



中国民用航空局民用航空医学中心
CHINA CIVIL AVIATION MEDICINE CENTER, CAAC



ICASM 2017

Nephrocalcinosis and Medullary Sponge Kidney in Aviation Pilots: Clinical and Aeromedical Practice

Cui Liang, Li Jing-min, W Zhou, Wang Qing, Xiong Ying, Zhu Hai-feng

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ICASM 2013

6-10 October 2013, Jerusalem, Israel



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ICASM 2013

**Retrograde Flexible Ureteroscopy for
Calyceal Calculi in Aviation Pilots
(Report of 6 cases)**

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Oct 2013



62nd International Congress of Aviation and Space Medicine
 Congrès International de Médecine Aéronautique et Spatiale
 Congreso Internacional de Medicina de Aviación y del Espacio

12 - 16 October 2014 Mexico City
 Hotel Presidente Intercontinental
www.Icasm2014.org

63rd International Congress of Aviation and Space Medicine
 20-24 September 2015 | Oxford, UK

ICASM 2015
 The sky's no longer the limit!

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ICASM 2014

CIVIL AVIATION GENERAL HOSPITAL
 民航总医院

**Clinical Practice and Aeromedical Certification
 of Civil Aviation Pilots with Renal Caliceal Calculi**

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CIVIL AVIATION MEDICINE CENTER, CAAC
 ICASM 2014

Comparison of results obtained by NHCT and FUS

Item	Renal Calculi	Calcification	Total
NHCT scan	69	14	83
FUS operation	52	31	83

➤ There is **significant difference** of two kinds of diagnostic examination methods of renal calculi ($p=0.0030$)

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ICASM 2017



**64th International Congress
of Aviation and Space Medicine**
6 - 10 November 2016 | New Delhi India



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ICASM 2016

Establishment of Aeromedical Certification System about Civil Aviation Pilots with Renal Caliceal Calculi

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Clinical Data



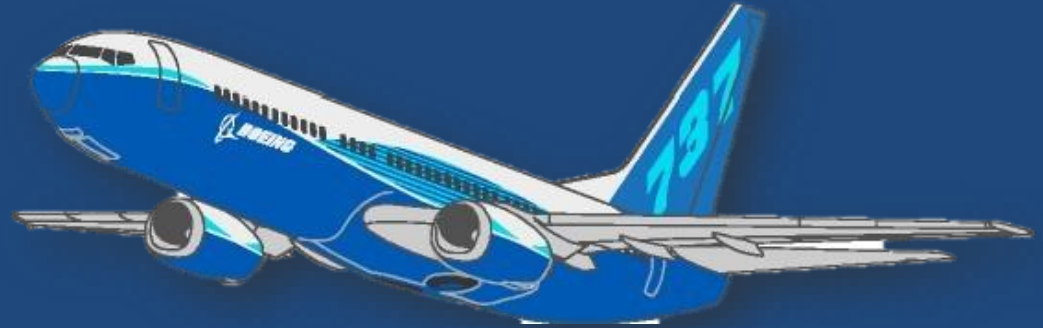
- 2013 May to 2017 May
- 126 Airline Transport Pilots, Male
- Flexible ureteroscopy check
- Two pilots: **Medullary sponge kidney** (MSK)



Example



Case 1



- Male, 27y
- Boeing 737 Co-pilot
- **Bilateral kidney Stone (US)**
- No Change after medical expulsive therapy, 4 months
- Potassium citrate: no effective



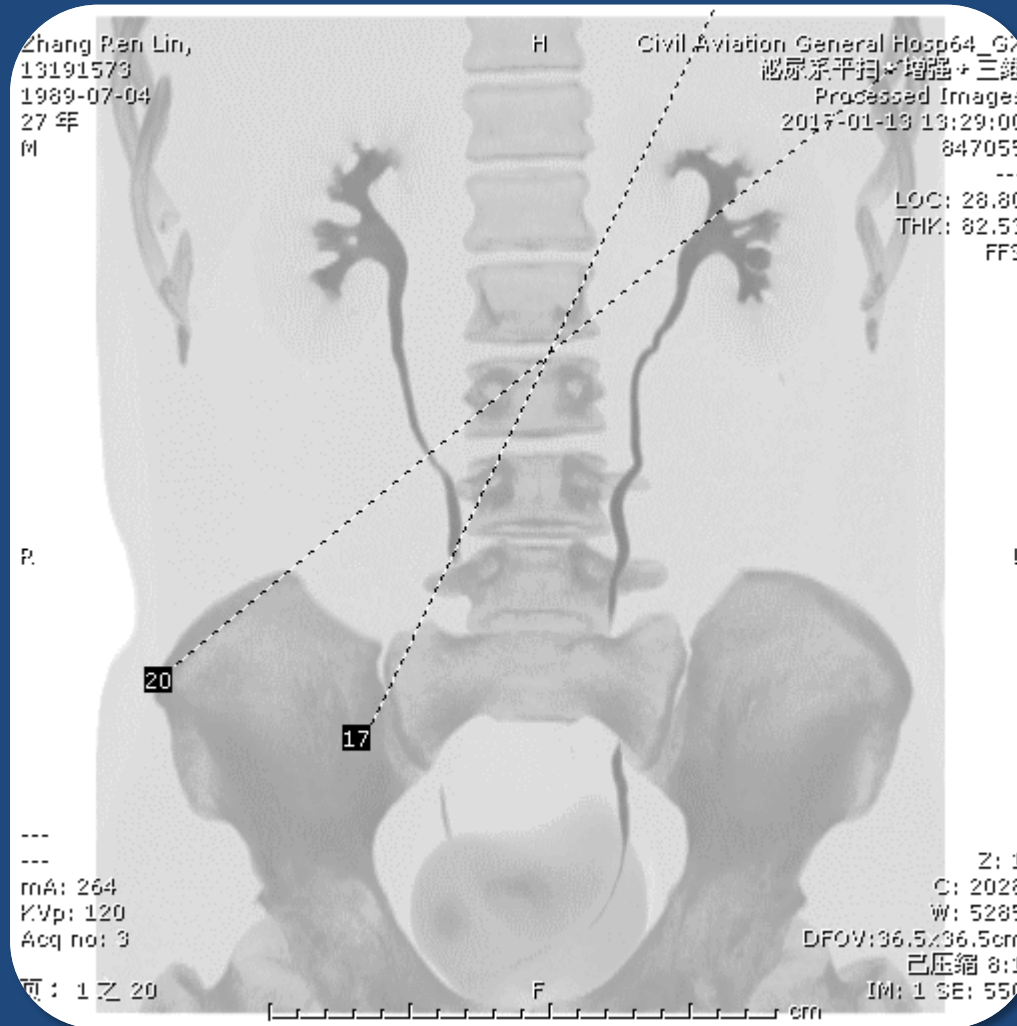
CT 1.25mm

- No symptoms
- What is it?

Renal Calculi?
Calcification?



Urinary CT & CTU/KUB





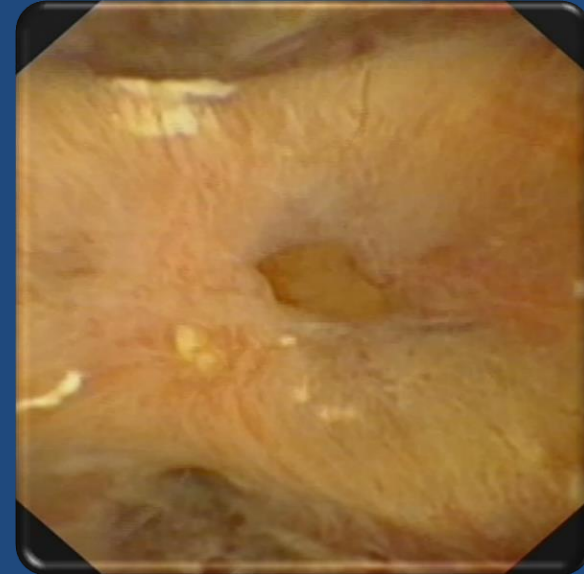
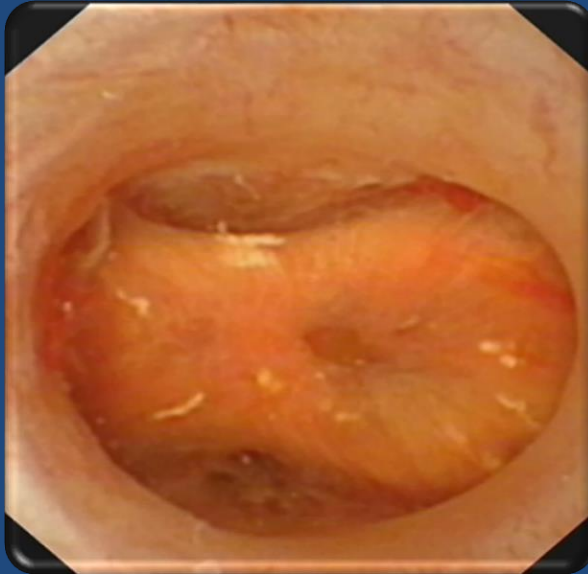
Metabolic Evaluation

Test Items	Test Result	Unit System	Reference Range	
Calcium (Ca)	2.36	mmol/L	2.11~2.52	
Uric acid (Ua)	381.31	umol/L	208~422	
Creatinine (Cr)	81.36	umol/L	57~97	

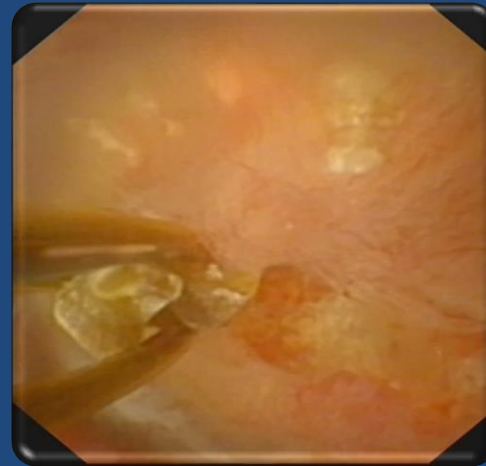
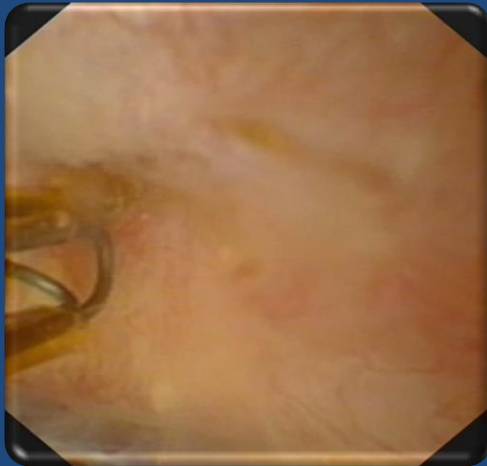
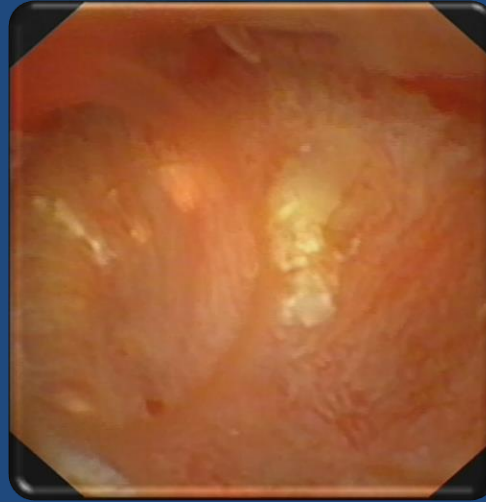
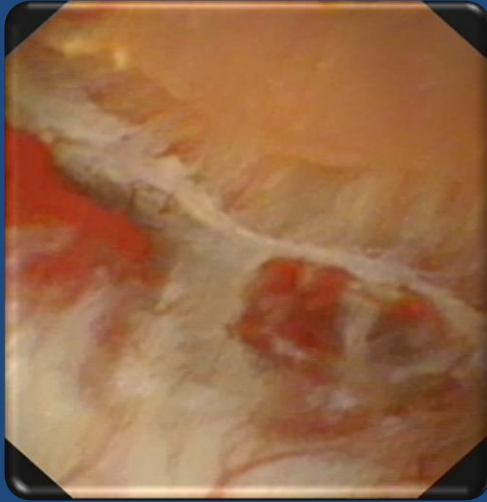


· Flexible retrograde ureterorenoscopy





- **No free stone**
- **Volcano-like papilla**



- **Submucosal stones**
- **Stone basket**
- **Mechanical expansion**



Analysis of Stone Composition

- Carbonated apatite
- Calcium oxalate monohydrate



Pre-operative



Post-operative

Diagnosis

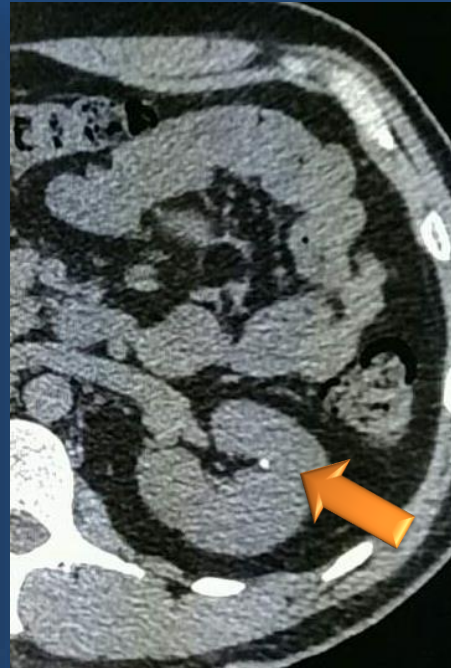
- Bilateral multiple renal calculi
- Nephrocalcinosis (Calcification)
- Medullary Sponge Kidney (MSK)



Case 2



- Male, 40y
- Airbus A320 Captain
- **Bilateral kidney Stone (US)**
- No Change after medical expulsive therapy, 10 months
- Potassium citrate: no effective



- No symptoms
- What is it?

Renal Calculi?
Calcification?



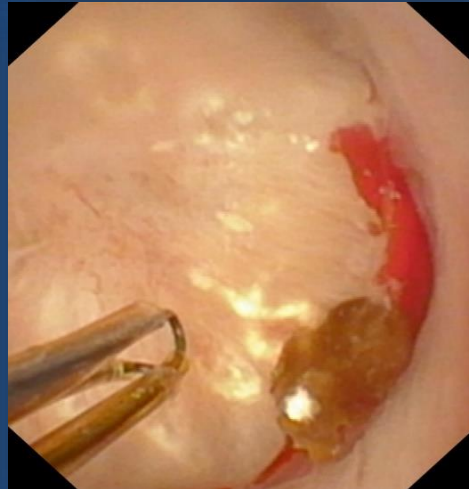
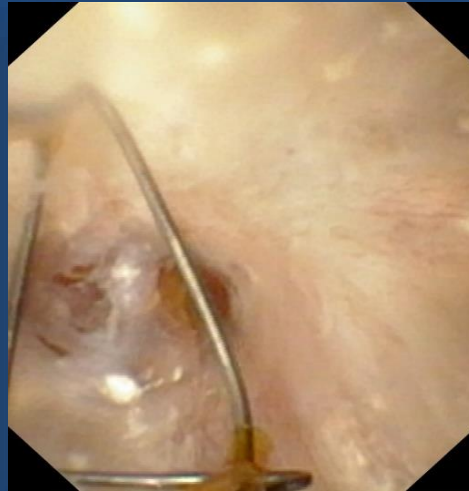
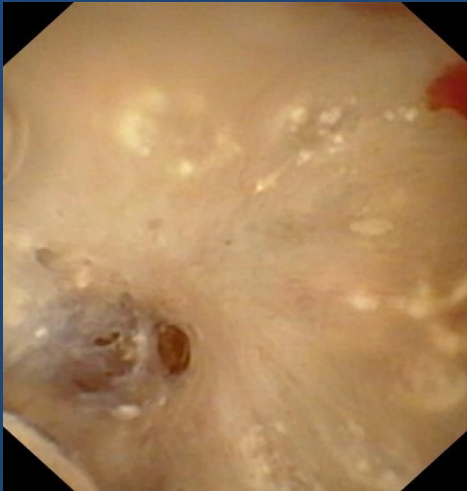
Metabolic Evaluation

Test Items	Test Result	Unit System	Reference Range	
Calcium (Ca)	2.36	mmol/L	2.11~2.52	
Uric acid (Ua)	491.59	umol/L	208~422	↑
Creatinine (Cr)	103.85	umol/L	57~97	↑
Triglycerides (TG)	1.33	mmol/L	0.56~1.7	

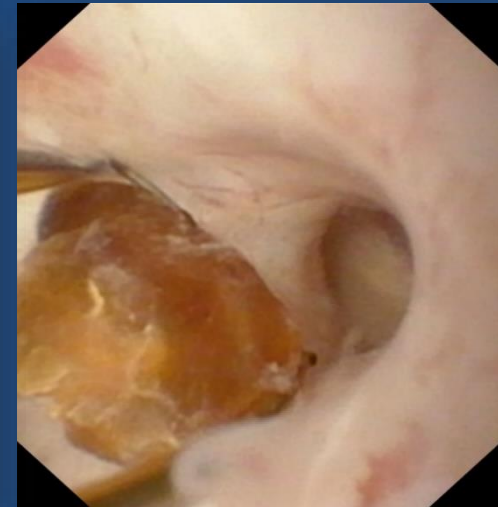
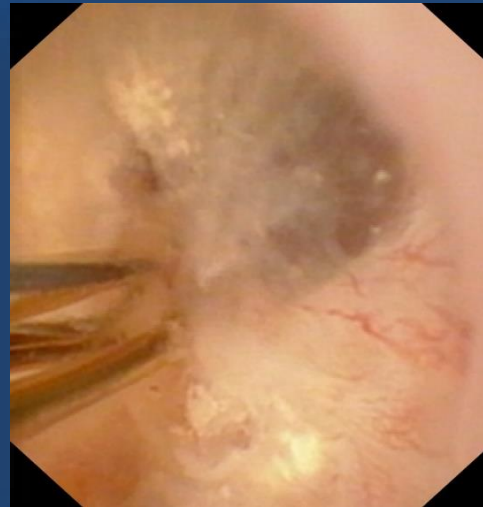
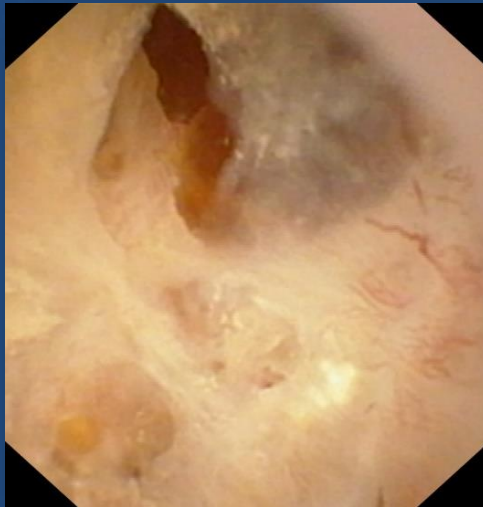


- **Flexible ureteroscopy**

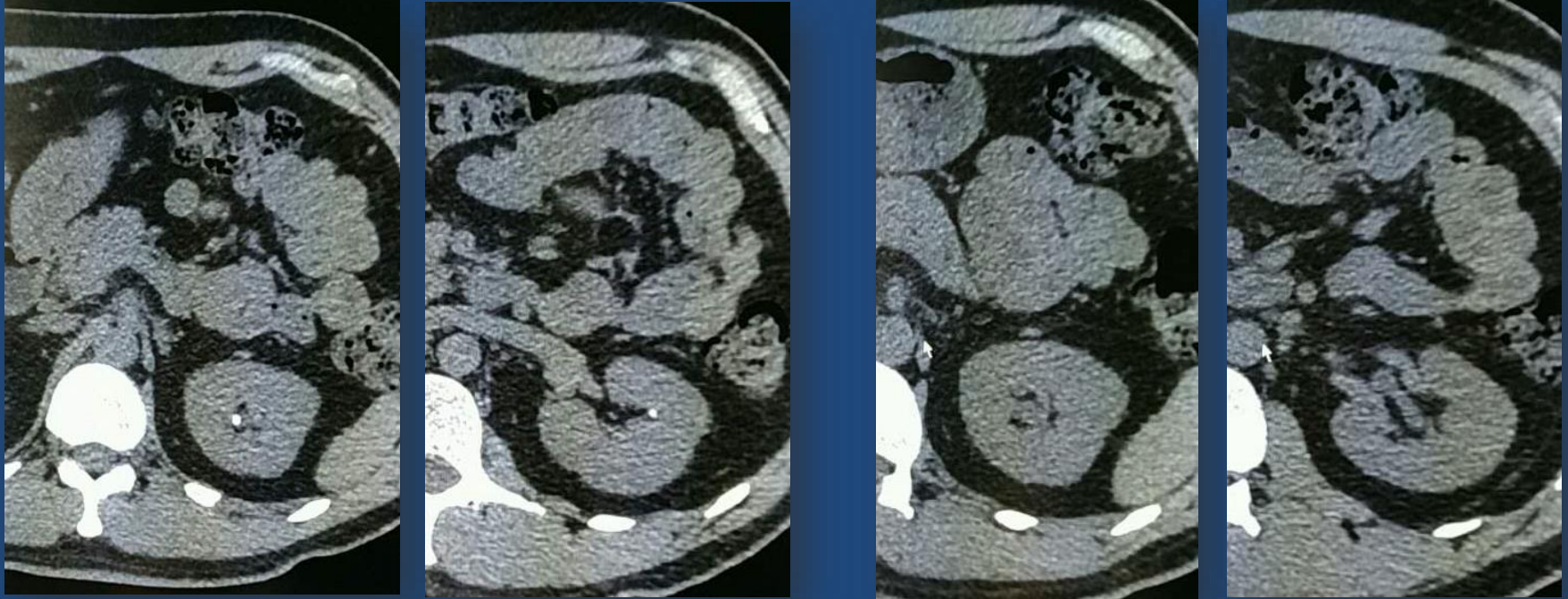




- Mechanical expansion
- Remove the stone



- Pathognomonic appearance of MSK in endoscopy



Postoperative

Diagnosis

- Bilateral multiple **renal calculi**
- **Medullary Sponge Kidney (MSK)**



Right



Left

Analysis of Stone Composition

- Calcium oxalate monohydrate



What Is MSK?



Medullary Sponge Kidney (MSK)

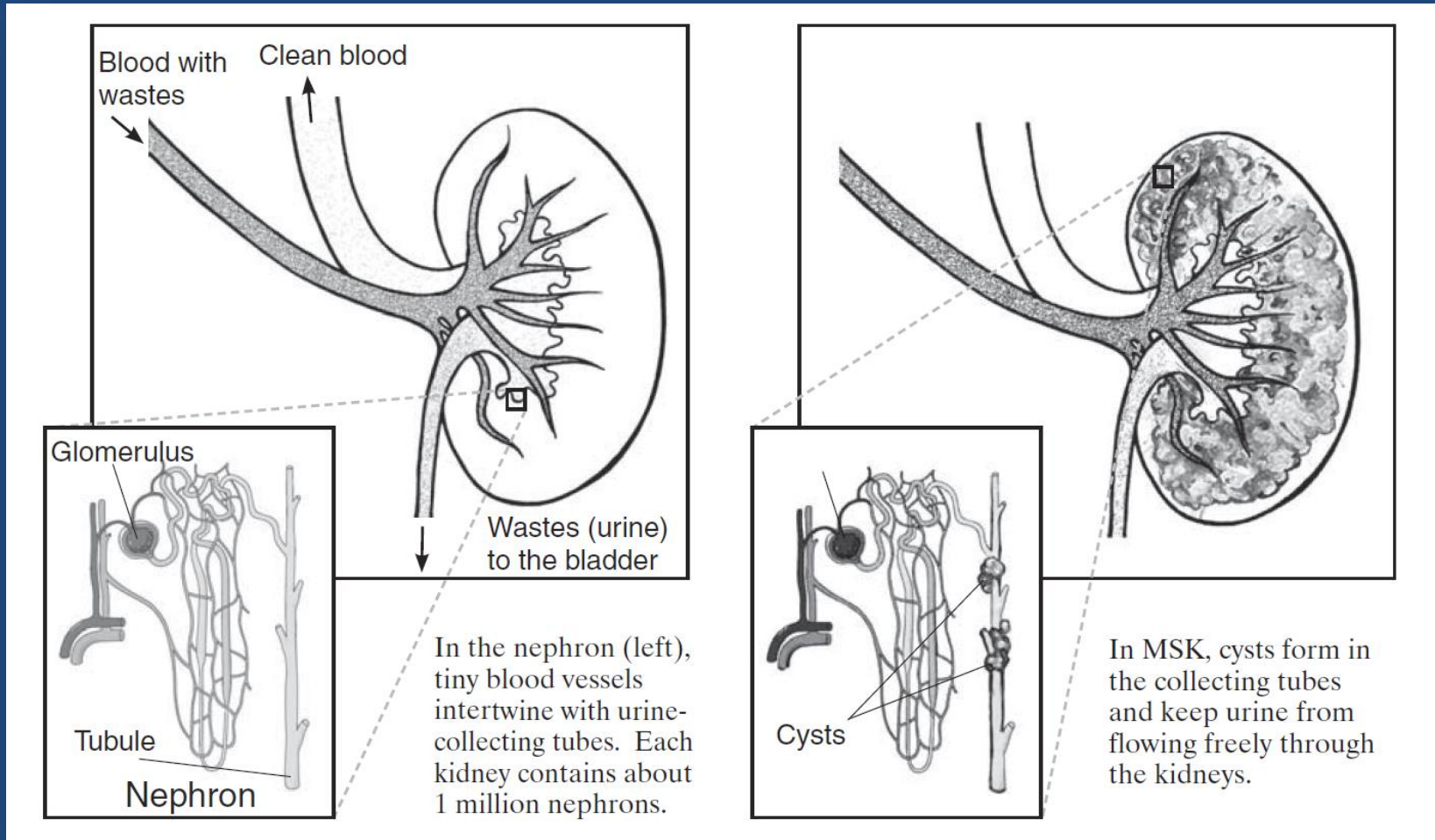
- Lenarduzzi-Cacchi-Ricci disease (1930')
- **idiopathic**
- 1:5000~20000
- Normal renal function
- Dilated distal portions of collecting ducts superficially resemble cysts:
 - **Urinary stones within the "cysts"**
 - Superimposed infection(pyelonephritis)
- Chronic back pain





The Anatomy of MSK

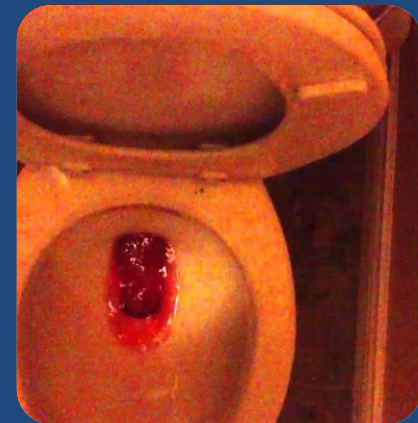






What are the signs and symptoms of MSK?

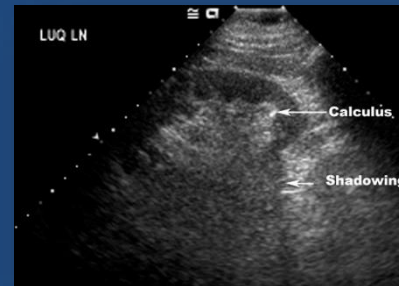
- Hematuria or blood in urine
- Kidney stones
- Urinary tract infections (UTIs)





Making the Diagnosis of MSK

- Ultrasonography is **screening method** of urinary calculi



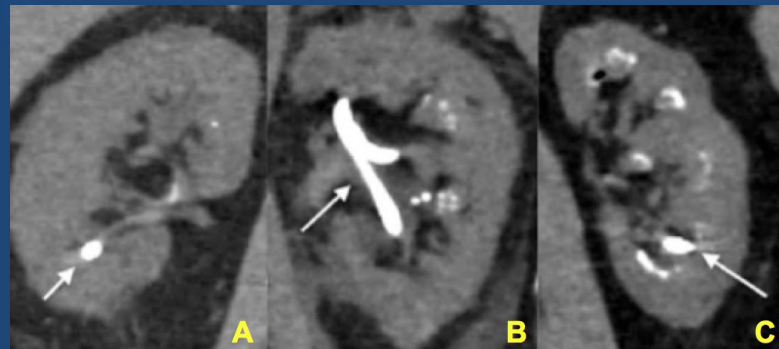
Ultrasounds are just as effective as CT scans at finding kidney stones and should be used as a first step to avoid unnecessary radiation exposure

--- 《*New England Journal of Medicine*》



Making the Diagnosis of MSK

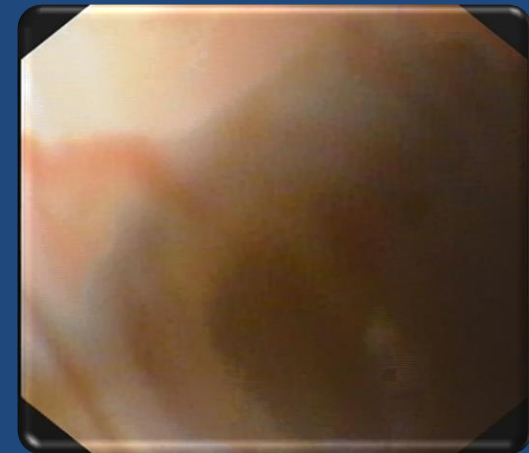
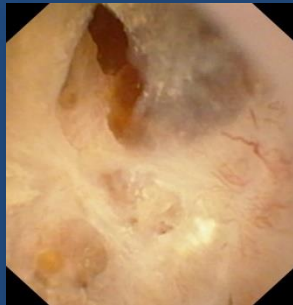
- Ultrasound
- Intravenous Urography
- CT Scans and Other Imaging

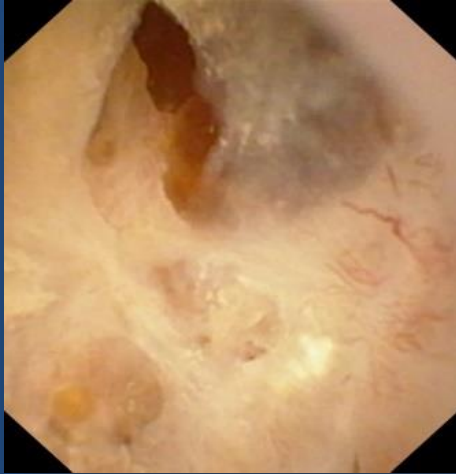




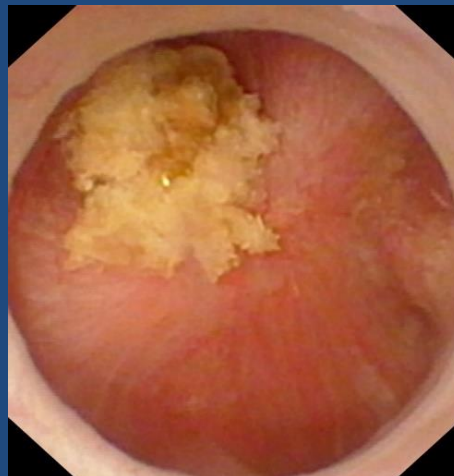
Making the Diagnosis of MSK

- Intravenous Urography
- CT Scans and Other Imaging
- **High Definition Endoscopy**





- **MSK papilla**
- **Submucosal stones**



- **Normal papilla**
- **Stones**



Treatment of MSK

- The optimal approach is **flexible ureteroscopy** as this can be both diagnostic and therapeutic



Nephrocalcinosis and MSK



July 2015
Volume 88, Issue 1

What is nephrocalcinosis?

[Linda Shavit](#), [Philippe Jaeger](#), [Robert J. Unwin](#)  

published online 25 March 2015



DOI: <http://dx.doi.org/10.1038/ki.2015.76>

‘Strictly, the term **‘nephrocalcinosis’** refers to the generalized deposition of calcium oxalate (CaOx) or calcium phosphate (CaPi) in the kidney’



Nephrocalcinosis and MSK

- Radiologists often speak “nephrocalcinosis”
- Nephrocalcinosis refers to the presence of calcium deposits in the kidney tissue
- Radiologists cannot differentiate reliably between tissue calcifications and stones
- Only urologists speak of nephrocalcinosis seen during flexible ureteroscopy, because they can see tissue calcifications, stones, or both



Tips for diagnosing MSK

- Confirmation with **flexible renal endoscopy** can make a definitive diagnosis in patients suspected to have MSK and can be diagnostic as well as potentially therapeutic in terms of stone removal.
- Consider urographic phase imaging either with IVU or CTU to confirm MSK suspicion in cases where renal endoscopy is not clinically indicated.
- Nephrocalcinosis is more common than previously appreciated and does not necessarily indicate systemic disease or the specific developmental disorder of MSK.



MSK and Aeromedical Management

- MSK is a kidney malformation that generally manifests with nephrocalcinosis and recurrent renal stones
- **Flexible Ureteroscopy** is the gold standard for the diagnosis of nephrocalcinosis and MSK
- These are the aviation pilots where **metabolic evaluations** and attempts at stone prevention are most critical
- Treatment strategies and aeromedical health management of MSK should be **individualized**

Welcome to China !



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