

An illustration on the left side of the slide shows four stylized human figures interacting with large puzzle pieces. One figure is suspended in the air, holding a yellow rope that supports a large purple puzzle piece. Another figure is sitting on top of a red puzzle piece. A third figure is pushing a red puzzle piece from the left, and a fourth figure is pushing a purple puzzle piece from the right. The background is a dark blue gradient with various circular patterns, including dashed lines and solid circles in shades of purple and red. The overall theme is teamwork and problem-solving.

ENURESIS IN CHILDREN- PANEL DISCUSSION

- ❖ DR AMISH UDANI
- ❖ DR KIRAN SATHE
- ❖ DR SANGEETHA
- ❖ **DR SENTHIL GANESH**

DEFINITIONS

Monosymptomatic Enuresis

Non Monosymptomatic Enuresis

Primary Enuresis

Secondary Enuresis

Nocturia

Nocturnal Polyuria



Pediatric Incontinence

evaluation and clinical management



Israel Franco • Paul Austin • Stuart Bauer
Alexander von Gontard • Yves Homsy

WILEY Blackwell

Primary nocturnal enuresis is the involuntary discharge of urine at night by children old enough to be expected to have bladder control

- **PRIMARY NOCTURNAL ENURESIS (PNE)**

Secondary enuresis is a condition that develops at least six months — or even several years — after a person has learned to control his or her bladder.

- **SECONDARY NOCTURNAL ENURESIS (SNE)**

Enuresis in children without any other lower urinary tract symptoms and without a history of bladder dysfunction

- **MONOSYMPTOMATIC NOCTURNAL ENURESIS (MNE)**

Enuresis in child with associated bladder symptoms such as urgency, postponement, dyscoordination, constipation, or faecal incontinence

- **NON MONOSYMPTOMATIC NOCTURNAL ENURESIS (NMNE)**

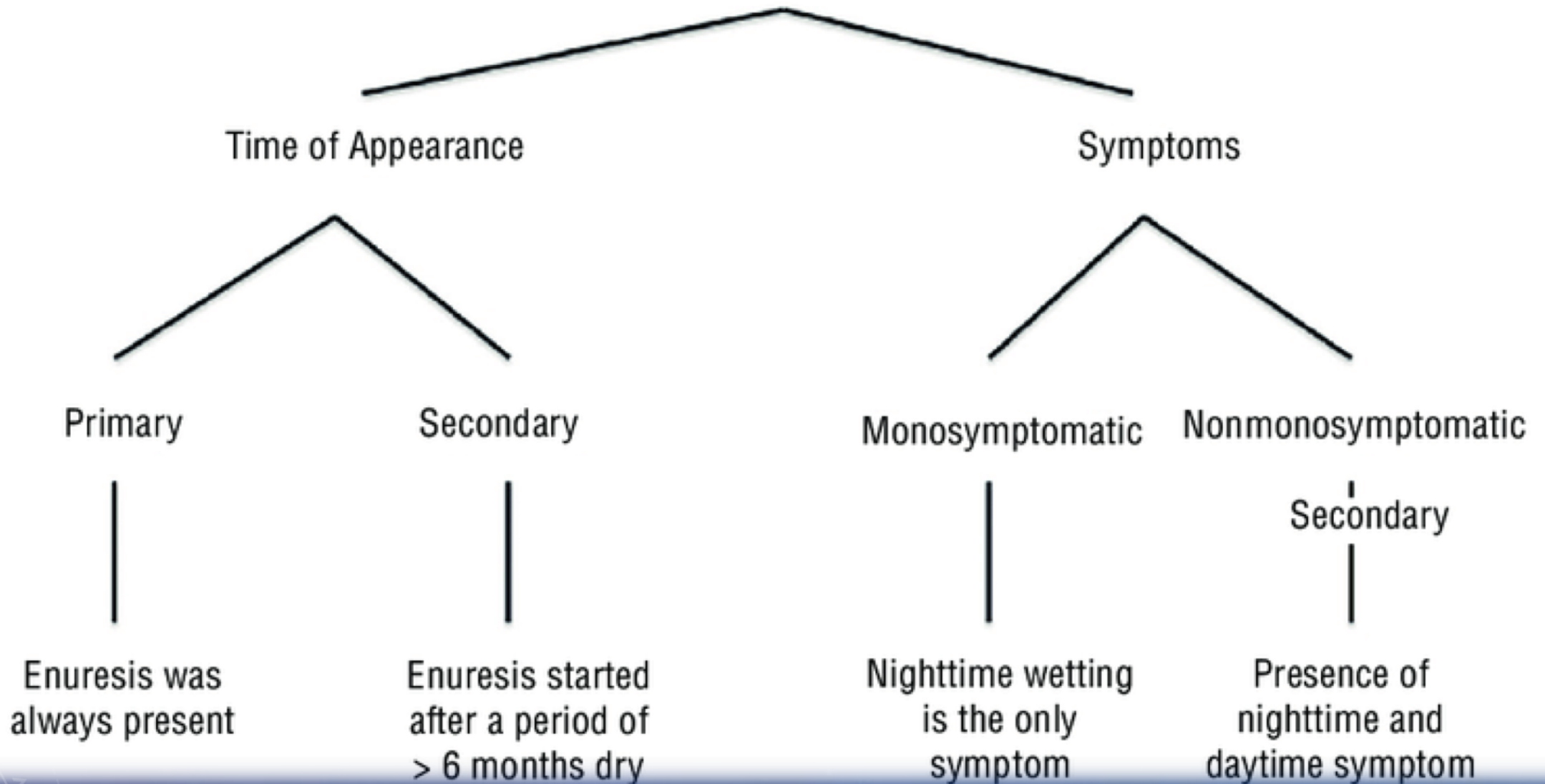
NOCTURIA

- **Nocturia is when you wake up more than one time each night to go void urine .**

NOCTURNAL POLYURIA

- **Nocturnal polyuria occurs when urine is overproduced at night while 24-hour urine production volume remains normal.**
- **> 20%-33% of total 24-hour urine**
- **Nocturnal urine volume > 130% of expected bladder capacity for age**

CLASSIFICATION OF ENURESIS



nocturnal enuresis

A photograph of a baby's foot sticking out from under a white hospital gown, resting on a brown cardboard surface. The background is a dark blue gradient with faint white circular patterns and numbers.

age	rate
5	16%
6	13%
7	10%
8	7%
10	5%
12-14	2-3%
>15	1-2%

secondary causes

renal

chronic kidney disease

haematological

sickle cell disease

lower urinary tract

bladder dysfunction

chronic uti

posterior urethral valves

ectopic ureter

neurological

seizures

spinal dysraphism,

endocrine

diabetes mellitus

diabetes insipidus

gastrointestinal

constipation

pinworms

sleep

obstructive sleep apnoea

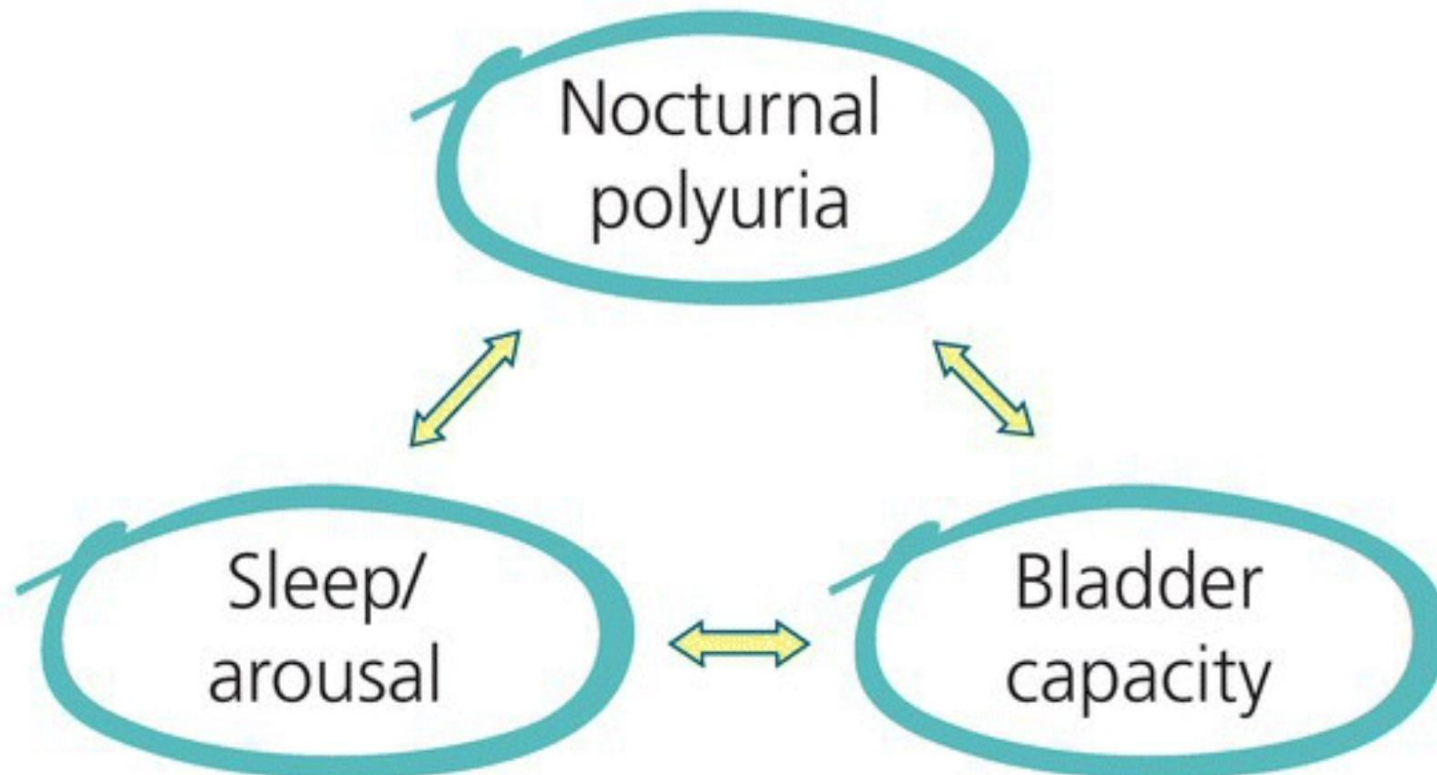
MECHANISMS – ENURESIS

- **Nocturnal urine production - ADH**
- **Nocturnal bladder storage capacity - detrusor**
- **The ability to arouse from sleep – cause or effect?**

Nocturnal enuresis is caused by a mismatch
between nocturnal urine volume and nocturnal
bladder capacity

+

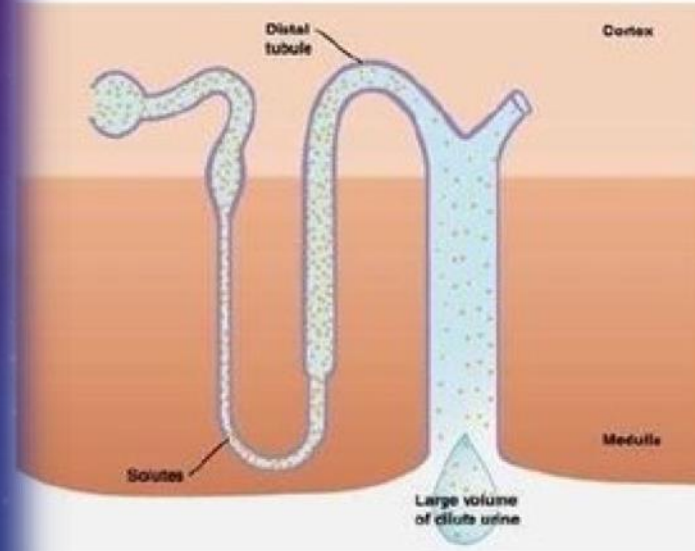
Inability to awaken when this occurs



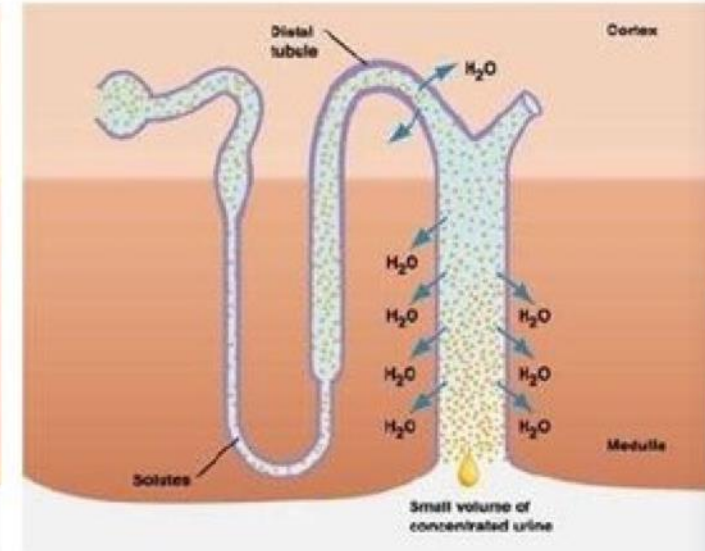
Nocturnal urine production – ADH ↓

- Less ADH ↓
- Abnormal v 2 receptors
- Genetic factors
- Familial predisposition

ADH acts on kidney



No ADH Present- Collecting Duct is NOT permeable to water and large volume of urine is produced



ADH Present- Collecting Duct is permeable to water and a small volume of urine is produced

ADH Physiology

✓ Physiology —

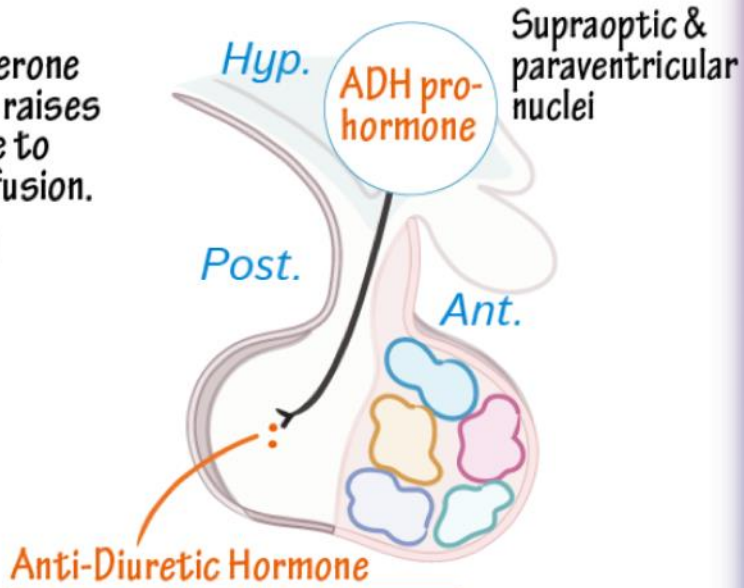
- ✓ ADH/AVP/Vasopressin
- ✓ Regulate body water & blood pressure

ADH assists aldosterone during hemorrhage - raises intravascular volume to maintain tissue perfusion.

- ✓ ADH is given during hypotensive crisis.

✓ Pathology —

- ✓ SIADH
- ✓ Diabetes insipidus



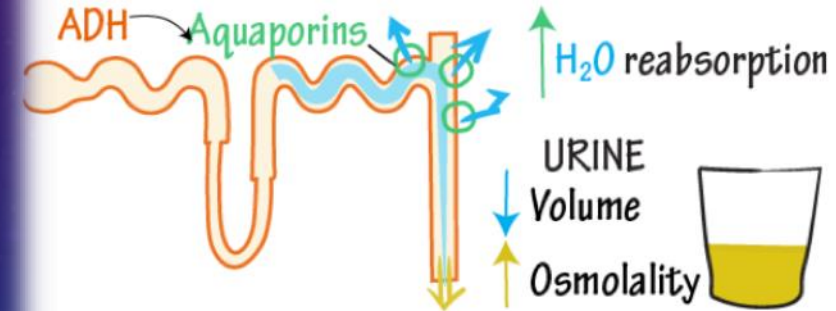
Anti-Diuretic Hormone

Released in response to minute increases in plasma osmolality above 280 mOsmol/kg H₂O (i.e. hypernatremia) or in response to decreases in intravascular pressure (hypovolemia).

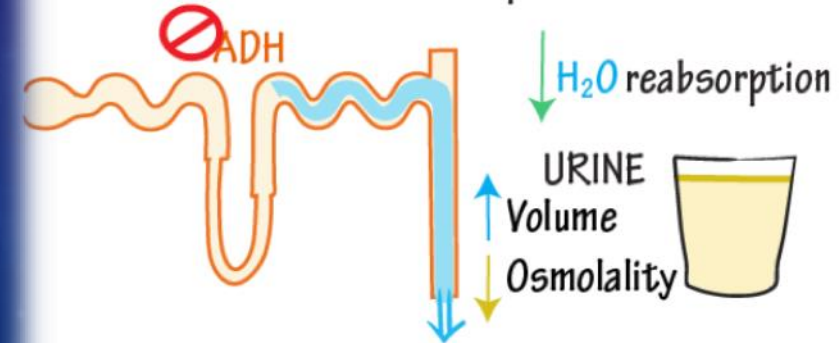
ADH Physiology

Serum Osmolality

- Sensed by hypothalamic osmoreceptors
- ADH binds V₂-receptors
- Distal nephron aquaporin insertion



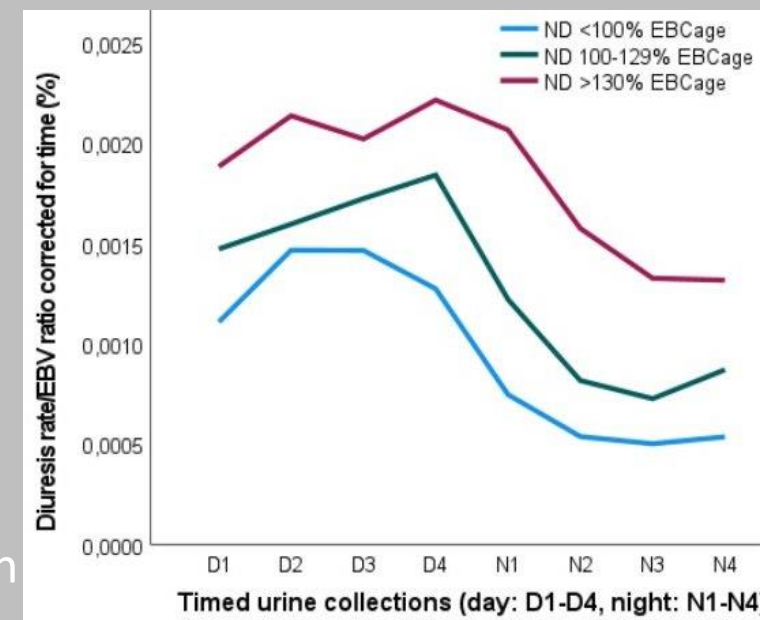
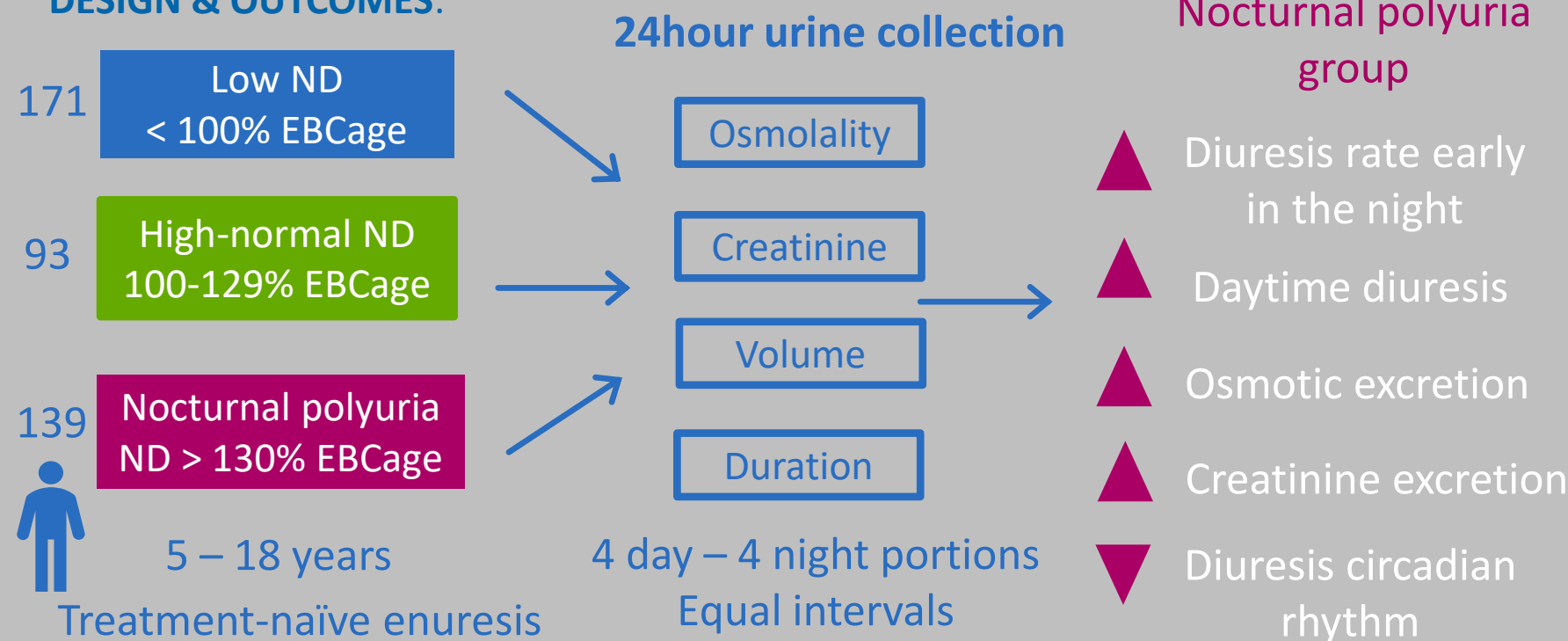
When osmolality returns to baseline, ADH release stops.



Circadian rhythm of water and solute excretion in nocturnal enuresis

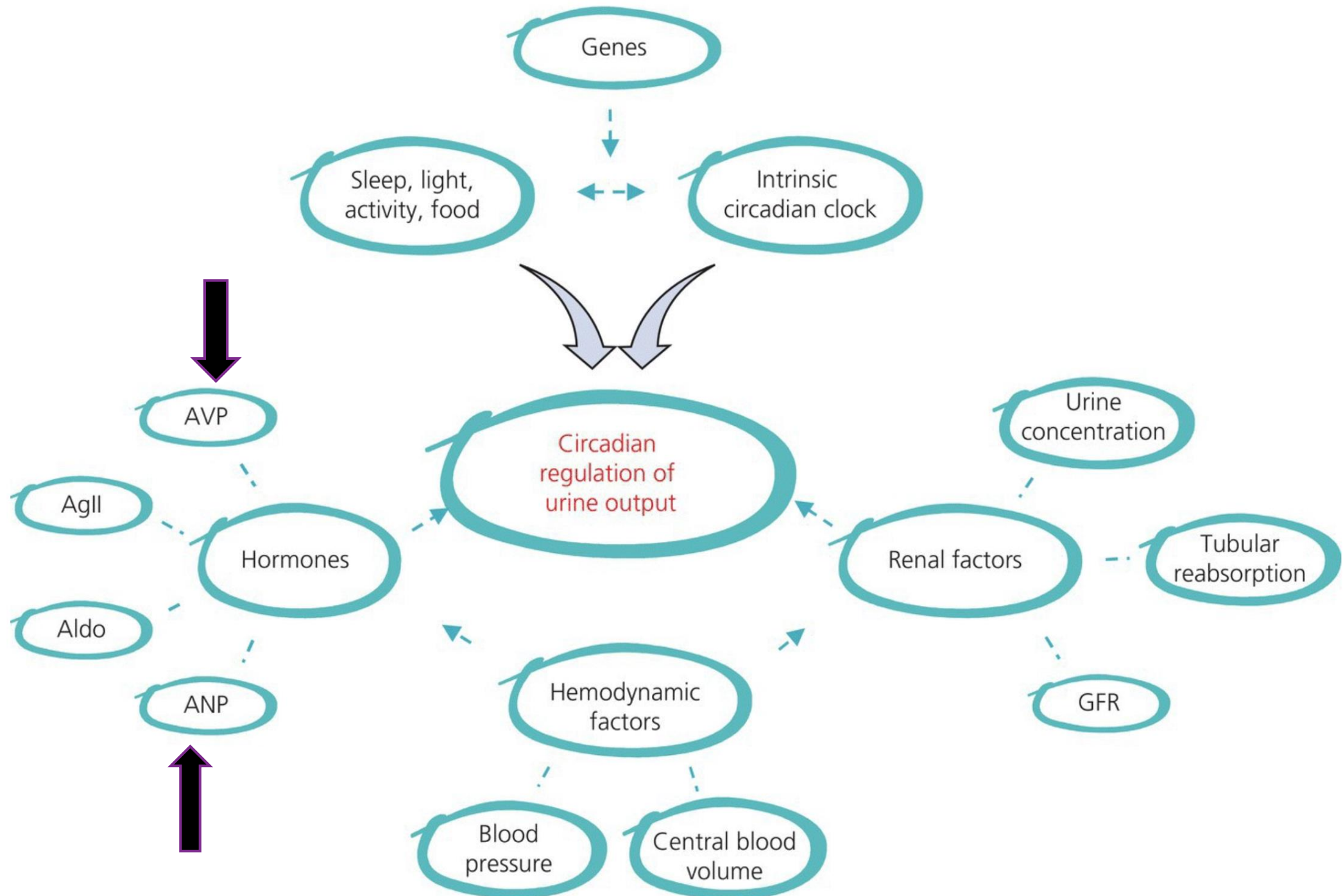
HYPOTHESIS: Several circadian rhythms of the kidney play a role in the pathogenesis of enuresis.

DESIGN & OUTCOMES:



CONCLUSION: Abnormal circadian rhythms of the kidney are involved in the manifestation of nocturnal polyuria. Increased diuresis rate early in the night, as well as the total nocturnal diuresis volume, are equally important.

Karamaria et al. 2022

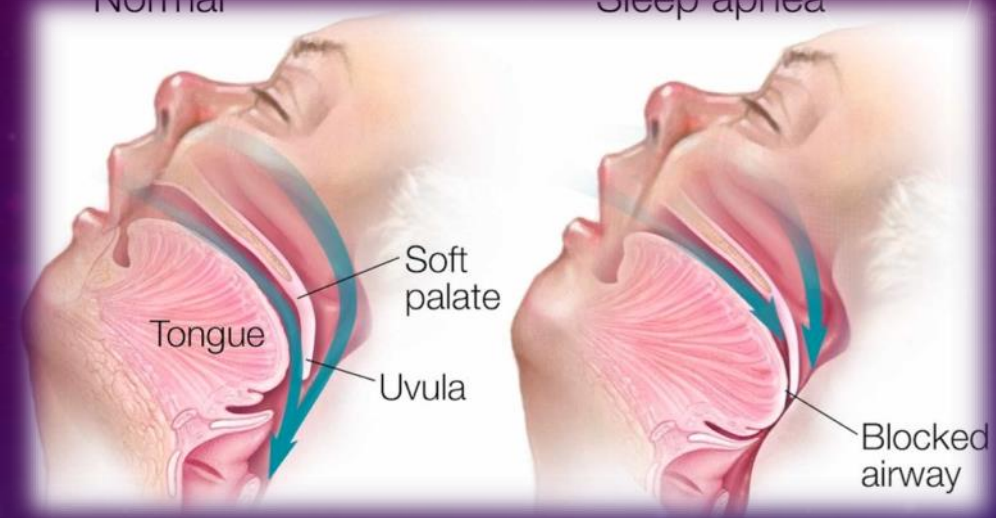


SLEEP – CAUSE OR EFFECT

- Enuresis is caused by deep sleep – earlier theory.
- Sleep EEG failed to show any convincing abnormalities in sleep architecture
- Recent theory - signals from an overactive bladder causes increased arousal levels during sleep.
- Sleep latency **↑** / sleep efficiency **↓** / poor sleep quality.
- sleep fragmentation **↑** / periodic limb movement **↑**
- **New pathogenesis paradigm - sleep in children with enuresis may in fact be too “light” and inefficient and currently focus is directed toward possible daytime consequences of a disturbed sleep.**

Normal

Sleep apnea



The ability to arouse from sleep –
cause or effect?

SLEEP APNEA SYMPTOMS



Impotence



Insomnia



Snoring



Dry Mouth
Throat



Morning
Headache



Memory
Loss



Attention
Deficit



Depression
Moody



Fatigue



Nocturia

Sleep disordered breathing



decreased arousal response

increased intra-abdominal pressure

increases in systemic blood pressure

increase in BNP and ANP; decrease in ADH



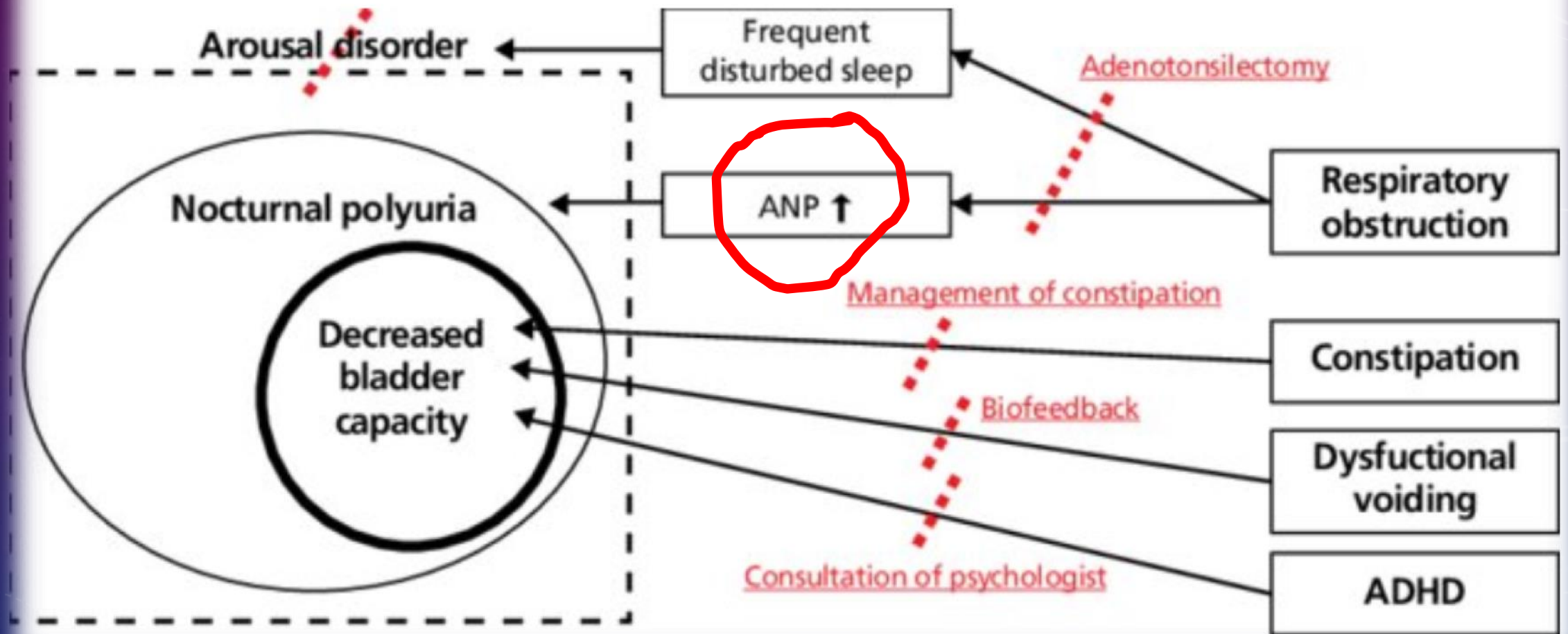
increased bladder pressure

pressure-induced natriuresis

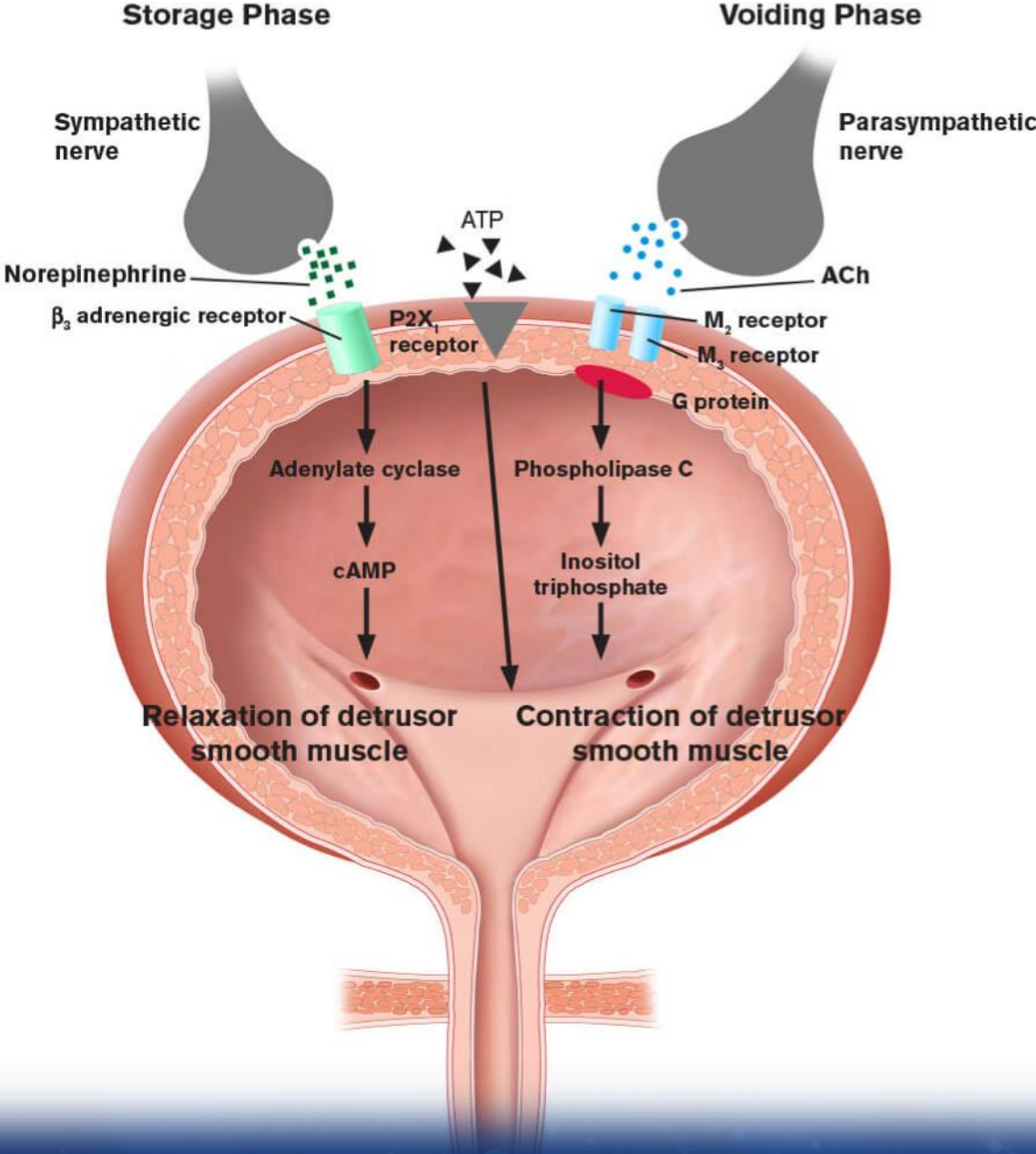
nocturnal diuresis and natriuresis



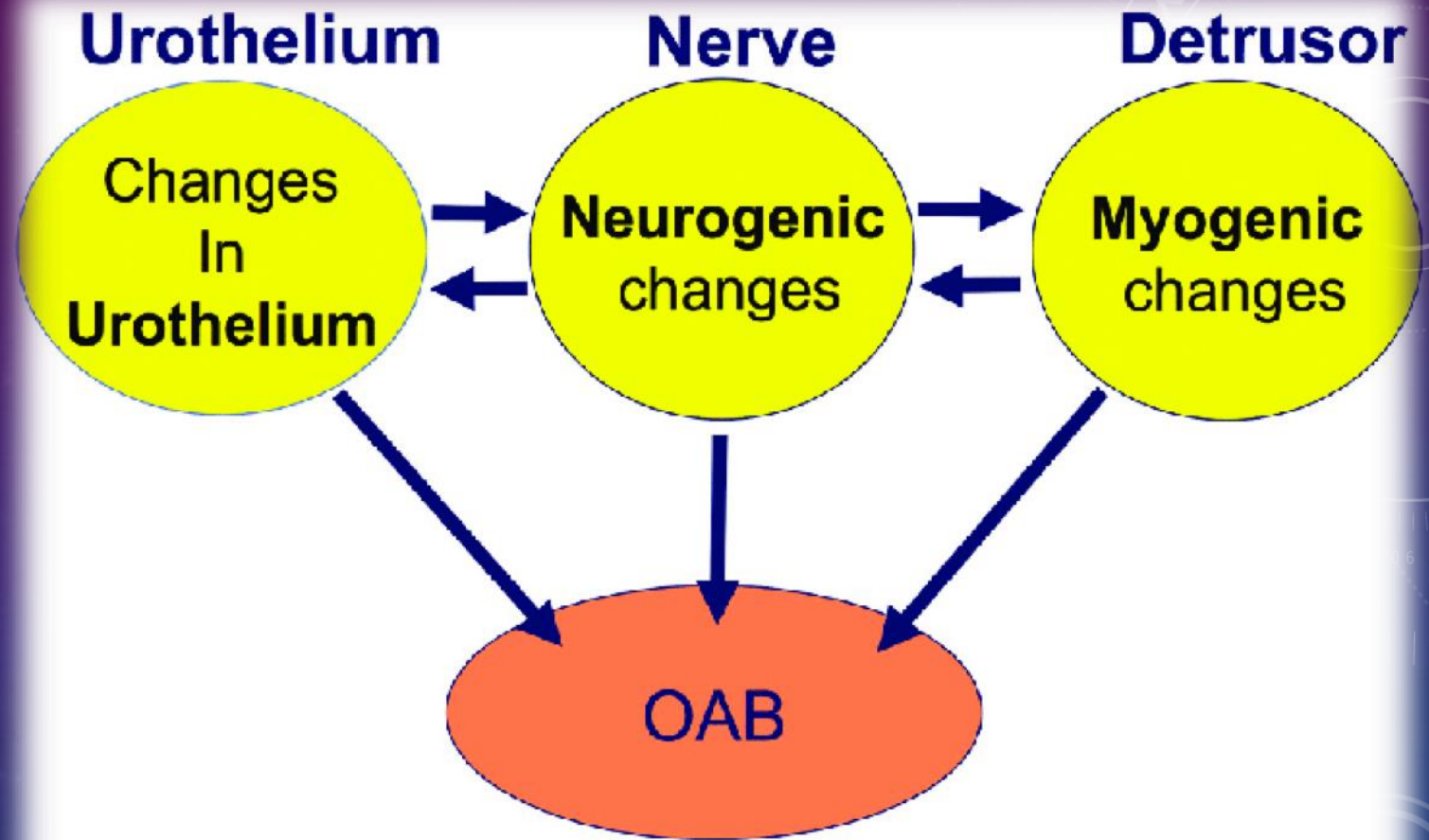
Enuresis



Functional bladder capacity



1. Recurrent cystitis
2. Bladder irritants
3. Day time symptoms
4. BBD
5. Neurogenic bladder
6. Valve bladder
7. Behavioral issues



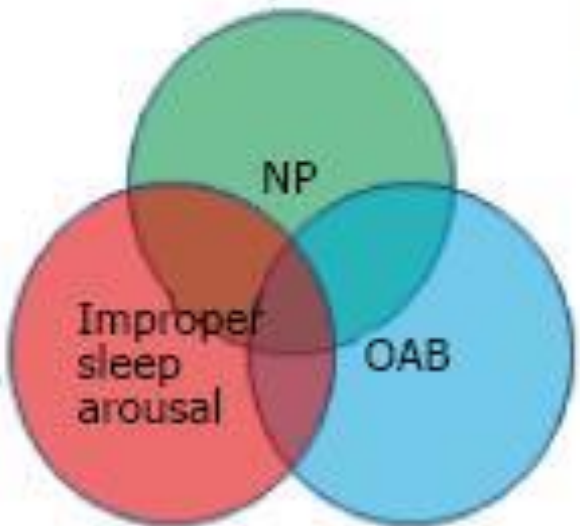
Aberration in the voiding reflex leading to involuntary detrusor contractions



Abnormal nocturnal plasma vasopressin release

NP: Nocturnal polyuria
OAB: Over active bladder

Failure to awaken in response to bladder sensations; deep and fragmented sleep; excessive daytime sleepiness



Co-existing daytime symptoms including urgency, frequency and incontinence; are often therapy resistant

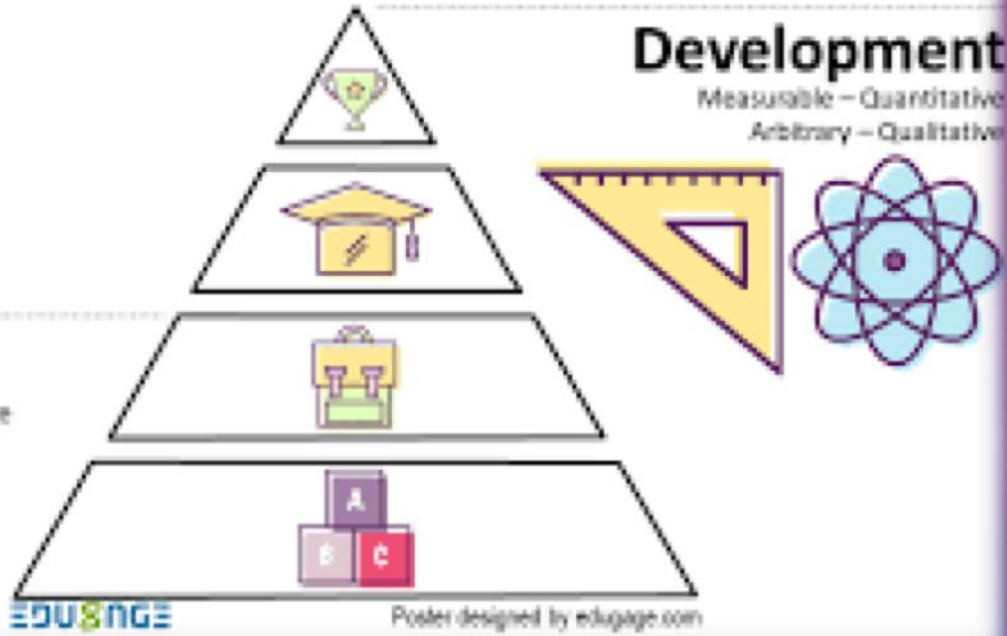
CLINICAL HISTORY

- **Parents**
- **Children**
- **Family / school issues**
- **Day time symptoms**
- **Psychological**
- **Neurological**
- **Anatomical**

- **voiding diary**

Growth

Measurable - Quantitative



Development

Measurable - Quantitative
Arbitrary - Qualitative

Polyuria (Frequent Urination)



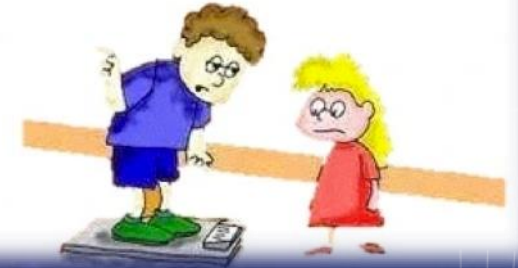
Polydipsia (Excessive Thirst)



Polyphagia (Excessive Hunger/Increased Appetite)



Involuntary Weight Loss



- Chronic diseases – renal tubular disorders
- Psycomotor development
- Diabetes mellitus / insipidus



LUTS are divided into storage, voiding and postmicturition symptoms

Storage

- Frequency
- Nocturia
- Urgency
- Incontinence
- Bladder pain

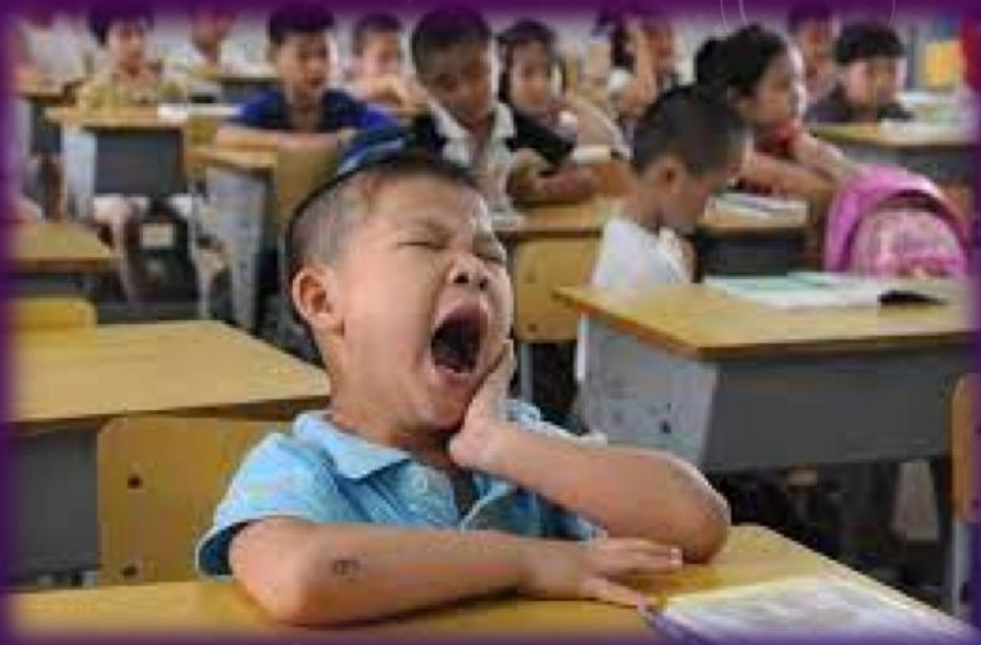
Voiding

- Hesitation
- Weak stream
- Intermittency
- Strain
- Terminal dribble

Postmicturition

- Feeling of incomplete emptying
- Postmicturition dribble





CHILDREN AND MENTAL ILLNESSES

- At home
- In school
- With friends

- Child
- Parents
- Caretakers

Attention Deficit
Hyperactivity
Disorder (ADHD)

Anxiety
Disorders

Mood
Disorders



Autism
Spectrum
Disorder
(ASD)

Eating
Disorders

? FAMILIAL ? GENETIC



75% risk where both parents have been enuretics as children



45% risk where only one parent has been enuretic



15% risk where there is no parental history of enuresis

Large protein rich diet

> urinary urea / Phospates/
sulphates excretion

Glomerular
hyperfiltration

Natriuresis

NOCTURNAL
POLYURIA

Is protein rich diet a cause ?

NOPTIA
NOCTURIA & POLYURIA
INTERNATIONAL NOCTURNAL POLYURIA RESEARCH GROUP (INPRG)

Bladder-Irritating Foods

Avoid...



Carbonated Drinks



Coffee, Tea



Acidic Fruits



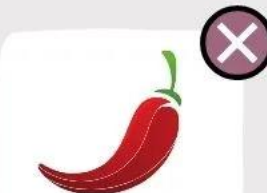
Chocolate



Tomato-Based Products



Food Dyes



Spicy Foods



Dairy



Sugary Foods

Bladder Diary



BED WETTING MONTHLY CHART

MARK THE DATES WITH X ON WHICH YOUR CHILD HAS WET THE BED

JANUARY						
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

FEBRUARY						
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28

MARCH						
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

APRIL						
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30					

MAY						
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

JUNE						
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30					

JULY						
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

AUGUST						
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

SEPTEMBER						
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30					

OCTOBER						
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

NOVEMBER						
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30					

DECEMBER						
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

PROGRESS CHART

Write your name here: _____

'S Progress Chart

Week 1	M	T	W	T	F	S	S
Wet					✿		
Slightly Wet							
Dry							

Week 2	M	T	W	T	F	S	S
Wet							
Slightly Wet							
Dry							

Week 3	M	T	W	T	F	S	S
Wet							
Slightly Wet							
Dry				★			

Week 4	M	T	W	T	F	S	S
Wet							
Slightly Wet							
Dry						★	★

Week 5	M	T	W	T	F	S	S
Wet							
Slightly Wet							
Dry					★	★	★

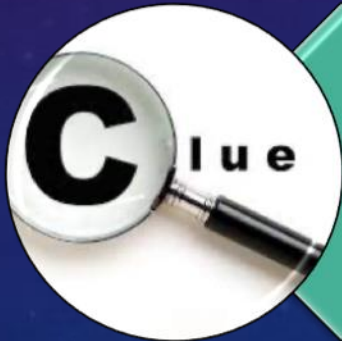
Week 6	M	T	W	T	F	S	S
Wet							
Slightly Wet							
Dry			★	★	★	★	★



Are there signs of underlying conditions that call for extra evaluation?



Is there significant comorbidity ?



Are there clues to guide the choice of therapy?

CLINICAL EXAMINATION

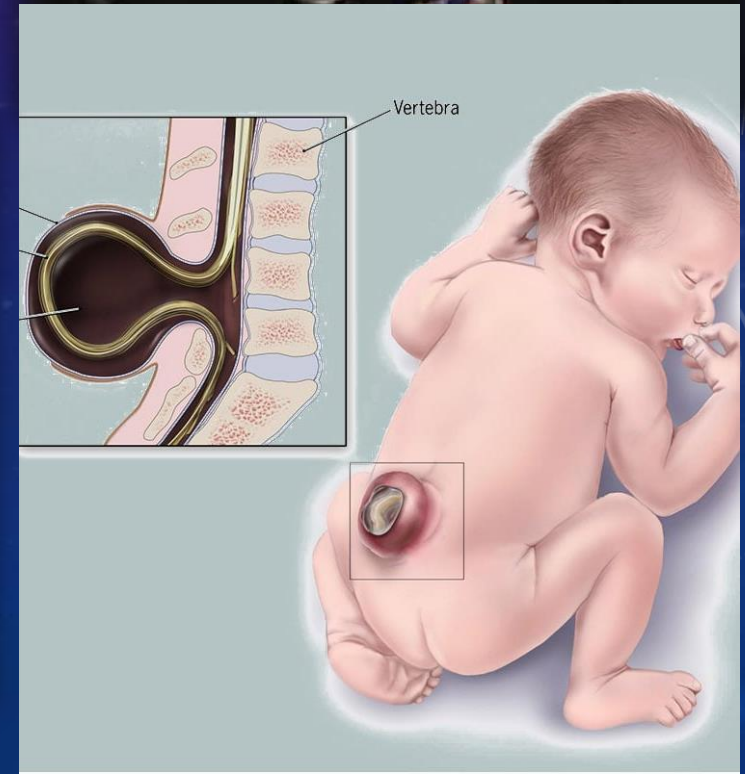
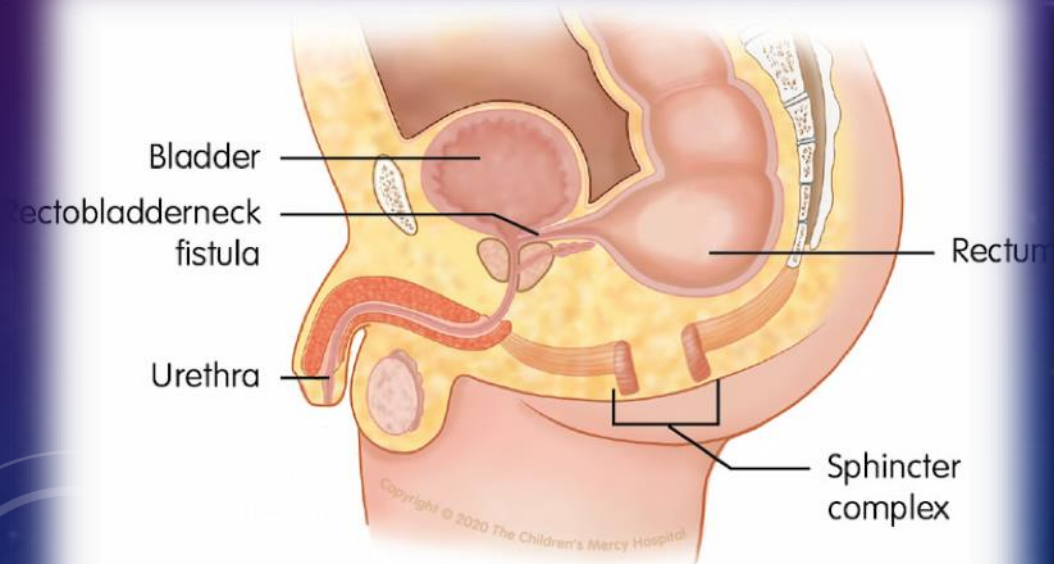
- Anatomical
- Neurological
- Mental comprehension
- Psychological





RECTOBLADDERNECK FISTULA

- Neurogenic bladder
- High ARM bladder
- Valve bladder
- Spinal cord anomalies





Forgetfulness



Carelessness



Risky behavior



Difficulties sitting still

ADHD Signs and Symptoms in Children



Trouble getting along



Daydreaming



Excessive talking



Disorganization

DEPRESSION

SIGN AND SYMPTOM

HELPLESSNESS

Aliquam vel arcu nibh. Fusce ultrices urna libero, id tincidunt nulla pretium nec.



ANGER

Aliquam ligula augue, blandit eu suscipit sit amet, dictum at nulla. Morbi sodales feugiat odio non ornare.



THOUGHTS OF DEATH

Nam in leo id est sollicitudin interdum. Praesent nec ex ante.



CAN'T CONCENTRATE

Nam in leo id est sollicitudin interdum. Praesent nec ex ante.



GUILT

Curabitur vel euismod arcu. Aliquam vel arcu nibh.



ENERGY LOSS

Suspendisse sed arcu neque. Duis vitae porta ligula.



WEIGHT CHANGES

Donec ornare blandit lacus non vulputate. Mauris quis lectus ut ex porta accumsan in a ipsum.



LOSS OF INTEREST IN DAILY ACTIVITIES

Maecenas ut libero ultrices fella bibendum euismod. Mauris at lobortis massa.



SLEEP PROBLEM

Fusce sagittis ullamcorper massa. Nulla ut risi vitae nulla sodales sodales.



INVESTIGATIONS

- Urine examination
- Ultrasound examination
- Uroflowmetry
- How to diagnose – nocturnal polyuria



Normal urine analysis

- Normal values are as follows:
- Color – Yellow (light/pale to dark/deep amber)
- Clarity/turbidity – Clear or cloudy
- pH – 4.5-8
- Specific gravity – 1.005-1.025
- Glucose - ≤130 mg/d
- Crystals – Occasionally
- Bacteria – None
- Yeast - None
- Casts – 0-5 hyaline casts/lpf
- Ketones – None
- Nitrates – Negative
- Leukocyte esterase – Negative
- Bilirubin – Negative
- Urobilirubin – Small amount (0.5-1 mg/dL)
- Blood - ≤3 RBCs
- Protein - ≤150 mg/d
- RBCs - ≤3RBCs/hpf
- WBCs - ≤2-5 WBCs/hpf
- Squamous epithelial cells - ≤15-20 squamous epithelial cells/hpf

- BACTERIURIA
- GLUCOSURIA
- PROTEINURIA
- SPECIFIC GRAVITY

Normal values :

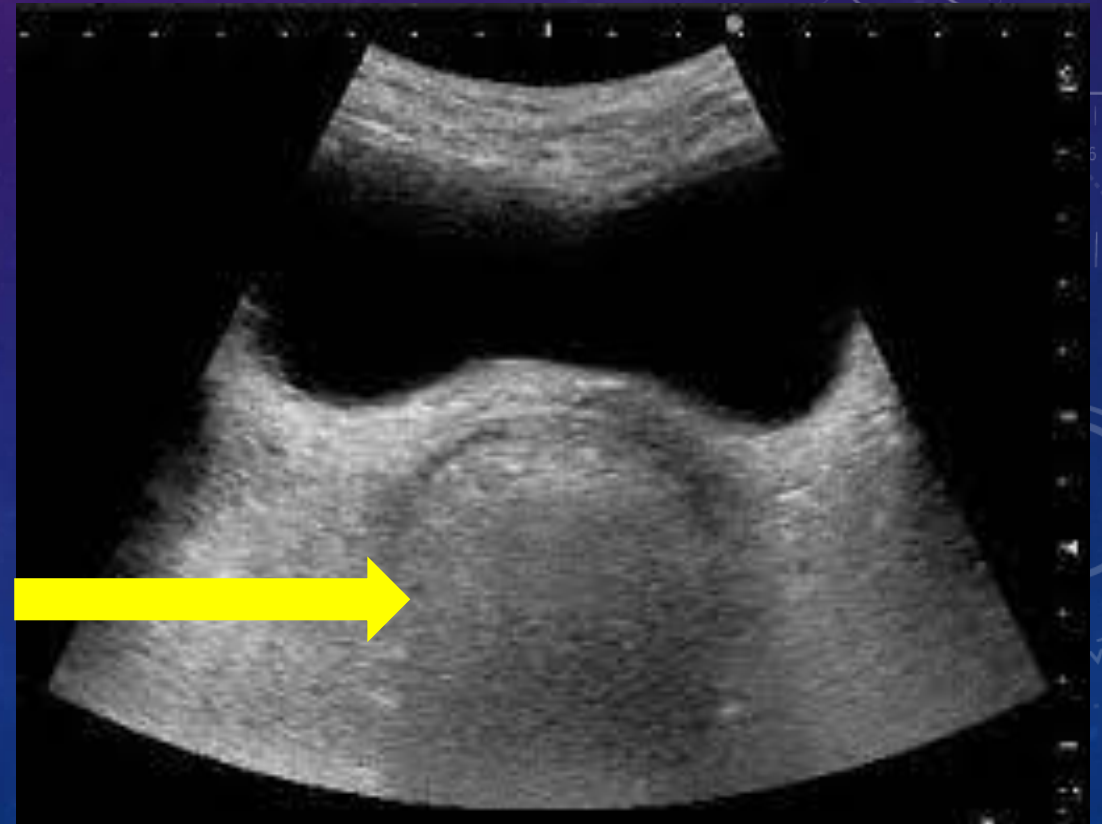
- 50 to 1200 mmol/kg
- 12 to 14 hour fluid restriction: > 850 mmol/kg

• HYPEROSMOLAR URINE
• HYPO OSMOLAR URINE



**1 . Post void residual urine – significant ? –
> 10% of the bladder capacity**

2. Rectal diameter >3cm



Voiding diary

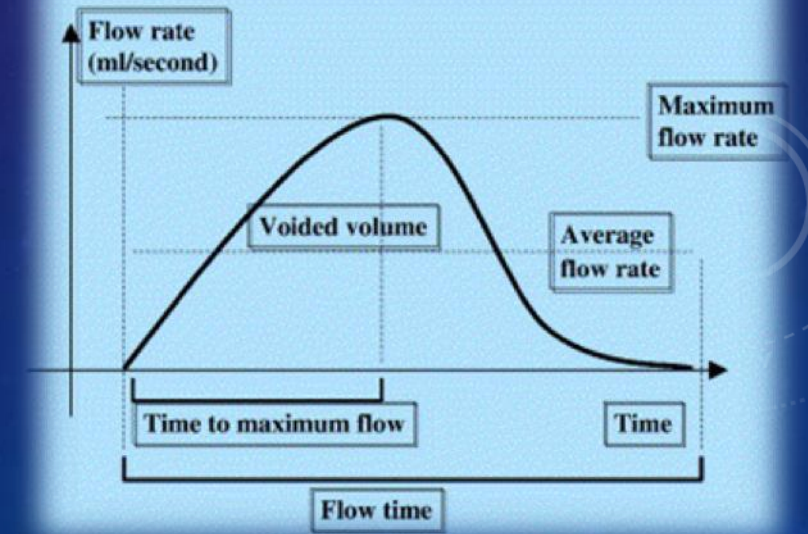
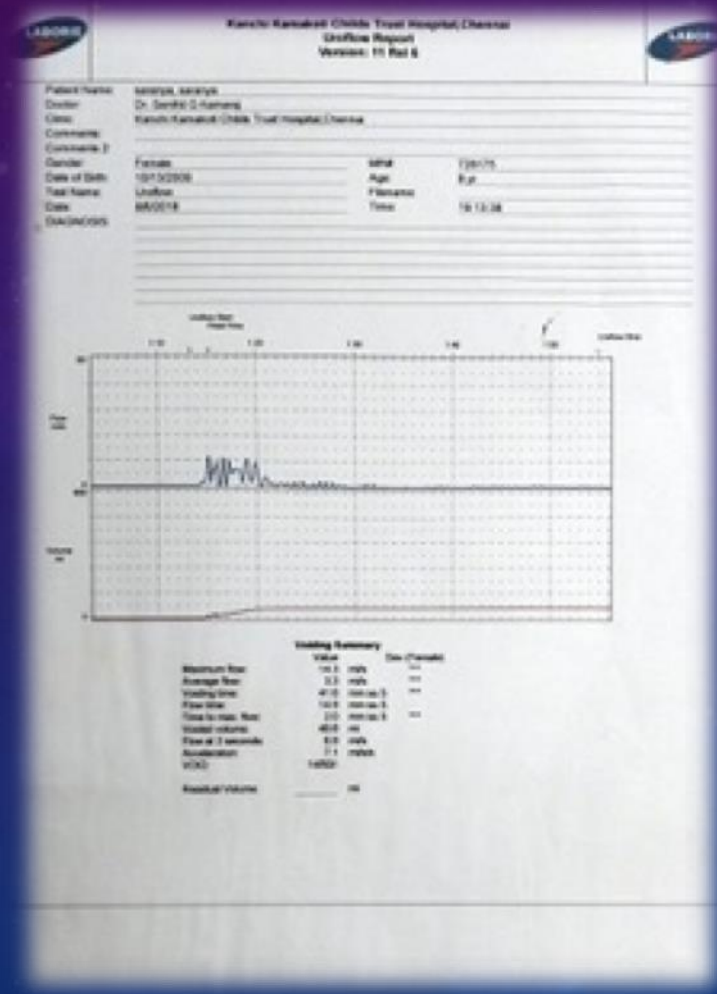
VS

Uroflowmetry

VOIDING DIARY

Time (any/pm)	Water Intake (ml)	Urine output Volume	Urinary urgency/ dribbling/ wetting	Stool Chart
7 am	500ml		+	
9:30 am		350ml		
10:00 am				Hard stool
11:0 am	300ml			
13:00 pm		600ml	+	
3 pm	400ml			
4:15 pm		350ml	+	
5:30 pm	600ml			
6:00 pm		600ml		
8:30 pm	325ml			
9 pm		350ml		
10 pm	150ml			
12:00 am				Big Verrucos

Start to fill. The backside if needed.
Total fluid intake today is equal to 3535 ml



TREATMENT

- Drugs
- Enuresis alarm
- Combination
- Antidepressants ?
- Anticholinergics ?
- Newer combinations – biofeedback / ? Surgery / botox /NTD
- Treatment holidays ? When to stop ?

Treatment

Non medical

General measures

- restrict fluid 3-4 hours before bedtime
- empty bladder before retiring to bed
- encourage child to make bedtime resolution
- keep a chart of wet and dry nights
- reward for dry nights
- Avoid punishment/criticism





Desmopressin

- 1st line ttt.
- It is a vasopressin analogue that reduces the amount of urine produced at night.
- Age : 6 years or older
- Dose : 0.2 – 0.4 mg at bed time.





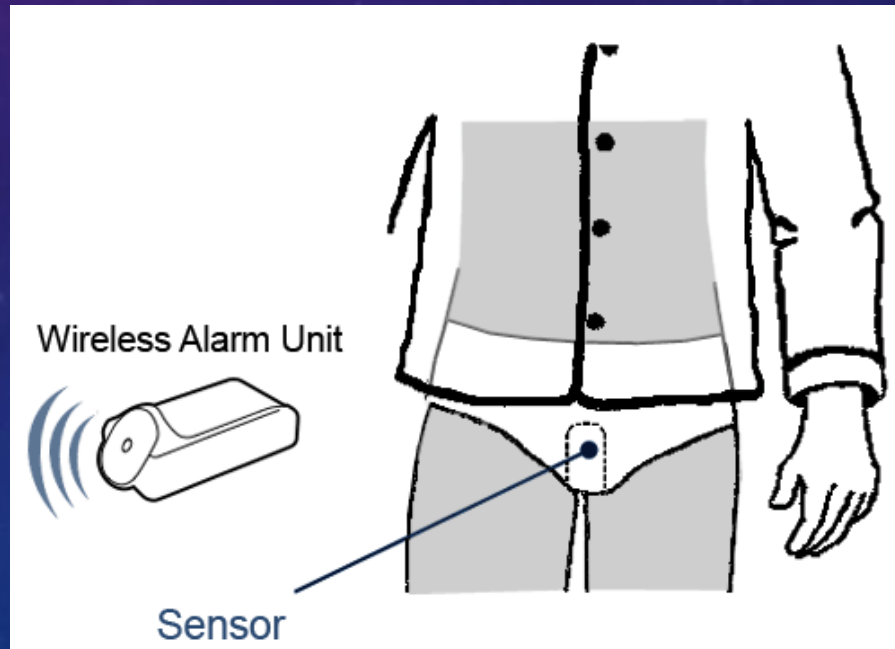
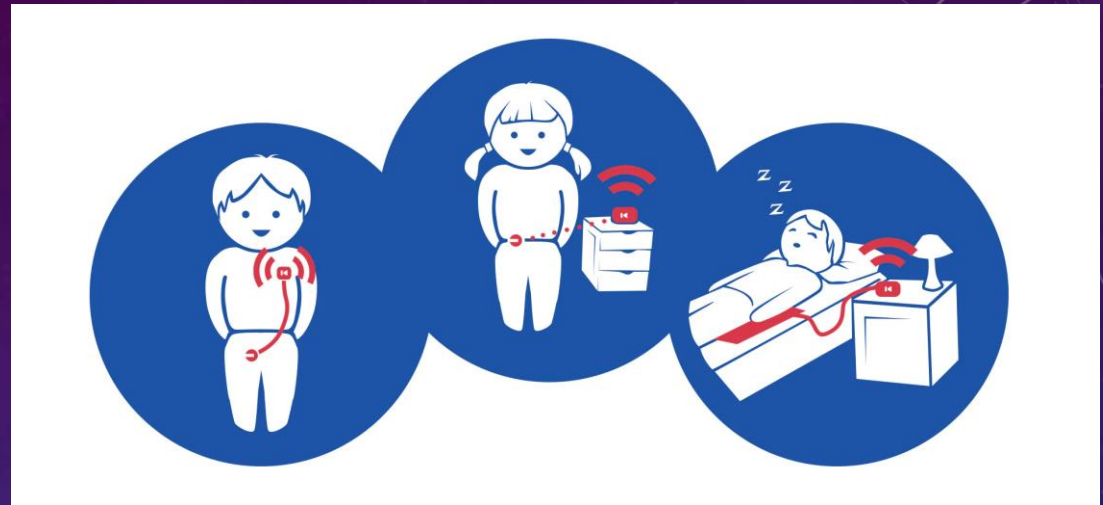
3RD LINE DRUG :
TRICYCLIC ANTIDEPRESSANT



2ND LINE DRUG -
ANTICHOLINERGICS



TYPES OF ALARM



HOW TO USE:



A
Activate the
Battery



B
Test the Alarm



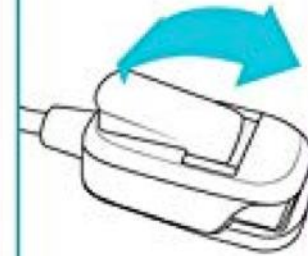
C
Adjust the
Elastic Band



D
Run the Core



E
Using the clip



F
Alarm Sound





Bedwetting Store





Bedwetting Store



Child and family centered care
Inform and educate – no blame
Do not exclude under-7s
General measures

1st line

Alarm treatment
High success rate
Lower relapse rate
Hard work and
needs support

Desmopressin
Rapid improvement
High success rate
Higher relapse rate
Fluid restriction

2nd line

Enuresis alarm +

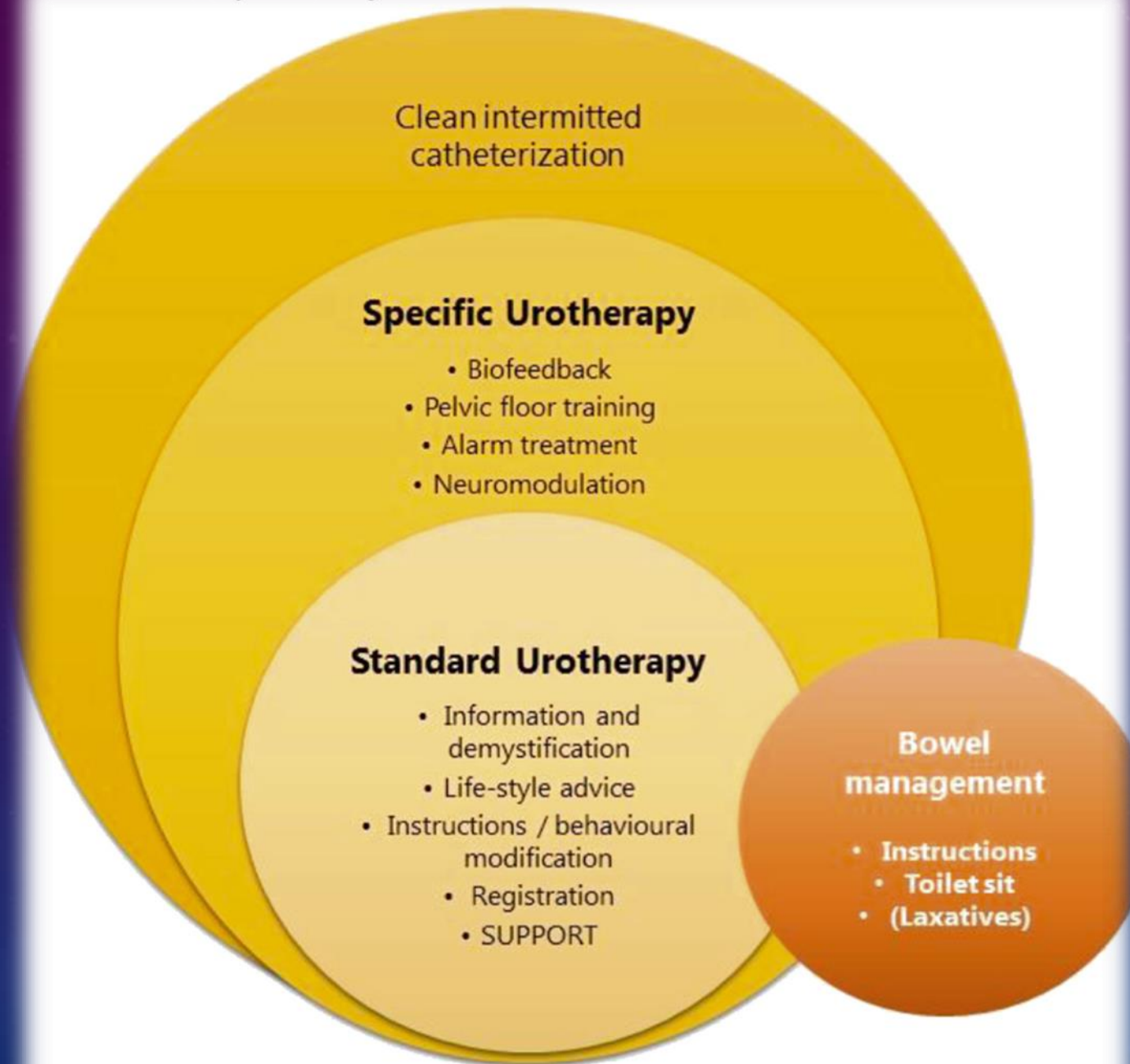
Desmopressin

Anticholinergic +
Oxybutynin
Tolterodine

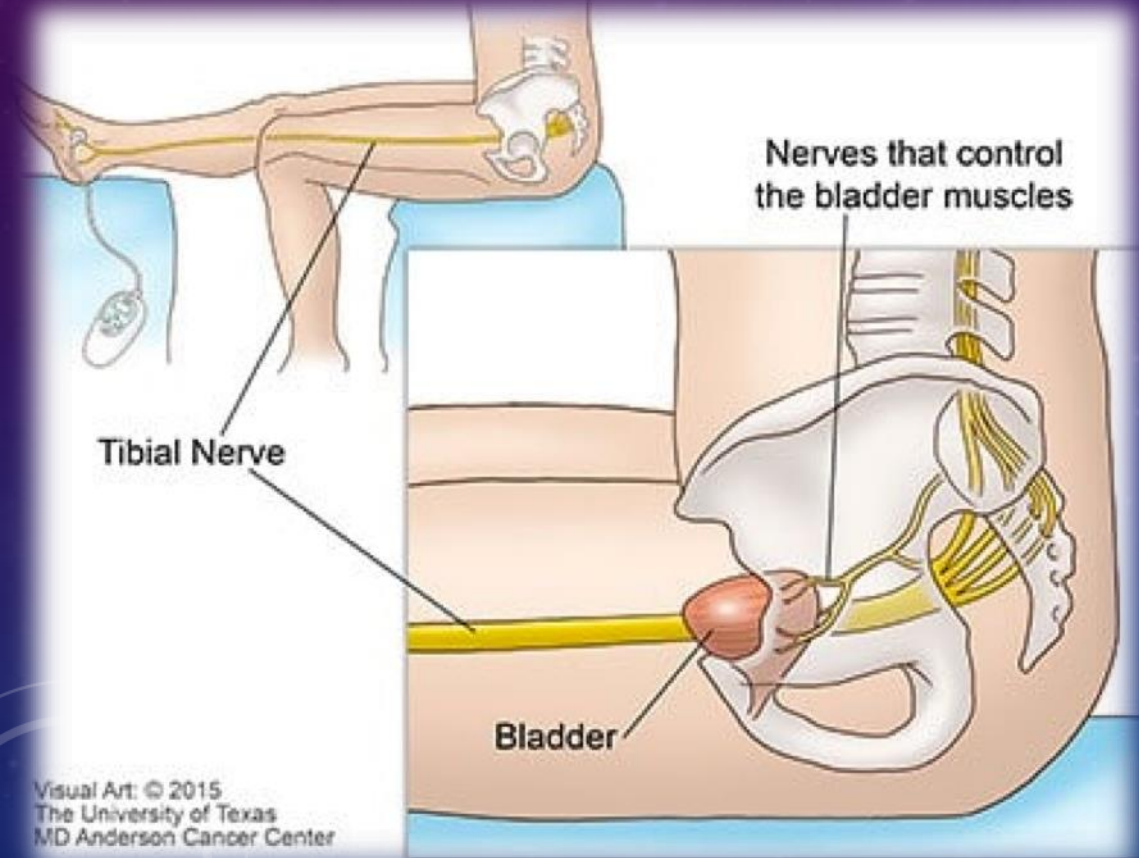
Desmopressin

3rd line

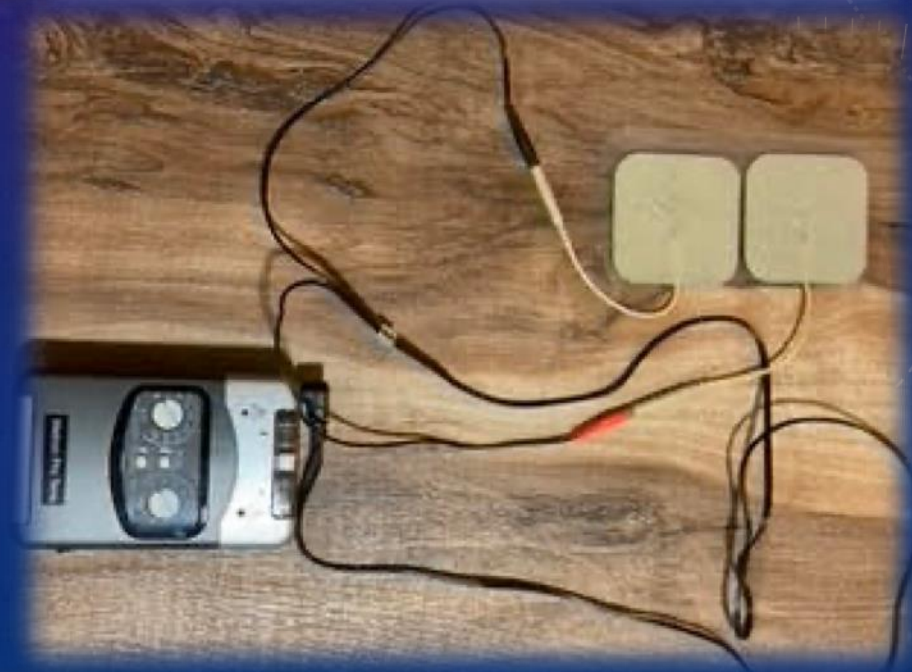
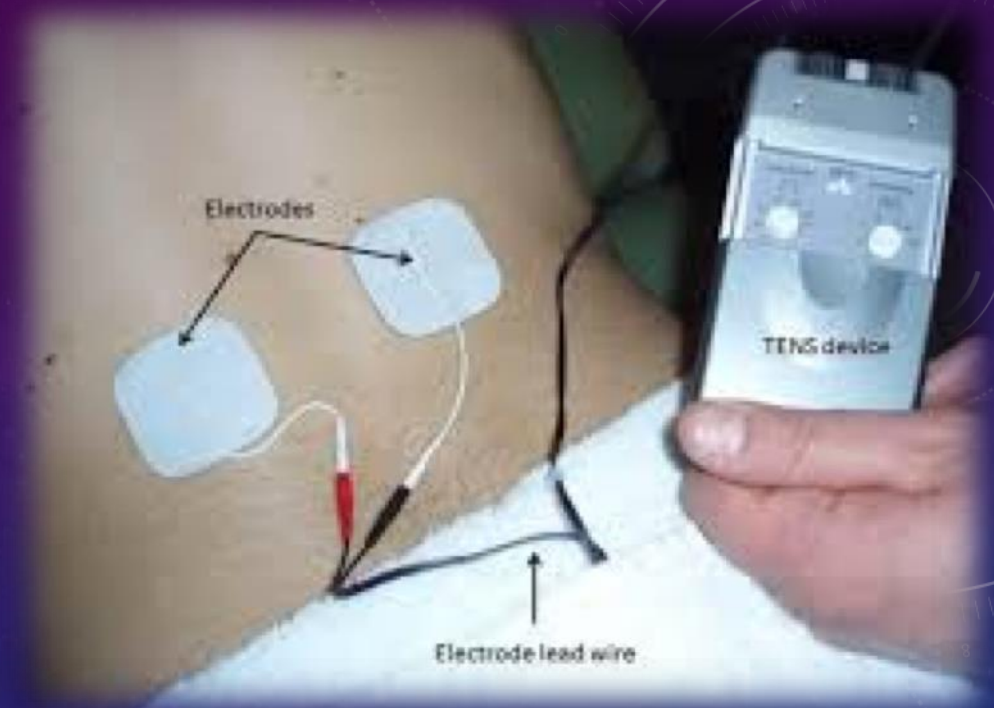
Imipramine



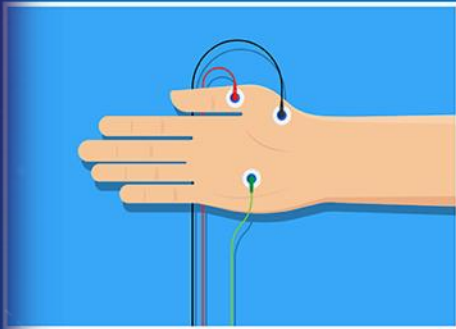
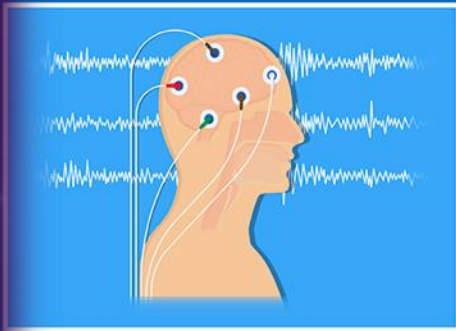
Posterior Tibial Nerve Stimulation



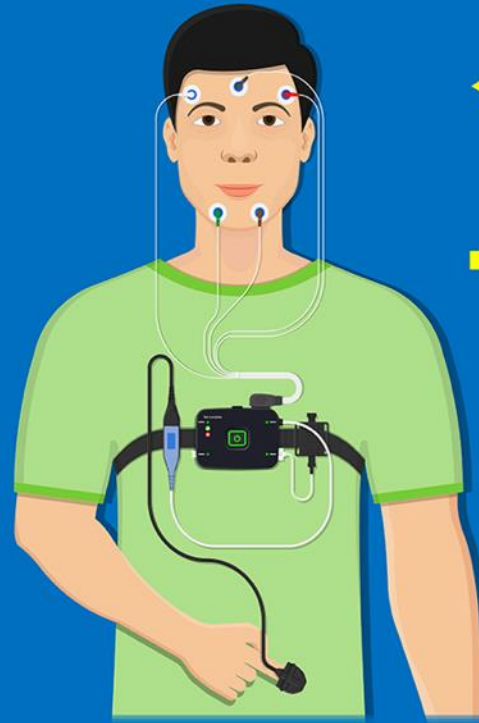
Transcutaneous Electrical Nerve Stimulation (TENS Or TNS)



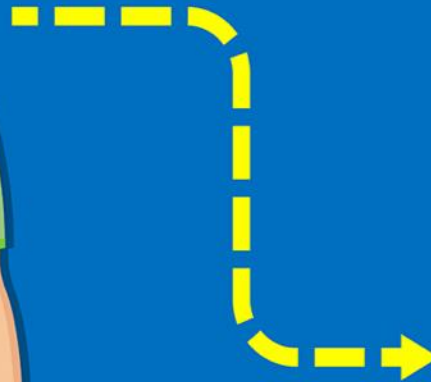
Measurement of
Brain's Electrical Activity
and Physiological



Patient

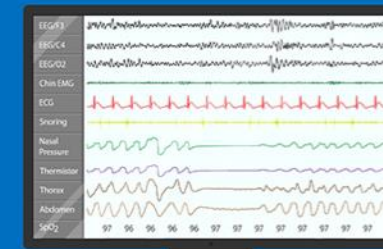


Audio - Visual
Feedback



Measured Signal
From Sensor - Transducer

Audio - Visual Stimulation
Screen Display

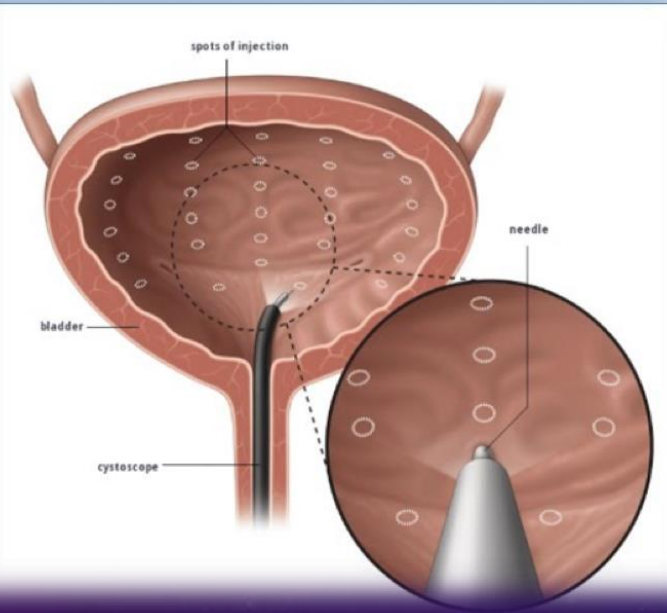


Signal
Processing



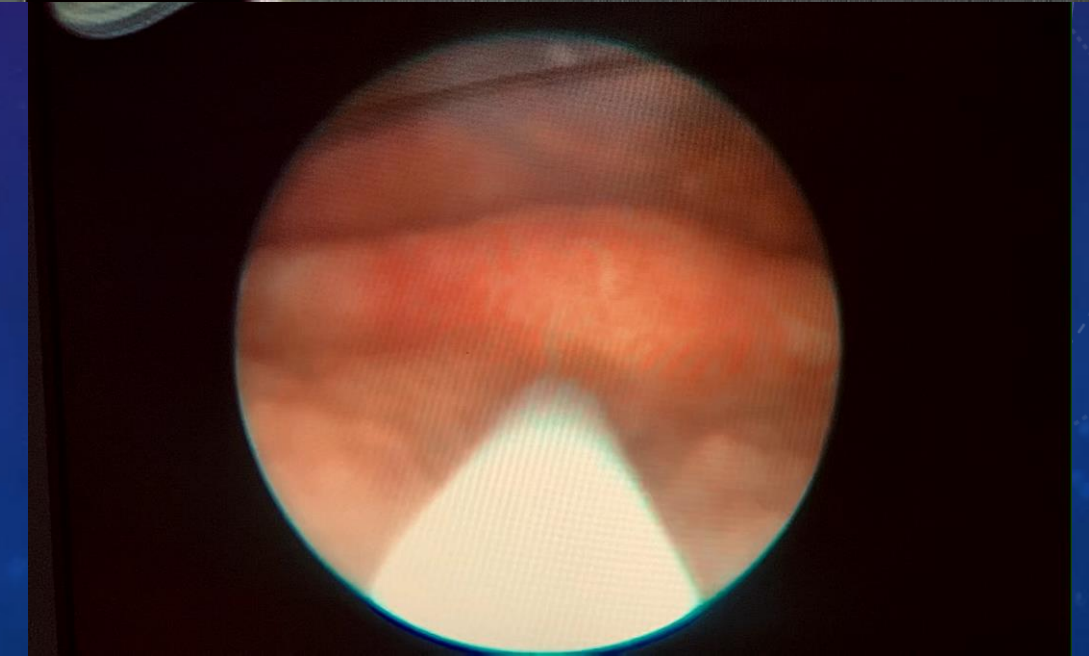
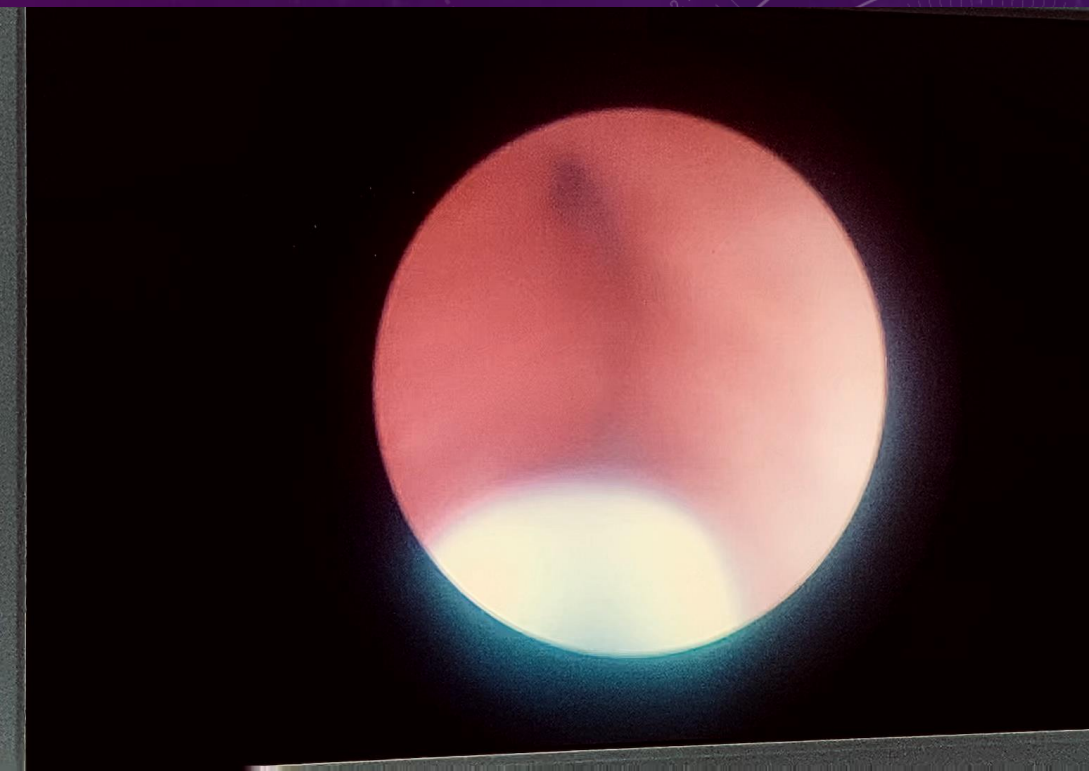
Biofeedback Therapy

You can learn to control your body's functions



Decreasing Bladder Spasticity with Botulinum Toxin Injections

Claire C. Yang, MD



DIFFICULT SCENARIO 1 – DR AMISH :

- **Football player under vigorous training / more water intake / difficult to arouse from deep sleep –**
- **what to do ?**



- Educate the child and the parents about enuresis – not a disease
- Reduce the stress / **POWER NAPS** – perform/win in football matches
- **Avoid energy drinks, chocolate containing energy bars or supplements**
- If infrequent enuresis episodes 1-2 week then no treatment
- Counseling for frequent day time voids 4-7/day, fluid intake to 2-2.5 litres/day with restriction after dinner time
- Diaper/plastic bed sheet use if frequent episodes or affecting his performance



DIFFICULT SCENARIO 2 – DR KIRAN :

- **Child with ADHD/ downs syndrome – on therapy / less comprehension / frustrated parents with sleep deprivation**
- **What to do ?**



- **8 y boy with Down's syndrome**
- **Presents with primary nocturnal enuresis**
- **Frequently voids 8-10 times/day**
- **Occasionally wets during the day**
- **Passes hard stools once in 2-3 days**
- **Fecal incontinence**

Behavioral issues

Hyperactive

Excess temper

Cries often

Socially withdrawn

Is scolded and beaten by parents for wetting clothes

- **Clinical issues**
- **Primary non monosymptomatic enuresis with fecal incontinence**
- **Day time frequency**
- **Psychosocial stressors – ADHD, Emotional issues**
- **Down syndrome**

- **Incontinence rates in children with Downs syndrome range from 45 % to 73%**
- **20% cases- Nocturnal Enuresis**
- **35%- Day time urinary incontinence**
- **45%- both daytime + night time urinary incontinence**
- **At risk for delayed toilet training (81% after 5 y age)**
- **Constipation in about 50%**
- **Often correlates with degree of Intellectual disability**

50%
of people with
Down syndrome
will have a
congenital
heart defect.



Imipramine (TOFRANIL)



FDA-approved for:

- ❖ Depression
- ❖ Enuresis (bedwetting)

Used off-label for:

- ❖ Generalized anxiety disorder
- ❖ Panic disorder
- ❖ Chronic pain
- ❖ Sleepwalking
- ❖ Sleep terrors
- ❖ Confusional arousals

Dynamic interactions:

- ❖ Serotonergic (strong)
- ❖ Sedation/CNS depression (moderate)
- ❖ QT prolongation (mild)
- ❖ Anticholinergic (strong)
- ❖ Lowers seizure threshold (moderate)
- ❖ Hyponatremia (5-HT)
- ❖ Hypotension (strong)

Kinetic interactions:

- ❖ 2C19 substrate
- ❖ 2D6 substrate



All TCAs
are 2D6
substrates



2C19
substrate

PRESCRIPTION ONLY MEDICINE
KEEP OUT OF REACH OF CHILDREN

Imipramine
Hydrochloride Tablets USP

10x10 (100)
film-coated tablets

25

TAJ PHARMA

...depressants... improve your mood

- Biofeedback training
- Motivational training
- Occupational training



Included: Progress Chart & Star Stickers
Recognize and reward success!



DIFFICULT SCENARIO 3 – DR SANGEETHA :

- Attention seeking child / divorcing parents / low self esteem / bullying in school/ depressed child / old grandparents as care takers –
- What to do ?

HOW DO I KNOW IF A CHILD IS DEPRESSED?

Some common symptoms of depression among children include:

- 1 Changes in weight
- 2 Disturbance in sleep patterns
- 3 Unusual and persistent sadness or irritability
- 4 Sudden loss of interest in activities they once enjoyed
- 5 Sluggishness
- 6 Lower self-esteem
- 7 Hopelessness
- 8 Thoughts of or attempts at suicide



STEPS IN ASSESSING THE PROBLEM

- Psychological problems are present in up to 30% of all children with enuresis
- **Step 1:** Detailed psychiatric/psychological assessment by a multidisciplinary team of trained professionals including a child psychiatrist/psychologist
- **Step 2:** Use a standardized classification system to diagnose depression.
- **Step 3:** Assess the profiles of psychological strengths and weaknesses of the child and his/her environment by diagnostic interviews, and questionnaires (e.g., IQ, parent–child interactions).



















MANAGEMENT

- Counseling, provision of information, encouragement
- **Reduction of distress / MOTIVATION** are the crucial steps
- Enuresis and comorbid disorder- **depression can be treated simultaneously** by the multi disciplinary team
- “simple” cognitive behavioral techniques: Observation, self-monitoring, and registration of wet and dry nights
- **Alarm treatment - the most effective therapy**
- Other cognitive behavioral additions (such as **arousal training**) can enhance the effectiveness of alarm treatment
- **Vasopressin analogue**

Biofeedback training

TODAY VS BEFORE

Biofeedback Therapy And The New Applications

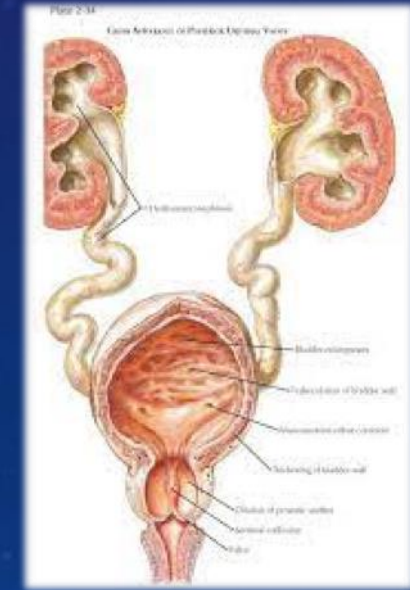
			
Pain	Incontinence	Muscles 2.0	Brainwaves
Chronic Pain, Tension And Migraine	Urinary & Digestive Symptoms	Help With Tension And Spasms	Tracking And Evaluation With Neurofeedback
			
Disorders e.g. ADHD & Epilepsy	High Blood Pressure & Heart Disease	Joints e.g. TMJ	Temperature e.g. Fever Measurement, High Performance
			
Anxiety & Depression	Eating Disorders	Insomnia	Muscle Tension Tracking And Workout-Evaluation
			
Help With Cancer Recovery	Cardiovascular System Heart And Blood Pressure Tracking Without Apps	Sleep Sleeptracker - Without Brainwave Stimulation	





DIFFICULT SCENARIO 4 – DR SENTHIL GANESH :

- **Small capacity bladder – valve bladder / detrusor hyperactivity / failing kidneys / resistant to drugs / unwilling for night time drain ?**
- **What to do ?**



CIC - Clean Intermittent Catherization

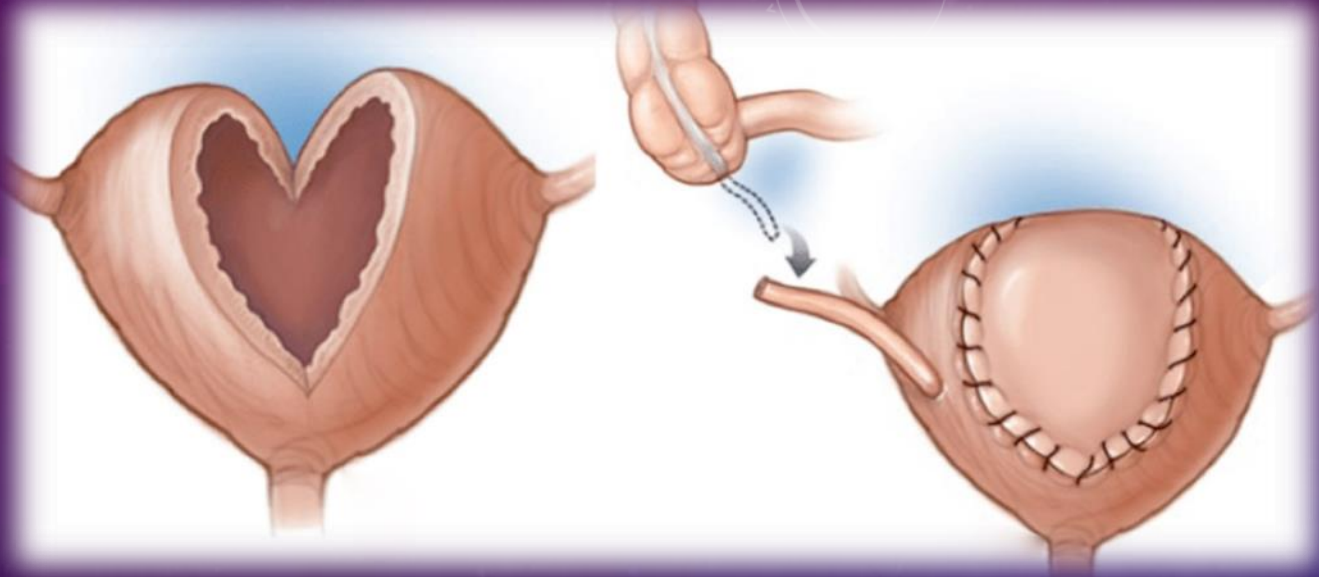
NTD – Night Time Drain



MITROFANOFF PRINCIPLE

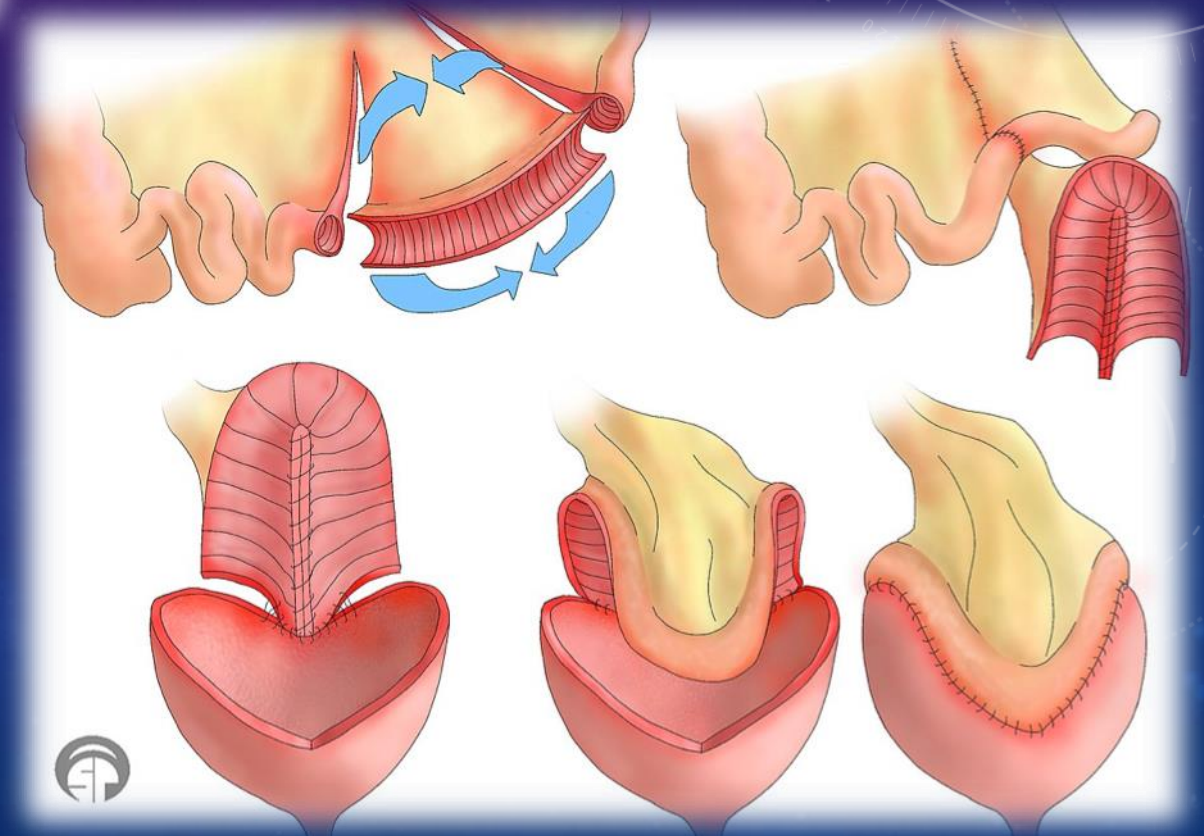


VESICOSTOMY BUTTON



MITROFANOFF

Augmentation Bladder





Thank you

