



The effect of puberty on LUT function and common adolescent gynaecological issues

W25, 30 August 2011 09:00 - 12:00

| Start | End | Topic | Speakers |
|-------|-------|--|--|
| 09:00 | 09:05 | Introduction | <ul style="list-style-type: none"> Wendy Bower |
| 09:05 | 09:50 | Review of childhood lower urinary tract parameters and impact of puberty | <ul style="list-style-type: none"> Wendy Bower |
| 09:50 | 10:30 | Impact of puberty on normal and compromised urinary tract and bowel | <ul style="list-style-type: none"> Laetitia de Kort |
| 10:30 | 11:00 | Break | None |
| 11:00 | 11:20 | The needs of adolescents with chronic illnesses as they go through puberty | <ul style="list-style-type: none"> Lucy Swithinbank |
| 11:20 | 12:00 | Adolescent gynaecological issues | <ul style="list-style-type: none"> Pavalli Latthe |

Aims of course/workshop

Basic Level course to develop understanding of changes in the urinary tract that can be associated with onset of puberty. A secondary aim is to review adolescent gynaecological issues.

Educational Objectives

- Develop an awareness of changes associated with puberty
- Develop an understanding of how such changes may affect urinary tract and bowel function
- Highlight assessment and management issues in pubertal adolescents presenting with bladder or bowel symptoms
- Develop an understanding of common gynaecological conditions precipitated by, or presenting during, puberty
- Identify appropriate and holistic management strategies for the adolescent with gynaecological conditions
- Review transitional care of adolescents

ICS Course 2011: i) The Effect of Puberty on LUT function

ii) Common Adolescent Gynaecological Issues.

Keywords: Adolescent; bladder dysfunction; gynaecology

Aims / Objective: Basic Level course to develop understanding of changes in the urinary tract that can be associated with onset of puberty. A secondary aim is to review adolescent gynaecological issues.

The aims of this ICS Course are to:

- Provide an overview of changes occurring during puberty in adolescents with both normal anatomy and compromised urinary tract function
- Review gynecological issues that present in adolescence and the evidence underlying current management

The objectives of this ICS Course are to:

- Develop an awareness of changes associated with puberty
- Develop an understanding of how such changes may affect urinary tract and bowel function
- Highlight assessment and management issues in pubertal adolescents presenting with bladder or bowel symptoms
- Develop an understanding of common gynaecological conditions precipitated by, or presenting during, puberty
- Identify appropriate and holistic management strategies for the adolescent with gynaecological conditions

Target audience: any clinician who may encounter adolescents with urinary tract dysfunction. No maximum audience.

Programme and Speakers:

- Review of changes associated with puberty
 - o Prof Wendy Bower, Aarhus University, Denmark
- Impact of puberty on normal and compromised urinary tract and bowel
 - o Dr Laetitia de Kort, Department of Pediatric Urology, University Medical Center Utrecht, The Netherlands
- The needs of adolescents with chronic illnesses as they go through puberty
 - o Dr Lucy Swithinbank, Urodynamic Unit, Southmead Hospital, Bristol, United Kingdom, Bristol
- Adolescent gynaecological issues

- Dr Pallavi Lathe, Subspecialist in Urogynaecology, Consultant Obstetrics & Gynaecology, Birmingham Women's National Health Service Foundation Trust, Birmingham UK

Changes associated with puberty

Adolescence can be considered the period of maturation from childhood to adult social and cognitive behaviours (Sisk 2004). It is largely driven by the onset of puberty, which begins between 8-10 years in girls and after 9 years in boys. Both the brain and the gonadal system respond to changing concentrations of hormones to ultimately deliver a reproductive and mature adult (Sisk 2004).

The process is multi-phasic with separate timing and neurobiological mechanisms. Gonadal maturation is the direct result of a cascade of events beginning with the production of gonadotrophin releasing hormone (GnRH) in the basal hypothalamus. This has been suppressed during prepubertal years but when produced signals the pituitary gland to release luteinizing hormone and follicle stimulating hormone. These hormones act on target cells to direct production of sperm and eggs and secretion of steroid hormones responsible for secondary sexual characteristics. There appears to be no single trigger for this process. Instead, timing of GnRH pulses is related to the interplay between metabolic, developmental, social and environmental cues and may be programmed by prenatal levels of sex steroids (Sisk 2004).

At the same time other hormones are changing concentration and signaling pubertal changes. Leptin is a regulator of lipid homeostasis and an increase in concentration is related to greater adiposity (Vigil 2011). Whilst there is no body weight threshold or given percent of body fat needed for onset of puberty, as the amount and regional distribution of fat changes leptin levels rise (Roemmich 2002). High leptin, along with abdominal fat stores can inhibit insulin secretion whilst muscle and subcutaneous fat reduces insulin sensitivity. Although this modest insulin resistance of puberty is compensated for by increased insulin secretion, puberty remains a high risk time for the development of type II diabetes and obesity (Roemmich 2002). Other hormones that vary in concentration and are linked to the onset of puberty include growth hormone, insulin-like growth factors, kisspeptin (involved in initiating GnRH secretion) and ghrelin (involved in appetite regulation) (Vigil 2011).

Extensive brain re-modelling occurs during puberty in order to establish a neural basis for maturation. The cortical and limbic systems have limited cross-communication in childhood and it is likely that in early adolescence limbic activation dominates, explaining the preponderance of emotional behaviour in young teens (Vigil 2011). Adolescents have a strong appetite system that

responds to gonadal hormones. They make irrational decisions that lack a basis of common sense and control and often have difficulty inhibiting impulsive behaviour (Leijenhorst 2010, Fareri 2008). Immediate gratification and over-responsiveness to potential rewards is common.

Oestrogens, progesterone and testosterone activate and organize central neural activity so that by the end of adolescence cognitive structures have developed and there is a balanced response to stimuli. The prefrontal cortex of a late adolescent is able to inhibit inappropriate responses, link up with regions controlling feelings and emotional behaviour and direct planned and goal-oriented behaviour (Vigil 2011).

This change may be related to an increase in white matter (myelinated axons) and a decrease of gray matter (cell bodies). In addition reduction in synaptic density via neural pruning facilitates strengthening of the frequently-used connections. Sex differences in relative brain volume also become evident. Regions associated with language and communication skills, formation of memory, panic and stress behaviour appear larger in females. Males have comparatively greater volume in areas related to integration of sensorimotor information, processing of visual information from the retina, processing of emotions and integration of amygdala to cortical regions.

The physical changes associated with puberty are generally complete by 16-18 years. Nervous system remodelling continues in order to support adult behaviours, but organisation may be altered by alcohol, nicotine, steroid hormones and other drugs (Romeo 2002; Vigil 2011).

Psychological changes continue into the early 20s and relate to the development of pathways to enable social functioning (Vigil 2011).

Puberty can arrive early or late and cause major psychosocial and emotional problems in families (Zacharin 2009). In general early onset of puberty is associated with earlier tall stature but the possibility of stunted final height. Early oestrogen production also impacts brain function often causing mature but disordered behaviours (Zacharin 2009). Evidence suggests that early puberty may be associated with maternal smoking during pregnancy (Ravnborg 2011) and small size for age at birth (Dunger 2006). Later onset of puberty is associated with short stature and altered body image.

Impact of illness or disease on puberty

- Cerebral Palsy: earlier onset of puberty but delayed completion when compared to non-affected population (Worley 2002).
- Infections within the first six months of life: onset of puberty later than in girls without early infections (Kwok 2011).
- Myelomeningocele: between 10-30% of boys and up to 50% of girls with MMC will have early onset of puberty. Early symptoms of brainstem dysfunction and perinatal increased intracranial pressure predict precocious puberty in boys (Proos 2011).
- CNS lesions: any sign of precocious puberty may be an early warning of cerebral lesions
- Chronic renal insufficiency: is associated with severely delayed pubertal development. Pubertal height gain is only 58% and 48% of that observed in late-maturing boys and girls, respectively. Successful transplantation does not restore full growth.
- Children with Insulin Dependent Diabetes Mellitus have normal onset of puberty and normal sexual maturation
- No association described between enuresis and onset of puberty
- Cystic fibrosis: girls have delayed growth and enter puberty later, with menarche occurring up to 2 years after than their healthy peers
- Elite sports participation: if intense training involves a negative energy balance the pre-pubertal stage is prolonged and pubertal development and menarche delayed in line with bone maturation.

Issues around puberty in adolescents with disabilities.

Adolescence is a time of physical and psychological change. These changes are just as important in a child with disability. An awareness of, and sensitivity to, the particular needs of adolescents with disabilities is important when managing this group of patients.

- No child is “Peter Pan”; all children will grow up and mature into adulthood, even though parents of children with disabilities may tend to be more protective of a disabled child than a child without disabilities.
- Although the same issues: sexuality, body image, self-image and a move towards independence, affect all children as they progress through adolescence, there are particular issues that affect the adolescent with disabilities. Young people with disabilities are inevitably more dependent on their parents than able children and this can cause problems during adolescence.

It may be difficult for both the child and their parent to steer an even course through this time. The consequences of this can affect physical wellbeing, as there may be problems with treatment compliance. Adolescents may also become more resentful of their disabilities, as they become more aware of the restrictions that disabilities may place on their lifestyle and opportunities.

Experimentation with alcohol and drugs can also have more serious consequences, for example in an adolescent where an augmentation cystoplasty has been performed.

There is also a tendency to infantilise a child with disabilities and the adolescent with a disability is no less aware of their sexuality than any other young person. Sexual maturation will need to be managed thoughtfully, as although adolescents need some freedom to explore their sexuality, adolescents with learning difficulties may need more guidance than others. The very dependence of adolescents with disabilities makes them more vulnerable to sexual abuse than their more able peers.

Body image may be more of an issue with a young person with disability, as they may become more aware of being different, particularly if there are continence issues. What may have been acceptable to their peers, particularly in terms of incontinence and pad use, when they were younger may be less so as they approach adulthood.

The continuing care of young people with disabilities is also a problem. The majority of people in an adult gynaecological or urological clinic will be considerably older and adolescents may fail to attend if they are reviewed in an adult setting. This can be managed with adolescent clinics.

Symptoms carried from childhood into adolescence

Non-neurogenic bladder population

- Urinary incontinence 15-17 yrs : 1-1.8%
- Nocturnal enuresis: 15-17 yrs 0.5-2.6%; 37% wet every night
- Faecal incontinence in 6-18 yrs: 2-3%

Underlying bladder dysfunction

- Overactive bladder
- Infrequent voiding: routine over-distension and detrusor underactivity. Likely to be associated with UTI and upper tract compromise or bowel dysfunction
- Dysfunctional voiding patterns
- Giggle incontinence
- Stress incontinence (in specific populations e.g. anorectal malformations, cystic fibrosis girls, high-impact athletes)

Other contributors

ADHD patients: 3 times risk UI vs controls

Cystic fibrosis girls: 5.8 times risk SUI

Sleep apnea patients: nocturnal enuresis

Obesity: OR → 2.4 for SUI; 30% have constipation / soiling

Distance or road runners: 12% faecal incontinence

Competitive athletics: especially high impact activities

- 43% elite athletes and dancers leak urine; 10% often

Neurogenic or congenital bladder disorders

Children with neurogenic disorders who have been managed optimally in childhood may arrive into adolescence with well-functioning urinary systems i.e.

- normal capacity compliant bladder
 - bladder emptying at acceptable intervals
 - dry between catheterisations

- have normal upper urinary tracts

Commonly bladder and kidney function will deteriorate after puberty. The aim of care is to identify issues that contribute to adverse changes in bladder and renal function during adolescence and to implement strategies to preserve upper tract integrity, social continence, patient autonomy and independence. Clinicians aim to reduce elevated detrusor pressures, maintain bladder compliance and maximise dryness. Intervention includes: antimuscarinic medications, botulinum toxin A, surgical strategies, bowel management regimes and regular nurse or urotherapist patient contact. Holistic care of the adolescent requires discussion of sexuality, fertility status, treatment compliance and behaviours that increase the risk of progressive urinary tract damage.

Conditions where bladder function may deteriorate during adolescence

Posterior urethral valves and obstructive membranes

- despite early correction of bladder outflow obstruction incontinence secondary to bladder dysfunction
- often overactive bladder
- poorly compliant detrusor → high bladder pressure and low volume
- detrusor hypocontractility: asymptomatic but → incomplete emptying (seen in 66% boys at 20 yrs)
- progressive hydroureteronephrosis: 50% renal failure at 15 yrs

Sacral agenesis: stable neurological lesion

- Varied urodynamic findings; most patients have faecal incontinence

Tethered cord: small group have primary / isolated tethering

Spinal cord injury: (infrequent in adolescents)

- spinal shock initially → urinary retention
- evaluate bladder function at 3 months
- Common U/D findings = uninhibited detrusor and sphincter dyssynergia

Anorectal anomalies: congenital lesions of the cloaca

- Normal spinal cord: 54% abnormal urodynamic findings
- Abnormal spinal cord: 59% abnormal urodynamic findings
- High lesions: superior to levator muscles, 60% patients - VUR, neurogenic bladder, renal dysplasia
- Low lesions: inferior to levator muscles, 20% patients have urological abnormalities
- Imperforate anus: 17% bladder dysfunction, ?% SUI; 57% faecal incontinence

Bladder exstrophy

- Higher continence rates after osteotomy and when bladder size is adequate
- Obstructed voiding / incontinence / persistent reflux

Female epispadias: short patulous urethral plate

- mild leakage, incompetent bladder neck

Myelomeningocele or spina bifida: neural damage, ± compromised brainstem and pontine centers, ± scar tissue from closure

- Dynamic effect on urinary tract
- 33% develop DSD or acontractile bladder by puberty
- Up to 60% can have upper tract deterioration due to high bladder pressure, RUTI or VUR; with CIC and anticholinergics proportion should be lower
- Occult disease: back pain, poor perineal sensation, LL asymmetry, weakness / abnormal gait. LUTD → 40%

Cerebral palsy: non-progressive brain lesion of variable severity

- spectrum of voiding dysfunction
- continence delayed but usually achieved by late childhood
- variable urodynamic findings

Symptoms and signs that need immediate investigation and/or therapy

- New incontinence in boys. This may be due a tethered cord or to severe non-neurogenic detrusor sphincter dyssynergy (Hinman bladder) with possible compromise of the upper tract
- Persisting ‘nocturnal enuresis’ which is rarely monosymptomatic but usually associated with underlying bladder dysfunction
- Girls with reflux nephropathy who are pregnant. These patients have a high risk of hypertension and toxocosis. Patients with pre-pregnancy hypertension or renal impairment should be advised not to become pregnant because of high risk of further renal deterioration, fetal growth retardation or even fetal death.

Indications for urodynamics

- Deteriorating renal function
- Incontinence: decreased tolerance to incontinence during adolescence with sexual development and peer pressure
- New symptom, whether incontinence, altered voiding or urgency

Implications of adolescence for service delivery

There are therapeutic implications from knowing that it is only in late adolescence that young people are able to inhibit inappropriate responses, link up regions controlling feelings and emotions and direct planned and goal-oriented behavior. Clinicians must strive to deal directly with the adolescent but balance input to parents. Adolescents prefer communication to be directed at themselves rather than their parents yet the support from their family is crucial to successful management. Consultations are often longer, can involve afternoon or evening clinics and require sufficient time for discussion as a family then alone with the adolescent patient. Issues surrounding confidentiality and consent are fundamental and especially relevant when counseling about sexuality and safety is involved. The process requires time, thoughtful enquiry and clear communication.

Awareness that health behaviors during adolescence, and compliance with treatment, may not align with therapeutic advice, should be discussed. Young adults frequently do not prioritize management of their LUTS, even when the outcome can be catastrophic. Discussion should continually reinforce information and reiterate the relevance of intervention. Clinicians and patients can negotiate a joint treatment plan and confer over appropriate follow-up periods. Text reminders about review appointments or text, Twitter or Facebook contact between appointments could be considered. Some consultations could be conducted over Skype rather than in person.

The adolescent service should be located near good transport links and be segregated in some way from services for young children. Where possible, electronic records should be shared between involved clinicians and form the basis of liaison with adult services.

References

Dunger DB, Ahmed ML, Ong KK. Early and late weight gain and the timing of puberty. *Mol Cell Endocrinol.* 2006 Jul 25;254-255:140-5.

Fareri DS, Martin LN, Delgado MR. Reward-related processing in the human brain: developmental considerations. *Dev Psychopathol.* 2008 Fall; 20(4):1191-211

Van Leijenhorst L, Zanolie K, Van Meel CS, Westenberg PM, Rombouts SA, Crone EA. What motivates the adolescent? Brain regions mediating reward sensitivity across adolescence. *Cereb Cortex.* 2010 Jan;20(1):61-9.

Ravnborg TL, Jensen TK, Andersson AM, Toppari J, Skakkebaek NE, Jørgensen N. Prenatal and adult exposures to smoking are associated with adverse effects on reproductive hormones, semen quality, final height and body mass index. *Hum Reprod.* 2011 May; 26(5):1000-11

Roemmich JN, Clark PA, Lusk M, Friel A, Weltman A, Epstein LH, Rogol AD. Pubertal alterations in growth and body composition. VI. Pubertal insulin resistance: relation to adiposity, body fat distribution and hormone release. *Int J Obes Relat Metab Disord.* 2002 May; 26(5):701-9.

Romeo RD, Richardson HN, Sisk CL. Puberty and the maturation of the male brain and sexual behavior: recasting a behavioral potential. *Neurosci Biobehav Rev.* 2002 May; 26(3):381-91

Sisk CL, Foster DL. The neural basis of puberty and adolescence. *Nat Neurosci.* 2004 Oct;7(10):1040-7.

Vigil P, Orellana RF, Cortés ME, Molina CT, Switzer BE, Klaus H. Endocrine Modulation of the Adolescent Brain: A Review. *J Pediatr Adolesc Gynecol.* 2011 Apr 20.

Zacharin M. Disorders of ovarian function in childhood and adolescence: evolving needs of the growing child. An endocrine perspective. *BJOG.* 2010 Jan; 117(2):156-62.

Urogynaecological issues in children and adolescents

How is Paediatric Adolescent Gynaecology different from adult management?

- Usually a family consultation
- Sometimes just with father
- Ethnicity challenges - child may speak English but parents do not
- Often anxieties about confidentiality
- Previous experiences at paediatric clinics
- Consultation often directed at parents

Presentation of adolescent girls with gynaecological issues:

- Embarrassment and Secrecy
- Identify whose problem it is
- Confusion
- May talk to parents and friends
- Commonly present to:
 - School nurses/doctors
 - Family planning clinics
 - GP/ A+E

Vulvovaginitis

–6 months to prepubertal

–Symptoms of

- soreness and itch
- dysuria
- abdominal pain and waking up at night
- discharge can be offensive (NOT BLEEDING)

Foreign Body

- Rare
- Persistent offensive and often bloody discharge
- History may suggest
- Exploration under anaesthesia
- Commonest finding is toilet paper

Labial Adhesions

Common symptom is Vaginal reflux

- The key to diagnosing this form of leakage is that the child notices the wetting after voiding
- Usually no associated urgency, frequency, or any definable dysfunctional voiding habits.
- Treatment involves having the child manually separate the labia when seated to ensure that the introitus is unobstructed during voiding.

Giggle incontinence

- +ve family history in 13% sufferers
- Clear history
- Difficult to reproduce (no need for UDS/VCUG)
- Reassure that it usually resolves as the woman grows up
- Rx of DO 100% improvement and 89% resolution
- CNS stimulants eg. methylphenidate may be used OD or on PRN basis before situations where leakage may occur.

Urinary symptoms

Causes of UI

- DO- idiopathic, neurogenic
- Giggle incontinence
- Vaginal reflux

- USI- abnormal bladder neck support (unusual unless connective tissue disorder)
- Urethral diverticulae
- Congenital abnormalities- ectopic ureter, spina bifida occulta, fistulae
- Transient incontinence- UTI, restricted mobility, constipation, confusion
- Pharmacologic (diuretics, cholinergics, tranquilizers)

Risk factors for urinary symptoms

- Spina bifida- Urinary and faecal incontinence common in young adults with spina bifida (60.9 and 34.1%, respectively), regardless of the bladder and bowel management they used.
- CP – more in tetraplegia and low intellectual capacity
- CF SUI was present in 31% of girls. The youngest patient with incontinence was 9 years old. Of the patients, 78% found their incontinence a problem and 44% had hidden the problem from parents and carers.
- No correlation between incontinence and the severity of CF as measured by the FEV in 1 study.
- Obesity - UI affects more than 10% of obese adolescent girls. Frequency and volume of urine loss are directly related to the impact that incontinence has on the sufferer.
- Constipation

Chronic Pelvic Pain Syndrome

- Characterised by pain in the pelvis, perineum and/or external genitalia and/or contiguous areas (lower back, groin, suprapubic area, upper thighs) lasting for more than six months
- LUTS, GI and sexual and psycho-social symptoms
- Ideally treated in specialised centres where there is a multi-disciplinary team
- Rule out severe endometriosis, haemorrhoids, anal fissure, PBS
- Pelvic USS, pelvic MRI, cystoscopy, recto-sigmoidoscopy are employed for assessment
- Examination aimed at assessing existence of provoked pain on touching the external genitalia (vestibulodynia, vulvodynia) and the pelvic floor which can be hypertonic and painful under digital compression in several points
- LUTS –Bladder diary, uroflowmetry, VDU

Treatment options for Chronic Pelvic Pain

- Counselling
- Behaviour therapy- antistress measures
- Pharmacotherapy- Opioid, Anti-convulsants, TCA, Muscle relaxants
- Alpha blockers
- Physical measures- PF rehab, Thiele massage, trigger point release,
- Electrical stimulation - TENS, PTNS
- Acupuncture

- Botox injection into pelvic floor muscles
- IC therapy

Ovarian torsion

- 3% of surgical gynaecologic emergencies
- Approximately 50-60% of cases of torsion are associated with an adnexal mass
- The signs and symptoms associated with adnexal torsion are variable and nonspecific
 - Most patients present with severe lower abdominal and pelvic pain, nausea, and vomiting.
 - Differential diagnosis include appendicitis, gastroenteritis, ectopic pregnancy, pelvic inflammatory disease, and ruptured corpus luteum/ hemorrhagic ovarian cyst
- Laboratory tests are not helpful, because most signs and symptoms of ovarian torsion can be associated with leukocytosis.
- The presence of an enlarged ovary with lack of intraovarian arterial or venous flow is highly indicative of torsion, particularly if the typical appearance of an enlarged ovary with small peripheral cysts is depicted
- Rarely, CT or MRI is needed to make a definitive diagnosis. CT or MRI can serve as a secondary modality when ultrasonographic findings are nondiagnostic

Treatment of torsion of ovarian cyst

- Admit for analgesia
- FBC, G&S, CA 125
- If reproductive age group_ ICON
- Confirm with USS then surgery

Accidents to Cysts

- Small cysts are often functional or dermoids
- Gravity allows them to drop to lowest point in the pelvis
- Can then tort, turn gangrenous or rupture
- Often subacute history
- Usually tender to one side of pelvis or behind uterus and may feel a mass

Case study

- Profile: 17 year old caucasian girl
- Complaint: recurrent cystitis for 15 months
- Last SI 6 days ago with steady 20 yr boyfriend of 1 month
- 3 relationships in the past 2 years
- Contraception -none
- Drinks 2 cans of “coke” and does not like water

Management

- Suggested check for UTI, Chlamydia and gonorrhoea
- Chlamydia +ve
- Azithromycin 1 g single dose or doxycycline 100 mg bd for 7 days
- Discussed contraception: pill and barrier
- Contact tracing
- Fluid advice

Conditions which require tertiary referral to Multi Disciplinary Team

Some children face medical issues that may make it difficult to determine their sex and may interfere with sexual and reproductive function. DSDs, or disorders of sexual differentiation, refer to conditions when average sexual development does not occur. They include mild to very significant alterations in reproductive organ development, pubertal development and gender identity. The treatments are quite varied, depending on the complexity of the disorder and may include medication, surgery and emotional/psychological support.

- Ovarian failure, X chromosome variations
- External genitalia reconstruction
- Complex utero-vaginal abnormalities
- Vaginal agenesis/ hypoplasia not responding to vaginal dilatation
- Chronic Pelvic Pain Syndrome

Members of Multi Disciplinary Team

- Endocrinologist
- Geneticist
- Reproductive subspecialist
- Psychosexual nurse counsellor
- Urologist
- Psychologist
- Gynaecologist
- Referrals to cardiologist, ENT specialist, Menopause specialist, pain specialist, psychiatrist

Wish-list when managing adolescents

- Multiprofessional collaboration in transition period
- Improved medical and surgical techniques and results constantly being sought by multicentre prospective studies using validated objective & subjective outcome measures
- Establishment of patient and parent support groups and family information service