

KIDNEY STONES

By

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DISCLOSURES

- STAFF PHYSICIAN AT BOCA RATON REGIONAL HOSPITAL
- GROUP PRACTICE WITH UROLOGY GROUP OF FLORIDA
- VOLUNTARY ASSISTANT PROFESSOR AT FLORIDA ATLANTIC UNIVERSITY, AND FLORIDA INTERNATIONAL UNIVERSITY
- NO COMMERCIAL AFFILIATIONS TO DISCLOSE

EPIDEMIOLOGY

- ABOUT 8.8% OF POPULATION IS AFFECTED-PREVALENCE BETWEEN 1-15%
- PEAK AGE INCIDENCE IS 30-69 IN MEN VS 50-79 IN WOMEN
- DOUBLE INCIDENCE OVER PAST 40 YEARS.-MAYBE DUE TO BETTER IMAGING
- ANNUAL HEALTHCARE EXPENDITURE \$2.1 BILLION IN 2000 (\$983 MILLION INPATIENT)

GENDER, RACE, AGE

- HISTORICALLY, MEN ARE TWO TO THREE TIMES MORE COMMON BUT NOW LESS THAN TWICE AS COMMON
- RACE PREVALENCE: WHITES, THEN HISPANICS (70%), ASIANS (63%) AND AFRICAN-AMERICANS (44%)
- PEAK INCIDENCE AT AGE 40-70 BUT PEAK IS LATER WITH WOMEN-(MENOPAUSE)

GEOGRAPHY, CLIMATE, OCCUPATIONS

- HOT, ARID AND DRY CLIMATES-TROPICAL, DESERT, MOUNTAINS
- HIGHEST PREVALENCE IN SOUTHEAST STATES-"STONE BELT"
- HIGHEST INCIDENCE JULY THROUGH SEPTEMBER-WARM MONTHS
- MORE COMMON IN WORKERS IN HOT ENVIRONMENTS (STEELWORKERS) AND SEDENTARY PROFESSIONALS

OBESITY, METABOLIC SYNDROME, DIABETES

- PREVALENCE AND INCIDENCE DIRECTLY RELATED TO WEIGHT AND BMI UP TO 30%-MORE SIGNIFICANT WITH WOMEN
- METABOLIC SYNDROME-OBESITY, HYPERLIPIDEMIA, HYPERTENSION, HYPERGLYCEMIA
- METABOLIC SYNDROME IS ASSOCIATED WITH UP TO TRIPLING INCIDENCE OF KIDNEY STONES
- TYPE 2 DIABETES IS ASSOCIATED WITH INCREASED INCIDENCE
- EXCRETION OF STONE PROMOTERS AND pH EFFECTS OF ABOVE

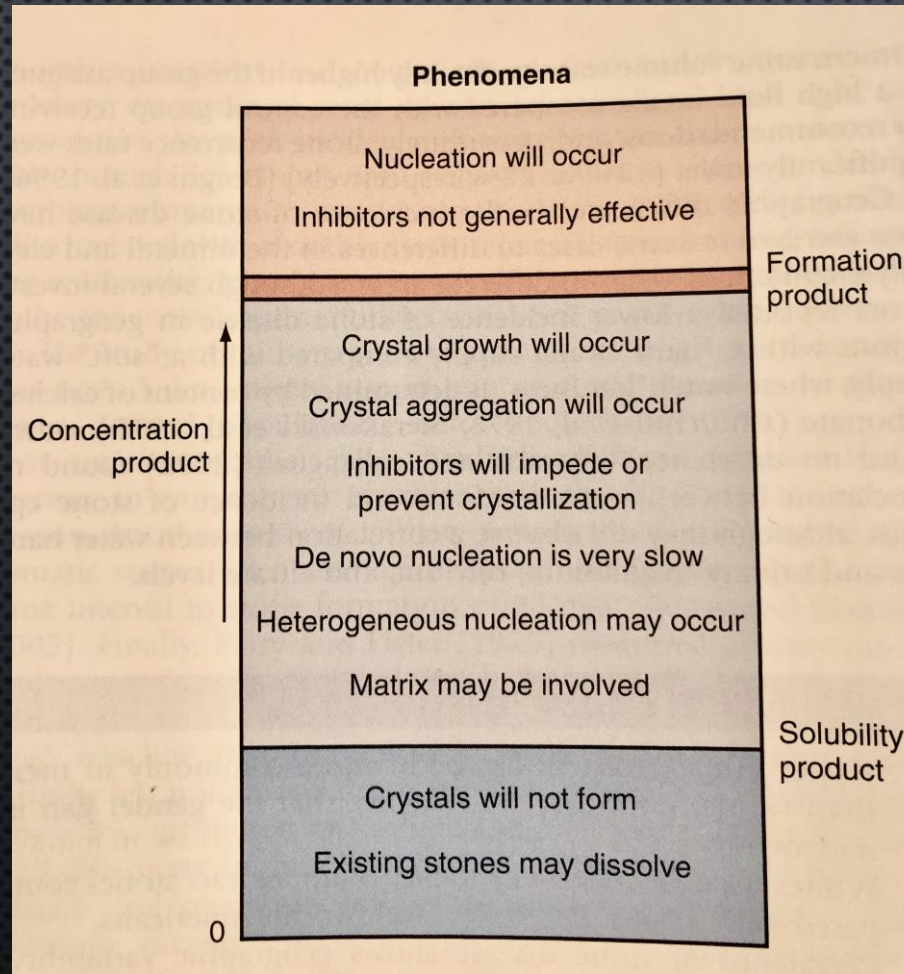
STONE TYPES

- CALCIUM OXALATE MONOHYDRATE
- CALCIUM OXALATE DIHYDRATE
- TRICALCIUM PHOSPHATE
- CALCIUM HYDROGEN PHOSPHATE DIHYDRATE
- URIC ACID
- MAGNESIUM AMMONIUM PHOSPHATE
- CYSTINE
- MEDICATION STONES (INDINAVIR, TRIAMTERENE, EPHEDRINE)

STONE CHEMISTRY

- URINE IS AN AQUEOUS SOLUTION THAT CONTAINS ORGANIC AND INORGANIC COMPOUNDS
- STONE FORM THROUGH SUPERSATURATION OF STONE FORMING SALTS (E.G. CALCIUM OXALATE)
- THERMODYNAMIC SOLUBILITY PRODUCT (K_{sp})-WHEN IT'S EXCEEDED, CRYSTALS WILL FORM
- URINE HAS PROTEIN INHIBITORS WHICH ALLOW HIGHER CONCENTRATIONS TO BE HELD IN SOLUTION BEFORE PRECIPITATION
- FORMATION PRODUCT IS HIGHER THAN SOLUBILITY PRODUCT
- MOST IMPORTANT FACTORS IN URINE ARE CALCIUM AND OXALATE CONCENTRATIONS

STONE FORMATION



CRYSTAL FORMATION AND GROWTH

- INCREASED CALCIUM OXALATE SUPERSATURATION DUE TO LOW VOLUME, MAGNESIUM AND CITRATE, HIGH URIC ACID, OXALATE, CALCIUM AND PHOSPHATE
- HOMOGENEOUS VS HETEROGENEOUS NUCLEATION-"THE MATRIX"
- OXALATE-INDUCED CELL INJURY ON RENAL TUBULAR CELLS
- ROLE OF PH

CITRATE- “THE GOOD GUY”

- BINDS CALCIUM ION IN URINE SO LESS IONIC CALCIUM IS AVAILABLE TO BIND OXALATE AND PHOSPHATE
- INHIBITS SPONTANEOUS PRECIPITATION OF CALCIUM OXALATE CRYSTALS
- PREVENTS HETEROGENEOUS NUCLEATION OF CALCIUM OXALATE BY MONOSODIUM URATE

OTHER INHIBITORS-"THE OTHER GOOD GUYS"

- MAGNESIUM
- NEPHROCALCIN
- TAMM-HORSFALL PROTEIN-MOST COMMON IN URINE, PRESENT IN MATRIX
- UROPONTIN
- HEPARIN SULFATE
- WATER!!!
- INHIBIT NUCLEATION, GROWTH AND AGGREGATION

CALCIUM-"BAD GUY"

- ONLY 30-40% OF INGESTED CALCIUM IS ABSORBED
- VITAMIN D STIMULATES INTESTINAL ABSORPTION
- $\downarrow Ca \rightarrow \uparrow PTH \rightarrow \uparrow 1\alpha\text{Hydroxylase} \rightarrow \uparrow \text{vit } 1,25(OH)D \rightarrow \uparrow \text{intestinal } Ca \text{ absorption}$
- PTH ENHANCES RENAL CALCIUM REABSORPTION AND REDUCES REABSORPTION OF PHOSPHATE
- MOST CALCIUM ACTIVELY REABSORBED AT RENAL PROXIMAL TUBULE

OXALATE-"THE REALLY BAD GUY"

- PASSIVE INTESTINAL ABSORPTION-ONLY 6-14% IN ION FORM
- COINGESTION WITH CALCIUM OR MAGNESIUM DECREASES ABSORPTION
- ROLE OF INTESTINAL *OXALOBACTER FORMIGENES*-OUR LITTLE FRIEND
- ALMOST ALL OXALATE ABSORBED GET EXCRETED IN THE GLOMERULUS

HYPERCALCIURIA

MOST COMMON ABNORMALITY NOTED IN STONE FORMERS

MORE THAN 200MG/DAY URINARY CALCIUM

ABSORPTIVE-INTESTINAL HYPERCALCIURIA: VITAMIN D MEDIATED, SARCOIDOSIS, NORMOCALCEMIA

EXCRETORY-RENAL HYPERCALCIURIA: IMPAIRED RENAL TUBULAR REABSORPTION, NORMOCALCEMIA

RESORPTIVE-BONE HYPERCALCIURIA: ROLE OF PTH, PTHrP, CORTICOSTEROIDS, HYPERCALCEMIA

HYPEROXALURIA

- MORE THAN 40MG/DAY OF URINARY OXALATE
- PRIMARY HYPEROXALURIA-GENETIC DISEASE
- INTESTINAL MALABSORPTION-CHRONIC DIARRHEA, CROHN'S, CELIAC SPRUE, BARIATRIC SURGERY, BOWEL RESECTION
- EXCESSIVE DIETARY INTAKE-PLANT SOURCE, TEA, CHOCOLATE, NUTS, SPINACH, POTATOES,ETC

HYPERURICOSURIA

- 10% OF STONE FORMERS
- URIC ACID MORE THAN 600 MG/DAY
- INCREASED DIETARY PROTEIN “GOUTY DIATHESIS”
- LYMPHOPROLIFERATIVE DISEASES, ANEMIAS, POLYCYTHEMIA
- URIC ACID STONES FORM IN LOW pH, LOW URINE VOLUME AND HYPERURICOSURIA
- INCREASE CALCIUM OXALATE STONES BY HETEROGENEOUS NUCLEATION

HYPOCITRATURIA

- CITRATE LESS THAN 320MG/DAY
- IMPORTANT AND CORRECTABLE CAUSE OF KIDNEY STONE FORMATION
- METABOLIC ACIDOSIS REDUCES URINARY CITRATE VIA ENHANCED TUBULAR REABSORPTION AND DECREASED SYNTHESIS IN KIDNEY-DISTAL RTA (HIGH URINE PH, HIGH SERUM BICARBONATE, HYPOKALEMIA, HYPERCHLOREMIA)
- CONSIDER ACQUIRED RTA-OBSTRUCTIVE UROPATHY, RECURRENT PYELONEPHRITIS, ATN, TRANSPLANTATION, NSAIDS, SARCOIDOSIS, PRIMARY HYPERPARATHYROIDISM

INFECTION STONES

- ROLE OF UREASE PRODUCING BACTERIA-*PROTEUS*, *KLEBSIELLA*, *PSEUDOMONAS*, *STAPH AUREUS*
- MAGNESIUM AMMONIUM PHOSPHATE HEXAHYDRATE AND CALCIUM PHOSPHATE
- 2:1 WOMEN VS MEN
- MOST STAGHORN STONES ARE INFECTION STONES
- INCREASED RISK-DIABETICS, SPINAL CORD INJURY, URINARY DIVERSION

MISCELLANEOUS STONES

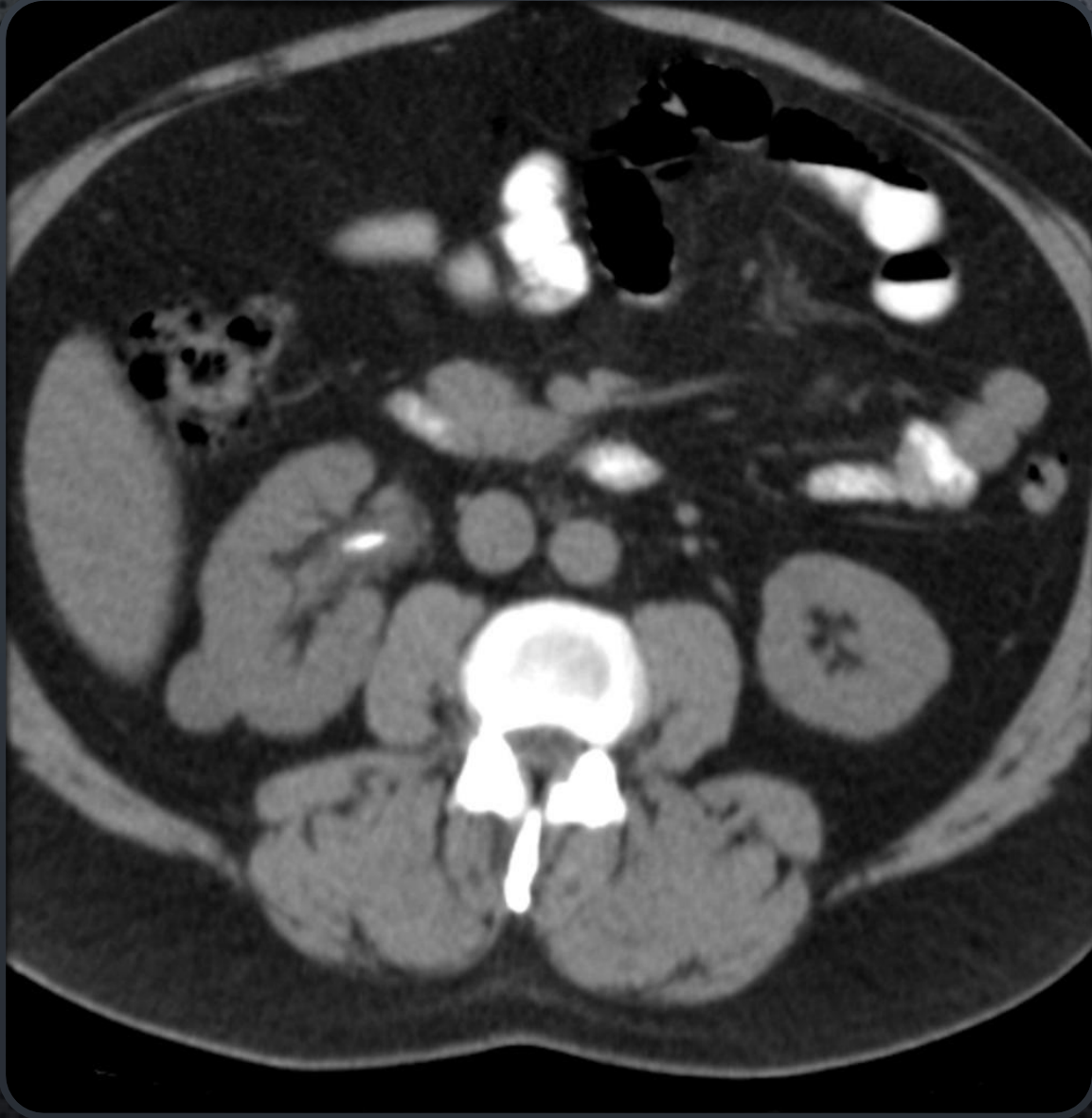
- AMMONIUM ACID URATE-LAXATIVE ABUSE AND INFLAMMATORY BOWEL DISEASE
- MATRIX STONES-CONFUSE WITH TUMORS ON CT
- MEDICATION STONES-INDINAVIR, EPHEDRINE, TRIAMTERENE
- WATCH OUT FOR CORTICOSTEROIDS, VITAMIN D, ANTACIDS, TOPIRAMATE (TOPAMAX)

METABOLIC STONE EVALUATION

- FIRST TIME STONE FORMERS HAVE 50% RISK OF RECURRENCE IN 10 YEARS
- CHILDREN-UNDERLYING METABOLIC DISORDERS
- STRONG FAMILY HISTORY
- RECURRENT FORMATION
- INTESTINAL DISEASE-ESPECIALLY DIARRHEA
- OSTEOPOROSIS AND FRACTURES
- RECURRENT UTI
- SOLITARY KIDNEY AND OTHER ANATOMIC ABNORMALITIES
- RENAL INSUFFICIENCY

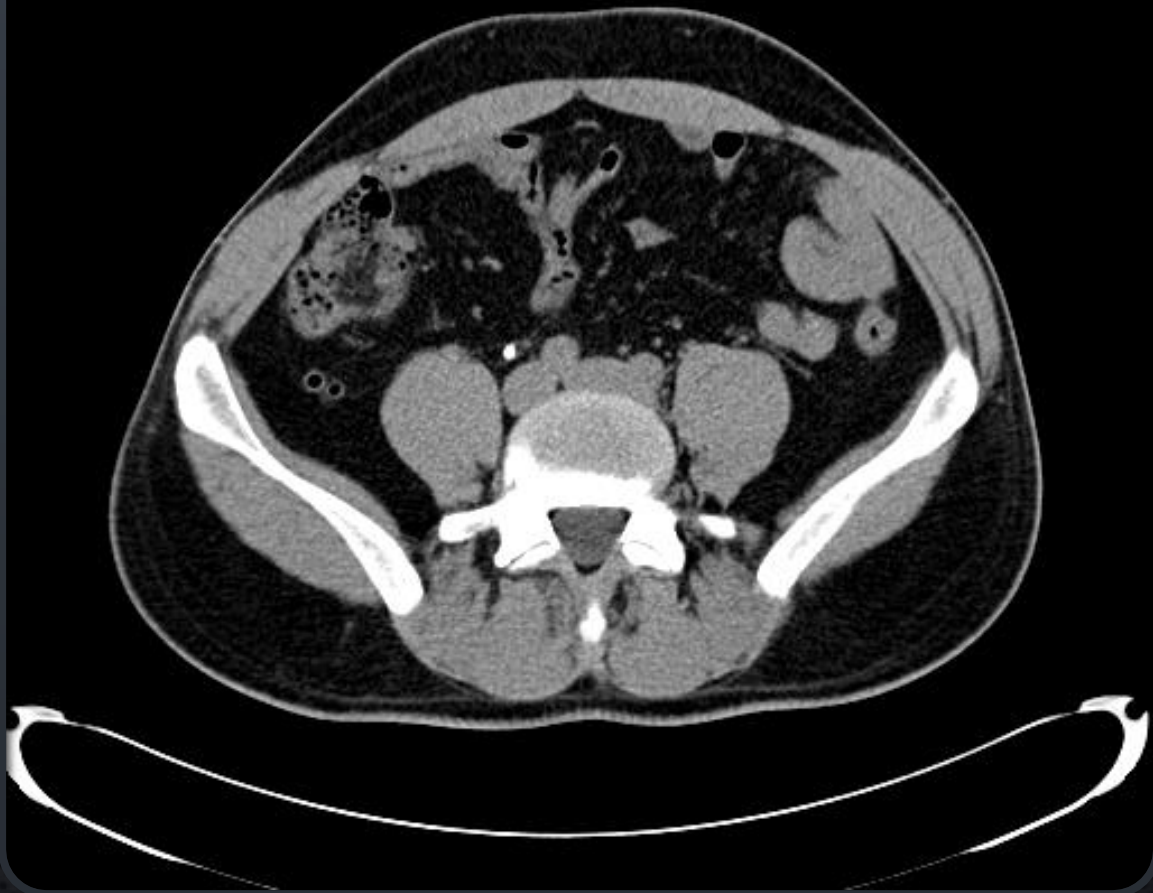
EVALUATION OF THE STONE PATIENT

- HISTORY INCLUDING MEDICATIONS AND SUPPLEMENTS
- BLOOD SCREEN: BASIC METABOLIC PANEL, CALCIUM, PTH, URIC ACID
- URINALYSIS (PH > 7.5 *infection*, PH < 5.5 *uric acid*) AND CULTURE
- RADIOGRAPHY-KUB, RENAL ULTRASOUND, NCCT
- STONE ANALYSIS
- 24-HOUR URINE STONE PANEL-VOLUME, CALCIUM, OXALATE, CITRATE, SODIUM, PHOSPHATE, MAGNESIUM, POTASSIUM, PH, URIC ACID, SULFATE



NON-
CONTRAST CT
ABDOMEN
AND PELVIS

NON-
CONTRAST CT
ABDOMEN
AND PELVIS



4161 · STONE ANALYSIS

Stone Analysis with Image

RESULT

Specimen Source Kidney

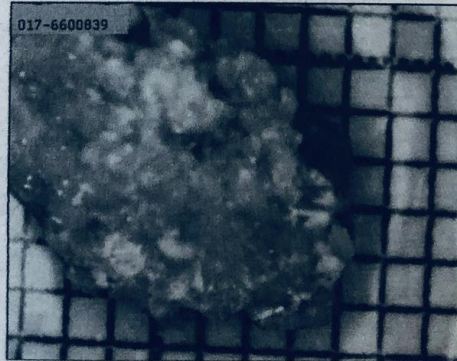
Nidus Not observed

Component 1 Calcium Oxalate Dihydrate (Weddellite) 50%
Carbonate Apatite (Dahllite) 50%

Stone Weight 0.1360 g

FILE COPY

IMAGE



Scale: 1 Division = 1mm

Basel Kashlan
Basel Kashlan, MD, FCAP

CASE STUDY: 65 YO FEMALE STONE ANALYSIS

Patient Results Report

PATIENT

[REDACTED]

DATE OF BIRTH

10/11/1952

GENDER

F

PHYSICIAN

[REDACTED]

Values larger, bolder and more towards red indicate increasing risk for kidney stone formation. See reverse for further details.

Stone Risk Factors / Cystine Screening: Negative (06/22/2006)

DATE	SAMPLE ID	Vol 24	SS CaOx	Ca 24	Ox 24	Clit 24	SS CaP	pH	SS UA	UA 24
09/21/16	S20316380	1.76	7.67	174	38	40*	1.94	6.652	0.23	0.755
05/27/09	S507682	1.83	7.76	130	51	608	1.55	7.514	0.02	0.553
11/18/08	S435277	1.55	7.92	226*	30	259	1.57	6.520	0.27	0.596
06/20/06	S188673	1.34	9.30	117	50	440	1.93	6.826	0.14	0.569
REFERENCE RANGE		0.5 - 4L	6 - 10	male <250 female <200	20 - 40	male >450 female >550	0.5 - 2	5.8 - 6.2	0 - 1	male <0.800 female <0.750

Dietary Factors

DATE	SAMPLE ID	Na 24	K 24	Mg 24	P 24	NH4 24	Cl 24	Sul 24	UUN 24	PCR
09/21/16	S20316380	82	49	54	0.813	34	68	55	10.60	1.2
05/27/09	S507682	111	75	63	0.515	13	96	26	6.91	
11/18/08	S435277	156	30	91	0.445	41	163	25	8.56	1.0
06/20/06	S188673	120	32	56	0.740	31	78	30	8.29	1.1
REFERENCE RANGE		50 - 150	20 - 100	30 - 120	0.6 - 1.2	15 - 60	70 - 250	20 - 80	6 - 14	0.8 - 1.4

Normalized Values

DATE	SAMPLE ID	WEIGHT	Cr 24	Cr 24/Kg	Ca 24/Kg	Ca 24/Cr 24
09/21/16	S20316380	63.5	1038	16.3	2.7	167
05/27/09	S507682		840			155
11/18/08	S435277	62.6	778	12.4	3.6	290
06/20/06	S188673	59.0	998	16.9	2.0	118
REFERENCE RANGE			male 18-24 female 15-20	<4	<4	<140

CASE STUDY: 65 YO FEMALE 24 HOUR STONE RISK

CLASSIFICATION OF NEPHROLITHIASIS

1. ABSORPTIVE HYPERCALCIURIA
2. RENAL HYPERCALCIURIA
3. PRIMARY HYPERPARATHYROIDISM
4. UNCLASSIFIED HYPERCALCIURIA
5. HYPEROXALURIC CALCIUM NEPHROLITHIASIS-ENTERIC, PRIMARY, DIETARY
6. HYPOCITRATURIC CALCIUM NEPHROLITHIASIS-DISTAL RTA, THIAZIDE, CHRONIC DIARRHEA

CLASSIFICATION OF NEPHROLITHIASIS-CONTINUED

- 7. HYPOMAGNESURIC CALCIUM NEPHROLITHIASIS
- 8. GOUTY DIATHESIS-URIC ACID STONES
- 9. CYSTINURIA-INBORN ERROR OF METABOLISM
- 10. INFECTION STONES
- 11. LOW URINE VOLUME ($< 2,000 \text{ mL}$)
- 12. MISCELLANEOUS-IDIOPATHIC

MEDICAL MANAGEMENT-FLUIDS

- FORCED INCREASE OF FLUID INTAKE TO MORE THAN 2 LITERS OF URINE A DAY
- CARBONATED WATER INCREASED URINARY CITRATE-ESPECIALLY CITRUS-FLAVORED SODAS
- BUT SODA FLAVORED WITH PHOSPHORIC ACID MAY INCREASE RISK
- WATER HARDNESS PROBABLY INCONSEQUENTIAL
- CITRUS JUICES INCREASE URINARY VOLUME AND CITRATE-PREFER LEMON JUICE
- DRINK AT LEAST 3 LITERS OF WATER A DAY

MEDICAL MANAGEMENT-PROTEIN AND SODIUM

- PROTEIN INGESTION INCREASES URINARY CALCIUM, OXALATE AND URIC ACID
- HIGH-SODIUM DIET CAUSES INCREASED CALCIUM SALTS IN URINE
- RECOMMEND LOW ANIMAL PROTEIN AND LOW SALT DIET
- ASSOCIATION WITH OSTEOPOROSIS IN WOMEN

MEDICAL MANAGEMENT-OBESITY

- OBESITY AND METABOLIC SYNDROME INCREASE STONE FORMATION-ESP. WOMEN
- URIC ACID AND CALCIUM OXALATE VIA MORE ACIDIC URINE AND INFLAMMATION
- LOW- CARB AND HIGH-PROTEIN DIETS CAUSE INCREASE STONE RISK AND BONE LOSS
- BARIATRIC SURGERY INCREASES STONE RISK

MEDICAL MANAGEMENT- CALCIUM, OXALATE

- MODERATE (NOT LOW) CALCIUM INGESTION IS RECOMMENDED
- LOW CALCIUM INGESTION LEADS TO HIGH OXALATE ABSORPTION
- CALCIUM SUPPLEMENTATION SHOULD BE TAKEN WITH MEALS-PREFER CALCIUM CITRATE
- VIT D SUPPLEMENTATION SHOULD BE DONE BY MONITORING 24-HOUR CALCIUM
- LOW-OXALATE DIET IS RECOMMENDED ON EVERYONE ESP. ENTERIC CAUSES
- LIMIT VITAMIN C TO 2 G/DAY

MEDICAL THERAPY-ABSORPTIVE, RENAL, HYPERPTH

- THIAZIDES DECREASE URINARY CALCIUM WHILE INCREASE URINARY SODIUM ON DISTAL RENAL TUBULE
- THIAZIDES ARE IDEAL FOR RENAL HYPERCALCIURIA-FIRST LINE
- USED IN ABSORPTIVE HYPERCALCIURIA
- CONSIDER CONCURRENT POTASSIUM CITRATE (40-60 MEQ/DAY)
- SIDE EFFECTS-POTASSIUM WASTING, CRAMPS, HYPERURICOSURIA, HYPOCITRATURIA
- ONLY THERAPY FOR PRIMARY HYPERPARATHYROIDISM IS ADENOMA SURGICAL REMOVAL

MEDICAL THERAPY-HYPERURICOSURIC CALCIUM OXALATE STONES

- DIETARY PROTEIN RESTRICTION
- ALLOPURINOL 300 MG/DAY-BLOCKS XANTHINE OXIDASE MEDIATED CONVERSION TO URIC ACID
- RECOMMEND URINARY ALKALINIZATION TO PH ABOVE 6.0 BUT NOT OVER 7.0
- POTASSIUM CITRATE (30-60 MEQ/DAY) CAN INCREASE URINARY PH

MEDICAL THERAPY-ENTERIC HYPEROXALURIA

- FORCED FLUID INTAKE –VERY IMPORTANT
- RECOMMEND DIETARY CALCIUM SUPPLEMENTATION (OTC 1 GR PO QID) TO BIND OXALATE
- AVOID SOLID POTASSIUM CITRATE FORMS-POOR ABSORPTION
- SUPPLEMENT WITH CALCIUM CITRATE
- CONSIDER PROBIOTICS FOR *O. FORMIGENES*

MEDICAL THERAPY-HYPOCITRATURIA, RTA

- FIRST LINE IS TO SUPPLEMENT WITH POTASSIUM CITRATE (UP TO 120 mEq/DAY FOR RTA)
- AVOID THIAZIDE-INDUCED HYPOCITRATURIA BY ADDING POTASSIUM CITRATE
- MOST COMMON SIDE EFFECT IS GI UPSET

MEDICAL THERAPY-OTHERS

- HYPOMAGNESURIC CALIUM NEPHROLITHIASIS-MAGNESIUM AND CITRATE SUPPLEMENTATION
- GOUTY DIATHESIS-VOLUME, PROTEIN RESTRICTION, INCREASE PH BUT NOT ABOVE PH 7.0
- CYSTINURIA-SODIUM RESTRICTION, THIOLA
- AMMONIUM ACID URATE-ANOREXIA, LAXATIVE ABUSE

MEDICAL THERAPY-INFECTIOUS STONES

- BEST TREATED WITH SURGICAL REMOVAL
- TREAT INFECTION FIRST
- HIGH RISK OF SEPSIS
- CONSIDER ACETOHYDROXAMIC ACID (LITHOSTAT) FOR NONOPERATIVE CANDIDATES
- SIGNIFICANT SIDE EFFECTS (DVT, ANEMIA, RASH, ETC)

I'VE ALREADY DIAGNOSED MYSELF
ON THE WEB BUT I THOUGHT
I'D COME IN FOR A SECOND OPINION.



UROLOGY
CONSULT

RENAL AND URETERAL STONES-SURGERY

- ΟΥ ΤΕΜΕΩ ΔΕ ΟΥΔΕ ΜΗΝ ΛΙΘΙΩΝΤΑΣ, ΕΚΧΩΡΗΣΩ ΔΕ ΕΡΓΑΤΗΣΙΝ ΑΝΔΡΑΣΙ ΠΡΑΞΙΟΣ ΤΗΔΕ
- HIPPOCRATIC OATH
- 10% OF SCREENED POPULATION HAVE ASYMPTOMATIC RENAL STONES
- FOUR MINIMALLY INVASIVE PROCEDURES
- ESWL, URS, PCNL, LAP AND ROBOTIC SURGERY

PRETREATMENT SURGICAL ASSESSMENT

- HISTORY-AVOID COAGULOPATHY, CONSIDER INFECTION, MEDICATIONS
- PHYSICAL EXAM-RENAL COLIC, TENDERNESS
- IMAGING-NON CONTRAST CT STONE STUDY (NOT UROGRAM) VS RENAL ULTRASOUND
- LAB-URINALYSIS, CULTURE, BMP, CBC, PT/PTT

RENAL AND URETERAL STONES-SURGERY DECISION

- SIZE, NUMBER, LOCATION, COMPOSITION
- ANATOMIC FACTORS: OBSTRUCTION, HYDRONEPHROSIS, UPJ, HORSESHOE, ECTOPIA
- CLINICAL FACTORS: INFECTION, COAGULOPATHY, PREGNANCY, SOLITARY KIDNEY, ELDERLY
- ALL STAGHORN STRUVITE STONES IN A HEALTHY PATIENT MUST BE SURGICALLY REMOVED (AUA GUIDELINE)



SHOCK WAVE LITHOTRIPTER

SHOCK WAVE LITHOTRIPSY

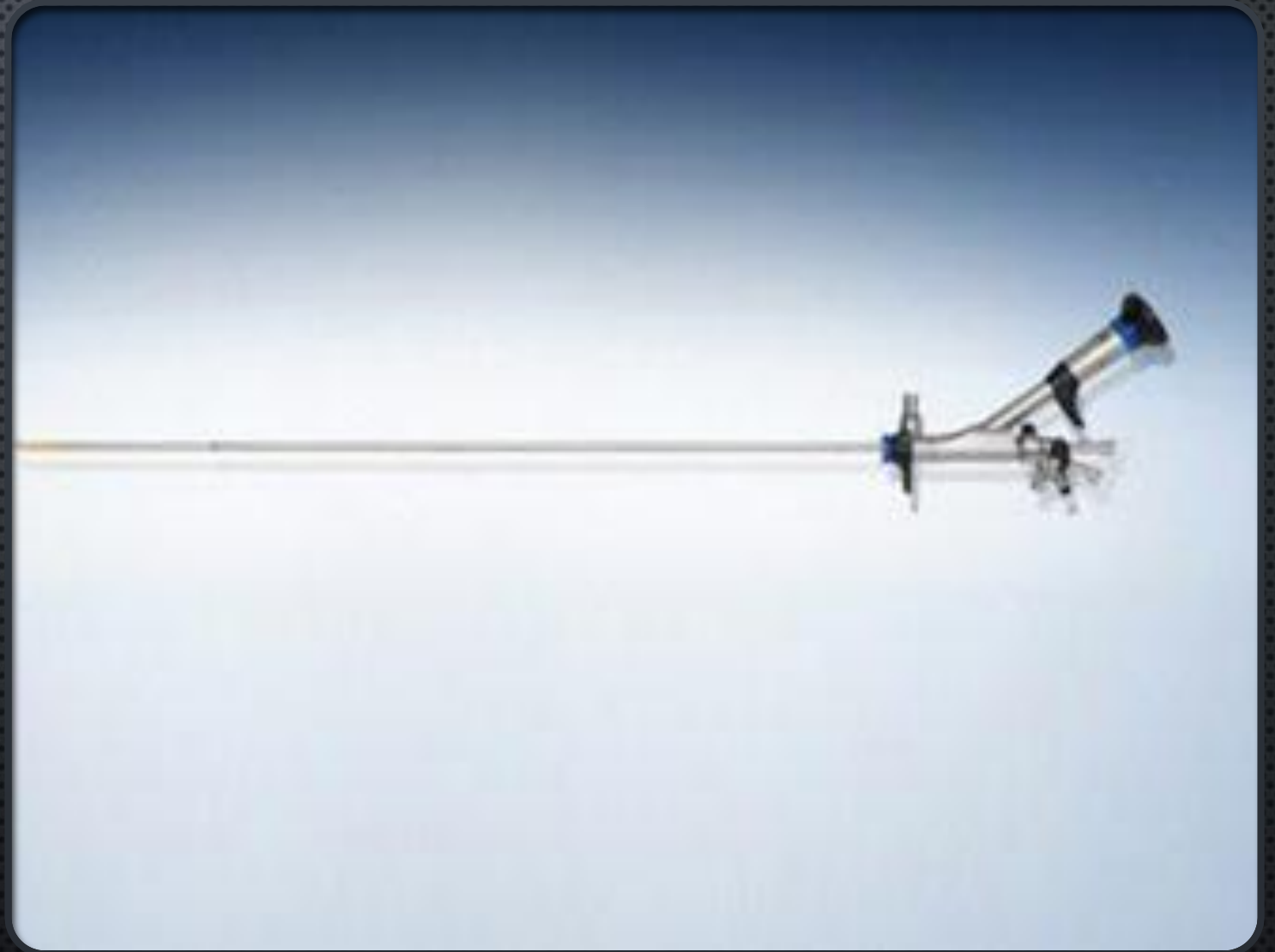
- OUTPATIENT PROCEDURE
- ESWL PRIMARILY DONE FOR RENAL STONES UP TO 2 CM AND PROXIMAL URETERAL STONES
- CAN AVOID STENT INSERTION
- CONTRAINDICATIONS ARE PREGNANCY, UNCORRECTED COAGULOPATHY, UNTREATED UTI, OBSTRUCTION DISTAL TO STONE, ARTERIAL ANEURYSM NEAR STONE
- CONSIDER PATIENT SIZE, STONE COMPOSITION, UNFAVORABLE LOWER POLE ANATOMY
- NOT READILY AVAILABLE

SHOCK WAVE LITHOTRIPSY

- SHOCK WAVES GENERATED OUTSIDE THE BODY PROPAGATE TO TARGET STONE AND FRAGMENT (F1 IS GENERATOR AND F2 IS STONE)
- LOCALIZATION IS DONE WITH FLUOROSCOPY AND ULTRASOUND
- REQUIRE DEDICATED UNIT AND TRAINED TECHNICIAN
- SIDE EFFECTS: ACUTE RENAL INJURY (HEMATURIA), ACUTE EXTRARENAL DAMAGE (RARE), ARRHYTHMIAS, CHRONIC RENAL INJURY
- MITIGATED BY DECREASING ENERGY AND SLOWLY RAMPING UP

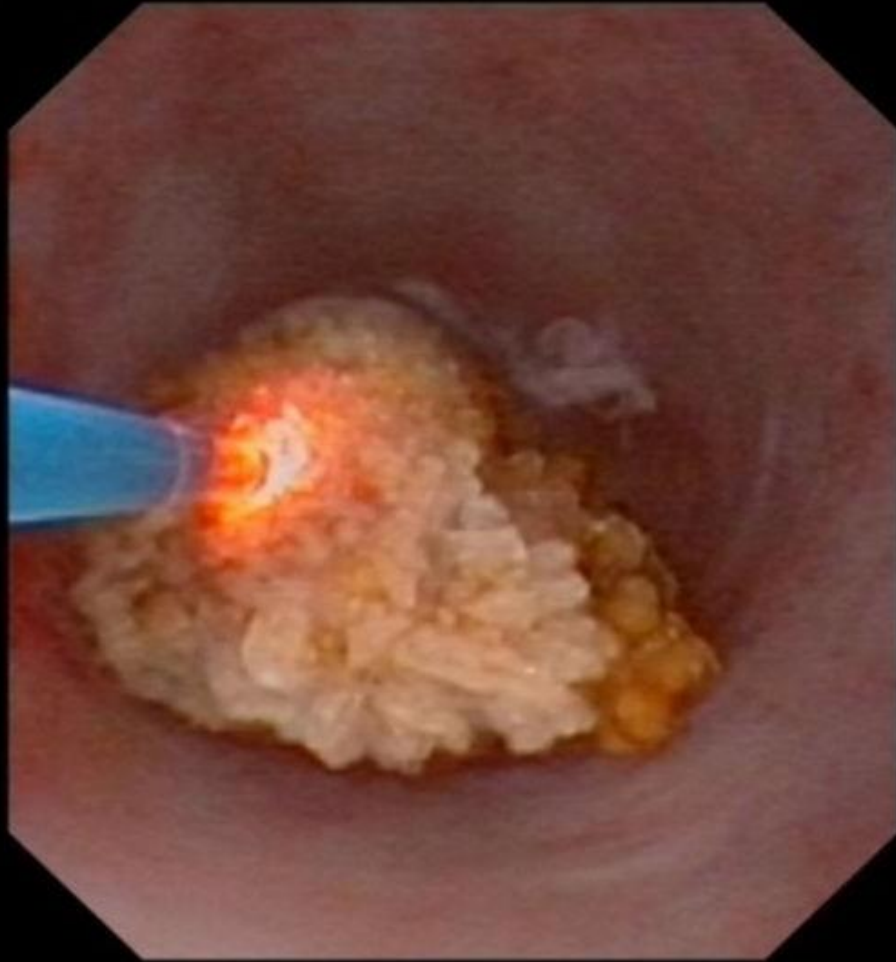
URETEROSCOPY

- FLEXIBLE OR RIGID
- IMPROVED TECHNOLOGY



URETEROSCOPIC EXTRACTION

- OUTPATIENT PROCEDURE
- PRIMARY THERAPY FOR DISTAL URETERAL STONE AND SMALLER RENAL STONES NOT AMENABLE TO ESWL
- FLEXIBLE URETEROSCOPY CAN BE USED FOR RENAL STONES
- IMPROVED DUE TO DIGITAL SCOPES AND SMALLER CALIBER SCOPES
- HOLMIUM:YAG LASER AND BASKET EXTRACTION
- ALWAYS LEAVE A STENT AFTER PROCEDURE
- READILY AVAILABLE IN HOSPITAL AND SURGICENTER



URETEROSCOPIC
LASER
LITHOTRIPSY

PERCUTANEOUS NEPHROLITHOTOMY- PCNL

INPATIENT PROCEDURE

DIRECT ACCESS TO RENAL COLLECTING SYSTEM AND
FRAGMENTATION AND REMOVAL OF ALL STONES

ASPIRIN AND ANTIPLATELET DRUGS HELD FOR AT LEAST 7
DAYS

MOST COMMON COMPLICATION IS HEMORRHAGE AND
SEPSIS

CONTRAINDICATIONS ARE UNCORRECTED COAGULOPATHY
AND UNTREATED UTI

ONE THIRD OF PATIENTS WITH A STENT AFTER PROCEDURE
DESPITE STERILE URINE WILL BE COLONIZED ON SUBSEQUENT
URINE CULTURE

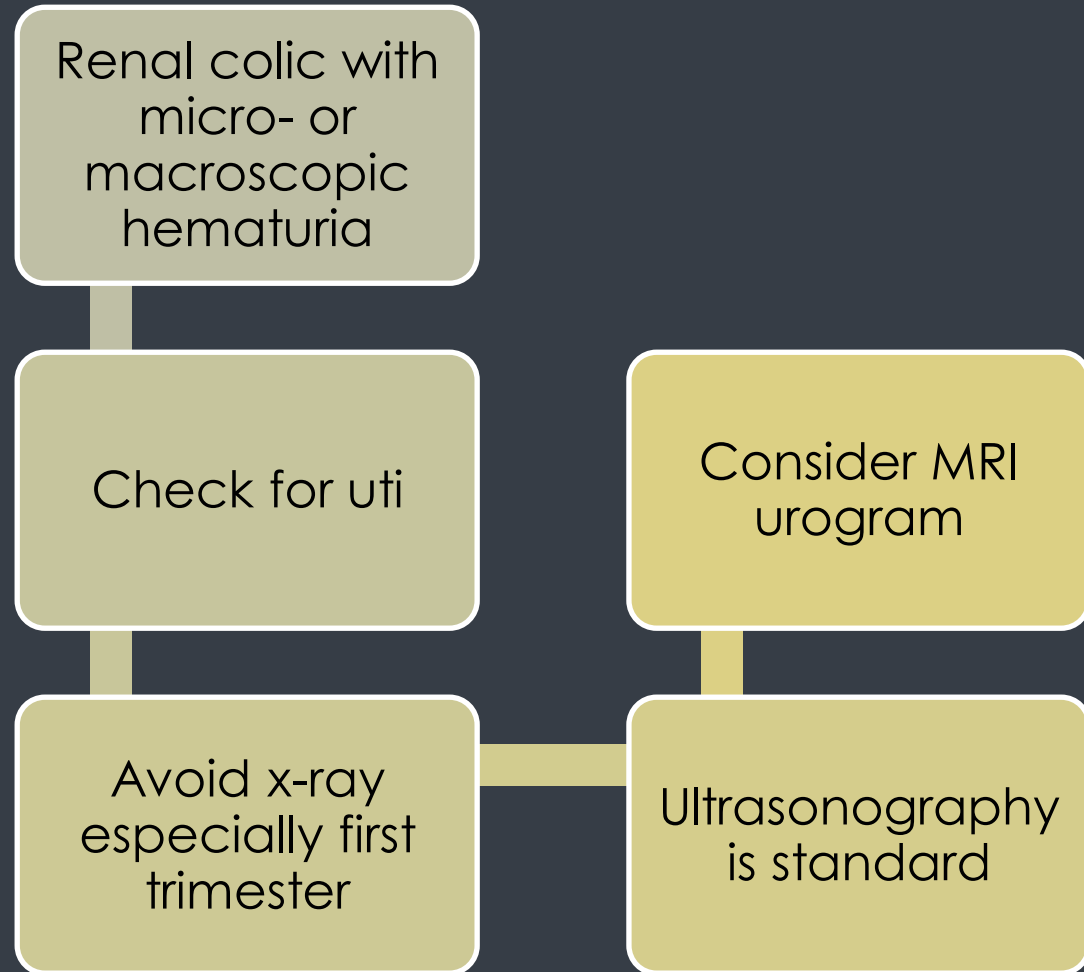
LAPAROSCOPIC AND ROBOTIC STONE REMOVAL

- RESERVED FOR UNIQUE CASES WHERE ANATOMIC FACTORS OR SEVERE STONE BURDEN PRECLUDE ANY ENDOSCOPIC PROCEDURE
- RARELY USED

STONES IN PREGNANCY

- INCIDENCE IS SAME AS AGE MATCHED NON-PREGNANT WOMEN
- UPPER TRACT DILATION SEEN IN 90% OF ALL PREGNANT WOMEN BY THIRD TRIMESTER
- INCREASED RENAL BLOOD FLOW BY 30-40% LEADS TO HYPERCALCIURIA AND HYPERURICOSURIA
- MITIGATED BY INCREASED URINARY CITRATE AND MAGNESIUM AND DIURESIS

STONES IN PREGNANCY- EVALUATION



STONES IN PREGNANCY-TREATMENT

- 50-80% WILL PASS SPONTANEOUSLY
- MAY USE URETERAL STENT OR PERCUTANEOUS NEPHROSTOMY AS TEMPORIZING MEASURES
- ACCELERATED ENCRUSTATION MAY OCCUR
- RECENT IMPROVEMENTS IN URETEROSCOPIC TECHNOLOGY PERMIT TREATMENT OF ALL URETERAL AND KIDNEY STONES
- MINIMIZE FLUOROSCOPY DURING PROCEDURE AND SHIELD FETUS

REFERENCES AND FURTHER READING

- CHAPTERS 51-54 CAMPBELL-WALSH UROLOGY, 2016