

# Injuries and Terminology 101

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# Injury

- “Any intentional or unintentional damage to the body resulting from exposure to thermal, mechanical, or
- Chemical energy or from the absence of such essentials as air or oxygen.”
- Webster’s Definition On-line:
- An act that damages or hurts

# Wound

An injury to the body (as from violence, accident, or surgery) that typically involves laceration or breaking of a membrane (as the skin) and usually damage to underlying tissues

Webster Dictionary retrieved online 11/3/07

# Death and Injury

- MVA
- Homicide
- Suicide
  
- Important to study injury/wounds in order to improve on safety and morbidity/mortality

# Trauma:

- Accidental vs Abusive
- Accidental trauma is more distal, shins, hands, forearms, forehead
- Abusive trauma is more proximal, back, abdomen, under arms

# Injury Mechanisms

- Severity, extent and appearance of **blunt force** trauma depends on:
  - -Degree of force applied
  - -the inflicting object
  - -the area of the body struck
  - -duration of force applied

# Blunt force trauma

- Abrasions
- Bruises or Contusions
- Ecchymosis
- Tears
- Avulsions
- Fractures

# Abrasions

- The removal of the outer layers of the skin by a compressive and or sliding force.
- Mark the exact point at which contact has occurred.
- Types of abrasions:
  - Scrape or burn
  - Impact (pressure)
  - Patterned
  - Scratch

# Bruises (contusion)

- Leakage of blood in soft tissue from sufficient force to distort the soft tissue and tear a blood vessel
- This leaking blood needs time to make it's way to the surface
- The skin itself is not torn
- Also called a contusion

# Bruises (Contusions)

- Have intact margins
- When you press on the bruise you will say ouch or it hurts or they will pull away
- Swelling, firm, painful and margins
- Color goes from red, blue, black or purple, brown and yellow
- This is the progression that all bruises follow
- Some bruises never make it to the skin surface

# Bruises cont.

- Repetitive trauma
- Scarring of tissues
- Bruising less likely

# Bruises cont.

- Exact aging of bruises is difficult.
- There are many variables:
  - **Age**
  - **Medications**
  - **Diseases**
  - **Life**

# Medications: At risk supplements and meds

- Aspirin-antiplatelet
- Warfarin(Coumadin-anticoagulant)
- Ibuprofen, NSAIDs
- Heparin-anticoagulant
- Valproic acid-Depkote(thromobcytopenia)
- Prednisone-steroids

# Patterned Injuries

- Will be able to tell by the outline of the injury what the object is that may have caused the injury
- Examples of objects used to cause the injury might be: spoon, belt, cord, hand, etc.

# Ecchymosis

- A hemorrhagic spot or blotch, larger than petechia.
- They go through the same color changes as a bruise/contusion
- Point of impact is the bruise, gravity pulls blood downward, ecchymosis spread

# Suction Mark

- Impact from teeth is variable
  - Indentation
  - Abrasions
  - Lacerations
- Negative pressure from suction ruptures blood vessels

# Petechiae

- Multiple, pinpoint hemorrhages under the skin or submucosal tissue
- Can be caused by blunt force injury

# Tears or Lacerations

- Due to blunt force producing tearing, ripping, crushing, bending, shearing or stretching of soft tissues
- No sharp instruments was used

# Tears or lacerations

- Ragged, irregular margins
- Scraping and bruising of the wound
- Crushed tissues may bleed less
- “Bridging” stronger tissue components may survive the force and bridge across the wound

# Sharp Injury

- Cuts = incisions = incised wounds
- Sharp object comes against the skin with sufficient pressure to divide it
- Longer than they are deep

# Stab Wounds

- Sharp and narrow object forced inwards
- Depth exceed length

# Erythema

- Redness of the skin caused by congestion of the capillaries under skin surface
- Often seen as the only physical finding in consensual intercourse

# Burns

- Caused by
  - Thermal – heat
  - Chemical
  - Electrical
  - Friction – abrasion

# Burns

- 114 degree's = redness, tingling
- 118 degree's= blistering
- 120 degree's=5 min. 3<sup>rd</sup> degree burns
- More hot at the front of the tub
- 120 degree are some hot water heaters

# Defense Wounds

- Bruises, cuts, lacerations
- Curl up in a fetal position
- Protect your face and chest

# Hesitation Marks (Cutting)

- Longer than they are deep
- If right handed may have more marks on the left side of the body
- Superficial
- Typically to the front of the body where the hand/arm can reach
- (breast , abdomen, arms-wrists)

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- [www.dundee.ac.uk/forensicmedicine/notes/woundsjp.pdf](http://www.dundee.ac.uk/forensicmedicine/notes/woundsjp.pdf)

# Comments or Questions?

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# BLUNT AND SHARP INJURY

## Examination - Interpretation - Documentation

Although we're accustomed to it, English is not an easy language. Many words have multiple meanings, which contribute to their misuse, but most of us are so busy with our daily activities that we think about it only when we're reminded.

For example, the word fire has at least nine common meanings: (1) The phenomenon of combustion manifested in heat and light (2) To inspire, a person (3) Liveliness of imagination (4) Brilliance, luminosity (5) To discharge or let off (6) To discharge from a position, dismiss from employment (7) To process by applying heat (8) To fuel/tend a boiler or furnace. (9) To eject or launch a projectile. Almost any large dictionary will list other less common meanings.

If you're still unconvinced, and have access to the full version of the Oxford English Dictionary (all 20 printed volumes, or a CD-ROM version) look up the word "set". You may be surprised by how many meanings and usages there are.

During their training, doctors, nurses, paramedics, emergency medical technicians, investigators, and police officers devote considerable time to mastering medical and technical terms. Failure to continue this into description of injury, often results in reduced quality of documentation, even though reports may be lengthy, at times even verbose. All too often a report dictated by a surgeon after an operation contains numerous statements about what was done to an injury, yet it may totally fail to report where a wound was located, state its size and appearance, direction or depth, which may be extremely important, or the main focus of attention, if a law suit is filed.

In the event you should be called upon to testify or to give a deposition, you cannot afford poor descriptions, sloppy use of terms, and failure to document simple characteristics of wounds. If you make minor errors and/or get your basic terminology wrong, these may be used by a lawyer to throw doubt on everything else that you did.

The object of this outline is to review the characteristics and descriptions of wounds resulting from blunt and sharp injury so that the quality of documentation and interpretation may be improved.

From a purely medical standpoint, the ability to distinguish between the various types of injury is extremely important. You may, for instance, be confronted by a rather confused young female patient in an emergency department, lying on a stretcher with a linear injury to her upper forehead. If, on the one hand, this injury was due to a sharp instrument such as a razor blade, there is little to be done except some suturing and then to ascertain the cause of her behavior and mental status. Perhaps she has been drinking and/or taking drugs?

If, in a similar but different instance, the linear injury were due to her being struck forcefully by the edge of a coffee table or a piece of angle iron, then the clinical problem is different and obviously involves wound contamination, blunt force injury, potential for skull fracture and neck injury plus the need to consider brain injury, with or without intracranial bleeding.

The obvious conclusion is that you are not in a position to proceed appropriately until you're able to reliably distinguish a sharp injury from a blunt injury, and to make matters worse the two are most frequently mistaken for one another in those areas of the body surface that have bone beneath them, including the skull. These basics are all too often assumed, or glossed over, during early training, and detract from ability to triage multiple victims of injury, and to institute appropriate care.

Experience will show that sharp injuries (cuts and stabs) are better understood than blunt injuries (scrapes, bruises, tears and fractures). Accordingly this review will start with blunt injuries and proceed onwards from there. Has it ever occurred to you that the direction of force is often quite obvious in two of the categories (scrapes and tears), and not uncommonly in a third (fractures)?

## BLUNT FORCE INJURY

There are four main subdivisions of blunt injury. These are:

- 1) Scratches and grazes - abrasions.
- 2) Bruises - contusions.
- 3) Tears - lacerations.
- 4) Fractures of bone.

Obviously these types of injury often occur in combination, so for instructional purposes, let's review each of them separately. Later it will be obvious how they may combine and inter-relate.

### ABRASIONS

An abrasion represents the removal of the outermost layer of the skin by a compressive and/or sliding force. Usually the skin is not perforated, but this can occur if the force and severity are sufficient, or if the injury is great enough for areas to be physically worn away. Abrasions are seldom a threat to life but they are often very important in interpreting what happened, because they must by their very nature, mark the exact point at which contact occurred. Thus, the presence, form and distribution of abrasions may need to be recorded in considerable detail. As blunt force is applied to the surface of the body, two force vectors come into play. One is directed primarily inwards and the other primarily longitudinally or parallel to the skin surface. The magnitude of each may differ, producing characteristics which allow us to subdivide them into pressure or sliding types. It is well to consider abrasions in these terms because it makes us think about the direction and mechanism of injury.

An alternative classification is by their shape. If long and narrow, as from contact with thorns, we call them scratches. If wider areas are involved we call them grazes. The claws of a cat will leave scratches. The knee of a child who fell from a tricycle onto some blacktop will be grazed.

The direction of force is so useful because it helps in evaluation of the patient or victim. For instance, are the abrasions due to being stamped on the thigh or buttock by the honeycomb radiator of a Model T Ford, or due to sliding along the road surface?

In summary, the main points with respect to abrasions are;

- A. They indicate contact with a rough surface or object.
- B. They indicate the exact site of contact or impact.
- C. In the living they will crust over or scab (dry and darken, see D below).
- D. After death, when there is no longer circulation or body movement to keep them moist, they will dry and as they do so they will darken. This may lead to the false interpretation that they resulted from burning, bruising or even that a hot object contacted the skin. (Darkening due to drying may be encountered, and misinterpreted at the edges of wounds, on the whites of the eyes, the lips, the tongue, in abraded areas, on exposed parts of the scrotum and elsewhere if the ambient conditions are right. Although this is seldom seen in a hospital setting with living patients it may still be encountered. Why is one taught to close the eyes and grease the lips of an unconscious person if not to prevent drying? The rule-of-thumb is that when tissues dry they usually darken. Remember the color of the crusts on your legs, or the color of gangrenous toes in diabetic patients prior to surgical amputation).
- E. The surface tissues may be pushed towards one end of a sliding abrasion, like dirt moved to the far end of the "push" by a bulldozer or road grader. Tags and tissue fragments frequently indicate the direction in which force was applied.
- F. They may exhibit characteristic patterns. (e.g. knurled tool handles, motorcycle drive chains.)
- G. They may be seen in conjunction with bruises and lacerations because forces sufficient to produce scraping may distort the underlying soft tissues enough to damage vessels to the point of leakage, or tear tissues.
- H. Because abrasions are not seen as life-threatening, they are often ignored or glossed over during first aid and medical care. This often deprives investigators of valuable information.

I. The form and appearance of abrasions should be documented, especially in forensic and medico legal cases, because they help in the interpretation of the mechanism and circumstances of injury.

## CONTUSIONS

A bruise, or contusion, results from leakage of blood from vessels into the tissues after sufficient force has been applied to distort the soft tissues and tear one or more vessels. Hence the term "extravasation" (extra = outside; vasa = vessel). The vessels involved are usually small or smallish, such as capillaries, but they may be bigger and on occasion, when a fairly large vessel is involved, leakage of blood can occur rapidly.

An abrasion may be observed over or near to a bruise, and if present, may signify the exact point of contact or application of force. Fresh bruises may be slightly raised above the adjacent surfaces, if enough blood escapes and, even when a large bruise is deeply seated some swelling may be apparent when the size of a limb or body part is compared to its opposite member. In the early stages a history of injury, complaints of pain, and using a tape measure to compare thigh circumference may be the give-away.

After death, it may be necessary to cut into the skin to demonstrate subtle or concealed bruising especially if there is any significant degree of natural pigmentation of the overlying skin. In some of the European countries, where open casket funerals are relatively rare, it is not uncommon to demonstrate the presence of bruising at autopsy by completely removing selected areas of skin, whereas in the United States, where open casket funerals are common, only the minimum of incisions necessary to demonstrate and define the nature and extent of bruising are usually made.

A fresh bruise usually begins with the reddish color of oxygenated blood, from the arterial side of the circulation, but like superficial vessels they may appear blue. This is because blue light bounces (blue light that bounces off dust particles in the atmosphere gives rise to blue skies) and red penetrates more deeply (infra-red lights in our bathroom ceilings, and over the prime rib in a restaurant to keep the meat warm). We also think in terms of varying depths of skin and yellow fat. Red with some yellow added gives a sort of brown, which is hard to describe. Later, bruises turn a more purplish hue and ultimately, as the blood pigments break down, the sequence of colors passes through those of a ripening banana, through greens, yellows and browns to the point at which the colors eventually fade.

The rate at which a bruise disappears depends on many factors, including the quantity of blood originally released, the effectiveness of the local circulation, age, location of the bruised area on the body and the general physical activity and condition of the individual.

Many textbooks would lead us to believe that the rates at which bruises fade are fairly predictable. However, if you have occasion to read several books, it will soon become obvious that the various authors disagree, unless they copied one another, which means that there's a range, or that some must be wrong. If you have ever had a bruise that faded before the authors claimed that a certain color should have been present, it should be enough to make you question everything. Any opinion concerning the age of a bruise based on its color is extremely difficult, and should be attained and stated with the greatest caution and circumspection.

Distribution of bruises may be important. Small bruises around the neck or on a limb may be the only external signs of violence. Indeed it is possible to have massive internal injury with very little evidence on the body surface, and on occasion none whatsoever! Sometimes superficial patterned bruising may be of value in identifying a particular instrument or weapon such as a cane, stick or rod, in which the bruises may have a linear or double line configuration.

If called upon to examine the victim of an alleged assault you must remember that bruises may not become visible immediately and therefore that they may not be visible at the time of an examination performed soon after an event. Bruises may take time to become visible on the body surface, so reexamination of a victim may be helpful. This is particularly true if you are dealing with a possible case of abuse of an elderly person in a nursing home. Bruising may be found in the areas around the eyes

and within the soft tissue of the eyelids themselves, particularly in the elderly who sustain minor impacts to these regions when they collapse or fall.

From time to time the question arises if it is possible to produce bruising at and around the time of death or even after death. To cut a long story short, it's not usually a problem, but it is possible to cause and demonstrate bruising after death, and it may occur if a body is carelessly handled or accidentally dropped, provided enough blood is still present within the vessels, and is free to move under the influence of gravity.

Think of it this way, if sufficient force is applied to the body to tear small vessels and cause them to leak, then a certain amount of blood can exit these torn vessels as it settles under the influence of gravity, but this must be before the blood sludges, sets, fixes, clots, or otherwise alters state so it can no longer move. Also the area must be free to receive it, not compressed by the weight of the body itself.

I have personally seen a body (following death from head injuries) which, when was first examined in the autopsy, room had a normal face, and unswollen eyelids. Photographs that included the face were taken of injuries on the front of the body and others for identification purposes. Later, after the examination of the front was completed, the body was turned face down for photography of injuries, and then written documentation of injuries on the back. By the time the body was once again turned face up for internal examination, both upper eyelids had swollen and turned blue-gray from leakage of blood from fractures of the supraorbital plates, the thin bone between the frontal lobes of the brain and the eyes. It's not usually a problem, but don't let anyone tell you that such things cannot happen. If the circumstances are right, if blood is present and free to move, and gravity acts, such changes can and do occur. Never is a long day, and freshly dead bodies can be dropped onto stretchers, body carts, or even onto floors with subsequent appearance of a bruise that is not easily explained.

In summary:

A. Significant blunt forces do not necessarily result in formation of bruises. Not every blow struck by a boxer results in a bruise and many such blows are forceful. Perhaps you have fallen and expected to change color, but nothing happened? Tissues exposed to repeated trauma may firm up and scar, making it harder for blood to enter them, and harder for bruising to occur.

B. Bruises may not become visible for minutes, hours or even a few days. This is possible because it may take time for blood leaking from vessels located beneath a layer of undisturbed fat or behind other structures such as fascial planes to wend its way to the surface; furthermore the blood pressure may drop due to shock arising from other injuries(s), and it is only later, after blood pressure is restored, that bleeding resumes and discoloration develops. Thus some of the leakage of blood, and subsequent discoloration may not occur exactly at the time of injury. Blood also has to make its way to the surface to become visible, and this takes time, especially if the circulation is in any way or for any reason not up to standard (old age, debilitated condition, blood loss, etc.). If fat is disrupted blood may make its way towards the body surface faster than if it is not. Most of us have seen bleeding and bruising begin or resume after we have succeeded in getting the blood pressure back up. If death takes place quite soon after injury a bruise may not become visible on the surface of the body.

C. Discolorations due to blood don't necessarily appear at the place(s) at which force was applied because the coloration may result from blood which has tracked around muscles, and moved in the flow of tissue fluids on route to the surface. You may even hit your ankle and see your toes discolor if you do it right, and blood tracks down the tendon sheaths! Only an abrasion or a pattern in or near the bruising itself will indicate the actual point at which force was applied.

D. Bruises are often larger than the area of impact or the causative object, because the free blood moves and spreads out as it makes its way to the surface.

E. Limited bruising can be produced in the period immediately following death if the body is accidentally mishandled, tripped over as it lies on a floor, or has something dropped on it, assuming enough blood is present and is free to move (not set, sludged, fixed, clotted or otherwise altered state) under the influence of gravity. Post mortem bruises are however, usually small, few in number and localized, nor do they usually pose much of a problem.

F. Bruising can be masked by natural coloration of the overlying skin and may be almost invisible if the skin is heavily tanned, naturally dark or very dark.

G. Bruises are easily overlooked in areas into which blood has been forced or has settled (including postmortem lividity), or in areas in which circulation is failing.

H. The intensity and/or duration of force are difficult or impossible to estimate, unless other features such as abrasions, lacerations, or fractures are present.

I. Estimating the age of bruises is very difficult, both before and after death. To convince yourself of the difficulty during life, simply observe bruises of known cause and age. Examples include when you trip, bang your knee on something, or your children fall ... when you know both the exact time and the cause. In the case of postmortem tissues, age estimation is difficult with both the unaided eye and the microscope. At the very least it is essential to obtain a thorough set of tissue sections to ensure a truly average and representative sampling. It is well to admit that there is every reason to be both very cautious and skeptical when trying to match changes in injured soft tissues in a person who may have been in shock and organ failure, undergone treatment (including advanced life support, transfusions, antibiotics, and dialysis) and then try to draw a parallel with results from studies in humans and experimental animals, in the days before modern life-saving techniques were developed.

J. Bruising is accentuated in the presence of any bleeding disease and we can illustrate with a present-day condition (leukemia, cancer of the blood cells), one which is now seldom seen (scurvy or vitamin C deficiency, first prevented by the British Royal Navy with raw lemon juice during a 23-week voyage in 1794) and many other such disease states.

K. Bruising is accentuated in the presence of any impairment of the blood clotting processes including Hemophilia and treatment with many common drugs such as aspirin and anticoagulants. Selective serotonin re-uptake inhibitors, a class of anti-depressant (e.g. Zoloft) inhibit blood platelets and may be associated with bruising in unusual locations.

L. It is generally easier for blood to escape into loose tissues, therefore bruising is more common in certain parts of the body, at the extremes of age, after weight loss, in obesity, may vary with sex, and will be more probable if there is any disease of the blood vessels themselves.

M. Persistence of discoloration will vary with age, location of the bruising on the body (circulatory efficiency) and the amount of blood that escapes into the tissues.

N. Some individuals bruise more easily than others of the same age and sex. Others seldom bruise.

O. In some instances of very severe injury accompanied by rapidly falling blood pressure, fresh bruises, which are still forming at the time circulation ceases, may assume colors which are more commonly associated with greater age. These often have a subtle, almost grayish (sun shining on thundercloud), appearance.

P. At very late stages long after injury discoloration may remain but it may well be more of a response to injury (scar formation, breakdown products of blood pigments, and melanin) than true bruising.

Q. The forceful distortion of tissues necessary to result in bruising, may itself selectively alter the ability of blood to make its way through the soft tissues, to the body surface.

R. Bruising is harder to see in areas where blood settles after death (postmortem lividity).

S. If a vessel is lacerated, any blood that escapes will tend to depart through the open wound rather than permeate into the adjacent tissues. Thus, a laceration may have less bruising adjacent to it, not more, even though the force was greater. Likewise if fat is torn beneath intact skin blood may be able to move in an abnormal way.

T. In the living, a bruise may appear more or less prominent, according to the amount of peripheral vasoconstriction (standing out in the cold), or vasodilatation (just after a hot bath) of adjacent and overlying skin.

U. One or more bruises of different ages may be adjacent to, or overlap, one another.

V. Bruise-like discoloration can appear many inches away from the point at which force was applied and look just like bruising when it was not involved in the force and remains the same color until it fades.

W. A closed bruise with only a scrape on the skin above it, will not behave the same as a bruise forming in torn tissue, or one that can leak blood through a defect in the skin. Thus the duration of bruising must be unpredictably linked to severity of injury.

X. If a bruise fades in several days, before the popular tables indicate it is possible, without significant color change, everything else must be called into question. Likewise if a bruise lasts longer than the popular tables indicate is likely or possible, the tables are also in error. A good example is when one gets a bruise under toenail. It may be purple for a while, then it turns brown, and the brown coloration often remain until the nail grows down, often a matter of many weeks or a few months.

Y. Anyone with experience of treatment with Prednisone and/or a skin disease clinic knows how abnormal the skin may appear.

Z. A bruise that is, for any reason (from appearance to aching sensations), rubbed, massaged, prodded, has cosmetic applied to conceal it, or is treated with cold or warmth, is likely to behave differently than one that is ignored and untouched.

Then there are circumstantial variations.

- People with physical deficits, tend to injure the same parts of their bodies repeatedly. Therefore there is a significant chance that a bruised area will be discolored because of more than a single event. People with physical deficits are also likely to spend time at rest, often in bed. Thus the circulation to the various parts of their bodies do not go at the rate of an active person.

- People involved in situation involving repeated violence (child abuse, domestic violence, elder abuse, school bullying, etc.) are also likely to have more than one set of injuries at the same time. It may make the situation and cause rather more obvious, but the timing more difficult.

The situation is further compounded by the fact that roughly 8% of men and about 0.4% of women have some form of color blindness. How many lawyers would question a doctor or nurse about their color vision if they have written something in a record about the appearance or age of a bruise?

Focal discoloration due to some blood under the skin does not always mean that blunt force was applied. It might have been caused by a needle when drawing some blood, or by giving an injection of something.

Next, ask yourself why bruises of many colors are seen simultaneously as result of a single episode of injury. This should be enough to prove that bruises do not develop at the neither same rate, nor progress and resolve in a uniform fashion. In addition you will sooner or later see cases in which several bruises result from something such as a fall or walking into a door, yet disappear at different rates, some taking longer than others. If you have ever known of a patient being taken back to surgery to tie off bleeding vessels, you should also be aware that bleeding into tissues may not occur until after the cause or event.

Forensic scientists and forensically oriented health care providers, who use special types of lighting equipment to search for stains and evidence of injury, have frequently seen cases in which resolving injury is visible under special lighting when it can no longer be seen with the naked eye. Therefore, the visible component is only a part of the evolution and resolution of injuries, not the whole story.

If you're interested in learning more about the practical aspects of bruising, use 3 x 5 file cards, or make forms on a computer, put headings on them, and fill in the data whenever you see bruises of exactly known age. Be extremely selective, and include only those cases in which you are absolutely sure of the time of injury, and therefore the true time since injury. You can study yourself and family members. You will often know the exact time when a child, falls off a bicycle, or when something happens, which may or may not cause visible bruising.

Consider conducting a study on yourself, if for instance, you should drop something onto one foot, or bump into something, note the date, exact time, the nature of the event and what happened. A bruise may not appear. If you don't bruise easily but a good friend or coworker does, you will acquire different sets of results to which you can both testify if some need should arise.

The point is to keep very good notes, which nowadays probably means starting a computer file called something like 'mybruises.doc' or 'bruisestudy.doc' and make notes on the following, if it isn't yourself, a family member, or close friend:

- a) Identifying information (e.g. hospital number, ambulance dispatch number, etc.)
- b) Date and time of event and subsequent observations
- c) Ambient/prevaling lighting
- d) Age sex, skin color ( $\pm$  race)
- e) Location and size of bruise/bruises
- f) Bruise color in your own words

- g) Cause of the injuries and bruising. (e.g. motor vehicle collision, bar fight, fall, etc.)
- h) Ambient/prevaling temperature and prior activity (vasoconstriction or vasodilatation)
- i) Any medications or conditions that might affect the blood clotting processes (if applicable)

Always be on the look out for injuries that occurred at the same time, but which develop different colors. For instance if you fall, and the bruise on your face is yellow, another on your trunk may be purple. About 15 years ago, a friend had a new German shepherd puppy. He was bouncing a ball when the dog tried to catch it, and two canine teeth bumped into his arm. Two bruises formed, turned different colors, and faded at different rates, yet both began at the same moment.

Another worthwhile study is to make a note of the date and minute whenever you accidentally hit yourself hard enough to notice it. If a bruise appears you will know the time of injury, and be able to record any discolorations that result. If you do not bruise you will still be able to state that when you hurt yourself to the point of discomfort you only get a bruise a certain percentage of the time. If you bruise easily, or do not, as the case may be, the results may surprise you.

About two years ago, I smashed my outer front right ankle (right anterolateral aspect) onto the corner of my dishwasher door. I uttered a strong word, noted the date and time, and briefly applied pressure. It stung for a few moments, and then I forgot about it. Two or three days later when I undressed for bed I found that my middle three toes had turned a medium purple. They stayed exactly the same color until the color faded and things returned to normal several days later. If you had examined my toes you could have wrongly concluded that someone had bruised my toes and that the color indicated the age. The reality was that the point of impact was elsewhere, blood had followed anatomical structures such as tendon sheaths, and since the color never changed you'd have been wrong about the duration a lot of the time.

If bruising is a part of your work, why not acquire a personal collection of photographs and notes about bruising, and see what conclusions you draw.

Focal bleeding within the soft tissues of decomposed/decomposing bodies is hard to interpret, and needs considerable experience. Decomposition makes it much harder to tell ante mortem from postmortem bruising. This is primarily a problem for forensic pathologists and police investigators.

If color is unreliable, are there other possibilities? Yes, for instance, when a pathologist examines stained sections under a microscope. Microscopic evaluation can help to determine the duration of an injury provided that:

- a) Thorough and truly representative tissue samples are obtained, not just a single piece, or a central or marginal portion which may not be truly representative of the overall situation.
- b) The pathologist has sufficient forensic training and skepticism, or specializes and has special interest in, and experience with, the type of specimen being examined.
- c) The reference standards, to which the specimens are compared, must be taken from recent times and relate to modern day conditions. That is to say not prior to the introduction and widespread use of advanced cardiac life support, respirators, blood transfusions and antibiotics. In former days people died at stages of illness from which, today, they often recover. Likewise activity levels, drugs, and food additives are not the same as they were years ago, and many drugs affect the inflammatory and reactive processes. Standards of nutrition and treatment were not the same in the first half of the 20<sup>th</sup> century, when many of the standards of comparison were developed. (Failure to take this into account is like referring to a book written in 1939 and reading that the speed record for land planes was 469 mph. This was true when the book was written, and for the Messerschmidt Bf109R, but it doesn't apply today.)
- d) Everyone involved with the case takes note of the history and/or takes the clinical course into account, remains skeptical and uses plenty of common sense. This is necessary, particularly if two distinct times or events, such as those of injury and subsequent surgical intervention are to be separated, not confused and/or misinterpreted.
- e) People will argue that the colors quoted in various text books are averages and can therefore provide useful guidance, and thus are valuable to about 50% probability. My comment then is that the age of a bruise is seldom questioned in cases other than suspected felonies and violent crimes in

which the burden of proof is not preponderance of the evidence (50.1%) but beyond reasonable doubt (approaching 100%), a far higher degree of certainty.

If that isn't enough, there are what I will call "conceptual and philosophical" matters that bear upon bruising.

- Tissue specimens that were used for the old dating studies, mainly came from fatalities (autopsies).
- Samples of bruises from living persons are rare, or infrequent.
- Age and duration are seldom an issue for hospital pathologists.
- Bruise age is usually more important when the victim is living (child abuse, domestic violence, elder abuse, and so forth), yet most histological specimens come from autopsy examinations.
- The rates of change and the findings in slightly and severely injured persons are likely to differ.
- Living people in abusive situations may be repeatedly bruised (re-bruising), and may therefore have bruises with mixed characteristics, for which there are few or no reliable studies.

That brings us to lighting. To get the idea across quickly, if we found a room we could darken completely, and put three suitable lights in the ceiling (one red, one green one blue), then turned all three of them on, we'd be able to see colors well. If we turned the red one off, we could no longer see colors normally because there would be no red to reflect from colored objects into our eyes. Many fluorescent lights are deficient in red. You may know this because of the greenish-brown photos you have taken with daylight film in years past.

There is a characteristic of fluorescent lamps called color rendering index. To find what it is, imagine taking a group of people into the room I've just described, presenting them with samples of colors, and asking them to match the colors in pairs, this time under fluorescent lighting. If they didn't get many right, the fluorescent lights in the room would have a low color rendering index, and if they got most of the colors properly matched the tubes would have a high CRI.

Question ... what is the color rendering index of the tubes lighting the examining rooms and emergency parts of your hospital? The odds are you don't know. If not, isn't it likely that the tubes were selected on the basis of cost by a purchasing agent from a low bidder? To cut to the chase, and save time, you need tubes with a color rendering index of 70 or more in those rooms where assessments of things like early jaundice and minor injury are made, as well as a color balance that is acceptably close to daylight (5000-5500 Kelvin). Mankind lived and evolved in sunlight for thousands of years, not under fluorescent tubes! We therefore see colors better in lighting that comes close to daylight. Fluorescent tubes have only been widely available since the late 1930s.

If someone states the age of a bruise on the basis of color, continue to evaluate the case independently, because there's a high probability that the estimate of age will be wrong. You should certainly not base suspicions, or make arrests on the basis of bruise color alone, but on the result of your investigation as a whole. Bruise color is far too unreliable.

## LACERATIONS

Before entering into a discussion of lacerations, it must be noted that this is the term which is most commonly misused when describing injuries. A surgeon may make an incision with a surgical knife (scalpel) and call it an incision, then walk into the emergency department, examine a knife cut on a patient's face and call it a laceration. It is confusing and makes no sense at all. Another example is when the public, and the boxing community refer to a tear (laceration) near the eyebrow of a boxer as a cut, whereas it's obvious that the cause was perhaps a clash of heads and that no sharp instrument was involved.

Strictly speaking lacerations are defects in soft tissues resulting from tearing, ripping, crushing, over stretching, pulling apart, over-bending and shearing. An easy way to circumvent the problem is to describe soft tissue defects as being tears or cuts. That way it will be easy to tell if an injury was sharp or blunt when a record is reviewed. In the case of the so-called boxers cut, the tear in the skin near the eye occurs when the heads of the two boxers collide so that the soft tissues between the bony ridges and surfaces are forced aside in the fashion you would see if you were to lay down a line of

toothpaste along the edge of your bathroom sink and then press a finger into it. The paste would escape either side of your finger. So it often is with soft tissues and, to be technically correct, lacerations do not result from sharp objects. Use of the word laceration should be strictly reserved to tearing wounds that result from blunt force.

Compressive shearing force applied to a tissue or organ may cause an internal tear without external tearing, the impact site in such instances may only be denoted by an abrasion or nearby bruise. Since over stretching of tissue is an important factor in the production of lacerations, it follows that the plasticity or potential mobility of the tissues will influence the occurrence of this type of blunt injury. Therefore skin lacerations are frequently found overlying bony prominences of the body where the skin is relatively fixed and less able to move when stressed. Similarly, laceration of the aorta (the main artery of the body) and the internal organs occurs most frequently at points of relative immobility, tethering or mechanical disadvantage, particularly if the energy of impact is conducted to a point at which the aorta or other organ is fixed to an adjacent structure.

The typical skin laceration has an irregular margin which may be scraped or bruised, especially if there was an impact with an object or rough surface. Because the tissue is torn apart there is frequently an incomplete separation with stronger tissue elements (such as little blood vessels, nerves and connective tissue strands) surviving to "bridge" or span the gap from part or side of the wound to the other. This bridging is particularly evident deep within a wound or at its corners and is as helpful as a sign saying "blunt force injury". Closer inspection of lacerations may reveal characteristics which are useful in interpretation of the mechanism of wound production. For example, if one side is scraped/abraded and the opposite margin undermined, partly crushed or pushed aside, these findings suggest that the force was directed at an angle over the surface which was scraped and directed towards the side which is crushed, undermined or pushed back.

Symmetry of abrasion, bruising and undermining is consistent with a more perpendicular application of force. An example would be on the scalp, over the curved surfaces of the skull, if an individual were struck with a flat surface of a 2 x 6 inch piece of wood. Because lacerations result from blunt impact, shearing or tearing, it is lacerations that are likely to be contaminated with foreign material such as road gravel and dirt, and to contain trace evidence such as headlight glass and paint chips or clothing fibers indicating the kind of surface which was contacted. For example, examination of a tear on the side of the head of a road traffic accident victim may reveal the presence of small fragments of paint, indicating that the head contacted part of a vehicle, or it might contain gravel and greasy dirt, which is more in keeping with contact with the underside of a vehicle. Improper description and interpretation of injuries may lead the police on a lengthy search for a knife or sharp object whereas in fact they should be looking for a brick, angle iron or other angular object with a definite "edge" to it.

Lacerations of internal organs are a relatively common result of blunt force or impact applied to the exterior of the body. Classical injuries involve the liver, spleen and kidneys, all of which tear with relative ease if the force is sufficient. The lungs may be torn by inwardly displaced ends of broken ribs or very severe forces. It is noteworthy that it is possible to have serious internal blunt injuries without surface manifestations such as abrasions and bruises. If this were not so, surgeons would never have to undertake exploratory procedures to rule out injury. Surface indications are often present, but they don't have to be, and their absence does not rule out the possibility of internal injury.

In summary, lacerations:

- A. Result from blunt force, crushing, tearing, ripping, shearing, over stretching, bending and pulling apart of soft tissues.
- B. They have ragged, variably irregular margins.
- C. If there was an impact there will, in most cases, be scraping and bruising of the wound margins.
- D. Crushed tissues, especially in some parts of the body, may bleed less and become infected if the victim survives.
- E. Stronger tissue components such as blood vessels, nerves, tendons and connective elements may survive the force and be observed "bridging" or "spanning" within parts of a wound. Hair roots

and other skin structures may be seen protruding from the margins, having been torn out of their supporting tissues.

F. Frequently contain foreign materials including trace evidence such as glass, paint chips, bark, fibers and grease.

G. They vary widely in their overall size and shape by virtue of their blunt, tearing, shearing or crushing origin. When reapproximation of the edges of a blunt torn injury is attempted, the wound still looks ragged, whereas most sharp injuries are more easily and "cleanly" restored for suturing.

H. Tears resulting from forceful contact with angular objects can, if there is underlying bone, lead to the formation of linear injuries which may be mistaken for cuts due to sharp objects.

I. They may show direction of force when, for instance, the bent knee of a vehicle occupant hits the lower part of the dash in a frontal collision.

Some people use the expression "trapdoor laceration" to describe the directional nature of such an injury, an inverted U or V shape flap of skin, that remains attached at one margin.

## FRACTURES OF BONE

The fourth major variant of blunt injury is fracture of bone. I don't intend to go into great detail in this summary, nevertheless it should be self-evident that bone may fracture in different ways according to the amount of force and the fashion in which it was applied. The classical transverse or V-like fracture of the lower leg due to being hit by a car bumper is likely to be different from the spiral twisting of the fracture sustained by a falling skier and so on. Most of the time it isn't that easy to tell what went on because most of the bones we encounter are covered by tissue and the fracture sites may have been dressed to prevent infection and be full of blood. The point is that, from time to time, an observant well-trained orthopedic surgeon, nurse, or paramedic, may see features at the time of treatment which can help others to solve the classic "hit from the front, back or side" question. It may be easier for a pathologist at the time of autopsy, because tissue can be removed and there is less blood to impede the examination, but even then it may not be easy or possible.

If you wish to learn more about the physical behavior of bone, refer to selected pages in:

"Biomechanics of Musculoskeletal Injury"

by E. R. Gonza and I. J. Harrington

published by Williams and Wilkins in 1982.

RD680.G65 617'.47 80-16573 ISBN 0-683-03728-5.

See also a relatively recent article (perhaps 10-15 years ago), probably in the Journal of Forensic Sciences, by:

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Similar information on the mechanical behavior of bone can be found in engineering-oriented parts of the automobile crash safety, and high-end orthopedic, literature.

Generally speaking, bone is strongest in compression, weaker in tension, and weakest in shear.

The four major varieties of blunt injuries have now been reviewed. Main points include:

a) Abrasions, although at first sight seemingly trivial, and rarely life threatening, can be of great assistance in working out what happened, determining if the history makes sense, and which person was in a particular seat of a vehicle during a crash.

b) Assessing the age or duration of bruises is difficult and unreliable, even with the best of help.

c) Laceration is a term that is widely misunderstood and misused. Lacerations result from blunt injuries, and may be contaminated with foreign material and/or contain trace evidence. Lacerations of soft tissue, brought about by contact with angular objects in areas which overlie bone, may be mistaken for cuts. This is a classic mistake in wound interpretation, and hinders patient care as well as police investigations.

d) Bone is covered by soft tissues for most or all of our lives, so we seldom think about it, or ask ourselves if we can tell anything about the direction of force.

e) Directional characteristics are frequently present in abrasions and lacerations, occasionally in fractures although we seldom examine broken ends of bone with direction of force in mind.

f) It is somehow assumed in training that we will learn about blunt injuries. This will be so only if we have a foundation upon which to build, and this may not be provided.

## SHARP INJURIES

There are two main subdivisions of sharp injuries:

- 1) Cuts = incisions = incised wounds
- 2) Stab wounds.

### CUTS = INCISED WOUNDS = INCISIONS

In cuts, a sharp object comes against the skin with sufficient pressure to divide it. The force is usually directed mainly along the surface while some inward pressure is applied. Thus such wounds are, by definition, longer than they are deep. They may tail off at one end and be more superficial at one end than the other. The characteristics of the cutting instrument are usually not well reflected by a cut. After all, did a cut result from the last inch of a long blade or most of a short one? If only one edge did any cutting, how can one hope to tell anything about the edge that never made contact? It is also difficult to assess the amount of force required because this largely depends on the sharpness and configuration of the instrument and the resistance offered by clothing, if any, that in many cases will be removed for treatment.

A slash, or slice is a variant of cut (see the glossary of terms).

In summary, characteristics of cuts include:

- A. They result from sharp objects coming against the skin with pressure to cause an injury.
- B. They are longer than they are deep (in contrast to stab wounds).
- C. They have clean cut edges, usually without abrasion or bruising.
- D. There is no bridging, spanning or selective sparing of tissues. Occasionally you may see a structure within a cut which at first glance appears to be bridging but in fact all that happened is that the cut extended down to the structure and stopped, thus exposing it. Sometime a tiny linear mark may be seen on a structure such as a tendon confirming the sharp nature of an injury.
- E. Overlying hair, the hair roots and other small structures within the skin will be cut if the object is sufficiently sharp.
- F. There is scarcity or total absence of foreign material and trace evidence unless something such as glass is present.
- G. Cuts tend to bleed freely unless vessels are completely divided and able to retract. There is no scraping or bruising at the edges.
- H. Cuts may be irregular if the skin was creased, wrinkled or affected by clothing at the moment of cutting.
- I. They may be deeper at one end than the other. This can give rise to questions of right or left handedness.
- J. A cut can be irregular if the skin was creased or folded at the moment of injury or moved between the time of injury and examination.

K. Some of the older texts from Europe indicate that incised wounds/cuts are always related to a crime or imply criminal intent. This may have been true years ago in a European setting but it is certainly not true today because it is possible to be cut accidentally by fragments of a broken bottle or by glass falling from high windows.

## STAB WOUNDS

This type of wound results whenever a sufficiently sharp and narrow object is forced inwards. This is not necessarily due to a thrust but can on occasion be due to falling onto something. What is required is relative motion, plus enough force to cause the object to pass through the skin. Incidentally it is the skin which offers most of the resistance and once it has been penetrated the amount of force required will diminish unless tissues such as cartilage or bone are encountered. While there is a great deal of deliberate stabbing with knives, other less sharp objects may be used such as old shear blades, metal rods, old swords, ice picks and screwdrivers. If a penetrating object is not truly sharp, or if it tapers and becomes thicker as it enters then it is possible to see some stretching of the wound margins with resulting abrasion, however stab wounds are primarily sharp in character. Occasionally force is so great that really blunt objects are forced into the body, in which case they are best classified and described as lacerations.

Stab wounds are more likely to reflect the causative instrument or weapon than are cuts, inasmuch as a rounded object tends to cause a rounded hole, a square object a squarer hole and so forth. For example, a fairly thick knife blade that is sharpened on only one of its two edges will tend to leave a defect which has a cleanly cut acute angle at one end and a more squared-off or slightly torn, angular appearance at the other. A cross shaped Phillips-type screwdriver may produce wounds which have a subtle but definite cross shaped configuration when examined carefully. Unless a known stabbing object is present for examination, the exact depth of penetration must remain unknown until the body is opened at surgery or autopsy. It is for this reason that many surgeons elect to explore the internal situation following stab wounds. Occasionally stabbing instruments (tips of cast metal blades, or big pieces of glass originating from sources other than automobiles) may break off in the depths of a wound especially if bone is encountered. Recovery and retention of such fragments may be vital to effective prosecution of a criminal case or even to prove the cause of an accidental injury. Always look for evidence that a knife or tool was forced in as far as its handle. Areas of abrasion near the entry defect may signify this. Regardless of the length of the blade, such features indicate that whatever it was went in all the way and, in general terms, this is not favorable to the patient and likelihood of deep seated injury is increased.

Clearly this classification into cuts and stabs is simplified for clarity and instructional purposes. Classic stabs and cuts represent opposite ends of a spectrum of injuries. Sooner or later you will encounter a wound which is about as deep as it is long and will wonder what to call it. The important thing is that you recognize it as being sharp in nature and are able to separate it from the results of a blow. Stabs and cuts are often seen together in a single patient or victim. Try to decide if the force was primarily inwards or transverse with respect to the skin and describe the injuries as best you can.

If criminal activity is involved one should try to document the surface dimension, depth and direction of wounds if at all possible. Cuts which are inflicted across the natural lines of tension in the skin will tend to gape open. Those inflicted parallel to the lines of tension will tend to remain closed and relatively undistorted - the "Zip Lock" bag effect. Surgeons know lots about these lines of tension and endeavor to make their incisions parallel to them. Members of the street scene don't know or care about such things, so the injuries they inflict are often distorted by the effects of tension in the skin combined with a subsequent change of body position. This means you often have to ask yourself what an injury looked like before skin tension and body movement led to a change of shape. Beveling or shelving of wound margins are again clues to internal direction of a wound track. Tracks should never be probed indiscriminately. In the event a chest tube or other device should be placed through a fortuitously located injury, this should be clearly indicated in the treatment or operative report. Otherwise, should the victim die, the pathologist may not be in a position to properly interpret the features and wounds inflicted by an assailant.

In summary, characteristics of stab wounds include:

- A. They result from variably sharp and/or pointed objects forced inwards by a thrust, movement or fall.
- B. Depth exceeds width.
- C. There is danger to vital internal structures and the risk of delayed incapacitation, exemplified by cardiac tamponade (blood in the sac surrounding the heart) or tension pneumothorax (air trapping between a lung and the chest wall).
- D. Stab wounds may bleed internally to start with, later blood may appear when the victim "overflows" or collapses. This often confuses inexperienced or untrained individuals.
- E. The wound may reflect the causative instrument or weapon (single edge, double edge, square, round, etc.)
- F. There is relatively little abrasion of the wound margins unless the weapon is tapering and wedges/stretches the skin on its way in.
- G. Occasionally fragments of a penetrating object will break off in a wound. Remnants should be recovered and retained whenever practicable and handled as potential evidence.

Not infrequently, autopsy or surgical exploration reveals a wound track which extends inwards for a distance greater than the length of the weapon alleged to have caused it. This is because when a blow is struck there may be compression of the body wall with momentary indentation of the tissues which may even be combined with a subsequent change in the position of the body by the time the internal examination takes place. Even the chest wall can be compressed. If this is not so, how is it that modern CPR can effectively squeeze the heart between the momentarily depressed sternum and the forward projection of the vertebral bodies and overlying structures? A short stubby knife is certainly capable of inflicting a wound an inch or two longer than its greatest dimension especially in the abdomen or when there is little muscle to resist momentary indentation. How much increase is possible is open to some question because of lack of controlled circumstances. The author feels confident of having seen more than two inches of compression in an unguarded abdomen. The point is that, in the living patient, by the time of surgical exploration the patient has been repositioned, the bowel has gone completely or partially into a state of ileus (mechanical or adynamic obstruction), blood and gas has collected and the intestine has rearranged itself leading to estimates of weapon size that are often significantly in error. In an elderly person with reduced abdominal musculature and a sagging, relaxed abdominal wall, a relatively short blade can easily reach the aorta and inferior vena cava if a sufficiently forceful blow is struck.

Mechanics of injury are illustrated during the lecture but it should be obvious that tangential injuries may appear larger at the surface than those directed radially inwards and so on.

### **MIXED BLUNT AND SHARP INJURIES**

It goes without saying that mixed blunt and sharp injuries exist, and are often observed, because people are attacked and injured by semi-sharp, semi-blunt objects. Examples include old axes, machetes, meat cleavers, roofing hatchets, being ejected onto crushed rock or falling onto heaps of scrap metal. People are also subject to both blunt and sharp injuries during assaults, when for instance a fist fight progress to stbbing or cutting. However, as soon as one understands the basic subtypes of blunt and sharp injury, there is seldom a problem in recognizing a mixture.

### **TERMS AND DEFINITIONS**

Anyone working in the medical or law enforcement fields may be called upon to interpret injury patterns, to write reports concerning the condition of someone, dead or alive, and sometimes to testify concerning the appearance of an injured party. Proper use of descriptive terms greatly enhances your ability to write effective reports and to provide meaningful information in depositions or testimony. This also applies to your day-to-day progress notes. Your skill and effort will be wasted if your descriptions are not absolutely clear and meaningful.

A common failing of treatment and surgical reports is not to mention the place, depth and direction of injuries. No one expects a busy surgeon to stand and take exact measurements while a patient is bleeding to death but, after surgery there is no reason why the dictated report cannot include the location of wounds to a reasonable degree of accuracy. In the case of a single stab wound, failure to note that it entered the abdomen at a point located about 3 inches diagonally above and to the (patient's) right of the umbilicus, penetrated for a maximum depth of about 3 inches, and was directed from front to back and slightly downwards is a significant omission. What was injured and repaired will almost always be mentioned, but without a location this won't be much use. Courtroom questions will inevitably be centered on the location, depth and direction, because it is these features that will fit or discredit the allegations and circumstances.

Following are many of the terms used to describe injuries. It is suggested that everyone who treats patients, evaluates injuries or who works in the fields of law and law enforcement be exposed to and be aware of them, not only for personal benefit but also to protect the interests of the institutions and individuals they serve.

#### ABRASIONS = SCRAPES = SCRATCHES AND GRAZES

Abrasions result when the skin contacts a rough object or surface with sufficient force to rub away part of the surface.

#### ABRASIVE OR ABRADED INJURY

An abrasive, or abraded injury, is one in which the primary mechanism of wounding is abrasive in nature.

#### AVULSION

A forceful separation or detachment; tearing away of a body part.

#### BLISTER = FRICTION BLISTER

The friction blister is not usually of medicolegal significance but blisters are observed from time to time on the feet of those who have been walking a lot. This is especially true if the person is not walking a lot, or has new, unsuitable or ill-fitting footwear. Blisters cause high rates of disability in the military services, especially during training and on the march. Occasionally the associated ulceration (when the surface layer separates) and secondary infection can be significant and may even become life threatening, especially in diabetics and the elderly with poor circulation to the area. Research has shown that dry and extremely wet skin affords less friction than slightly moistened surfaces.

The friction blister is not due to heat and they do not represent second degree burns even though they may feel hot. Research has never shown more than a few degrees of temperature rise even under extreme experimental conditions. Blisters are formed by a shearing between the more superficial and deeper skin structures, resulting eventually in a split or cleft into which fluid flows or transudes. They are most frequent in the skin of the Hands (palms) and feet (soles, heels, sides of the feet and tops of the toes). The cleft almost invariably occurs above the basal cells, in and/or below the granular layer of the skin. The fluid within them contains most of the proteins of blood serum, but in lesser concentration usually with little or no fibrinogen. (Note that there are other possible causes of skin blistering, including burns, exposure to chemicals, prolonged immersion, and decomposition).

#### CLOCK FACE

The clock face is sometimes used to document the angulation or inclination of a feature or wound. For instance, if a person is standing at attention (in the standard anatomical position) and has a streak of dirty material running from the inner part of the left eyebrow to the lower right corner of the mouth, then this might be described as being oriented from 1 to 7 o'clock when viewed from the front.

If the standard (at attention) anatomical position is not used, then additional wording is frequently needed to assure clarity, for instance: "With the patient lying face up, the wound is angled between 10 and 4 o'clock when viewed from the left side".

## CONTUSIONS (BRUISES)

Contusions result when blunt forces distort the soft tissues to an extent sufficient to result in disruption and leakage of blood vessels. Escape of blood from the blood vessels is what produces the discoloration. The amount of blood which escapes from the vessels will depend on features such as their size and the pressure within them, the ability to clot, the space available for blood to leak into and so on.

There are subcategories, depending on how you look at them, including:

- a) Deep seated, such as in the internal organs, often in the form of hematomas.
- b) Beneath the skin, where they give the discolorations we commonly know as bruises
- c) In the skin itself, where they often give rise to patterned bruises.

Previous comments concerning contusion, in the main body of this review, should not be confused with two other meanings of the word contusion, both of which relate to the brain:

(a) The clinical bedside meaning of contusion describes "A somewhat imprecise clinical diagnosis of a patient who, after a blow to the head, suffers prolonged loss of consciousness with appearance of some clinical signs of brain injury". Note that the expression "contusion of the brain" is not used in the presence of dramatic and definite clinical signs such as paralysis. In such circumstances the description becomes "head injury with hemiplegia".

(b) Contusion of the brain substance occurs when forces are exerted on the head, sufficient to cause the crests of the gyri (surface ridges of the brain) to contact the inner surface of the skull. This results, in the early stages, in small linear hemorrhages resembling splinters of wood under a finger nail. These hemorrhages may become larger and more confluent if injury is more severe.

## COMA

Coma is a state of unrousable unconsciousness with absence of any physiologically understandable response to external stimuli or inner need.

## CHOP WOUNDS

Chop wound are deep gaping wounds often involving major structures, resulting from the use of relatively heavy and sharp objects such as meat cleavers, axes, machetes and brush hooks. If the instrument is fairly sharp, wounds may show a mixture of both sharp and blunt characteristics. One key to recognizing them is the combination of force and depth.

## CONCUSSION

The old definition was: A condition manifested clinically by a loss of consciousness as a result of a blow to the head, with rapid and complete recovery in the absence of any signs of damage to the brain.

In recent years the definition has shifted to reflect subtle changes and complaints after minor injury, such as reduced awareness of surroundings and feeling strange, but without signs of brain damage.

## CONSCIOUSNESS

Consciousness is an alert wakefulness with full awareness of self and environment.

CUT (Same causation as an INCISED WOUND or a surgical INCISION)

Cuts are sharp injuries resulting from sharp objects coming against the skin with sufficient pressure to result in a division of tissues. For simple classification and educational purposes they are longer than they are deep and are generally inflicted with a lengthwise/longitudinal motion.

A cut is typically accidental or caused by an assailant, whereas the term incision usually refers to a part of a medical or surgical procedure.

DEFENSIVE INJURIES = DEFENSE WOUNDS = PARRYING WOUNDS

These are injuries incurred in attempts to ward off blows of a weapon or assailant or in trying to grasp a sharp weapon. Those resulting from blunt attack will be in the form of scrapes, bruises, tears and even fractures. In the case of a sharp attack there will be cuts and stabs. All are likely to be found on the arms and hands but may be seen elsewhere. They are usually found on those parts of the body which a victim tends to interpose between him or herself and the assailant and including the backs of the hands, wrists, forearms, and to a lesser extent the shoulders and elbows etc.

Defense wounds are helpful in that they indicate that the victim was, regardless of drugs and alcohol, at least for a while, aware, conscious and able to resist also if the attack was sharp or blunt. On occasion the type of weapon may be evident and the sequence of events apparent.

DIVERSIONARY WOUNDS

Not that common a term but it's sometimes used to describe those wounds, inflicted in the course of an attack, in order to promote a response which will facilitate the exposure of previously guarded, less exposed or more vital areas. They merge into, and may be indistinguishable from, defensive injuries.

ECCHYMOSIS

A purple patch in the skin caused by extravasation of blood (akin to a bruise, but usually natural, when a slight force is applied to atrophic skin, vascular disease, or coagulopathy). A "black and blue" spot.

A term used to describe a leakage of blood from vessels, in the near-total absence of trauma, due to things like fragility of blood vessels in the elderly, clotting disorders, anti-coagulant therapy, and other conditions predisposing to leakage of vessels. (Not due to blunt force, like a bruise).

ERYTHEMA

Redness of the skin.

FACTITIOUS INJURIES (fabricated, forged, invented)

Injuries which are self-inflicted, not with the intent of suicide but with the intent of accusing or blaming someone else; obtaining money or reward by false pretenses, or avoiding unpleasant duty. They are not particularly common in North America and are more common elsewhere, nevertheless they occur just often enough that you can't ignore the possibility. They are often superficial or relatively minor in nature, usually located on readily accessible parts of the body and may be encountered in disturbed or mentally ill persons or in those who bear a grudge. They are usually superficial, blunt, not too painful and if sharp usually located in those areas where self-infliction is easy. Injuries on the face are likely to be vertical and more oblique on the left in a right handed individual, and they do not show the irregularity associated with a fight or the movement in struggle.

Another clue is often that the person with self-inflicted wounds is very open about them and wants them to be noticed. Try an experiment in which you ask a non-medically trained person to inflict imaginary injuries using a crayon or water-soluble dye on a swab. The angles and directions will soon become far more obvious.

## HEMATOMA

A localized mass of blood that is relatively or completely confined within an organ, tissue, space or potential space and which is usually or partly clotted.

## HESITATION MARKS (TRIAL, TENTATIVE, DECISION CUTS)

These are the superficial, often somewhat parallel cuts, made in the course of suicide, in attempt to gain courage or attention, or arising from vacillation. For instance, a person bent on self-destruction by cutting may, as it were, try the blade on the wrists and neck to see how painful it is before inflicting deeper wounds. The significance is that they strongly support the conclusion that all wounds are self-inflicted and help to separate suicide from homicide. In any suspected suicide it is always worth looking for well healed, faint, barely visible parallel cuts on the wrists, arms and neck from a previous episode of self-inflicted injury.

## INSTRUMENT AND WEAPON

An instrument is something with, or through which, something is done or effected. A tool, implement or utensil. Namely an object the primary function of which is not that of an offensive or defensive weapon.

A weapon is an instrument of offensive or defensive combat; something to fight with; an object of any kind used in combat to attack or overcome others. Namely an object whose primary function is that of an offensive or defensive device.

An object such as a kitchen knife, while manufactured as an instrument, can be used as a weapon.

Proper use of the terms will depend on the circumstances, and fashion of use. (To cut bread or to cause injury).

## LACERATION

Laceration is one of the most frequently misunderstood and misused terms.

A laceration is due to blunt force that results in tearing, ripping, crushing, bending, shearing or overstretching of soft tissues. It is also correct, if desired, to use the term to reflect deformation, rupturing and splitting of internal organs such as the liver or spleen.

If medical personnel should hesitate, and maintain that a cut due to a knife or piece of glass should be called a laceration, simply ask them why they don't refer to an incision (cut), which they made in a patient, with a scalpel as a laceration!

The reality is that many primary care providers fall into the classic trap of using the term laceration to describe almost every wound in the skin of an injured person regardless of its blunt or sharp nature.

The whole problem can be circumvented by using the term tear for blunt injuries and cut for sharp.

## PAIRED / GROUPED INJURIES (meaning injuries incurred simultaneously)

It is essential to keep in mind the possibility that more than one injury may be inflicted simultaneously by instruments such as scissors, shears, and forks. Some medieval weapons also produced injuries in this fashion. The same thinking applies today with irregularly shaped objects such as tools and gear wheels. Some of these injuries may have an obvious pattern to them. An important aspect is that the number of wounds observed may exceed the alleged/reported number of thrusts or blows.

## PATTERN OF INJURY

A combination or distribution of external and/or internal injuries which suggest a causative mechanism or sequence of events.

## PATTERNED INJURY

An injury which possesses features or configuration indicative of the object(s) or surface(s) that produced it. For instance the imprint of clothing, a honeycomb radiator, or knurling on a tool handle.

## PENETRATING AND PERFORATING

A penetrating injury is one that enters but does not exit, whereas a perforating injury passes through-and-through.

Confusion may therefore arise because a knife that entered the front of a thigh and stopped just short of the thigh bone represents not only a penetrating injury of the thigh as a whole, but also a perforating, through-and-through, wound of the skin.

It is necessary therefore to specify what was or is penetrated or perforated. A quick fix is to use penetration as the common term for the majority of injuries which do enter only and refer to all others as being through-and-through. The choice is a personal matter so long as you get it right.

The armed forces add to the confusion by referring to penetration of armor of a fighting vehicle, although the armor itself has been perforated. To them, what matters is getting at the personnel, no matter that only the armor, not the entire vehicle, has been perforated.

As an aid to memory, there are perforations (all the way through) between postage stamps.

## PETECHIAE

Multiple hemorrhagic spots, pinpoint to pinhead in size.

## PRECISION AND ACCURACY

Precision is the degree of agreement between repeated measurements of the same thing or quantity.

Accuracy is the agreement between the result of a measurement and the true value of the quantity measured.

So, if two highway patrolmen look at an overloaded truck and both of them estimate that it weighs 50,000 pounds, their precision is good. However, if the truck actually weighs 35,000 pounds their accuracy is poor.

## PUNCTATE

Marked with points or dots, differentiated from the surroundings by color, elevation or texture.

## PUNCTURE

- a) A prick or small hole made with a pointed instrument.
- b) To make a hole with a small pointed object, such as a needle.

## SCRIMAGE WOUND or SCRIMAGE ENLARGEMENT.

This term is not recommended, and is perhaps best avoided, but it has been used in the past, so it is included, mainly for completeness and instructional purposes.

Scrimmage wound or scrimmage enlargement is a term which has been used to describe the enlargement by tearing of a wound as a consequence of relative motion between the tissues and a weapon before it is completely withdrawn. Sometimes it is used to refer to a partially double track, for instance in a stab wound when the wound was inflicted, the victim moved and the assailant promptly pressed the knife in again to its fullest extent. Obviously this usually applies to stab wounds when the penetrating weapon enters and is then withdrawn in a forceful manner to one or other side of the plane in which it entered. The point is that such wounds show features of both the initial stab and the subsequent sideways or reinsertion component.

#### SEQUILA (plural sequelae)

- a) An after effect of injury or disease.
- b) A secondary result.
- c) A consequence.
- d) In old English law; process or prosecution of a case

#### SEVERITY OF INJURY

Apparent severity (intent, viciousness, savagery or extent) of injury is not a totally reliable criterion for the distinction of suicide from homicide. Nearly all those who have worked in the medicolegal and surgical fields have encountered occasional cases in which the extent of self-inflicted injury was truly amazing. By all means investigate such cases as potential homicides, it's the right thing to do, but never close your mind to the possibility of self-infliction if the injuries are on parts of the body readily accessible to the injured or deceased person.

#### SLASH or SLICE (VARIANT OF CUT)

Slash and slice are two very similar terms which refer to sharp injury. Slash means cutting or wounding with strokes or in a sweeping fashion with a sharp instrument or weapon; to gash, to strike violently or at random; to move rapidly or violently; to cut slits in, or to deliver cutting blows.

A slice is a relatively thin, flat, broad piece cut from anything; a sharp cut or to cut cleanly.

Thus these terms are commonly used in two circumstances:

- a) on the wrists, neck and other body parts of a person attempting suicide and as a descriptive term, for example "she slashed her wrists".
- b) In reference to reckless savage cutting, with overtly malicious intent, often forcefully and in a sweeping manner without careful aim. Such injuries are associated with gang wars, vendettas, crimes of passion, sex murders, control of prostitutes and retaliation against suspected informants.

#### STAB WOUNDS

Stab wounds result from relatively pointed and/or sharp objects forced inwards by thrust or relative motion. For Classification and educational purposes they are usually deeper than they are long and primarily due to an inwardly directed force.

#### STANDARD ANATOMICAL POSITION

For a variety of anatomical and developmental reasons, the human body is best described using a standard position. This is standing at attention, military-style, with the hands open, and palms to the front, thumbs to the outside, and the fingers pointing downwards, towards the ground. (It's easy to remember, because we often refer to the backs of our hands, so the palm is the front anatomically).

The head is regarded as properly oriented when the plane formed by the top of each bony ear canal and the lowermost point of the rim of each eye socket, is parallel to the ground (The Frankfort plane).

Thus if a bullet passed into the front of a right shoulder and came out the back of the left shoulder, it would be correct to describe its trajectory as being from right to left, from front to back (at about 20°) and level/horizontal.

## STRESS AND STRAIN

Stress:

- a) A force or influence.
- b) The applied force per unit of area to which the force is applied.
- c) A physical, chemical or emotional factor that causes bodily or mental tension and may be a factor in disease causation.
- d) A state resulting from stress, especially one of bodily or mental tension that tend to alter a state of equilibrium.
- e) To emphasize or accent a point or aspect.

Strain:

- a) To injure a body part by overuse or improper use.
- b) The strain of an object is the distortion of the object divided by the original dimension before distortion. This distortion may be temporary or permanent.
- c) An act of straining a body part.
- d) To filter or percolate.

And, there are several other common meanings in genetics and microbiology.

The easy way to remember is that people commonly say "I strained my back", in other words a strain is the result of a stress.

## TRACK and TRACT.

A track (spelled with a "k") is detectable evidence that something has passed, a vestige or trace, or the course along which something has moved.

A tract (spelled with a "t") is a series of bodily parts collectively serving some combined anatomical purpose. There are more than 50 of these within the human body.

So, unless someone swallows or inhales a bullet, it will pass down a track, not a tract. Failure to distinguish between track and tract is a remarkably reliable indicator of the amount and/or quality of training received, as well as the care, or lack of it, in producing reports.

Note that the word "tracks" is also used to describe the linear scars overlying veins resulting from repeated intravenous injections associated with drug abuse.

## TRAUMA (traw-mah)

- a) A physical injury, usually caused more or less suddenly, by some physical agent.
  - b) A psychologically damaging experience or an experience of a painful emotional character.
  - c) An injury, wound or the resulting condition of neurosis.
- (There are other meanings, some pertaining to dentistry, but these do not concern us here).

## WELTS

A welt is a raised ridge or bump in the skin, caused by a whip, stick, or cane. Thus, they tend to be linear, but flexible objects such as extension and electrical cords can produce curving welts.

Hard linear scratches can also produce them, but should have surface abrasion. A blow with a hard linear object, such as a walking cane, or length of copper pipe, can also force blood to both sides, causing more or less parallel zones of redness.

## WRINKLE WOUNDS

The term wrinkle wound(s) is sometimes used to describe a situation wherein a single sweeping cut or motion of a sharp instrument contacts the skin in more than one or several locations in sequence as it passes by. This may occur if the skin is folded or deeply creased, if the individual is obese, or if clothing intervenes and produces folds or offers a variable amount of resistance.

The obvious importance is that the number of cuts, slashes or thrusts reported by witnesses may not match the number of wounds on the body.

A similar thing may occur in relation to anatomical landmarks or positions. For instance, two cuts sustained when the arm was bent at the elbow may appear distinct and separate when the patient or victim later comes to assume the arms-at-the-side position during treatment or autopsy examination.

## THE BOTTOM LINE!

An injury that is of little consequence from a purely medical viewpoint, may be extremely important to family members, investigators, insurance companies, attorneys, and to the courts.

Suppose there's a L-shape abrasion (graze) about 1¼-inch in greatest dimension, on the inner aspect of the left lower leg near the bony prominence of the ankle joint. It isn't life threatening, and it will soon heal. A little later it turns out that both occupants of the vehicle are unconscious, the brake pedal is bent, and the main issue is who was driving. If the leg is by then in a cast, and there's nothing in the chart (because of the "abrasions don't matter" approach), the wrong person may be charged with negligent driving, manslaughter, or even vehicular homicide. How would you feel if you were related?

There are several routes to good documentation. Some come from training and others from experience, but we all have our first day on the job, so for the benefit of relative newcomers to the medicolegal field, here are some points to consider:

- 1- Describe wounds in some sort of logical sequence, such as from head to foot, or from front to back, or from wrist to elbow. You need to look organized, especially in court.
- 2- Use landmarks that cannot easily be challenged (or shifted, almost at will), by a skillful attorney. Good landmarks include the midline of the body, the notch at the top of the breastbone, the centerline of a limb, the base of a heel (provided the ankle is at 90 degrees!), the top of the head, the external ear canals, the Frankfort plane (which is the horizontal line between the bottom of the eye sockets and the tops of the external ear canals), etc. The best choice depends on the case, even upon the direction of force.
- 3- When dealing with stab wounds (and bullet holes) measure to the center of each. You'll "survive" by using the top, bottom or sides if there are only one or two, but as soon as there are many irregular wounds the distances between them won't add up without superhuman effort, or much wasted time.
- 4- If measurements are made around a body curvature, make it clear in the description. Failure to do so will cause a wound that's recorded as 12 cm to the left of the front midline of the face to sound as though it's out somewhere in space, instead of 5 cm in front of the ear canal.
- 5- Don't locate one injury and then say that another was at a certain distance from it. Do this a few times and measurement errors will accumulate rapidly. This does not apply if injuries are obviously paired (e.g. carving fork) or grouped (e.g. dinner fork).

6- Don't split-up or disperse parts of a single injury within your notes unless you have to. If there's no choice but to examine the outside before you get to the inside, then "Subsequent examination of ..." will get your narrative back on track.

7- When describing marks that encircle or partly encircle the wrists, ankles, or neck, pick a convenient starting point, and then state that "For descriptive purposes, the marking commences at a point ..." and continue with your description, until you return to your chosen starting point.

8- Use national standard, or internationally accepted, abbreviations. A common error is to use cc for fluid volumes, when fluids are measured in liters not centimeters. Thus ml is technically correct. If a case is important enough, consultants will read your report, note minor errors, and will bring them to the attention of the attorney concerned, who may "nit-pick" or try to "needle you" with them.

9- If someone misinterpreted a birthmark as a bruise, but injuries were not substantiated, it will help to make notations such as "Not found - evidence of injury to the face" or "Incidental findings - birth mark ("Port Wine" stain) on face".

There are many more, but good forms and a personal notation system (using things such as arrows and lines with clock face numbers at each end), make notes so much easier to read during a deposition, or when testifying. Outline diagrams of the human body, and various body parts help a lot. Simply draw your findings on them and add some notations. It's fast, accurate, helps to prevent right/left errors, and makes it far easier to record angulations, and patterns. Photography is better, but the two together are very hard to attack.

For example, imagine reading the following item in a report. "On the back of the left wrist there is an abrasion, measuring 2.5 x 0.3 cm, with minimal underlying contusion". The nature of the case makes you wonder if it might have resulted from handcuffs, because the subject was arrested for a minor offense, not long before the wrist was examined. Wouldn't you want to know if the abrasion was vertically or circumferentially oriented? Words don't make it clear, but a diagram would, at a glance. It's also much quicker to draw a small line, and make a notation of size, than to write all the words.

Don't leave blank spaces on printed forms. Instead always enter a dash, or put N/A (not applicable) so it won't look as though you forgot to do something.

We all make mistakes, so the aim is to make as few as possible, and become proficient as soon as we can. Don't feel badly if you make a mistake, or admit one in court, because we all do, sooner or later. The aim is not to repeat it.

Failure of documentation results from a variety of things, including:

- Lack of clinical independence
- Inadequate training
- Economic and other pressures
- Excessive work load, which translates to shortage of time for each case
- Time spent on paperwork, instead of patient care
- Physical and psychological pressures
- Lack of body diagrams on which to draw and make notes  
(Unless there are digital pads, or means of importing digital images, this will get even worse as medical records become more computerized)
- Lack of photographic equipment  
and, last but not least
- Lack of awareness that little things matter.

Lack of awareness is well-illustrated by the failure to document the exact position of the entry and exit components of a through-and-through bullet wound of the forearm. An inexperienced person might say it was pointless, because the position of the forearm at the moment of injury was unknown. However, an experienced campaigner will know that, when trial begins, an attorney will almost certainly ask if the track through the forearm is consistent or inconsistent with instinctive attempts to ward off the bullet, or with pointing something (a cell phone or even a finger, in the half dark) at the

shooter. If the wounds and angle of the track are not properly recorded it may be impossible to give a sensible, or sufficiently reliable, answer.

You must document the location, size, and appearance/character of injuries,

- Where it is (with respect to fixed landmarks)
- How big it is
- What it looks like

and if the angulation is potentially relevant, as in most gunshot wounds

- The angle with respect to the standard anatomical position (whenever it's possible)

before they are altered by passage of time, treatment, inflammation, or infection, and by the healing process. Usually there's only one chance, and by the time of a trial there will probably be nothing, except for some scars ... and hopefully ... your forensically excellent records!

We pay a great price for failing to teach our first responders, emergency nurses, and emergency physicians about the importance of minor injuries. They often see them as irrelevant when keeping a patient alive, whereas, in fact, poor documentation frequently leads to much loss of time, legal expenses, appeals, and prolonged disputes about insurance benefits. For instance, who was sitting in each seat of a car, and issues such as who was driving at the time of crash, may revolve around the imprints of seat belts, roll seams on armrests, wheel wells and head restraints. A fracture might get all the attention, but it could have been due to an unrestrained object or occupant.

There are look-alike injuries, and look-similar features, that can cause difficulties, especially for the less experienced examiner. Don't feel badly about this because we all start as beginners. We all learned to walk, write, spell, and tie a necktie, or do buttons at the back of a blouse, and we all have our first day on the job.

As an example of a look alike, the rounded end of ball-pein hammer can produce injuries similar to a gunshot wound if the victim is struck over bone. Likewise, the discolored, thickened fingernails that result from the administration of Taxotere (a chemotherapy agent for treating cancer) might be mistaken for resolving injuries. The clue is that more than one nail will look abnormal, and they don't all look the same. Unusually weak bones (advanced osteoporosis of old age, or defective bones such as in osteogenesis imperfecta) can have fractures that were not "caused" by anyone else, and are therefore not a sign of abuse. Cancer that has spread (metastasized) to bone can lead to fractures that otherwise would never occur, for instance when a person slips, someone grabs an arm on the way down, and a fracture occurs. Patchy discoloration due to senile ecchymosis (senile purpura), and leukemia can resemble bruising. Even a hard massage will cause bruises in some people. There are other possibilities, so if you see something that concerns you, start by asking a few simple questions. Do not jump to conclusions. The history and circumstances often lead quickly to the right answer.

Remember that there are a number of Oriental medical practices, such as:

- Acupuncture
- Coining, coin rubbing, kua-sha, spooning, cao gio
- Cupping (with alcohol or a suction pump)
- Moxibustion
- Mahendi

all of which may be mistaken for abuse or deliberate injury, when the intent was completely the opposite, namely the promotion of healing and faster recovery.

Lastly, beginners and "low-timers" should recognize that medical terminology was created, and has since evolved, for the purpose of conveying information from one medical professional to another. However, if you have occasion to think, you will realize that the vast majority of those who refer to forensic reports will not have received any medical training, and do not usually understand more than a few words of medical terminology.

So, when you're creating reports that will mostly be read by persons who are not medically trained, it is frequently, if not usually, best to minimize the use of medical terms. Some still have to be used

because there are no good substitutes for them, but it's usually better to say lying face up instead of supine, and the back of the hand rather than the dorsum (or dorsal surface) of the hand.

In short, the object of most medicolegal reports is to convey information to people who have no medical training. In the course of my career I have heard so many complaints and derogatory remarks about the reports issued by certain offices, or by particular pathologists and clinicians, that I've long since lost count. I won't go into detail, simply consider the fact that, when jury members with high school educations are attempting to reach a verdict, they may wish to review parts of your written report to refresh their memories. If so, did you make a reasonable effort to write it so that the jurors could understand, without resorting to a medical dictionary, which is unlikely to be available in a jury room, and most of the jurors will probably want to go home as soon as they can.

Diagrams help to prevent ambiguity. Doing something as simple as numbering each description of injury, and using corresponding numbers on your diagrams, will go a long way. Sadly, some people lapse into bad medical habits and never recover, or fail to refine their techniques, as time passes.

One pathologist, who I nearly worked with years ago, had a mania for binding reports into little booklets with clear covers. Guess what ... they wouldn't Fax, and if an envelope ever came open or was left unsealed there'd have been a whole report for finders to read, instead of a few scattered pages. Times change, and so does equipment, therefore what's needed today may be different only a few years from now. Remember the days of microfilm? I'd rather scan documents and use some hard drives in a RAID. If you didn't immediately know what a RAID was (it means Redundant Array of Inexpensive Discs), or sometimes (Redundant Array of Independent Drives), why on earth should a lay juror understand medical terms such as volar, inferolateral, superomedial and caudal? Most American jurors will understand better if you testify in inches rather than centimeters, whereas it would be the reverse in most other countries. So let's face realities, and do what is best for conveying information clearly and quickly.

Likewise, when testifying, if you use high school language first, and then the corresponding medical or technical terms, you'll be seen as respecting and educating the jury. Whereas, if you use the medical or technical term first, and then explain it a bit condescendingly ("the aorta, er, the main artery of the body") you're more likely to be seen as "talking down" to "inferior" "ignorant" jurors ... who just might decide that they don't like your demeanor - or your opinions!

## RESOURCE

Much of this material was put on two videotapes: "Blunt Force, Sharp Force, Pattern Injury" (and may now be available on digital disks), from:

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