Injuries in prepubertal and pubertal girls

Jean Price, MB.BS, DObs RCOG, DPH, DPM, FRCPCH, Community Paediatrician

12, Woodview Close, Bassett, Southampton, Hampshire SO16 3PZ, UK

In this chapter, examination techniques are first recommended, and then terminology for genital injuries that may occur after child sexual abuse or rape (e.g. lacerations, notch, transaction) are described. Current evidence for these injuries is provided. Areas of controversy (e.g. hymenal diameter, hymenal width) are described and completed with cautionary notes on inflammation, bruising, abrasions, bumps and mounds, tags, labial fusion, lichen sclerosis). The chapter concludes with a debate on normal findings that are reported to occur in up to 99% of children referred for examination.

Introduction

When pre-pubertal girls complain of child sexual abuse, it is not unusual for the general public and indeed professionals to expect there to be obvious genital injuries. The fact is that it is much more usual for there to be little or no evidence of injury. Signs are subtle and require a careful history to be taken and a full examination to be carried out with the aid of photodocumentation (preferably a colposcope), with a DVD recording made of the examination. The doctor must have a good understanding of normal child development and genital anatomy (i.e. the normal anatomy, anatomical terminology and the various forms the hymen may take) (Fig. 1).

A careful history should be taken and a detailed examination of pubertal girls alleging child sex abuse or rape should take place. Other consensual sexual activity needs to be noted. When was the last sexual intercourse and was this abusive or consensual? This helps with knowing when to take forensic samples (i.e. usually up to 5 days after the alleged event). Menstruation and type of protection used should be noted. Also, was protection (condoms) used during the sexual act? This is an important
consideration so that risk of pregnancy can be established and whether the ‘morning after pill’ needs to be provided.

All children and young people should be considered for sexually transmitted infections and blood-borne infection screening.

**Examination of pre-pubertal girls**

Examinations of pre-pubertal girls should be carefully explained in language the child understands, and carried out at the child’s pace.

*Supine position*

It is usual to first examine a pre-pubertal girl in the supine (frog leg) position. This can be with the child on the bed or for younger children on their mother’s lap (Fig. 2).

Separation of the labia (by putting two fingers on the labia majora and pressing downwards and laterally) will assist visualisation of the hymen, but if the hymen does not open, then traction may be used (take hold of the labia majora and pull outwards, downwards and laterally) (Fig. 3).

*Prone position*

The prone position (knee chest) should be used when there is anything unusual, or of concern, seen in the supine position. For this to be effective, the child lies on their front with their head and shoulder girdle flat on the bed. The child’s knees are pulled up under their pelvic girdle so that the child’s bottom is in the air with their back assuming an ‘S’ shape. This allows gravity to pull on the pelvic musculature, which smoothes out any artefacts in the hymen that may have been seen in the supine position. To visualise the hymen, labial separation will need to be used and possibly labial traction, only this time...
the labia majora will need to be pulled outwards, upwards and laterally (Fig. 3). Dripping warm sterile water or saline over the genitalia may also help to separate tissues that appear adhered together. If all else fails, and you need to check adherence of tissues or smooth out folds, then a small moistened swab (ENT) can be used to run around behind the margin of the hymen, or to tweek a possible tag or adhered tissue.

Examination of pubertal girls

Pubertal girls should also be examined in the supine, frog leg position. By now, oestrogen has made the hymen thick, fleshy and folded. It will not automatically open to reveal the free margin of the hymen, and it is no longer appropriate to expect the young person to adopt the prone position. Other techniques become necessary, as it is essential to visualise the free margin of the hymen, including the area between the folds. In these young people, a moistened swab can be used (as the hymen has lost the sensitivity of the pre-pubertal girl) to run behind the hymen stretching out the folds to look for damage. Alternatively a foley Catheter (size 11) can be used (Fig. 4)
Injuries

When injuries are found, they need to be clearly described and the recommended terminology used\(^3\) (Table 1).

**Fresh injuries: lacerations**

Lacerations can be partial or full-thickness tears through the hymen. These injuries will bleed, have raw edges, and may have adjacent bruising, but they will heal remarkably quickly. Examinations should, therefore, be treated as urgent once a child makes an allegation.

Hepenstall-Heger et al.\(^4\) reported lacerations in prepubertal girls in both penile and digital penetration, but none were found in those girls experiencing straddle injuries. Myhre et al.\(^5\) found no lacerations in non-abused 5- and 6-year-old girls. Adams et al.\(^6\) reported 6% hymenal tears in those alleging penile penetration and who were examined within 72 h. More were seen in self-reported virgins. Muram\(^7\) reported hymenal tears in two out of six pubertal girls where there is perpetrator confession.

Palusci et al.\(^8\) examined girls alleging sexual abuse within 72 h, and found that 6% had tears greater than 50% of the width of the hymen. This was associated with forensic evidence.

Lacerations can also be found in other genital tissues when a girl has been abused, particularly the fossa navicularis and the fourchette. The fourchette and other genital tissues can be injured as a consequence of a straddle injury. A clear history of such an accident is important in differentiating between the two diagnoses.\(^4,6\)

**Fig. 3.** Examination techniques. a. Labial separation-supine position. b. Traction-supine position. c. Separation-knee chest position.

**Fig. 4.** a. Catheter insertion. b. Catheter bulb inflated.
It is important that when girls present with genital bleeding and are alleging abuse, that they receive an early examination preferably within 24 h. When lacerations are found on the genitalia, then sexual abuse should be strongly suspected provided there is no history of straddle injury.3

Healed injuries

Notch, cleft or concavity

Healed injuries are smooth concave deficiencies found on the free margin of the hymen. There are no raw edges. They can be shallow (i.e. less than 50% depth of the hymen) or deep when they are more than 50% of the depth of the hymen.

Berenson et al.9–11 found shallow notches at any point around the hymen in newborn babies and Myhre and Heger also found them in children who were thought not to have been abused.5,12 Some lacerations can heal to leave a shallow notch.3,4

In pubertal girls, shallow notches are difficult to determine in view of the folded, fimbriated nature of the hymenal edge, which must be stretched out using a swab or Foley catheter.

Deep notches (more than 50%) have only been described in pre-pubertal girls alleging abuse and not in non-abused girls.10 Deep notches in adolescent girls alleging penile penetration have been found in 25%.13 Deep notches have also been found in girls having consensual intercourse and in a small number of girls denying intercourse.14 Deep notches more than 50% width of the hymen are more concerning, and penetrative injury should be considered.3

Transection

Transection is a healed, full thickness loss of tissue through the hymen, with no raw edges. Berenson et al.10 found one case in her sexually abused group of pre-pubertal girls, and none in the non-abused group. Hepenstal–Heger et al.4 in her paper on healing, found 12 transections in girls alleging penile penetration, but also found them in four girls with straddle injury.

Transections have not been found in non-abused groups of girls, with the exception of one girl whom the authors felt may have been abused.5,11

In the study by Palusci et al.8 of sexually abused girls under the age of 13 years, 3% with transections were reported, whereas in the adolescent group in the study by Adams and Knudson,13 17 transections were reported in the posterior border of the hymen.

When a transaction is found, penetrative injury should be strongly suspected.3

Scars

Scars are rarely seen on the hymen and never seen in non-abused girls. Scars have been seen on the posterior fourchette after injury. Scars are clearly signs of previous trauma, and sexual abuse should be considered.3

Width of the hymen

In the past where examination of the width of the hymen found it to be narrow it was referred to as ‘attenuation’. This term, however, implies that a previous examination has been undertaken, with which the current examination can be compared. Usually, this is not the case. The Royal College of Paediatrics and Child Health working party3 decided to use the ‘width’ of the hymen as the preferred description. Some investigators refer to hymenal width as being narrow (i.e. 1 mm). It is incredibly
difficult to take such small measurements and, in the UK, such measurements are not recommended; however, this may have some significance should an area of the hymen be thought to be narrow compared with the rest of the hymen.

All newborn babies seem to have hymenal tissue at birth.9,15 If the posterior hymenal rim seems to be narrow or absent in the supine position in a pre-pubertal girl, it is essential that the child is examined in the knee chest position when a rim of hymen is usually found. If the posterior rim remains thin in this position, child abuse must also be considered.3

**Hymenal diameter**

At one time, the size of the hymenal orifice was thought to be helpful in determining whether penetrative sexual abuse had occurred. On occasions, it is possible to see the margins of the hymen in pre-pubertal girls without using separation or traction. This has been referred to as ‘gaping’ by Myhre et al.5 and Hobbs et al.16 The significance of this is not understood, and Heger et al.12 considers this to be a normal finding.

It must be appreciated that the hymen is elastic even in the pre-pubertal girl. This elasticity makes the accurate measurement of the diameter impossible. This elasticity increases with the effect of oestrogens. The hymen can, therefore, stretch with gentle pressure, allowing penetration without tearing even in the pre-pubertal child.7

When the transverse diameter was measured using labial traction, Berenson et al.17 found that girls alleging digital or penile penetration had a larger mean diameter than non-abused girls when examined in the knee chest position but not in the supine position. It was felt that the overlap of measurements was too great to allow this to be helpful in making a diagnosis of child sex abuse. Adams et al.13 also found no significant difference in transverse diameter when comparing children alleging penetration and where there was perpetrator confession compared with published data on normal measurements.

Berenson et al.17,18 Found the hymenal orifice increases with age. Myhre et al.5 Found that, in girls thought not to have been abused, the hymenal diameter varied with different examination methods, the skill of the examiner and the degree of relaxation of the child. Height and weight also appeared to make a difference.

White and Ingram19 reported larger hymenal diameters in girls reporting penetration than those reporting fondling. It was also larger in girls reporting more than one episode of abuse.

The bottom line is that, because so much overlap occurs in the measurements of abused and non-abused girls, and difficulties occur in measurement, the transverse hymenal diameter cannot be used to diagnose child sex abuse. Measurement of the hymenal orifice is not recommended by the Royal College of Paediatrics and Child Health.3

**Inflammation**

Inflammation can be seen on internal and external genitalia as a consequence of rubbing and friction by fingers, penis, or an object during child sexual abuse or by the child rubbing themselves. Inflammation can also be found with overheating, poor hygiene, infection, vulvo vaginitis, skin conditions and thread worn. These must all be eliminated before inflammation can be considered as possibly being a consequence of child sex abuse. Inflammation will fade quickly (2–3 days).

Inflammation between the labia or buttocks with clearly demarcated margins may be seen as a consequence of intra-crural intercourse (rubbing of an erect penis against the genitalia or anus). This will, of course, cause pain and discomfort, and may be misinterpreted as penetration by young children when they do not fully understand their anatomy.

**Bruising**

Bruising can also be found on internal and external genitalia after abuse, but can also be seen as a consequence of straddle injuries (i.e. accidental injuries). Usually, however, straddle injuries are seen
over the anterior parts of the genitalia. They can also be found over the external genitalia more posteriorly, but it is unusual for such accidents to involve internal genitalia, as these structures are generally protected by the labia majora, which generally lie closed together. In exceptional accidents, penetration has been reported of the perineum and even the hymen. A good history of events leading to examination must be taken, and independent observations and reports of the accident sought. Bruising as a consequence of child sex abuse can be found on the hymen and perihymenal tissues as well as the external genitalia. An early examination is recommended.

When bruising of the genitalia is found, sexual abuse should be considered.\textsuperscript{3} 
Bruising cannot be aged from its appearance or photographs.\textsuperscript{20} 

Differential diagnoses to be considered are skin conditions (e.g. Lichen sclerosis, haemangioma, or pigmented lesions). It can be more difficult to see bruising in pigmented skins.

Healing of bruises can be rapid, but Finkel\textsuperscript{21} found a well-marked ecchymosis on the hymen and perihymen still present 10 days after the abuse had occurred. Heppenstall-Heger et al.\textsuperscript{4} reported all haematomas healing completely.

Bruising has not been found in those studies selecting girls for non-abuse.

Bruising is a non-specific sign for sexual abuse.

\textbf{Abrasions}

Abrasions of the external and internal genitalia can be found in sexually abused children and as a consequence of accidents. Heppenstall-Heger\textsuperscript{4} found abrasions on the hymen, perihymenal tissue, fourchette and labia majora and minora in girls alleging penile or digital penetration. She also described abrasions in similar areas with straddle injuries, but child sex abuse was not robustly excluded in this group. No abrasions have been found in non-abused children examined.\textsuperscript{5}

In adolescent girls alleging penile penetration, abrasions have been reported on the labia minora, fossa navicularis, and fourchette.\textsuperscript{6}

Early examination is recommended. When abrasions are found, child sex abuse should be considered alongside other causes of abrasions.\textsuperscript{3}

\textbf{Other findings to be aware of}

\textbf{Hymenal bumps and mounds}

Hymenal bumps and mounds are localised thickened areas of hymenal tissue, which usually lie on the free margin of the hymen but they can also be seen in the vestibule. When seen during examination in the supine position, they may or may not smooth out in the knee chest position. They can be associated with intra-vaginal ridges (support bands)\textsuperscript{4,10} when they are considered to be normal. They can be found at any point on the rim of the hymen.

Berenson et al.\textsuperscript{10} found hymenal bumps in sexually abused and the non-abused pre-pubertal girls. She also found them in her non-abused study,\textsuperscript{11} as did Myhre et al.\textsuperscript{5}

\textbf{Hymenal tags}

Hymenal tags also consist of hymenal tissue. They are longer than they are wide. They can cause confusion during examinations as they can fall over the hymenal orifice obscuring it. Both examination positions should be used, but it may still be necessary to use a swab to delineate the tag and move it so that the rest of the hymen can be visualised. These are considered a normal variant, and may be the result of a septate hymen breaking down.

\textbf{Labial fusion}

Labial fusion is said to occur when the inner aspects of the labia minora fuse together. This can be seen at various points along the labia minora, or can involve the greater part of their length leaving
only a small orifice for urine to escape. Such a condition can lead to a child experiencing after dribbling. As a consequence, they may sit in damp pants leading to sore genitalia, and possibly vulvovaginitis.

Labial fusion is seen in younger girls wearing nappies, but it is unusual for it to occur for the first time at 6–7 years of age. Causes are thought to be inflammation from incontinence, vaginitis, poor hygiene, or frictional irritation. Usually, this condition naturally resolves, particularly when a child moves into adolescence with the production of oestrogens.

Inflammation was found in abused and non-abused girls by Berenson, and Myhre et al. found labial fusion in his non-abused study.

Heppenstall-Heger et al. reported that labial fusion could occur after healing of injuries to the posterior fourchette and fossa navicularis. If child sex abuse is suspected, then the fusion may need to be treated so that the hymen can be visualised.

**Lichen sclerosis**

Lichen sclerosis is an itchy skin condition that can be seen in pre-pubertal girls. The skin is silvery in appearance, usually has clear demarcated margins, and can surround both the anterior genitalia and the anus in a figure of eight configuration. The skin is friable and easily broken when the child rubs because of the intense itching. This rubbing can be mistaken for excessive masturbation, and when the skin is broken there can be bleeding and the appearance of bruising when child sex abuse is often suspected. This condition should be recognised, as treatment can be very effective.

**Normal findings**

The general assumption is that, as an adult erect penis is larger than a small child’s hymenal orifice, penetration will inevitably produce damage. This is not what we find, however. Most examinations have normal findings; Hepenstall-Heger et al. have cited 99%. Normal or no clinical findings, however, does not mean that nothing has happened. Healing is rapid, and frequently these children do not come for examination until some time has passed since the last episode of abuse, thus giving ample time for healing to occur. Some children may misinterpret fondling and masturbation for penetration. Although these are still abusive acts, they are more likely to leave minimal or non-specific findings, as will kissing of the genitalia. It is, therefore, important that when a child makes a disclosure, their examination should be treated as urgent.

The most important aspect of any investigation is the child’s story. Laming in his two Inquiries stated we should always talk to the child on their own.

### Practice points

- A clear history of events is essential.
- Children and young people should be given the opportunity to be spoken to alone (without parents).
- A careful and thorough examination should always take place even when the allegation is historical. It can provide considerable reassurance to the child and ensure all their needs are met.
- Different examination positions and techniques should be used to confirm clinical findings. Consistent terminology should be used. Time from event to examination should be noted.
- It is now recommended that photodocumentation (DVDs) should take place.
Research agenda

- A case-controlled, prospective study of confirmed cases (as far as possible) of child sex abuse, compared with a normal population, in which stringent efforts have been made to exclude child sex abuse.
- Further studies of healing that clearly differentiates which cases are abused and which are accidental.

References

20. Cardiff Child Protection Systematic Reviews; http://www.core-info.cf.ac.uk; [last accessed 14.08.12].