Kidney Stone Composition in Saudi Arabia

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This seems like a really simple project...
The Back Story
• Joint venture inaugurated in 2014
• Saudi Aramco
  – World leader in energy
• Johns Hopkins Medicine
  – Extensive experience in global care delivery
Precursor Organization

• SAMSO
  – Saudi Aramco Medical Services Organization
  – Tasked with:
    • Healthcare delivery
    • >300,000 lives covered
    • Extensive network of facilities
  – Primary focus: clinical care
Tripartite Mission
Patient Care
Teaching
Research
Pre-Johns Hopkins Aramco Healthcare (SAMSO)

• Medical research was not a point of emphasis
  – Focus was on clinical care
• Nonetheless, a small group of highly motivated clinicians did achieve research related accomplishments
  – Labors of love
  – Nights and weekends
  – Unrecognized
Johns Hopkins Aramco Healthcare

Strategic Intent

Johns Hopkins Aramco Healthcare will evolve into a health system of excellence that provides enhanced specialty and subspecialty services, new lines of treatment and research.
What is our part of these strategic goals?

• Develop medical research within Johns Hopkins Aramco Heathcare
  – Infrastructure
    • Institutional Review Board
    • Office of Research
  – Education
    • Research methodology
    • Study design
  – Cultural recognition
    • Research is a core component of JHAH
Our accomplishments thus far...

• Formalized Office of Research
  – Budget
  – Staffing
  – Reporting capabilities

• Institutional Review Board
  – Ensured consistency with Johns Hopkins Medicine standards
Our accomplishments thus far...

• Education
  – Introduction to Clinical Research didactic
  – In Dhahran, December 2016

• Collaboration
  – Between Baltimore and Dhahran
  – Professional linkages
  – Educational conferences
This Project’s Background

• Kidney stones are a common and costly disease
• Prevalence rates vary globally
• Influenced by:
  – Diet
  – Occupation
  – Genetics
  – Co-morbidity
    • Diabetes, Hypertension, obesity
  – Climate
Project Background

• Prevalence rates can vary regionally
  – Rates in the Middle East are reportedly among the highest in the world
    • Affects ~15-20% of population in some areas

• Stone composition varies regionally, too
  – Calcium oxalate
  – Calcium phosphate
  – Uric acid

• An understanding of stone composition is important as it will guide prevention
Project Background

• To date, our understanding of regional differences in stone composition is poor
  – Few centers have long-term data repositories of stone composition
  – In reality, the sum of our knowledge relies on small case series
Our Approach

- JHAH has tremendous long-term pathology data
  - Particularly robust in oncology
  - But also, kidney stone composition
Study Design

- Retrospective analysis of kidney stone composition
  - From 1999-2013
  - All stones analyzed at JHAH
  - Data retrieved through electronic medical record
  - Validated by on-site pathologist (Dr. Sheikh)
Our Results

• A total of 1747 stones were analyzed in the study period
• Male patients predominated (79%)
• For both men and women, the majority of stones were calcium oxalate
• Overall, there were no significant differences in stone composition between gender
## Our Results

<table>
<thead>
<tr>
<th>Stone Type</th>
<th>Men</th>
<th></th>
<th>Women</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
</tr>
<tr>
<td>Calcium Oxalate</td>
<td>1179</td>
<td>85.2</td>
<td>313</td>
<td>85.9</td>
</tr>
<tr>
<td>Calcium Phosphate</td>
<td>8</td>
<td>0.6</td>
<td>6</td>
<td>1.6</td>
</tr>
<tr>
<td>Uric Acid</td>
<td>140</td>
<td>10.1</td>
<td>33</td>
<td>9.0</td>
</tr>
<tr>
<td>Ammonium Acid Urate</td>
<td>5</td>
<td>0.3</td>
<td>3</td>
<td>0.8</td>
</tr>
<tr>
<td>Cystine</td>
<td>1</td>
<td>0.7</td>
<td>4</td>
<td>1.1</td>
</tr>
<tr>
<td>Mixed</td>
<td>40</td>
<td>2.9</td>
<td>5</td>
<td>1.4</td>
</tr>
</tbody>
</table>
Implications in Disease Prevention

• Calcium oxalate stone risk usually mediated by:
  – Fluid intake
  – Urine calcium excretion
    • Sodium consumption
  – Associated with obesity

• These data will begin to guide steps for prevention / risk reduction
Our study in context...
Changes in upper urinary tract stone composition in Australia over the past 30 years

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¹Department of Urology, Westmead Hospital, and ²University of Sydney, New South Wales, Australia

Objectives
- To investigate upper urinary tract stone composition rates in Australia
- To investigate changes in stone composition in Australia over the past 30 years

Patients and Methods
- The Institute for Clinical Pathology and Medical Research (ICPMR) database was used to obtain – stone composition statistics from 2009–2011
- Historical comparisons of stone composition rates were obtained from previous Australian studies; Rose; 1981, and Baker; 1993 for epidemiological data from the 1970s and 1980s respectively.
- Stone composition data was separated into gender and age-groups

Results
- From the 791 stones analysed between 2009 and 2011, calcium oxalate remains the dominant type accounting for 64% of stones in our dataset, which compares to 68% from both the 1970s and 1980s.

- Uric acid stones contributed 16% of contemporary stone compositions, comparable to 16% in the 1970s and 17% in the 1980s.
- Struvite stones showed a decreasing trend from 14% in the 1970s, to 12% in the 1980s and 7% in the current data.
- For struvite stones, while the female 21–30 age-group was the most prolific for struvite stone formation in the 1980s, the peak group in contemporaneous records is 61–70 year-old men.

Conclusion
- Stone composition in Australia has remained relatively static over the past 30 years. Modifications in diet and body habits have not resulted in significant changes in the proportion of uric acid and calcium oxalate stones detected.
- The decreasing trend in the proportion of struvite stones most likely reflects improved management of urinary tract infections within the Australian population.

Keywords
Australia, stone composition, kidney stones
# High Prevalence of Opaline Silica in Urinary Stones From Burkina Faso

**Arnaud Dessombz, Brahima Kirakoya, Gérard Coulibaly, Richard W. Ouedraogo, Lise Picaut, Raphael Weil, Dominique Bazin, and Michel Daudon**

## Objective
To underline peculiar composition of kidney stones and to propose an epidemiologic study of urinary stones in West African countries, where epidemiologic studies are scarce. Only few data are available regarding stone composition in sub-Saharan countries. Recently, a set of 100 stones consecutively removed by surgery in the Department of Urology of the University Hospital of Ouagadougou in Burkina Faso were collected for physical analysis, which provided the opportunity to obtain an epidemiologic profile of stone composition in this country.

## Materials and Methods
A total of 100 stones from 64 men, 22 women, 10 boys, and four girls were analyzed by morphologic examination, infrared spectroscopy, and electron microscopy in our laboratory. The results were considered by sex and separately for adults and children.

## Results
Sixty-five percent of the 100 stones contained calcium oxalate as the main component. Interestingly, the second main component was opaline silica (18%). Furthermore, opaline silica was identified in any proportion in 48% of the stones. The prevalence was sex and age dependent. Opaline silica was detected as the main component in 42% of the nuclei, which underlines its role as one of the main components involved in the initiation of calculi in this country.

## Conclusion
For the first time, a dramatically high occurrence of a “scarce” urinary stone component, namely opaline silica, was reported in a series of consecutive calculi from a single country. We propose that a regular consumption of clay could be the origin of this phenomenon in these populations. UROLOGY 86: 1090–1096, 2015. © 2015 Elsevier Inc.
Stone composition among first-time symptomatic kidney stone formers in the community

Prince Singh, MBBS¹, Felicity T. Enders, PhD², Lisa E. Vaughan, MS², Eric J Bergstrahlh, MS, John J. Knoedler, MD³, Amy E Krambeck, MD³, John C Lieske, MD¹,⁴, and Andrew D Rule, MD, MSc¹,²

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Results—There were 2961 validated first-time symptomatic kidney stone formers. Stone composition analysis was obtained in 1508 (51%) at the first episode. Stone formers were divided into the following mutually exclusive groups: any brushite (0.9%), any struvite (0.9%), any uric acid (4.8%), majority calcium oxalate (76%) or majority hydroxyapatite (18%). Stone composition varied with clinical characteristics. A multivariable model had a 69% probability of correctly estimating stone composition, but assuming calcium oxalate monohydrate stone was correct 65% of the time. Symptomatic recurrence at 10 years was approximately 50% for brushite, struvite, and uric acid, but approximately 30% for calcium oxalate and hydroxyapatite stones (P<.001). Recurrence was similar across different proportions of calcium oxalate and hydroxyapatite (P-trend=.10). However, among calcium oxalate stones, 10-year recurrence rate ranged from 38% for 100% calcium oxalate dihydrate to 26% for 100% calcium oxalate monohydrate (P-trend=.007).
Urinary stone composition in Oman: with high incidence of cystinuria

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Abstract  Urinary stones are a common problem in Oman and their composition is unknown. The aim of this study is to analyze the components of urinary stones of Omani patients and use the obtained data for future studies of etiology, treatment, and prevention. Urinary stones of 255 consecutive patients were collected at the Sultan Qaboos University Hospital. Stones were analyzed by Fourier transform infrared spectrophotometer. The biochemical, metabolic, and radiological data relating to the patients and stones were collected.
Kidney stones in a Mediterranean population from the south of Spain

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Clinical Analysis Service, Biochemical Section of University Hospital Virgen de la Arrixaca, Murcia, Spain

Keywords: kidney stones; renal lithiasis; urinary stone.

Methods: We analyzed the composition and the evolution of all of the cases concerning calculi received at Biochemical Clinical Analysis Laboratory from 2007 to 2010, using interferometry with Fourier transformation (FTIR). The relationship between composition, gender and age was studied for an aleatory group in 2010 (n=657, 431 men and 226 women).
Changes in Urinary Stone Composition in the Tunisian Population: A Retrospective Study of 1,301 Cases

Akram Alaya, Ph.D.\textsuperscript{1}, Abdellatif Nouri, Ph.D.\textsuperscript{2}, Mohsen Belgith, Ph.D.\textsuperscript{2}, Hammadi Saad, Ph.D.\textsuperscript{3}, Riadh Jouini, Ph.D.\textsuperscript{2}, and Mohamed Fadhel Najjar, Ph.D.\textsuperscript{1}

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Biochemical diagnosis in 3040 kidney stone formers in Argentina

Francisco Rodolfo Spivacow\textsuperscript{1} \textsuperscript{1d} \cdot Elisa Elena del Valle\textsuperscript{1} \cdot Armando Luis Negri\textsuperscript{1} \cdot Erich Fradinger\textsuperscript{1} \cdot Anabella Abib\textsuperscript{1} \cdot Paula Rey\textsuperscript{1}

Changes in stone composition over two decades: evaluation of over 10,000 stone analyses

Rachel Moses \cdot Vernon M. Pais Jr \cdot Michal Ursiny \cdot Edwin L. Prien Jr \cdot Nicole Miller \cdot Brian H. Eisner
Our study in context...

• We have produced one of the largest analyses of regional stone composition ever published
  - Only two studies larger in the published literature
• Will be an important contribution to our understanding of the increased stone prevalence in the Gulf Region
• This showcases the incredible power of multi-institutional partnerships fostered by Johns Hopkins International