Bruises

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Anatomy of skin

- Skin is a complex, multi-layered structure
- When injuries resulting in bruises occur, there is disruption of blood vessels in the dermis and subcutaneous tissue which causes the vessels to leak blood, resulting in a visible bruise
- Most bruises are the result of injuries to the subcutaneous tissue

- Epidermis - compact firm outer layer; not easily damaged
- Dermis - capillaries and fibrous tissue; resistant to damage
- Subcutaneous tissue - rich in capillaries and fat, easily deformed; majority of hemorrhage occurs here

Bruises

- Bruises are caused when soft tissue is compressed between two hard surfaces and blood vessels leak blood into the tissue
- Swelling develops due to inflammation, and resolves over first two to three days after injury
- Not a skin injury, but a blood vessel injury

Why are we concerned when we see bruises in a non-ambulatory infant?

- Previous injuries are common in children who present with severe abuse
  - One study found that 27.5% of infants classified as definitely abused had a previous injury suspicious for abuse reported in their medical history
  - In 41.9% of cases, medical providers were aware of the previous injuries
- Any bruise without a plausible explanation in a non-ambulatory child (child who does not crawl, pull to stand, or walk) is highly suspicious
- Intervention with less severe injuries may prevent future (and more serious) injuries
Extensive facial bruising in deceased infant

Facial bruises were noted on this 8 week old child the day before her death.

Locations of accidental and abusive bruises


<table>
<thead>
<tr>
<th>Accidental</th>
<th>Inflicted</th>
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<tbody>
<tr>
<td>Lower legs</td>
<td>Upper arms</td>
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<tr>
<td>Lower arms</td>
<td>Thighs</td>
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<tr>
<td>Chin</td>
<td>Chest</td>
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<td>Forehead</td>
<td>Abdomen</td>
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<td>Cheekbones</td>
<td>Genitals</td>
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<td>Hips</td>
<td>Buttocks</td>
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<td>Elbows</td>
<td>Face (fleshy areas)</td>
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<td>Ankles</td>
<td>Ears</td>
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<td>Neck</td>
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Accidental bruises are more likely to be found in:
- Lower legs
- Lower arms
- Chin
- Forehead
- Cheekbones
- Hips
- Elbows
- Ankles

Inflicted bruises are more likely to be found in:
- Upper arms
- Thighs
- Chest
- Abdomen
- Genitals
- Buttocks
- Face (fleshy areas)
- Ears
- Neck

Facial bruises in 5 week old child

Multiple facial bruises without a plausible explanation are seen in this infant.

Bruise incidence and prevalence

- Bruises uncommon in infants <6 months old: when bruises are seen in young infants, a plausible explanation must be provided to explore the possibility of abusive trauma.
- “Those who don’t cruise rarely bruise”
  - In other words, a child who cannot crawl, pull to stand, or walk isn’t likely to cause injuries through their own activity.
- Three characteristics separate abusive from accidental bruises:
  - LOCATION
  - PATTERN
  - AGE AND DEVELOPMENTAL ABILITIES OF CHILD


Forehead, cheek bruises in head-injured 6 week old infant

Although many consider bruises a minor injury, any bruise in a non-ambulatory child is a marker for serious future injury.

Accurate dating of bruises by color is not possible because:

- Color varies with depth of bruise and skin color
- Rate of healing varies with location on body
- Timing of bruise appearance depends on depth
  - superficial bruises appear early
  - deep bruises may take days to appear

Patterned injury

This injury was caused by the end of a belt, with the buckle also leaving an impression mark, on the right side of the child’s back. To the left of this patterned injury is a healing linear abrasion. The clarity of the impression mark, and the fact that the abrasion is healing, points to more recent injury. The color cannot be used as a factor in determining the likely age of injury.

Myths about aging of bruises

- Bruise with yellow is >18 hours; bruise with yellow, green, or brown is old
  - This is untrue; studies have shown that there is low interrater reliability in estimation of color of bruises
  - Any color can be present in new, intermediate, or old bruises
- Red, blue, or purple color means bruise is fresh
  - This “conventional wisdom” is also untrue. Red, blue, or purple color can be present anytime from one hour after injury to resolution of injury
  - Bruises of the same age on the same person can vary in color

What is a patterned injury?

- Patterned injuries are injuries which have the shape and/or size of the object used to inflict injury
- A variety of shapes are seen, depending on the object
- Some classic injury patterns are:
  - Paired semicircles (human teeth)
  - Oval/circular marks (adult fingertips or knuckles)
  - Linear (belt)
  - Loop (cord)

Patterned injury:

This is a classic injury pattern, with paired semi-circles composed of rectangular bruises caused by each tooth; there is often a suction bruise at the center, as pictured here. The clarity of the impression marks, and the presence of abrasions and swelling, point to more recent injury.

Patterned injury: Human bite mark, recent

This injury again has the classic pattern of a bite mark, with paired semicircles. However, with this injury, the separate bruises caused by each tooth cannot be seen, as the bruise has faded. Also, no abrasions or other signs of acute injury can be seen. These features indicate a less recent injury.
Patterned injury: Animal bite

Some people attempt to explain bites in children as being caused by an animal bite. However, as can be seen above, an animal bite is substantially different in appearance from a human bite. An animal bite has puncture wounds caused by canines (long, sharp teeth) puncturing the skin. With a bite from a large animal, there may also be crushed tissue or tears at the site of trauma.

Patterned injury: Densely clustered petechiae

Petechiae are caused when small blood vessels under the surface of the skin (capillaries) rupture. This can be caused by blunt trauma to the area, or can result from increased pressure from excessive vomiting or coughing. This finding can also be caused by strangulation due to decreased venous return. Any time there are densely clustered petechiae ending abruptly or at a ligature mark, strangulation is a likely cause.

Patterned injury - Pattern of bruises consistent with widespread buttock trauma

This distribution of injuries, with extensive bruises on the buttocks and sparing of the gluteal crease, is a pattern characteristic of widespread blunt force trauma to the buttocks. This pattern follows anatomic lines, likely caused by stress from impact (perhaps crimping of skin along gluteal crease with traumatic impact, or from shearing blood vessel rupture at the junction of the affected and unaffected blood vessels), rather than from the shape of the object.

Patterned injury: Grab marks

The shape (oval) and size (approximately 1.5 cm in diameter) of these grab marks on the mandible (jaw) of this critically ill child are characteristic of the injuries caused by an adult’s fingertips or knuckles.

Patterned injury: Pinch marks

Pinch marks are another classic injury pattern most often consisting of paired semicircular marks.

Patterned injury:

The shape (circular) and size (approximately 1 cm in diameter) of these pinch marks on the mandible (jaw) of this critically ill child are characteristic of the injuries caused by an adult’s fingertips or knuckles.
Pinch marks can also look as they do above, with a bruise having a crimped semicircular edge on the back of this child’s ear.

Patterned injury: Grip or squeeze injuries
This injury type is caused by a forceful grip which squeezes tissue between the fingers, resulting in blood vessel rupture in a linear pattern in the affected areas.

Patterned injuries: Linear/overlapping injuries

The object used

Patterned injuries: Loop marks

The potential culprits
Patterned injury on infant’s back

Injury location is also an important consideration in determining whether an injury is likely to be accidental, or likely to be inflicted. This injury on an infant’s back is suspicious for inflicted trauma because it is outside the expected distribution of accidental trauma.

Common excuses given to account for bruises in an infant

- The baby bruises easily, and so do I
- He slept on a pacifier
- His sibling/the dog/his father plays rough with him
- He hits himself in the face with his own hands
- He hit himself with a bottle or toy
- He crawled into something

Analysis of common excuses

- The first excuse (“the baby bruises easily, and so do I”) implies that there is an inherited (familial) condition which results in easy bruising
- Even in people with bleeding disorders, there is some impact which causes bleeding to occur
- A qualified medical professional can help distinguish whether there is some inherited condition which increases bruise likelihood
- None of the excuses given provides a history of blunt force trauma sufficiently forceful to account for bruises

The significance of ear and eye bruises

- Eye and ear bruises are the result of direct impact to the affected areas
- Unless there is a plausible history which accounts for the injury, these injuries are highly suspicious for abuse, particularly when patterned
  - “Fell on the floor” is not a sufficient history, as falling onto a flat surface would not injure a recessed surface (such as the eye), or a structure on the side of the head (such as the ear)
- When bilateral (affecting both sides), more than one impact took place

Ear bruising in 11 month old

No history of injury was offered to account for ear bruising in this critically ill infant

Eye bruising in toddler

This child had a reported fall to the floor from a bed. He impacted a foam toy which was located on the floor. This history was inadequate to account for his eye injury.
Lacerations and abrasions

- Abrasions are caused by forcible removal of the uppermost layers of skin with an object sufficiently sharp or rough in texture.
- Lacerations result from forceful contact of the skin with an object sharp enough to pierce the skin.
- When these injuries are encountered in a child too young to be ambulatory, they are highly suspicious for abuse.

Frenular tear, nasal abrasion in 1 month old
Explanation offered was that child’s face had gotten caught in a pocket zipper.

Abraction on 2 month old infant’s cheek
The abrasion pictured above was seen on the face of a fatally injured infant.

Facial laceration in a 1 month old
This 1 month old infant presented for care with multiple abusive injuries. When examined, she was noted to have this healing facial laceration which occurred at 2 weeks of age without an adequate explanation.

Other injuries

Cauliflower ear

- Blunt trauma to ear causes auricular hematomas (collections of blood within ear).
- Depending on location of bleeding, permanent damage to ear may result from disruption of blood supply to ear cartilage, and formation of fibrous (scar) tissue.
Cauliflower ear

Fatty necrosis due to chronic tissue injury
This unusual finding is due to death of fat cells as a result of chronic mechanical injury to the area (likely repeated beatings with a rigid object). This injury is permanent.