

Chapter 4: Evaluating Cutaneous Trauma

Reading:

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Bruises, abrasions, lacerations and other physical trauma to the skin are the commonest physical findings resulting from child physical abuse. These injuries are also the most common physical findings resulting from accidental trauma. Distinguishing between the two causes is at some times obvious, and at others quite difficult. Epidemiological facts about cutaneous injury can help to raise suspicion in the youngest of children. Patterns apparent in visible injuries may provide readily identifiable evidence of the causative traumatic event. Whenever minor cutaneous lesions give rise to abuse concerns, a complete history, physical examination, and appropriate imaging and laboratory work up should be performed so as to fully understand the nature of traumatic events.

A. History:

When a child can give historical evidence in his or her own assessment, the child should be taken aside for an independent history. When multiple adult historians are available, interviewing them separately contributes to the assessment. Additionally, whenever information is provided, the source of the information should be ascertained. Information from direct observation must be distinguished from information that is inferred from circumstances and second hand information obtained from the report of others. Failure to do so may attach too great a weight to consistency or inconsistency between one history and another, or the physical findings.

It is good to request a trauma history both before, and during the physical examination. Taking a trauma history before the physical exam, provides no clues to patterns and locations of injury. This will make it harder to fabricate or conjecture explanatory trauma. Ultimately, the consistency and completeness of this history will be scrutinized. Bruises, however, may not develop until a day or so following the inciting trauma. As children become older, and more mobile, bruises may occur during independent activities, of which a caretaker may be unaware. During the physical examination, it may be good to again request an explanation for each important injury. This will give the historian clues to what we are attempting to explain, prompting memory, or creativity. We will later analyze variations in given histories.

The behavioral and developmental abilities of the child will be important when assessing the given trauma history, and when assessing the physical findings. The current motor abilities of the child may preclude the child's acting in the way the adult historian describes, forming a historical inconsistency. They may also convey surprising ability that raises the likelihood of accidental injury. The child's behavior may be quite passive and mild, explaining delayed recognition of pain and disability. It may also be difficult and challenging, explaining relational difficulties between a caretaker and the child.

The past history and family history should rest on a foundation of completeness. Still, certain topics are worthy of focus. Recent viral illness, followed by easy, or spontaneous bruising may signal immune thrombocytopenia. Weight loss, fevers, body pains, or pallor may indicate lymphoma, leukemia or other bone marrow disorders. Bleeding, bruising, surgical and dental histories provide an opportunity to evaluate for hemophilias. If the child is a boy, bleeding following circumcision may point to a bleeding disorder. For adult female relatives, a menstrual history, probing duration and flow may provide the only clue to von Willebrand's disease, the commonest of the hemophilias. A much less common concern is the possibility of collagen vascular disorders. Joint hypermobility, skin laxity, unusual paper thin scars, easy laceration, and difficulty retaining surgical sutures all point to Ehlers Danlos syndrome, and will impact on the injurability of skin.

The family social history is sometimes highly germane, but must not be over-interpreted. Domestic violence increases the likelihood of child abuse by both the assailant and the victim. The stresses of single parenting and poverty may increase the likelihood of abuse. Personal limitations may be evident as substance abuse, low education, or mental illness, further decreasing the caretaker's resources when faced with childhood challenges. Risk, however, does not demonstrate abuse. The recognition of risk helps to direct treatment for the abused child, and risk reduction of the non-abused child. When the evidence of abuse is equivocal, an assessment of risk may form the basis for resolving that uncertainty and developing a plan.

B. Physical Examination:

As with the history, the foundation of the physical exam is a complete clinical assessment. Rather than outline this complete exam, important and overlooked areas will

be stressed. Injury to the head is particularly important in young children, as they may be the only sign that a vomiting, somnolent, or irritable child suffers from intracranial injuries. Examination of the scalp can be pursued by inspection through the hair and by palpation. Bruises, step offs, swelling, tenderness or crepitation should prompt suspicion of significant impact to the head. Fine petechiae and alopecia may be evidence of hair pulling, particularly if short broken hairs are also found. Impact to the face may leave bruises outside, on the skin, and inside, on the oral mucosa. Look at the buccal and labial mucosa for bruises and lacerations from impact to the face. Other important oral findings are torn frenulae of the tongue and lips, and pharyngeal bruises and lacerations.

The eyes require careful evaluation. Ophthalmoplegia, inappropriate constriction or dilation, and non-reactivity to light may be a sign of cerebral injury. The sclerae may show petechiae and hemorrhaging from direct trauma, or from indirect effects of suffocation, strangulation, and valsalva. Inspection of the retinas of neurologically intact infants is often difficult. Direct ophthalmoscopy should be attempted, as retinal hemorrhages create great concern for intracranial injury. False positives are rare, though false negatives are more common, and a direct ophthalmoscopy should not replace indirect ophthalmoscopy whatever the result.

Examination of the body may proceed by complete disrobing, or serial disrobing of the body, but all body surfaces should be well inspected. Whenever a bruise is suspected several observations are relevant. A historian, or the child, may be asked for an explanation. Similarly, they may be asked if the mark is recent, like an injury, or long lasting, like a birth mark. Pressure on the lesion may elicit tenderness, in an injury, or blanching, in a vascular mark. Palpation will demonstrate whether the mark is over soft tissue, or a bony prominence. The color, shape and size of the bruise should be noted, diagramed, and photographed according to techniques that will be discussed later. Non-injured areas should be palpated as well. Palpation of the abdomen is routine, and any evidence of abdominal tenderness requires follow-up to rule out visceral trauma. Palpation of the rib cage may identify tenderness, swellings, and crepitation from underlying bony injury. Similarly, palpation of the appendicular skeleton may demonstrate tenderness, motion, crepitation, swelling or deformity from skeletal fracture.

Aside from acute injuries, other marks may be important to the assessment. Pigmentary changes in otherwise normal skin; changes in texture, with or without color change; and true scarring, with thickening of skin and disturbance of the sub-cutaneous tissue, all may persist as long lasting evidence of injury. Inspection, palpation, and manipulation of the skin are needed to distinguish these entities, and they should not be lumped together under the broad heading of "scarring." Hyperpigmentation commonly persists in dark skinned individuals, following inflammation, burning, bruising, abrasion, and many other skin conditions. This is a result of superficial injury. The pattern may give specific indication of the inciting trauma, similar to the case with bruises, and this must be evaluated against the history to assess the possibility of abuse. Hypopigmentation, and textural changes usually result from deeper injury, to the basement membrane. Burning, cutting and deep abrasion are typically the cause. Spontaneous vitiligo, and striae must be eliminated in certain circumstances. A true scar, with changes in the mass and

elasticity of subcutaneous tissue, usually implies damage of subcutaneous structures with subsequent repair. Incision, laceration, or particularly deep burning or abrasion are implicated. The presence of unusual paper thin scars should also direct the CHAMP physician to consider Ehlers Danlos syndrome. The general nature of the skin is of interest as well. If the skin is loose and baggy, or if the skin is unusually elastic, Ehlers Danlos should be suspected.

Observations on growth and development will help assess the past health and nurturing of the child. A height or length, weight, and head circumference need to be measured and plotted. Obviously a single point is not as helpful as the growth trend demonstrated on a growth curve. The history, or review of past records will aid in evaluating growth parameters. The developmental abilities of the child should be independently confirmed where possible. Motor abilities inconsistent with the explanatory trauma history create concern for fabrication to hide abuse. Developmental delays will require addressing, whatever the abuse assessment. Delays in language development are very common in abused and neglected children, and must be addressed in the child's care plan.

C. Imaging and Laboratory Investigation:

The laboratory investigation is designed to look for occult injury, and to explore a differential diagnosis to inflicted trauma. Coagulopathy screening is the most frequent recommendation. Screening is not usually recommended if the only finding is a clearly patterned injury, such as loop marks. When the case is based on "too many bruises", when there is a pertinent child or family medical history, or when there is internal bleeding, a coagulopathy will be required, whatever the bruise pattern. A complete blood count with platelet count, PT, INR, and PTT are routinely ordered. This screen, however, is incomplete. Many would add a von Willebrand's panel to evaluate for the commonest form of bleeding disorder. The presence of petechiae may suggest a platelet disorder, and platelet aggregation studies might be appropriate. Thrombin time, fibrinogen, and factor VIII, IX, and XIII, have all been recommended, but usually for severe internal bleeding. Coordination of this work-up with a hematologist is preferred.

If a child appears to have been recently beaten, laboratory testing will add to the sensitivity of the examination for internal injuries. ALT and AST testing improve the sensitivity of the clinical exam for liver injury. These enzymes rise and fall rapidly, and may be unhelpful several days after the incident. Amylase and lipase increase the ability to detect pancreatic injury, and urinalysis contributes to evaluating renal injury. Amylase takes time to rise, so testing less than four hours following the traumatic incident may miss the injury. Testing urine and stool for occult blood may help detect occult abdominal trauma.

Deep muscle injury may occur with extensive forceful beating. Myoglobinuria may be detected as a color change, or as heme positive urine with no red cells. Testing the blood for CPK and myoglobin will demonstrate deep muscle necrosis. Additionally, myoglobinuria may result in renal failure, and so merits special acute medical management.

Genetic testing is available for collagen disorders such as Ehlers Danlos syndrome. Blood and skin biopsy sample based tests exist. While the need to perform a skin biopsy will obviously give the family and practitioner pause, neither test should be performed without a clinical indication based on the history, family history or physical examination.

The skeletal X-ray survey is recommended for all suspected child abuse cases under age two years. We will discuss this imaging modality in more detail, later. Certainly children under age two with suspicious bruises are candidates for a skeletal X-ray survey. The finding of occult injuries has great significance. If the exam produced concern for skeletal injury, the region of concern should be explored radiologically, whatever the child's age.

Computed tomography of the head has been recommended in very young infants with suspicion for child physical abuse. Infants under one year of age, with contusions of the head and face or skeletal injury, and infants under six months of age with any evidence of physical abuse are most likely to have intracranial injuries found on screening evaluation.

D. Assessment and Diagnosis:

Once again, a diagnosis of child abuse will rest on direct evidence that abuse has occurred. Bruising and pigmentary marks may display patterns that reflect the inciting contact. Bruising in the shape of a hand bespeaks a slap. Parallel lines of bruising may outline the impact of a board, belt, or cord used to whip the child. Clusters of oval bruises may correspond to the finger tips of a grasping hand, or the knuckles of a fist. Many such patterns have been recognized. Each tells the tale of inflicted injury. Barring a convincing and physically consistent history, abuse must be suspected whenever there is a pattern. Classic patterns such as belt marks, loop of cord marks and slap marks effectively document abusive injury.

Another sort of pattern speaks of child abuse. The battered child syndrome is a pattern of multiple independently occurring injuries that are ill explained and unusual for the child. This pattern rests on the idea that when a single unusual and ill explained injury occurs, abuse is suspected but unusual other events cannot be excluded. The repetition of such a circumstance however, suggests abuse, which tends to be repetitive, rather than unusual circumstances that should not arise repeatedly. Injuries may be judged to be independent on various grounds. A fracture with evidence of healing, and a new bruise likely occurred at differing times. If the fracture is of the ribs, and the bruise is on the face, they occurred in different locales. Even two skin injuries may be distinguished if their locations indicate they must have arisen from two separate blows. Finally, different traumatic mechanisms, such as a burn and a blow, would be judged to be independent.

There has been a tendency, in the past to "date" bruises, so as to label them separate events, and fix them in time. Charts of color change in bruising, with proposed age criteria have been published, and various charts are internally inconsistent. Recent research has shown these schemes to be inaccurate, and physician assessment of bruise

age to be inexact. Yellow coloration will not be seen in a bruise until at least 18 hours following injury, but a red color may persist throughout the life of a bruise. Two bruises of the same generation may have very different appearances. While a CHAMP physician may have some feel that one bruise is very recent, and another is very old and resolving, more exact comment on age, and differentiation should not be made.

There was earlier reference to ill-explained, and unusual injuries “for the child.” A knowledge of what injuries are expected in children, and of normal child behavior is necessary to make such a determination. Young infants very rarely manifest any bruising at all, but may have short shallow abrasions, usually of the central chest and face. These abrasions should be consistent with scratching by the short soft nails of the infant itself. As the child begins to pull to standing, and walk along objects, he or she will begin to fall and collide with objects. There are very seldom more than five bruises on a single child, and bruises are typically oval, anterior, and overlying bony prominences. The forehead, scalp and anterior shins are the most common locations for such injuries. Walkers bruise more commonly still, with a greater number and extent of bruising. As many as half of toddlers will have bruising, with up to eleven bruises per child. Still, the great majority of bruises are found over the knees and shins, and bruises should be predominantly oval, anterior, and over bony prominences. Children at this level of ability get around, and into trouble, beyond the direct observation of a caretaker. Even a diligent caretaker will not be able to explain each injury. In general, the more severe the injury, the more expectation there should be of an explanation. When injuries do not tell a specific tale of abuse, and are not part of a pattern of repetitive injury, but remain ill-explained and unusual, suspicion of abuse remains, even though a firm diagnosis may not be made. As in much of medicine, the gray zone is quite big.

E. Diagnostic and Treatment Plan:

The great majority of cutaneous injuries heal well on their own. Bruises resolve over about two weeks time. More extensive injuries may take longer, but extended persistence should raise the possibility of another diagnosis. A plan for re-examination may assist when the nature of a finding is in doubt. Evolution and resolution is expected for all bruises, but is much slower for congenital lesions such as hemangiomas and nevi. Distinguishing traumatic pigmentary lesions and scars from pigmentary birth marks, striae etc. is harder, as each are long lasting. Re-examination will allow the CHAMP physician to do some library research, get some consultation, and take a second look.

Deep muscular injury, with myoglobinuria, requires hydration and monitoring to protect the kidneys. Evidence of intracranial or visceral injury will require additional imaging, observation, and sometimes surgery.

The presenting injuries are often only the tip of the iceberg. They are unlikely to tell the CHAMP physician the full extent of neglect and emotional abuse that has accompanied the physical treatment. These are highly damaging forms of maltreatment. Additionally, severe corporal punishment may be more likely in situations where the child has an underlying behavioral or developmental problem. A thorough assessment of behavioral

and developmental issues is warranted in all of these children. Speech and developmental delays have been found quite commonly in abused children. Referral to the “infants and toddlers” or “child find” program is highly desirable, and mandated by the state.

Many of these families re-unify rapidly? Fewer than 1 in 5 substantiated cases involve out of home care. Therapy directed at the parent, to manage child behavior, has the greatest body of research evidence for efficacy in these situations. Ongoing domestic violence both damages the child directly, and undermines other therapeutic plans. Domestic violence must be ended, and appropriate individual and family therapy initiated. Substance abuse is another related condition that must be addressed.

F. Conclusion:

Physical abuse is a common reason for referral by CPS, and cutaneous injuries are the most common presentation of physical abuse. Unlike sexual abuse, these injuries are always physically apparent, creating an object for examination, and for discussion during the history. Unlike sexual abuse, accidental injury is a significant likelihood to be differentiated. Like all forms of maltreatment, a medical approach, relying on subjective and objective data, and careful consideration of a differential diagnosis within a holistic consideration of the child best leads to an appropriate diagnosis and treatment plan.

Cutaneous findings create a particular burden on documentation. Thorough record preparation has been stressed previously. Diagramming injuries, with comments on measurement and color is a common supplement to the written note on these patients. Finally, photographic evidence is expected to accompany these cases. While CPS and law enforcement may take photographs, the CHAMP physician should not rely on those images unless the physician has seen the images and knows them to be both excellent and fully representative of what they see with their own eyes. When cases go to court, the CHAMP physician can expect to be confronted with photos, and asked if they are a “fair and true representation of what you saw that day.” Positive steps should be taken by the CHAMP physician to assure they can answer that question, “yes.” With that in mind, our next chapter will discuss photography.