Advanced Analysis of Bladder Diary
Objective Measures

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Course objectives:

- Calculate objective measured from a measured bladder diary
- Interpret those finding within the current body of knowledge of norms
- Red text is our sample patient - see attached bladder diary

Bladder diary research team (BDRT) (Amundsen 2007, Parsons 2007, Tissot 2008)

- Alfred Coats – Life Tech Houston, TX
- Linda Brubaker, Mary Pat FitzGerald, Kimberly Kenton – Loyola Medical Centre Chicago, IL
- Cindy Amundsen, George Webster – Duke University Medical Center Durham, NC
- Ananias Diokno, William Tissot – Beaumont Hospital Detroit, MI
- Linda Cardoza, Mathew Parsons, Maria Vella – King's College Hospital London, UK

This lecture will focus on

- Clinical use of the bladder diary
    - Documentation of patient's status before, during and after treatment
    - To develop treatment plan
    - Educate and training the patient
- In the male and female adults in an outpatient setting

Types of records (Haylen 2010 – Appendix one IUGA and ICS definitions)

- Frequency volume chart (FVC or FV chart)
    - Volumes voided
    - Time of each micturition
    - Day and night, for at least 24 hours
- Bladder diary
    - Volumes voided
    - Time of each micturition
    - Incontinence episodes and degree of UI (urinary incontinence)
    - Fluid intake
    - Degree of urgency

Psychometrics (Parsons 2010)

- FVC have been shown to be a valid and reliable tool for assessment of micturition patterns (Larsson 1988, Brown 2003, Wyman 1988)
- Test-retest reliability – high to moderate
- Not reliable for
    - Quantity of urine loss
    - Diagnosis discrimination between urge UI (UUI) and Stress UI (SUI)

Information from bladder diary (www.bethshelly.com)

- Subjective
  - Intensity of the desire to void
  - Leakage occurrence, type and amount
  - Pad usage and type
- Objective
  - Fluid intake type and amount
  - Micturition pattern - timing and volume of voids

"Bladder diary day"

- Starts – time of getting out of bed to start the day
- Ends – last void of the night – the one before you get up out of bed to start the day

Proper fluid intake (Mayo 2004)

Fluid need depend on

- Health / illness
  - Increased fluid need
    - Fever
    - Vomiting / Diarrhea
    - UTI / stone
    - Pregnancy and breastfeeding
  - Decreased fluid needs
    - CHF
    - Kidney, liver, adrenal disease
- Exercise - sweating, increased respiration
  - Amount of need depends on:
    - Length of exercise
    - Intensity of exercise
    - How much you sweat
- Environment
  - Higher fluid intake needed
    - Hot, humid weather due to sweating and fluid loss through skin
    - Indoor heated air due to fluid loss through skin, dry air
    - Altitude above 8,200 ft due to increased urine production and increased respiration rate

Normal intake for a Average healthy adult living in a temperate climate

- The Institute of Medicine and American Dietetic Association
  - Men 3000 ml (13 c)
  - Women 2200 ml (9 c)
- 8x8 rule
  - Take in 8 eight oz glasses per day = 1900 ml
  - No scientific data to support this
- Pregnancy – 2300 ml (9.5 c)
- Breast feeding – 3100 ml (13 c)
- Exercise more than 1 hr – need to increase fluid intake 400 to 600 ml (1.5 c to 2.5 c)
- Most clinicians - 1500 ml to 2000ml - 2440 ml total fluid intake

Thirst

- Thirst is not a good measure of need
  - You may be dehydrated and not thirsty
  - You can be fully hydrated and still thirsty
- Not a good idea to let thirst alone guide fluid intake
- Urine output should be colorless or slightly yellow

Timing of Fluids

- Should be evenly spaced throughout the day
- Strong relationship between evening fluid intake, nocturia, and nocturnal voided volume (Griffiths 1993)
- Intake arrives in bladder about 45 to 60 minutes after ingesting
- Decreasing fluid intake after 7 PM (or 2 hrs before bed) may decrease nocturnal UI (Tomlinson 1999)

Evidence for fluid amount recommendations

- Fluid intake over 2,400 ml (80 oz) or under 1,500 ml (50 oz) can contribute to UI (Tomlinson 1999)
- Fluid intake over 3700 ml - associated with voiding > 10 x/ day and 2 x/ night, higher UI rates as compared to 2400 ml. (Lukacz 2011)

Primary polydipsia - good review article Sailer 2017

- Excessive water intake - over 3000 ml in patient of 60 kg (132 lbs)
- Excessive water intake in combination with abnormal renal function, uncontrolled diabetes, psychosis, and syndrome of inappropriate antidiuretic hormone (SIADH) can result in hyponatremia (Diamond 2004, Gilbert 1976)
- Most commonly occurring in patients with schizophrenia or other psychiatric illnesses – 4 to 6 liters per day (Rae 1976, Vieweg 1986)

Type of Fluid Intake / irritants

- Caffeine
  - RCT decreasing caffeine (less than 100mg) significantly decreased UI in combination with PFM exercises. (Bryant 2000)
  - Decreasing caffeine intake has no significant effect on leakage, frequency, urgency, or QOL (Swithinbank 2005; Bird 2005)
  - A multivariable analysis showed no association between coffee drinking or alcohol consumption and UI (Brown 2000)
  - Approximately 50% of adults are sensitive to caffeine - try removing caffeine - then decide
- Alcohol
- Carbonated beverages
- High acid containing foods can be irritating, especially in patients with painful bladder syndrome
- Artificial sweeteners (Newman 2007)
- Consider calculating % of non-irritants
  - Irritant intake – Total intake / Total intake x 100
    - 2440 ml total fluid intake
    - 900 ml irritants
      - 900 ml irritant intake - 2440 ml total fluid intake / 2440 x 100
      - = 63.1% of fluid intake is not irritants

Urine Output

- Total 24 hour urine volume – V24
- Total 24 hour frequency – F24
- Average voided volume - Vavg
- Maximum voided volume - Vmax
- Day Voiding Intervals
- Nocturnal urine volume - Fn
- Frequency of night time voids - Vn
- Nocturnal Polyuria index - NPi

Unmeasured voids

- Ideally the patient would measure all voids in a continuous 3 day period – especially if nocturia is a concern.
- Practically this might not be possible
- If the patient is in a location where it is not possible to measure they will place a check in the box – Do not guess
- In this case Vavg would be calculated by adding all measured volumes and dividing by the number measured
- This number can then be inserted into the diary at each check mark for other calculations

24 hour urine output – V24

- Add all volumes voided in 24 hrs starting with the second void of the day and including the first void of the following day - V24 = 2625 ml per 24 hrs
- BDRT data 1250-1900 ml (means calculated by scatter plots)
- Many clinicians use ave 1500 to 2000 ml
- Too low - under 600 ml
- Too high - over 3000 ml

Global polyuria

- Excessive V24 urine production
- Most common parameters sited – over 3000 ml per day
- Standardization document – over 40 ml/ kg of body weight
- Psychiatric patient with polydipsia syndrome produce V24 of 4934 to 9884 ml (Vieweg 1986)
- Causes of global polyuria (Weis 2011, Laureanno 2010)
    - Diabetes mellitus (type 1 and 2)
    - Diabetes insipidus (pituitary and renal)
    - Polydipsia (psychogenic, dipsogenic, iatrogenic)
    - Secondary nephrogenic due to lithium or electrolyte disturbance such as hyperkalemia, hypokalemia
    - Secondary to medications such as diuretics

F24 - Total 24 hour frequency

- Count number of voids in 24 hrs starting with the first morning void - 11
- F24 should be adjusted for age, sex, and 24 hour urine volume (BDRT)
- Average 7 voids per 24 hrs (range 5.3 to 8.5)

- Voiding frequency is related to (Gulur 2011)
  - Rate of urine output
    - Higher V24 (more urine produced)
    - Higher F24 (more trips to the bathroom) BDRT
  - Reservoir capacity of the bladder
    - Older patients (smaller bladder capacity)
    - Higher F24 (more trips to the bathroom) BDRT
  - Sensitive lower urinary tract sensation
  - Psychological response

Vavg – average voided volume (also called functional bladder capacity)

- V24/F24 - 2625 / 11 = 238.63 ml per void
- Vavg should be adjusted for age, sex, and 24 hour urine volume (BDRT)
- Average 250 ml per void (range 180 ml to 385 ml)
- Vavg - Volume per void (BDRT)
  - Increases with increasing V24
    - Higher V24 (more urine production)
    - Larger Vavg (larger bladder capacity)
  - Decreases with age
    - Older patient
    - Smaller Vavg (smaller bladder capacity)

Vmax – maximum voided volume (also called diary bladder capacity)

- List single largest volume voided 350ml
- Vmax increases with increased V24 (BDRT)
  - Higher V24 (more urine production)
  - Higher Vmax (larger bladder capacity)
- Average 500 ml (range 400 ml to 750 ml)

Day voiding intervals

- Voiding interval (Lukacz 2011)
  - Adult (under 75 year old) - every 3 to 4 hours
  - Older patients (over 75 years old) – every 2 to 3 hrs, due to smaller bladder capacity
- Average day voiding interval
  - Can be formally calculated
  - But better to state a range of voiding interval
  - Used as a starting point for bladder training

Vn - nocturnal urine volume

- Add up all voided volumes 550 ml night time urine volume
  - After the patient retires for the night - includes only voids preceded and followed by sleep
  - AND the first void on getting out of bed for the day
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- Add up all voided volumes included in after the patient retires for the night to before the patient leaves the bed for the day - includes only voids preceded and followed by sleep and the first void on getting out of bed for the day
- Voided volumes at night are on average 1/3 larger than Vavg (Laureanno 2010)
- Varies greatly (470 ml to 1020 ml) and affected by many factors
- Not reliable in evaluating nocturnal polyuria

Fn - Frequency of night time voids

- Count number of voids from after the patient retires for the night to before the patient leaves the bed for the day - includes only voids preceded and followed by sleep 1

Types of nocturia

	Night frequency	Night urine production
Low bladder capacity	High	Normal
Nocturnal polyuria	High	High

NPi - Nocturnal polyuria index

- Vn/V24 x 100 = 550/2625 x 100 = 20.95%
- Nocturnal polyuria: (D'Ancona 2019) Increased proportional production of urine during the night-time compared with the 24 h urine volume. (NPi) is most commonly used
    - 33% in elderly, eg, >65 years
    - >20% in younger individuals
    - 20-33% in "middle age"
- This measure does not consider amount of time sleeping

Our patient example - see attached bladder dairy

- V24 - 26525 ml - increased voided volume
- F24 - 11 - increased urinary frequency
- Vave - 238.63ml - low average voided volume
- Vmax - 350ml - low max voided volume
- Vn - 550ml - WNL
- Fn - 1 - WNL
- NPi - 20.95% - WNL

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