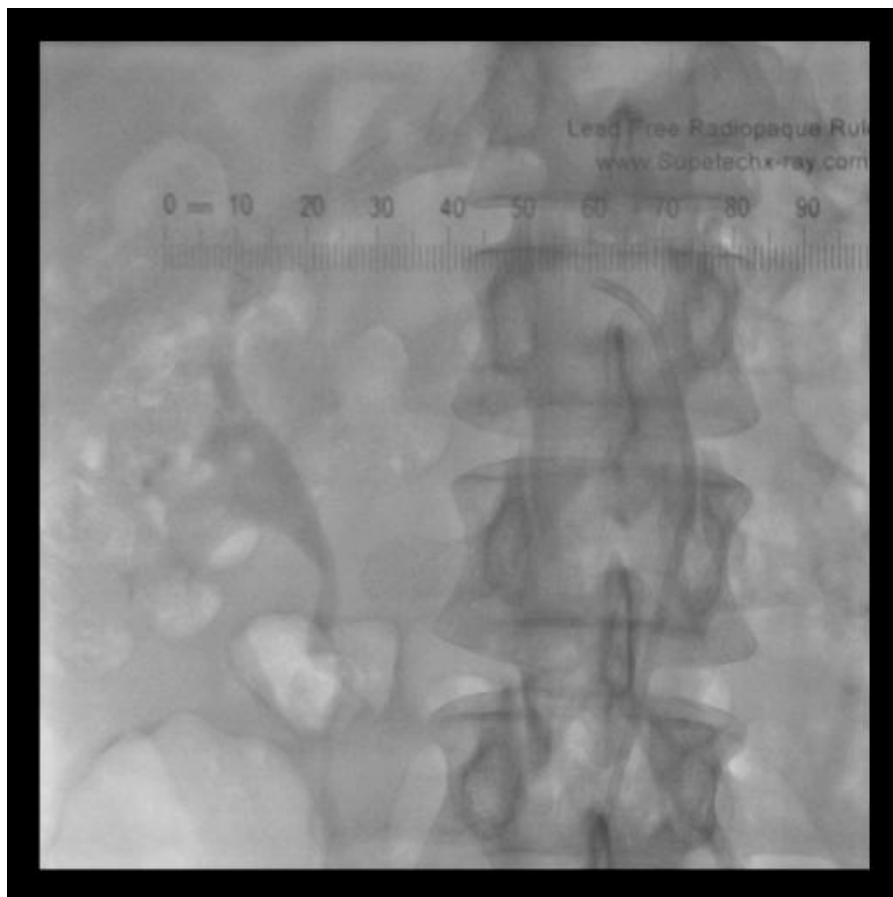
Safety profile – data from SMC



- **procedure related complications (n=36)**
 - **No access site complications**
 - **No renal artery complications including dissection**
 - **3 spasm**
 - **1 junctional bradycardia**

„Ablation notches“ after treatment

Pre



Post



Moderate spasm

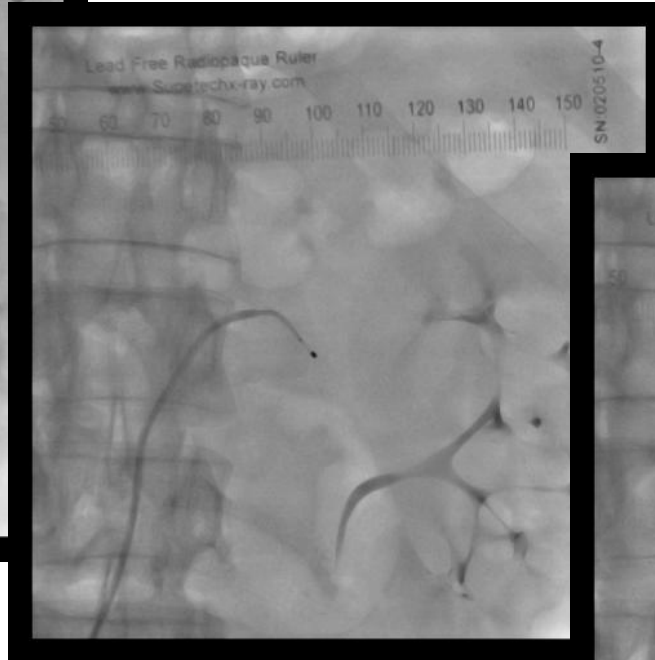
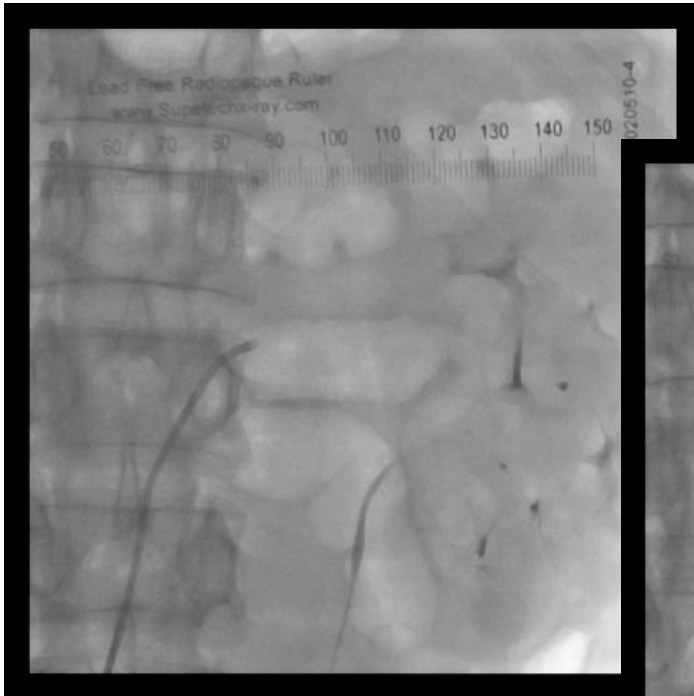


#22, M/47

Post

Final

Pre



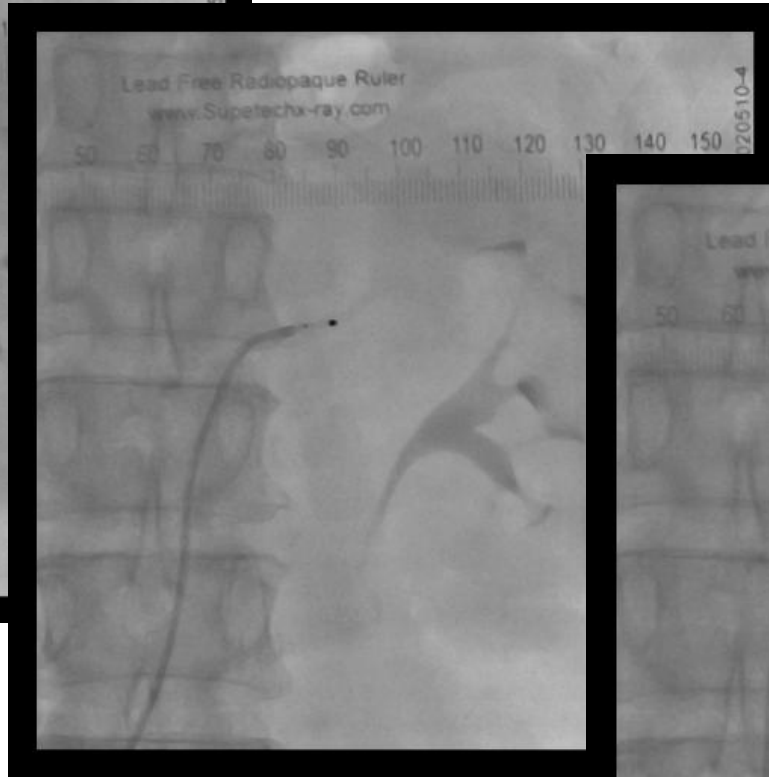
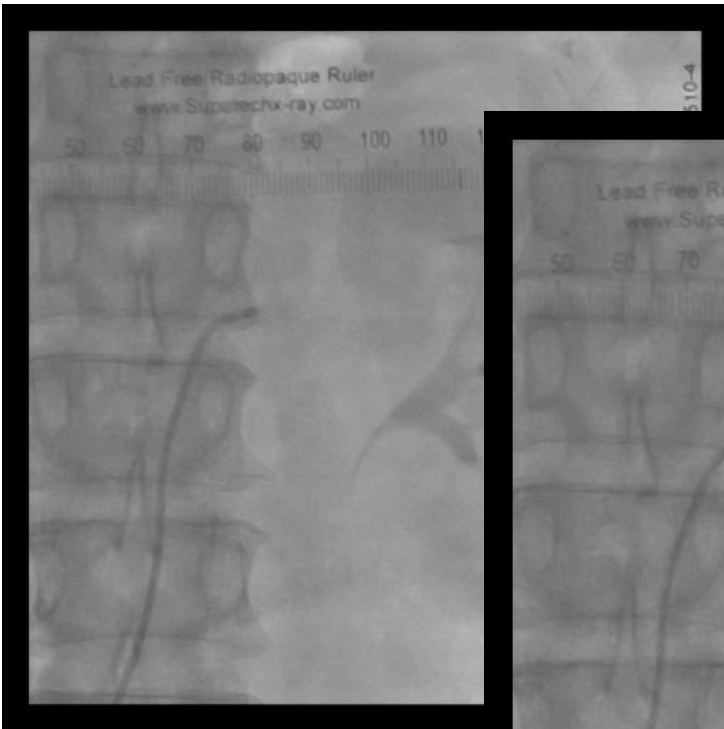
Severe spasm



#19, F/59

Post

Final



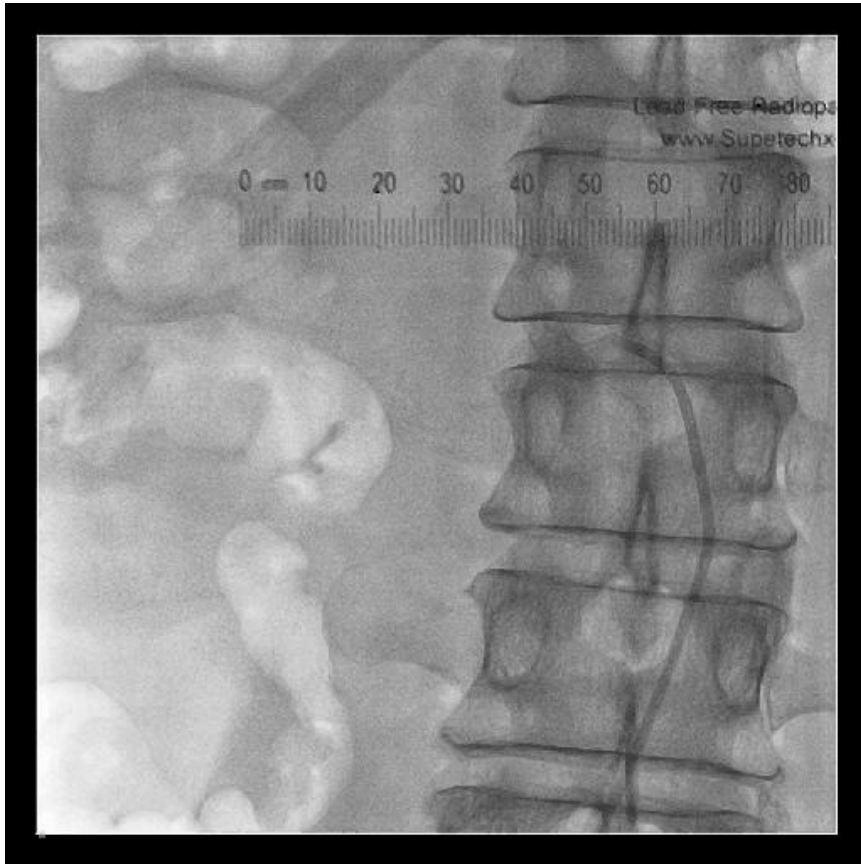
BP 190/96 mmHg



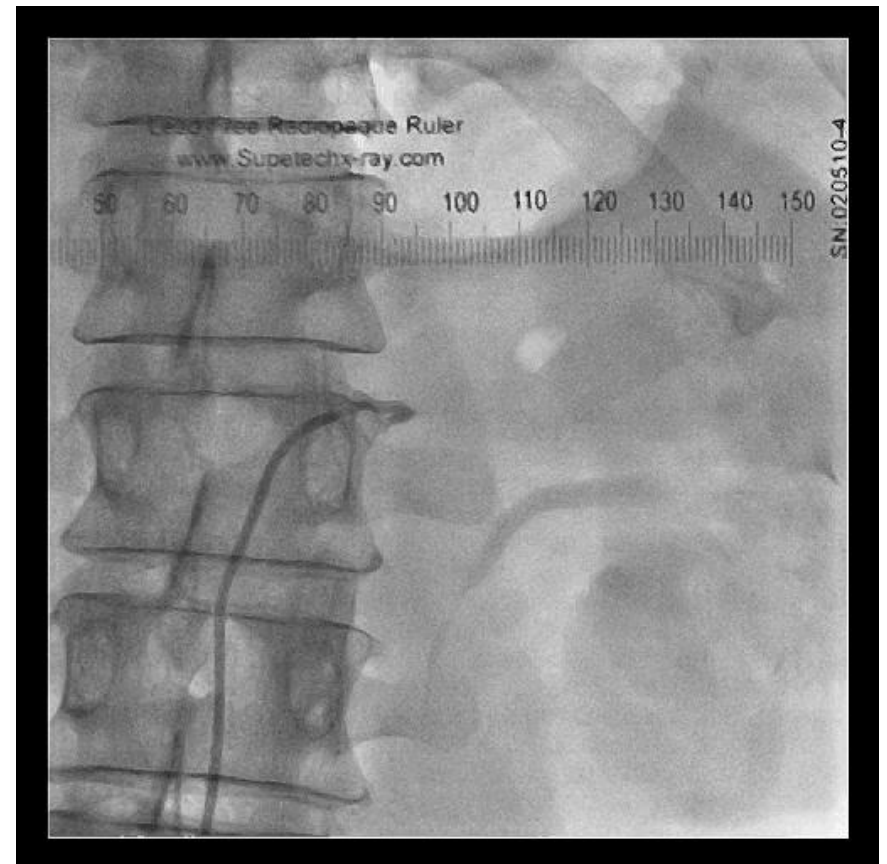
6 months f/u

BP 147/84mmHg, no stenosis, no GFR change

Short to the renal bifurcation

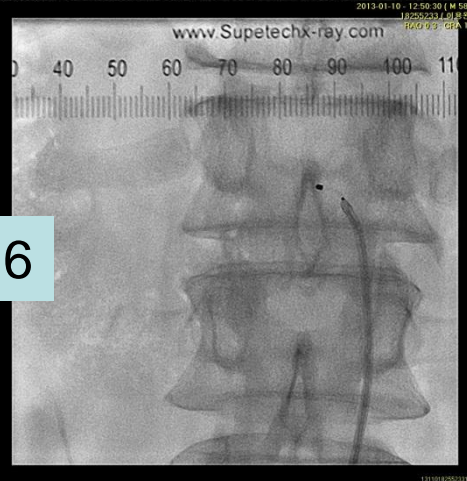
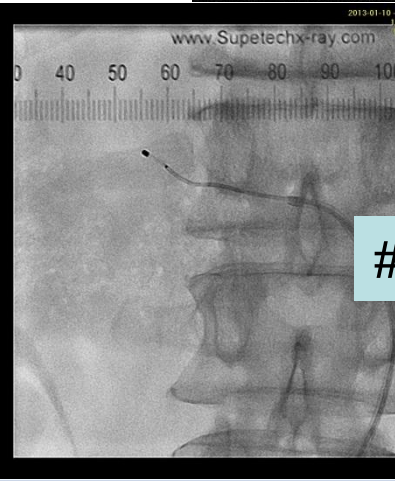
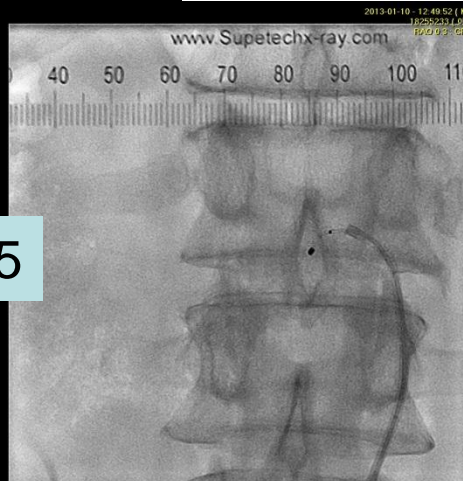
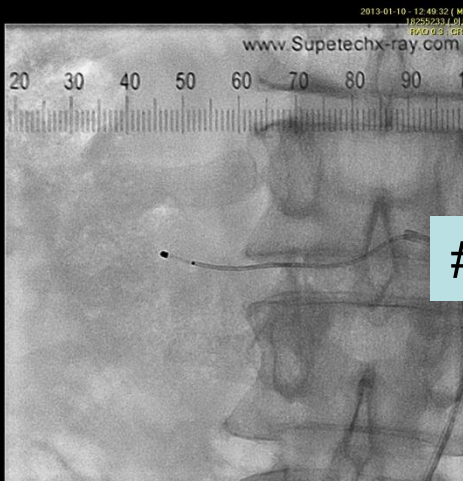
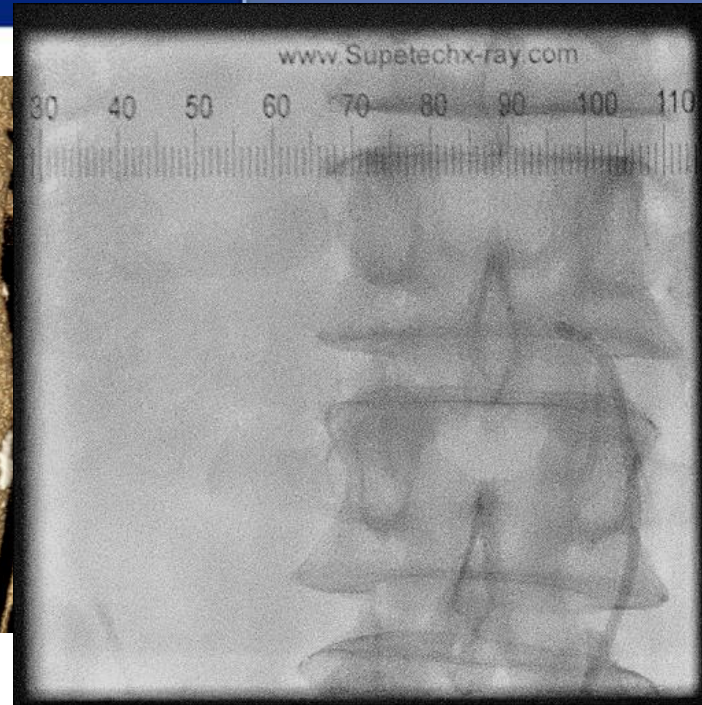
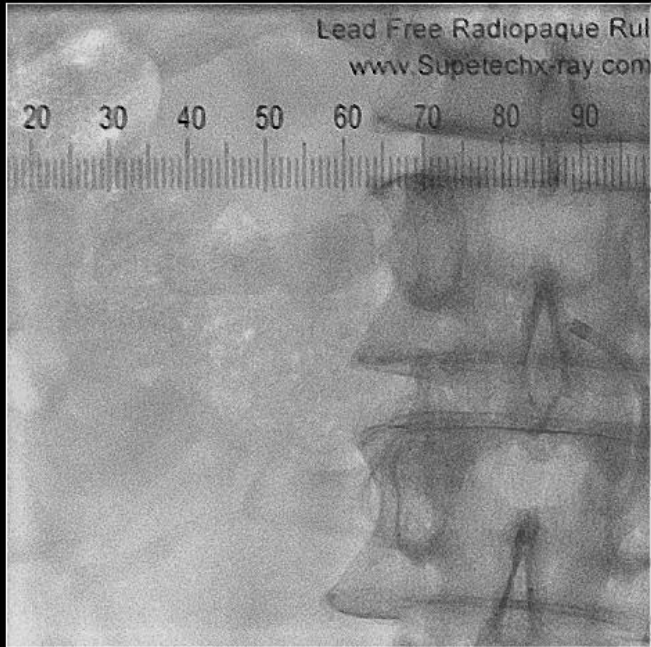


8



8

Dual supply to the kidney

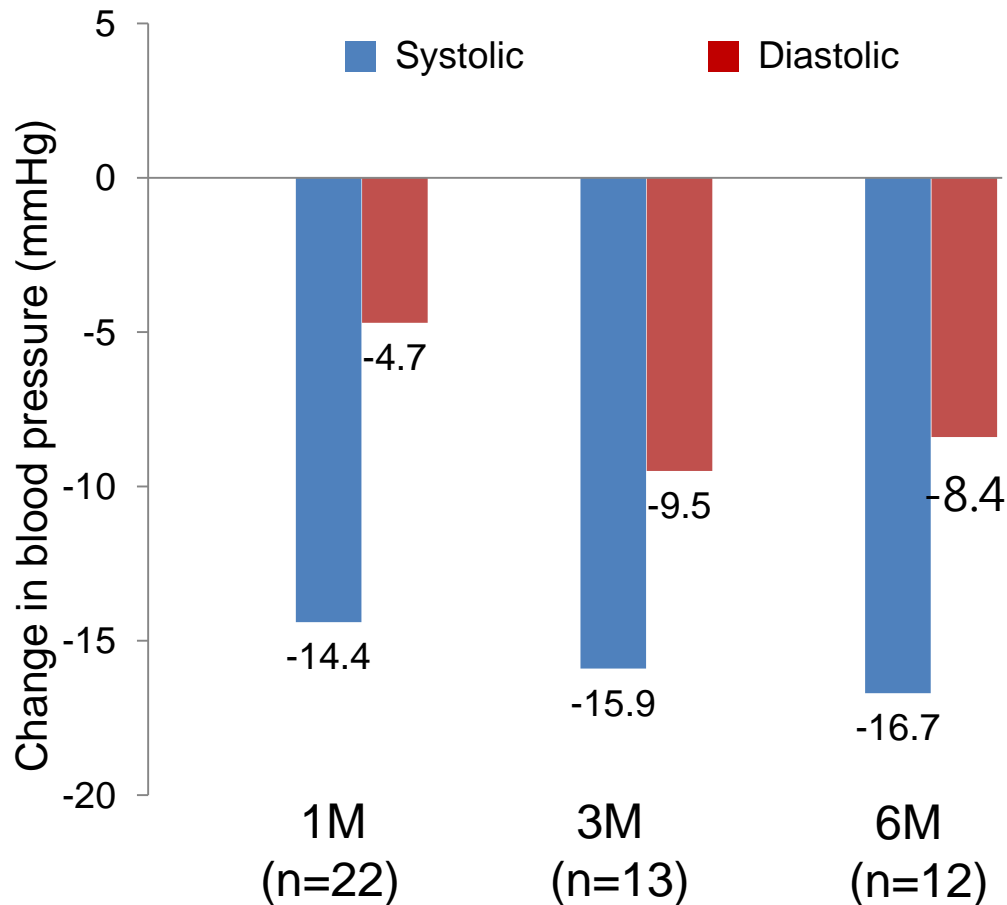


SMC registry (n=27)



| | | |
|-----------------------|---------------------------------------|------------------------|
| Demographics | Age (years) | 51 ± 13 |
| | Gender (% female) | 15.4% |
| Co-morbidities | Diabetes Mellitus II (%) | 11.5% |
| | CAD (%) | 23.8% |
| | Hyperlipidemia (%) | 42.3% |
| | eGFR (mL/min/1.73m ²) | 77.3 ± 16.4 |
| Blood Pressure | Baseline BP (mmHg) | 166/104 ± 18/21 |
| | Number of anti-HTN meds (mean) | 3.5 ± 0.6 |
| | ACE/ARB (%) | 92.3% |
| | Beta-blocker (%) | 69.2% |
| | Calcium channel blocker (%) | 84.6% |
| | Vasodilator (%) | 3.8% |
| | Diuretic (%) | 84.6% |
| | Spironolactone (%) | 11.5% |
| | Alpha-blocker(%) | 3.8% |

Office BP change (n=27)



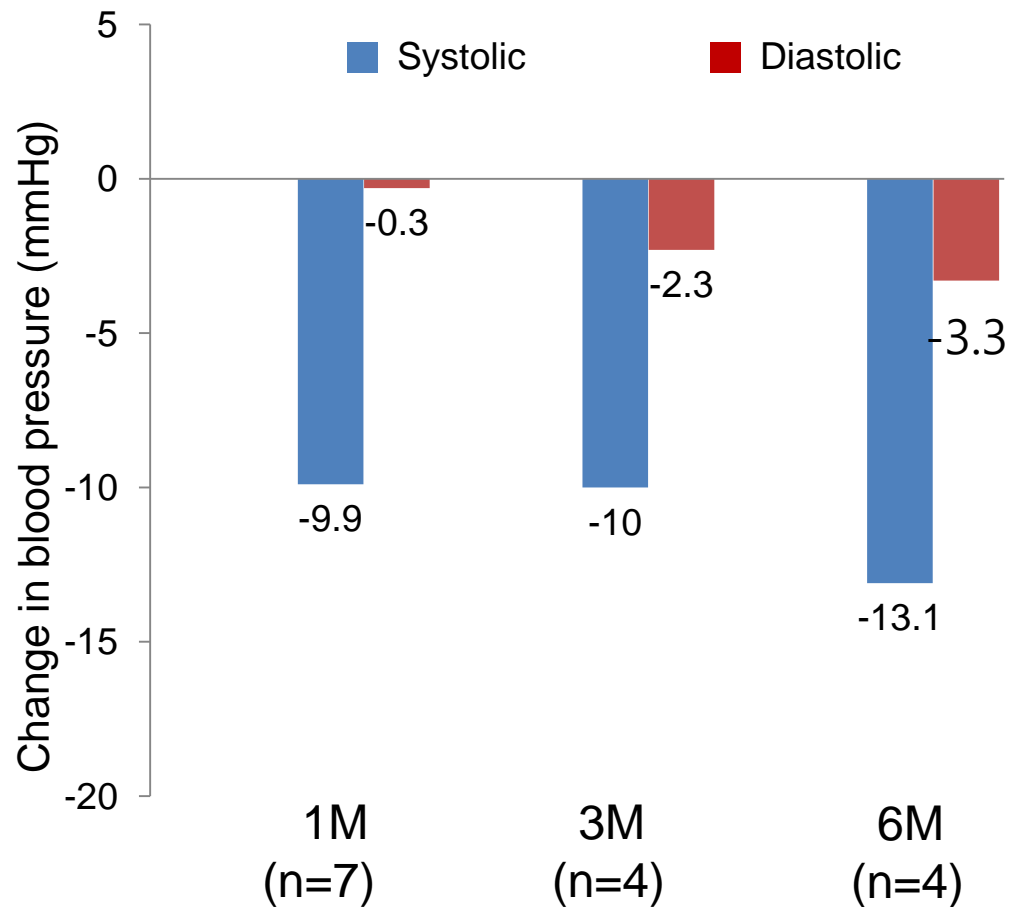
1 Month Non-responder : 5/22(22.7%)
: defined as a SBP reduction of < 10mmHg

Sub-group analysis

140 mmHg < Baseline systolic BP <160mmHg (n=9)

| | | |
|-----------------------|---------------------------------------|----------------------|
| Demographics | Age (years) | 53.1 ± 14 |
| | Gender (% female) | 11.1% |
| Co-morbidities | Diabetes Mellitus II (%) | 22.2% |
| | CAD (%) | 22.2% |
| | Hyperlipidemia (%) | 66.7% |
| | eGFR (mL/min/1.73m ²) | 84.6 ± 23.3 |
| Blood Pressure | Baseline BP (mmHg) | 154/94 ± 5/11 |
| | Number of anti-HTN meds (mean) | 3.7 ± 1.3 |
| | ACE/ARB (%) | 88.9% |
| | Beta-blocker (%) | 66.7% |
| | Calcium channel blocker (%) | 88.9% |
| | Vasodilator (%) | 11.1% |
| | Diuretic (%) | 88.9% |
| | Spirolactone (%) | 11.1% |
| | Alpha-blocker(%) | 11.1% |

Office BP change (n=9)



Safety profile – data from SMC

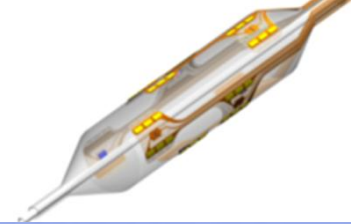


- **procedure related complications (n=36)**
 - No access site complications
 - No renal artery complications including dissection
 - 3 spasm
 - 1 junctional bradycardia
- **Long term complications**
 - No renal artery stenosis at 6 month duplex (n= 18)
 - No renal dysfunction at 6 months lab (n= 19)

Take Home Message



- **Renal denervation is an effective and safe treatment modality for Korean patients with resistant hypertension**
- **Renal denervation may be a safe and effective treatment for patients with milder resistant hypertension**



Thank you for your attention



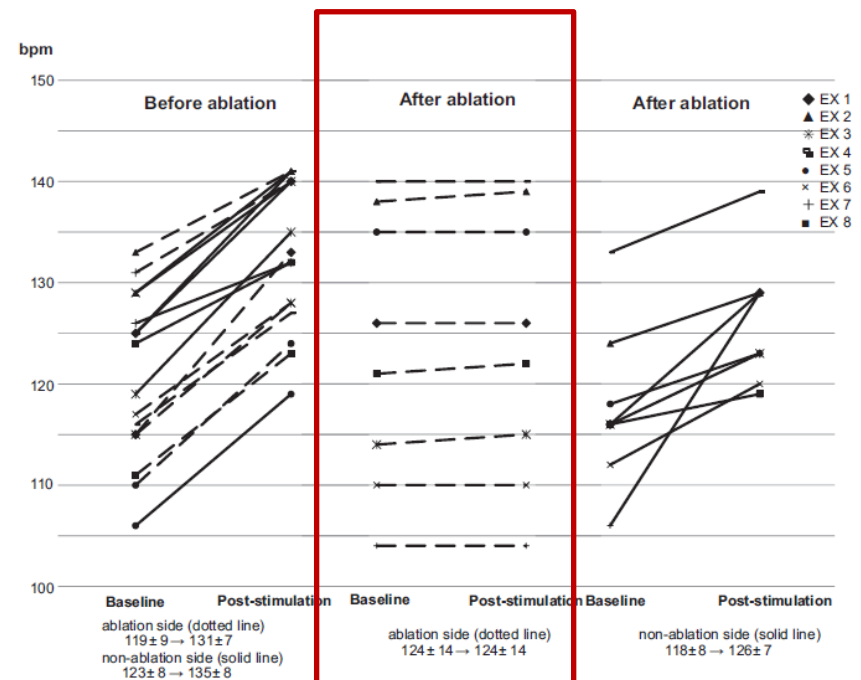
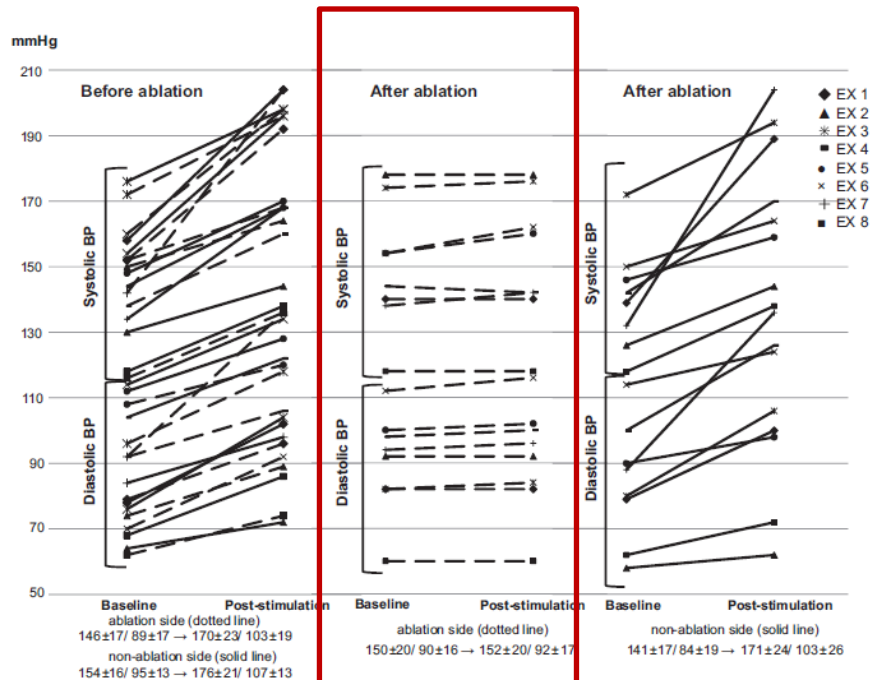
How to monitor the efficacy of renal denervation during procedure



8 dogs

RDN on a renal artery

Electrical autonomic nerve stimulation; pre & post



CORRESPONDENCE

Research Correspondence

Secondary rise in blood pressure after renal denervation

Oliver Vonend, Gerald Antoch, Lars Christian Rump, Dirk Blondin

Lancet 2012; 380: 778
University Düsseldorf, Medical Faculty, Department of Nephrology (O Vonend MD, Prof L C Rump MD), and Department of Diagnostic and Interventional Radiology (Prof G Antoch MD, D Blondin MD), Heinrich-Heine-University Düsseldorf, Medical Faculty, Düsseldorf, Germany

Correspondence to: Prof Lars Christian Rump, Moorenstr. 5, 40225 Düsseldorf, Germany christian.rump@med.uni-duesseldorf.de

In July, 2011, a 58-year-old man with type II diabetes and hypertension resistant to treatment was referred to our hospital for renal denervation. He had had hypertension for 30 years; had been in minor stroke implanted. 170/90 mmHg. Hypertension was confirmed by measurements treated with Aldosterone antagonists on both sides. In August 2011, a relevant stenosis was identified. His medication was not changed. In February, 2012, blood pressure had increased to 180/92 mmHg. Serum creatinine was stable, but renin activity was elevated.



5 months f/u

Figure: Digital subtraction angiography

Showing (August, 2011) renal denervation at a superior position (position 5 of 6) near the ostium; and (February, 2012) ostial stenosis and blood pressure gradient across the stenosis.

For mild hypertension ?

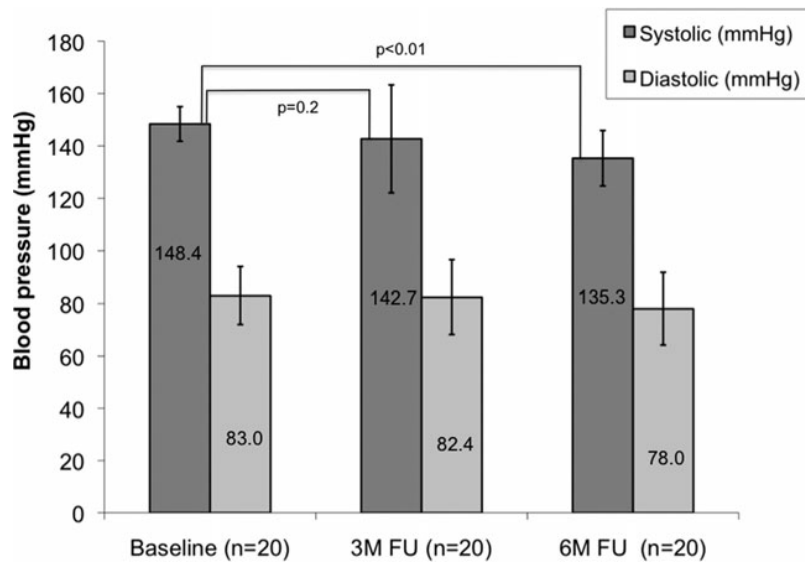


Original Studies

Renal Sympathetic Denervation as Second-Line Therapy in Mild Resistant Hypertension: A Pilot Study

Benjamin Kaltenbach,¹ Jennifer Franke,¹ MD, Stefan C. Bertog,^{1,2} MD, FACC, FSCAI, Daniel H. Steinberg,³ MD, Ilona Hofmann,¹ MD, and Horst Sievert,^{1*} MD, FACC, FSCAI, FESC

N=20 patients
Baseline systolic BP 148.8 mmHg
diastolic BP 83.0 mmHg
No of medications : 5.4



6 months F/U : **-13.1 mmHg**

