NEPHROLITHIASIS PART 2: SUPPLEMENTARY MATERIAL

BLOCK 1:

DIETARY ASSESSMENT AS REQUIRED BY THE STONE CLINIC DIETICIAN

Remember that no dietary advice should be given before the work-up tests and assessments are completed

Renal stone clinic patient dietary information sheet:

Food intake diary:

- Please complete the form to determine the dietary risk factors for stone formation.
- Please write down everything that you eat and drink.
- Write down the time at the start of each meal, snack or drink.
- Try to describe the food as accurately as possible e.g. a sandwich is actually three or four foods: bread – wholemeal, white, thick or thin; spread – butter, margarine or low-fat spread; cheese and lettuce, etc.
- In addition, all spices added must also be indicated.
- Describe the portions as a weight where possible, or in household measures e.g. slices, tablespoons, etc.
- Only record food that is eaten (e.g. not what is left on the plate).
- If you are on any supplements, vitamins or medication, please indicate the brands, how many you are taking and when they are taken.
- Remember this includes salt, pepper, spices, condiments, etc., etc., etc.
- EVERYTHING THAT YOU EAT OR DRINK!

Please note:

- The form must be completed on the following days:
    - A normal weekday (to evaluate the diet on a normal weekday)
    - The Sunday of urine collection (to evaluate the diet on a weekend day and compare results with urine results)
    - Monday of urine collection (to evaluate the diet on a normal weekday and compare results with urine results)
- Please bring the completed form with you to your consultation with the dietician

Example of a dietary information sheet:

Please tick the applicable box: **Normal weekday** ☐ **Sunday** ☐ **Monday** ☐

Meal	Food	Amount	Cooking methods	Spices/ Flavourants/ sauces added	Time eaten	Where eaten
Breakfast						
Snack						
Lunch						
Snack						
Dinner						
Snack						

Example of a meal filled in on the dietary assessment form:

<u>Please tick the applicable box:</u> **Normal weekday** **Sunday** **Monday**

Meal	Food	Amount	Cooking methods	Spices/ flavourants/ sauces added	Time eaten	Where eaten
Breakfast	Egg Bacon White toast Flora Light margarine	1 large egg 2 rashers 2 slices 1tsp on each slice	Scrambled Fried Toasted	Salt (a pinch), pepper (a pinch), Parsley (1/2 tsp)	8:00	At home
Snack						
Lunch						
Snack						
Dinner						
Snack						

Reproduced with permission from Meyers.[1]

BLOCK 2:

PATIENT INFORMATION SHEET

Remember that no treatment advice should be given before the work-up tests and assessments are completed

4 lessons to remember and share with the patient:

1. How a stone forms
2. How to prevent any new stones occurring in the future:
    a. Dietary advice
    b. Medication adherence
3. Follow-up tests:
    a. Urine in 2 - 3 months after therapy started
    b. Annual (occasionally 6-monthly) follow-up visits
    c. Annual follow-up urine and blood tests
    d. Annual either ultrasound or CT scan (without contrast) of kidneys to detect either new stones or change in size or position of old ones for the first 5 years. After this, only when indicated
4. Remember, follow-up is life-long

Explanation of points 1 and 2:

1. **Formation of a stone:**
    a. **Urinary indications:**

    Urinary factors in the formation of a kidney stone

Excess in the urine of:	Lack in the urine of:
Calcium* Oxalate** Sodium (salt) Uric acid Low urine pH Cystine Bacteria	Urine volume <1.8-2.4L/day Inhibitors of stone formation: • Organic • Inorganic – especially "citrate"

    *Upper limit of normal calcium excretion ± 6.8mmol/day in females and 7.2 in males or, 0.1mmol/kg per day of mean value of ideal body weight.
    **Upper limit of normal oxalate = 350mmols per day in males and females.
    Note: Urinary levels of urea and creatinine are used to roughly assess the amount of protein in the diet – high or low and if less than the lower limit of normal represents strong evidence that the 24-hour urine sample is incorrect.

    b. **Blood level indications:**

    Excess or deficiency in the blood in terms of:
    - Hypercalcaemia – multiple causes
    - Hypokalaemia – diet or multiple causes
    - Hyperuricaemia – gout or other causes
    - Metabolic acidosis – renal tubular acidosis

2. **Prevention**
    a. **Dietary**
        - Avoid high protein diet

- Avoid or minimize red meat
- Avoid a high carbohydrate/sugar diet
- Avoid foods high in oxalate
- Ensure a normal Ca diet (i.e.>1.2g per day)
- Avoid unnecessary supplements:
    - Vitamins (especially Vit C and Vit D);
    - Tablets high in Ca; and
    - "Health" foods high in Ca

The most important dietary advice relates to excessive salt intake. The more salt the more Ca is lost in the urine with the production of CaOx stones.

Ingestion of <5g of NaCl/day will result in a maximum of Na- excretion of 80mml Na/24-hour. (See the following graph)

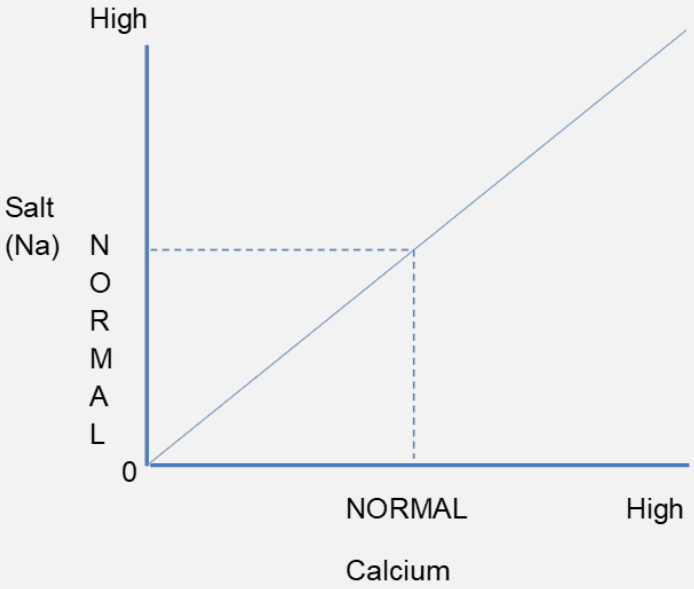

Figure 1: The Salt:Ca ratio

Excessive salt intake accounts for 80% of hypercalciuria. Therefore, limitation of salt intake will benefit the patient in 3 ways:

- No new stones
- Blood pressure control
- Cardiac health

b. Medication advice

i. Has to be life-long otherwise the stones will occur again.

ii. If the cause of your kidney stones is either CaOx or CaP, please remember to always take potassium citrate liquid and not other preparations such as Uralyte U.

iii. The potassium citrate solution has to be taken 3 times per day (with meals). If taken less, the urine citrate concentration will decrease

rendering it possible that calcium oxalate could precipitate and form a new stone.

iv. If you are put onto Allopurinol to lower urine uric acid please remember 3 important points:
    - All patients must start with a low dose (100mg/day) going up to 300mg per day at 2-monthly intervals.
    - If you develop any rash, stop immediately and consult with your doctor.
    - Never take Allopurinol with a sulphur containing diuretic e.g. HCTZ, Indapamide. Cases of either serious skin rashes, some of them with blisters and hypotension can occur.

Reproduced with permission from Meyers.[1]

BLOCK 3:

ROUTINE 24-HOUR URINE TESTS

Two 24-hour urine microscopy and culture collections (one on Sunday (specimen I) and one on the following Monday (specimen II) to assess the "weekend" effect). Electrolyte: creatinine ratios are not accurate enough and 24-hour collections are essential. [Reynolds TM. ACP Best Practice No 181: Chemical pathology clinical investigation and management of nephrolithiasis. J Clin Pathol. 2005 Feb;58(2):134-40. doi: 10.1136/jcp.2004.019588 https://jcp.bmj.com/content/jclinpath/58/2/134.full.pdf]

- **Collection bottles:**
  - Neither 1L or 2L plastic bottles are permitted for urine collection for obvious reasons i.e. multiple specimen bottles increase the risk of contamination.
  - Patient to label the bottles clearly.
  - Bottles with samples must be refrigerated at all times and for travel it must be kept in an adequate cool bag which can accommodate a 4L bottle and 3 to 5 free ice gel blocks. This includes the specimen taken by the patient on the Tuesday morning to the central stone clinic laboratory. Note: Distant laboratories cannot be used as delay in specimen handling is not acceptable (e.g. contamination noted).

- **Urine acidity or basicity levels:**
  - pH must be read on a sophisticated pH meter as soon after sample delivery as possible. Urine dipstick methods are not permitted.
  - Notes on pH levels:
    - A pH of ≤5.3 rules out type 1 distal renal tubular acidosis but pH of ≥ 5.8 suggests high food protein acid load.
    - A pH of ≥6.4 is unusual on a normal 24-hour urine.
    - A pH of 7.6 is suggestive of either complete type 1 distal renal tubular acidosis or a patient on a carbonic anhydrase inhibitor.
    - A pH of ≤7.0 is highly suggestive of a CaP (brushite) stone. Again, to remember, brushite calculi are associated with a marked increase of fibrosis and a higher rate of developing significant future renal dysfunction.

  The laboratory measurement of oxalate, urine pH should be performed with a urine pH of ≤3 (some suggest 1.5) using either hydrochloric acid or concentrated nitric acid.

- **Low urine volume**
  - Renal stone formers should pass at least 2.25 to 2.5 (up to 3) litres of urine per day.

- Highly concentrated urines are more common in hot areas, However, the commonest stones found in these regions is not CaOx but rather uric acid.
- It has been noted that recent climate changes may be linked to an increase in stone formation in children [Tasian GE, Ross ME, Song L, Sas DJ, Keren R, Denburg MR et al. Annual Incidence of Nephrolithiasis among Children and Adults in South Carolina from 1997 to 2012. CJASN (2016 March) 11 (3) 488-496. doi: 10.2215/CJN.07610715 https://doi.org/10.2215/CJN.07610715] and adults [Brikowski TH, Lotan Y, Pearle MS. Climate-related increase in the prevalence of urolithiasis in the United States. Proc Natl Acad Sci U S A. (2008 Jul 15) 105(28):9841-6. doi: 10.1073/pnas.0709652105. Epub 2008 Jul 14. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2474527/]

- **An important stand-alone point on the discussion with the patient**
  - It is mandatory to emphasize that when performing 24-hour urine tests for mineral and other measurements of stone promotors and inhibitors, NO advice on fluid intake adequacy is to be discussed with the patient. The reason for this is the essential knowledge of assessing whether the "correct" volume of fluid, as assessed by a 24-hour urinary volume, is being ingested.

Following is the proposed patient information sheet and collection instructions for a 24-hour urine specimen:

PATIENT INFORMATION SHEET FOR 24-hour URINE TEST

How to do a 24-hour urine test with 0-1% error

- When not to measure a 24-hour collection:
  - In-hospital patients (always erratic unless an indwelling catheter)
  - In females during menstruation
  - In unreliable subjects
  - In young children
  - In patients with possible or definite UTI
- Importance of instructions:
  - Using correct materials (no metal or glass)
  - Store in fridge (why? pH control and prevention of contamination)
  - Inability to comply – tests will show and process will have to be repeated before any treatment decisions can be made

- We can accurately assess the validity of a complete or incomplete 24-hour sample. If incomplete, patient will have to repeat the sample and his/her medical aid will be informed thereof.
- Urines for stone assessment are collected in 2 separate bottles - routinely on a Sunday (bottle 1) and a Monday (bottle 2). If urine is lost during this collection the process must be repeated the following weekend. The receptionist must be informed of this in order to move the next (assessment) appointment forward.
- All patients are charged R50 per bottle refundable at the next (assessment) appointment.

Collection instructions for a 24-hour urine specimen

- If awake at e.g. 7am, set alarm for 7am and get up immediately, go directly to toilet and empty bladder down toilet. Flush away and this will now be the "start-time".
- Then every time urine is passed it must be collected into a plastic jug and poured directly into the collecting bottle.
- This goes on all day and all the coming night if you wake up to pass urine.
- Set alarm for 7am in the morning and immediately get up, pass urine into the jug and pour it into the collection bottle. This last urine represents the "stop-time" i.e. the 24-hour collection is complete.
- If there is bowel action, first collect the urine into the jug before allowing the bowels to work.
- If urine is lost down the toilet or if you do not have the bottle with you for collecting then the process must be stopped, urine already collected must be poured down the toilet, the bottle rinsed with tap water and the process started again the next morning. Your doctor will be able to tell from the results if the sample is a "true" sample or not and will act accordingly.
- Label clearly with date and name. If samples are for stone assessment the bottles must also be clearly marked "Sunday – bottle 1" and "Monday – bottle 2".
- Once collection is complete the bottle must be taken to the laboratory as soon as possible for the tests to be carried out.
- No preservative is used and be careful to avoid any contamination with soaps, sprays, etc.

SUGGESTED STANDARD PRINTED FORMAT FOR WORK-UP DATA (FOR SA LABORATORY STAFF)

A Urine tests – Notes:

1. No collections to be undertaken if patients either have an associated UTI or during menstruation.
2. Laboratory staff to fill in:

	Yes	No
• Has the patient fasted	☐	☐
• Was the 24-hour collection complete (i.e. any urine "lost" e.g. down the toilet?)	☐	☐
• Did the 2 bottles arrive in a suitable cooler bag?	☐	☐

3. All other electrolytes and citrate to be measured on unchanged specimens
4. If specimen II tests positive on dipstick for nitrate and has excess leucocytes do not measure citrate. Please report as such so that a repeat collection can be arranged.
5. If urine microscopy needs to be done do so on specimen II. Put a slot in to be ticked if microscopy is needed.

B Instructions to laboratory staff:

- Please do not insert any result as e.g. mmol/L or as amount : creatinine
- Please do insert all results as quantity / 24 hour (including microalbumin).
- Please store adequate (10 ml) of urine from each specimen (I and II) (frozen).
- Please use an accurate urine pH meter only to measure pH.
- Please add either hydrochloric acid (HCL) or Nitric acid (HNO3) to aliquots for measurement of Ca and Ox. Get pH to 3 or even down to 1.5 (best).
- Please add sodium hydroxide to aliquot to measure urate. Get pH to ≥7.8.

C Urine Chart

Suggested printed format for work-up data:

Measurement (24-hour)	Specimen I (Sunday collection urine)	Specimen II (Normal day collection urine)
24-hour urine pH		
Volume		
Creatinine		
Urea		
Calcium		
Na		
K		
Mg		
PO4		
Albumin*		

Citrate**		
Acidify	Acidify this urine	Acidify this urine
pH		
Calcium		
Oxalate		
Alkalize	No alkalisation of this urine	Add alkali to this
pH	No measurement	
Uric acid	No measurement	

*If urinary tract infection (dipstick positive for nitrate) is present, omit 24-hour microalbumin and repeat test later.

**NB: If dipstick is positive for white blood count and nitrate then no citrate to be done but repeat 24-hour collection for citrate only.

Reproduced with permission from Meyers.[1]

1. Meyers AM. The pivotal role of a kidney stone clinic in the management and prevention of recurrent calcium oxalate nephrolithiasis. 2020. Wits Institutional Repository on DSpace: http://wiredspace.wits.ac.za/browse?authority=77f47495-e38c-4841-9362-428505767a29&type=author accessed 07/07/2021