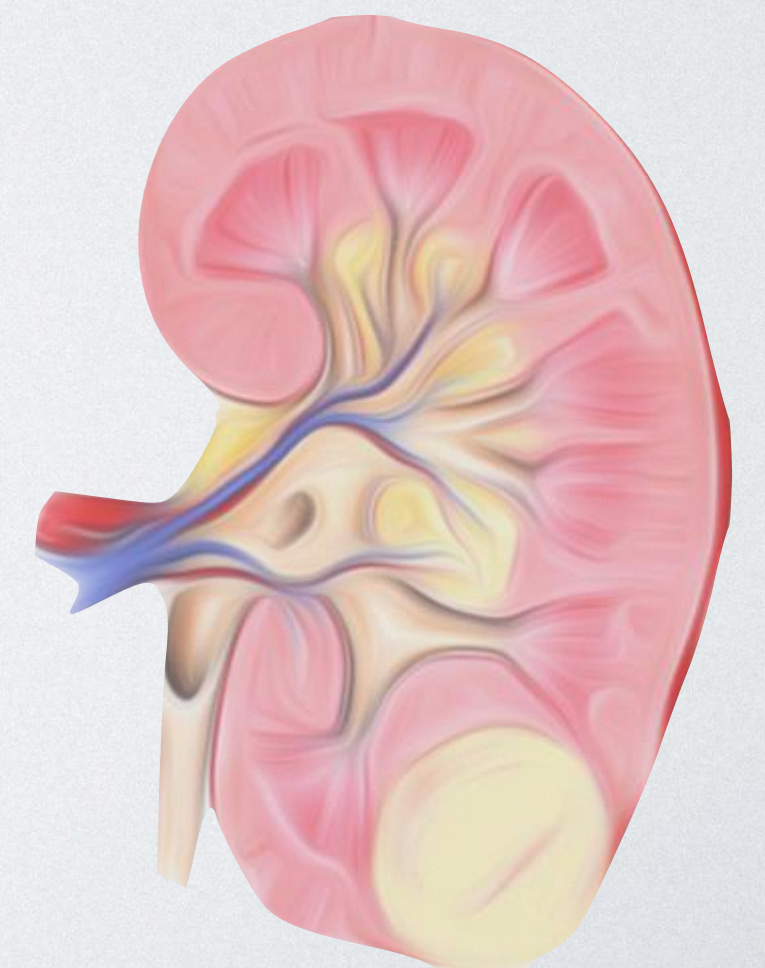


# SRS IN RENAL TUMORS

Michael Staehler, Alexander Muacevic  
Comprehensive Cancer Centre LMU, Cyberknife Center Munich





# PROBLEM

- Patients often too old and non-surgical candidates
- Conventional RT not effective
- Ablational methods inferior to surgery

## Patient selection for ablative techniques<sup>2</sup>

Small cortical tumours and age >70 years

High surgical risk

Solitary kidney

Compromised renal function

Hereditary RCC or multiple bilateral tumours

1. NCCN Clinical Practice Guidelines in Oncology. Kidney Cancer. v.2.2016.

2. Ljungberg B et al. EAU Guidelines on Renal Cell Carcinoma. 2016.

<https://uroweb.org/guideline/renal-cell-carcinoma/>

Accessed on 22 March, 2016.

3. Escudier B et al. *Ann Oncol*. 2014;25(suppl 3):iii49-iii56.

4. Schiavina R et al. *Clin Genitourin Cancer*. 2015;13(2):e87-92.

5. De Meerleer G et al. *Lancet Oncol*. 2014;15(4):e170-e177



# SOLUTION?



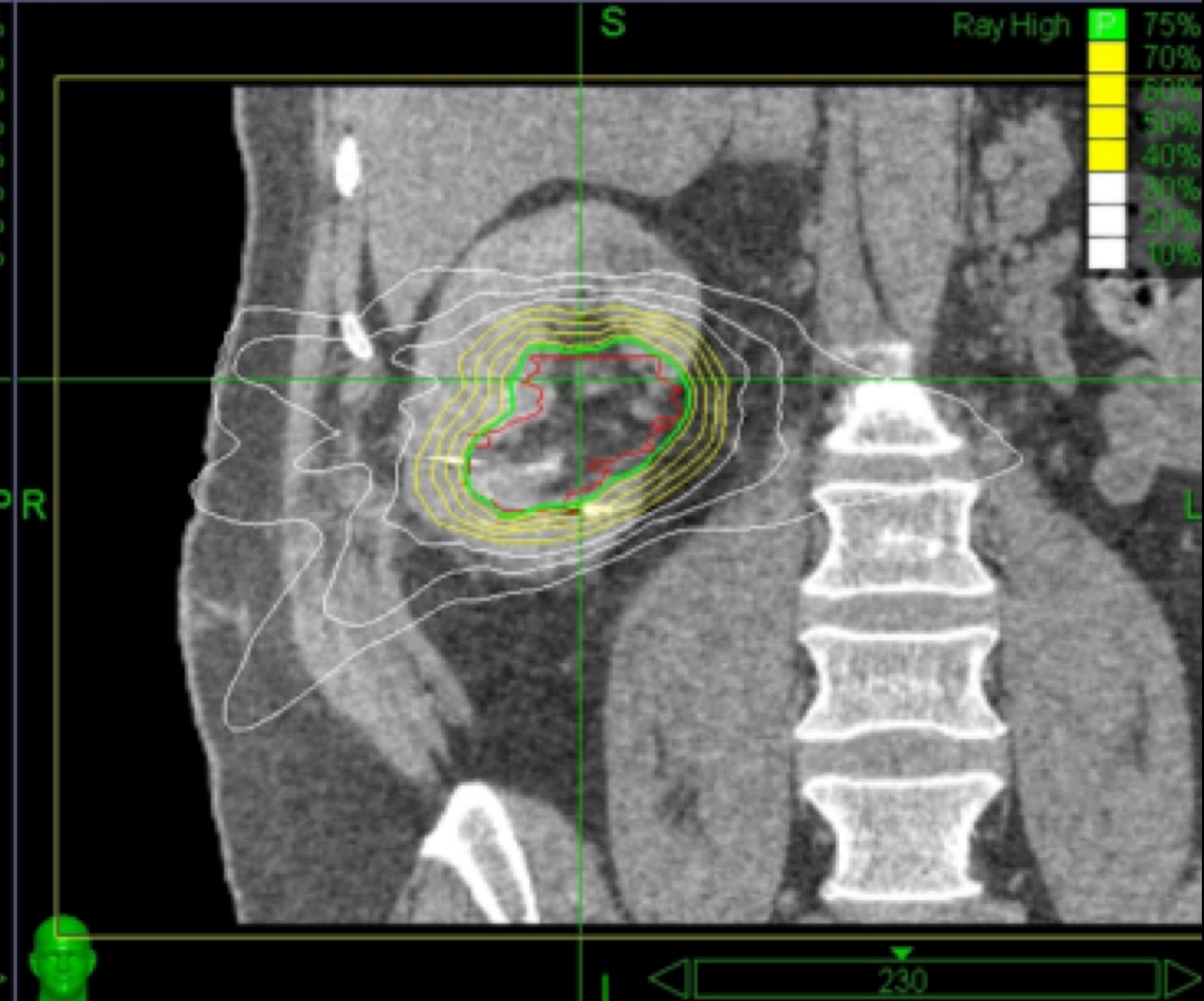
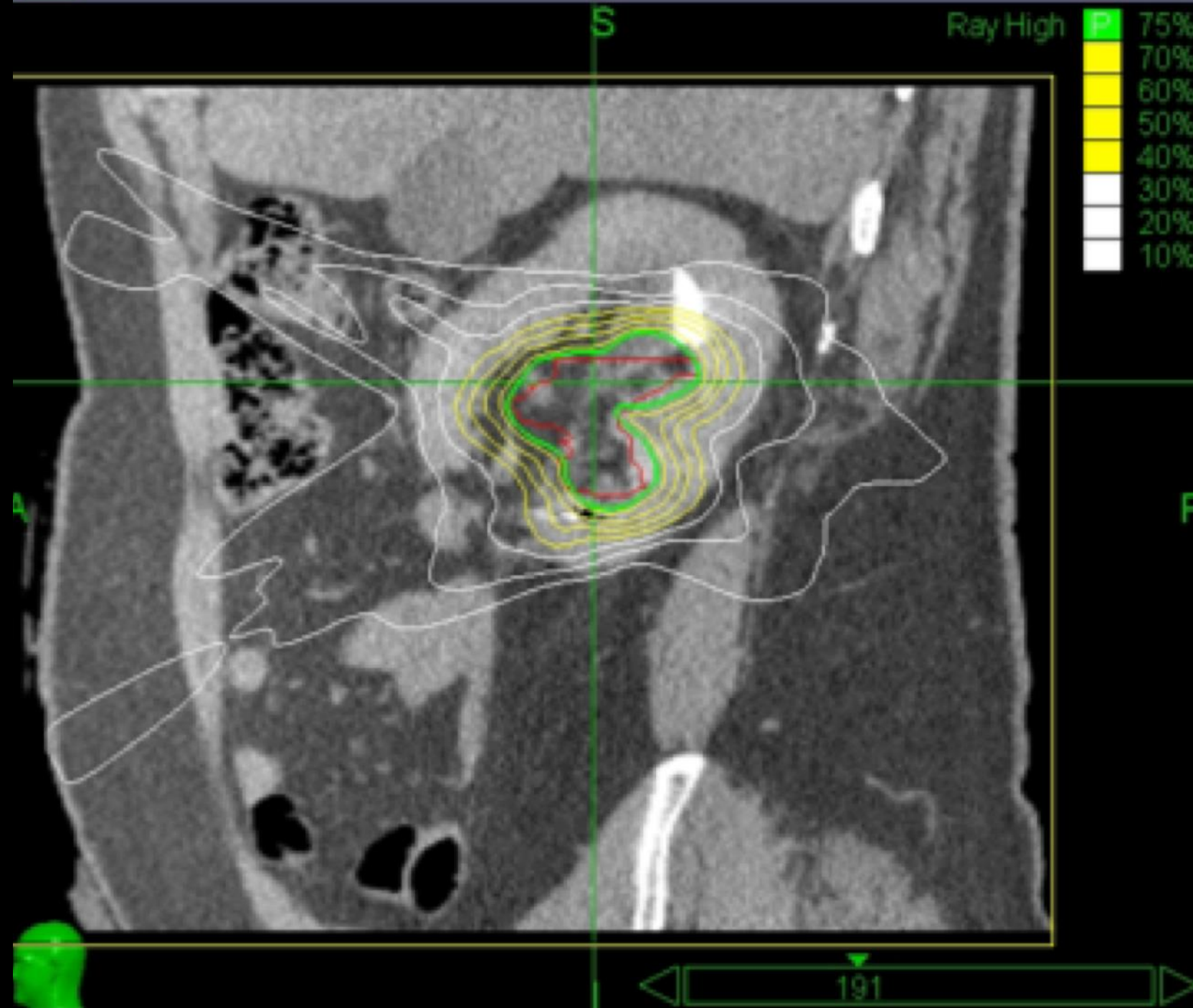
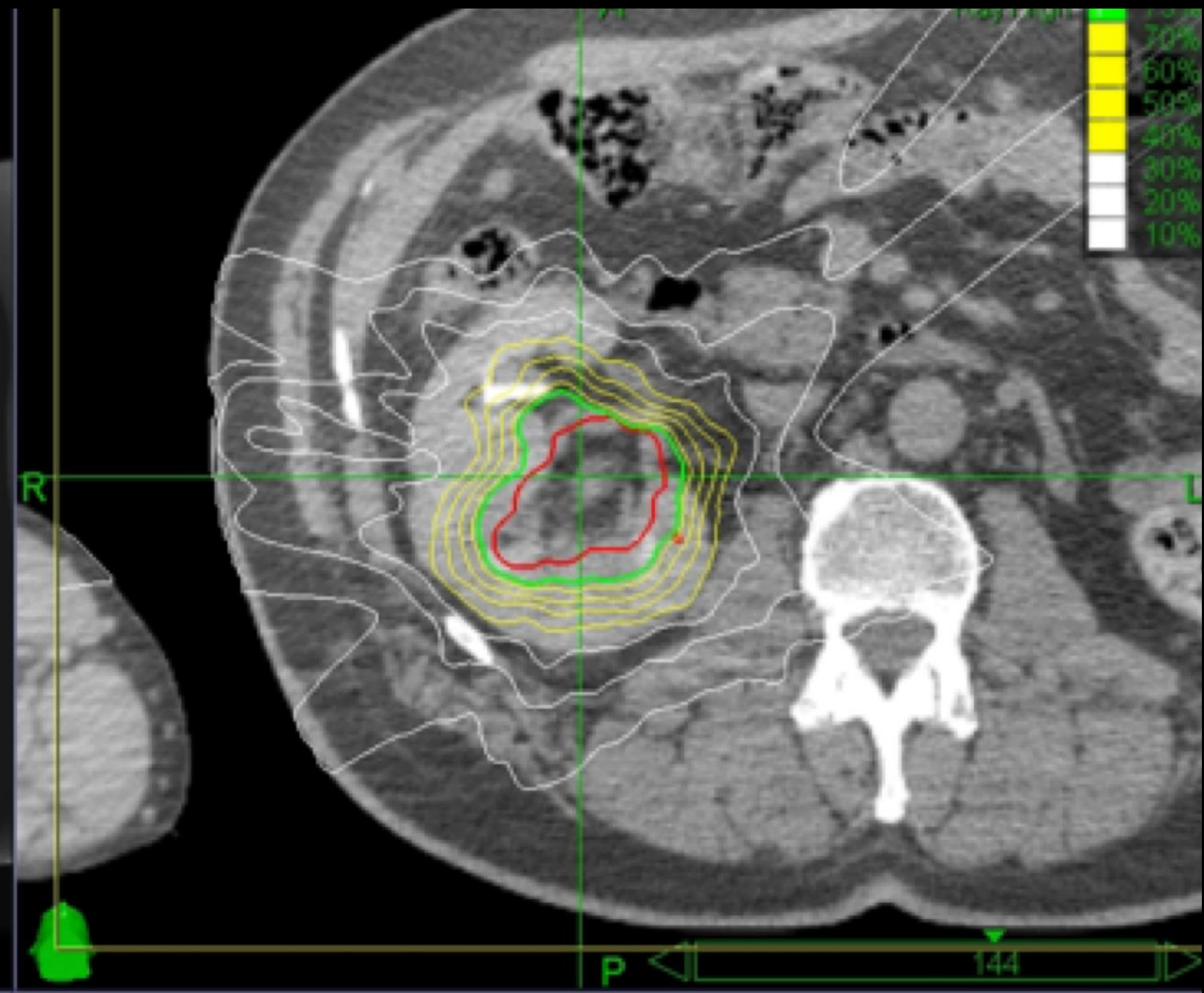
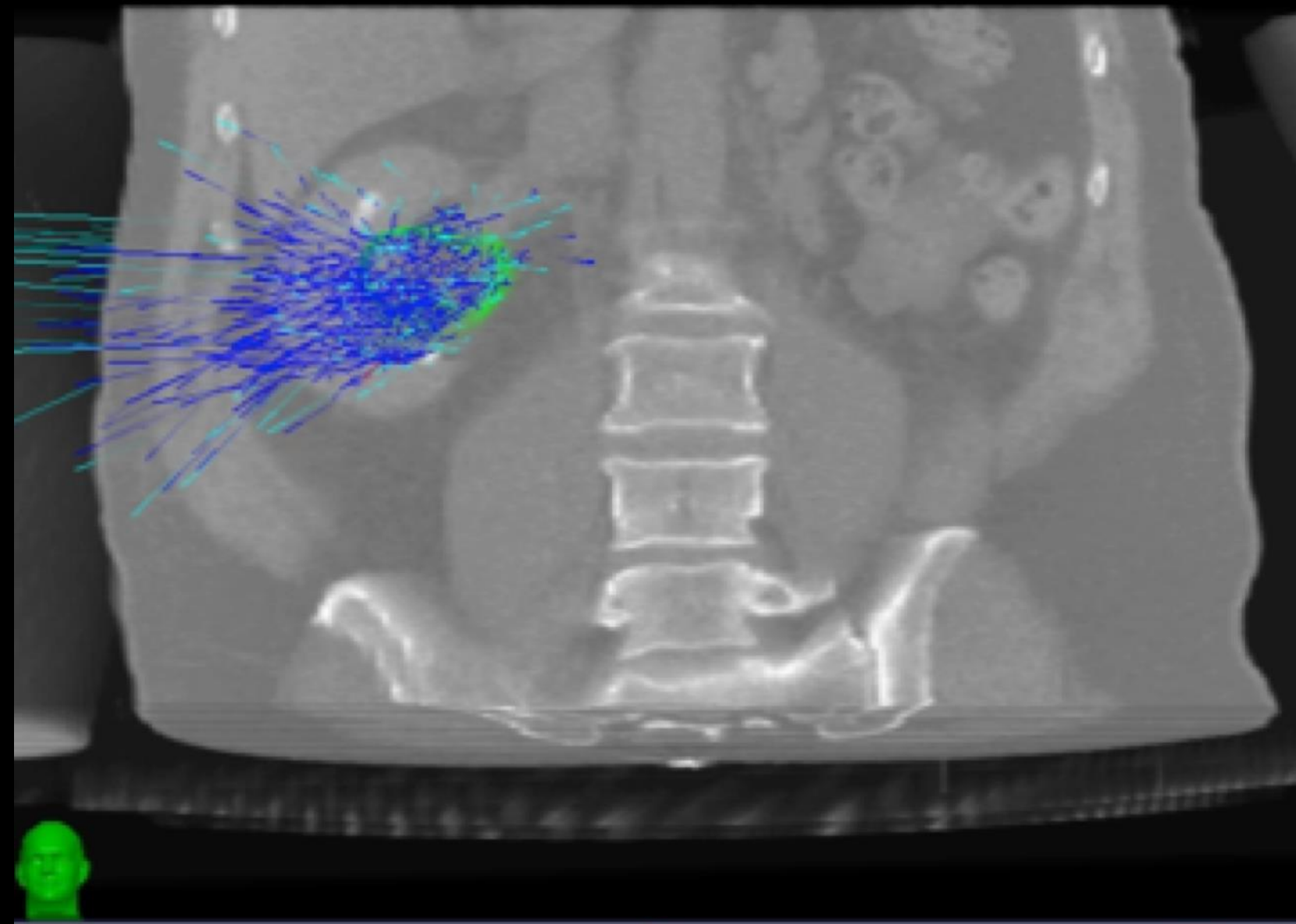


2 different entities

- UTUC
- RCC



# Planing





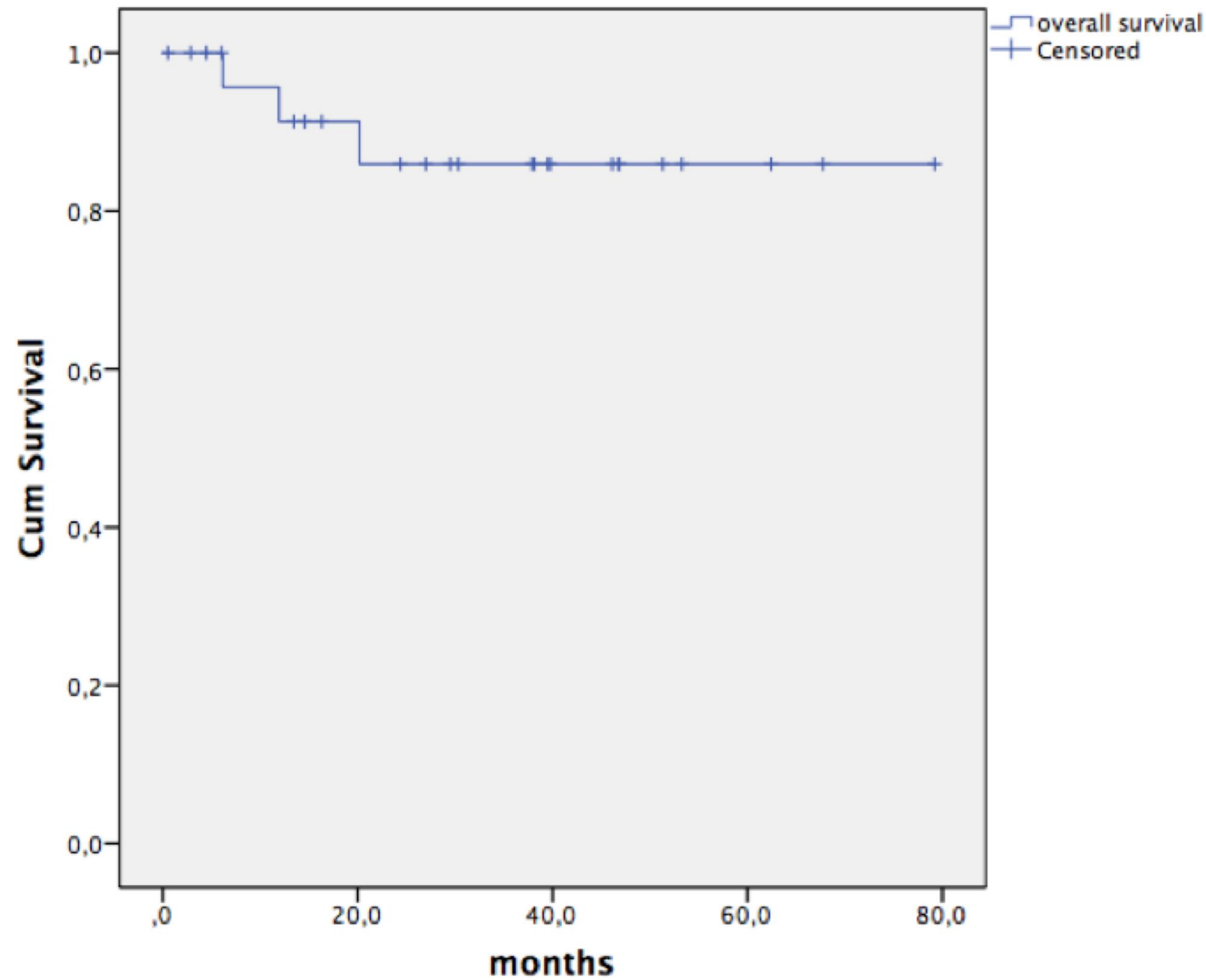
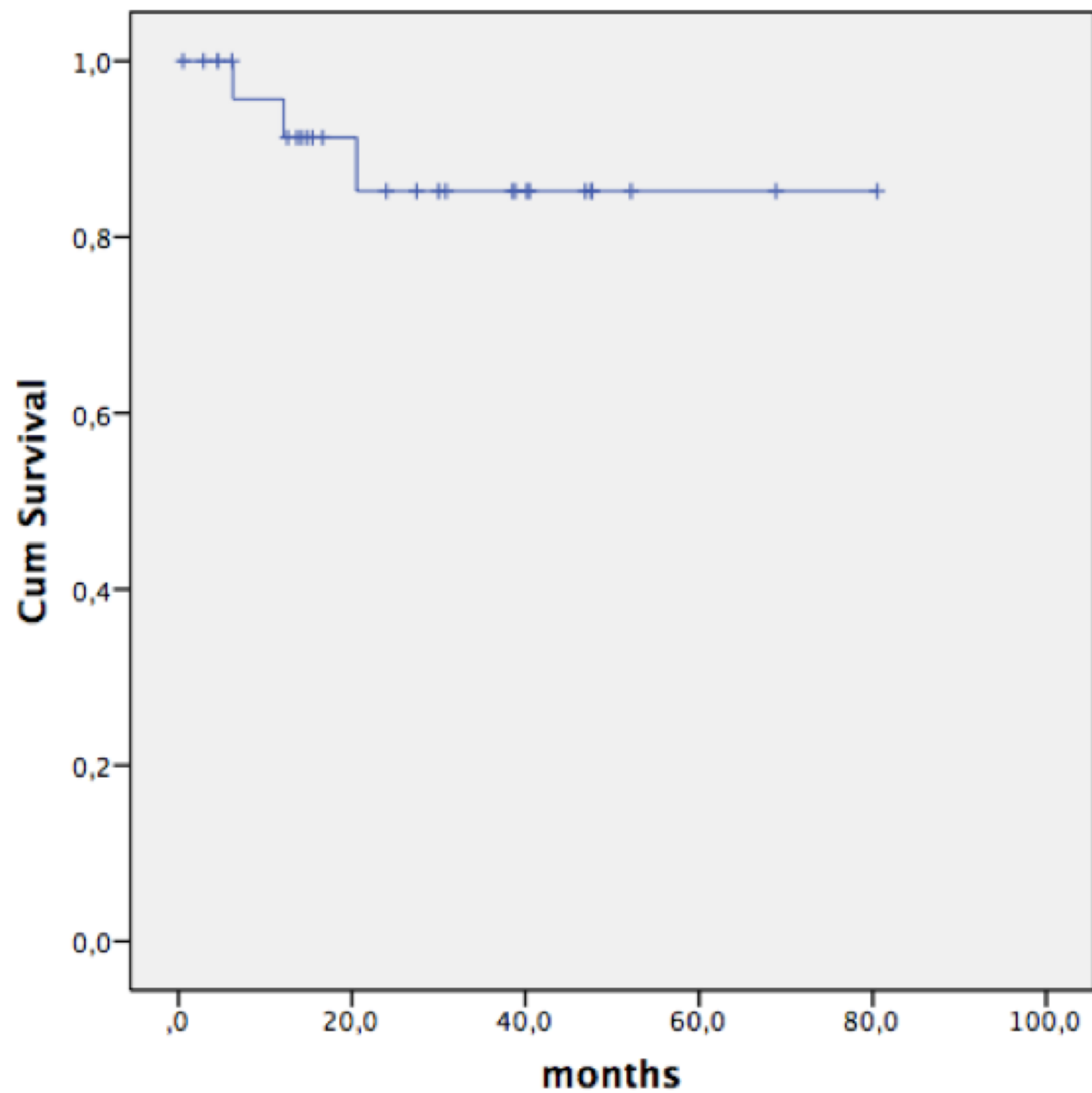
# UTUC Patients

- n=27 UTUC, singular Kidneys
- Median Age 66.2 years (47.8 - 87.4)
- ECOG 0 or 1 and life expectancy > 1 year
- SRS using 25Gy, 1 Fraction
- No therapeutic alternatives

# Baseline Characteristics

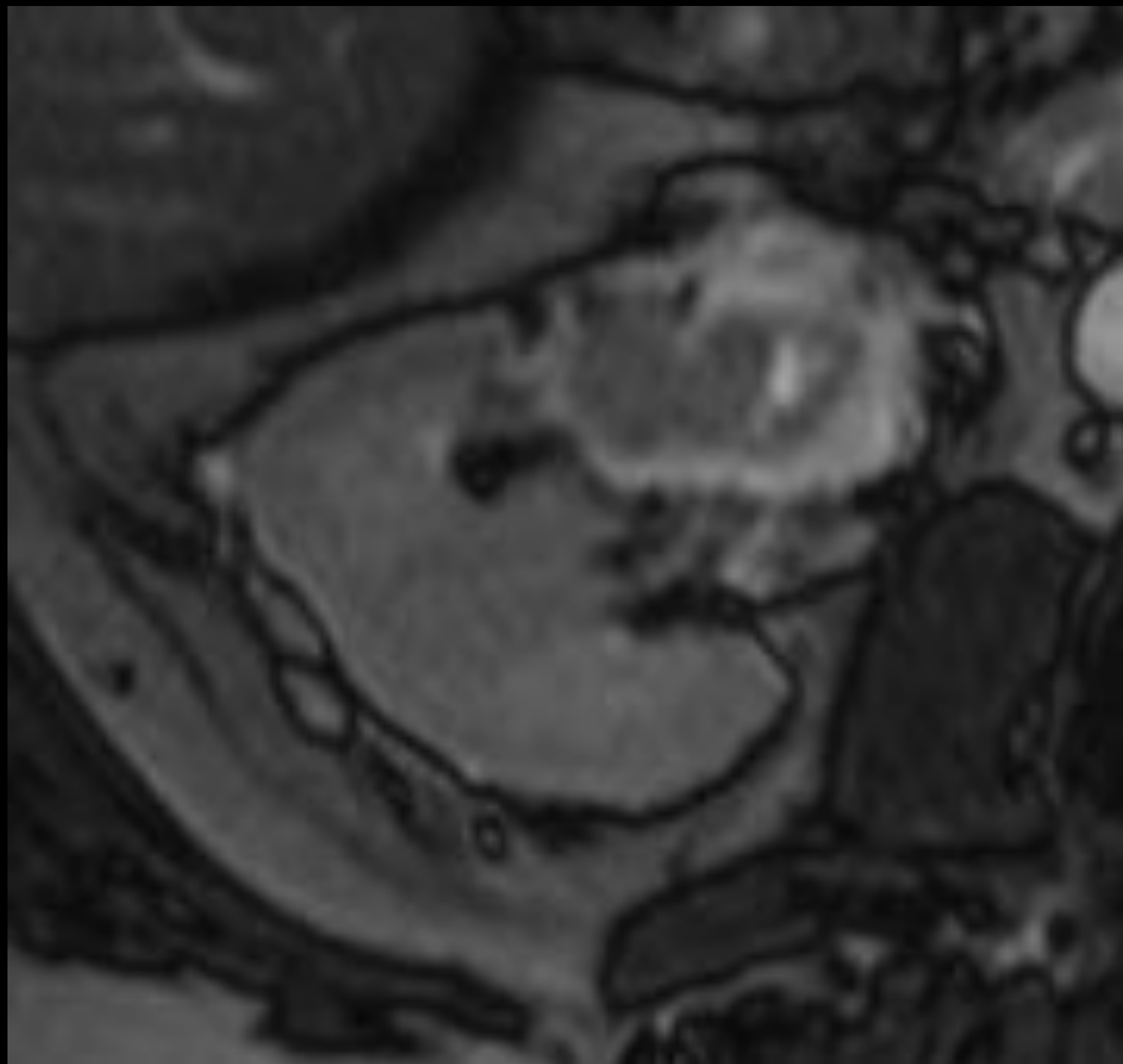
| Parameter                   | Value              |
|-----------------------------|--------------------|
| Men/Women, n                | 17/10              |
| Median Age (years)          | 66.2 (47.8 - 87.4) |
| Median time to SRS (months) | 52.1 (0 - 152.5)   |
| Histology, n(%)             |                    |
| pTa                         | 11 (41)            |
| pT1                         | 12 (44)            |
| pT2                         | 3 (11)             |
| pT3                         | 1 (4)              |
| Carcinoma in situ, n(%)     | 3 (11)             |
| High grade                  | 16 (59)            |
| Low grade                   | 11 (41)            |

# Progression Free Survival, Overall survival

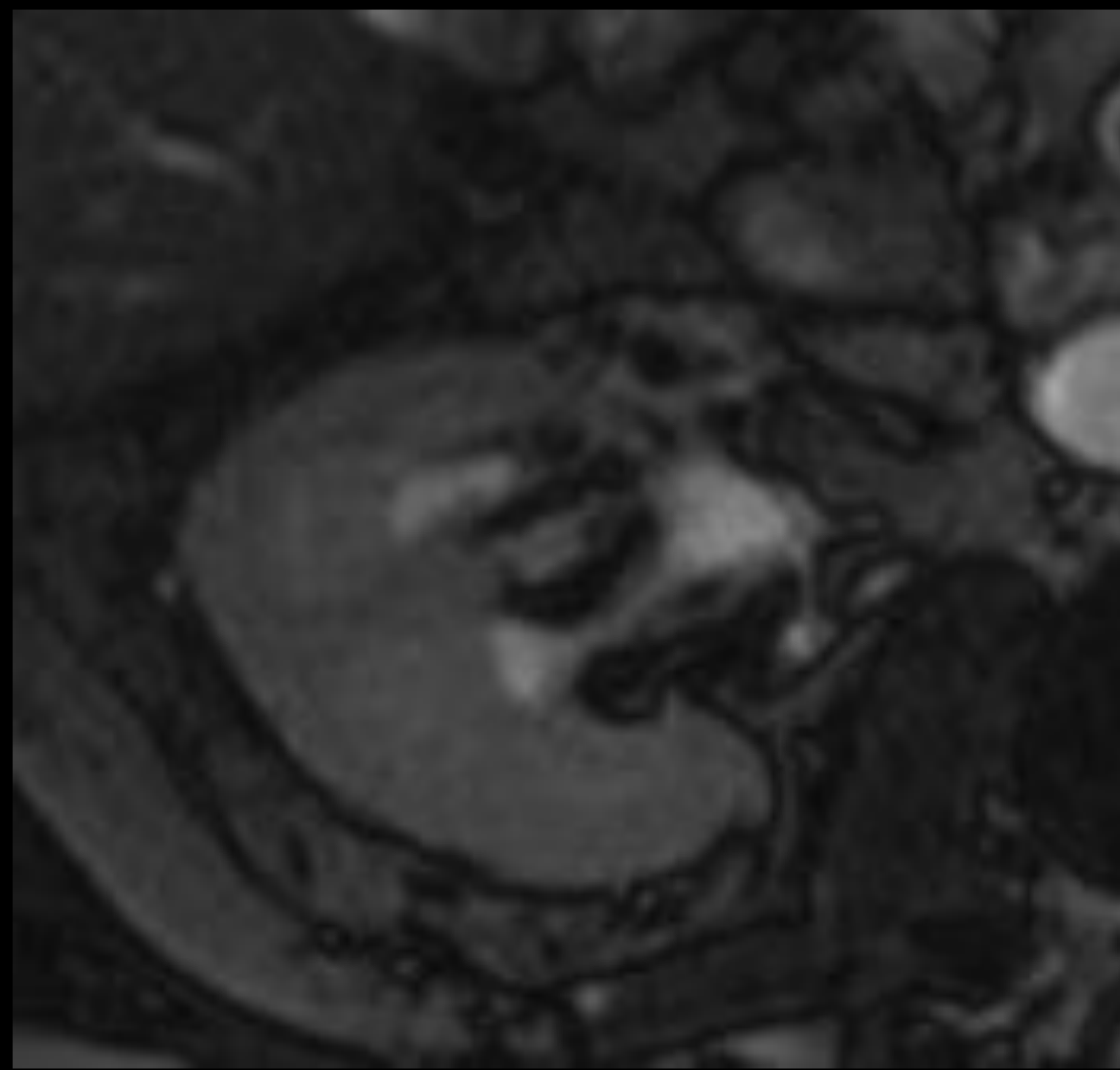




# TCC pT2 G3



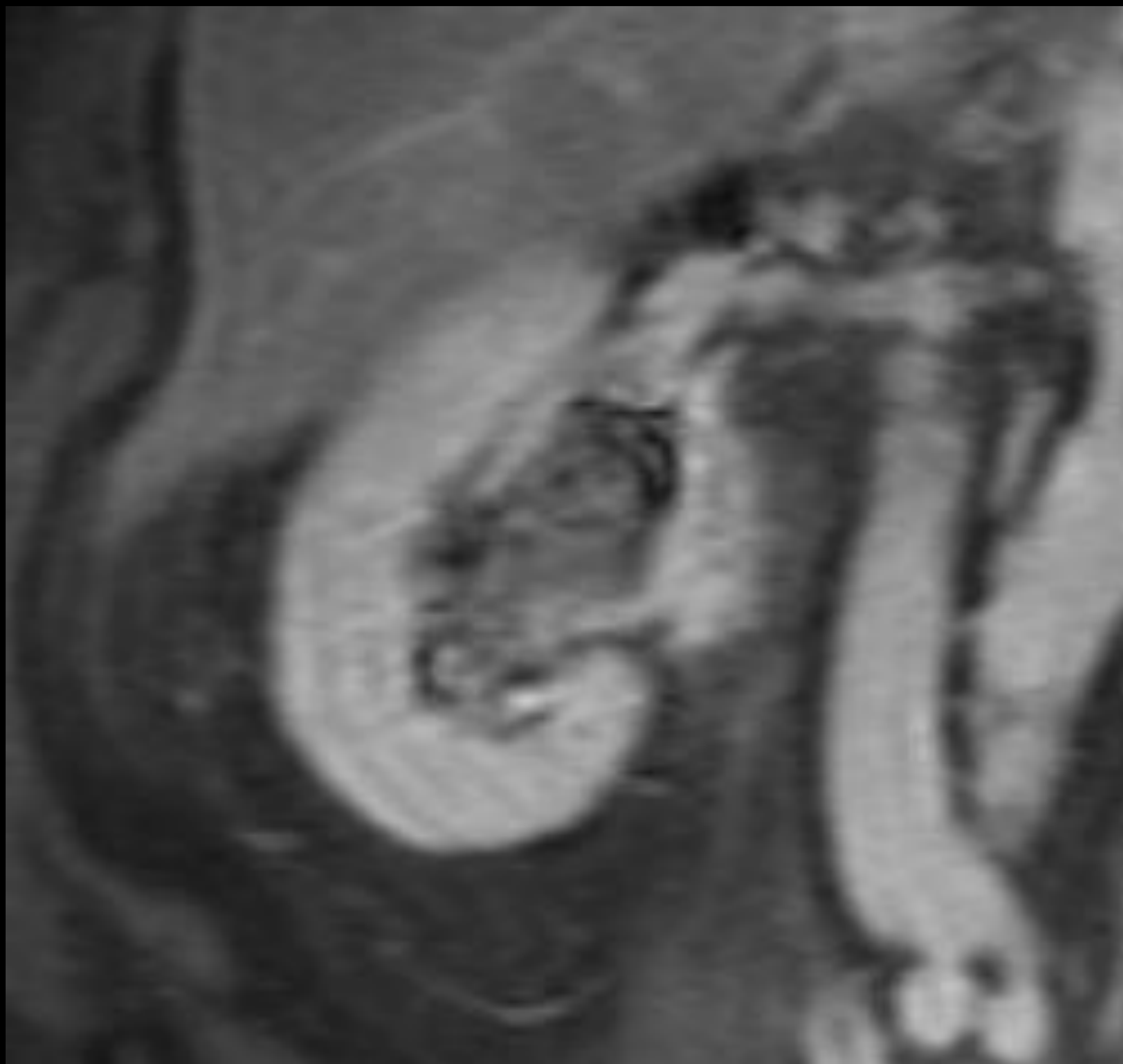
Baseline



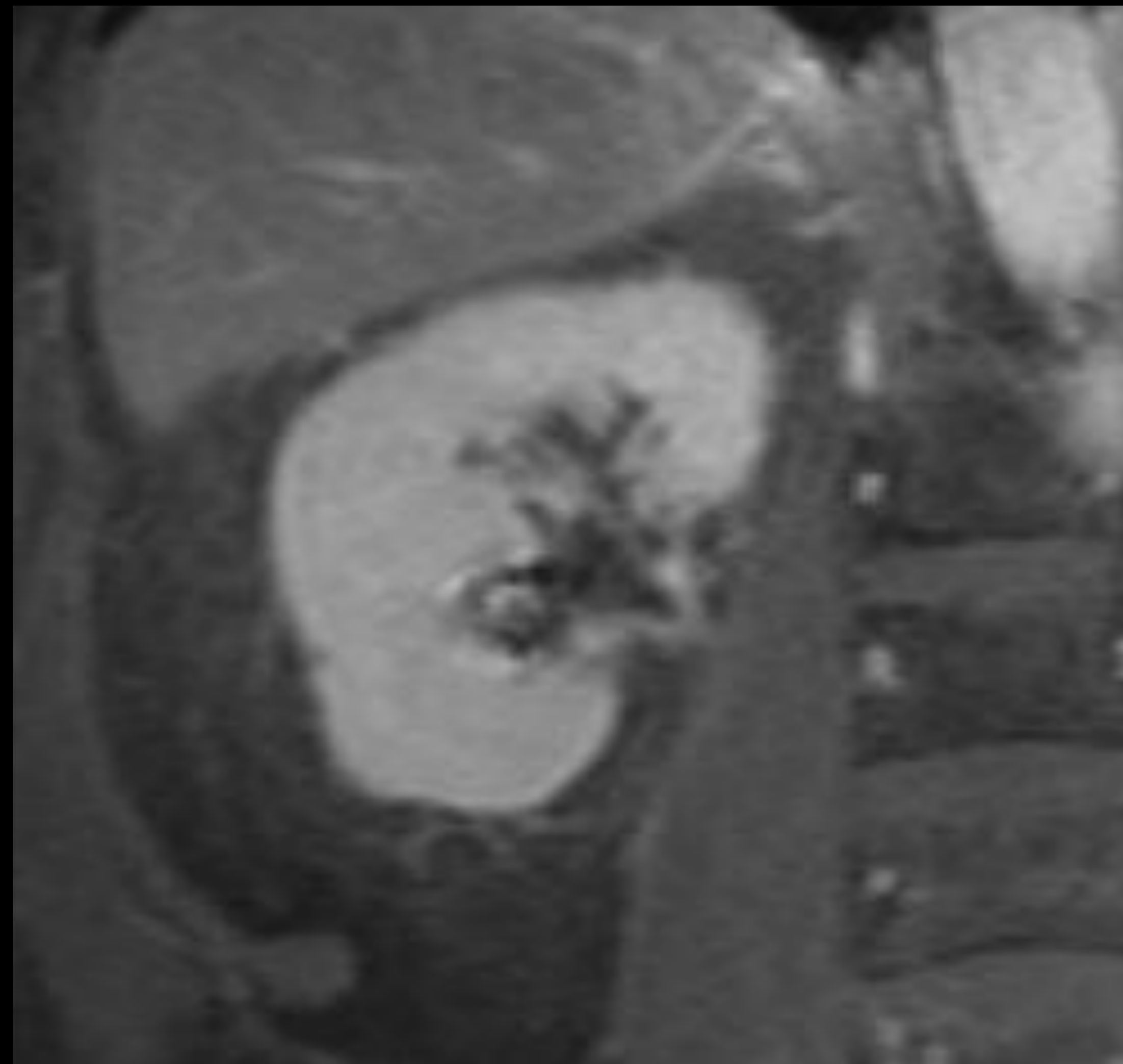
2 years post CK



TCC pT2 G3



Baseline



2 years post CK

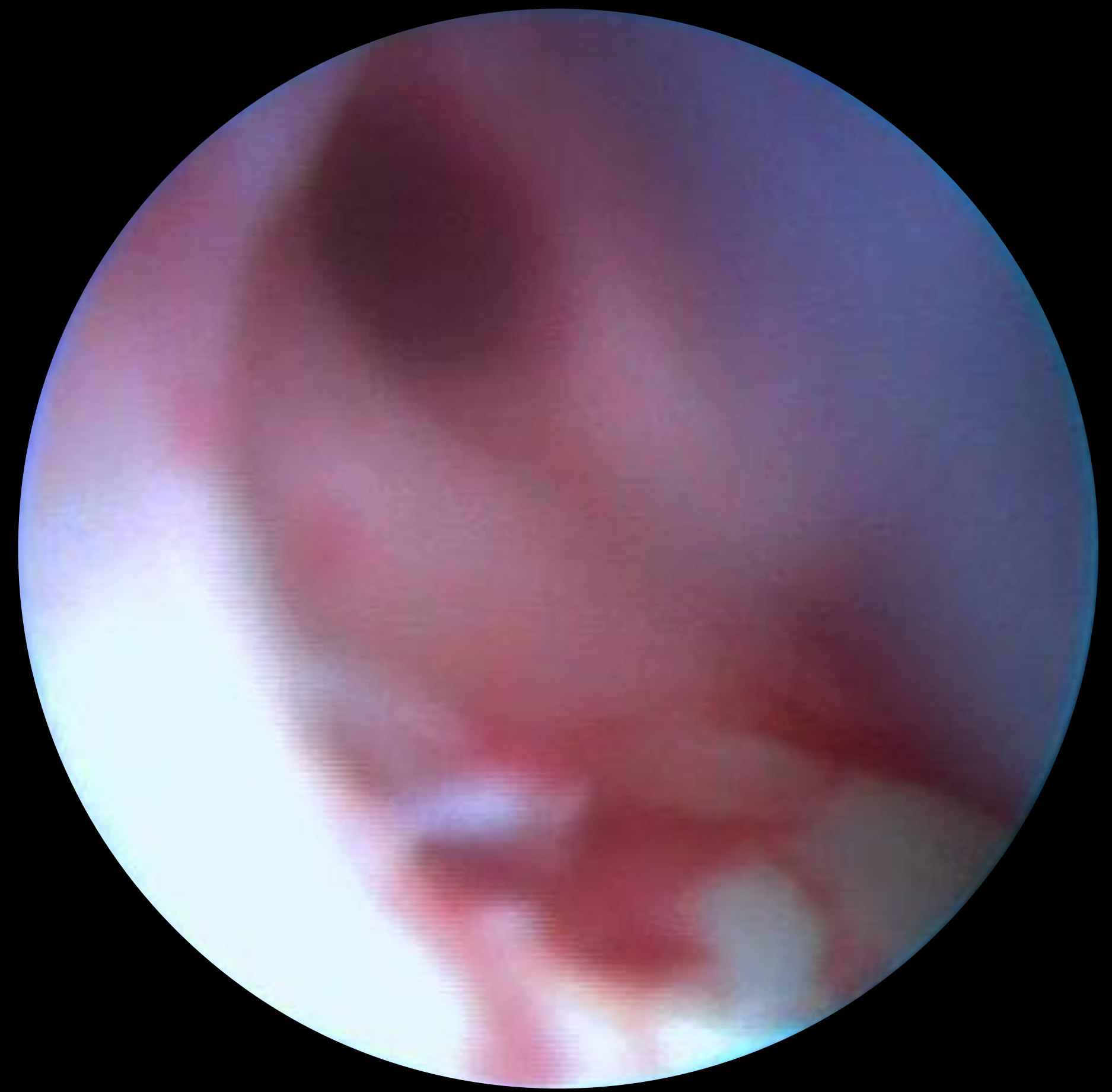








Baseline



2 months post CK



# Variations in Patient Selection and Treatment Characteristics with SRS/SBRT in Primary RCC: *International Survey of 8 Institutions*

| Patient selection                              | Institutions, % |
|------------------------------------------------|-----------------|
| Would treat patients with                      |                 |
| Pre-existing hypertension                      | 8 (100)         |
| Solitary kidney                                | 8 (100)         |
| Bilateral primary RCC                          | 5 (63)          |
| Required minimum ECOG PS 0-1 or KPS $\geq$ 70  | 6 (75)          |
| Recommend SBRT for:                            |                 |
| Medically inoperable RCC                       | 8 (100)         |
| Unsuitable for ablation                        | 8 (100)         |
| Operable RCC at risk of dialysis after surgery | 8 (100)         |

| Treatment characteristics                               | Institutions (8 total) |
|---------------------------------------------------------|------------------------|
| <b>Number of fractions, range</b>                       | 1-12                   |
| <b>Total dose, range</b>                                | 25-80 Gy               |
| <b>Treatment delivery system used, institutions (%)</b> |                        |
| Robotic                                                 | 3 (38)                 |
| Gantry-mounted LINAC                                    | 4 (50)                 |
| Carbon ion                                              | 1 (13)                 |
| <b>Response assessment, institutions (%)</b>            |                        |
| CT                                                      | 8 (100)                |
| With additional MRI                                     | 7 (88)                 |
| With additional PET-CT                                  | 1 (13)                 |
| <b>Response scored using RECIST, institutions (%)</b>   | 7 (88)                 |



# SBRT in Unresectable Primary Renal Tumours

## Prospective, Case-Control Study

### Anti-tumour response

|                | RCC<br>(30 lesions) | TCC<br>(15 lesions) |
|----------------|---------------------|---------------------|
| Best response  | N (%)               |                     |
| CR             | 6 (20)              | 13 (87)             |
| PR             | 5 (17)              | 1 (7)               |
| Minor response | 12 (40)             | 1 (7)               |
| SD             | 7 (23)              | 0                   |

<sup>a</sup> Creatinine elevated for 4 days in a patient with TCC as a result of pre-existing gross haematuria, which stopped 2 days after SRS.

CKD-EPI, chronic kidney disease epidemiology collaboration; CR, complete response; PD; progressive disease; PR, partial response; SD, stable disease; TCC, transitional cell carcinoma.

### Safety (N = 33)

- No treatment-related deaths or late complications after SRS
- Grade 1 fatigue (*n* = 3)
- Grade 1 nausea (*n* = 2)
- Grade 1 erythrodermia (*n* = 1)
- Temporarily elevated creatinine (*n* = 1)<sup>a</sup>

### Renal Function

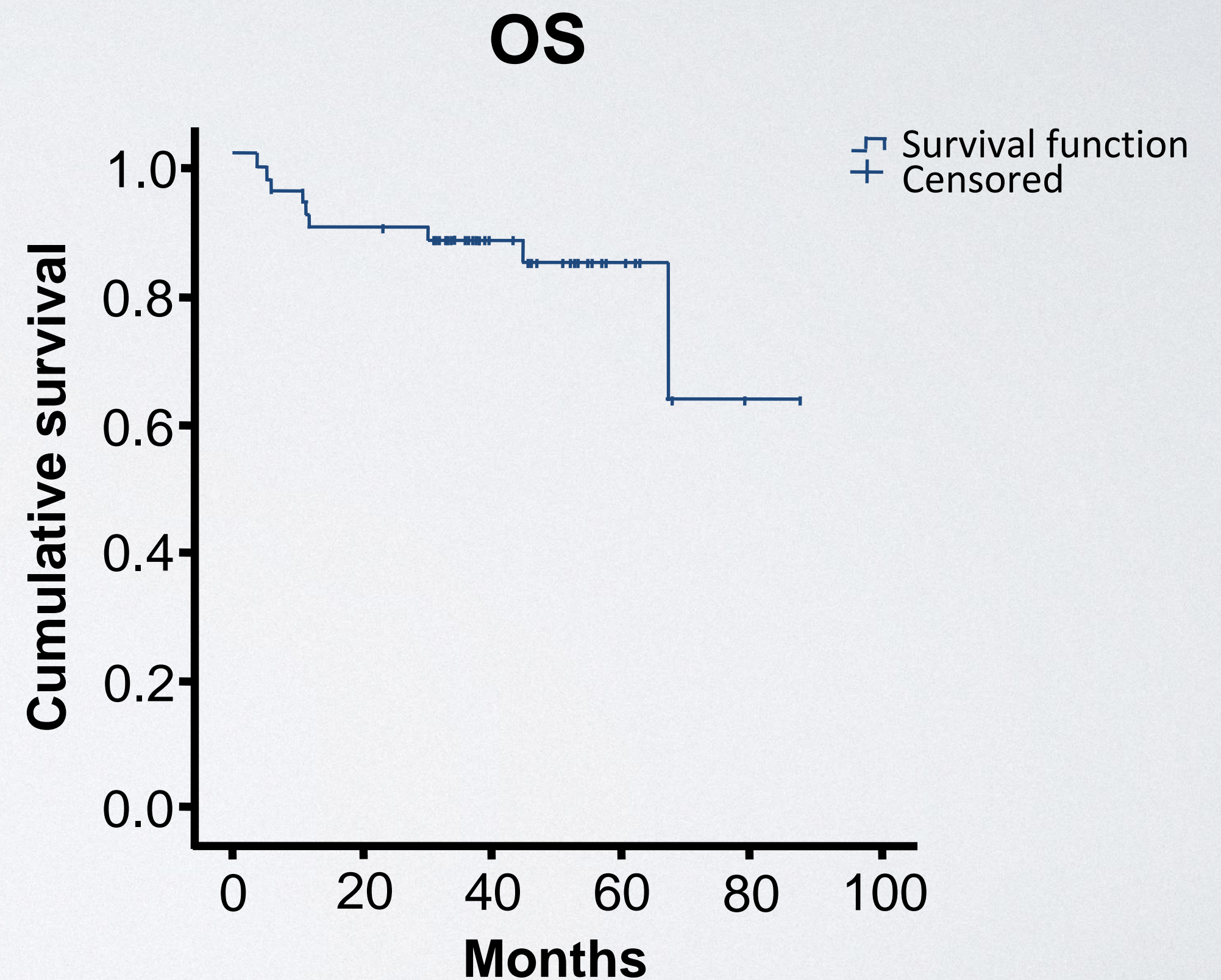
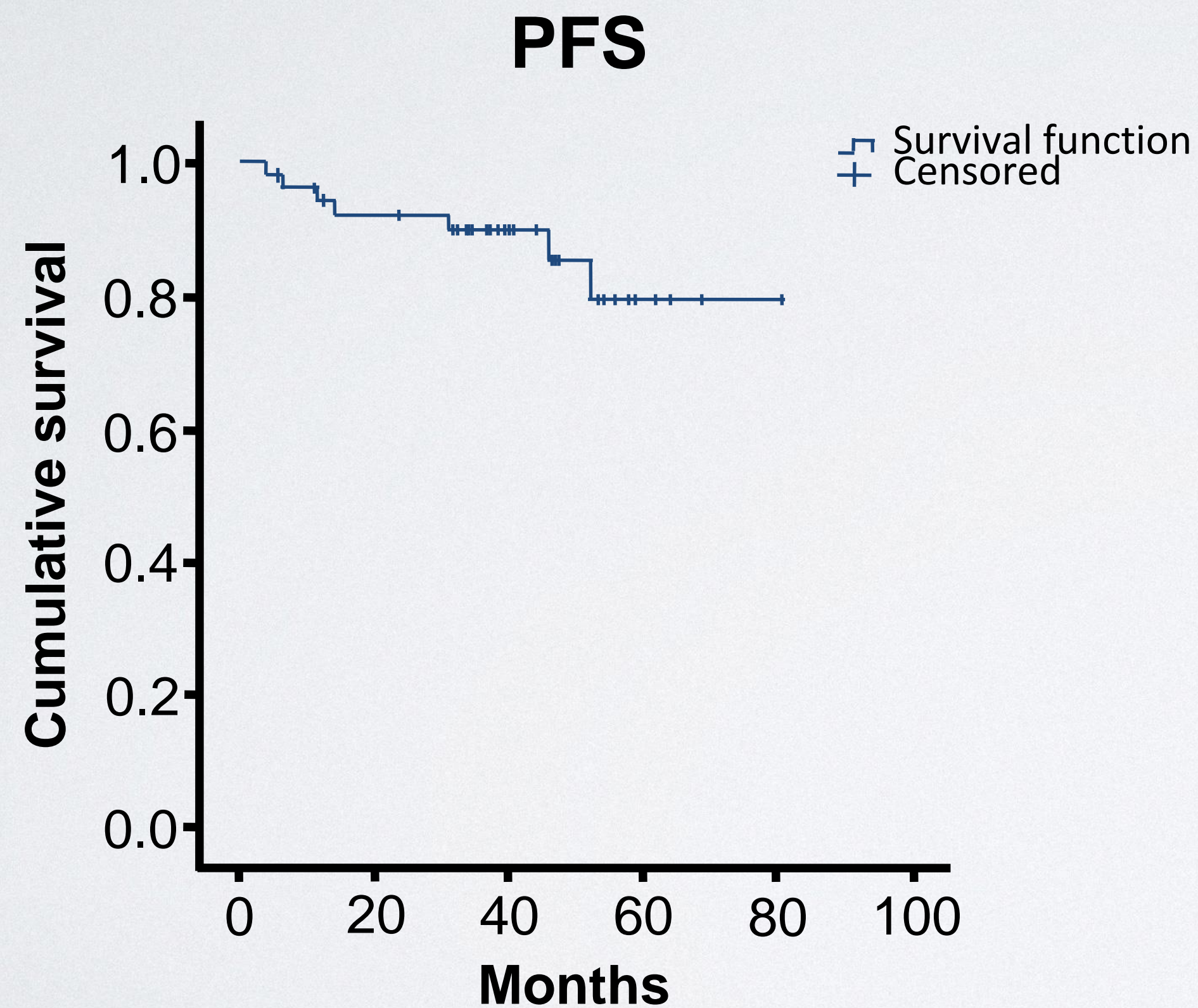
- Median CKD-EPI–defined creatinine clearance:
  - Baseline: **76.8 ml/minute/1.73 m<sup>2</sup>** (range, 25.3-126.3)
  - Follow-up: **70.3 ml/minute/1.73 m<sup>2</sup>** (range, 18.6-127.3) *P* = 0.89 for baseline vs follow-up



# SBRT in Unresectable Primary Renal Tumours

## Prospective, Case-Control Study: PFS and OS

- Median PFS and OS was not reached after 28.1 months follow-up in the overall population (30 RCC + 15 TCC lesions)





# THE INTERNATIONAL RADIOSURGERY ONCOLOGY CONSORTIUM FOR KIDNEY

|                                                        |                                                                                                                                    |
|--------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------|
| Rohann J. M. Correa, Andrew Warner, Alexander V. Louie | Department of Radiation Oncology, London Regional Cancer Program, London, ON, Canada;                                              |
| Shankar Siva                                           | Division of Radiation Oncology & Cancer Imaging, Peter MacCallum Cancer Center, and University of Melbourne, Melbourne, Australia; |
| Michael Staehler, Alexander Muacevic                   | University of Munich Hospitals, Munich, Germany;                                                                                   |
| Lee Ponsky, Rodney J. Ellis                            | University Hospitals Seidman Cancer Center, Case Comprehensive Cancer Center, Cleveland, OH, USA;                                  |
| Irving D. Kaplan, Anand Mahadevan                      | Beth Israel Deaconess Medical Center, Boston, MA, USA;                                                                             |
| William Chu                                            | Department of Radiation Oncology, Sunnybrook Health Sciences Centre and the University of Toronto, Toronto, Ontario, Canada;       |
| Anand Swaminath                                        | Division of Radiation Oncology, Juravinski Cancer Centre, McMaster University, Hamilton, ON, Canada;                               |
| Hiroshi Onishi                                         | Department of Radiology, University of Yamanashi, Yamanashi, Japan;                                                                |
| Bin S. Teh                                             | Department of Radiation Oncology, Houston Methodist Hospital, Cancer Center and Research Institute, Houston, TX, USA;              |
| Simon S. Lo                                            | Department of Radiation Oncology, University of Washington School of Medicine, Seattle, Washington, USA                            |



# SABRT FOR PRIMARY RCC – IROCK DATA

- 223 patients, 118 single fraction / 105 multi-fraction  
SAS
- median follow-up period was 2.6 years
- mean patient age was 72 years
- Solitary kidney was present in 81/223 patients



# Results IROCK

- Local control (LC) at 2 years 97.8%
- Cancer specific survival (CSS) at 2 years 95.7%
- Progression free survival (PFS) at 2 years 77.4%
- SRS patients appear to be less likely to progress distantly or to die of cancer than SBRT patients



Siva S, Louie AV, Warner A, Muacevic A, Gandhidasan S, Ponsky L, Ellis R, Kaplan I, Mahadevan A, Chu W, Swaminath A, Onishi H, Teh B, Corre RJ, Lo SS, Staehler M. [Pooled analysis of stereotactic ablative radiotherapy for primary renal cell carcinoma: A report from the International Radiosurgery Oncology Consortium for Kidney \(IROCK\)](#). *Cancer*. 2018 Mar 1;124(5):934-942.

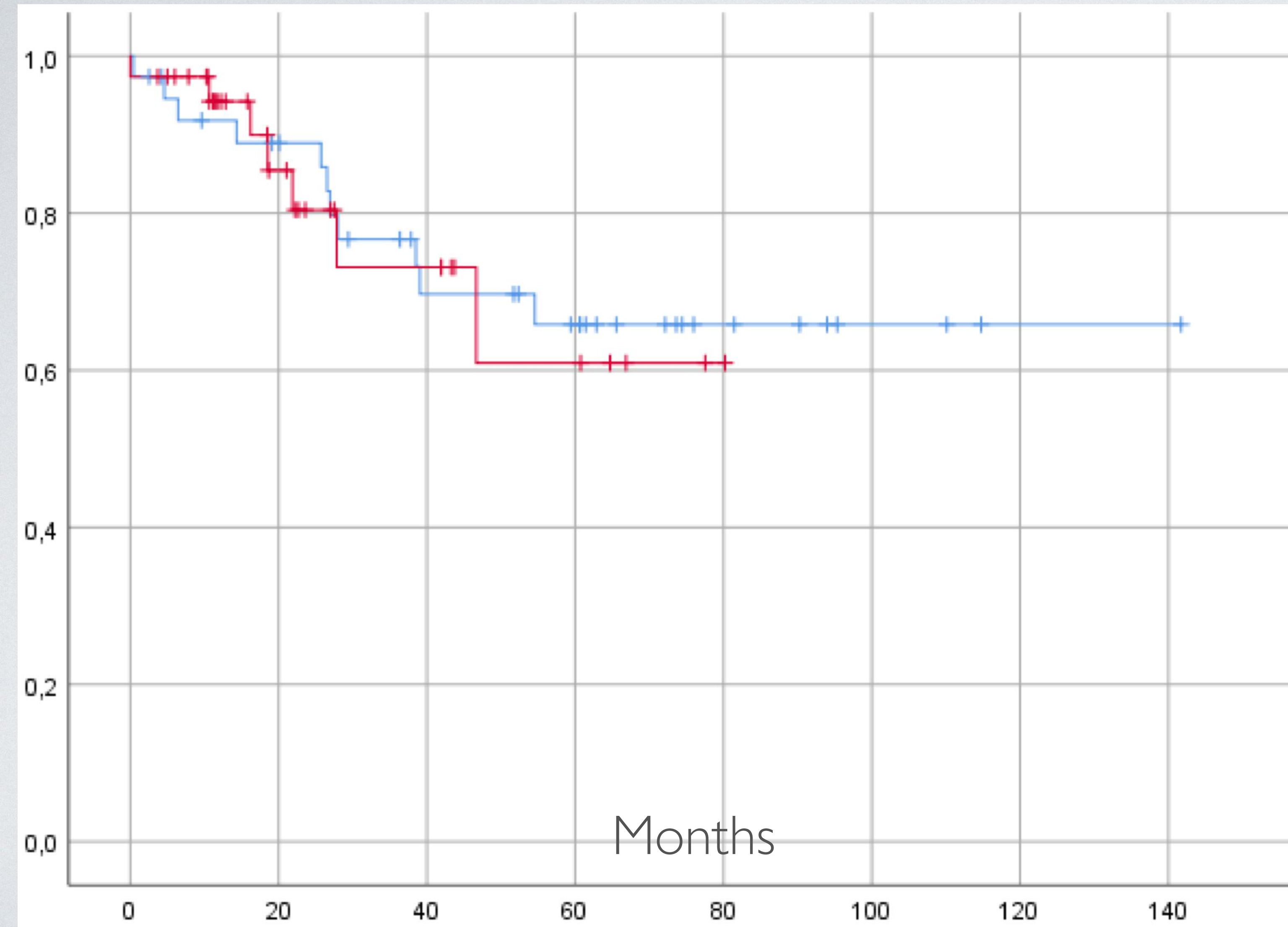


# PROPENSITY SCORE MATCHED SURVIVAL ANALYSIS pNX vs. SRS

- n=571 partial Nephrectomy and n=99 SRS
- Variables to calculate the Propensity-Score:
  - - age
  - - M0/M1
  - - ECOG 0/1
  - - Tumor-Size



# PROPENSITY SCORE MATCHED SURVIVAL ANALYSIS PNX vs. SRS



- n=35 matched pairs
- Kaplan-Mayer Logrank  
 $p = 0.880$
- univariate Cox-Regression  
Analysis:  
HR = 1.48 (95% CI 0.52 –  
4.16);  $p = 0,461$