

Neurogenic Bladder in Children

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Case presentation

3 hours baby
girl born with
lumbo-sacral
myelo-
meningocele



Case Presentation

Urology consulted:

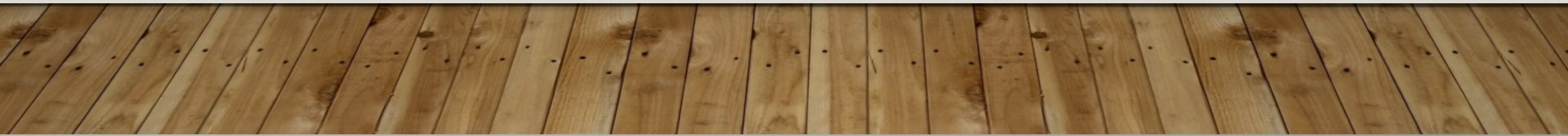
History: mother with inadequate pre-natal care. (Poor social condition. No supplementation of folic acid). Similar abnormality described in a relative (cousin)

PE:

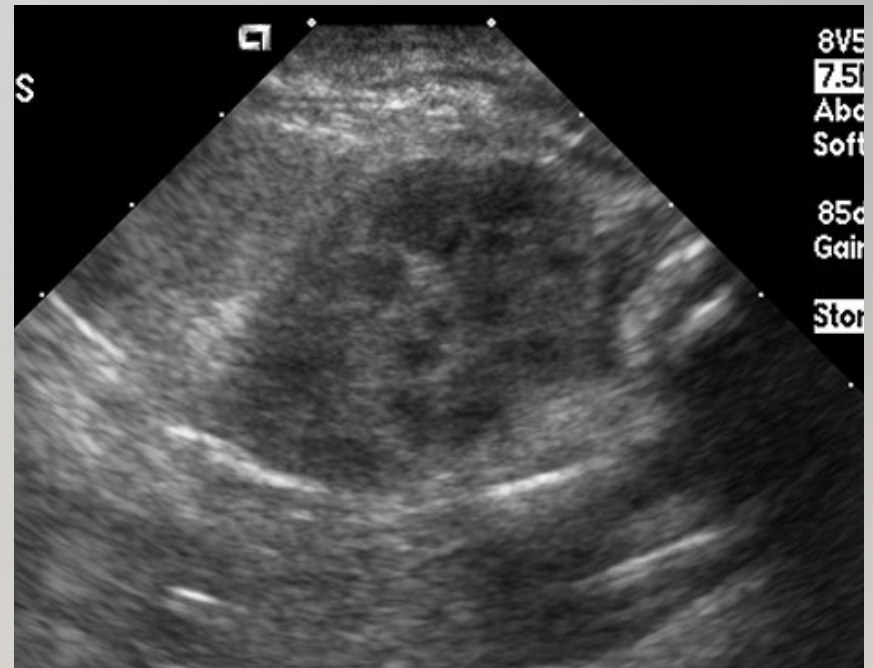
Well baby with lumbo-sacral MMC

Bladder palpable pressing the supra-pubic area and urine dribbles

Orientation: Start on CIC and obtain US prior to neurosurgical intervention and creatinine within 24 hours.



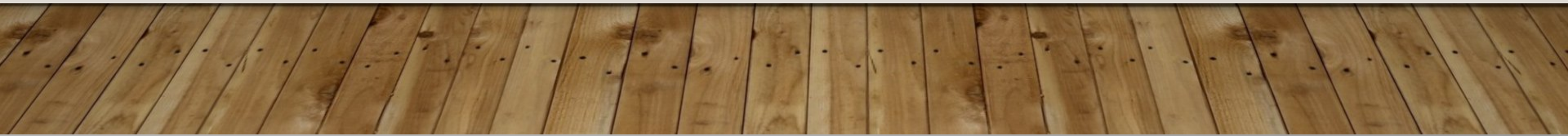
Initial US (1 day)



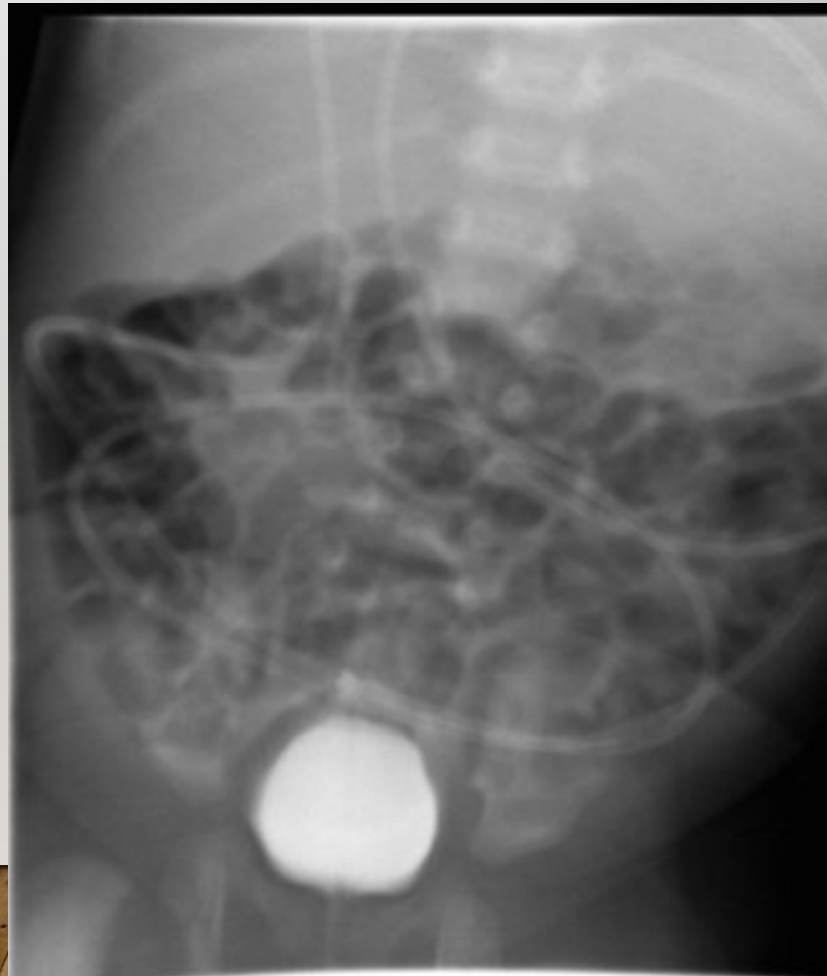
Case Presentation

Patient underwent uneventful MMC closure.

Discharged with orientation to perform CIC every 3 hours.



VCUG 2 months

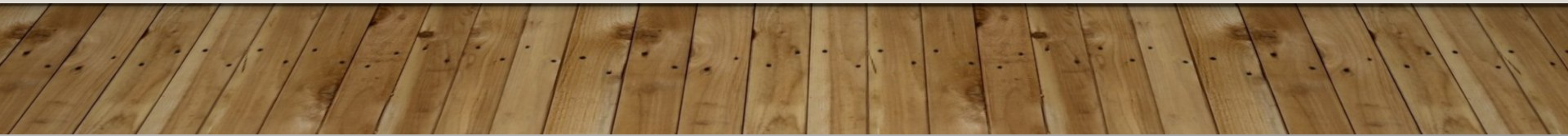


Case Presentation

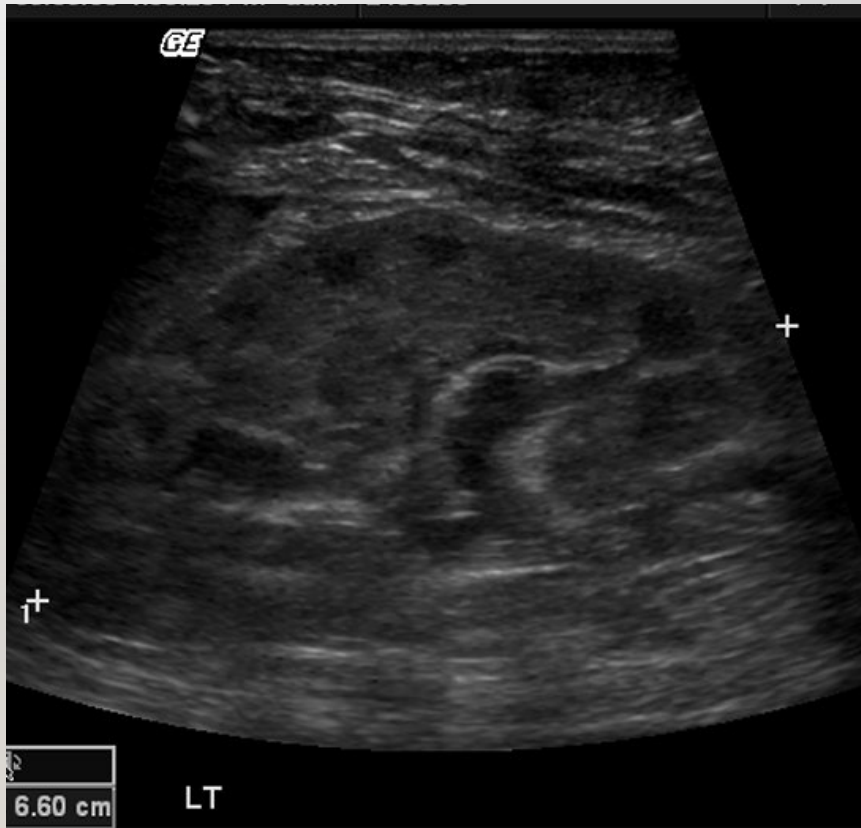
Lost follow-up for 9 months. (During this time **NO CIC was performed !**)

Return with urosepsis. Admitted.

Bladder decompressed and started ATB



US 9 months later at second admission



VCUG 10 months



Case Presentation

Started on a controlled CIC program

UDS:

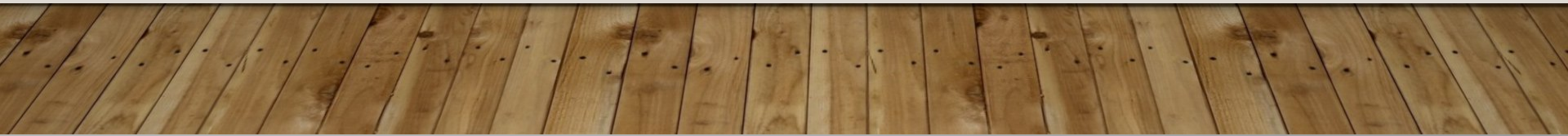
LPP: 60cm water

Capacity (110 ml – not interpretable due to massive reflux)

Frequent uninhibited contractions

Despite anticholinergic + CIC develops new episode of urosepsis .

Vesicostomy performed. Well age 2 years.

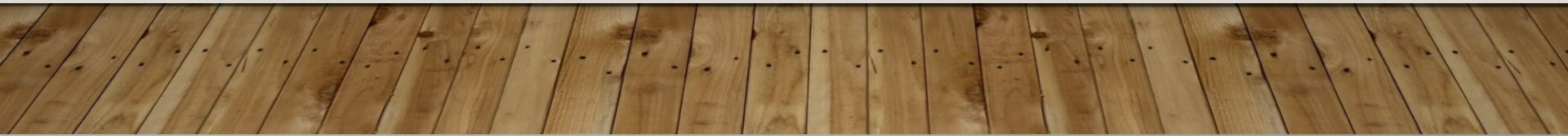


Neurogenic Bladder in Children

Mainly secondary to **Myelodysplasia**

Mielitis

Trauma



Myelodysplasia

Incidence decreasing!

- Termination

- Adequate prenatal care (folic acid supplementation)

Familial risk:

- Mother of affected child (3-5%)

- Mother 2 affected children (10%)

- Patient with myelodysplasia (4%)

- Mother older than 35 years (3%)

Kroovand (1986)

Myelomeningocele

Cervical-high thoracic 2%

Low thoracic 5%

Lumbar 26%

Lumbo-sacral 47%

Sacral 20%

(Kroovand – 1986)



* Level of the MMC does not necessary correlate with degree of lesion produced

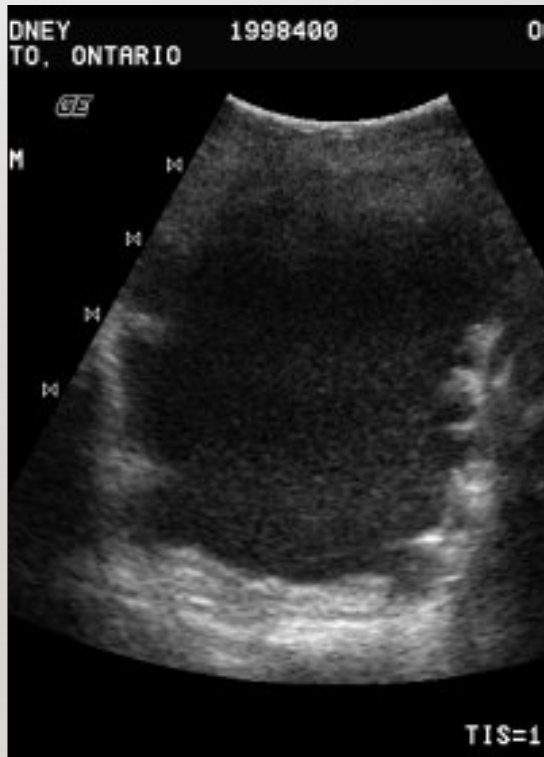
INITIAL ASSESSMENT

10 to 15 % have hydronephrosis at initial investigation (10% in utero!).
VUR!

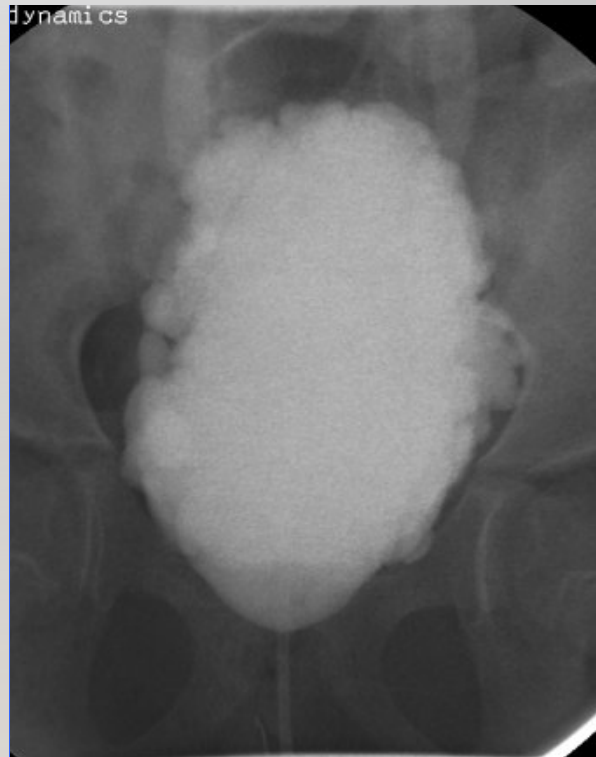
Early investigation and treatment:
less upper tract damage!

Investigations

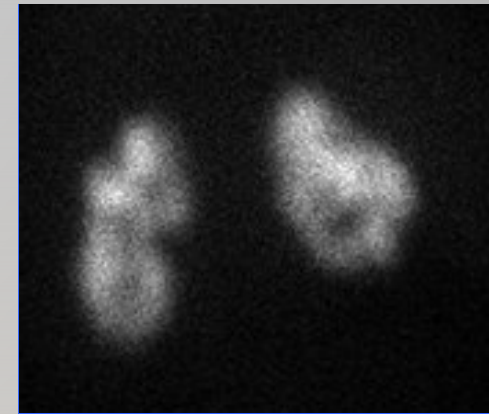
Ultrasound



Cystogram

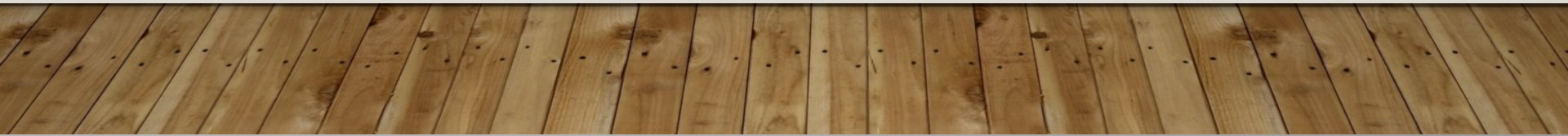


DMSA



Multi-disciplinary approach is mandatory
(urology, orthopedics, neurosurgery, social
work, psychology, physiotherapy and dedicated
nurse (s). Integrated decisions!

Essential to identify patients at risk!



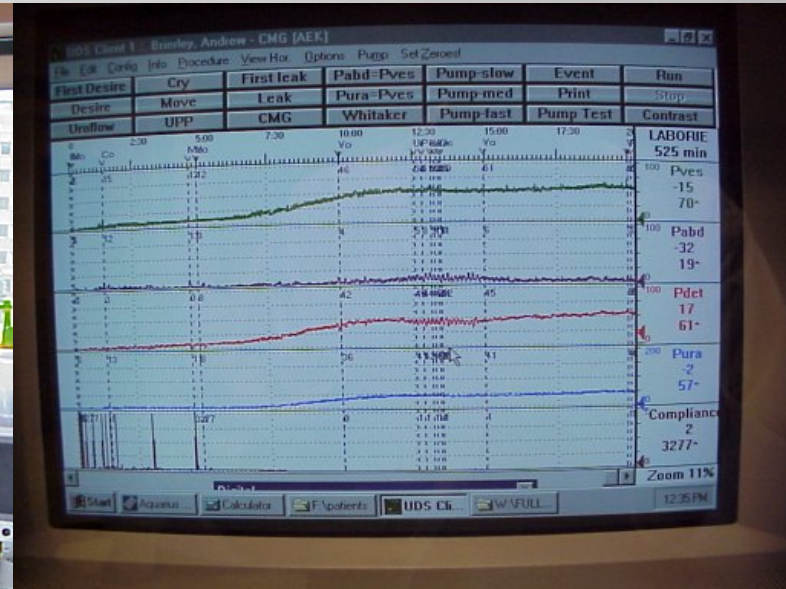
Natural history of untreated Spina Bifida

Progressive renal deterioration by 3 years in 58%

Smith ED (1972) Urinary prognosis in spina bifida. J Urol 108:815



Urodynamic Workup

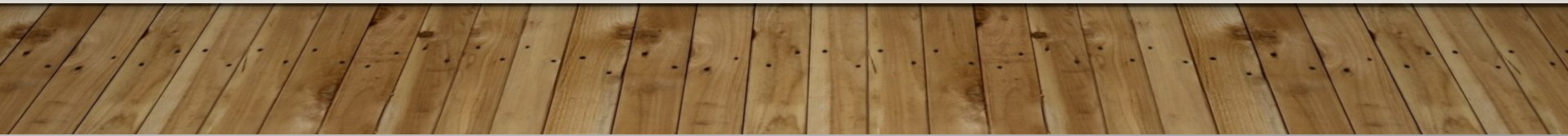


UDS evaluation

UDS can be difficult in infants (cry, agitation).
Also uninhibited contractions often seen in normal infants.

Utilize slow filling (< 10% expected capacity for age/ min) and, in infants, infusion of fluid at 36-37 C?

Chin-Peckert, L et J. Urol. 2004; 172 (4): pp 1657-61.



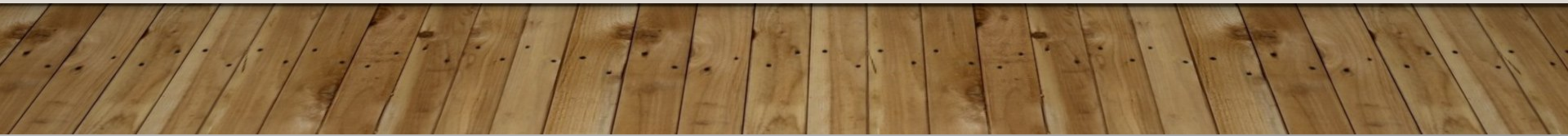
UDS evaluation

Bladder capacity at 20, 30 and 40 cm of water
(infusion of CO is not indicated)

Assess degree of hyper-reflexia

Sphincteric activity (DSD)

*When UDS not available it is possible to obtain a **simplified UDS** assessment! Small feeding tube at various levels of water column, observing urethral leak .



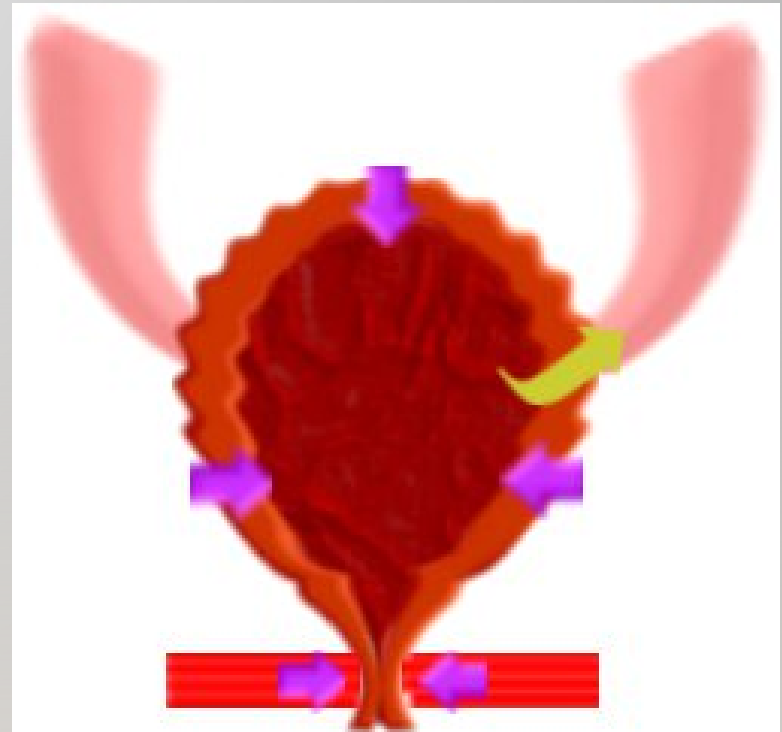
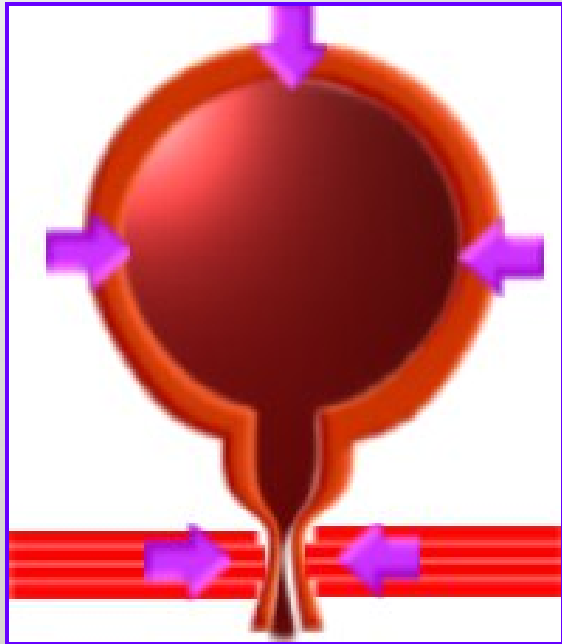
UDS

Important points to obtain :

Detrusor leak point pressure (DLPP):

Patients with DLPP > 40 cm water are at risk to develop upper tract damage. (utilize small catheter to avoid blockage of the urethra!)

McGuire, E et al J.Urol. 1983;124:823

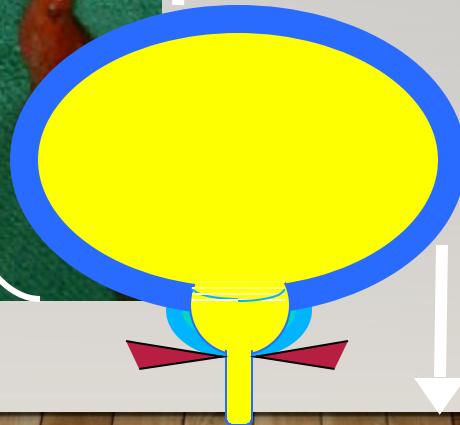


Abnormal Bladder Function

Hydronephrosis
Reflux

Pressure > 35 cm H₂O

Incontinence



Follow-up

Serial follow-up mandatory

Frequency depends on initial and subsequent status of bladder, outlet, upper tracts

Change in continence or lower limb/back symptoms requires urgent reevaluation for tethering of the cord:

Repeat U/S, VCUG, UDS

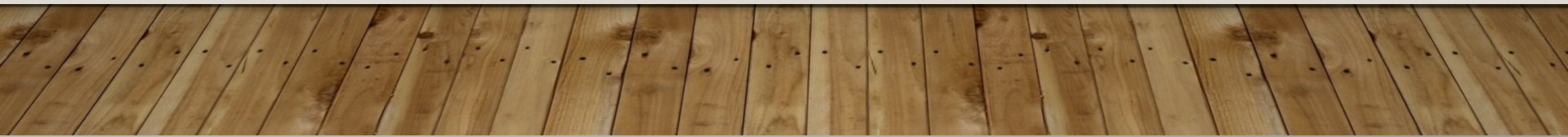
If positive, spinal MRI

- Tethering cord

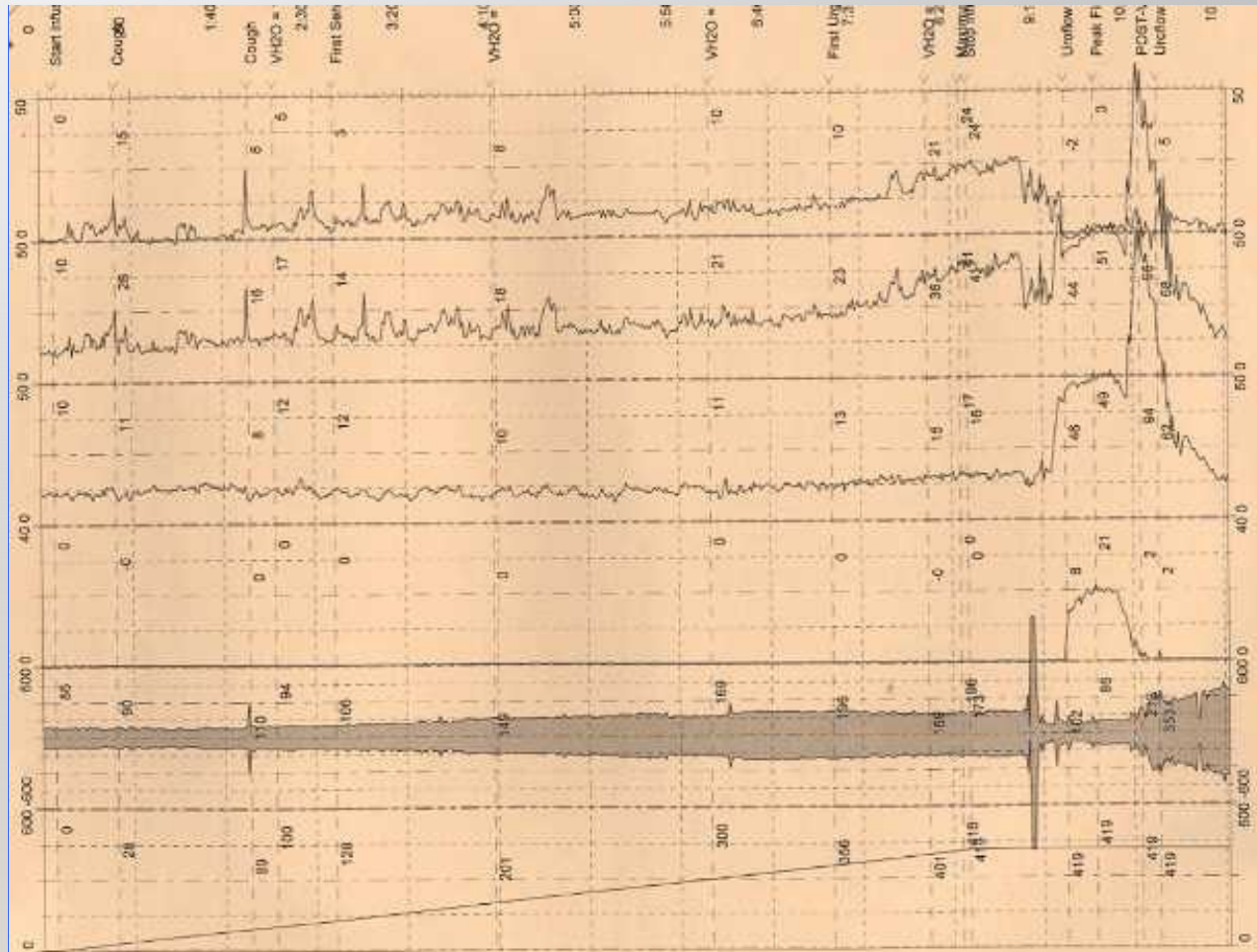
- Hydromyelia of the cord

- Increased intracranial pressure

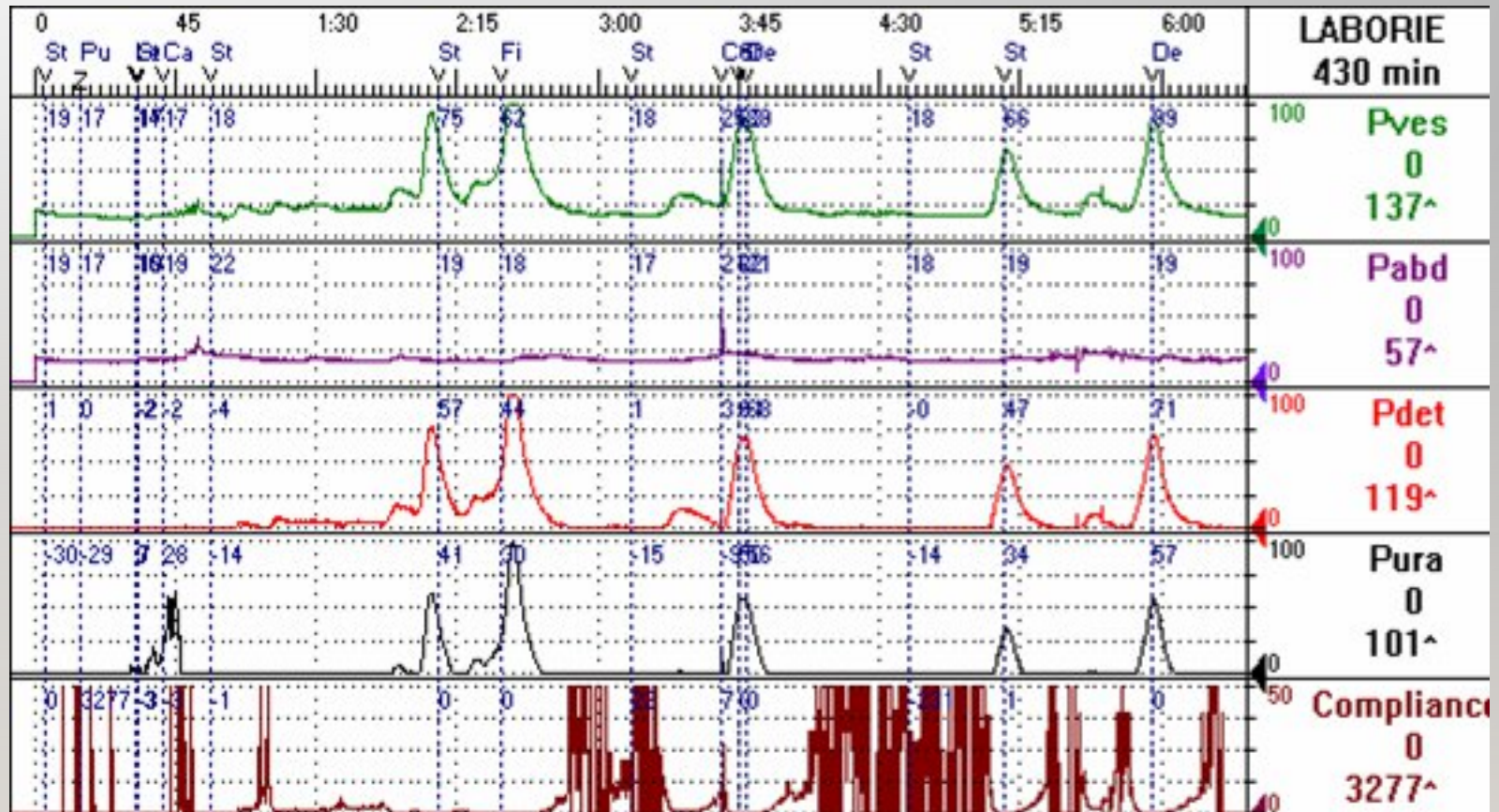
- Partial herniation of brain stem and cerebellum

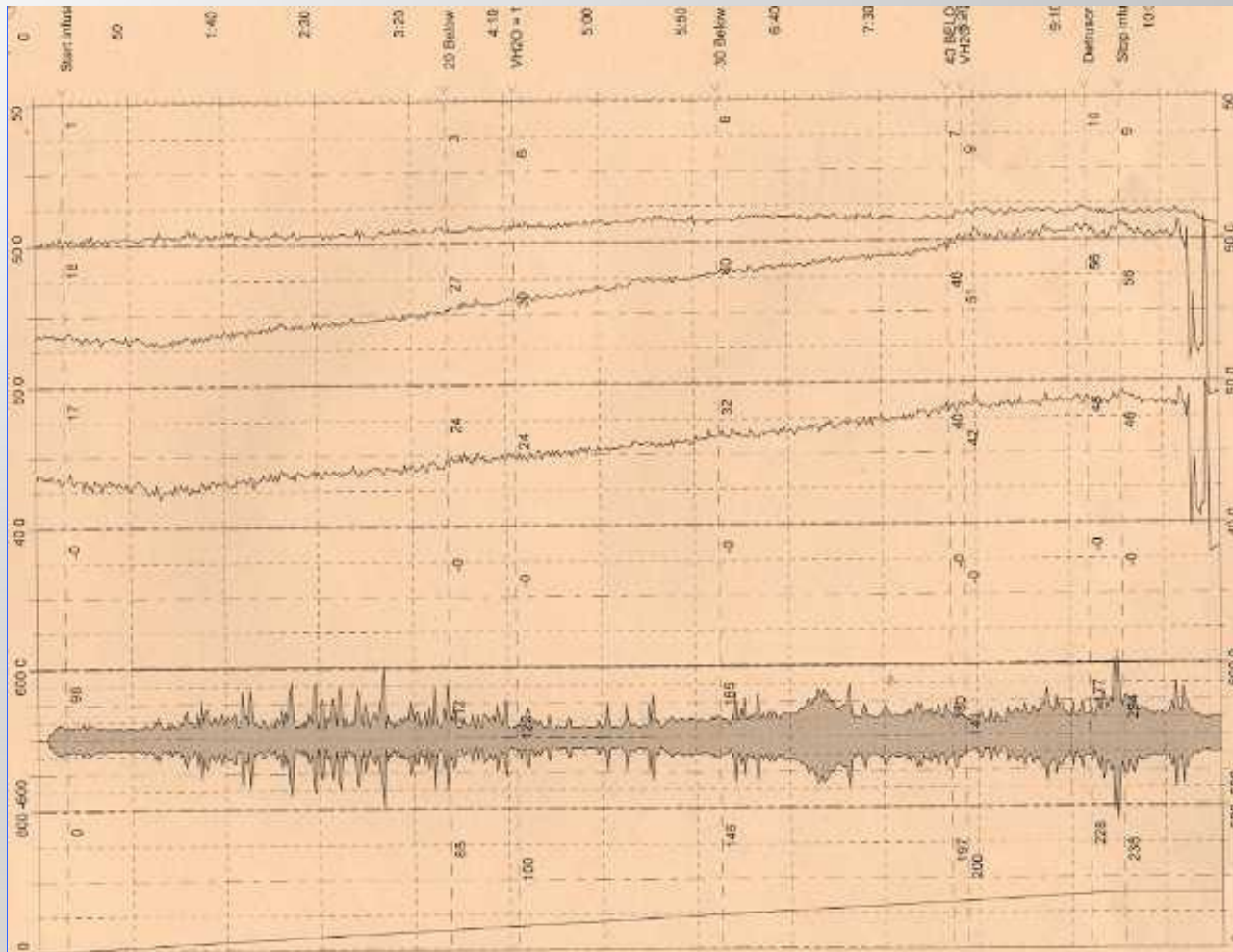


Normal UDS



Hyperreflexia





Abdominal
Vesical
Detrusor

Low compliance on anticholinergics

Simplified Classification and Management of Neurogenic Bladders

**Compliant and Good
Outlet Resistance**

**Low
Compliance,,
Good Outlet
Resistance**

**Compliant,
Low Outlet
Resistance**

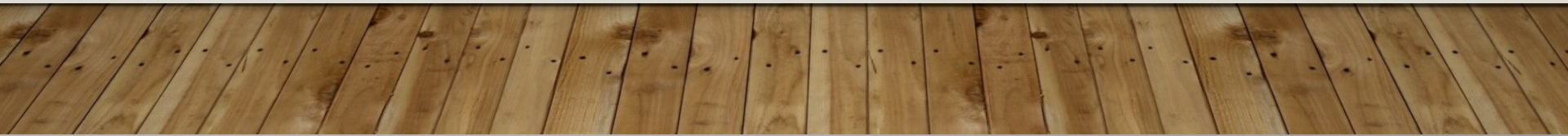
**Low Compliance,
Low Outlet Resistance**

CIC alone

CIC +
anticholinergics.
Augmentation?

BN repair +
Augmentation?

BN repair+
augmentation



Pre-op UDS evaluation for refractory incontinence

UDS performed in two cycles;

First : regular filling cystometrogram

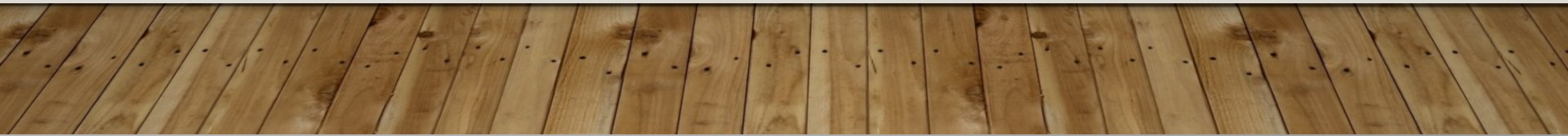
Second: Bladder filling occluding the bladder neck

Important decisions:

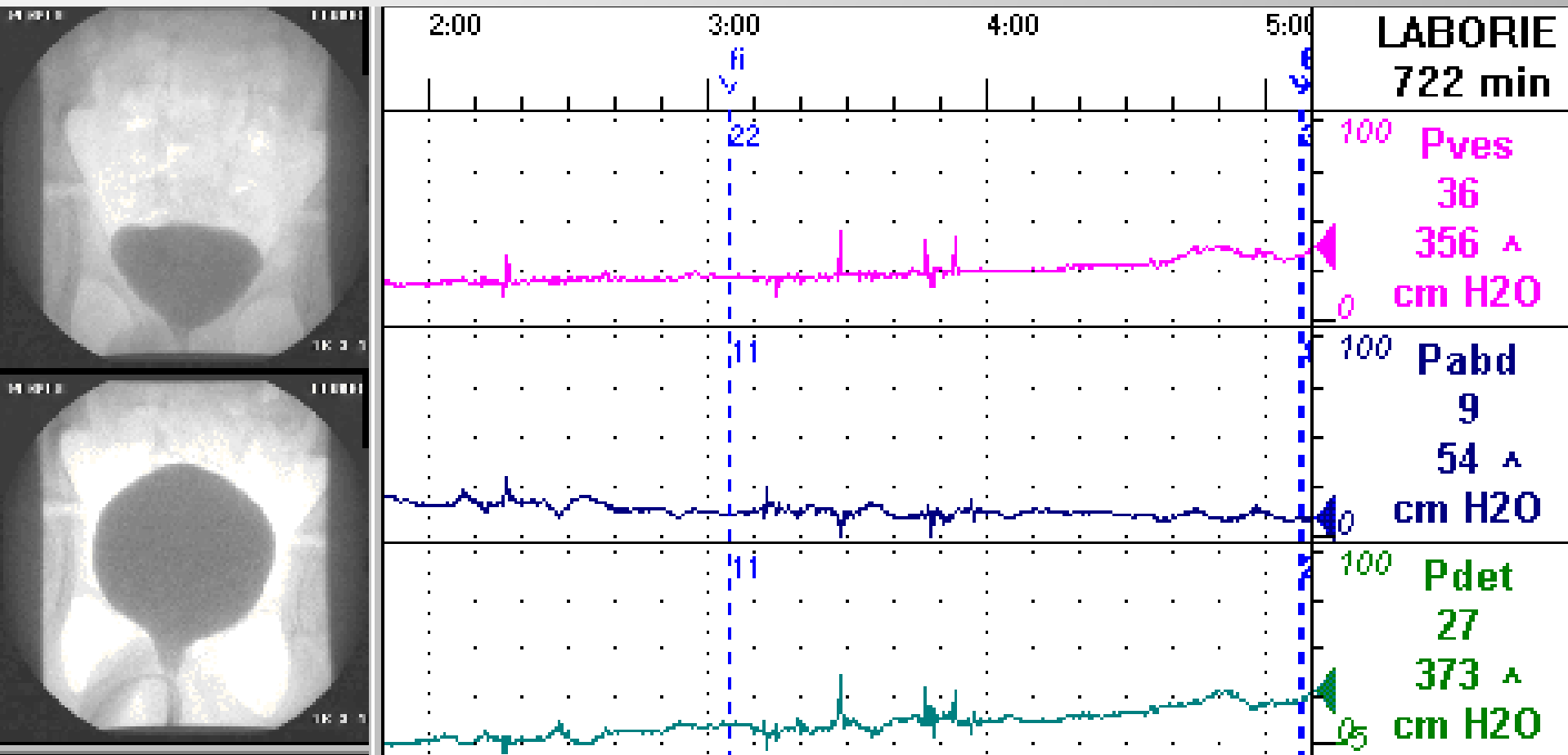
Augmentation alone?

Bladder outlet procedure alone?

Augmentation + Bladder outlet procedure?



Videourodynamics



Identification of timing of
incontinence and or VUR



Video UDS to evaluate
detrusor pressure when
VUR start

It may be important to
determine the need of
concurrent correction of
VUR (rare).

Videourodynamics

A technique that simultaneously combines the evaluation of the anatomy of the lower tract with recorded urodynamic studies

Delineates the bladder outlet during storage and voiding and may identify the cause of incontinence

Main indications:

- Associated **VUR**
- Evaluation of **bladder outlet resistance**

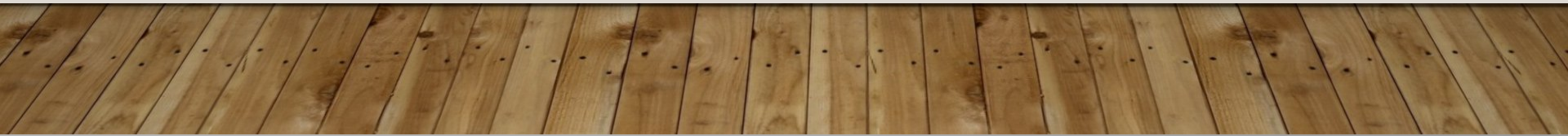
Compliance

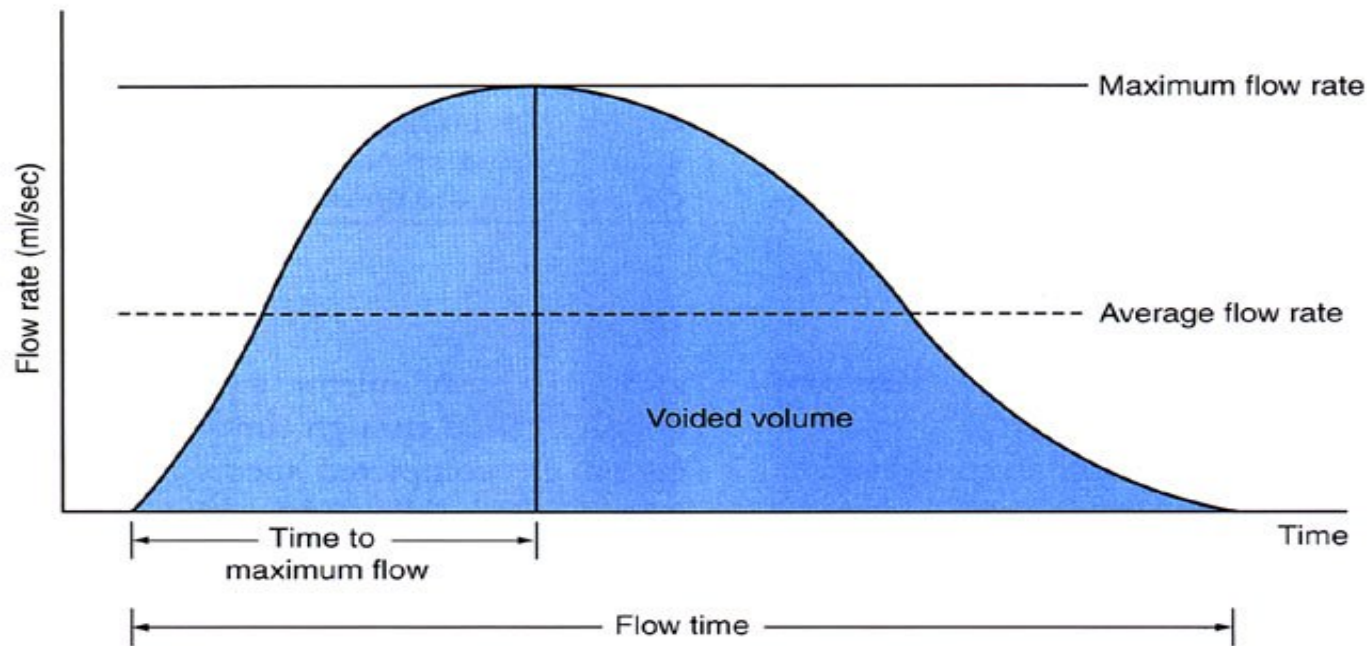
Volume / Detrusor pressure= ml per cm H₂O

Normal compliance: Little or no pressure change is noted during normal bladder filling

Factors which control compliance

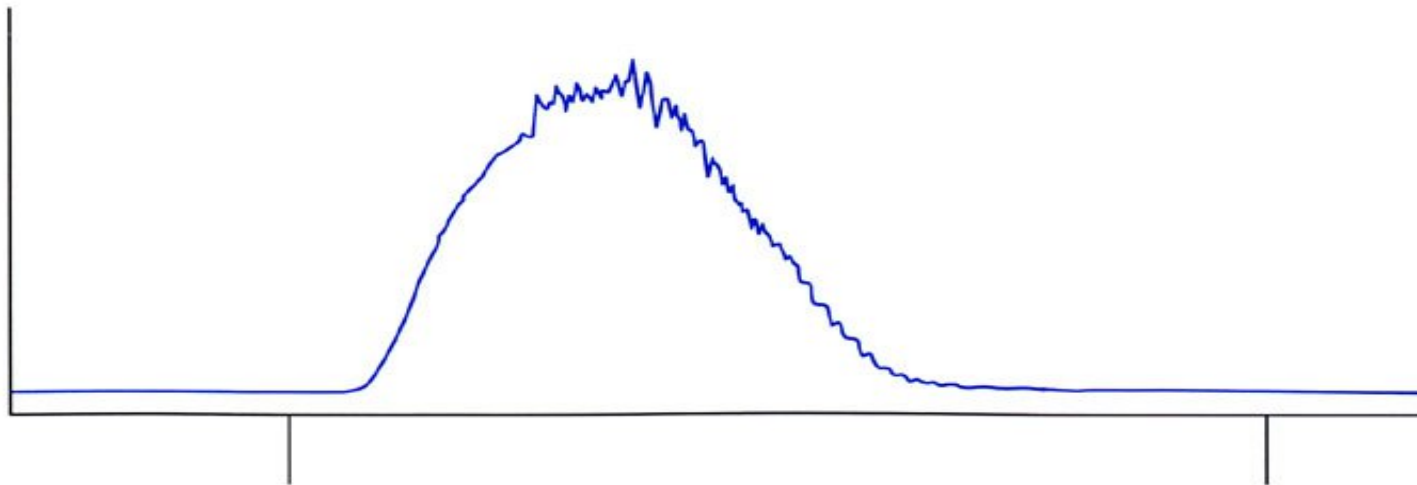
Filling, bladder wall, shape, thickness, contractile & relaxant properties of the detrusor



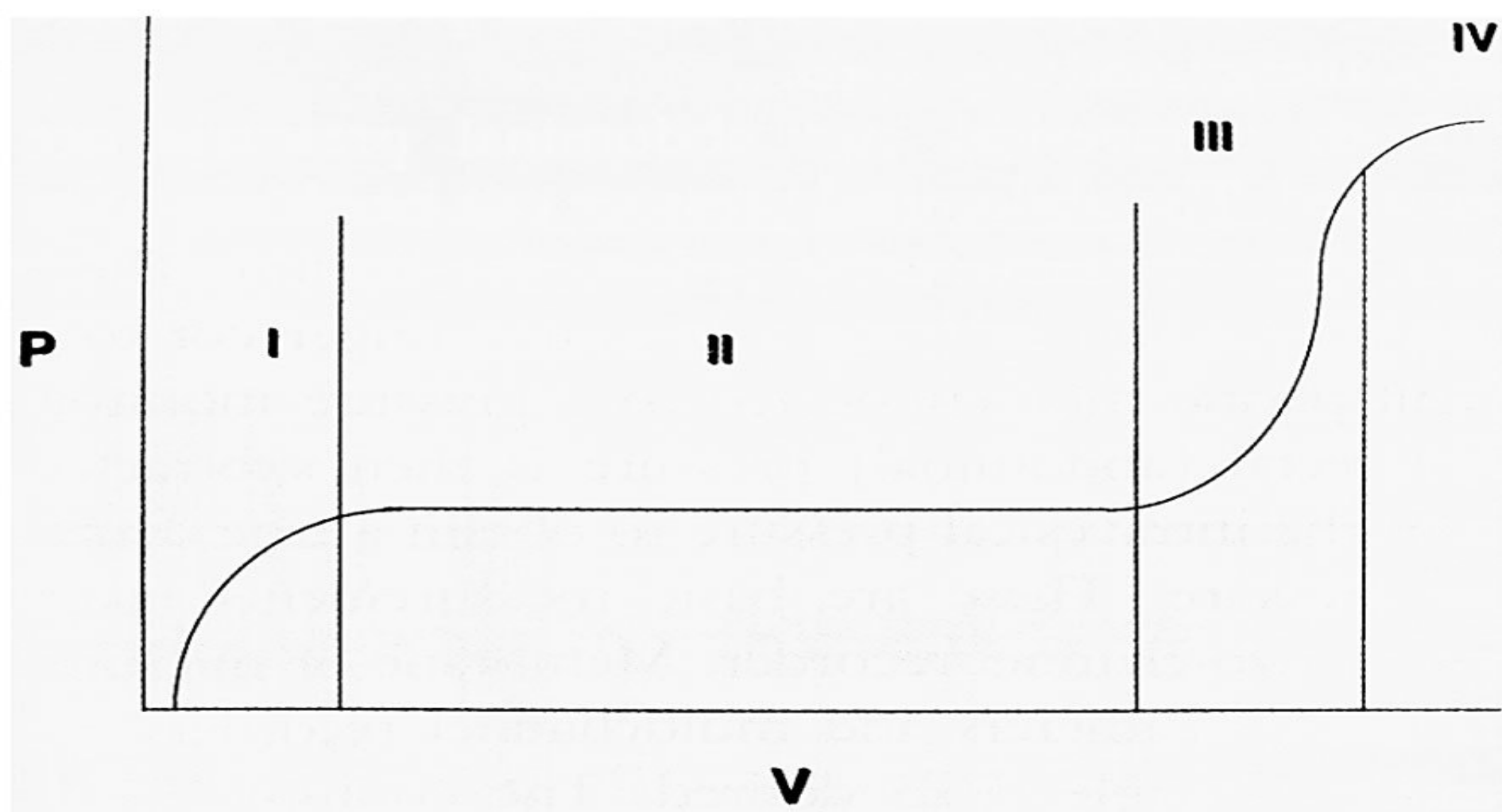


Idealized diagram of urine flow. (Modified from Blaivass and Chancellor 1996.)

Normal Flow Rate



Normal uroflow in a 12-year-old male: maximum = 38 ml/s, average = 17 ml/s, volume = 222 ml.



Cystometrogram indicating four phases and filling and detrusor activity: I, initial vesical pressure with early filling; II, stable tonus limb; III, increase in tonus at full vesicoelastic expansion; IV, voiding. (Modified from Dmochowski, 1996.)

Bladder Capacity

Normal Capacity

Age in years + 2 = Capacity in ounces

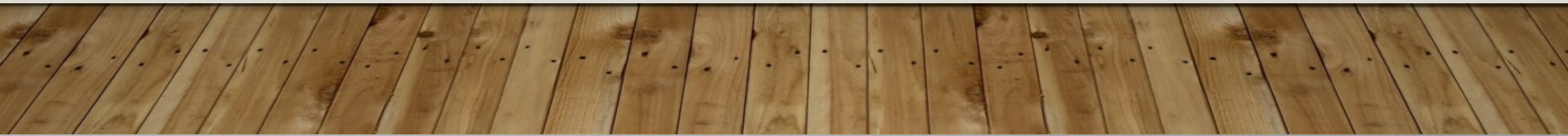
e.g. 10 year old boy + 2 = 12 oz. x 30 = 360
mls

Spina bifida patients often have small
bladder capacity

Low Capacity

Anatomical (detrusor fibrosis)

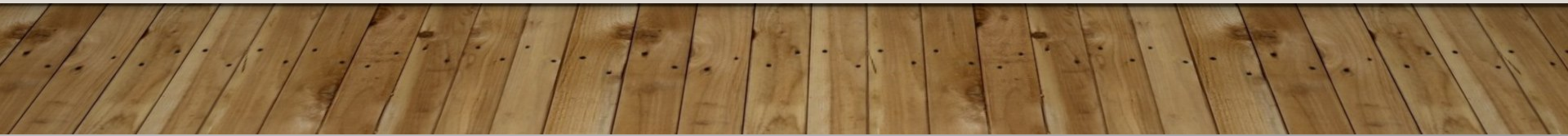
Functional (hyperreflexia)



Medical Management

Clean Intermittent Catheterization (CIC)

Liberal use of anticholinergics (until mild side effects such dry mouth or hot flushes are present)



Side effects

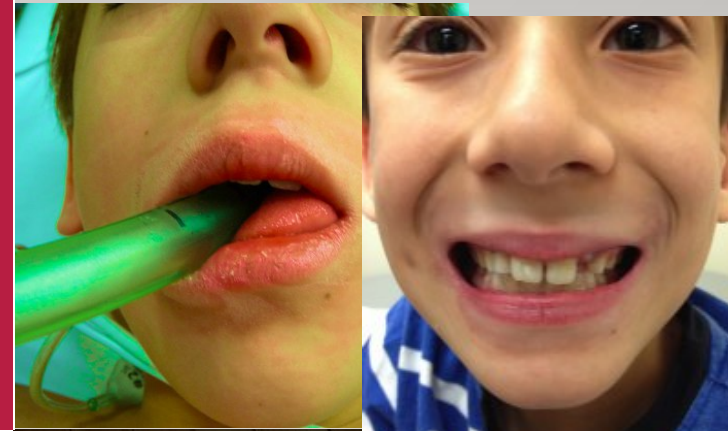
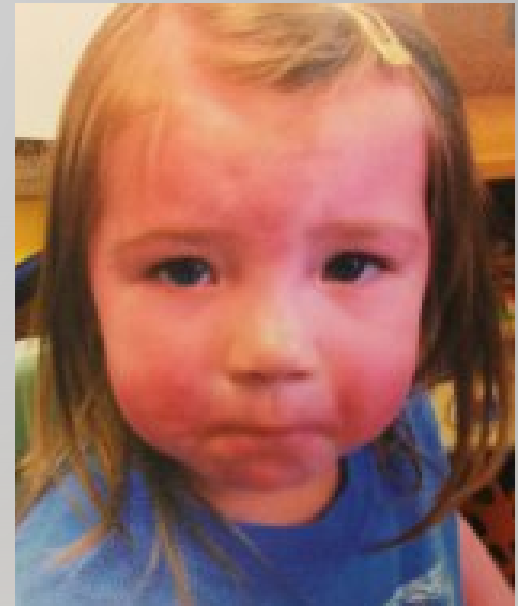
dry mouth

blurred vision
dry eyes, nose, or
skin
stomach pain
constipation
diarrhoea
nausea
heartburn
gas
change in ability
to taste food
headache
dizziness

weakness
confusion
sleepiness
difficulty falling
asleep or staying
asleep
nervousness

flushing

swelling of the
hands, arms, feet,
ankles, or lower
legs
back or joint pain
frequent, urgent,
or painful
urination



Medical alternatives

Ditropan XL

Trans-dermal Oxybutinin

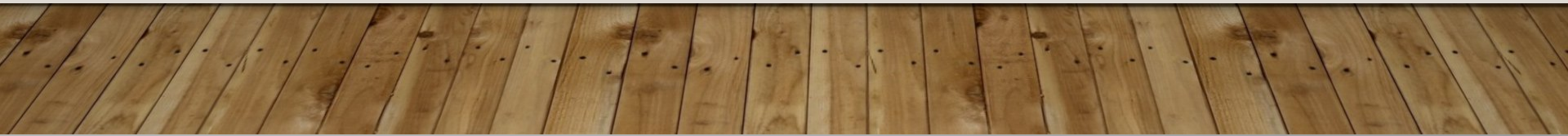
Intra-vesical oxybutinin

Tolteridine (M2 & 3), Detrusitol

Solifenacin (M3), Vesicare

Darifenacin (M3), Enablex

Botulinum A toxin

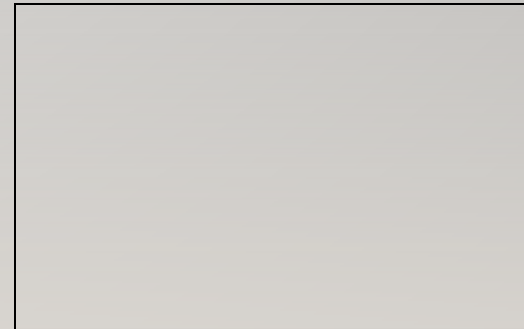


Depth of injection

Patients with idiopathic DOA,
randomized

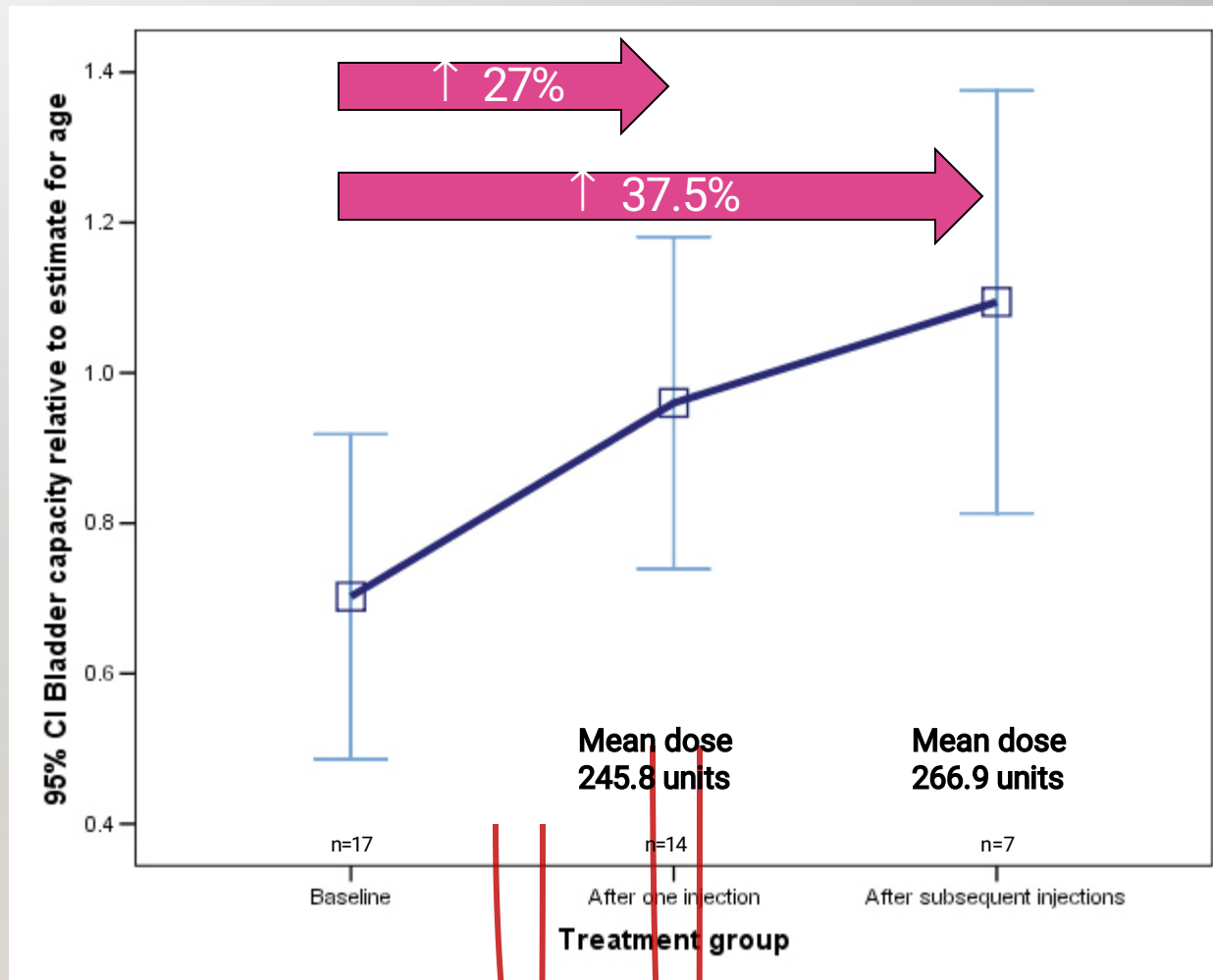
Similar response in both

It really is somewhat of a blind
injection!



Kuo. J of Urology 2007

Bladder capacity relative to expected volume for age at baseline and change following intra-detrusor injection with OnabotulinumtoxinA



p=0.039*

p=0.043*

* Paired samples test (2 tailed)

Bladder Augmentation

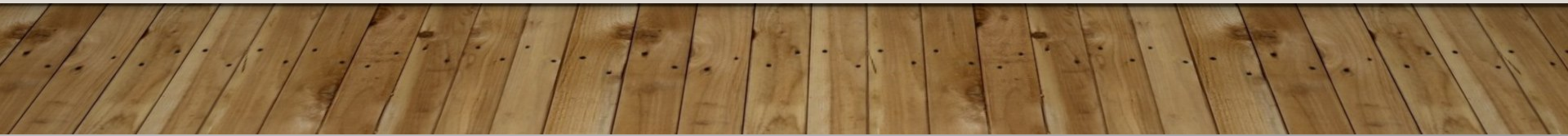
When ?

Complications

Should be liberally indicated with procedures to increase outlet resistance?

What type ?

Concurrent construction of catheterizable conduit
(Mitrofanoff, Yang/Monti)

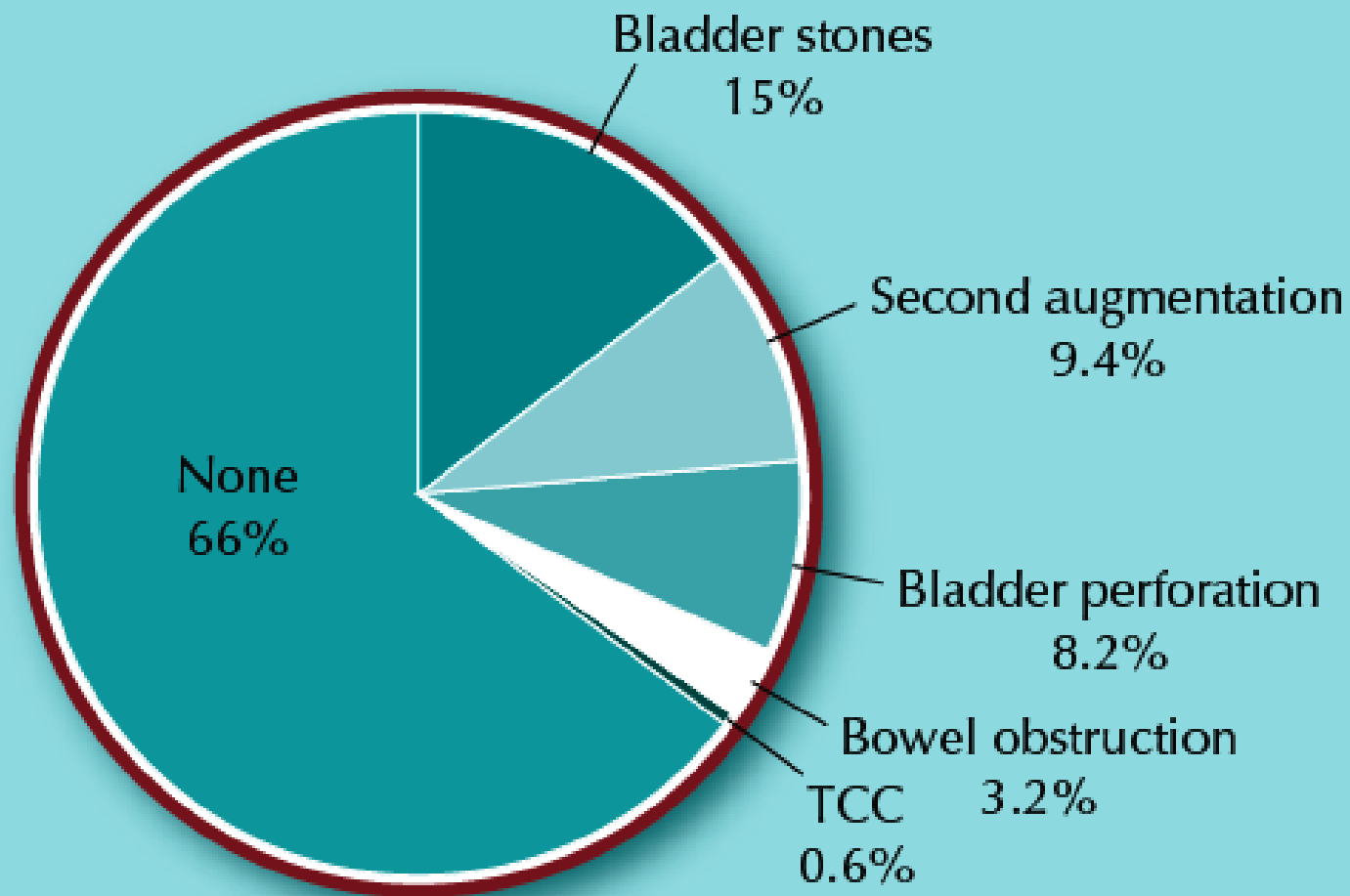


Who Needs Augmentation?

Upper tract deterioration

Persistence of incontinence on
adequate medical management

**DO NOT OPERATE BASED ON
URODYNAMICS ALONE !**



Preventing reservoir calculi after augmentation cystoplasty and continent urinary diversion: the influence of an irrigation protocol

T.W. HENSLE, J. BINGHAM, J. LAM and A. SHABSIGH

Division of Paediatric Urology, Children's Hospital of New York, Columbia University, College of Physicians and Surgeons, NY, USA

BJU Int 2004 93 585-7

No Irrigation Routine Routine Irrigation

39/91 (43%) stones

3/42 (7%) stones

Mean 24 mths to presentation

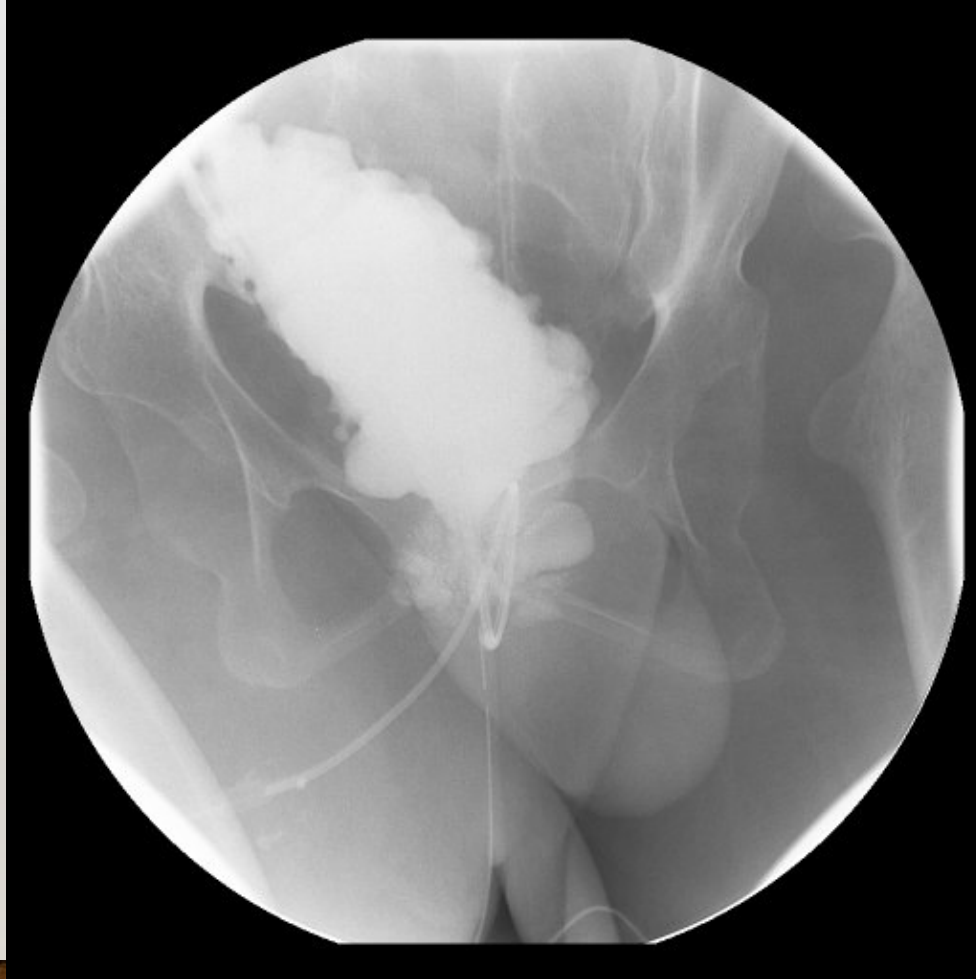
Mean 26 mths to presentation

240 ml saline irrigation twice weekly

&

240-480 mg/L Gentamicin sol'n: 120 ml once weekly

How to proceed?



Severe bladder trabeculation obviates the need for bladder outlet procedures during augmentation cystoplasty in incontinent patients with neurogenic bladder

Antoine E. Khoury, Sumit Dave, Maria Helena Peralta-Del Valle, Luis H.P. Braga, Armando J. Lorenzo and Darius Bāgli

Division of Urology, The Hospital for Sick Children, Toronto, Canada

Accepted for publication 17 May 2007

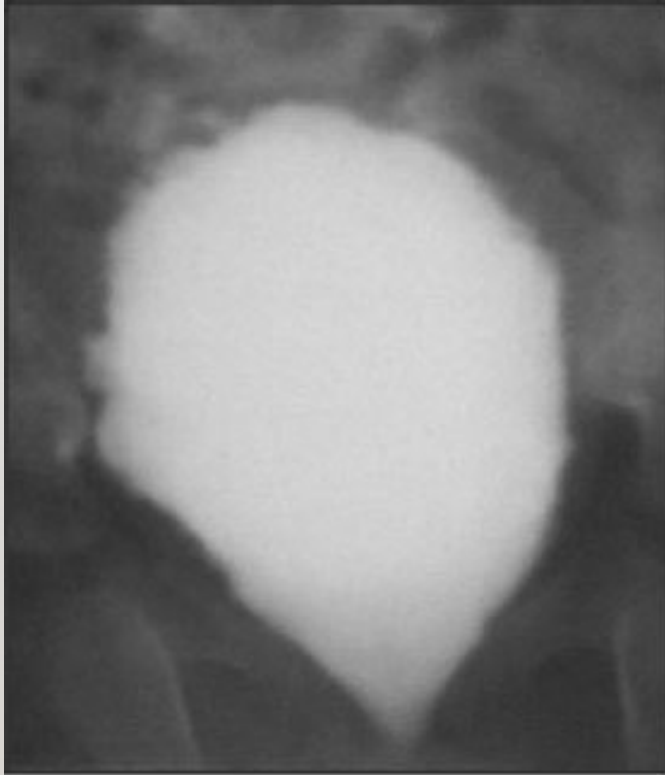
TABLE 1

Preoperative findings and results in the two groups of patients

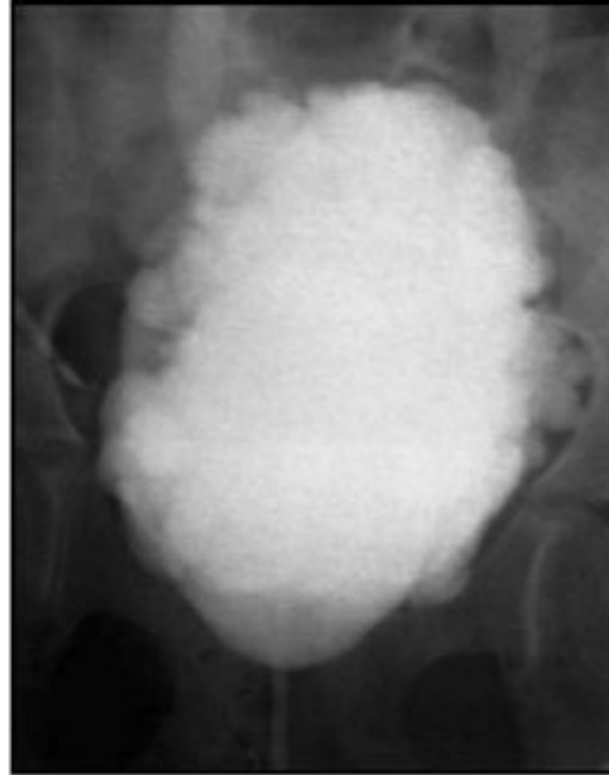
Variable	Group		P
	AC	AC + BOP	
N	23	10	
Mean age, years	7.7	9.8	NS
Sex, M:F	10:13	5: 5	NS
N (%) or n/N:			
Ambulatory	10 (43)	4/10	NS
Hydronephrosis	13 (57)	3/10	NS
VUR	16 (70)	2/10	0.009
Trabeculation:			
mild	9 (39)	5/10	NS
severe	14 (61)	5/10	NS
BN (open)	9 (39)	8/10	0.031
DO	13 (57)	4/10	NS
Mean DLPP, cmH ₂ O	49.7	42.8	0.4
Dry after surgery, n/N (%)	21/23 (91)	8/10	NS

NS, not significant.

Augmentation alone in case 1?



Case 1



Case 2

Bladder Neck Repair

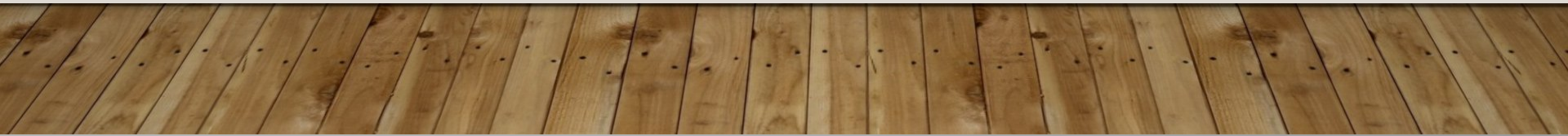
Slings / Suspension

Artificial urinary sphincter (AUS)

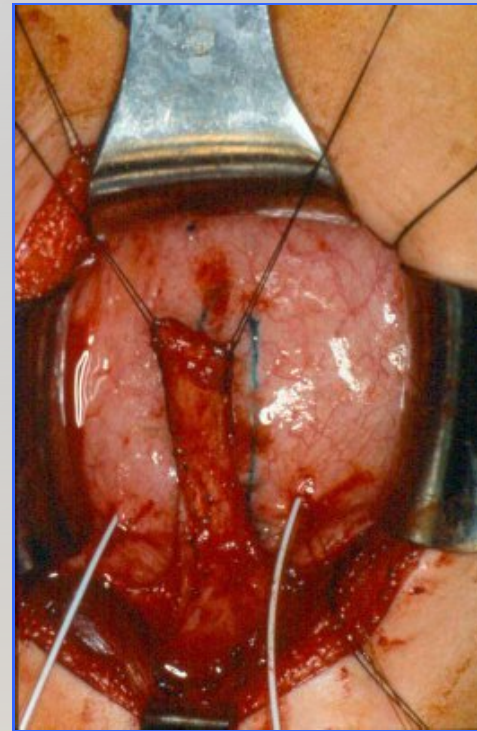
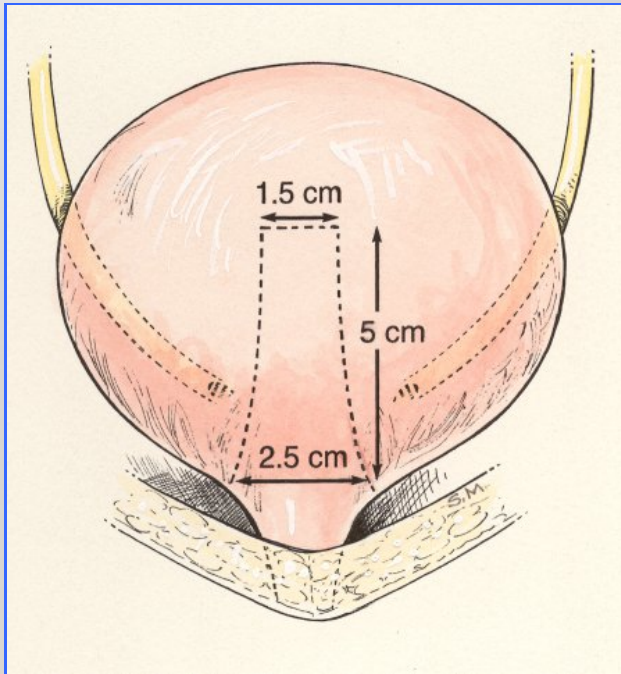
Bladder neck reconstruction (BNR)

Bladder neck closure

Endoscopic injection of bulking agents



ONLAY ANTERIOR BLADDER FLAP: trapezoid shape to improve flap vascular supply



Macroplastique injected in neourethra and
Mitrofanoff.

Persistence of incontinence (slight initial
improvement)

Recurrent UTIs!

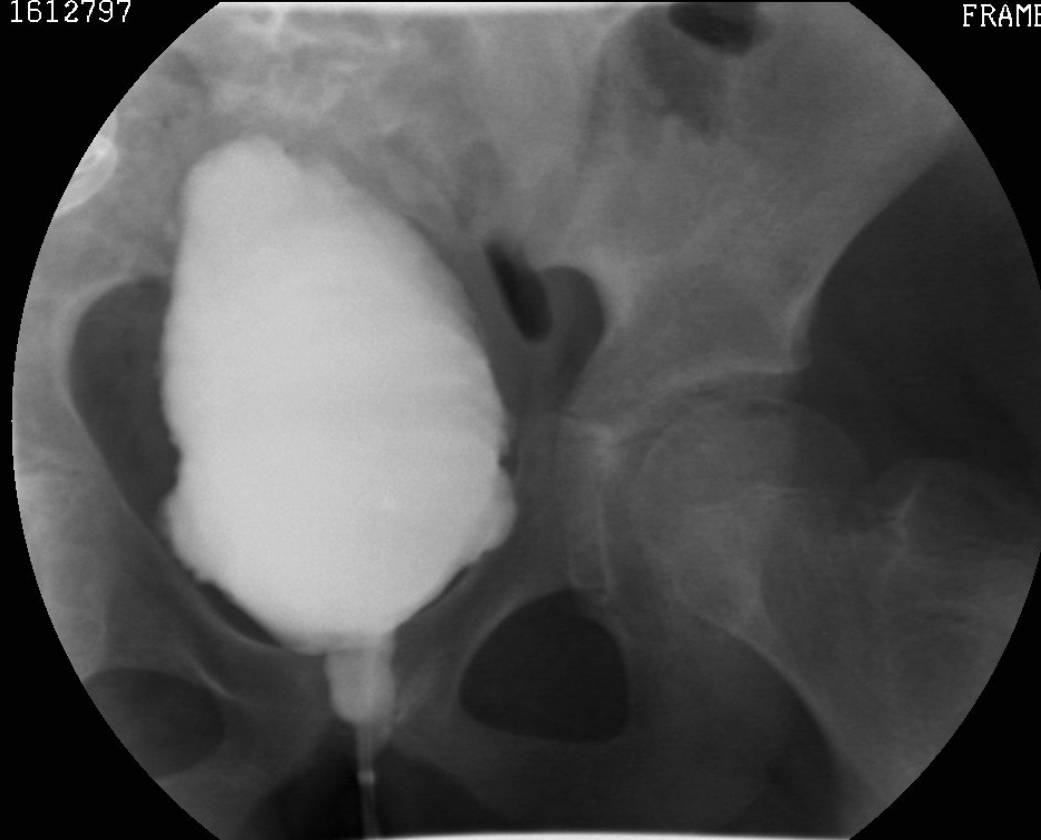
MACDONALD ERIC

M.ERIC
Study Date:2005/10/27
Study Time:11:47:00 AM
MRN:

GU Cystourethrogram Voiding
1612797

N

FRAME= 08



11:58:50
27-OCT-05

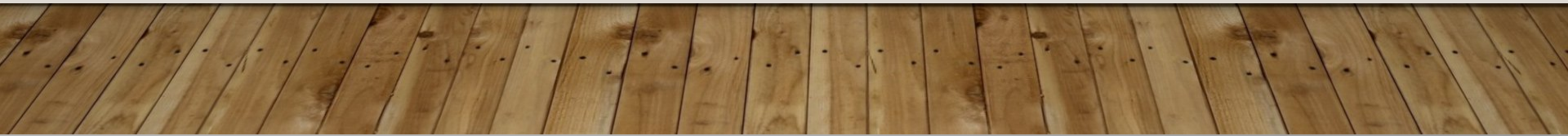
H.S.C. TORONTO
DIAGNOSTIC IMAGING FL2

L = 127
W = 255

SP= 04
FL 05 03634

C127
W255

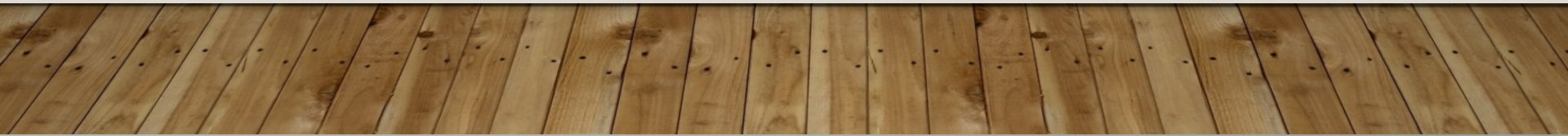
Ileocystoplasty performed
Patient becomes dry and
without UTIs...



BNR + Augmentation ?

Neurogenic bladders often decompensate after increase of outlet resistance: more liberal indication of augmentation Bauer, S et al, 1986; Roth, DR et al, 1986; McGuire, EJ, 1989; Nill, TG et al, 1990; Kreder, K and Webster, GD 1992; Dave, S et al. J.Urol. 2008

Bladder exstrophy/epispadias: augmentation can be avoided as they grow with time after increase of outlet resistance Gearhart, J and Jeffs, R.,1989 – 8%; De Castro, R. et al, 1994 – 12%; Shaw et al., 2004 : 30/43 pts (70%) required augmentation.



Sling without augmentation for Neurogenic Incontinence

Snodgrass, W et al J. Urol 177:1510, 2007

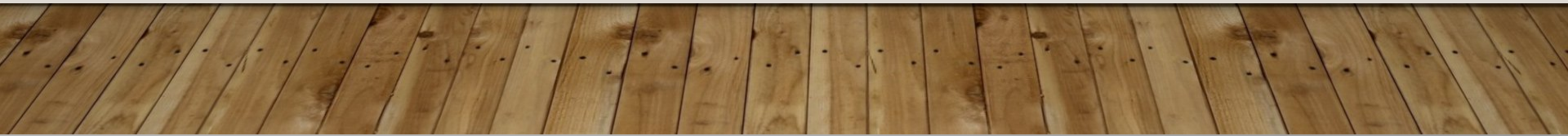
30 pts, Mean F/U: 22 months

Satisfactory continence (2 or less damp pads/day): 83%

Dry: 53%

Post-op hyperreflexia: 8/30 (26%)
responded to anticholinergics

Loss of compliance: 10/16 (63%)



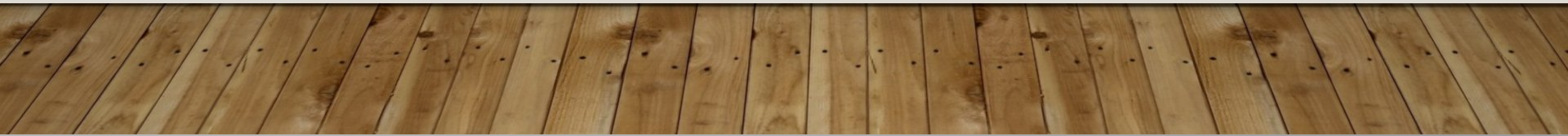
Indications for Vesicostomy

Inability to perform CIC (social conditions, extreme body deformity in small infant)

Progressive deterioration despite adequate CIC program

Contra-indications for bladder augmentation

Recurrent febrile UTI and associated VUR (despite CIC)



URINARY INCONTINENCE

Patient selection: Important considerations

- Compliance with CIC
- Manual dexterity
- Commitment
- Renal function



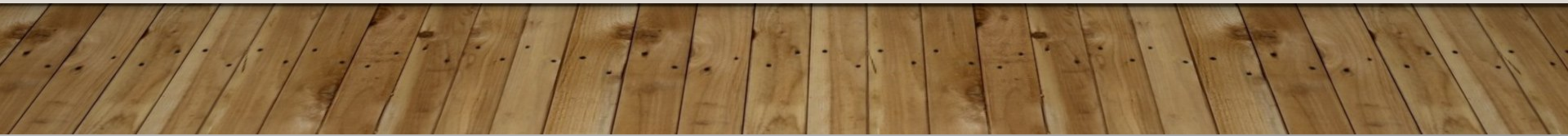
Best Procedure...

Procedure	Utilize	Normal	Need for	Durable	Allow easy CIC
AUS	N	Y (20%)	50-60%	N	Y
Slings	Y	N	80- 90%	Y	Y
Younga Dees	Y	N	90 %	Y	N
Kropp	Y	N	70-90%	Y	N
Pippi Salle	Y	N	70-80 %	Y	Y

Surgeon's preference and experience.

“Dilation of the external urethral sphincter undoubtedly lowers dangerous leak point pressures and improves bladder storage characteristics in terms of capacity and compliance”

Park, JM et al. J. Urol. 165, 2383, 200 1

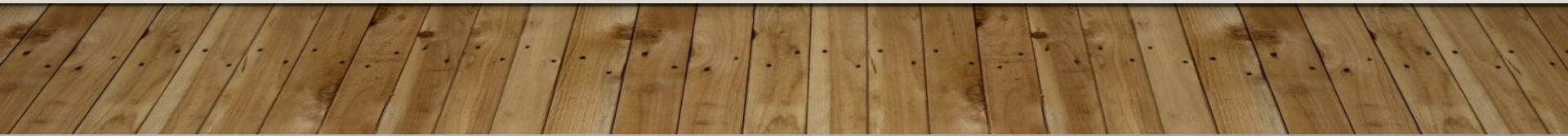


Summary

Early adequate management of neurogenic bladder is essential to avoid bladder decompensation

Maximum conservative treatment is successful in the majority of cases

Bladder augmentation is often necessary when outlet resistance is created



Assessment

History

Physical Examination (assoc. malform.)

Images:

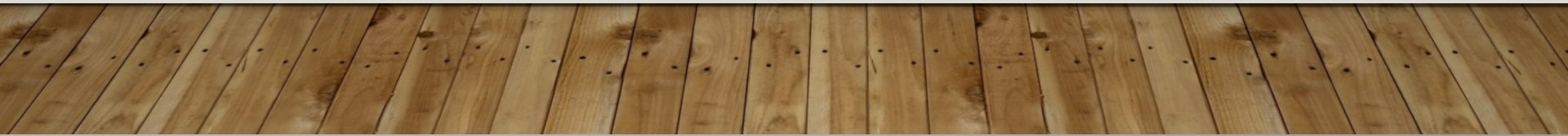
- Abdominal ultrasounds (US) prior and post MMC closure

- After stabilized from spinal shock:

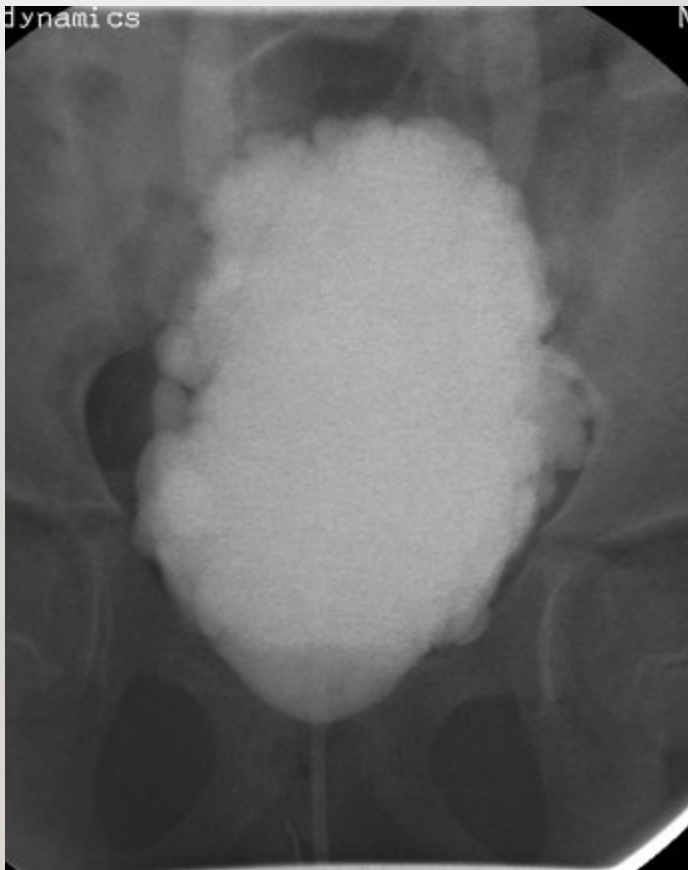
 - Abdominal US

 - Voiding Urethrocystogram (VCUG)

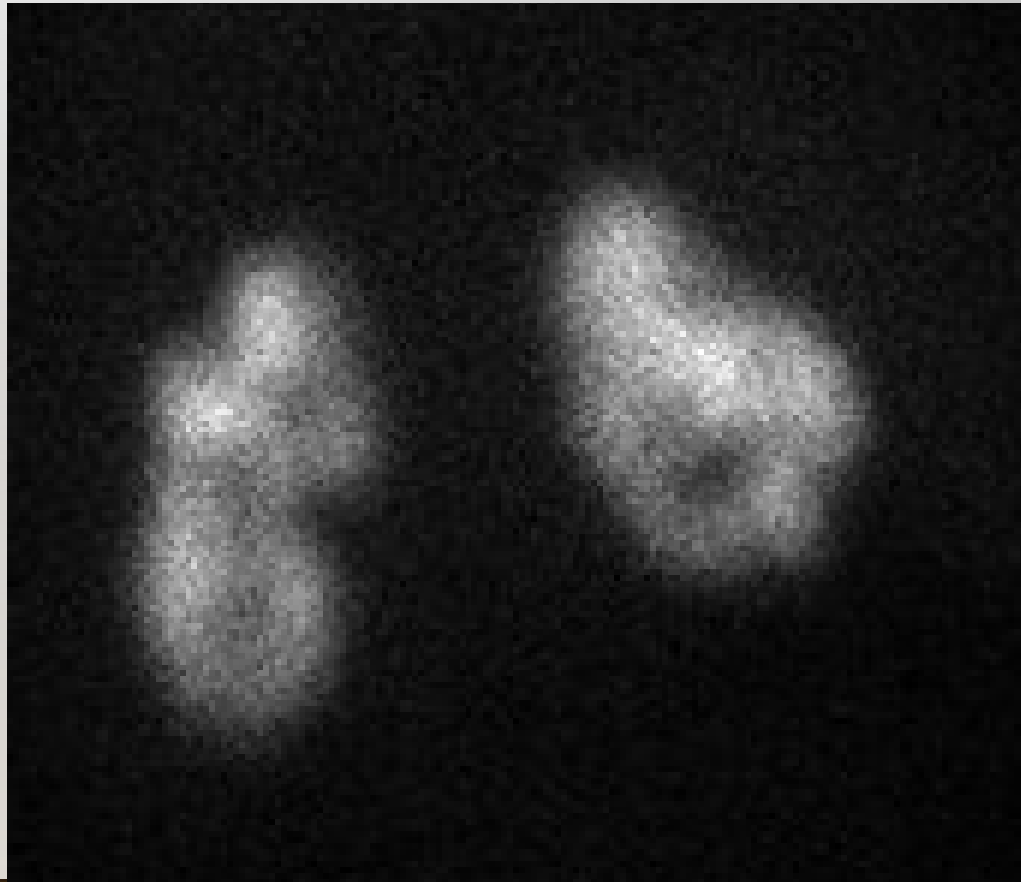
 - Urodynamic evaluation (UDS)



VCUG



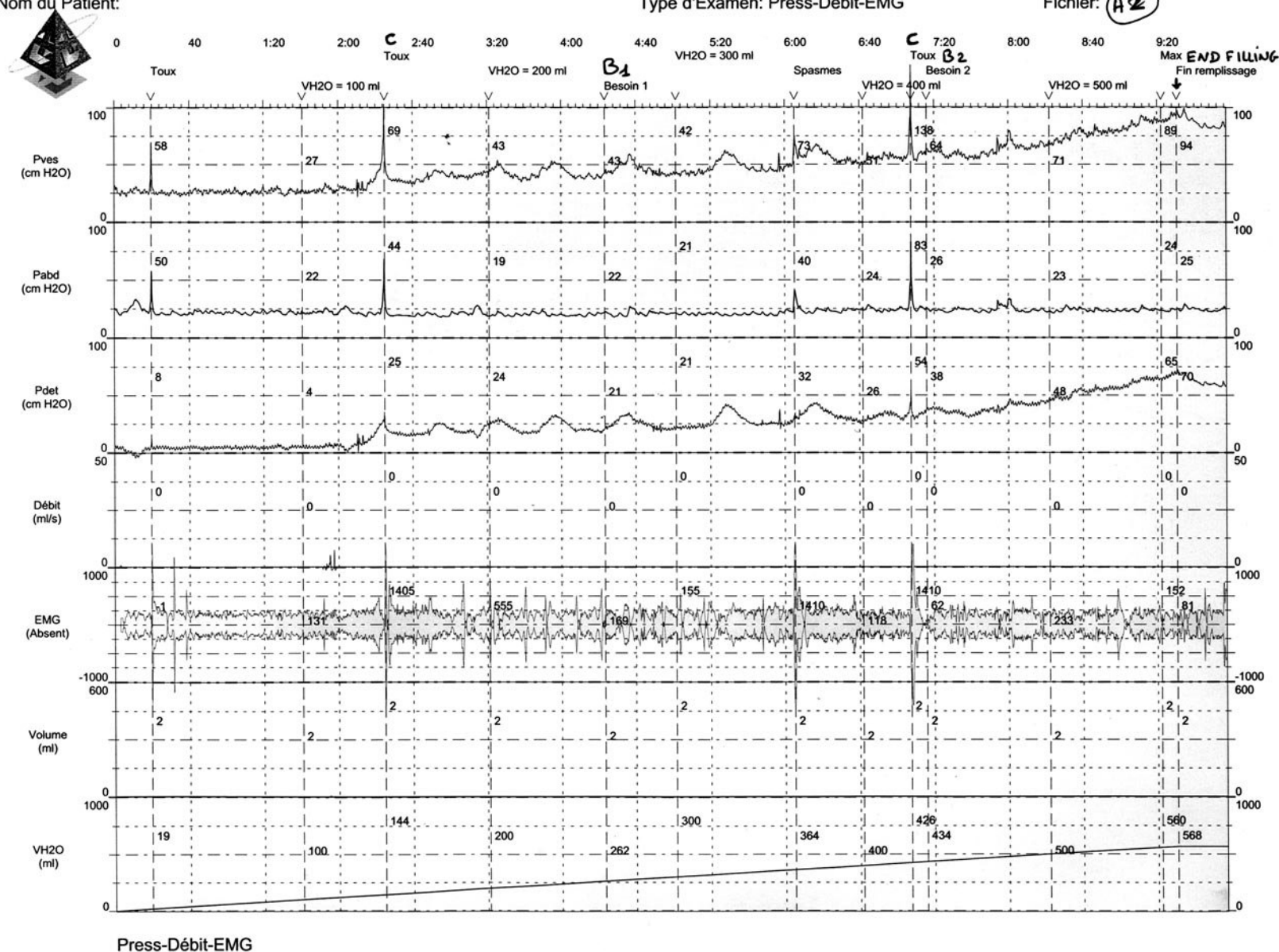
DMSA



Nom du Patient:

Type d'Examen: Press-Débit-EMG

Fichier: H2



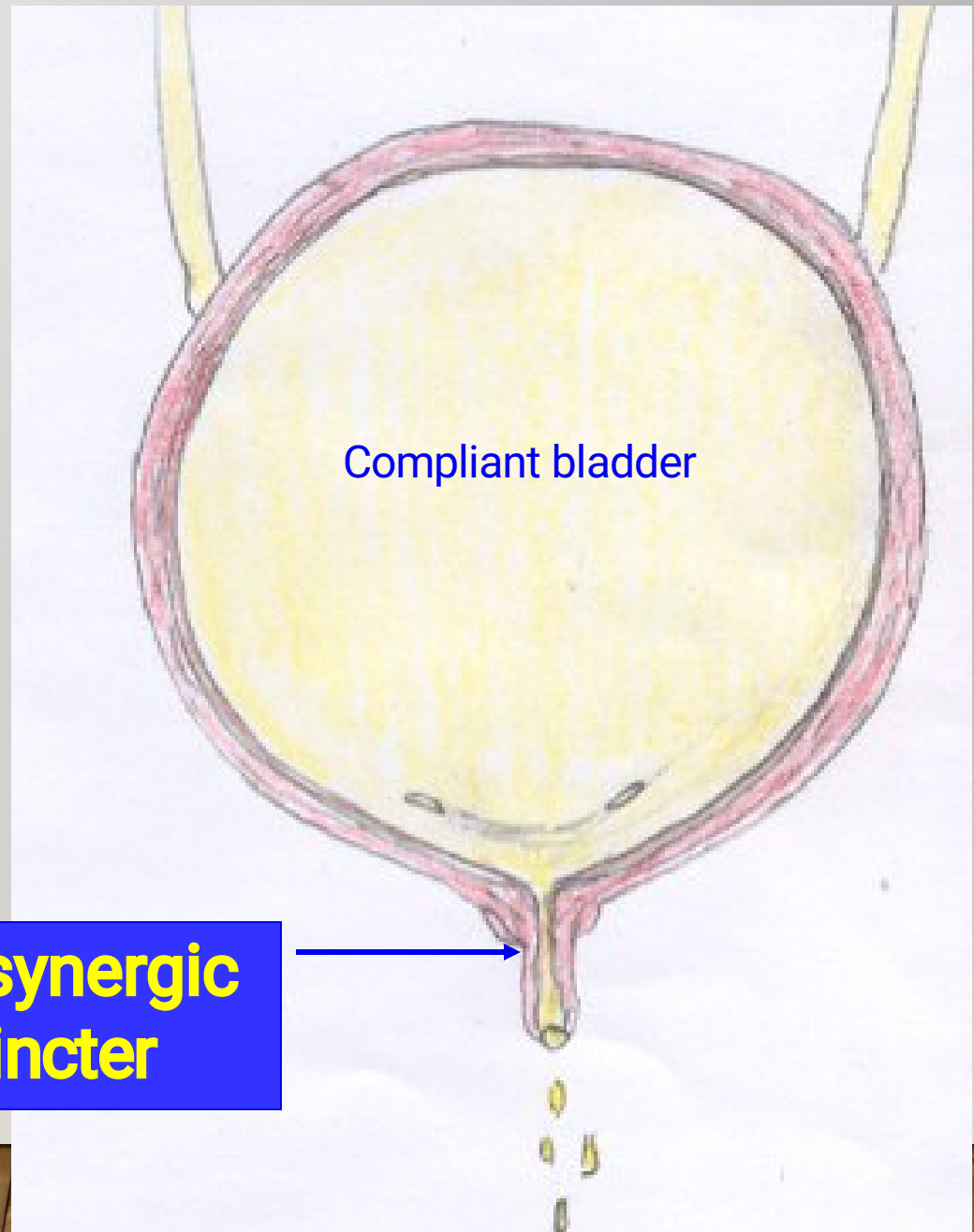
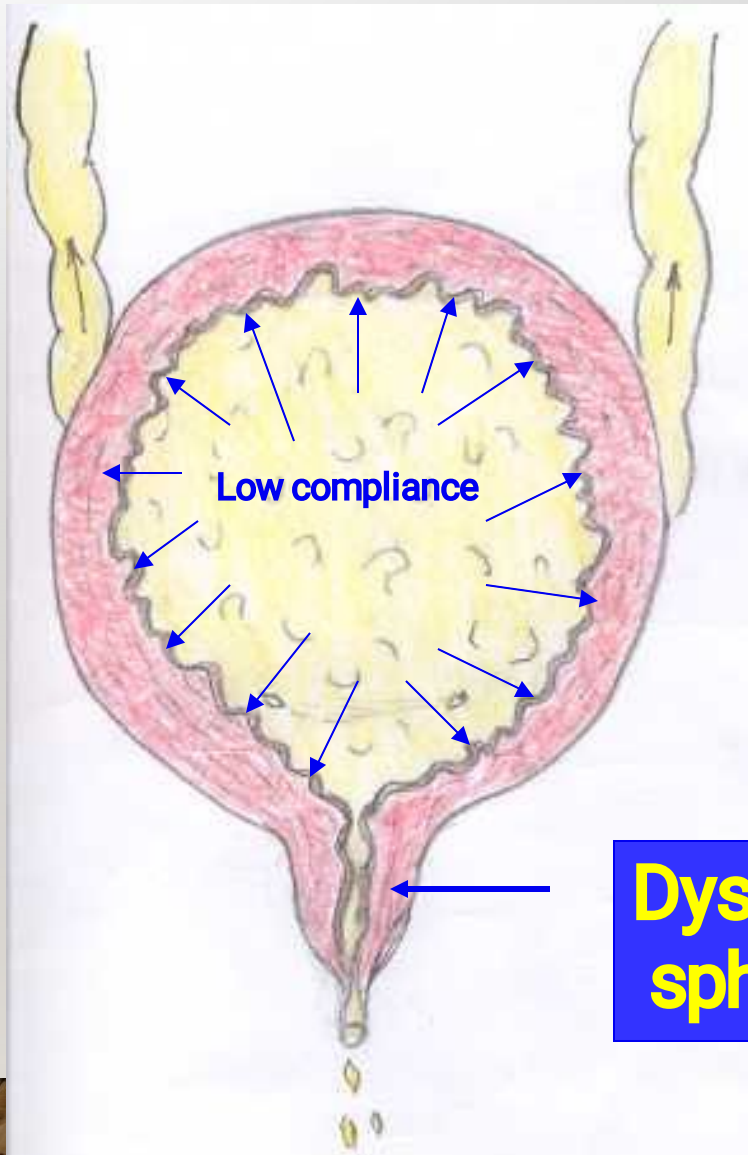
Low Compliance, hyperreflexic bladder

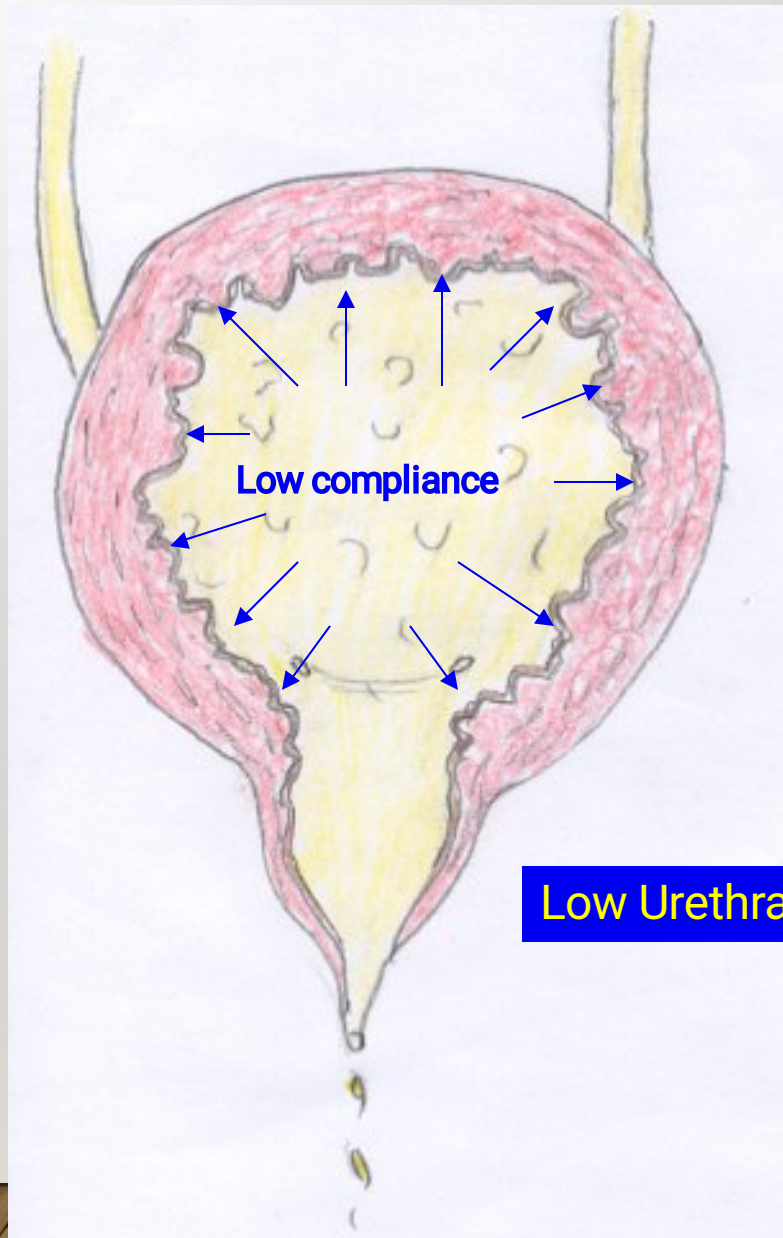


Classification of Neuropathic **Bladders**

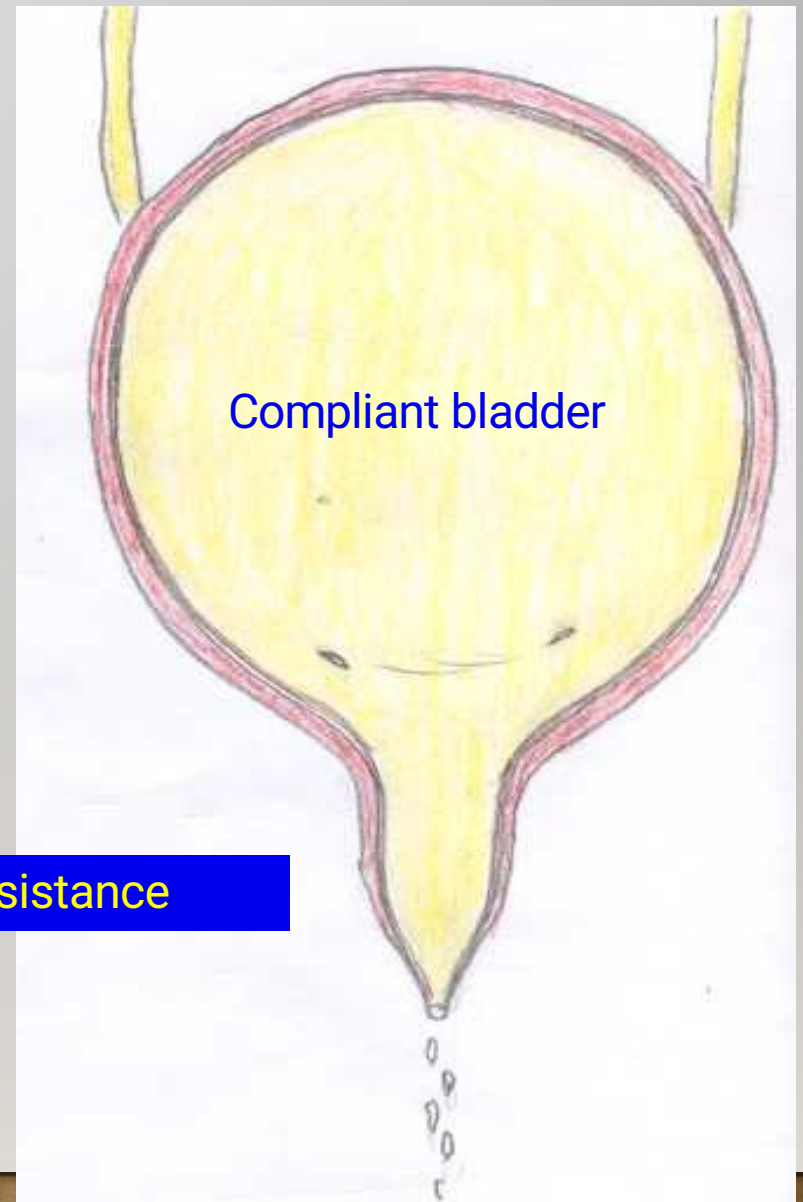


Overflow incontinence





Low Urethral Resistance



Management

Patients with **DLPP > 40 cm water** (dyssynergic sphincters) need immediate decompression by:

Clean intermittent catheterization (CIC) - ideal! It is easier to start very early in life!!!!

Anticholinergics (if hyperreflexia or diminished compliance on UDS)

*If not possible to establish a reliable CIC program a **VESICOSTOMY** is indicated.

Augmentation should be avoided in infancy!

Clean Intermittent Catheterization (CIC)



Early
Start !

THANK YOU

