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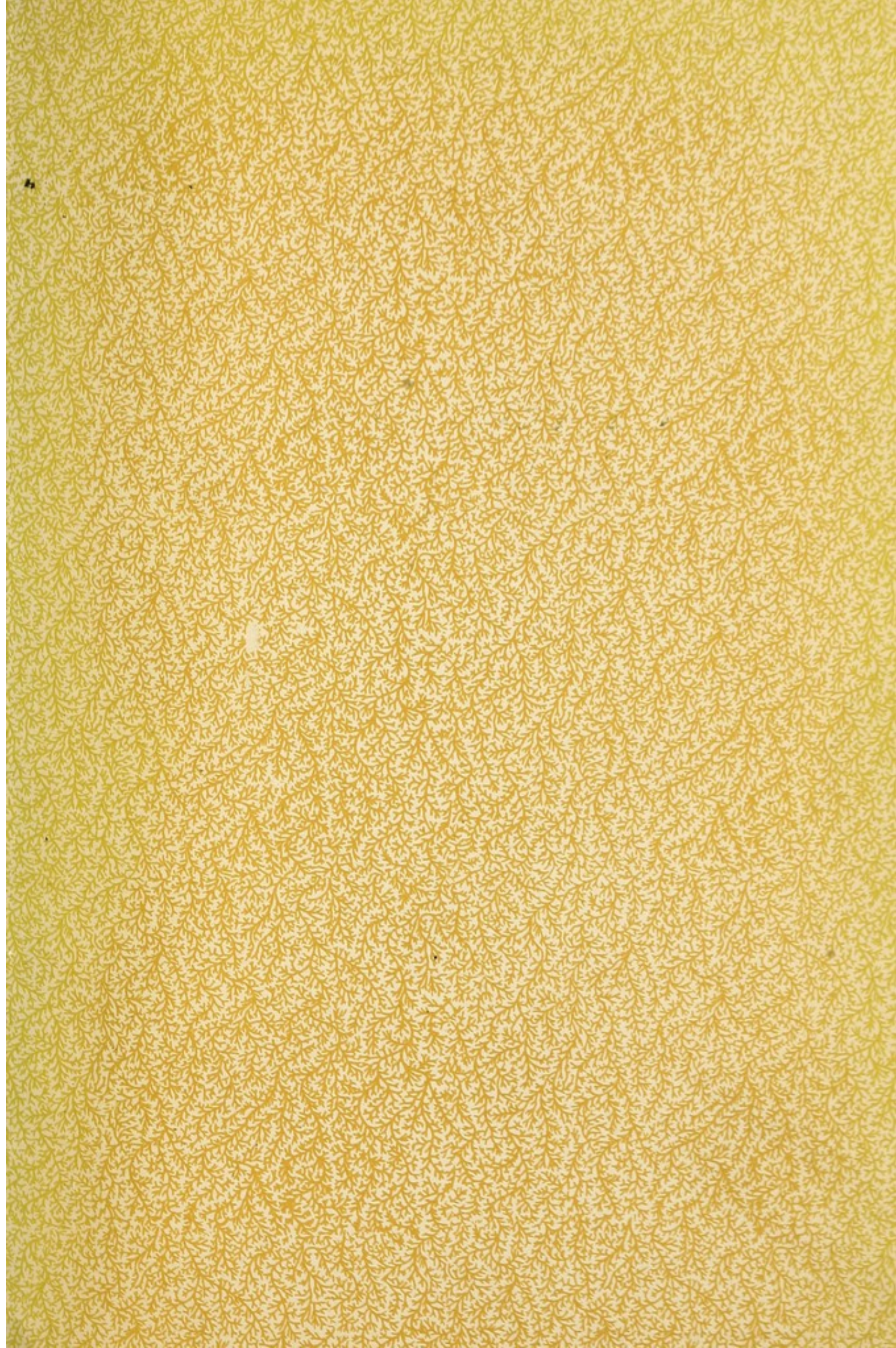
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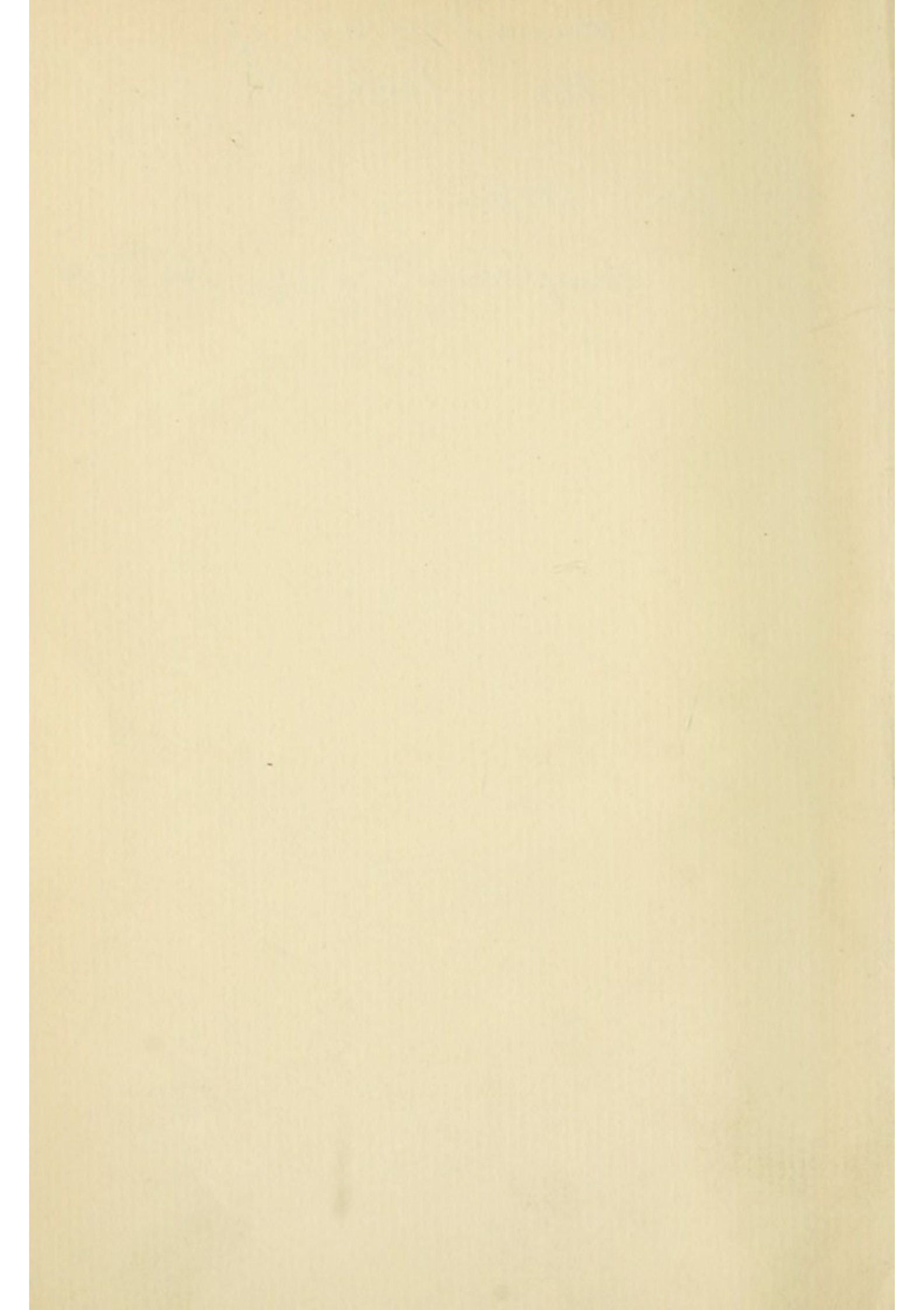




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# STREET RAILWAY ACCIDENTS

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THE TRIAL DEPARTMENT

OF

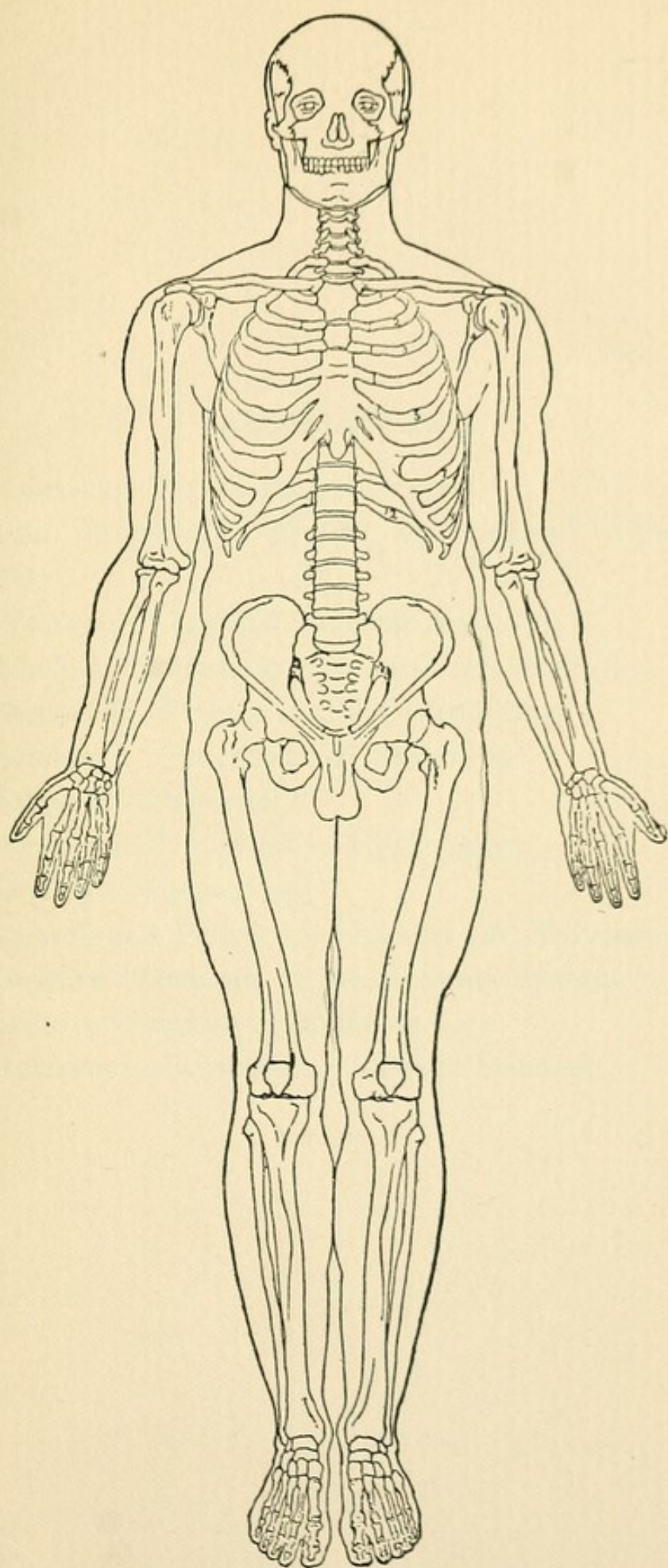
THE NEW YORK CITY RAILWAY COMPANY


BY

JOHN J. MOORHEAD, M. D.  
*Chief Surgeon*

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### AUTHORITIES.

American Text Book of Surgery.

Von Bergman's "System of Surgery" (Translated by Bull).

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Osler's "Practice of Medicine."

Reference Handbook of Medical Sciences.

## PREFACE.

These monographs respecting diverse surgical ailments are the outgrowth of requests from the Trial Counsel for information on respective subjects. It was finally deemed advisable to anticipate such demands by furnishing articles on the more common injuries alleged, and these took the form of manifolded typewritten brochures. The list has now grown large enough to warrant publication in the present form, and in offering the following pages, no attempt has been made to exhaustively treat any given topic, the aim being to furnish the necessary working knowledge for Trial purposes; and to give enough technical explanation to understandingly consult recognized quoted or mentioned standard authorities.

There has constantly been in mind the description of the average and usual, rather than the exceptional or unusual case, and careful mention has been made of the elements liable to modify the causation or outcome of a given injury. The diagrams used were obtained through the courtesy of the medical publishers, W. B. Saunders Company, of Philadelphia.

Oct., 1906.

J. J. M.

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## GENERAL REMARKS.

The physical evidences of any injury manifest themselves by:

(A) **Objective** and (B) **Subjective** symptoms.

(A) **Objective Symptoms** are those which are apparent to the observer; they can be seen or felt, or otherwise become manifest to the senses.

(B) **Subjective Symptoms** are those which are unapparent to the observer and are complained of by the patient; they are invisible and impalpable.

A **Subjective Symptom** can often be made **Objective**; as, for example, genuine pain can be elicited by the uniform complaint of the sufferer, if an exclamation be made each time the alleged sensitive place be touched. Likewise, if pressure over a painful area accelerates the pulse-rate, then pain becomes objectively manifest—this test is referred to as “Mannkopf’s Sign,” and has considerable corroborative value.

A complete examination of the injured is comprehended by the following six methods:

- |                 |                   |
|-----------------|-------------------|
| (1) Inspection; | (4) Auscultation; |
| (2) Palpation;  | (5) Mensuration;  |
| (3) Percussion; | (6) Motion.       |

(1) **Inspection** determines the site, type, degree and surface extent of the injury; for example, a broken limb would be located in a given site, it would be of a certain type, and of moderate or severe degree. Whatever can be seen by the eye is noted under the head of Inspection.

(2) **Palpation** determines the nature of the injury as manifested to the sense of touch; the broken limb would give the characteristic “crepitus” (grating sound) and the “abnormal mobility” and other corroborative indications. Whatever can be felt (either by the hands or apparatus) is noted under the heading of Palpation.

(3) **Percussion** refers to the information elicited by tapping (with the fingers or special instrument) the in-

jured part; a broken rib might thus be shown to have a blood collection in the chest as indicated by the dull sound and feel when the part was "tapped" upon.

- (4) **Auscultation** means the confirmation obtained by listening over an injured part, either with the ear or an instrument ("Stethoscope"). A broken rib could be heard to crepitate (grating or "clicking" sound), or the breathing might be found to be more or less affected.
- (5) **Mensuration** determines the magnitude of the injury in terms of inches or centimeters.
- (6) **Motion** becomes manifest either by:
  - (a) Active, or
  - (b) Passive means.

**Active Motion** means the patient's voluntary ability to functionate an injured part, and **Passive Motion** refers to the motion obtained by the examiner's efforts; for example, by **Active Motion**, a person could move a stiff shoulder to a right angle, but, by **Passive Motion**, the examiner could put the part through the normal movement-range.

It can hence be seen that **Inspection** appeals to the sense of **Sight**; **Palpation** or **Percussion** to the sense of **Touch**; and **Auscultation** to the sense of **Hearing**.

Manifestations obtained by the aid of the Microscope, Chemical Analysis, Electrical Apparatus, X-rays, Blood Examination, or other diagnostic means, are generally cumulative rather than essential, and the ordinary injury can be sufficiently comprehended by the six standard methods mentioned.

The essential in any examination is the capacity to accurately determine the self-propounded question regarding every injured-site; viz.: What does it look like, and how does it act?

## I. WOUNDS.

---

**CLASSES:** All are divided into four classes:

1. Incised.
2. Lacerated.
3. Contused.
4. Punctured.

An **incised** wound is one in which the edges are clean cut, such as that made by a knife or glass.

A **lacerated** wound is one in which the edges are ragged and irregular.

A **contused** wound is one in which the edges are ragged and bruised and more or less dented.

A **punctured** wound is one in which a punched-out appearance is presented, usually with loss of skin or tissue.

**SYMPTOMS:** All wounds have the following in common: Bleeding, gaping edges, swelling, pain, inconvenience or disability.

**HEALING:** This depends upon the type of the wound, its location, the treatment, and the individual.

**INCISED** wounds heal promptly in from three to ten days, and usually leave a thin, more or less noticeable scar.

**LACERATED, CONTUSED and PUNCTURED** wounds heal more slowly, and are usually attended with the presence of pus and some inflammation due to dirt or foreign germ-containing matter. They commonly heal in from one to three weeks, and the scar is irregular, thick and often-times raised or puckered.

All healing is by:

- A. First Intention;
- B. Second Intention;
- C. Granulation.

FIRST INTENTION HEALING (also known as "**Primary Union**") is where the edges of the wound coapt and heal kindly without the presence of pus; most **incised** wounds heal in this manner.

SECOND INTENTION HEALING (also known as "**Secondary Union**") is where the edges do not freely unite and new tissue springs up from the sides and bottom of the wound, pus usually being present; most **lacerated** wounds heal in this manner.

GRANULATION HEALING is where an excessive amount of new tissue forms from the bottom of the wound (this being called scar or granulation tissue), and it later contracts and causes an irregular and ugly raised scar; it follows severe **lacerated** and **punctured** wounds.

**TREATMENT:** This can be summed up under the three headings of:

- A. Bringing the wound edges together by stitches or adhesive plaster or bandages;
- B. The application of apparatus such as bandages or splints to keep the parts at rest;
- C. The use of antiseptics to prevent blood poisoning.

## II. CONTUSIONS.

---

A **contusion** is commonly known as a bruise or "black and blue" spot, and is the result of violence inflicted upon the **skin** or **subcutaneous tissue**; technically it is the **subcutaneous rupture** of small blood vessels, usually capillaries or veins.

**SYMPTOMS:** The average contusion at first shows nothing but a red or slightly puffed spot where the violence has been inflicted, but within a short time—usually within 24 hours—this spot becomes more or less swollen, dusky or blue; if it extends over a large area and gives a more or less mottled appearance, then the term **ECCHYMOSIS** is given to it, this meaning a diffuse area of discoloration (the best example of this is a "black eye"). With the above, there is more or less swelling, pain and disturbance of function. Later on the blue color gives place to a lighter shade, and finally becomes decolorized and a yellow mark remains; this in turn finally gives place to the normal appearance, all depending upon the severity of the contusion and the activity of the adjacent blood vessels. The better supplied the involved part is with blood, the more rapid will be the absorption of the blood that has been thrown out.

If the contusion be **DEEP SEATED** and sharply localized, it is of a severer type and then shows itself as a decided, usually more or less egg-shaped swelling, and is referred to as a **HEMATOMA**—this literally meaning a Blood Tumor or "Blood Blister."

No contusion ever becomes darkly discolored until some hours have elapsed, and the early onset of "black and blue" marks usually denotes a mild, superficial bruise.

**COURSE AND DURATION:** A mild contusion is of no consequence and causes no disability; if it be severe,

it may cause partial or complete disability; but, in a general way, no contusion ought to disable for a longer period than ten days or two weeks. A contusion of the parts about the hip is frequently severe enough to cause considerable disability, this being the main exception.

**TREATMENT:** This can be summed up under the head of **rest and external soothing applications**, usually in the form of **liniments**.

If a **HEMATOMA** be present, or if the blood is not readily absorbed by other means, a hypodermic needle is frequently introduced and the more or less clotted blood is drawn off. This is a rapid, safe, sure and modern method.

### III. SPRAINS, STRAINS, AND RUPTURED LIGAMENTS.

---

A **SPRAIN** is the sudden stretching or wrenching of the ligaments or muscles of a part **with** a tearing of some of the finer fibres of the same.

A **STRAIN** or **WRENCH** is the sudden stretching of the ligaments or muscles of a part **without** rupture of any of the fibres.

A **RUPTURED LIGAMENT**, or A **RUPTURED MUSCLE**—as the name implies—is the severing, more or less completely, of the ligaments or muscles of the part involved.

**CAUSE:** ALWAYS due to violence, either direct, or indirect; and each also occurs as an accompaniment of a **dislocation** and **fracture**.

**SYMPTOMS:** These can be summed up under the headings of  
Pain,  
Swelling,  
Diminution of Function.

**COURSE AND DURATION:** A **STRAIN** is rarely disabling, but causes more or less lameness and discomfort for a short time only.

A **SPRAIN**, especially if it be of an **ankle**, oftentimes disables for from ten days to four weeks.

A **RUPTURED LIGAMENT** will frequently disable from three weeks to six weeks.

**SPRAINS** and **RUPTURED LIGAMENTS** usually heal completely without leaving permanent defects; but **in rheumatics** and **in the aged** the tendency to recurrence is liable, and oftentimes a persistently swollen and somewhat disabled joint remains.

**TREATMENT:** This consists in placing the part at rest either by splints, bandages, or adhesive plaster; and the application of liniments, or ointments, or iodine, as counter-irritants.

Later, the part is massaged and used; and, in fact, the most modern surgeons encourage early action of the joint. In certain joints, notably the ankle, the "Adhesive Plaster Strapping" method of treatment is the standard hospital procedure, and with this application a swollen and disabled joint is promptly reduced and function is most speedily restored. Strips of one inch wide adhesive (or "sticking") plaster are wound in a somewhat "figure of 8" manner about the swollen joint, completely encircling it snugly. The scheme was devised by Dr. Gibney, and is often referred to as "Gibney's Basket Weave Dressing."

## IV. SHOCK.

---

SHOCK is a general term which commonly means a TRANSITORY DEPRESSION OF THE VITAL FORCES, especially those connected with the HEART and the NERVOUS SYSTEM.

**CAUSES:** It is a constant accompaniment of any injury, and is present to a greater or lesser degree following every sort of violence.

**DEGREE:** SHOCK is of varying degrees, and is usually classified as MILD, MODERATE, and SEVERE; and which degree prevails dependent largely upon the type of the violence and its duration, but mainly upon the individual.

Women stand shock very much better than men.

Those of a happy, sanguine temperament are less affected than those of opposite disposition.

Young people react from it better than the aged; and those who are accustomed to an out-of-door occupation are less affected than those of sedentary habits.

**SYMPTOMS:** Depend upon the degree of the shock and the producing cause.

In the MILD form there is a sudden giddiness and pallor, but the effects are slight and like a mild "fainting spell."

In the MODERATE form of shock, the individual is more or less dazed or stunned, the face is blanched, the circulation is depressed so that the pulse is slow and weak—or very rapid—and oftentimes there is vomiting; but the individual very readily regains his senses and his normal appearance.

In the SEVERE grades of shock the individual is usually unconscious; very pale; skin is cold and clammy; pulse is slow—or very rapid—and weak; he nearly always vomits and not infrequently passes faeces and urine involuntarily; in a word, he is in a state of **profound collapse**. This is a very serious condition to deal with, but is not often met unless in grave injuries. An individual in this condition may die within an hour, or may remain 24 hours in a semi-comatose state and very slowly regain his normal condition.

A main characteristic of **shock** is the fact that it occurs immediately upon receipt of the violence, and, if it is postponed, it is not due to the violence directly, but to some intervening cause, or to something complicating the violence; for example: if a person receives a **blow on the abdomen**, he may walk and give no evidence of having been injured, but within an hour or two he may go into a state of **shock and collapse** and then be found to have **internal hemorrhage**—but he would still be said to suffer from “SHOCK.”

It is also true that when shock is recovered from, the individual is very rarely liable to recurrence; but when it does recur it almost always indicates bleeding, and is then referred to as “SECONDARY SHOCK.”

**TREATMENT:** This can be summed up under the headings of:

**Stimulation;** as by heart tonics like whiskey, digitalis or strychnine;

**Rest and**

**Hot Applications;** such as hot water bags or hot water bottles.

## V. SYNOVITIS.

---

This is a general term which means the inflammation of the lining membrane of any joint, this membrane being known as the **SYNOVIAL MEMBRANE**. Because of the frequency of synovitis in the **KNEE**, when the term **SYNOVITIS** is used, it usually refers to this ailment affecting this joint, and is commonly known then as "**water on the knee.**"

**ANATOMY:** This **SYNOVIAL MEMBRANE** is a shiny, tissue-paper-like, fibrous substance lining the interior of every joint, and which secretes a fluid known as the **SYNOVIAL FLUID** to act as lubricant for the joint. When this membrane is irritated, as by outside violence, it becomes inflamed and the normal synovial fluid is increased, and hence fluid accumulates in the joint to a greater or less degree, producing **SYNOVITIS**.

**CAUSES:** Injury is a very common cause, and can be inflicted directly over the joint or at a distance from the joint. It is a usual accompaniment of **sprains, contusions of a joint, dislocations and fractures** at or about the junction of a joint; other common causes are **cold, rheumatism, and the presence of floating cartilages**, due to prior injury. It is also present in cases of **joint tuberculosis**.

**VARIETIES:** It occurs in **two forms**, either **ACUTE** or **CHRONIC**.

In the **ACUTE** form it follows soon after the receipt of violence (or other producing cause), and the joint becomes rapidly swollen, painful, and more or less disabled.

The **CHRONIC** form is a progression of the acute, and the joint is still swollen, but is less painful, but is more or less disabled.

**SYMPTOMS:** In a general way, every case of synovitis shows **swelling** of the joint because of the excess of fluid in it, and more or less rounded outline of the part; pain; and limitation of the movement of the joint, with stiffness of greater or lesser degree.

**DURATION:** ACUTE SYNOVITIS lasts—depending upon its severity and location—from two to six weeks.

CHRONIC SYNOVITIS lasts from six weeks to many months, and is not infrequently to some extent permanent, especially when neglected or improperly treated.

**TREATMENT:** In the ACUTE form this can be summed up under the head of **rest** and **immobilization**. The joint is kept quiet, ice-bags or other applications (such as lead and opium wash) are placed about the part and a firm bandage or splint applied, these being frequently changed, so that constant pressure is made to reduce the amount of the fluid. Some surgeons introduce a needle into the joint and draw off the fluid, if the above means do not show rapid tendency towards cure.

In the CHRONIC form, treatment is moderate motion, massage and electricity; and if the joint has assumed a position of stiffness so that it can only be bent part way (technically known as ANCHYLOSIS), then the part is more forcibly moved so as to break up the bands of fibre which have formed across the joint (technically known as ADHESIONS), and this not infrequently requires the use of an **anaesthetic**. Various external applications, usually irritating ointments and iodine, are often employed to hasten the absorption of the fluid, all of them acting as counter-irritants.

**PROGNOSIS:** There is sometimes a tendency for **recurrence of synovitis** in either of its two forms, and it is especially liable to reappear in those of rheumatic tendency, or in those who have laborious occupation, especially such as requires much bending of the joint affected, and in instances where ordinary precautions are neglected.

## VI. VARICOSE VEINS.

---

A **Varicose vein** is an enlarged, dilated, and more or less visible vein, or usually a set of veins; and because varicose veins occur most commonly in the leg, when the term is used, this location of the body is usually inferred.

They are commonest in the lower extremity because this portion of the body is furthest away from the heart (the pumping center) and hence the blood in the veins remains in this locality owing to gravity and posture.

**ANATOMY:** Veins are elastic tubes which are made up of three coats, and the **circulation in a vein is toward the heart**, being just the opposite of circulation in the arteries, which is away from the heart.

All veins, especially the larger veins, are provided with valves made up of two segments which point toward the heart; and when veins become varicose, they lose their elasticity, and hence the valves do not properly close and more blood remains in a vessel than it is intended to hold, and soon it permanently expands; it is precisely as if a rubber tube were many times over-distended and finally became rigid and brittle.

All varicose veins are enlarged, visible and somewhat painful, mainly because of the fact that the blood remains in the extremity and causes more or less enlargement of the limb, and this in turn produces pressure on the sensitive nerves.

In old people especially, there is the liability of what are technically known as **VARICOSE ULCERS**, this referring to a wound of ulcer-like form that occurs around about a mass of dilated veins, and usually results from slight injury; as, for example, a scrape of the shin will very frequently result in a varicose ulcer because of the fact that the circulation is inactive and

the healing process is therefore diminished. These ulcers are healed with great difficulty, and they often last for years. Cases of this sort form a very large percentage of all dispensary practice.

**CAUSATION:** There is nothing physiological as to the occurrence of this condition and the sole productive factor is long continued abnormal obstruction to the passage of a fluid in an elastic tube; in other words, the fluid contents of the veins are "dammed back," the veins hence increase their calibre, and in time remain so permanently, because they have lost by over-distention their power of contractility.

An arbitrary classification would denominate the causes as:

- (a) Superficial Causes
- (b) Deep Causes

(a) Superficial Causes:

Tight lacing. Prolonged standing.  
Tight garters. Occupation causing legs to dangle.  
Obesity.

(b) Deep Causes:

**Poor pumping action** on part of the heart and consequent inability to push the blood fast enough out of the veins, and they hence increase in size; this may occur (and often does) in:

Heart Disease; Kidney Disease (Bright's Disease); Liver Disease (Cirrhosis); Disease of Arteries (Arterio Sclerosis); and in any ailment in which poor circulation is a factor.

**Pressure** over a main trunk of a vein is a frequent factor, especially in the lower extremities, and this may be due to: **Pregnancy** where the child's body bulges the lower abdomen (pelvis); or **Constipation**

resulting in straining and engorgement of the lower bowel (rectum); or to Tumors pressing upon the veins that empty the extremities.

Some persons are born with veins that are incapable of standing the necessary pressure and they soon permanently dilate; Prof. Osler refers to such vessels as lacking in "Vital Rubber."

**Aged Persons**, or those who have worked hard, for this same reason are more prone to this ailment owing to the strain and stress incident to years of service.

**Structurally**, dilated veins are more common on the left side because the blood vessels are more sharply bent and hold the column of blood more rigidly; and also because the contents of the bowel lodge in the left lower abdomen ("Colon" and "Rectum") and cause more or less firm pressure almost constantly.

**INJURY** is never a direct cause of Varicose Veins unless there has been actual damage to the vein itself (as by a wound penetrating it), or unless there has been considerable inflammation of the skin and deeper tissues about the involved vein or set of veins, as in Cellulitis (blood-poisoning of the skin from a pus-containing wound). This last cause occasionally results in Phlebitis (vein-inflammation) which may lead to varicosities.

Tight bandaging or splints, if over-long continued or carelessly used, may by pressure impede the circulation and cause temporary varicosity, but it is rare for permanency to ensue from such causation.

**TREATMENT:** This is:

1. **Palliative;**
2. **Radical.**

By **PALLIATIVE** treatment is meant the wearing of an elastic stocking or bandage, or some other support, that will prevent the further dilating of the veins and the associated swelling of the limb.

By **RADICAL** treatment is meant the cutting out of the dilated veins by operation. This is the safest and surest method, and offers good prospect of permanent cure, and it can often be done under cocaine.

## VII. FRACTURES.

---

A fracture is the breaking of a bone.

**CLASSES:** All Fractures are divided into two classes:

1. Simple or "Closed" Fracture, where the bone is broken without any external wound;
2. Compound or "Open" Fracture, where the bone is broken with an external wound.

Each of the above are further sub-divided into:

- A. Comminuted Fracture, where the bone is broken into fragments;
- B. Green Stick Fracture, where the bone is bent but not broken completely across. This is also known as a Partial or Bending Fracture, and it commonly occurs in children;
- C. Multiple Fracture, where the same bone is broken in more than one distinct spot;
- D. Impacted Fracture, where the broken ends of the bone are jammed together.

**FREQUENCY:** The commonest of deep-seated injuries.

Stimson in his standard work on "Fractures and Dislocations" quotes statistics of over 12,000 fractures treated by various surgeons at the Hudson St. Hospital of N. Y. City. As to order of frequency, he gives the following:

I. Fingers .....	1,737	cases
II. Ribs .....	1,396	"
III. Colles (outer forearm bone at wrist) .....	1,007	"
IV. Ankle .....	907	"
V. Palm .....	873	"
VI. Leg (one or both bones) .....	764	"
VII. Skull .....	577	"
VIII. Nose .....	571	"

IX.	Clavicle (Collar Bone).....	534 Cases
X.	Femur (Thigh) .....	422 “
XI.	Lower Jaw .....	415 “
XII.	Humerus (Arm) .....	325 “

Bones oftenest broken (rated by 51,000 cases in the London Hospitals):

Forearm .....	18.17%
Leg .....	16.02%
Ribs .....	15.90%
Clavicle .....	15.09%

**CAUSATION:** They are all due to either “direct,” or “indirect violence,” or “muscular action.”

**DIRECT** violence breaks bones at the point of the receipt of the violence;

**INDIRECT** violence breaks bones at a distance from the point of receipt of the violence; this is the common method;

**MUSCULAR** action breaks bones by the forced contraction of muscles; this is the rarest method.

### **SYMPTOMS:**

These in part depend on the site of the fracture, but any broken bone presents all or most of the following:

1. Abolition of Function, partial or complete.
3. Localized pain at fracture site on pressure or motion.
3. Crepitation or Crepitus, the grating feel and sound produced when the broken ends are rubbed together.
4. Abnormal mobility, so that the usual range of movement is increased or lessened.
5. Change in appearance, so that the

part is swollen, lengthened, shortened or otherwise deformed or distorted.

A combination of the above may exist in other injuries also (as certain dislocations), but "abnormal mobility" is **the** characteristic of a fracture and exists in no other condition.

**TREATMENT:** This is summed up in three parts:

1. Reduce or "set" the bone;
2. Immobilize it by bandages, plaster of Paris or splints;
3. Massage and gradual motion after the bone has knit.

In Compound Fractures, the accompanying wound is treated like any other wound, but with great care to prevent infection (blood poisoning).

**DURATION:**

Clavicle (collar-bone),	}	Unite usually in from three to six weeks.
Ribs,		
Forearm,		
Fingers.		
Toes,	}	Unite usually in from four to ten weeks.
Arm,		
Leg.		
Thigh.		

In a Compound Fracture the healing is often less rapid than in a Simple Fracture, owing to the presence of the wound; but if the wound be small and heal kindly, the healing process is little affected.

**RESULTS:** When the splints or apparatus are removed, the soft parts (muscles and skin) are more or less in a condition of **ATROPHY** (wasting), due to the disuse of the muscles; this occurs even when an uninjured

part is kept idle, and hence is not due to injury direct.

The adjacent joints are usually stiff and more or less in a state of ANCHYLOSIS (anchoring or fixation), due to inactivity; this may be either FIBROUS ANCHYLOSIS, where the joints are stiffened by inelastic bands of fibre, or BONY ANCHYLOSIS, where the bones entering into the formation of the joint (usually two) are involved in the fracture so that union of their broken ends is by firm bony material.

FIBROUS ANCHYLOSIS can usually be overcome by massage, use, or forcible bending of the joint under the influence of an anæsthetic or special apparatus; hence no permanency of great degree is usual.

BONY ANCHYLOSIS causes deformity and disability that is little, if any, benefited by operation.

CALLUS is nature's method of repair of broken bone, and it is the throwing out of a soft cartilage-like material about the break, this gluing the ends of the broken bone together and forming a sort of splint, exactly like the solder about a joined lead pipe. It is an incident in the healing of **all** fractures, but the better the fracture is set, the less will be the callus; it always persists (it can be called a bone scar), and by it a fracture can be located for many years; it, however, is gradually converted into firm, smooth bone (especially in young persons), and rarely causes a noticeable deformity, and it interferes with function only when it is near or within a joint.

In the young, it is frequently so well absorbed as to defy detection even by means of X-Rays.

**DISABILITY:** This depends upon the type of the fracture (simple or compound), its location, method of treatment, and on the individual.

In a general way it can be said that after the fracture of an extremity (except the thigh) the individual can do some work in from five to eight weeks, and in

twelve weeks the function is generally restored enough to permit of return to active duty.

**Age** plays some slight part, as children usually recover more rapidly than adults.

Stimson says: "Fractures heal as rapidly in one sex as in another, and in the old as rapidly as in the middle-aged."

Alcoholics, rheumatics, syphilitics, and those suffering from kidney or heart disease, make poor subjects (as they do under any condition of illness), and are longer in idleness by one-third to one-half than the average.

**DEFORMITY:** If the fracture be well set and of ordinary type, there is usually but slight deformity; but if it be about a joint, or severe, or compound, some deformity (generally a bowing, swelling or shortening) always persists.

**COMPLICATIONS:** Delirium tremens frequently develops in steady drinkers.

If the bone does not unite within the usual time, we speak of **DELAYED UNION**; if it unites at an angle or with deformity, we call it **VICIOUS** or **ANGULAR UNION**; if fibre and not bone is interposed between the broken ends, we speak of **FIBROUS UNION**, and all of the above make healing longer and disability and deformity the more probable, but each is amenable to appropriate treatment that oftentimes restores a large measure of function.

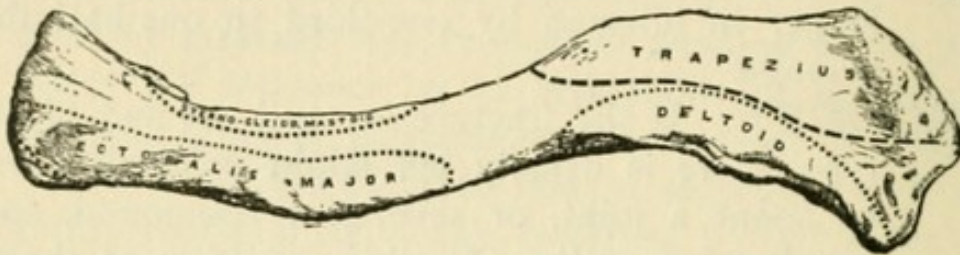
Even with a marked deformity, there is often a wide range of usefulness.

## VIII. FRACTURE OF THE CLAVICLE.

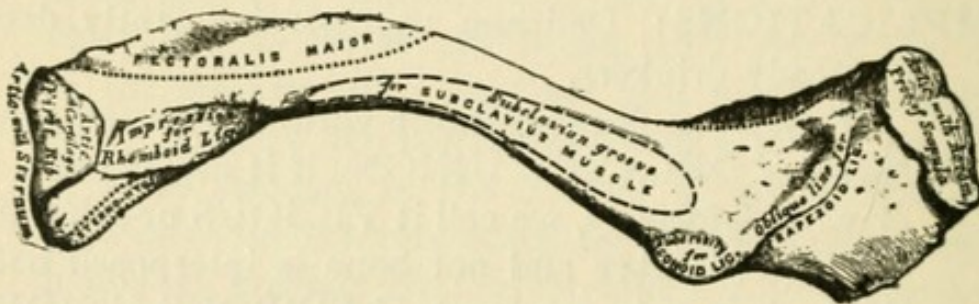
This is a cylindrical bone about six inches long that runs from the breast bone (Sternum) to a prominence on the summit of the shoulder blade (Acromion Process of Scapula). It is bound to these respective bones by ligaments, and at each articulation, a slight amount of motion is possible. (*See Diagram.*)

Sternal extremity.

Shoulder extremity.



Left clavicle, upper surface (Gray).



Left clavicle, under surface (Gray).

The word Clavicle means "A key," and in a sense it is a key-stone and is also somewhat key-shaped, although in outline it more aptly suggests the letter "S."

It consists of two extremities, known respectively as the INNER and OUTER (or as Sternal and Acromial), and it is arbitrarily divided into an INNER, a MIDDLE and an OUTER THIRD, each about two inches long.

**FREQUENCY:** It is one of the most common fractures, and various authors rate it as third or fourth in frequency of all broken bones.

It occurs almost exclusively in adults, as in children

the same productive violence dislocates the shoulder oftener than the adjacent bone is broken.

**CAUSES:** It is due to DIRECT VIOLENCE (as by a blow upon the bone) occasionally, but usually follows INDIRECT VIOLENCE, as by a fall on the shoulder (the most frequent manner) or by transmission of the violence from a fall upon the hand or elbow. Another rare method of causation is MUSCULAR ACTION, where a sudden strain is put on the part, as by heavy lifting or the forcible striking of, or at an object.

The bone is oftenest broken at the outer part of the MIDDLE THIRD, that is, about two inches from its junction with the shoulder-blade prominence. Fracture of the INNER THIRD is a clinical curiosity and that of the OUTER THIRD is also rare.

**SYMPTOMS:** A characteristic, almost diagnostic deformity immediately ensues, and by it alone the condition is usually apparent; viz., the patient tilts his head toward the affected side, his shoulder droops downward, forward and inward, and he supports the elbow with the uninjured hand and is very guarded in his movements.

In addition, the other main signs of **any** fracture are present, such as ABNORMAL MOBILITY and CREPITUS (i. e., the broken ends are movable, and they produce a grating effect that can be felt and often heard); there is also LOCALIZED PAIN over the fracture-site and LOSS OF FUNCTION—this last is shown by the inability to place the affected hand on top of the head, this being an almost universal diagnostic test.

**COURSE:** Healing is usually uneventful and union is generally complete by the end of the fourth week (28 to 30 days).

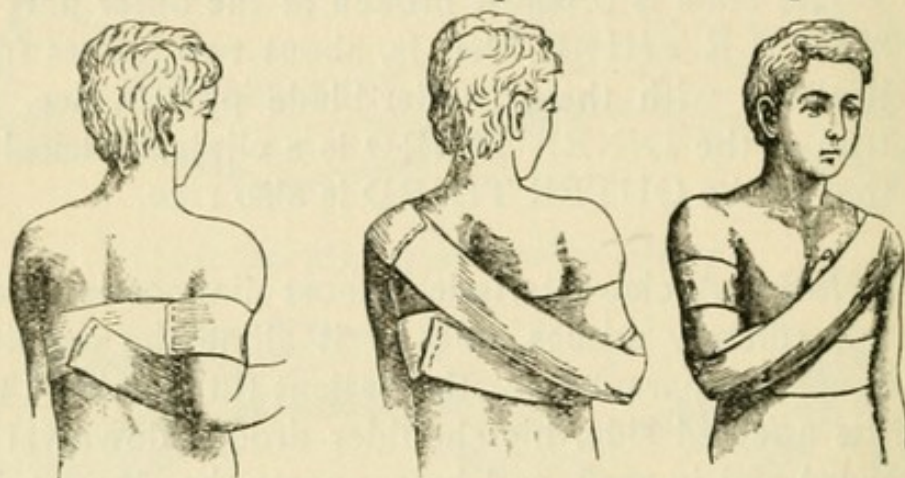
Complications are exceedingly unlikely, and if they

occur are in the nature of "pressure symptoms" due to involvement of surrounding nerves or blood vessels.

**TREATMENT:** The aim is, as in all fractures, to REDUCE ("SET") and then IMMOBILIZE the fragments.

This is done by pushing the shoulder up, out and back and holding it in this position pending union.

Various forms of splints and bandages have been devised for the purpose, the most frequently used of which is probably SAYRE'S DRESSING (named after the late Prof. Sayre, a well-known Surgeon) and this consists of two straps of adhesive plaster (each



"Sayre's Adhesive Plaster Dressing" in fractured clavicle.

about 3 inches wide), one of which begins at the centre of the breast bone (Sternum), passes under the sound arm, across the back, and loops around the damaged arm, the aim being to pull the shoulder back; the other strap begins at the unaffected shoulder-blade (Scapula), passes over the summit of the sound shoulder and is looped under the damaged elbow (it being next the chest, the injured hand being folded across the chest and resting on the front of the opposite shoulder) and thence to the back to join the first strap. (*See diagram.*)

Other forms of RETENTIVE APPARATUS are the VELPEAU BANDAGE, the FIGURE OF EIGHT DRESSING, or a very light STARCH or

PLASTER OF PARIS CAST; all of the above design to fold the damaged arm across the chest allowing the hand to rest against the opposite shoulder, and thus take all weight from the injured joint and permit apposition of the fragments. These last named dressings are objectionable as to their bulk, but mainly because they do not permit ready inspection of the part, and also because they require time to apply, are insecure and exceedingly uncomfortable, being composed of many turns of bandages which completely encircle the shoulder and arm and most of the chest.

Dressings are worn from 20 to 30 days, and thereafter a sling is substituted and massage and gradual use instituted.

**RESULTS:** There is always more or less DEFORMITY in the form of CALLUS (Nature's reparative splint) to mark the fracture-site; and if the fragments have overlapped, some SHORTENING will also persist. Despite considerable DEFORMITY and SHORTENING, function is speedily and permanently regained, and these defects are hence important only from a cosmetic standpoint.

The shoulder (and perhaps the elbow) is usually somewhat stiff (ANCHYLOSIS) because of the prolonged disuse and **not** from the injury itself; but if the immobilization be not too long, and if massage and gradual use are instituted at the period named above, the stiffness promptly disappears and work can be resumed in from 6 to 8 weeks.

Very exceptionally the parts fail to join by BONY UNION and the fragments coapt by FIBROUS UNION (fibre bridges over the gap instead of bone); but even under such conditions, function is practically perfect.

If re-fracture occurs, rarely is the bone broken at the original site because the CALLUS there acts in the solder-around-a-broken-pipe-manner and fortifies a weak place effectually.

## IX. FRACTURE OF THE HUMERUS.

(Arm-Bone.)

**ANATOMY:** This is a somewhat cylindrical, thick bone, the second in size in the body, about 10 or 12 inches long, reaching from the shoulder-socket to the elbow; it hinges ("Articulates") with the GLENOID CAVITY of the SCAPULA (a cup shaped depression of shoulder-blade) and is bound thereto by a very strong band of fibres (CAPSULAR LIGAMENT).

It consists of two ENDS and a central portion, the SHAFT. The upper end is called the HEAD and NECK, the lower end the CONDYLES. (*See Diagram.*)

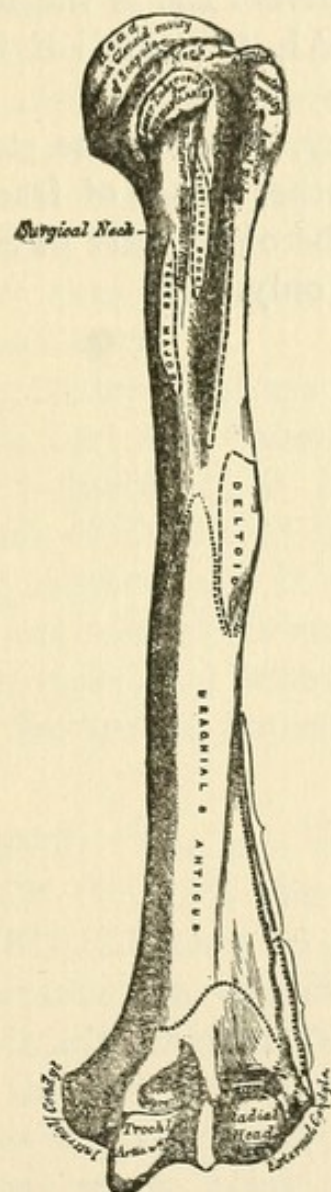
The HEAD is rounded, very hard and tough and is rarely broken.

The NECK is that portion just below the HEAD, and because of the construction, we speak of the ANATOMICAL NECK and the SURGICAL NECK.

THE ANATOMICAL NECK is that part most closely joined to the head, and because of its structural strength, it is rarely broken.

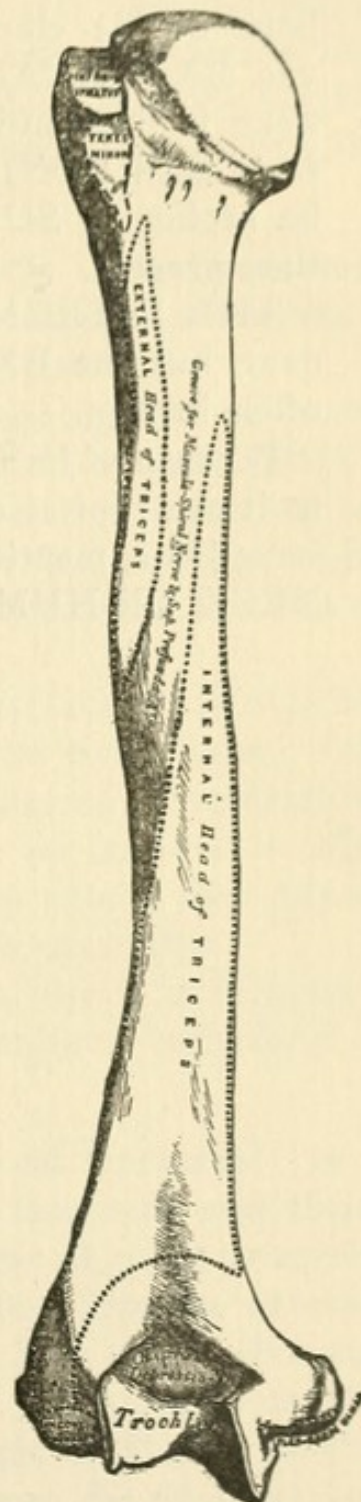
THE SURGICAL NECK is that part between the anatomical neck and the shaft, that is, about 3 inches from the upper tip of the bone. It receives its name because it is the weakest section of the bone and oftenest broken, and hence requires "Surgical" attention most frequently.

The SHAFT is that straight cylindrical portion between the NECK and the CONDYLES. It is not infrequently broken, and if same occurs, it sometimes involves a nerve which runs in a groove on the front of this part of the bone (MUSCULO-SPIRAL nerve), and if affected, a temporary partial paralysis results so that a characteristic deformity occurs called



Left humerus, anterior  
view.

(Gray.)



Left humerus, posterior  
view.

"WRIST DROP," in which the hand droops and is more or less powerless.

The CONDYLES are the marginal flanges of the bone at the elbow, called respectively INTERNAL and EXTERNAL CONDYLE. This section of the bone is frequently fractured, as is the ridge leading from each CONDYLE to the SHAFT; if this ridge be broken, a SUPRACONDYLOID FRACTURE is then present.

THE INTERNAL CONDYLE is the more prominent, but the EXTERNAL CONDYLE is the more often broken.

Because of its frequency, and because statements as to it are typical of the other types of fracture in the same bone, mention will be of fracture of SURGICAL NECK OF HUMERUS only.

## FRACTURED SURGICAL NECK OF HUMERUS.

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**CAUSES:** Usually follows a blow or fall upon the arm (DIRECT VIOLENCE), but occasionally results from a wrenching or straining (MUSCULAR VIOLENCE) and from a fall upon the elbow or shoulder (INDIRECT VIOLENCE).

**SYMPTOMS:** The deformity is usually typical, inasmuch as the hand hangs, the shoulder droops somewhat, and the elbow is straight and tilted outward.

In addition, there are the usual signs of **all** fractures, such as ABNORMAL MOBILITY and CREPITUS (motion between the fragments and a grating sensation that is often audible); also there is LOCALIZED PAIN over the fracture-site when it or the elbow are pressed upon.

Accessory signs are SWELLING or DEFORMITY of the part and (usually several hours later) diffused bluish discoloration from ruptured superficial blood vessels (ECCHYMOSIS); in no fracture is this last more marked, and it may even extend over the entire arm and sometimes reaches the chest also.

An individual with such an injury is in great pain and the arm is useless and requires immediate attention.

**TREATMENT:** The aim is (as in **all** fractures) to REDUCE ("SET") the broken fragment and then IMMOBILIZE them in some form of splint or apparatus.

Because the side of the chest forms a natural and practically immovable splint, it is taken advantage of and the arm is bound thereto (with cotton or a "Pad" under the armpit) by bandages or Plaster of Paris, a helmet or cap being placed over the shoulder summit (made of Plaster, Metal or Felt), the elbow being at right angles and supported in a sling.

In certain instances, more complicated and uncomfortable apparatus is required, but the above fits the average case.

Union of the bone is prompt and is generally complete in from 30 to 40 days (4-6 weeks), but prior to this time (usually at the end of the third week) the apparatus is removed daily so that massage can be given to prevent stiffness (ANCHYLOSIS) of the shoulder and elbow and wasting (ATROPHY) of the muscles from disuse.

The more modern Surgery advises that **all** fractures (especially if near a joint) receive massage as early as the third week, and that in the fourth week, some motion of the involved joints be made; by this method, repair is hastened and the disability period is shortened from one to three weeks.

**SEQUELS:** A certain amount of stiffness (ANCHYLOSIS) of the shoulder and elbow, with wasting of the muscles (ATROPHY) is to be expected from the long disuse, but if massage be given early, and if the parts be kept actively moved, disappearance of the above promptly occurs, and within seven or eight weeks, function should be restored.

**CALLUS** (Nature's reparative splint) is generally in excess, but in an adult, enough of it persists to mark the fracture-site through life.

**SHORTENING** of the arm occasionally occurs as does **DEFORMITY**, but neither is usually great enough to produce **DISABILITY**.

## X. COLLES' FRACTURE.

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This receives its name because best described (in 1814) by an Irish Surgeon called COLLES.

It is a fracture of the lower end of the Radius (outer forearm bone, thumb side) about 1/3-inch to 3/4-inch above the wrist-joint.

**ANATOMY:** The RADIUS (which means "A rod") is a thin bone about 8 to 9 inches long reaching from the wrist to about 1 inch below the elbow. It consists of two ENDS and a central portion, the SHAFT. The upper end is rounded and is called the HEAD and does not come into contact with the elbow joint unless the latter is flexed (bent); the diameter of the bone here is about 3/4-inch, and because it is well protected and strong, it is rarely fractured, but not infrequently dislocated. The lower end of the bone is thinner than the upper, and at its outer part there is a projecting prominence known as the STYLOID PROCESS; this can be felt by grasping the lateral margins of the joint. It is just above the STYLOID PROCESS that the above fracture occurs, hence it is sometimes referred to as "FRACTURE OF THE BASE OF THE STYLOID PROCESS." (*See Diagrams.*)

**FREQUENCY:** Next to the ribs, COLLES' FRACTURE is probably the most frequent broken bone; fractures of the upper extremity constitute 47.89% of all fractures. It is more frequent in the aged than in youth, as in the latter, dislocations and soft part injuries occur under the same sort of violence.

**CAUSES:** Falls on the outstretched hand, resulting in transmitted violence to the wrist causes practically ALL such breaks; this is what is known as INDIRECT VIOLENCE. Rarely, DIRECT VIOLENCE produces



the injury, as for example a blow directly over the wrist.

In this connection it may be stated that the other bone of the forearm (ULNA) paralleling the RADIUS does not join the wrist-joint, but it does join (or "Articulate") with the elbow; hence it is that wrist-violence breaks the RADIUS, and elbow-violence breaks the ULNA.

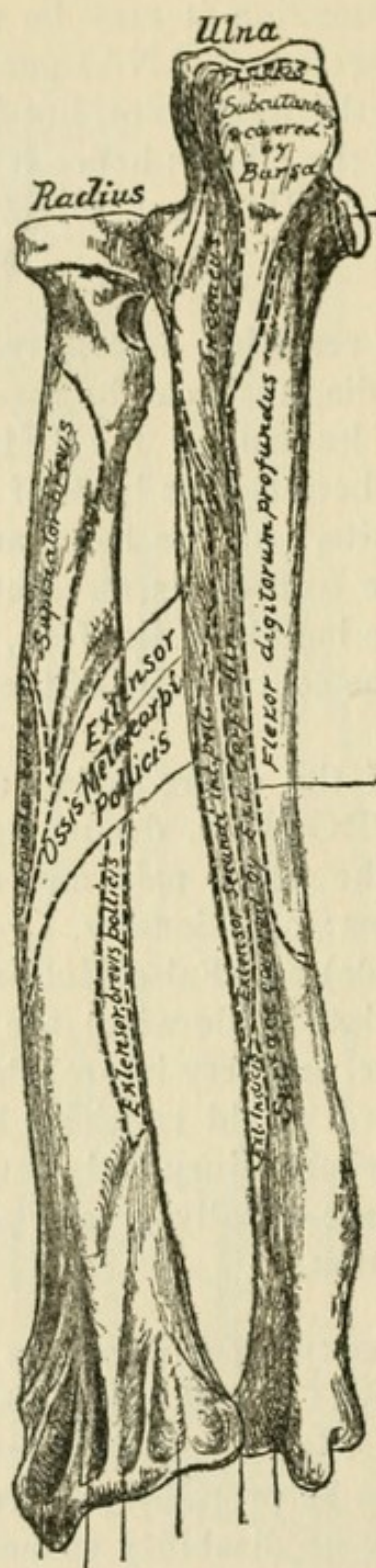
**SYMPTOMS:** The resulting deformity is characteristic and by it alone a diagnosis can be made on inspection; this deformity is known as the "SILVER FORK DEFORMITY" because the back of the wrist is raised at the fracture-site, and the hand and fingers tilt downward, and the forearm is straight; hence the forearm represents the handle of the fork, the raised wrist corresponds to the central part of the fork, and the fingers are the tines.

Swelling of the entire wrist, a pushing up of the STYLOID PROCESS, deepening of the wrinkles at the back of the wrist, pain and abolition of function are other signs; occasionally, Crepitation (grating of the broken ends) and False Motion (fragments moving when manipulated side-wise) are also obtainable.

It is possible, but very improbable that a person with such a fracture would continue long without knowledge that a serious injury had occurred because the pain and swelling are usually great enough to demand immediate attention.

**TREATMENT:** The two essentials, as in all fractures, are REDUCE ("SET") and IMMOBILIZE.

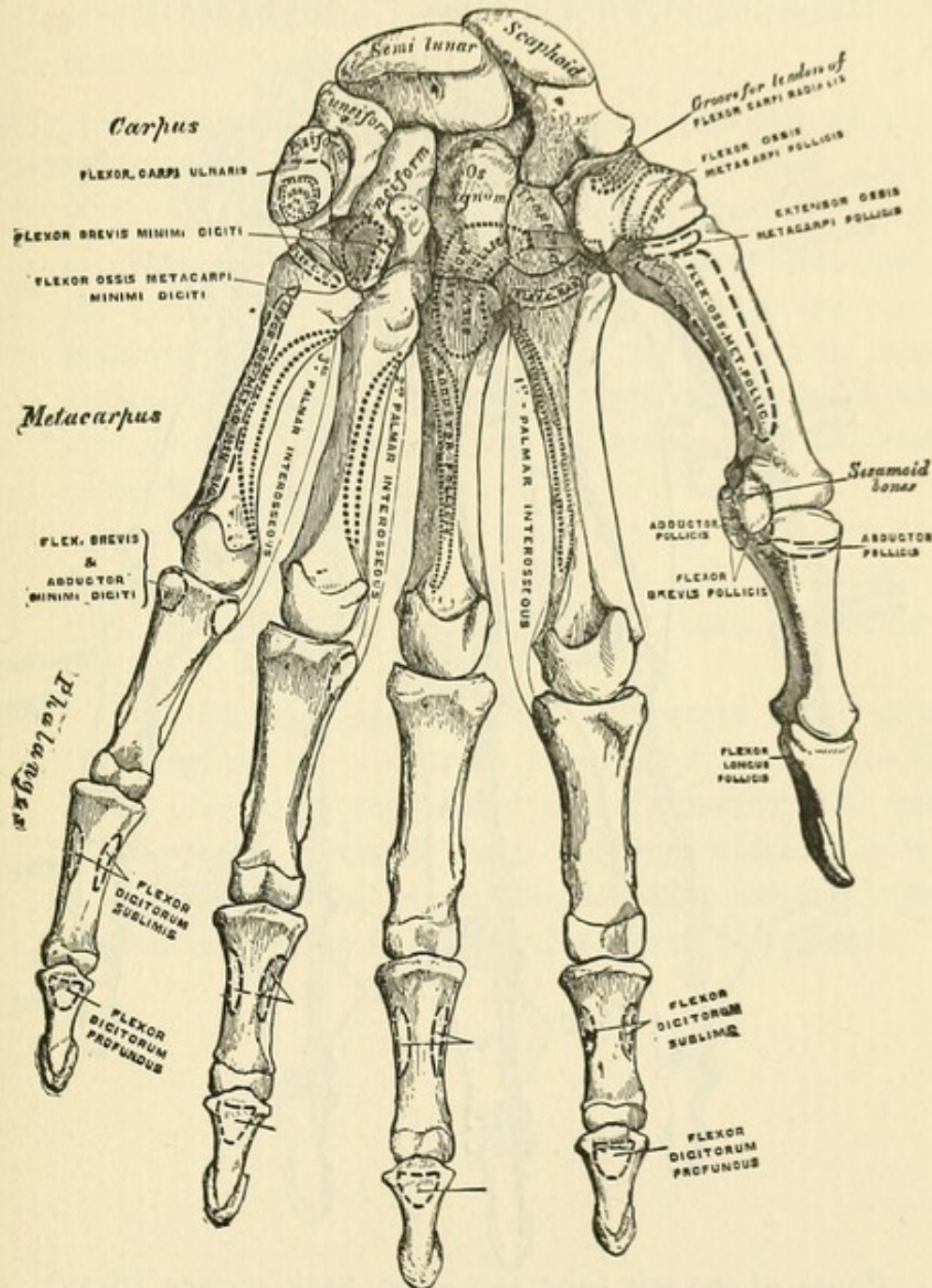
In no fracture is Reduction ("Setting") more important, and if this be properly performed, little deformity and practically no disability ensues; it is accomplished by pulling on the hand and pushing on the back of the wrist so as to bring the broken ends into apposition.



Bones of the left forearm, posterior surface.

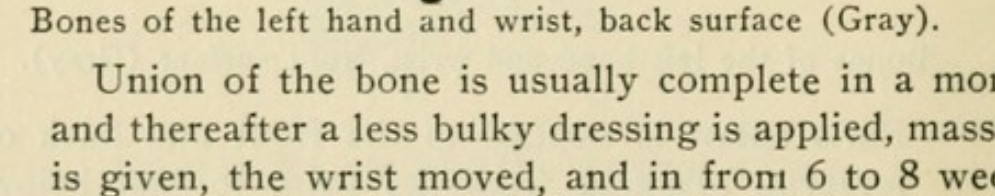
This is not always easy and frequently the fragments are IMPACTED (jammed together) and an anaesthetic is needed.

After Reduction, some form of wooden or Plaster of



Bones of the left hand and wrist, front surface (Gray).

Paris splint is applied to the front and back of the forearm, reaching from the palm to just below the



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work can be done; many of the better Surgeons counsel removal of the splint in three weeks, daily massage twice a day with replacement of the splint, and the abolition altogether of the latter in four weeks. The usual Dispensary practice, however, is splintage for five or six weeks.

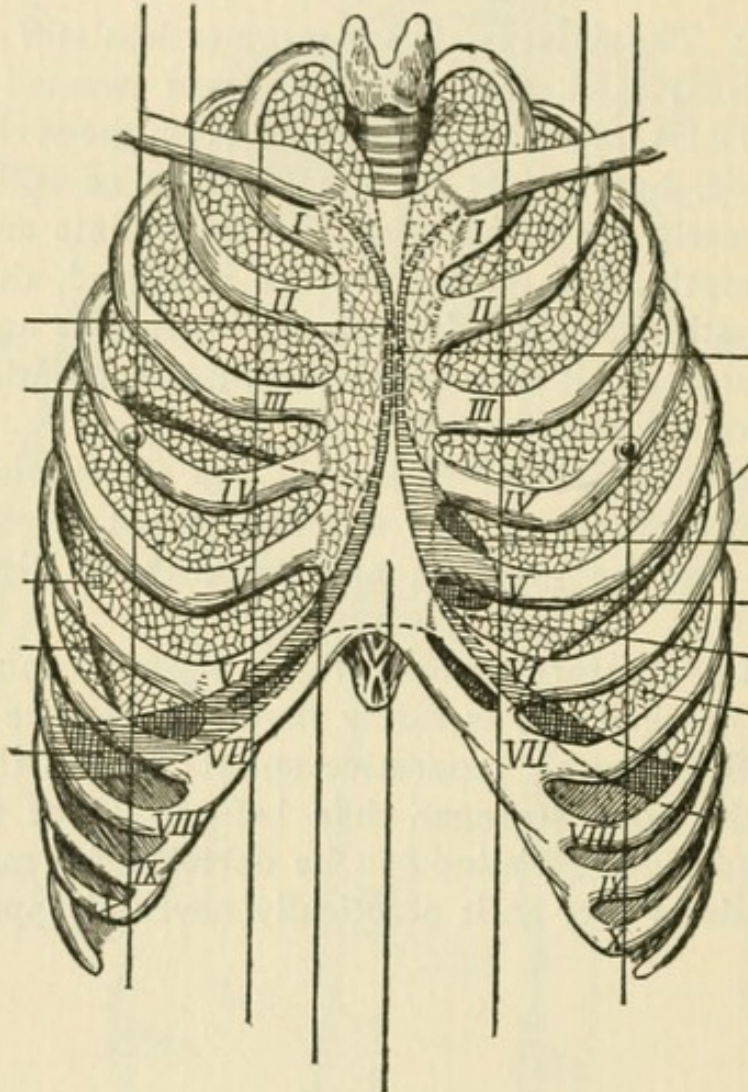
**RESULTS:** The wrist is always more or less stiff (ANCHYLOSIS) and the adjacent parts wasted (ATROPHIED), these depending in part on the severity of the injury, but mainly on the duration of splintage and the early use of massage. If the Splints are removed promptly, and if the parts be exercised, this wasting and stiffness soon disappears; but in the aged, and in rheumatics, it may persist for many months, and occasionally permanently.

Some DEFORMITY over the fracture-site, in the form of more or less swelling is not infrequent, but this can be great in amount without disabling the joint.

If re-fracture occurs, after a lapse of some months, the original site is rarely involved because the CALLUS (Nature's reparative splint) makes that section of the bone stronger than before. Once this injury has occurred, Callus can be detected for many years; in adults over 40 it practically never disappears.

## XI. FRACTURE OF THE RIBS.

**ANATOMY:** There are twelve ribs on each side, the seven upper being called **TRUE RIBS** because they are bony and firmly attached to the **STERNUM** (breast bone), and the lower five are known as **FALSE RIBS** be-



Relations of the lungs to the anterior chest-wall (after Joessel).

cause they are somewhat cartilaginous and unattached to any bone in front; of these five, **THREE** are joined to the ribs above by cartilage, but **TWO** are unattached or free, and are called **FLOATING RIBS**. (*See Diagram.*)

The ribs form a bony cage or lattice work, and with

the STERNUM (breast bone) in front and the VERTEBRAL COLUMN (spine) in back, go to make up the **thorax** (chest) or THORACIC CAVITY, containing the HEART and LUNGS, the latter being covered by a double layer of fibre called the PLEURA which also acts as a lining for the inner side of the ribs.

Between each rib is a space—INTERCOSTAL SPACE—filled in by muscle, and over each rib are many layers of muscle, and the bony part of each rib is further protected by a fibrous covering such as exists on every bone, PERIOSTEUM. All this, together with considerable motility and elasticity, acts as a protective, so that when a rib is broken, separation of the broken ends is usually slight, and the fracture is generally more of a slit or crack or fissure than an actual overlapping separation such as occurs in other bones.

The LUNGS are separated from the inner side of the ribs by the PERIOSTEUM (fibrous bony covering) and by the PLEURA (fibrous sac lining the chest cavity) and they do not come into contact with the latter except during very full inspiration; hence it is that a broken rib (unless much displacement of the broken ends occur) rarely penetrates or damages the lung.

The HEART is overlapped to a very great extent by the lung, and hence fractures of the ribs almost never involve it.

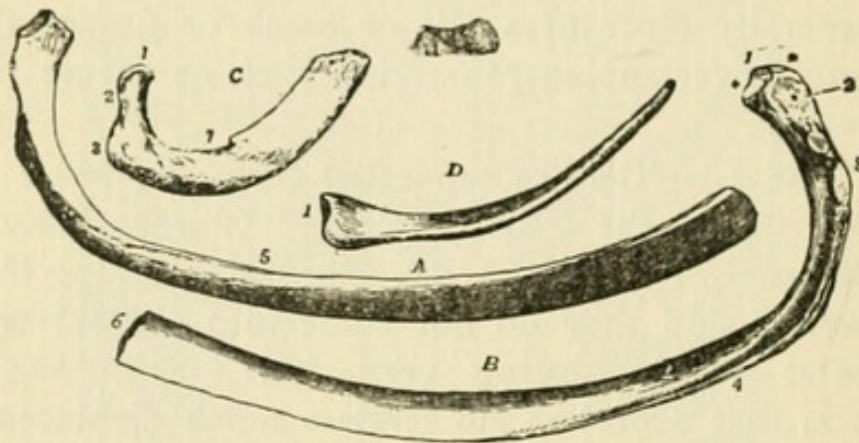
**FREQUENCY:** A very common injury, and of all fractures, various authors rate them as second, third or fourth in frequency; Stimson's work on "Fractures and Dislocations" (perhaps the best known authority) rates the fracture as the second in order of occurrence. Von Bergman's Surgery is one of the latest general textbooks and it states that the injury is the second most

frequent as to fractures, constituting from 15.9 to 16.07 per cent. of all fractures.

**LOCATION:** Ribs are broken at the most exposed portion of the chest, where they are longest and most bulging; hence the 5th, 6th and 7th ribs are the most often involved, the fracture site being generally in the line of the armpit ("Axillary Line"). The location can be fixed when it is known that the nipple is close to the fifth rib.

Fracture of the first rib is a museum curiosity.

The last two ribs, the 11th and 12th—the "FLOATERS"—are also rarely broken, because they extend only half way round the body, and their forward end



A and B, typical ribs; C, first rib; D, twelfth rib. A: 1, place of attachment to vertebral column (spine); 6, attachment to cartilage which joins it to the sternum (breast bone).

is unattached, permitting wide range of motion if violence is applied over them; Stimson says that he has only seen two cases of fractured twelfth rib, and quotes another authority who states that there are only two others in all literature.

The strongest portion of the rib is at its attached portions, that is, where it fits into the Spine and STERNUM (breast bone), the former being the stronger. (*See Diagram.*)

**CAUSATION:** Occasionally fracture occurs by MUSCULAR ACTION, as by lifting, or coughing, or sneezing.

Usually DIRECT VIOLENCE is responsible, as by a blow over the front or side of the chest, the break occurring at the place of impact or being transmitted.

The mechanism of the breakage of ribs has often been compared to a hickory barrel hoop attached at both ends; depending on where it is struck, the fracture occurs, but generally the widest part of the hoop is less resistant—this corresponds to the middle of a rib which is in the armpit line, as above stated.

**TYPES:** “Partial” or “Incomplete” fractures are rare and hard to diagnose with certainty because their symptoms almost equally well fit a Contusion or Sprain of a chest muscle.

“Compound” fractures (where the bone pierces the skin) are also rare.

“Complete” fractures are the most usual, and they generally cause a more or less vertical crack or split of the bone.

**SYMPTOMS:** There are three diagnostic signs:

1. Localized tenderness over the broken site on breathing and pressure and exertion;
2. Embarrassed breathing; generally a shortness of breath, with a catch in the speech and disinclination to talk;
3. Crepitus (clicking) on rubbing the broken ends or on listening; or abnormal motion between the fragments.

Coupled with the above, is frequently a characteristic anxious look; a favoring of the injured side in walking or moving; perhaps some duskiness of the lips; occasionally a short cough; and if the lung has been punctured (sometimes even without puncture) blood is expectorated in variable quantities.

**TREATMENT:** The one indication is to limit the normal

up and down motion of the rib, and this is done by placing a strap of ADHESIVE PLASTER (about 3 inches wide) three-fourths around the chest, making the fixed ends at the spine and sternum (breast bone); this adheres firmly and is applied while the patient has deeply exhaled so that in ordinary respiration it will force him to take shallow breaths and act as a splint.

Some of the older Surgeons advise plaster of Paris encircling the chest; this is obsolete now because it cannot be applied tightly enough to act as a splint.

**COURSE:** Knitting is very rapid, and to quote Stimson: ". . . the course of an uncomplicated fracture is usually quite uneventful; the patient remains quiet, sometimes keeping his bed, and breathes carefully and superficially to avoid pain; after two or three weeks he finds these precautions unnecessary, and the surgeon on examination finds that local tenderness has disappeared and that crepitus can no longer be obtained. . . ."

Healing is generally complete in from three to four weeks, and after this period light work can be resumed; for some weeks thereafter it is not uncommon for justifiable claim to be made of localized pain on deep breathing or exertion, but the **vast majority** of patients cease to even comment after three months.

There are many cases in which the individual has kept on working with a broken rib, and football players and boxers have many times sustained such an injury and continued physical exertion.

It is a very common Hospital and Dispensary experience to have laborers return to work after having a broken rib bound up with a "Strap of Adhesive Plaster."

An uncomplicated broken rib presents no difficulties, and of all fractures there is none that Nature has en-

dowed with more perfect natural splints (the muscles) and none in which healing is more rapid and uniform.

**COMPLICATIONS:** Because of the proximity of the Pleura (fibrous lining of the chest), in some fractured ribs there is an inflammation of this tissue—hence we have **TRAUMATIC PLEURISY**. This is usually localized to the vicinity of the fracture and subsides before healing is complete, and rarely causes serious delay in convalescence. If it is due to the injury, it develops within a day or two thereafter, and its treatment (like that of Pleurisy of other origin) is that of the broken rib, plus remedies to allay the accompanying cough.

The above Pleurisy is called a “Dry” Pleurisy to distinguish it from a “Wet” Pleurisy which occasionally follows it; this means that the normal fluid between the two layers of the pleura (the latter tissue acting as a protective and also as a lubricant for the motion of the lung) has increased in amount, resulting in **PLEURISY WITH EFFUSION** (“water on the lungs”).

Still more rarely, this serum-like fluid turns into pus and we then have **PURULENT PLEURISY**, also called **EMPYEMA**.

If the lung has been ripped by the broken end of a rib penetrating it (which is very rare except in severe **crushing** injuries), there may be extensive bleeding from the torn blood vessels and we have **HAEMORRHAGIC PLEURISY**.

The above varieties of “Wet” pleurisy are unusual complications and commonly are the associates of severe injuries only, in which Compound (break penetrating the skin) Fracture has occurred, usually of many ribs.

The “wet” products are removed by inserting a needle, or in some instances, by cutting out a portion of a rib and inserting a tube to drain away the effusion.

PNEUMONIA is also an occasional complicating development and is then called TRAUMATIC PNEUMONIA, and it occurs from direct injury to the lung by a broken fragment of the rib, or less often, by extension of a **Pleurisy**.

Its course and treatment follows that of Pneumonia from the usual origin.

Occasionally the end of a rib may penetrate the Pleura or the Lung and allow some air from the airtight Thorax (chest) to escape under the skin, giving rise to another complication called SKIN EMPHYSEMA; this shows itself in a bloated appearance about the fracture site, and the air bubbles may dissect the skin over the entire chest and even go as high as the face and swell it enough to close the eyes, but it almost always subsides in a short time, either spontaneously or through openings made purposely to permit its escape.

NEURALGIA of one of the nerves lying on the margin of the broken rib (Intercostal Nerve) may ensue, giving rise to INTERCOSTAL NEURALGIA, but this is very uncommon and usually indicates a rheumatic or neurotic individual.

**SEQUELS:** CALLUS (Nature's reparative solder) almost always persists in sufficient amount to be felt and often seen; but if the displacement between the bones has been slight, and if the union has been firm and true, the CALLUS will be less prominent. In a general way, persisting CALLUS follows broken ribs in an adult in amount sufficient to diagnose the injury by it alone within a period of five years; absorption of it is more rapid in some than in others, but the above statement is conservative.

Very rarely the Callus is stated to be more prominent on the inner than the outer surface of the rib, and in such instances an X-ray examination alone

(after a lapse of some years) would be determinative; but generally the Callus is uniformly distributed in the solder-around-the-broken-pipe-manner.

Even though the Callus be large in amount it causes no difficulty as a rule.

**PARALLEL CONDITIONS:** Pleurisy from other causes, even if extensive (and under such circumstances it usually is) once recovered from does not rob the patient of any of his chances and does not disable.

In practically all cases of Pneumonia there is more or less Pleurisy, but even with great involvement of the Pleura and the Lung, once recovered from, there are in the vast majority of cases no after effects.

The same is true of collections of fluid in the chest from causes other than injury; the pleura then usually remains somewhat thickened, but this constitutes more of a clinical than a disabling feature, and Life Insurance and Civil Service examinations can be passed with such manifestations persisting.

Even where a Pleurisy has turned into pus (Empyema) and where a piece of one or more ribs has been cut away to drain same (it is not uncommon to remove an inch or more of several ribs), the patient often recovers full strength, even though very much weakened by an associated attack of Pleuro-Pneumonia of which the Empyema is a sequel. In the event of such an operation, the patient may have a rubber tube stuck into the chest cavity (through a hole made by cutting out a piece of one or more ribs) and pus may drain for months, the chest "cave in," and yet recovery is very often complete.

The pleura is punctured by a needle with impunity in suspected cases of fluid within the chest cavity, and it readily resumes its function; hence it can stand considerable insult from injury and disease without resultant permanent weakness to the individual.

## XII. FRACTURE OF NECK OF FEMUR.

---

By this is meant a fracture at the bent portion of the thigh bone, where it joins the hip-socket.

**ANATOMY:** THE FEMUR or **thigh bone** is the longest and strongest bone of the body, and it is divided into three sections. (*See Diagram.*)

The upper portion, which fits into the socket of the **hip joint** (technically known as the **Acetabulum**), is called the **Head** and **Neck**.

The long straight portion below these is known as the **Shaft**.

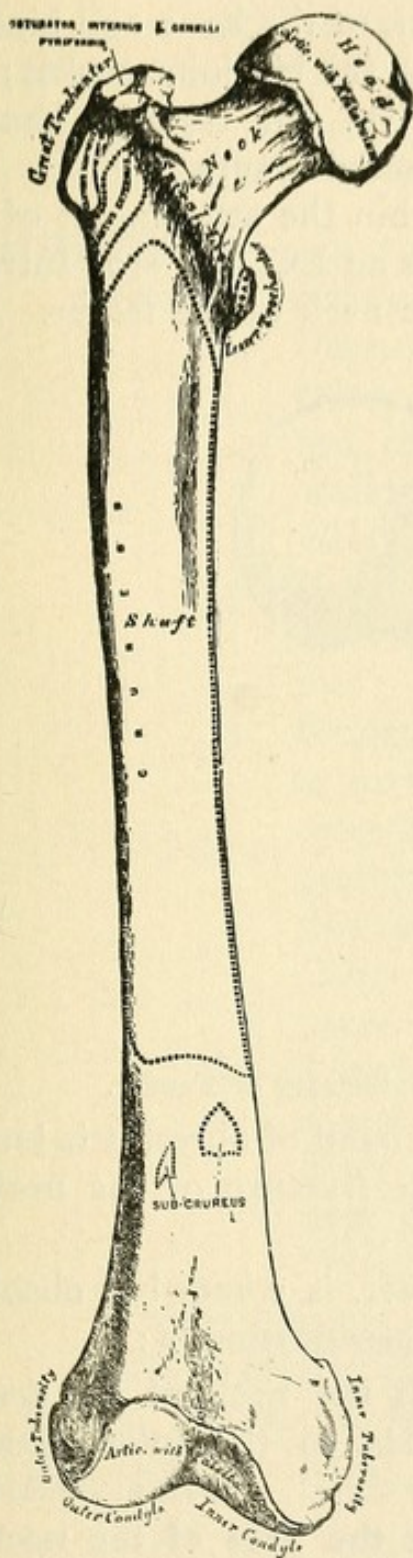
And the expanded part below this is technically known as the **Condyles**; that is, the flanges at the end of the bone.

FRACTURE MAY OCCUR at any portion of the entire bone, but very commonly occurs at the upper portion; that is, the **neck** of the femur. This is known as the **fracture of the aged**, and in any injury to the hip joint in a person over 45 years of age, it is a good rule to suspect this fracture until it can be excluded with absolute safety.

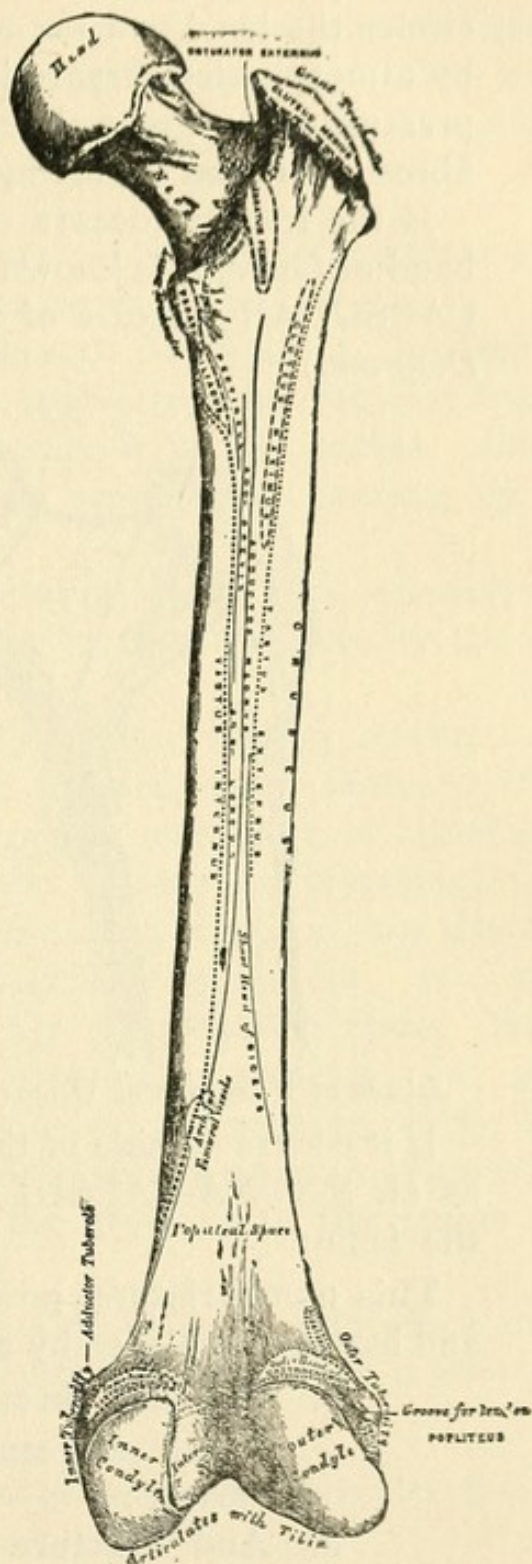
**FREQUENCY:** It is very common, and is liable to occur in those predisposed under conditions of slight violence, as by a trip, or an effort to regain one's balance; and, in certain old people (because of the fragility of the bone and the lack of bony and the preponderance of cartilaginous tissue), it not infrequently happens even from such slight exertion as the attempt to get out of bed hurriedly.

It may occur as a result of Direct Violence, that is, by a fall immediately over the hip joint; or by Indirect Violence, as by a fall on the feet, or a wrench of the joint.

**VARIETIES:** Fracture of the neck of the thigh-bone is di-



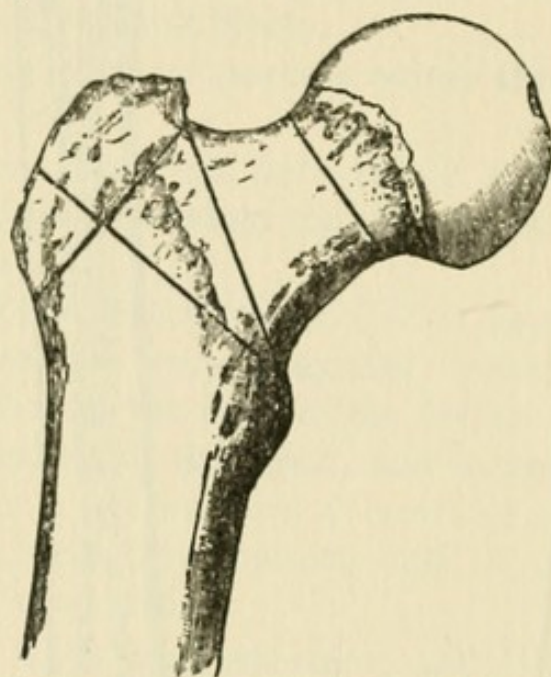
Right femur, anterior surface.



Right femur, posterior surface.

vided according to its relation to the **Capsule** of the bone, this being the strong band of fibre which encircles the head and the neck of the bone and binds it by atmospheric pressure into the hip joint socket; this pressure is so great that when this capsular band of fibres is torn, an exploding sound occurs.

If the fracture occurs within the attachment of this band of fibres, it is known as an **INTER—(or Intra)—CAPSULAR** fracture of the neck of the femur. (*See Diagram.*)



Lines of Fracture of Upper Extremity of Femur.

If it occurs outside of this band of fibres, it is known as an **EXTRA-CAPSULAR** fracture of the neck of the femur.

This nomenclature, however, is somewhat obsolete, and has been replaced by a classification of:

1. **Fracture through the neck** of the femur, which corresponds to the **intra-capsular** variety;
2. **And Fracture at the base of the neck** of the femur, which corresponds to the **extra-capsular** variety.

In former times, attempts were made to differentiate between these two types of fracture by the symptoms, but this is not now regarded as good surgery, nor is it possible except by **X-ray examination**, and for all practical purposes no attempt is made to needlessly separate a break in this location.

**SYMPTOMS:** There are certain cardinal symptoms of this fracture, and they can be stated to be:

1. Disturbance of function, so that the individual is unable to raise the foot from the bed, or rotate it in its socket, although walking is occasionally possible by great effort.
2. Pain on motion of the part, whether movement be voluntary or made by the examiner.
3. Deformity of the extremity, so that the foot is turned upward, tilted outward (technically known as **eversion**), or tilted inward (technically known as **inversion**). With this is associated more or less shortening.
4. Other associated symptoms, not always present, are discoloration about the hip joint; occasionally **crepitus** (a grating sound made by the rubbing of the broken bony ends); and sometimes abnormal fullness in the groin or in the region of the buttocks.

Many persons are able to walk with effort immediately receiving this fracture, but after a short interval, function is lost.

**TREATMENT:** This can be summed up under two headings:

1. Reduction or setting of the fracture.
2. Immobilization of the part.

Setting is very readily accomplished by traction on the foot which aims to place the extremity in the same straight line as the long axis of the thigh.

Immobilization takes the form of splintage by various forms of apparatus.

The commonest of these may be said to be what is technically known as the LONG SIDE-SPLINT; that is, a thin piece of basswood about 5 inches wide and about 1/2-inch thick, which is padded by cotton and bandages, and which reaches from the arm-pit to below the foot, and the thigh and leg and foot are bound to this by turns of bandages, sand-bags being placed on the inner side of the injured member to prevent any movement of the limb.

A PLASTER OF PARIS CAST is frequently used, and this begins at the toes and runs up the leg, and thigh, and across the abdomen, and it is technically known as a PLASTER OF PARIS SPICA BANDAGE.

Both of these are occasionally reinforced by a pulley attachment fastened to the leg, with a weight dangling from the foot, so as to overcome the tendency to shorten—this weight varying from 4 lbs. to 15 lbs.—and it is suspended over the foot of the bed, and changed from time to time, and usually can be dispensed with after the second week, if not before.

A third form of treatment is that known as the BUCK'S EXTENSION APPARATUS; and by this is meant a special form of splint which is bound to the under surface of the injured leg, this being grooved so as to rest in tracks on another piece of apparatus which rests on the bed, and from the patient's foot a pulley arrangement is attached with a weight, so that the grooved portion of the apparatus runs on the track, and allows considerable up and down movement of the individual, but in such a manner that the fragments

are not displaced. This type of apparatus, however, finds its chief use in fractures of the shaft or middle of the bone, where there is greater tendency for overriding and displacement of the broken fragments.

After all the apparatus is removed, the parts are gently, then forcibly moved, and later on massage is resorted to so as to prevent stiffness and wasting of the part.

**DURATION:** Depending upon the type of the fracture, but more especially on the individual's general condition, immobilization or splinting is determined.

If the individual be in good general condition, he is kept in bed from three to six weeks; but if this is bad, he is taken out of bed almost immediately, and the general health, rather more than the local fracture, is the object of treatment.

This fracture, **above and beyond all others**, is associated with a stagnation of the circulation through the kidneys and the lungs, producing in the first named what corresponds to a **congestion of the kidneys**, often developing into **URAEMIA**; and in the latter to a low grade of **pneumonia** (**HYPOSTATIC PNEUMONIA**) or **OEDEMA** of the lungs.

Both of these conditions are dependent on the lack of heart-pumping power to propel the blood through the kidneys and the lungs, and the watery part of the blood (because of the patient's lying so long on his back) oozes out and the parts become literally waterlogged and drown in their own secretions.

It is rare in the aged for a fracture of the neck of the femur to unite by what is known as **BONY-UNION**; and the best that can be hoped for is that the fragments may co-apt by bands of fibre joining them, and to this the name of **FIBROUS-UNION** is given.

For all practical purposes the latter acts as well as the former, and is what is aimed at in the treatment.

**DISABILITY** is generally absolute for six to ten weeks, at least, and thereafter the individual is able to get around with crutches; at the end of ten to twelve weeks he is usually able to get about with a cane or crutch, and at the end of the third month can usually get about with little or no support.

**RESULTS:** There are certain almost invariable **sequelae** of this condition, and they may be said to be:

1. **Limp** more or less pronounced;
2. **Eversion** (turning out), or **Inversion** (turning in) of the foot;
3. **Shortening**, with more or less stiffness of the hip joint, and occasionally also of the knee and ankle joint;
4. Lesser accompaniments are occasionally **Excessive Callus** (Nature's reparative tissue about the fractured site);
5. **Fullness in the groin**;
6. **Shrinkage** or "**ATROPHY**" of the muscles from disuse, thus obliterating the "gluteal fold;" that is, the crease at the junction of the buttocks and the thigh.

The **Limp** is dependent upon the amount of shortening, the presence or absence of stiffness of the hip joint, and the amount of **atrophy** or wasting of the muscles.

The amount of **Shortening** varies between one-half inch and three inches, and a certain amount of it can be compensated for by a tilting of the **spinal column** and the **pelvis** (bony margin of hips), so that the individual unconsciously bends toward the shortened side so as to make both limbs of equal length.

In a normal individual it is not uncommon to find limbs of unequal length, this discrepancy varying between one-eighth and three-quarters of an inch.

Shortening can also be compensated for by the wearing of an insole or a specially builded up shoe.

**ALLIED CONDITIONS:** Dislocation, Contusion, Sprains and laceration of the ligaments of the hip, all give points in common with the above, and a differential diagnosis can frequently only be made by repeated examinations, and oftentimes an **anaesthetic** has to be given to absolutely determine which exists, and even an X-ray examination may be the only method of obtaining early confirmation; however, after a short lapse, the diagnostic features are generally positive enough to prevent error.

### XIII. FRACTURE OF THE PATELLA.

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The PATELLA (derived from "Patella" which means "A little pan") is also called the knee-cap or the knee-pan.

**ANATOMY:** It is located in front of the knee-joint and covers same when the extremity is straight ("Extended") but when the part is bent ("Flexed") the Patella rides on the lower end of the thigh-bone ("Femur"); hence it is that some Surgeons claim that the bone cannot be broken by a fall upon the knee unless the limb chances to be in a straight position at the time the violence be inflicted.

Strictly speaking it is not a "bone" because made up of very thick cartilaginous tissue rather more than bony tissue; this accounts for the infrequent occurrence of the injury in those under 20 years of age because until that time, the "cartilage" element of bones is in excess of the "bony" element.

It is somewhat triangular or pear shaped, with the broad end uppermost, and is about 2 1/2 inches or 3 inches long, and 1 1/2 inches to 2 inches wide and from 1/2-inch to 7/8-inch thick; the front is smooth and covered by very dense "Periosteum" (fibre-like tissue covering every bone); the under side is in the form of two cup-like depressions to fit into the knobbed ends of the thigh-bone (Femur). The top of the bone is bound to the four very strong muscles of the front of the thigh in the form of a united tendon (QUADRICEPS TENDON), this being the strongest conjoined muscular band in the body. The bottom of the bone is bound to a prominence on the front of the shin-bone (Tibia) by a less strong tendon (PATELLA TENDON), and the sides are reinforced by thick fringes of the above referred to fibre-like covering of the bone ("Periosteum"). (*See Diagram.*)

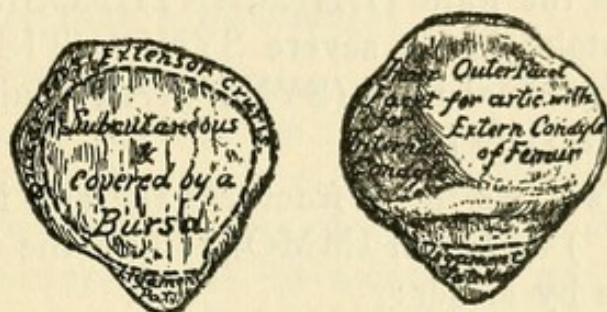
Hence it is seen that structurally, the PATELLA is the keystone binding the thigh to the leg and the hinge on which considerable knee joint motion depends.

The TENDONS mentioned are usually stronger than the bone, and the latter breaks before they rupture; of the two, the weaker PATELLA TENDON is the more frequently affected.

**FREQUENCY:** Comparatively a rare fracture, forming from 1 to 2% of all fractures.

From 80 to 88% of cases are in males.

Generally occur in those between 30—50 years of age; clinical curiosities in children for the reason stated above.



Right patella: a, anterior surface; b, posterior surface.

**CAUSES:** Results from DIRECT VIOLENCE, as by a blow or fall directly on the part; or by INDIRECT VIOLENCE AND MUSCULAR ACTION, as when by tripping in an effort to regain the balance, the knee is suddenly contracted, the TENDONS are put forcibly on stretch, and they literally tear the bone asunder. This last method is claimed by many to be the **only** way in which the fracture can occur, and it presupposes sudden leverage upon an over-bent knee.

**SYMPTOMS:** A sudden "snap" can often be heard or felt by the patient, and at the same time inability to use the knee is at once apparent; by firmly walking on the heel, it is possible with great effort to go a short distance, but bending the joint is totally impossible.

Aside from the above characteristic sign, there are also the usual symptoms of **all** fractures, such as **SWELLING**; **PAIN** on **PRESSURE** over the part; **CREPITUS** (a grating sensation, often audible); **ABNORMAL MOBILITY** so that the broken fragments can be laterally moved, oftentimes being separated an inch or more by the contraction of the **TENDONS**, and later by the fluid in the joint.

The bone is oftenest broken directly across (about 80% of cases) at a point just above the middle; occasionally, the line of cleavage may be multiple so that there are three or more fragments.

In no fracture is there a greater involvement of small blood vessels and by their tearing, much blood collects in the joint (**HAEMARTHROSIS**) and there is also established a severe **SYNOVITIS** due to an excess of normal joint (**SYNOVIAL**) fluid. (See article on **SYNOVITIS**.)

**TREATMENT:** As in **all** fractures the aim is to **REDUCE** ("SET") and then **IMMOBILIZE** the fragments; this is done by either:

1. The **NON-OPERATIVE** method.
2. The **OPERATIVE** method.

If the first named be adopted, the aim is to bring the fragments together by adhesive plaster straps (or other similar contrivance) and then to place the part in a Plaster of Paris or other form of knee-immobilizing splint.

The other method designs to coapt the fragments by means of stitches ("Sutures") introduced between the bony edges (silver wire fastened through drill holes) or by heavy catgut (or "Silkworm" gut) encircling the bone and penetrating the Tendons. This can either be done under Cocaine or by "Freezing" the part (Local Anaesthesia) without the aid of Ether or Chloroform (General Anaesthesia).

The present hospital vogue in New York is what is technically known as THE OPEN OPERATION METHOD in which a four inch incision is made vertically over the bone, and it is then united by a few sutures of silkworm or catgut and the joint placed on a long gutter-shaped tin or plaster splint, the superficial stitches being taken out in ten days, but those beneath are permitted to remain permanently.

Whatever the method, heavy splints are worn four or five weeks and then removed, and massage and gradual motion of the knee instituted; for six or seven weeks, or longer, a light splint (or heavy leather support) is used to prevent undue strain. Many persons wear a knee-cap for months, but this is often more of a reminder than a necessity.

**RESULTS:** The knee is always stiff (ANCHYLOSIS), but usually by the 10th or 12th week it can be bent to a right angle, the limit of bending being the measure of function; this degree of restoration meets all practical purposes, but in ascending and descending, a LIMP or other DISABILITY is apparent.

By continued use, and often by forced bending (under an anaesthetic) nearly full function is restored.

Occasionally the extremity cannot be fully straightened (EXTENSION LIMITED), but this does not rob the part of function and its disappearance keeps pace with that of the damaged bending power (FLEXION LIMITED.)

The muscles of thigh and leg are wasted (ATROPHIED) from the long disuse, but if massage be given early, and the joint be promptly used, this soon disappears.

In no bone is FIBROUS rather than BONY-union more usual, but even with the presence of the former, and a wide separation of the fragments, a functionally active knee is the rule.

In this, more than any other bone, refracture is liable unless care is taken; but it is most imminent within the first six weeks after the splints are removed. If it occurs, the line of cleavage is generally at the original site, this being because of the non-bony structure of the Patella (and hence the lack of the usual bony CALLUS), but mainly because fibre rather than bone so often unites the fragments.

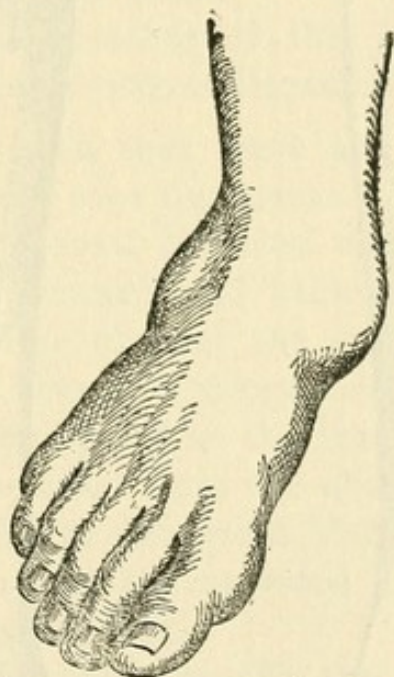
#### XIV. POTTS' FRACTURE.

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This fracture is commonly referred to as "the fracture of the ankle joint," and it receives its name because it was first described by a Dr. Pott, of England.

**ANATOMY:** The lower ends of the leg bones join a bone of the foot (ASTRAGALUS) to form the ANKLE JOINT.

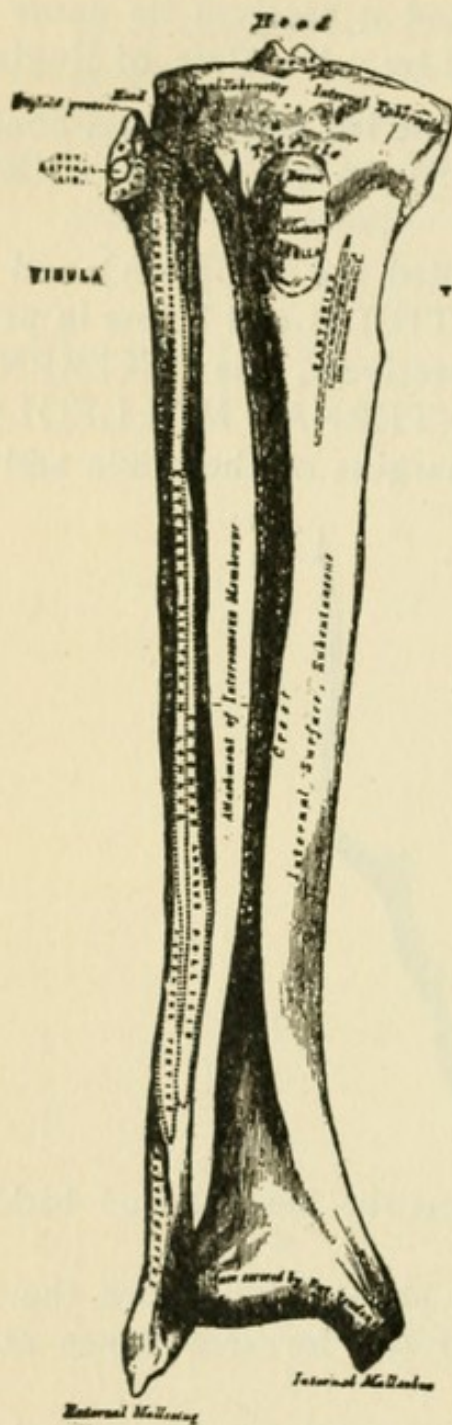
The outer leg bone (called the FIBULA) and the inner leg bone (called the TIBIA) end below in prominent flanges called, respectively, the EXTERNAL MALLEOLUS and the INTERNAL MALLEOLUS; these can be felt at the margins of the ankle and are



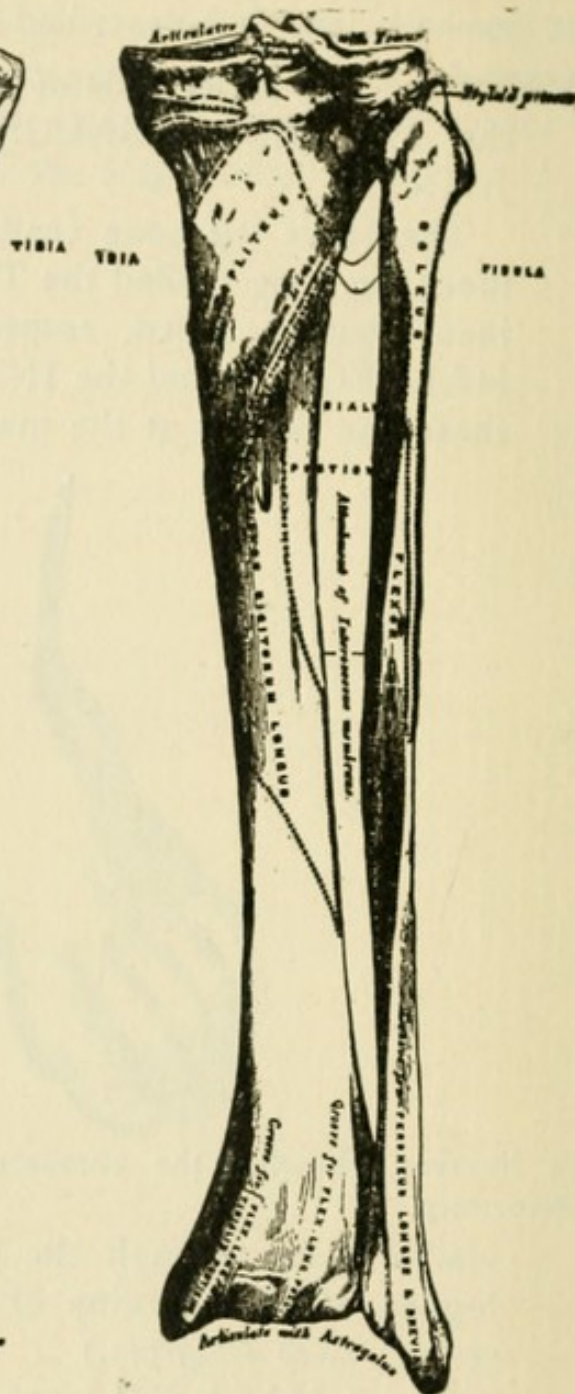
Pott's fracture, showing the characteristic outward and backward deformity.

visible even through the shoes. They are the analogues of the margins of the forearm bones at the wrist. (*See Diagram.*)

These MALLEOLI are bound to a square shaped bone of the foot (called the ASTRAGULUS) by strong ligaments, that on the outside being known as the EXTERNAL LATERAL LIGAMENT; that on



Bones of the right leg,  
anterior surface.



Bones of the right leg,  
posterior surface.

the inside, being the INTERNAL LATERAL LIGAMENT; there is also another ligament that holds these parts transversely, this being the INTEROSSEOUS LIGAMENT.

This fracture (according to the recognized classification of Stimson) involves:—

- (1) A break of the outer bone (Fibula) about three inches above its lower tip;
- (2) A break of the lowest tip of the inner bone (Tibia);
- (3) A chipping of the small prominence on the lower outer margin of the inner bone (Tibia); and
- (4) A tearing of the Internal Lateral and Interosseous Ligaments.

It is thus seen that there are three lines of bony injury and two torn ligaments. With the above, and because the normal relations are so much disturbed, there is an outward and backward deviation of the entire foot, this making the deformity so characteristic as to be instantly recognized. (*See Diagram.*)

The essential point in the fracture (however much it may be modified from the above) is the separation of the outer flange (External Malleolus) from the inner bone (Tibia) and the outward and backward distortion of the entire foot.

Various authorities modify the elements of the fracture, but the above is the standard employed in local Hospitals and Medical Colleges.

**SYMPTOMS:** As has been stated, the immediate deformity is typical of this injury alone, and with it is associated much swelling, pain, and total abolition of function so that it is impossible to bear unsupported weight on the injured part. Later, discoloration is extensive. The other corroborative signs of fracture are also pres-

ent, such as Crepitus (grating) and unusual lateral motion.

**TREATMENT:** The essentials of treatment are: First, the reduction or setting of the fracture, this not infrequently requiring the aid of an anaesthetic to overcome the above-mentioned deforming dislocation.

After this is entirely overcome, the part is put in a **temporary splint** (made of tin or wood) and ice-bags or other applications placed about the extremity to reduce the swelling.

Later—within a week or ten days—a **Plaster of Paris apparatus** is applied, with the foot sharply bent upward and inward; and this is allowed to remain in place for about two weeks, the patient preferably being on a couch or big chair. The apparatus is then removed and re-applied. If the swelling decreases before this interval, the Cast then becomes loose and requires earlier replacement. At the end of from four to six weeks all apparatus is removed except a snug muslin bandage, and massage, gradual motion and use of the part is insisted upon. Firm union of the broken bones is usually complete in about four weeks, and thereafter the greater use that is made of the part the earlier and speedier will be the recovery.

It is important that an old person be not allowed to remain in bed because of threatened stagnation of circulation through the heart, lungs and kidneys.

**RESULTS:** If the original deformity be not reduced and the fracture be not properly set, a permanently stiff and greatly deformed joint will ensue. If the apparatus be permitted to remain longer than four weeks without removal, or if it be retained for a period of more than six weeks, then some permanent stiffness (**ANCHYLOSIS**) of the ankle is sure to result from the more or less wasting (**ATROPHY**) of the leg muscles. In

persons over 45 years of age a somewhat damaged joint is reasonably sure, this taking the form of swelling, some tenderness, and inability to fully bend the ankle. A certain amount of pain is usually present for some time, especially after exercise and following changes of the weather.

At the end of from six to eight weeks the patient is usually able to walk with the aid of a crutch or cane, and in about three months is able to go to work.

There are certain exceptional cases in which the above period of treatment may be shortened or lengthened because of associated or unusual conditions; but even an extensively deformed ankle may permit of almost perfect function.

## XV. FRACTURE OF THE SKULL.

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**ANATOMY:** The Skull is a bony cage made up of the **Cranium** (which means a helmet) and the **Face**, comprising 22 separate bones; but for all practical purposes the Skull is that portion exclusive of the face, made up of 8 bones.

These bones are closely mortised to each other much in the same manner as would be the interlocked fingers, the line of junction being saw-tooth-like; these lines of union are known as **SUTURES**, and in early life they are unjoined to permit of expansion of the brain, and even in adults they are capable of considerable motility, this being a provision of Nature to overcome the effects of violence.

Each bone of the Cranium has three layers (or tables), an **Outer**, **Middle**, and **Inner**.

The **Outer Layer** or Table is thick and tough and very resistant. Attached to it is the **Periosteum**, or fibrous membrane that covers every bone.

The **Middle Layer** is soft, meshed like a sponge and designed to carry blood-vessels and act as a bumper between the outside and inside layers.

The **Inner Layer** is also hard, and it is grooved to permit the passage of large blood-vessels.

The Brain proper is also covered by three membranes (called Dura Mater, Pia Mater and Arachnoid), and between the outside layer of the Brain and the inner layer of Skull is a layer of fluid, the Cerebro-Spinal fluid, this extending into the spinal cord by a hole in the bottom of the skull.

Hence it can be seen that the contents of the skull are well protected by thick bones (that yield somewhat

to pressure), by a bumper of water, and by a fibrous network on the inside of the skull and the outside of the brain.

The bone at the back of the head (Occipital bone) is the strongest of the skull, that of the forehead is next in thickness (Frontal bone) and those at the side of skull (Parietal bones) are the thinnest; the densest and hardest section of the entire region is that prominence just back of the ear known as the "Mastoid Process."

The danger of a skull-injury depends in large measure upon the site of the infliction of the violence for the reason that all portions of the underlying brain do not perform equally important functions; for example, a blow on the back of the head would need to be given with much force before that section of bone would fracture, and further, this portion of the brain could stand considerable insult without appreciable effect. But if a fracture were to occur in the vicinity of a line joining the tops of the ears, running over the crown of the head, serious effect could result from lesser violence and the damage might be greater because of the important underlying functioning segment of the brain.

It has been well said that the Brain is comparable to a Hotel in which some rooms are furnished, occupied and doing work; others are idle and of no proved value. The brain has been divided into "rooms," many of them occupied (called "Centers"), some of them unoccupied, and if the latter, then that section is referred to as a "**Silent Area of the Brain.**" These have been accurately located by repeated animal experimentation, and also by observation in cases of severe head injury in which portions of the brain have been pulpified and even scooped out; and, further, where at autopsy or on the operating table, large

growths have been found instead of normal brain tissue, the symptoms in life not pointing to any such possibility.

**TYPES OF FRACTURE:** These depend on the (a) Site and (b) Degree of the fracture.

(a) The **Site** is arbitrarily determined by an imaginary line that passes backward from the outer border of the eye-socket, to the exit of the ear, to the prominence of the back of head ("External Occipital Protuberance"), and thence to the starting point.

Any fracture above this line is called a **Fracture of the Vault**, and any fracture below is known as a **Fracture of the Base of the Skull**.

(b) The **Degree** is determined by the amount and sort of violence, and we may have the following varieties of Fractured Skull:

**Simple**, in which there is a crack or crevice without breaking of the skin.

**Compound**, in which there is a crack or crevice with breaking of the skin leading to the fracture-site.

**Depressed**, in which the bone is dented or pushed in, either without (Simple) or with (Compound) a break in the skin.

**Comminuted**, in which there is fragmentation of the bone, either Simple or Compound.

**Linear**, in which there is a line-like crack, either Simple or Compound.

**CAUSES:** Always due to (a) **Direct** or (b) **Indirect Violence**.

(a) **Direct Violence** means that the impact has been delivered directly over the fracture-site, as by a fall, or blow with a hammer.

(b) **Indirect Violence** implies that the force has been transmitted from a distance,

as by a fall on the feet or buttocks;  
this form is rare.

**SYMPTOMS:** These depend on the Site, Degree and Extent of the fracture, and somewhat on the age and general physique of the individual.

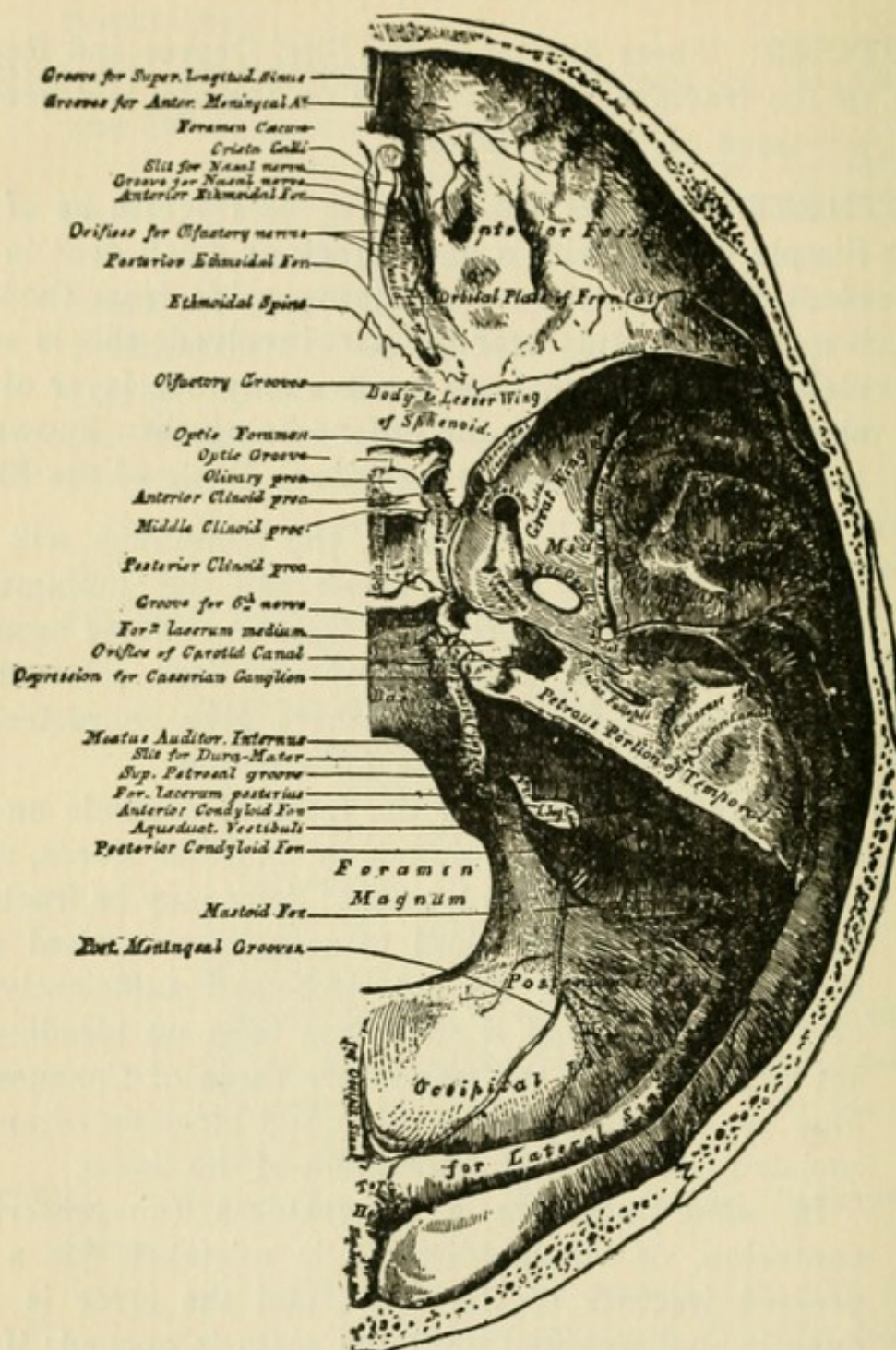
**FRACTURES OF THE VAULT:** If the fracture be of the Simple variety with a mere crack or small dent in the skull, there will be no symptoms aside from those of bruises or wounds near the part involved; this is especially true if the fracture involve only one layer of the skull—almost always the outer—being then known as a fracture of the **External (Outer) Table of the Skull**.

If the skull be Depressed, the symptoms will depend on the site of the break and the amount of pressure due to the driven-in fragment; some sections of the brain (as stated above) are little affected by considerable pressure, but others give characteristic signs which are too diverse for mention.

The entire outcome of the fracture depends on the degree of pressure symptoms, or, in other words, upon the extent of brain-involvement; there may be fracture-lines enough on the skull to suggest a cracked egg-shell, but if these are not depressed sufficiently to cause pressure, and if there has been no bleeding to act likewise, then the effects are those of Concussion, plus the swelling, discoloration and bleeding of an associated Contusion or Laceration of the Scalp.

In some instances a Haematoma (circumscribed contusion, or "blood-blister") is mistaken for a depressed fracture of the skull, and the error is frequently undiscovered until the scalp is opened; if the diagnosed depression has been large, and if it disappears after the swelling subsides (without operation), there of course has been no injury except to the soft parts.

If the fracture be of the "Compound" type, the associated wound receives the same treatment as would



Base of the skull, inner or cerebral surface (Gray), showing the Anterior, Middle and Posterior Fossa.

a wound in any other location; the danger in such an instance is the possibility of infection (poisoning) of

the wound by germs which might traverse the fracture-line and cause involvement of the brain-coverings (Meningitis), and later damage the brain tissue enough to produce Abscess of the Brain. Complications of this sort are, however, rare and very remote under proper surgical care.

Children stand head-injury much better than adults because their bones are more elastic.

**FRACTURES OF THE BASE:** These may occur as the primary injury, or be associated with a fracture of the vault, and vice versa.

The base of the skull is divided into three shallow basins, called respectively the ANTERIOR, MIDDLE and POSTERIOR BASIN, or FOSSA, and from each fossa there are certain openings leading to the external air. (*See Diagram.*)

The **symptoms** depend, to a considerable degree, on which fossa is broken, but in a general way, a fractured base of the skull will present some or all of the following:

- Concussion symptoms, especially unconsciousness;

- Bleeding from the nostril or nostrils, from the mouth, from the ear or ears, and "blood-shot" eyes ("Subconjunctival haemorrhage");

- Changes in the pulse and respiration.

If the brain itself be involved, or if bony or bloody pressure be present (as by a clot), there may be:

- Paralyses of groups of muscles;

- Deviation of the eyes;

- Changes in the reflexes;

- Impaired control of bowels and bladder;

- Convulsions.

The **cardinal signs** of "fractured base" are:

- Unconsciousness, and bleeding from the nostril or ear or mouth or into the eyeball.

What has been said regarding each type of fractured skull applies universally; viz., unless there is pressure on the brain (by bony fragments or blood clot), the broken bone is of little importance. It was formerly considered mortal to sustain a fracture of the skull, especially a basal fracture, but there are countless cases of even extensive depression with marked signs of brain injury in which perfect recovery has occurred.

**TREATMENT:** The rule is, "Do nothing radical unless there is pressure enough to give symptoms," then relieve the pressure by operation which trephines over the pressure-site, elevates depressed bone, removes blood-clots, or otherwise meets the emergency by appropriate surgical means.

Fractured base of the skull is inaccessible to surgical methods, and all that is aimed at is the disinfection (by mild antiseptics) of the bleeding zones (eye, mouth, ear or nose); if symptoms arise pointing to brain involvement, subsequent steps are determined by the individual signs presented.

**RESULTS:** The usual linear **simple** fracture of the **Vault** makes a complete recovery within a short time, but it must be remembered that such a condition cannot be positively diagnosed unless the scalp be incised; hence nearly all skull-fractures are originally "compound" in type or are made so by the Surgeon.

The **Compound** type differs from the above only in the presence of the wound, and if healing in it is prompt, the scar is the sole remnant in the majority of cases.

The **Depressed** fracture becomes of importance if thereby pressure is induced in a functioning location; if the pressure be promptly relieved, and if the brain

tissue has been uninvolved, and if the brain-coverings do not become adherent, recovery is the rule. The individual usually carries a scar and has a hole in the cranium to mark the site where the trephine was applied; such a defect (if small) is sometimes filled in by new bone, otherwise a special plate can be inserted. There are many persons who have had a very extensive removal of bone, and in whom the brain can be seen to pulsate through the skin covering the bony defect, and despite this apparent structural damage, they have perfect mental power.

**BASAL FRACTURE** is a serious condition because the brain or its coverings are so often affected. In this location are the "Twelve Pairs of Cranial Nerves" controlling the special senses and facial expression, and some of them are frequently involved, especially the nerves of the eyes and ears.

Bleeding from one orifice (as an ear) is usually an indication of a fracture without much associated brain-damage and complete restoration is probable, even though the ear-drum has been extensively torn.

It has been said that if the patient survive twenty-four hours, his chances are good.

It is not uncommon for persistent special-sense defects to occur, these commonly taking the form of deafness, impaired or distorted vision and perverted taste and smell; occasionally also there will be paralysis of groups of muscles, as of the face or an extremity.

There are occasionally after-effects in the form of Epilepsy, Memory Defects, Gait-unsteadiness, Eye and Ear difficulty, and Diminution of Muscular Power—but in every such instance, there has been some associated injury to the brain or its coverings.

A well-known authority (Phelps' "Traumatic Injuries of the Brain") says that of 245 cases of fractured base, only six showed involvement of the optic

nerve, and that if the nerves of the eye are to be affected, signs thereof occur within the first two weeks.

This same author also says that the callus (Nature's reparative solder) following linear fracture is very slight, and in fractured base, persistent callus is practically unknown; hence it is specious to claim after-effects from the pressure of such a substance.

As to fractured base he says that approximately 36 per cent. of the 286 cases reported made a good recovery, and many of these were gunshot wounds and very severe falls (from scaffolds, into holds of steamers, down stairs, from windows, etc.), and if the cases due to such great violence were excluded, he estimates that approximately 50 per cent. would recover.

There are frequently many subjective symptoms claimed such as buzzing in the ears, spots before the eyes, dizziness, headache, unsteadiness in gait (especially when at a height or in ascending or descending), nausea, and diminished mental aptitude. Some of these are natural sequels, but if unassociated with objective findings, and if not borne out by the person when apparently unobserved, they are assumed or a part of a neurasthenic condition.

**SUMMATION:** Fractures of the skull, per se, are unimportant, and they become dangerous and permanently damaging only when there has been associated injury to the brain by pressure (depressed fragments of bone, or blood clot) or by actual laceration or destruction of its tissue. In fracture of the **Vault**, these sequelæ are infrequent; in fracture of the **Base** they are common, but not to the extent formerly believed as statistics show that from 36 to 50 per cent. of such cases recover.

The possibility of remote after effects (of which Traumatic Epilepsy, Memory and Eye and Ear Defects are types) depend in great measure on the in-

itial variety, location and severity of the fracture, and if signs of structural involvement are lacking after the stage of convalescence, subsequent symptoms may or may not be attributable to the original trauma, and differentiation must be made with great care and only after rigid examination.

## XVI. DISLOCATIONS.

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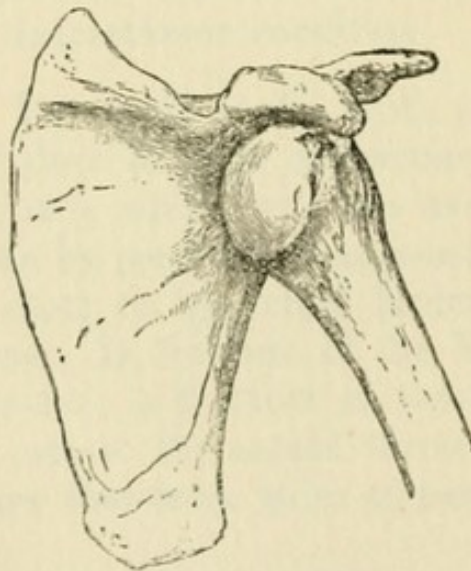
A dislocation is the separation of the ends of the bones entering into the formation of a joint. The condition is sometimes called a "Luxation."

All dislocations are attended by a tearing of the ligaments about the joint and synovitis (excessive fluid in a joint).

### CLASSES:

- A. **Simple Dislocation** is where the bones are merely out of place **without** the presence of a wound. Also called a "closed" dislocation.
- B. **Compound Dislocation** is where the bones are out of place **with** the presence of a wound; this class is very rare and is usually associated with a fracture. Also called an "open" dislocation.
- C. **Partial or Incomplete Dislocation or Sub-luxation** is where the bones are but partly displaced and spontaneously or easily resume their normal position. This is the classification of the older Surgeons, and is not given much prominence to-day.

**FREQUENCY:** Comparatively common, but only one-tenth as common as Fractures.



The commonest form of Dislocation of Shoulder ("Subcoracoid Dislocation)."

The shoulder is most frequently dislocated, forming

from one-third to two-thirds of all dislocations. Next in frequency are the elbow and ankle. (*See Diagram.*)

**CAUSATION:** Some persons have a normal "Dislocation Tendency" from their conformation ("Loose-jointed"), or from previous inflammation of a joint.

The ordinary causes are: External violence, as by a fall directly on the joint; or muscular action, as in pitching a ball, thus "throwing the shoulder out of joint."

**TREATMENT:** Can be summed up by the three "indications":

1. Reduce or "Set" the dislocation; this is done by pulling on the parts or by special manipulation.
2. Immobilize it by bandages or apparatus.
3. Massage and gradual motion after a short time.

If a wound be present, it is treated on general principles. After the dislocation has been "set," the injury practically becomes similar to a lacerated ligament with Synovitis (fluid in joint).

**RESULTS:** When the bandages are removed, a certain amount of ATROPHY (wasting) has occurred because of the disuse. This results even when an uninjured part has been kept idle for a similar period, and hence is not due directly to the injury itself.

The joint is more or less stiff and full use of it can not be made; and, if bandages have been employed longer than the requisite period, a certain amount of ANCHYLOSIS (anchoring or fixation) may be present so that motion is interfered with to a considerable degree.

This may be either FIBROUS ANCHYLOSIS, where the joint is bound by inelastic bands of fibre; or BONY ANCHYLOSIS, where the bones of the

joint are firmly bound together by **bony tissue**. (This is rare.)

**FIBROUS ANCHYLOSIS** is overcome by massage and use, and generally leaves no permanency.

**BONY ANCHYLOSIS** is remediable to some degree by operation, but some permanent disability or deformity is invariable.

**DISABILITY:** This depends upon the site of the dislocation, its type (simple or compound), and the method of treatment (especially as to the time the dislocation is set and the period of bandaging), and on the individual.

In a general way idleness should not extend over six weeks, but if **ANCHYLOSIS** be present, this is more or less lengthened.

## XVII. STIFF JOINTS.

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Such a condition is technically known as ankylosis (sometimes spelled anchylosis), and by it is implied either partial or complete limitation of normal joint motion.

There are two sorts of stiff joints as to manifestation:

1. Fibrous stiffness, or "False" ankylosis, or adhesions;
2. Bony stiffness, or "True" ankylosis, or adhesions,

**FIBROUS ANKYLOSIS** is that due to the joining together of the joint surfaces by more or less elastic bands of fibre, either in the form of individual strands or as a diffused network of "adhesions."

This form of ankylosis occurs most commonly after fractures, dislocations, sprains, synovitis and inflammatory conditions of the interior of the joint; and also from disuse consequent upon the foregoing or bad treatment.

**BONY ANKYLOSIS** is less common than the above, and is the joining together of the joint surfaces by bony tissue. It is usually an accompaniment of severe or compound joint-fractures, and implies that the normal cartilaginous covering of the ends of the bones has been destroyed, and thus the irregular exposed bony surfaces glue together. New bony tissue is then interposed, the process of formation being not unlike the healing of a broken bone by callus.

This form of ankylosis only follows if the ends of the bones have been denuded, and hence there is nothing in the form of cartilage separating the apposing surfaces to prevent bony bands from interposing.

### **ANATOMY:**

Roughly speaking, all joints are of two varieties:

1. **HINGE JOINTS**, as the elbow and ankle;

2. **BALL AND SOCKET JOINTS**, as the shoulder and hip.

In the first variety, there is practically only a forward and backward, or up and down motion. In the second, there is the hinge action, but in addition, rotation.

The ends of the bones forming the joint are capped by a layer of cartilage for ease of motion, affording an elastic smooth wearing buffer surface.

Within the joint cavity (which is usually air tight), there is a lining of thin fibre called the **SYNOVIAL MEMBRANE**, which secretes an oily substance acting as a lubricant, this being called **SYNOVIAL FLUID**. When this membrane becomes inflamed or irritated, the secretion increases, the fluid accumulates, and **SYNOVITIS** ensues; every membrane in the body acts in an identical manner, a "Cold in the head" being an apt illustration of increased secretion from an irritated surface.

All the joints are richly supplied with a network of blood vessels, and in some deep seated joint injuries (most commonly in the knee), these vessels break, blood accumulates and mixes with the **SYNOVIAL FLUID**, and we have what is technically known as **HAEMORRHAGIC SYNOVITIS**; this is also sometimes called **HAEMARTHROSIS**.

### **INJURIES CAUSING ANKYLOSIS.**

1. Contusions;
2. Sprains;
3. Dislocations;
4. Fractures.

**CONTUSIONS** must be exceedingly severe in order to produce a joint stiffness, and the latter results therefrom either by direct injury to the joint surfaces, resulting in **SYNOVITIS**, or from disuse of the part due to prolonged bandaging or splinting.

In such a case there will be external evidences in the form of discoloration or swelling about the soft parts

near the joint, and, in addition, the accompanying signs of SYNOVITIS (see article on this topic). The accumulated synovial fluid is absorbed, or otherwise removed, or some of it may remain and become converted into fibre-like tissue, binding together the joint surfaces as by a strong network of threads. The longer the part is kept immovable, the tighter and stronger will these bands become, and in time (if untreated) the gluing becomes so firm as to be almost unbreakable.

**STRAINS** act in an identical manner to the above, but the effect is usually more severe.

**DISLOCATIONS** act as do the foregoing but to an advanced degree, because there is a tear in the capsule about the joint in every dislocation, and this adds to the inflammatory reaction within the joint. The amount of resulting stiffness is also greater because of the necessarily longer period of bandaging or immobilizing.

**FRACTURES** act mainly because the prolonged disuse of the involved part lessens the normal secretion of the synovial fluid, the joint is improperly lubricated, and ceases to do its normal work when called upon after a period of inactivity; joints are like any hinge that gets rusty from lack of use.

### **DIAGNOSIS.**

Granting that any of the above four named injuries have occurred with the accompanying disuse, there are certain corroborative evidences of an alleged inability to move a joint, and of these the most important are:

1. **ATROPHY** or wasting of the muscles that normally move the joint;
2. **FLABBINESS** of the muscles;
3. **INABILITY TO ROTATE** or otherwise move one or both of the bones entering into the formation of the joint;

4. **INABILITY TO CONTRACT** the muscles about the involved joint, because of their lessened power.

The extent of the above quartet of signs depends on the location, nature and treatment of the original injury, but within six weeks a disabled joint will show most or all of these corroborative evidences.

**ATROPHY** (or wasting) is the cardinal indication that the part has not been used, for the muscle tissue is the motive power, and it is an invariable rule of Nature that an idle part or organ shrinks and finally becomes useless or disappears. This wasting is directly proportionate to the amount of stiffness and disuse existing and affects the muscles normally operating the joint to the extent of producing a visible or measurable diminution, or both.

**FLABBINESS** is the accompaniment of the wasting and is based on the same causation, that is, lessening of tone following inaction.

**INABILITY** to perfectly use the joint is the sequence of the above, and in a part that is genuinely stiff or fixed, it will be impossible to move the separated joint surfaces without moving all the bones entering into the formation of the joint; for example, in a genuinely stiff shoulder, not only will the arm be incapable of full up and down motion, but there will be also a movement of the entire shoulder-blade when attempts are made to perform any of the usual arm motions, because the arm is firmly glued into the socket of the shoulder-blade, and for functional purposes there is no separation or joint.

**INABILITY TO CONTRACT** the muscles is also a necessary sequence, because there is so much loss of muscular tissue and tone that normal action of the muscles is prevented and function is impaired.

Of course, the firmer and more complete the stiffness,

the greater will be the prominence of the above diagnostic symptoms; in addition, there are other less important, but corroborative

### **ACCESSORY DIAGNOSTIC SIGNS:**

1. **TEXTURE** of the skin. If it be firm and hard or calloused, the surmise is that function is not abolished to the claimed extent.
2. **SENSATION** to pain and touch is usually lessened to some degree, especially in long standing and severe cases.
3. **ACTION** of surrounding joints is sometimes diminished because they also are less used; for example in a stiff shoulder, the elbow would be less employed than normally and perhaps exhibit some of the signs of the involved joint, especially as many of the affected muscles have an action on both joints.
4. **TRANSPOSAL** of function so that the opposite unimpaired side become more dexterous; this is well shown where a right side is injured, the left being trained to take its place.
5. **ATTITUDE** of unconsciously favoring the affected part in every movement; to a trained eye, this is one of the most certain of signs.

### **COMMON SITES OF JOINT STIFFNESS.**

1. **SHOULDER**:—This may be total, but commonly is claimed to affect motion **beyond** a right ankle so that the outstretched arm can be lifted only as high as the shoulder. Common causes of this are:
  - (a) Dislocation of shoulder;
  - (b) Fracture of upper end of arm;
  - (c) Fracture of Clavicle (collar bone);
  - (d) Sprains of much severity.

If the disability is genuine, the **most apparent** signs will be:

- (a) **ATROPHY** (wasting) of the Deltoid muscle

(that which caps the outside of top of shoulder) and to a lesser degree of Trapezius muscle (that on back of neck reaching to top of shoulder-blade).

- (b) ATROPHY of Biceps and Triceps muscle (middle of arm).
  - (c) FIXATION of head of arm bone so that it cannot be rotated without moving the shoulder-blade.
2. **KNEE**:—Stiffness here may be total, either in a straight or partly bent position, but commonly the claim is that the part cannot be bent beyond a right angle.

Common causes of this are:

- (a) Fractures about the joint, as of the Patella (knee-cap) or lower end of Femur (thigh) or upper end of Tibia (shin);
- (b) Synovitis of knee due to severe Contusions or Sprains.

If the fixation be genuine, there will be;

- (a) ATROPHY of the muscles above and below the joint;
- (b) WRINKLING or swelling of the joint itself depending upon the underlying cause;
- (c) DIMINISHED or abolished motion between the lower end of the Femur (thigh) and upper end of Tibia (shin);
- (d) APPEARANCE of the shoes; in a genuine stiffness, there will be a limp or swinging of the foot to cause wearing of the sole in a manner different from the opposite.

3. **HIP**:—This is rarely total, but most frequently the claim is (as in the foregoing) of the inability to bend beyond a right angle, or of being fixed in some vicious position, so that lateral as well as up and down motion is limited.

Common causes are:

- (a) Sprains or very severe Contusions accompanied by Synovitis;
- (b) Fractures of Neck of Femur (thigh at hip-socket).
- (c) Dislocations.

4. **ELBOW**:—the most common abnormal position is one midway between a right angle and a straight position but all intermediate degrees are met with.

Common causes are:

- (a) Severe Contusions and Sprains in which long immobilizing (splints or bandages) has been employed:
- (c) Fractures; as of the upper end of Ulna (inner forearm bone) or Radius (outer forearm bone) or lower end of Humerus (arm bone).

The HIP and ELBOW give corroborative signs similar to those mentioned for the SHOULDER and KNEE. Any of the other joints may be similarly affected by a like set of causes, the rule being that stiffness is directly proportionate to the severity of joint damage and the period of disuse.

### LIMITS OF NORMAL JOINT MOTION.

There are very few joints called upon to perform their full limit of motion in order that an individual may carry on his usual occupation; only an acrobat is concerned as to the ability to bend the knees far enough to cause the heels to meet the buttocks, or to spread the hips to the extent of "doing the split." This gives rise to the phrase, "FUNCTIONAL ACTIVITY OF A JOINT", this implying the usual and ordinary motion performed by the part during average daily necessity. Hence it is that the measure of success after a joint injury is dependent upon its relation to the "functional activity" of the joint, and not upon the "physiological activity", the latter meaning the fullest possible range of motion by unusual effort. A joint functionally recovers following an injury when all practical purposes are subserved, despite the

fact that extraordinary actions are diminished or abolished.

Surgeons also make use of the term "THE NORMAL CARRYING ANGLE", meaning thereby the usual position assumed by a joint when unengaged in some special act.

The CARRYING ANGLE of the arm at the elbow is not a straight line (180 degrees), but there is a slight outward bend of the elbow (with the hand dangling at the side with inturned palm) causing the extremity to assume an angle of 160 degrees; hence it is no measure of elbow recovery to assert inability to make the arm and forearm assume a straight axis.

Similarly the KNEE AND WRIST are not in the same absolutely straight axis to the limb to which they are attached.

#### **CAUSES OTHER THAN INJURY FOR JOINT STIFFNESS.**

1. RHEUMATISM affecting the joint itself or the muscles adjacent.
2. NEURITIS (inflammation of nerve fibre) due to any cause other than injury, such as ALCOHOL, LEAD, ARSENIC (or other poisons) or to OCCUPATIONS calling for constant pressure along nerve trunks; or to germ diseases, such as GRIPPE and TYPHOID FEVER.
3. DISEASE of germ origin, notably GONORRHOEA in the form of GONORRHOEAL RHEUMATISM.
4. BRAIN OR SPINAL CORD disease, of which APOPLEXY and LOCOMOTOR ATAXIA are types.

**TREATMENT:** This may be said to be (a) Prophylactic (preventative), and (b) Curative:

- (a) PROPHYLACTIC treatment aims to secure use of an injured joint before idleness causes or increases stiffness; with this in view, Splints and Bandages are early removed, massage and gradual use instituted and stiffness overcome. (See Treat-

ment in "Fractures", "Dislocations", and "Sprains and Contusions").

(b) CURATIVE treatment aims to break up the fibrous or bony bands ("Adhesions") locking the joint, and this is done by:

1. Massage (by hand, or vibratory machine);
2. Slight movement of the joint, by Doctor or patient or attendant;
3. Forced movement of the joint, by Doctor or patient or attendant;
4. Electricity;
5. Chloroform, or Ether, or "Laughing Gas";
6. Operation.

When the joints are firmly bound, the administration of small amounts of Chloroform, or Ether, or "Laughing Gas" (Nitrous Oxide) will relax contracted muscles and permit painless forced motion; under such circumstances, the "fibrous adhesion" can be frequently heard to snap when "broken up."

If the above method fails, incision into the joint is needed, the adherent surfaces are partly severed, but full restoration does not usually occur if the relaxation be firm enough to require this procedure which is usually demanded only in bony ankylosis.

Certain Surgeons and Hospitals employ an apparatus (technically known as an Arthromotor) to mechanically move stiff joints, and many remarkable results are thereby obtained in apparently hopeless cases.

## XVIII. HERNIAE.

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A HERNIA, commonly called **rupture**, is the protrusion of any organ, or portion of an organ, from its normal position within the body.

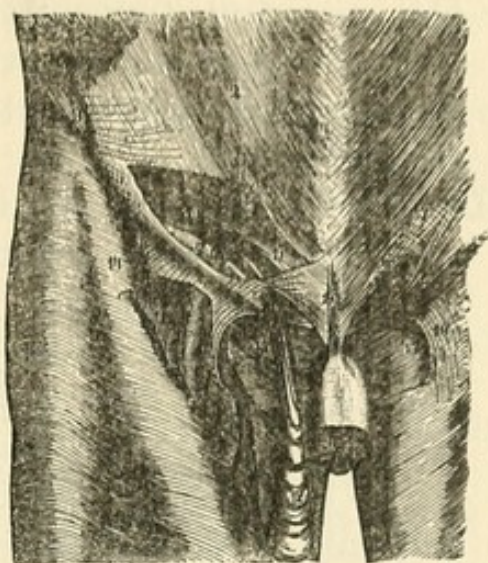
As ordinarily applied, the term means the presence of a **rupture in the groin**, this remaining therein or pushing its way further down to show in the scrotum (bag enclosing testicles).

**ANATOMY:** That part of the body in which Herniae (Ruptures) most often appear is the lower segment of the abdomen in the region of the groin, this latter being technically known as the **INGUINAL REGION**, and it corresponds to the crease at the junction of the front of thighs and the abdomen.

This part of the body is layered by many muscles which are superimposed in a shingle-on-a-roof manner, and normally there are no intervening spaces through which the abdominal organs might escape under the influence of sudden or prolonged pressure. However, in the lower inner part of this crease, there is a groove or canal which is called the **INGUINAL CANAL**, and through it passes (in men) a cord that goes down to the testicle on each side; in women this is called the **Round Ligament** and it is one of the guy-ropes of the womb. This **CANAL** is about two inches long, (and runs outward from the middle of the lower abdomen) and at each end of it is a **RING** or constriction; the one furthest in is called the **INTERNAL ABDOMINAL RING**, or **INTERNAL RING**, and the one nearest the skin is called the **EXTERNAL ABDOMINAL RING** or **EXTERNAL RING**. (*See Diagram.*)

At birth, the testicles escape through these **RINGS** along the **CANAL**, and Nature then shuts in the **CANAL** to prevent any of the intestines or abdominal contents from getting through also; but in some instances, Nature does not do her work thoroughly, or the individual is perversely constructed,

and a piece of intestine or its covering will manage to protrude—and then we have what is called a **CONGENITAL HERNIA**.



The anatomy of inguinal and femoral hernia (Leidy). 8, Inguinal Canal; 11, External Ring; 17, Location of Femoral Hernia.

All Herniae, according to their location, can be roughly divided into four kinds:—

1. **INGUINAL HERNIA**—that which shows itself as a **rupture of the groin**;
2. **FEMORAL HERNIA**—that which shows itself as a **rupture in the upper, inner thigh**, below the creases of the groin;
3. **UMBILICAL HERNIA** — that which shows itself as a rupture through the **navel**;
4. **VENTRAL HERNIA**—that which shows itself as a rupture through any part of the **the abdominal wall other than the navel**.

**INGUINAL HERNIA:** This is the commonest form of rupture, and can be divided into two sorts:—

- (a) **Direct** (also called **Internal**).
- (b) **Indirect** (also called **Oblique** or **External**).

**DIRECT INGUINAL HERNIA** is the rarer of the two forms, and by it is meant a pushing out of a piece of the intestine or intestinal covering (**omentum**), this showing, as an enlargement, about the middle of the groin; this form does not follow the course of the "Canal."

**INDIRECT INGUINAL HERNIA** is the commonest form met with, and forms 93% of all **inguinal herniae**. This is a protrusion through the natural openings in the abdominal wall, the enlargement traversing the fold of the groin and showing itself as an enlargement within or close to the **scrotum**; if it remains in the Canal it is known as a **BUBONOCELE**; if it reaches the **scrotum** it is then referred to as a **SCROTAL HERNIA**, and this last named form is almost always of **congenital origin**.

**HERNIAE** are further subdivided by their capability of being pushed back into their normal position; that is, they are either:

- (a) **Reducible**;
- (b) **Irreducible**;
- (c) **Strangulated**.

**REDUCIBLE HERNIAE**: A reducible hernia is one that can be readily replaced and made to disappear, this usually occurring when the individual lies down or when the enlargement is manipulated, and it then disappears with a characteristic gurgling sound—hence the necessity of examining the patient while standing.

**IRREDUCIBLE HERNIAE**: An irreducible hernia is one that cannot be pushed back into its normal position, even under the influence of an anaesthetic. A further degree of this form of hernia is sometimes referred to as an **INCARCERATED HERNIA**.

**STRANGULATED HERNIAE:** A strangulated hernia is that form where the intestine or its covering has been literally strangled so that its circulation is shut off and the part is practically dead. This is the dangerous element of any hernia, and is liable to occur if the individual over-exerts himself, or if an improperly fitting truss be worn; such a contingency demands an immediate operation, and even then recovery is oftentimes problematical.

**CAUSES:** One in every 20 to 30 persons has a Rupture of some sort.

It is 3 times more frequent in men than women, and occurs oftener on the right side.

All Herniae are either **Natural** or **Acquired**.

A **NATURAL HERNIA** may be congenital, due to some defect in the abdominal wall by which the normal openings have never been properly closed or protected; it may also follow a decrease in bodily tissue so that a fat person becomes thin, this increasing the size of the openings which normally existed. Conversely, it occasionally occurs in people who have suddenly become fat; this causing a stretching and widening of normal openings.

**ACQUIRED HERNIAE** are the result of **long continued INTRA-ABDOMINAL strain or pressure**, and they almost never occur as a result of a **single sudden act of violence**. Any occupation that calls for strain or stress upon the abdominal muscles, or in which lifting is demanded, or where vomiting or coughing ensue, or where the parts have been weakened by operations or the wearing of apparatus, or following pregnancy; then, under such circumstances, herniae are liable to occur. Individuals developing a hernia under conditions of this sort (in the absence of some unusual circumstances) are said to have what is termed a "**HERNIAL TENDENCY**."

The vast majority of herniae occur very gradually, and most authorities doubt the possibility of a complete hernia occurring INSTANTLY. It is said that only between 6 and 7% of herniae occur within a short time after the receipt of violence (Von Bergman's Surgery).

In an Article by a well known surgeon of New York City, the statistics of 50,000 cases, treated at the New York Hospital for Ruptured and Crippled, show only FOUR CASES in which the rupture was directly attributable to an injury.

This proportion is not excessive, and it is in line with the opinion of the best teachers, writers and practitioners.

**For the production of a TRAUMATIC HERNIA (one due to an injury), there are two essentials:**

1. The hernia must be completely developed IMMEDIATELY after or within a very few days of the receipt of the injury;
2. There must have been no predisposition to hernia, no matter of what nature.

Nearly all the authentic cases of TRAUMATIC HERNIAE that have been reported are those resulting from a sudden impinging of the affected portion of the body on a blunt surface and the immediate occurrence in this area of the characteristic swelling, usually accompanied by more or less discoloration. The majority of of these cases have been the result of kicks directly over the part of the body where the rupture showed itself, or falls from a height so that the individual impacted upon some sharp raised surface.

Indirect violence, such as a fall upon the feet or back or buttocks, cannot be looked upon as a causative factor, because of the fact that the transmitted concussion has so many obstacles before it reaches the usual

location for the occurrence of a rupture; so that what is known as "CONCUSSIVE FORCE" is not looked upon as a productive feature.

It cannot be denied, however, that any accident which increases the pressure within the abdomen in a person with a hernial tendency may be a producing cause for accelerating or producing a Hernia that was in great part already formed.

**SYMPTOMS:** The vast majority of persons know nothing of the existence of a hernia until their attention is called to it by an examination for some other purpose. Instances of this are common in Life Insurance, Army and Navy, and in Civil Service Examinations.

Certain individuals complain of a dragging, gnawing sensation in the groin or in the region of the testicles, and occasionally, by self-examination, feel a protrusion. It is notoriously true that a well developed hernia may exist for a long time without giving any symptoms whatever. If the hernia becomes strangulated the individual becomes extremely ill, has a distended abdomen, vomits, and, in a word, has the usual signs of Peritonitis.

When a Hernia is claimed to have occurred as the direct result of an accident, the following factors must be complied with:

1. There must have been no "Hernial Tendency;" by this is meant that the individual must not have had structurally weak abdominal muscles, and the "Rings" must not have been abnormally large (ordinarily each "Ring" will admit the tip of the little finger).
2. The violence must be inflicted in the region where the Hernia subsequently appears; it is anatomically impossible for a blow at a distance from the groin to be forcibly enough transmitted to cause a Hernia in that location.

3. There must be almost immediate protrusion in the injured site of the Intestine or its covering; and the smaller the protrusion, the greater likelihood of recent origin. It is practically impossible for a "lump" larger than a walnut to appear as a result of the ordinary single act of violence, and if the Hernia remains in the "Canal," the diagnosis of recency is also fortified.
4. There are usually signs of Shock (faintness, pallor, nausea, weak pulse, etc.,) following a blow on the abdomen severe enough to force out abdominal contents through well protected walls.
5. There are usually signs of discoloration (Contusion) in the vicinity of the recently formed Rupture, and not infrequently, a local inflammation also.
6. There must be no laxness of the abdominal wall, or of the Scrotum (bag holding testicles), nor dimpling of the skin in the region of the Hernia.
7. There must be absence of the characteristic glossy, smooth appearance of the skin near the Hernia, these all being denotive of long continued prior tension of a pre-formed "Lump"; harshness of the skin, and some tanning of it, usually indicates the pressure of a Truss.
8. The person recently herniated acts in a characteristically careful manner and unconsciously favors a part which he knows to have been recently damaged; absence of this affords strong corroboration of a suspected ancient Rupture.
9. Rupture on each side of the abdomen usually verifies old origin and decided "Hernial Tendency."

**TREATMENT:.** This can be either:

- (a) Palliative; or
- (b) Radical.

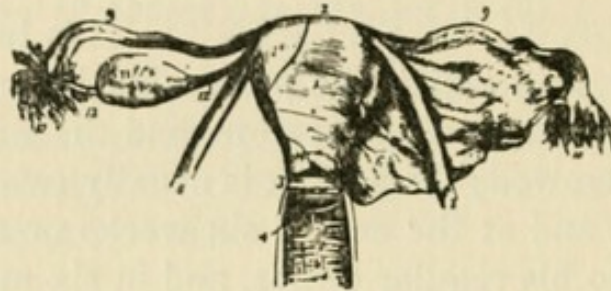
By **PALLIATIVE TREATMENT** is meant the wearing of a truss or other apparatus to keep the enlargement in place; and in children the use of such an apparatus will sometimes cause the enlargement to disappear, but in adults spontaneous cure is practically unknown.

**RADICAL TREATMENT:** This implies a cutting operation in which the protrusion is exposed, then returned to its former location, and the Ring is sewed up and narrowed; the patient is usually two or three weeks in bed, and at the end of six weeks or two months returns to his regular duties, and in six months is practically as well as ever. The mortality following such an operation is very small and it is one of the safest and surest of modern surgery. **This operation** is frequently done under **cocaine**, and less than one-half of a grain of the drug is needed. The operation (either under a general or local anaesthetic) takes from 15 to 35 minutes, and little or no pain is felt while in bed.

## XIX. UTERINE TROUBLE.

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The Female Generative Organs consist of the WOMB or UTERUS, and on each side of this is an OVARY connected to the WOMB by the FALLOPIAN TUBE. (*See Diagram.*)



Front view of the internal generative organs (Leidy.) 1, Womb; 3, Cervix or Neck of Womb; 7, Broad Ligament; 9, Fallopian Tubes; 11, Ovary.

The above organs rest in what is technically known as the PELVIS; that is, the lower half of the bones which form the flanges of the hips.

### ANATOMY:

**THE UTERUS** is a pear-shaped organ, varying in size from three to four inches in length and from one and one-half to two and one-half inches in breadth.

It is suspended in the lower part of the pelvis with the heavy end upward and forward, seated at an angle of about 65 degrees, vertically.

The upper part of it is called the **FUNDUS** (roof); the middle part is the **BODY**; and the lower part the **CERVIX** (neck).

It is normally held in position by a series of eight elastic guy-ropes termed **LIGAMENTS** which hold it suspended and allow the greatest motility, so that it can be moved a distance of several inches in all directions; hence, under the influence of an anaesthetic it can be pulled down so that its neck can be shown at the outlet of the vagina ("Privates").

These eight Ligaments are:—

The ANTERIOR, reaching from front of Uterus to the Bladder.

The POSTERIOR, reaching from back of Uterus to the spinal column (Sacrum) and Rectum.

TWO LATERAL, or BROAD LIGAMENTS, reaching from each side of Uterus to the bony flange of hips (the Pelvis); these enclose the Ovaries and the Fallopian Tubes, the latter joining each Ovary to the Uterus. These are the **main supports** and are very strong and important.

TWO SACRO-UTERINE, reaching from the lower end of Sacrum (near the lower part of spinal column) to the neck of the Uterus; that is, nearly to the lower front of the organ.

TWO ROUND LIGAMENTS, reaching a distance of four or five inches from the upper part of Uterus and running in the above Broad Ligaments to the front of abdomen, then through a hole in the muscles there (Internal Abdominal Ring) and finally ending in the outside lips of the Vagina.

Hence it can be seen that the Uterus is steadied in a remarkable manner by three ligaments going from the front, three from the back, and two from the sides.

It is further protected by a wise Nature in being situated deep in the abdomen, with the soft and always more or less filled bladder in front, and an almost equally elastic rectum back of it, each acting as a water-bumper. On top, it is surrounded by a similar cushion of intestines; and on each side it has, in addition, the bony barrier of the flanges of the hips ("Pelvic Bones"), and outside of this the thick muscles of the buttocks.

There is no organ in the body better isolated, and none more invulnerable to outside violence or structurally better protected to perform the important function of reproduction.

#### **MAL-POSITIONS OF THE UTERUS:**

It may be displaced **downward**, technically known as **PROLAPSED**; **forward**, technically known as **ANTEVERTED** or **ANTEFLEXED**; or **backward**, technically known as **RETROVERTED** or **RETROFLEXED**.

"FLEXION" as a suffix means a displacement greater in degree than "VERSION."

#### **DOWNWARD DISPLACEMENTS OF THE UTERUS—**

or, technically, "**PROLAPSUS UTERII**"—is one of the rarer displacements of the **WOMB**, and almost invariably occurs in those who have had children. This is due to the fact that a **main support of the uterus** (preventing its sagging into the pelvic cavity) is a strong band of muscle and fibre which guards and floors the space between the vagina and rectum. This space is technically known as the **PERINEUM**. In childbirth, especially at the initial confinement, this perineum is almost always torn; and—unless it is carefully sewed—it offers a natural means for downward, forward, or backward displacements.

Other causes of this "**FALLING OF THE WOMB**" would be anything causing pressure on the interior of the abdomen so as to force the womb from its normal position; such as tumors within the abdomen, dropsy, and (occasionally) tight lacing, or a very protuberent or fat abdomen.

#### **DEGREES OF PROLAPSED UTERI:**

**FIRST DEGREE**, that in which the womb is but slightly displaced;

**SECOND DEGREE**, where it can be seen at the outlet of the vagina;

THIRD DEGREE, where it comes between the lips of the vagina and rests within the thighs.

INJURY CAN NEVER directly produce this condition except the violence be inflicted upon the abdomen so as to force the womb and other contents downward—as by the passage of a wheel over a prostrate body.

**ANTEVERSION and ANTEFLEXION:** The womb is normally anteverted, that is, turned forward; but if this turning forward exceeds an angle of 65 degrees, the condition passes into one of ANTEFLEXION; that is, a definite bending forward.

This is rather a rare condition, and occurs usually in those who have had inflammation of the vagina or ovaries or tubes; however, tight lacing; straining, as in relieving the rectum or bladder; long continued standing; sneezing; violent coughing; or any unusual muscular effort, as in lifting a heavy object from the floor—all may also cause this anteflexion.

A fall from a height with the violence transmitted to the pelvis, either by landing on the feet or buttocks, can also contribute to its causation in those predisposed. Many Surgeons claim that it is impossible to cause forward displacements and that all such cases are congenital.

**RETROVERSION and RETROFLEXION:.** This is the commonest form of uterine displacement, and is usually associated with more or less downward displacement of the womb (PROLAPSE).

It can occur from any of the causes given above for forward displacements, but is most commonly found in those who have borne children and hence have a predisposition.

In discussing the displaced conditions of the uterus, it must be remembered that any displacement may be congenital as well as acquired.

DISPLACEMENTS forward and backward have a definite set of symptoms; and they may be summed up as follows:

Pain in the back;

"Bearing down sensation";

Headache at the nape of the neck;

Constipation and irritability of the bladder, so that the individual has difficulty in long retaining the urine.

With the above are also associated:

Catarrhal discharge from the vagina (known as LEUCORRHEA; or, colloquially, "THE WHITES");

More or less disturbance and pain in menstruation;

And almost always that set of **neurotic** symptoms termed by the laity "**nervousness.**"

Granting a healthy woman with normal muscular and ligamentous supports, it requires considerable violence to displace so small and well protected an organ, especially when it is considered that it has a normal range of motion of several inches, to which it is daily subjected in the jostle and strain of activity.

But in a woman who has borne children, and in whom the ligaments have thereby become stretched and inelastic, and in whom the normal muscular flooring has become torn from the same cause, the conditions are vastly different, and violence might play an ulterior role. However, it must be remembered that a **single** act of violence, even in a person thus predisposed, is not nearly so potent a causative factor of displacement as is **constant**, long continued lack of support and undiminished pressure; and the vast majority of distortions found in those who have borne children long antedated the ordinary accident alleged to have been the only producing cause. Proof positive as to

this is afforded if the organ is bound down and immovable, the technical descriptive term being "Adhesions" or "Adherent"; this always indicates chronicity and inflammation not attributable to trauma.

Practically there are only three common causes for displacements:

Congenital origin; pregnancy; germ inflammation (as Gonorrhoea, Abortions, or pus collections).

**DURATION:** Any displacement of the womb that is due to injury occurs **at once** so soon as the violence is inflicted, and is usually associated with definite symptoms of shock, so that the individual is aware that something unusual has happened.

If treatment is at once resorted to, the mal-position can be corrected and will not tend to become worse; and, in a general way, it can be said that nearly all displaced conditions of this organ are capable of almost complete relief.

Many women have a marked displacement and attribute its symptoms to other causes, notably to lumbago or rheumatism; in many, symptoms are entirely lacking even in decided malposition.

**TREATMENT:** This may be:

1. Palliative.
2. Radical.

By the **PALLIATIVE** treatment is meant the bettering of the individual's general condition by the use of tonics, and relief of the catarrh by douches; and in correcting the distorted position by the wearing of some form of apparatus to hold the displaced organ in its position.

Apparatus designed for this purpose is technically known as a **PESSARY**, and is usually a hard or soft rubber disc which is placed either in front or behind the womb within the vagina, and is worn with comparative comfort.

Cotton, rolled into balls—technically known as TAMPONS—also serves the same purpose.

The **RADICAL** cure of a displaced uterus is by means of an operation; and this designs to shorten the ligaments which are stretched, and repair the floor of the pelvis (the PERINEUM) so as to make the organ resume its usual position by restoring its normal elastic supports.

## XX. MOVABLE AND FLOATING KIDNEYS.

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By "**Movable Kidney**" is meant any descent of the organ beyond a few inches from the normal; a "**Floating Kidney**" means the descent below the foregoing limit and the ability to move the organ almost at will, hence this variety is often called "**Wandering Kidney**."

**ANATOMY:** Each kidney is about four inches long, two inches wide, and one inch thick, and of the well-known semi-circular, bean shaped appearance. The weight is four to six ounces.

They are **LOCATED** in the back part of the abdomen and rest in the hollows of the arches of the back ("The loins") very close to the spinal column.

They are **COVERED** by a tough fibrous envelope called the **CAPSULE**, and this in turn is imbedded in a mass of fat, the latter being practically a guy rope maintaining the normal relations of the organ; hence when the fat is small in amount, motility of the Kidney is permitted, and thus it is that thin persons are apt to have displaced Kidneys (see below).

Their **POSITION** can be determined by locating the last (12th) Rib, which is practically at the middle of each organ; a line drawn around the body at the level of the navel would be a little below the lower end of each Kidney.

The **Right Kidney** is about one inch lower than the left owing to the fact that the overlying Liver depresses it to this extent; hence displacement of the organ is more usual on this side.

There is a **NORMAL MOVEMENT** of each Kidney during the usual up and down motion of chest and abdomen in respiration; so that the determination of the extent of motion is arbitrary, and what is normal for one is abnormal for another.

### **CAUSES OF DISPLACEMENT:**

(1) **CONGENITAL** mobility is not rare and can

often be assumed if the person conform to the below mentioned "Movable Kidney Type."

- (2) ACQUIRED mobility is the result of any condition robbing the kidney of its normal supports, such as:
- (a) Prolonged muscular effort or strain, as in lifting.
  - (b) Any constriction about or above kidney-level, as tight lacing.
  - (c) Any pressure from above, as by enlargement of the liver, stomach or other organs.
  - (d) A general lowering or drooping of all the organs of a relaxed abdomen due to former obesity or other causes; this is called ENTEROPTOSIS, as the intestines occupy an especially low position.
  - (e) TRAUMA applied to the back, in the neighborhood of the kidney, so as to jar it from position; or severe falls upon the feet or buttocks, the transmitted impact stretching or loosening the supports.
  - (f) Childbearing causing a laxness of the supports from pressure.
  - (g) Tumors or other enlargements of the abdomen.
  - (h) Prolonged coughing, gagging or vomiting.
  - (i) Certain occupations calling for bending or arching or straining of back or abdomen.

**FREQUENCY:** Fifteen times more frequent on the right than left side.

Eighty-five per cent. of cases in women.

Abnormally low in from twenty to forty-six per cent. of all women.

Movable in nearly ninety-four per cent. of all women, and six per cent. of men (quotation from Von Bergman's Surgery).

Very often associated with Appendicitis.

Can "float" far enough down in abdomen to impinge on floor of pelvis (bottom of abdomen), and give no symptoms; or it can move but slightly, and yet cause much complaint.

**Von Bergman's Surgery** (written by a famous German surgeon) and edited in the United States by Prof. W. T. Bull (of New York City) is one of the latest surgical authorities, and it states: "At any rate most who complain of symptoms due to movable kidney are of the nervous type, and describe pains which are partly of a neuralgic and partly of a hysterical character. It is often difficult to say whether the movable kidney is the cause of the suffering or simply happens to be present in some individual and is observed by a person who is in a state of nervous excitability. Be that as it may, the distress may be so marked as to be unbearable whenever any occupation is undertaken. . . ."

**SYMPTOMS:** Usually those of Dyspepsia, or tenderness in region of liver or large intestine or region of ovaries or appendix; hence the symptoms are VERY VARIABLE.

Occasionally pain in back is complained of, especially on exertion. If the organ "float," sometimes the tube leading from it to the bladder (the Ureter) becomes twisted and the urine cannot escape, and thus a painful engorgement occurs which gives symptoms allied to those of RENAL COLIC (pain in kidney of the type found when a stone is passed).

There are a host of HYSTERICAL, or NEURASTHENIC, or HYPOCHONDRIACAL symptoms al-

leged, of the well-known subjective type, especially by women.

**DIAGNOSIS:** This is made by placing the patient on the back with knees drawn up, and locating the kidney between the examiner's hands, one of which is placed on abdomen, and the other on the patient's back; a deep breath is then taken, the kidney comes down and the distance is measured. This is **only** accurately possible in a reasonably thin person; a very obese abdomen makes such a test farcial, and further, fat people practically never have displaced kidneys.

It can be mathematically demonstrated whether or not a given person, from the build, is entitled to a displaced kidney; thus: Take the distance between top of breast-bone (Suprasternal notch) and the middle of the bones forming the floor of abdomen (Symphysis Pubis) and divide this by the smallest circumference of the abdomen, and multiply the result by 100 (to eliminate fractions) and the result will be from 63 to 95, the mean being 76. Anything above 76 means a movable kidney, anything below shows a non-movable kidney. This gives an absolute anatomical and mathematical basis for an opinion, and surgeons can tell at a glance if the person is of the "Movable Kidney Type." (Von Bergman's Surgery.)

A kidney that can be felt is not necessarily a movable kidney because the natural descent in full inspiration (in some people) allows the lower edge to come in contact with the examiner's hands.

In a fit subject, squeezing the kidney between the examining hands causes a peculiar nausea; this eliminates the possibility of mistaking a growth or other organ for the kidney, and is a confirmative test.

In some persons, examination lying on the back is unavailing, but when standing slightly bent forward

with the hands on the back of a chair, the organ can sometimes be better mapped out.

Some authorities contend that a Floating Kidney is always congenital.

**TREATMENT:** This is (a) Palliative or (b) Radical.

(a) **Palliative Treatment** adopts a belt or specially shaped corset to hold the kidney from slipping out of the grooves of the back alongside the spinal column. This is very effective, and many Surgeons employ this method solely, meanwhile building up the patient to add needed fat and strength.

(b) **Radical Treatment** is by operation in which a cut is made through the muscles of the back exposing the organ; stitches are then taken through its covering and it is drawn up and stitched into place.

The operative method is not looked upon by some Surgeons with as much favor as formerly, for experience has shown that even a perfect "anchoring" of the organ does not cure the symptoms, the latter being in the vast majority of cases of the nervous, subjective type.

The operation is not severe, the scarring is slight and the period abed does not exceed three weeks, and in selected cases serves admirably.

**SUMMARY:** A very frequent condition, especially in women, but it cannot be reasonably said to follow trauma unless a severe blow be inflicted on the back close to the kidney-region; then the signs of Shock should appear, with probably evidences of "Internal Injury" and the onset of difficult urination and blood in that voided.

If in a woman of "long and lean" build, the great probability is that it antedated the alleged violence;

this is made reasonably certain if she conforms to the formula given above.

Granting its occurrence from violence, it is not a dangerous condition and is frequently amenable to treatment by non-operative means.

It is usually an old (perhaps congenital) condition discovered in a nervous, irritable woman, and its existence was unknown because no careful examination had ever been made prior to the time that some accident called attention to this and every section of the anatomy.

## XXI. CONCUSSION OF THE BRAIN.

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The above is commonly referred to as "Concussion," although any organ enclosed in a bony or more or less unyielding cavity is capable of undergoing "Concussion;" for example, older Surgeons frequently referred to the now almost obsolete expression, "Concussion of the Spine," and occasionally the term "Concussion of the Chest" is also met with.

In derivation, "Concussion" means a "shaking up," and a technical definition of the Concussion under discussion would describe the condition as the sudden jarring impact directly upon or transmitted to the skull, which in turn is transmitted to the brain, manifesting itself by more or less transitory unconsciousness, depression, pallor of the skin, and other associated symptoms allied to Shock (see article on latter).

Synonymous terms are, "Commotio Cerebri," "Cerebral Concussion," "Contusion of the Brain," and "Cerebral Contusion."

**CAUSES:** It always results from (a) Direct, or (b) Indirect Violence.

Examples of **Direct Violence** would be a blow or a fall upon the skull, with or without damage to the soft parts (skin, muscles, tissues) and bones of the skull.

If it follows as a result of **Indirect Violence**, there has been a heavy fall upon the feet or buttocks, so that the impact is transmitted to the unyielding bony cage of the skull; injury to the soft parts is then lacking in the region of the skull, and if the latter be injured, a fracture of the base (bottom) of the skull is probably present.

**SYMPTOMS:** These depend on the severity of the violence, its location of receipt and the individual tolerance.

In degree, Concussion can be

- (a) Mild;
- (b) Moderate;
- (c) Severe.

- (a) Mild C. causes the person to momentarily "see stars," he is slightly confused, he may be temporarily unconscious, he is giddy, is nauseated and may vomit; but he soon responds, and in a short time recovers completely, barring, perhaps, "a bump on the head," some pain, soreness and dizziness for a few days.
- (b) Moderate C. is an aggravation of the foregoing, the unconsciousness being more profound, the vomiting being almost invariable, and aid will probably be required in reaching home. His after-effects may last a week or two, and during that time he may be unfitted for mental or physical stress, but the vast majority of such cases completely free themselves of symptoms within the time named.
- (c) Severe C. is a serious condition, and its severity is proportionate to the duration of the coma and the profundity of the associated symptoms of collapse; such a person remains inert perhaps for days, and on "coming to" has no recollection of what intervened from the instant the violence was inflicted, and for some days may be mentally disturbed, suffer from memory-lapses, and may even manifest disturbances closely allied to affections of the brain itself, such as localized paralyses, or defects of the special senses.

**ANATOMY:** The brain is enclosed in a bony cage, the skull, each bone of which is mortised into that adja-

cent, the junctions being free enough to permit some sliding and even over-riding; this is especially true in children.

Surrounding the brain is a layer of fluid ("Cerebro-Spinal fluid") which extends down into the spinal cord through a large hole at the base (bottom) of the skull, and hence the brain is well protected against violence by the bony cage and the water-jacket-bumper of fluid.

The brain proper is covered by three layers of parchment-like tissue (the chief of which is called the "Dura Mater") and does not come directly into contact with the interior of the skull at any point, and in some locations is an inch distant from the bones.

Running in this protective tissue, and over and in the brain, are many blood-vessels, and the present theory of the development of Concussion is that some of the capillaries, or minute blood-vessels, are torn by the transmitted impact so that temporary abeyance of function ensues. For a long time the Concussion-theory was that of "Molecular Vibratory Change" in which the molecules of the brain-substance were supposed to be set in motion by the jarring, with the consequent disturbance of function: some older Surgeons still hold to this idea.

Even at the present day, it is generally conceded that there are few if any structural changes accompanying this condition, and in cases of death (from associated injuries), autopsy fails to reveal evidences of actual damage even when microscopical sections are repeatedly examined; if damage has been done, the Concussion was then an associate of Laceration or Contusion of the Brain, with or without fractured skull.

In Concussion of this type, remnants in the shape of headache, giddiness, unsteadiness of gait and station, mental and physical inaptitude, "buzzing" in the ears,

"spots" before the eyes, and depression are frequently complained of for weeks. If these exist, they are associated with corroborative signs indicative of illness, many of which are visible and readily provable; if they are lacking, the subjective allegations may be result of an attempt to deceive for a purpose, or are incidents of a neurasthenic or hysterical type.

There are usually no permanent effects from Concussion; and if such are present, there has probably been allied with the injury some damage to the brain tissue, and in such an event there are invariable determinative findings, such as paralyzed muscles, speech, eye or ear defects, and changes in the reflexes.

The feature of Concussion is its transitory nature—if the symptoms persist, the diagnosis must shift to brain-injury.

**TREATMENT:** This is entirely dependent upon the symptoms, but it can be summed up by stating that absolute rest is given, and the heart is stimulated if necessary; later, individual complaints are appropriately treated in the usual manner by drugs.

Operative interference is never required.

**ALLIED CONDITIONS:** The milder manifestations of Concussion closely resemble Syncope ("fainting fit"), Shock and Fright, and they must be differentiated sharply; this is usually possible if the history be scrutinized, and if there be no direct head-violence, and if the transmitted impact be light, then a diagnosis other than Concussion is justifiable.

## XXII. NEURASTHENIA.

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Strictly speaking, the derivation of the word means **weak nerves**. It has been defined by a well known writer as a **functional nervous disorder**, characterized by excessive nervous weakness and nervous irritability, so that the patient is exhausted by slight causes and acts morbidly to slight irritations.

As it is generally used, it is synonymous with "**nervous prostration**," "**nervous exhaustion**," "**railroad spine**," "**railroad brain**," "**the American disease**," and what has been jocularly called "**nervous prosperity**."

It is among the most widespread of nervous diseases, and is regarded by most competent observers as a combination of a lowered nerve vitality plus more or less well marked hysteria; others regard it as the male form of hysteria.

Abeyance of will power ("**Aboulia**") is the characteristic feature of the ailment.

**CAUSES:** It is universally admitted that as a basis the individual must show an excitable nervous organization, this being either congenital or acquired.

The congenital manifestations may be directly transmitted from ancestors or the result of physical or mental defects.

The acquired causes include physical or mental strain of whatever type; commonest of these being worry, business stress, grief, shock, over-work; the abuse of stimulants, tea or coffee; and the existence of prior or coincident disease, such as rheumatism, gout, syphilis, stomach trouble, liver trouble, kidney disease, heart disease, hardened arteries; or, in fact any physical or mental departure from the normal.

Certain authors have gone so far as to claim that injury produces a definite form of neurasthenia apply-

ing to it the term "TRAUMATIC NEURASTHENIA," synonyms of it being "Railroad Spine" or "Railroad Brain," or "Litigation Neurasthenia." However, the concensus among the authorities is that **traumatic neurasthenia** differs in its manifestations from **general neurasthenia** slightly, if at all; any difference depending largely upon the physical injury inflicted.

**TYPES:** There are four main classes of neurasthenia usually referred to, but this does not imply that one division is separated from the other, the fact being that the symptoms are so multiple and varied that one type blends more or less completely with the other.

These four types may be said to be:

1. SPINAL NEURASTHENIA: that form in which the symptoms are referred to the spine or back;
2. CEREBRAL NEURASTHENIA: that form in which most of the symptoms are of the mental type;
3. GASTRIC NEURASTHENIA: that form in which "nervous indigestion" is uppermost;
4. CARDIAC NEURASTHENIA: that form in which the heart is more or less disturbed, and palpitation is the principal element.

Other authors add to these, RENAL NEURASTHENIA, meaning by this, bladder and kidney irritation.

There is also a form sometimes referred to as SEXUAL NEURASTHENIA, in which the sexual functions are lowered, perverted, or abolished.

**SYMPTOMS:** These depend, in part, as to which of the types the individual may present.

**SPINAL NEURASTHENIA** is probably the commonest form; and under this condition the main complaints are: Pain in the back, localized or diffuse tenderness along the spine, inability to bend forward or backward, weakness on exertion, inability to stand or walk; and, occasionally, shooting pains in the back, and tremors of the face, fingers or tongue.

If this type be present, the individual will usually allege that he has received a sprain, or a wrench, or a contusion of the back, the violence being inflicted directly over the affected part, or indirectly, so that an impact was received at the point of maximum complaint, this actually being the lower middle (**lumbar**) portion of the spine.

Under the **CEREBRAL FORM**, the chief symptom may be said to be headache, this usually being referred to the forehead, or the nape of the neck, and claimed to be of a peculiar boring nature, oftentimes giving the sensation as if a lead cap or helmet were placed upon the scalp.

The individual will also claim that he is mentally inapt; that his powers of concentration are lost; that he readily fatigues under mental stress; that he is easily depressed; he is morose, irritable, introspective, imaginative; and he oftentimes sums it up by saying: "I cannot think or use my mind."

A chief symptom under this form is **insomnia**; this manifesting itself as an inability to fall asleep, or, failing this, he falls asleep, but readily awakens and paces the floor in an effort to again fall into slumber. Dreams and nightmares are also alleged.

Under the **GASTRIC OR STOMACH FORM**, it is usually claimed that there are multiple symptoms of indigestion; distress before and after eating; gas collects in the stomach; the tongue is foul and coated; constipation exists, and in general the food does not assimilate and the appetite is capricious.

Under the **CARDIAC FORM**, palpitation is the main element, this occurring on slight physical or mental exertion, especially if the patient be suddenly startled or if unusual exertion be demanded. Associated with this is oftentimes numbness of the extremities, a feeling of heat or cold therein, and a peculiar flushing of the skin, allied to blushing; many of these individuals have what is technically known as **Derma-graphy** (a red line produced on the skin when the finger nail is drawn across it) so that letters may be written on the individual as if in "symbols of blood."

If the **SEXUAL FORM** exists, either separately or allied with any or all of the above, the sufferer will claim that the sexual power is lost; that the sexual apparatus is defective; and that virility is abolished.

Under the **RENAL FORM**, the chief manifestations are irritability of the bladder, so that he is unable to retain his urine long at one time; that the passage of it is painful, and especially that he has to get up at night to relieve himself. His fears will be especially marked if he happens to void his urine into a vessel and observes next morning that sediment is present, and he immediately jumps to the conclusion that he has an incurable kidney or bladder affection.

From the above it will be seen that the **SYMPTONS ARE VERY VARIED**, but the great majority of

these cases present as main **subjective** (invisible) symptoms:

**Headache;**  
**Backache;**  
**Palpitation of the Heart;**  
**Mental and physical inaptitude, and lack of initiative;**  
**Insomnia;**  
**Stomach irritability.**

**OF OBJECTIVE** (visible) symptoms, there may be mentioned:

**Exaggeration of the Reflexes**, especially that of the knee;

**"Limitations of the Visual Field,"** by which is meant a symmetrical dimming of vision demonstrable by appropriate tests;

**Hypersensitiveness of the skin**, so that when the finger is drawn across it, a red line appears—technically called **"Dermography"** or **"Dermographism"** (meaning skin-writing);

**Rapidity of pulse and heart fatigue**, most apparent after exertion;

**Increase of pulse beats when pressure is made over the alleged tender spots**—this being known as **"Mankopf's Sign."**

The appearance is oftentimes characteristic to an experienced observer; but the apparently good physique of the individual occasionally belies actual conditions.

**COURSE:** The duration is variable, and depends very largely upon the individual's nervous and physical makeup, the causes underlying the condition, and those producing it, but especially on the treatment that is afforded.

If he be of unstable nervous or physical structure, the duration will be indefinite, and he may go on into a state that is sometimes called CHRONIC NEURASTHENIA, and practically never regain his normal tone; but, on the contrary, if he be of a strong and healthy disposition, and if he be treated in a proper manner, cure is as nearly certain as in any nervous disease. He may recover within a few weeks, or he may be ill for many years, so that sometimes no definite statement can be made as to the length of time the ailment will exist.

**GENERAL CONSIDERATIONS:** One main characteristic of the disease is that the individual, almost invariably, recognizes the baselessness of his ills, but he claims no inherent power to relieve or control them.

The subjective or personal symptoms are always in excess of those visible or objective, and it is not essential that there should be any severe injury or sickness in order that the disease be produced; in fact, it is a well known feature that the sights and sounds incident to an accident are oftentimes a greater producing cause than the infliction of actual physical violence in the susceptible.

A further point is that the neurasthenic is fond of relating his ills to sympathizers, and at each repetition his list grows longer and is, perhaps, added to by the experience of the sympathizer, who relates a case in which the symptoms varied somewhat from those just related; hence the vicious circle increases as if by geometrical progression.

It may also be stated that there is no definite anatomical basis for the condition, so that at autopsy no central or superficial nervous disturbance can be found.

It was first described by Dr. Beard, of New York, and for a long time was not regarded by foreigners as

a definite disease, and was laughingly referred to by them as the "American sickness."

It has been aptly called the disease of the strenuous and not of the simple life.

It has been said to be the result of bad heredity and foolish living.

Certain of these individuals get a fixed idea of some mental or physical impairment and self-hypnotize themselves into the belief that this functional ailment has an organic basis, and delude themselves into believing that every pain and ache proceeds from this as a center. This sort of NEURASTHENIA is referred to as the outcome of AUTO-SUGGESTION, and the imagination in such a case sways the will and leads to the development of all sorts of impossible conditions. The symptoms in every case are very real to the individual, but have no constancy, and to-day may exist in one portion of the body and to-morrow in another, none of them having any palpable existence, nor are all capable of external demonstration by any means within the power of the physician, except to the extent noted.

It is this connection that the element of MALINGERING enters, and it is oftentimes a difficult matter to draw the line between the real and the unreal.

Likewise HYPOCHONDRIASIS (imaginary disease) must also be differentiated; and, given a tendency to exaggerate, plus a disturbed imagination, then all the factors for multiple symptoms are present.

Here enters also the effect of litigation, and so long as an individual is harrassed by the narration of an accident in his preparation for a jury appearance, together with the worry over the outcome, then just so long will his many sided ailments be on the increase and remain uppermost in his mind; and if to the importunities of his attorney be added the technical sug-

gestions of a physician, his multiplicity of symptoms will be surprising and often disproportionate to his good appearance.

A certain class of physicians even go so far as to deny the reality of neurasthenia, and believe that allegations of this sort are founded solely on a desire to deceive, and class all such sufferers as **malingerers**. This, however, is regarded as an extreme view, and is not well borne out by that class of individuals who genuinely suffer.

**TREATMENT:** The essential rule in the treatment of any disease is "Remove the Cause," and in no ailment is this dictum more important. Hence the keynote in the management of the neurasthenic is Isolation, and the earlier he is removed from the zone of anxious "friends" and sympathizers, the earlier and more complete will be his recovery. This is especially important where litigation is in view, or where there is some object to be gained (vacation; relief from irksome work, etc.) and it is safe surmise that no case will recover under home surroundings where there is the suggestion of an interested family, a designing Doctor or a "Contingent Fee" lawyer, all of whom are rehearsing for a Jury presentation.

Having removed the case to proper quarters, the object is to divert the attention from self; and with this in view, moderate exercise is given, a new occupation is perhaps advised, and the physical rather than the mental side is occupied.

In some cases, the "Rest Cure" is used, and by this is meant total cessation from all exertion, absolute rest with an attendant to aid even in such simple acts as turning in bed; this is especially potent with "highly strung" women and is antidotal to the strenuous career that was causative of the "Nervous Breakdown."

Electricity and Massage also have a place, and special forms of Baths are frequently employed.

Drugs are not used as routine measures, and the best Physicians have long ago ceased the use of "Nerve Tonics" or "Bracers" of the Bromide order.

Individual symptoms (like weak-heart-action and insomnia) are treated by appropriate remedies, but medicines are of little avail unless the environment is bettered.

### XXIII. AFFECTIONS OF THE COCCYX.

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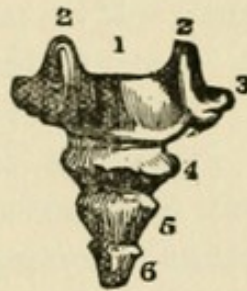
COCCYX is derived from a Greek word meaning a Cuckoo, the idea being that its triangular shape resembled a cuckoo's beak.

**ANATOMY:**—it is made up of four small segments of bone, the upper often remaining unattached to these below until late in life. (*See Diagram.*)

It is a rudimentary segment of the lowest end of the spinal column and represents the tail of lower animals.

It is about 3 inches long,  $1\frac{1}{2}$  inch wide and  $\frac{1}{2}$  inch to  $\frac{3}{4}$  inch thick.

Above, it joins the broad segment of the spinal col-



The Coccyx.

umn known as the SACRUM, to which it is attached by a **very** strong ligament, the SACRO-COCCYGEAL LIGAMENT, this acting as a hinge permitting considerable forward and backward motion of the Coccyx; and under forced bending by a finger in the rectum, it can be bent forward almost to a right angle and almost an equal distance backward; hence, it is very motile and is made so by Nature, for otherwise, each time we sat down forcibly, it would break or dislocate. It is also designedly movable because the Rectum lodges in its hollow, and, when distended, forces the Coccyx backward. In pregnancy, also, the child lies "in the hollow of the Sacrum and Coccyx"; hence, from many standpoints it is structurally a hinged "flail joint."

The normal axis of the Coccyx is forward, making approximately an angle of about 120 degrees from a straight line, it and the Sacrum being hollow (especially in women), forming a semi-circle.

The upper part is the broadest, and it gradually tapers, so that at its lowest end it forms a pointed surface about as large as the tip of the little finger; the upper segment is also the longest (about an inch), the other three segments making up the remainder almost equally, so that it looks not unlike an arrow-head.

Late in life (approximately at fifty) the motility between the Coccyx and the Sacrum in part disappears, and the two bones are then practically one; this change in the character of tissue takes place at this time in many other joints also.

In some cases, up to the age of about twenty, there is more or less motion between each of the four respective segments, the second and third segments being the last to join; hence, before the age of full growth, injury to this section of the Spinal Column is exceedingly rare, because the cartilaginous element predominates over the bony.

### **RELATION TO THE SPINAL CORD.**

The main trunk of the SPINAL CORD (or SPINAL MARROW) ends at the first Lumbar Vertebra ("small of back") approximately ten inches above the beginning of the COCCYX, so that there are no **main** nerve trunks in this vicinity. The Spinal Cord, from the above named terminal, sends thereafter numerous fine nerve filaments that are spread out in this region in a manner resembling a horse's tail, hence, this portion of the Spinal Cord is known as the CAUDA EQUINA (horse's tail).

The nerves about the Coccyx play an unimportant part inasmuch as their main function is to supply sensation to the skin near the rectal outlet; thus it is that the entire Coccyx can be removed without leaving any material defects, and in this respect it resembles the Appendix, another rudimentary section.

## AFFECTIONS:

Being structurally a bone and a joint, it is subject to the same forms of violence as any other bone or joint, but because it has unusual protection from the fat-layered thickest muscles in the body (those of the buttocks) it is affected only by violence strongly administered **directly** in its vicinity, and it is made less vulnerable also because of its structural motility. Inaccessibility to violence can be best appreciated by the statement that only a portion of it can be touched by the tip of a fully introduced finger into the rectum or vagina.

Practically, there are but three abnormalities of surgical occurrence, and hence only the following will be discussed:

FRACTURE OF COCCYX;

DISLOCATION OF COCCYX;

IRRITABLE COCCYX.

## FRACTURE OF COCCYX.

This is a rare injury and occurs usually as an accompaniment of other graver injuries involving the pelvic bones (side-walls of abdomen) following crushes (such as being run over by heavy wheels, or jamming between cars).

A kick between the buttocks, or a heavy fall DIRECTLY upon same, or an impingement astride a rail or raised surface, could cause a fracture; but by INDIRECT violence (as a fall on back or hips) no such effect can be produced.

The recent edition of STIMSON on "FRACTURES AND DISLOCATIONS" (perhaps the best recognized authority in this country) devotes only 19 lines to the subject of "Fractured Coccyx," and says: ". . . There is but little definite knowledge concerning it. . . ." The author doubts its occurrence except in old people where the motility of the part has disappeared.

The "AMERICAN TEXT BOOK OF SURGERY" devotes two lines to the topic, thus: "Fracture of the Coccyx, which is very rare, resembles in symptoms and treatment, dislocation of the same bone."

There are a few recorded cases in which difficult or instrumental pregnancies are said to have resulted in a fracture of the bone. The rarity of this fracture can be estimated when it is stated that only 0.3% of all sorts of fracture involve the Pelvis (bones forming the base of the abdomen), and of the five pelvic bones, fracture of the Coccyx is most infrequent.

## DISLOCATION OF COCCYX.

This is more common than fracture, but it is also rare, and occurs only as a result of the same forms of violence, viz., severe **direct** force applied to the part.

The "AMERICAN TEXT BOOK OF SURGERY" says: "Dislocation of the Coccyx is a rare injury, more common in women than in men, and is accompanied by symptoms of pain, disability and nervous disturbance that are present also in cases where there is no dislocation or fracture. . . . .".

The bone may be dislocated **forward, backward or laterally.**

**FORWARD DISLOCATION** is the commonest, and speaking of the symptoms of same, Stimson says: "The pain at the moment of the accident is so severe as sometimes to cause the patient to faint; there is pain in defecation (movement of bowels) and frequent calls to urinate. The pain radiates down the thighs, and sometimes over the trunk, head and arms; the patient is unable to sit up, and the slightest movement may greatly increase the suffering. Coughing and sneezing, and sometimes even every act of respiration, increases the local pain. If the condition remains unrelieved (a week to a month), the general health suffers seriously, the patient becomes feverish, and the mind dulled."

**BACKWARD DISLOCATION** occurs only during childbirth, or as an accompaniment of fracture of adjacent bones of Pelvis.

**LATERAL DISLOCATION** cannot occur, according to many Surgeons, except as associated with injury to adjacent parts. Stimson says only one case of this sort is found in all surgical literature, and it was caused by a fall astride a chair.

## IRRITABLE COCCYX.

Under this heading is included all forms of Coccyx irritation, including Fracture or Dislocation, especially COCCYGODYNIA (painful Coccyx) or COCCYGITIS (inflammation of Coccyx) and Neuralgic Coccyx, these last three being practically synonymous.

### COCCYGODYNIA

This is nervous manifestation and is usually an incident in an hysterical or neurasthenic person and is especially common in women.

It may be caused by:

- Neuralgia;
- Rheumatism (common);
- Uterine trouble;
- Rectal trouble;
- Bladder trouble;
- Piles;
- Rectal fissures;
- Trauma (contusions, fractures, dislocations).

SYMPTOMS (of all Coccyx affections):

- (1) PAIN: this is most marked by pressure, so that in genuine COCCYGODYNIA, the individual sits down and arises with great care, chooses soft seats and lowers into a seat from the edge of the buttocks. Walking, especially up or downstairs, by jarring the spine, also causes pain. Movement from the bowels and bladder is painful, as is any strain or stress causing pressure upon the part.
- (2) SWELLING AND DISCOLORATION (due to contusion) is found in cases caused by trauma; this usually disappears in from five to fifteen days.
- (3) NEURASTHENIC signs of the usual subjective kind, especially claim as to pain in lower back, weakness on muscular effort and irritability of rectum and bladder.

IN THE VAST MAJORITY OF CASES, COCCYGOD-

YNIA (in the absence of an unrelieved fracture or dislocation) is but a part of NEURASTHENIA, HYSTERIA, HYPOCHONDRIASIS, or MALINGERING.

THE REFERENCE HAND-BOOK OF MEDICAL SCIENCES on the subject of "Coccygodynia," says: "A favorable prognosis may always be given unless the pain should be dependent upon some incurable disease elsewhere; otherwise, with proper treatment, complete relief can be promised."

The fact that **Coccygodynia** is discussed more fully in text books on Nervous Diseases than on Surgery, is the best proof that it is generally looked upon as a nervous manifestation, despite its occasional surgical origination.

### TREATMENT

If a FRACTURE OR DISLOCATION, the bone is placed in the normal position and kept there by a plug placed in the rectum or by any other of the numerous methods of improvising a retaining splint.

If COCCYGODYNIA exists, the treatment is that of Neurasthenia.

In some cases, removal of the entire Coccyx remedies the pain; this operation is simple and not dangerous and the remaining scar is small.

## XXIV. ELECTRIC SHOCK.

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The following refers solely to the surgical manifestations of electric current having origin at a Power House and distributed by charged Rails or Wires; in other words, the effects of ELECTRIC SHOCK derived from Dynamos used to distribute motive power.

**DEFINITION:** By "Electric Shock" is meant the effect produced by the passage of an electric current through the body, this manifesting itself by visible ("objective") or invisible ("subjective") symptoms.

**MODES OF RECEIPT:** Electric Shock can be applied to the body by contact with:

1. Charged Wires or Rails;
2. " Metal Conductors of current;
3. " Flashes or Sparks.

**DETERMINING FACTORS:** The effects of Electric Shock are generally dependent upon the following:

1. The Individual; an excitable person is generally more affected than one of stolid type; women are generally more affected than men; the alcoholic more than the temperate; the aged more than the young; the weak more than the strong;
2. Strength of Current; the stronger it is the greater its effect;
3. Method of Contact; the more imperfect and nearer together, the less the effect. For example, contact at the top of head and also at soles of feet will transmit the current through the intervening portions more perfectly than if the contacts were closer together;
4. Duration of Contact; the longer the current is applied, the greater its effect;
5. Clothing; if rubbers are worn, or other in-

insulating material is close to the place of contact, the effect is less marked than if an unbroken path of conduction existed.

There is no one portion of the body that transmits electrical charges better than another, so that contact on the head does not necessarily mean more damage than if contact had been made on the hand; this does not imply that the various structures are equally resistant to Electrical Shock, for it is well known that the Heart and Nervous System are more responsive to electrical stimulation than other portions, hence it is that in diseases common to these parts, electricity is frequently made an adjunct of treatment.

#### **ELECTRICAL TERMS:**

1. VOLTS are units of Tension (pressure).
2. AMPERES are units of Strength.
3. OHMS are units of Resistance.

For all practical purposes, the VOLT will be the measure mentioned, inasmuch as "Voltage" is the quoted standard in the vast majority of instances.

#### **AVERAGE ELECTRICAL CAPACITY:**

- 1,300 to 2,000 Volts are used in Electrocutions;
- 550 to 575 Volts are used in Channel Rail and Overhead Trolley Systems;
- 100 to 225 Volts are used in Electric Lighting (Edison) Systems;
- 200 to 500 Volts are usually not dangerous.

There are special differences as to electrical effects depending upon the factors mentioned under the paragraph, "Determining Factors," and also as to the technical amount of the current and the manner of its transmission. For example, the Amperage is important; only 7 or 8 Amperes are used at electrocutions. Essential differences also exist as to whether or not the current is of the "Direct" (continuous) or "Al-

ternating" type; the higher the frequency, the greater the current which can be delivered without harmful effects.

**EFFECTS OF ELECTRICAL SHOCK:** The passage of electricity into the body may act in two ways:

1. Externally, or Locally;
2. Internally, or Systemically.

**External Manifestations** are in the form of Burns of varying extent at the place of entrance or exit of current, and these may be of three degrees:

- 1st. Degree Burns show as mere red marks on the skin;
- 2d. Degree Burns are deeper than the above and show as raised blisters (Blebs);
- 3d. Degree Burns cause definite destruction of tissue in the form of ulceration or scarring (Eschars).

The depth or degree of the burn is not always an indication of the severity of the electric shock, but if the contact has been with a charged metallic substance (as a wire or rail) it is reasonable to expect some external evidences to mark the place of entrance and exit of the current.

**Internal Manifestations** are in the form of effects upon the central or superficial nervous system, or upon the heart, plus symptoms referable to the direct effect upon the tissue the electrical energy may have been centered upon.

In a general way, the internal effects of electricity are those of Neurasthenia and Hysteria, or both; there are no special physical changes produced by electricity that are common to it alone, and when nervous effects follow, they are of the ordinary "Traumatic" Neurasthenia or Hysteria type.

It has been alleged that deafness and blindness occasionally result because of electrical contact, but in

the absence of a destructive burn of the damaged part, such effects are almost invariably Hysterical in nature; this is especially true if the contact has been of the "Flash" variety in which a spark or flame, rather than the current, has come into contact with the involved site.

**INDIRECT ELECTRICAL CONTACT:** It has been claimed that electrical effects can occur when the body is impinged upon by a flash or spark or flame, the results being identical with those due to actual contact with an electrically charged substance.

Aside from the effect of an Electrical Spark, the element of "Electric Shock" is lacking in such indirect methods of contact, and the effects are those of fright, burns, or temporary dazzling, such as follow the sudden appearance of any unusually bright light.

The sudden "Flash" or "Flame" (such as appears through slot-rails) does not differ as to causation or effect from a flame produced by other methods, inasmuch as it is the product of ignited foreign matter in contact with charged metal, and it is in no sense "a shock of electricity." In experimental work, persons have stood over slot-rails from which such "Flame" emanated, and no effects have been noted, and even a piece of cheese-cloth is but slightly scorched under such conditions.

**POINTS OF CONTACT:** Electrical effects due to accidents on our System are claimed to occur under the following circumstances:

1. **Direct Contact** with electrically charged materials; as for example, employees in Power Houses, or workers about Channel-Rails or overhead wires. In such instances, the point of entrance of the current is generally well marked by decid-

ed burns, and, less frequently, the place of exit of the current is similarly identifiable.

The effect of the contact is modified by the factors named above, chief of which are the strength and duration of current and the resistance offered by insulation.

2. **Indirect Contact** with charged objects at a distance from an electrical source; as for example, stepping upon a charged metal car-step, touching a grab-handle or a trolley-pole.

Under such conditions, the electrical effects are less apt to be marked by external evidences in the form of burns, and the manifestations are stated to be of the "pins and needles" variety, with the usual subjective Hysterical and Neurasthenic signs as later developments.

It is not infrequently claimed that the "Shock" of such a contact has been sudden and startling enough to make the person lose his balance, and the sustained injuries are then said to be electrical, plus those due to direct violence; if, however, such a condition arises, the duration and degree of the contact must be very slight, for otherwise the strength of current would be great enough to paralyze motion and the person "could not let go," if, for example, he had gripped the handle or dash.

The manifestations of this kind of electrical contact are dependent upon factors identical with those named above, but

it is to be borne in mind that the individual and the type of clothing worn (rubbers, gloves, etc.) and the site of contact play a very important part.

3. **Flashes or Flames.** The effects of these are identical with burns following contact with any overheated substance, and the physical manifestations differ only because subjective nervous symptoms are allied as allegations.

**SUMMARY:** Electrical effects cause either:

1. Burns;
2. Neurasthenia or Hysteria;
3. Malingering.

If the contact be not too strong or too prolonged, and if external effects are lacking, and if the person can be up and about after the receipt of the "shock," the effects are entirely subjective and are usually created for the purpose in view.

Electrical energy is a valuable adjunct in the treatment of certain ailments, and the sudden thrill due to the passage of an electrical current through the system has tonic properties so well recognized that it has become a standard means of treatment, especially in nervous affections; viewed from this standpoint, the effects of current speedily recovered from (so far as objective signs are concerned) is often salutary rather than harmful.

## XXV. X-RAYS.

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The "X-RAYS" were discovered by Wilhelm Conrad Roentgen, in 1895, and they are sometimes referred to as "Roentgen Rays" or "New Rays."

The theory of their existence is the discovery that rays of light can be produced by the passage of an electrical current of small volume and high tension through a vacuum tube.

**APPARATUS:** For the application of the Rays there is necessary:

1. Electric "Current" transmitted via Storage Batteries, Static Machine or Street System;
2. The "X-Ray Tube" in which they are produced and from which they emanate;
3. The "Fluoroscope," or shadow box, through which the observer gazes.

Accessory to the above, or as modifications, are:

4. The "Induction Coil" to be used with Battery or Street current;
5. The "Vibrator" or "Interrupter" to quickly "make and break" the current;
6. The "Rheostat" to temper the force of the current.

**ELECTRIC CURRENT** derived from Storage Batteries or Street wires needs no comment. That derived from a **STATIC MACHINE** is less reliable and hence less used; if employed, the machine must be large, having over a dozen plates (generally glass or mica) of a diameter approximating three feet, being operated by a small motor or by hand.

**X-RAY TUBES** are thin glass vacuums usually globular (about the size of a grape fruit) with pipe-like projections at each end (about three inches long), to which the current-wires are attached, respectively, to a pos-

itive ("Anode") and a negative ("Cathode") pole. Within the tubes is a concave disc of platinum on which the RAYS bombard to be reflected by a small mirror to one-half of the tube so that all the lumination can there be centered. In operation, the interior of the tube is filled with a yellowish green light and the surrounding air is permeated by a characteristic odor (ether).

**FLUOROSCOPES** are generally oblong wooden boxes (usually about 12x10 inches), painted black. The open end is for the observer's head; the sides are very firmly sealed. The closed end has a removable slide, one surface of which is covered by a substance that is fluoroscent to the RAYS, this usually being a CYANIDE of BARIUM and PLATINUM. The RAYS themselves are invisible, and they become of value only by virtue of causing fluorescence in other materials, such as the above.

#### **SURGICAL USES:**

1. Examination of fractures;
2. Location of solid foreign bodies (bullets, swallowed coins, etc.);
3. Outlining solid organs (heart, kidneys, etc.);
4. Treatment of certain **superficial** tumors, and skin diseases.

It is to be carefully noted that the fluoroscent rays show as silhouettes only and are in the truest sense shadow pictures; hence they fail fully to illuminate the soft parts, such as the skin, thin muscles, bony covering (Periosteum) or in fact any tissue that offers no obstacle to their passage. Some manipulators have been able to obtain outlines of the more delicate tissues, but the majority of operators are capable of imaging only the denser objects.

**TERMS:** FLUOROSCOPIC EXAMINATION is where the object to be examined (as a fracture) is interposed between the tube and the Fluoroscope, the closed end of the latter being placed on or close to the examined portion, and by regulating the strength of the current, the firmer tissues (as bone) are outlined. If there is any fissure or loss of continuity of the examined parts, the Rays penetrate it and a bright or light appearance contrasts with the surrounding shadow; or if there be any irregularity (as callus, or a growth), the abnormality is also appreciable.

This sort of examination is valuable in early **fractures** to determine the amount of separation between broken bones, the overlapping of same; or after "setting," whether or not the line of junction is good; and after healing, the amount of callus and the restoration of outline.

Obviously, its value depends **entirely** upon the skill of the observer and his willingness to interpret what he has seen. It is capable of purposeful misinterpretation unless the precautions named below are complied with.

RADIOGRAPHIC EXAMINATION receives its name from the derivation of the first word, which means "Ray-writing;" it is also sometimes called SKIAGRAPHIC EXAMINATION, meaning "Shadow-writing."

Each of the above refers to the photographed X-Ray image made on an ordinary (but specially prepared) sensitized photograph glass-plate; hence we have the equivalent terms:

1. RADIOGRAPH;
2. SKIAGRAPH;
3. ROENTGENOGRAPH.

**METHOD OF EMPLOYMENT:** Whether the examination is to be Fluoroscopic or Radiographic, the principles

involved in the reproduction of **any** image are to be observed, but because the object viewed is portrayed as a shadow, and because only the denser outlines are visible, extreme care must be taken not to distort the part inspected or photographed.

Inasmuch as FLUOROSCOPIC examinations are based entirely on the skill and honesty of the observer, comment is unnecessary.

For the absolute correctness of a RADIOGRAPH it is essential that the following be complied with, taking as an example a fracture of both bones of the leg:

1. Apparatus must be in good order, and the examiner must be familiar with it;
2. Photos must be made of the **sound** as well as of the **unsound** limb;
3. Photos must be made in both axes of each limb (from before back, and from side to side);
4. In each of the four photos, the X-Ray tube, the limb and the plate must be at exactly the same distance, or focus;
5. The plate must be free of all evidences of manipulation (over or underdevelopment, or "touching up").
6. The plate should be previously numbered or otherwise marked to avoid mistake;
7. All dressing should be removed, as most of them cast shadows easily misinterpreted;
8. The operator must be experienced, and preferably a Surgeon.

If both axes of an injured limb be not "Rayed," it is preferable that the fore and aft view be taken, but it should not be regarded as of **any** value unless it be accompanied by an identical view of the normal limb

taken at the same time, by the same operator and **absolutely** in the same manner. For this reason, X-Ray plates are now made large enough to portray both limbs at the same exposure, but it is imperative that the tube be centered exactly and at a right angle to the object.

There is the same difference in taking a shadow-picture of a limb in one direction, and calling it standard, as there is in photoing an individual under like conditions; a profile pose does not often look like a full face.

RADIOGRAPHS can be so manipulated by changing the distance of the object from the Tube, or by directing the Rays slantingly instead of vertically, as to distort the real conditions and bring into relief the desired portion, which in fact may be a natural irregularity and which remains undiscovered because the normal side is not Rayed under like conditions.

Dr. L. G. Cole, Radiographer of Roosevelt Hospital, has written an article on the fallacies of the X-Ray (in our Library) and in order to demonstrate his topic, Radiographed his own wrist and produced a plate which indicated the callus following a Colles' Fracture (break of outer forearm bone at wrist), but this was specious, as he never had any such injury; conversely, he so manipulated his Tube, Object and Plate, as to show absence of callus in instances where the latter was visible to the eye and could be felt by the examiner.

For purposes of deception, it would be very easy for an operator not only to manipulate his apparatus and object as above stated, but equally simple to interpose some impenetrable object (a coin or small piece of metal) in the desired spot, the image of which could be attributed to an alleged irregularity following the injury.

**PRINTS FROM RADIOGRAPHS:** If the plates are unreliable and worthy of scrutiny, the prints from same are doubly so, as the opportunities for accidental or purposeful misconception are much greater.

No PRINTED RADIOGRAPH should be accepted when the PLATE can be viewed, and both should be excluded unless the conditions above named be fulfilled.

The above is well shown by reference to the prints in the X-Ray album of our own Library.

## XXVI. ABORTIONS AND MISCARRIAGES.

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From a technical standpoint there are three terms denoting interruption of the normal period of pregnancy, and these are known as:

- (a) Abortions;
- (b) Miscarriages;
- (c) Premature Birth.

ABORTION is the interruption of pregnancy prior to the end of the third month.

MISCARRIAGE is the interruption of pregnancy prior to the end of the seventh month.

PREMATURE BIRTH is the interruption of pregnancy prior to the end of the tenth month.

Full term pregnancy is 280 days, or ten lunar months, which is equivalent to nine calendar months.

**TERMS:** An Abortion or Miscarriage can be:

- (a) Complete;
- (b) Incomplete;
- (c) Spontaneous;
- (d) Induced;
- (e) Concealed.

COMPLETE ABORTION or MISCARRIAGE is the expulsion of the fetus and the intact, unseparated "membranes."

INCOMPLETE ABORTION or MISCARRIAGE is the expulsion of the fetus, the "membranes" (whole or in part) remaining in the uterus.

SPONTANEOUS ABORTION or MISCARRIAGE is one that results from any of the causes named below, except such as may be induced by drugs or instruments, with or without criminal intent.

INDUCED ABORTION or MISCARRIAGE is one that results from drugs or instruments and in which intent is the basis.

CONCEALED ABORTION or MISCARRIAGE is one in which the fetus dies and remains for a time (days, weeks or months) in the uterus; a rare form.

Of the above, the "INCOMPLETE" variety is the most common.

**FREQUENCY:** An exceedingly common condition, but reliable statistics are obviously hard to collect because of the secrecy involved, and also because pregnancy interrupted within the first eight weeks gives symptoms so slight as to pass unnoticed, or at most the signs are ascribed to excessive menstruation (Edgar's "Obstetrics").

Of 10,000 cases of labor collected by Edgar (he has written one of the latest and largest books on the subject of "Obstetrics" and is Professor of that subject in Cornell Medical College), it appeared that 635 were interrupted pregnancies, distributed as follows:

242 were Abortions (before fourth month),  
175 were Miscarriages (before eighth month),  
218 were Premature Births (before tenth month).

Or in other words there was:

1 Abortion to every 41.3 Labors;  
1 Miscarriage to every 57.1 Labors;  
1 Premature Labor to every 45.8 Labors.

The above means that there was either an Abortion, a Miscarriage or a Premature Birth **once in every 15.7 Labors.**

These records, based on 10,000 cases, are accurate and made for statistical purposes based on Dispensary or Out-Door patients who were treated, mainly, in their own homes.

King's "Manual of Obstetrics" says that "90 per cent. of children-bearing women abort once or more during their lives", and by this is meant interruption of pregnancy at any stage.

Interrupted Pregnancy is more common among those who have borne children than in those who have not, as is well shown by quoting Edgar's figures based on the same series of 10,000 cases:—

				Tot. Int.		
No. Preg.	Abort.	Misc.	Prem. Preg.	Tot. Full.	All.	
1st .....	29	22	71	122	2,009	2,131
2d, 3d, 4th, 5th.	120	94	97	311	5,202	5,513
Beyond 5th ..	79	49	46	174	2,047	2,221
Unknown ....	14	10	4	28	107	135
Total .....	242	175	218	635	9,365	10,000

There are certain months at which pregnancy is most likely to be interrupted, and the same author gives the following statistics, based on 635 cases:

Third month,	23.9 %	interrupted before "Full Term."
Fourth	" 11.18 "	" " " "
Fifth	" 6.93 "	" " " "
Sixth	" 6.15 "	" " " "
Seventh	" 9.60 "	" " " "
Eighth	" 12.63 "	" " " "
Ninth	" 12.25 "	" " " "

Figures for the first and second month are unquoted by this author because they are unreliable; one "skipped period" does not indicate pregnancy.

Some women have interruption of pregnancy so often as to contract what is called the "**Abortion**" or "**Miscarriage Habit**," and Edgar says that of 407 cases of Abortion or Miscarriage, 34 per cent. had previously had one or more similar experiences.

In 218 cases of Premature Labor, he found 26 per cent. who had heretofore an identical occurrence.

It is a well-known fact that repeated miscarriages render the uterus intolerant of subsequent foetation, and the fetus is retained at each subsequent impreg-

nation a shorter time; for this reason, the duration of pregnancy generally becomes progressively less at each successive interruption, so that instead of Miscarriages, Abortions are substituted because of the increasing uterine irritability, and finally it becomes impossible for impregnation to occur; this of course implies that the causative factors are unrelieved.

### APPEARANCE OF FETUS AT END OF DIFFERENT MONTHS:

Month.	Length.	Weight.	General Conformation.
1st	1-3 inch.	20 grains.	Indistinguishable as a human form.
2d	1.5 "	60 "	Size of a pigeon's or hen's egg. Features and limbs, with webbed fingers and toes are visible, but sex undetermined.
3d	3.6 "	450 "	Size of goose-egg. Webbing of digits disappears. Head distinguishable from chest. Sex fixed.
4th	4-5 "	1800 "	Hair-like covering on body. Sex well defined.
5th	8-10 "	10-12 oz.	Face wrinkled and senile. Head huge.
6th	11-13 "	1½ lbs.	Hair thicker on head. Fat on body. Can live for a few days; some cases on record of survival if incubator reared.
7th	14-15 "	2½ "	Some survive with great care.
8th	15-16 "	3½ "	Survive with care. Nails do not project beyond finger tips (this a test at this stage).
9th	16-18 "	5½ "	Survival positive with care.
10th	18-20 "	7 "	Fully formed; nails beyond finger tips; eyes opened. "The infant."

Technically speaking, the terms "OVUM" and "EMBRYO" are used in reference to development prior to the fourth month (i. e., the "Abortion period"), and thereafter the term FETUS or FOETUS (meaning "Offspring") is employed.

It will be seen from the above that the human form is not distinguishable until the second month, and that the sex is not determinable until the third month.

Many women when menstruating have the discharge in a clotted or membranous form in a size often equal-

ling an embryo of the first or second month, hence an abortion at this period has not enlarged the uterus to any great degree and the symptoms are generally no more severe than at the menstrual epoch. For this same reason, tears or lacerations of the neck of the uterus ("Cervix") or of the space between the vagina and rectum ("Perineum") are impossible at this period because the pregnancy products are not large enough to overdistend the parts mentioned; lacerations and the resulting scars do not usually ensue until the fetus has reached the sixth or seventh month, hence the finding of a scar in the Cervix (neck of the womb) or Perineum (fleshy space between rectum and vagina) is proof positive that conception to the period named has occurred at some time in the woman's history, this being further confirmed by the appearance of the breasts. However, a scar of the cervix alone may follow an operation for the scraping of the interior of womb ("Curettage"), with or without previous impregnation.

After the seventh month, survival of the fetus can occur with great care, and hence the term "Viable Period" is applied to a birth at this stage.

The Board of Health Statistics do not require reports of Abortions or Miscarriages, but all cases beyond seven months are regarded as "Still Births" if born dead, and are reported on a special certificate; but if life be present for even a short time, the regular "Death Certificate" is filed.

**CAUSES OF ABORTIONS AND MISCARRIAGES:** These are usually referred to as:

- (a) Predisposing Causes;
- (b) Exciting Causes.

**Predisposing Causes:** These may refer to the mother, father or child.

**Maternal Causes:**

Too early, late or frequent pregnancies;  
Obesity; Emaciation; Constipation; Excessive Vomiting;  
Marriage of Consanguinity;  
Fevers and illness, such as Malaria and Typhoid;  
Certain poisons such as Alcohol, Lead and Arsenic;  
Drugs used with intent, such as Ergot, Cotton-root or Tansy;  
Syphilis (manifest or hidden) a cardinal factor;  
Kidney trouble very potent; also disease of heart or liver;  
Mental shock, such as fright, worry, grief, etc.;  
Anaemia (poor blood) a large factor;  
Tuberculosis and infectious diseases;  
Hard or overwork, especially if implying abdominal strain;  
Any set of causes lowering vitality;  
Local conditions, such as Uterine or other pelvic inflammation;  
Displacements of womb, especially backward;  
Criminal or intended, by instruments or electricity;  
Trauma, especially violence over abdomen.

**Paternal Causes:**

Disease, such as venereal trouble or alcoholism;  
Syphilis, exceedingly important;  
Extremes of age;  
Debility from any cause.

**Fetal Causes:**

Malformation of ovum or its membranes;  
Excess or decrease of "bag of waters;"  
Too long or too short a "Cord."

Edgar states " . . . Perhaps the most important cause is previous uterine disease, as Endometritis, which is quite common . . . " "Endometritis" means inflammation of the lining of womb and it is an exceedingly common condition usually manifesting itself by a more or less profuse whitish discharge of a Leucorrhoea type ("The Whites"), and it causes interruption of pregnancy because it has inflamed the inside of womb to such an extent that the latter contracts and expels the fetus or kills it by the irritating and germ-containing "catarrhal discharge."

TRAUMA (injury) as a causative factor is often over-estimated, and in the absence of some of the above predisposing influences, considerable violence is generally necessary before pregnancy is terminated thereby. Force applied to the region of the enlarged uterus is the most productive type of violence, but in a susceptible woman (due to the predisposing factors mentioned, or having previously aborted or miscarried), the amount of force required is often inconsiderable, and it can be inflicted on almost any portion of the body, the element of Shock often being as important as the actual violence.

Jewett, in his "*Practice of Obstetrics*" says: Traumatism as a cause of abortion must always be accepted with considerable scepticism. Pregnant women have been known to sustain the most severe injuries without aborting. On the other hand, to the most trifling accident, such as a misstep or a simple fall, is frequently ascribed by the laity the interruption of pregnancy."

Of the great number of possible causes, Edgar gives the six following as the **most common**:

1. Diseased lining of womb ("Endometritis");
2. Backward displacement of womb, with or without adhesions;
3. Syphilis;

4. Kidney trouble;
5. Criminal interference;
6. Low attachment of Placenta ("afterbirth").

It has been said that a healthy ovum in a healthy womb is dislodgable only by instrumentation.

**SYMPTOMS AND DURATION:** These in part depend on the period of pregnancy, but in a general way the symptoms during the first three months ("Abortion Period") are much like those of an excessive menstruation.

The usual combination of symptoms can be stated thus:

1. Abdominal pain or tenderness; after third month this becomes paroxysmal and is separated by intervals and approaches the true "Labor Pain" type;
2. Vaginal bleeding; at first this is slight, later clots are expelled, and often actual hæmorrhage occurs. During the "Abortion Period" (first three months) the blood loss is slight because the entire contents of womb are generally expelled in a "soft-shelled egg" manner;
3. Stomach symptoms, such as nausea and vomiting;
4. Constitutional signs, such as weakness, perhaps actual fainting ("Syncope"), headache and pallor.

Whatever be the initiating cause, it is usual for the symptoms to begin soon after its infliction; for example, after a fall or other trauma, symptoms are usually not delayed beyond a few hours, and if more than a day intervenes, it is not unlikely that other factors play at least a contributing part.

From the beginning to the end of "Abortion Symptoms," 24 to 36 hours usually elapses. (Edgar).

The period abed varies with the stage of pregnancy, the symptoms, the treatment, and the individual, but, generally speaking, a week or ten days is sufficient; some women do not go to bed at all nor are their regular duties interrupted.

The lying-in period at full term is generally 8 to 12 days.

**TREATMENT:** A "Complete" Abortion or Miscarriage (one in which the entire contents are expelled) requires no treatment aside from the giving of drugs (such as Ergot), and douches to promote uterine contractions. If, however, the membranes are not expelled completely, they become a menace and may cause blood-poisoning ("Sepsis") or later be the focus for the development of ovarian or other pelvic trouble.

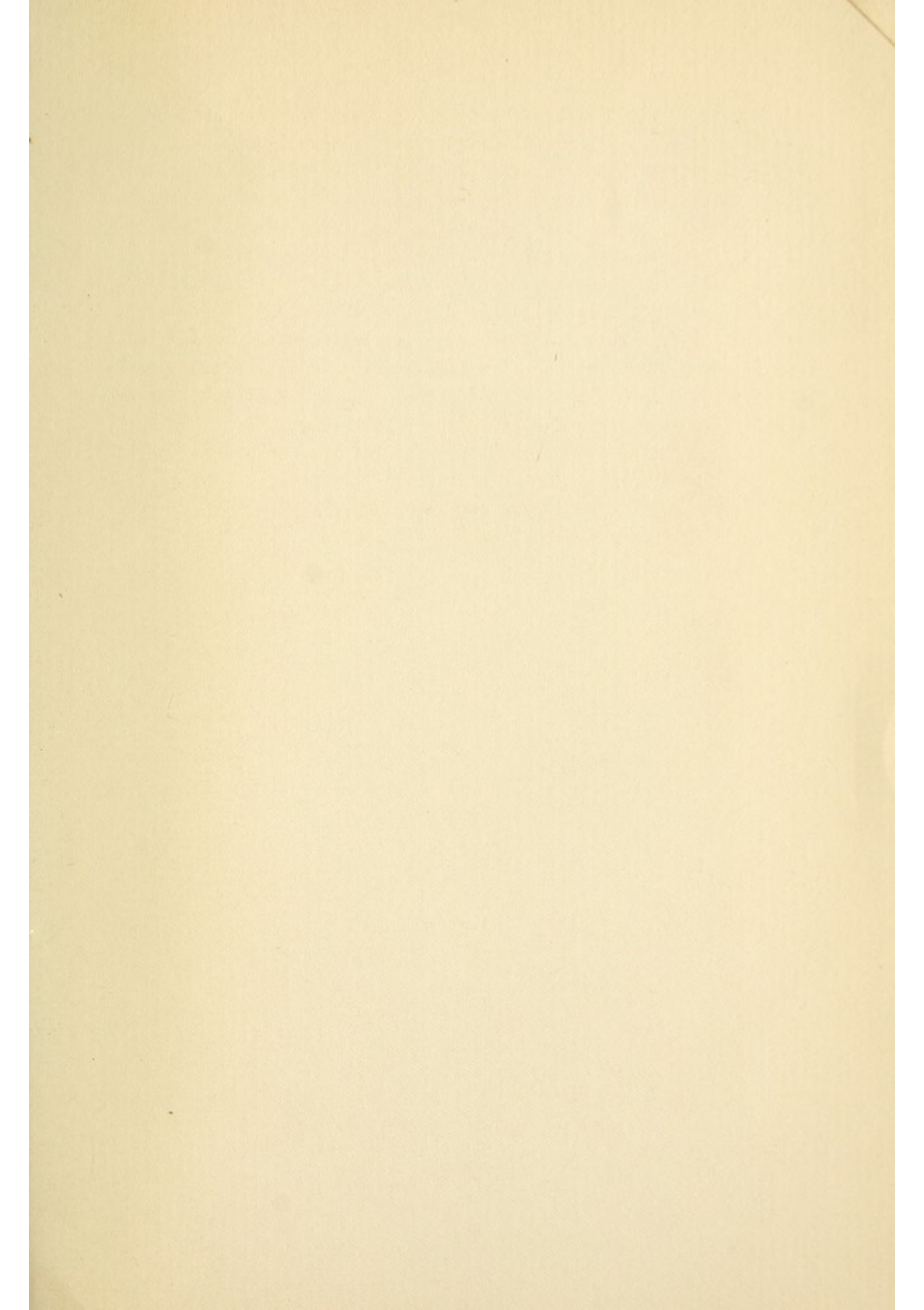
For this reason, the treatment of such an interrupted pregnancy designs to remove the retained membranes, and if drugs and douches fail (as is frequent) resort is to "Curettage" or "Curettement," this meaning the removal of what remains by a spoon-shaped small instrument introduced into the uterus. Frequently the operation can be performed without the use of an anaesthetic, and it is by no means severe and is the commonest operative procedure among females.

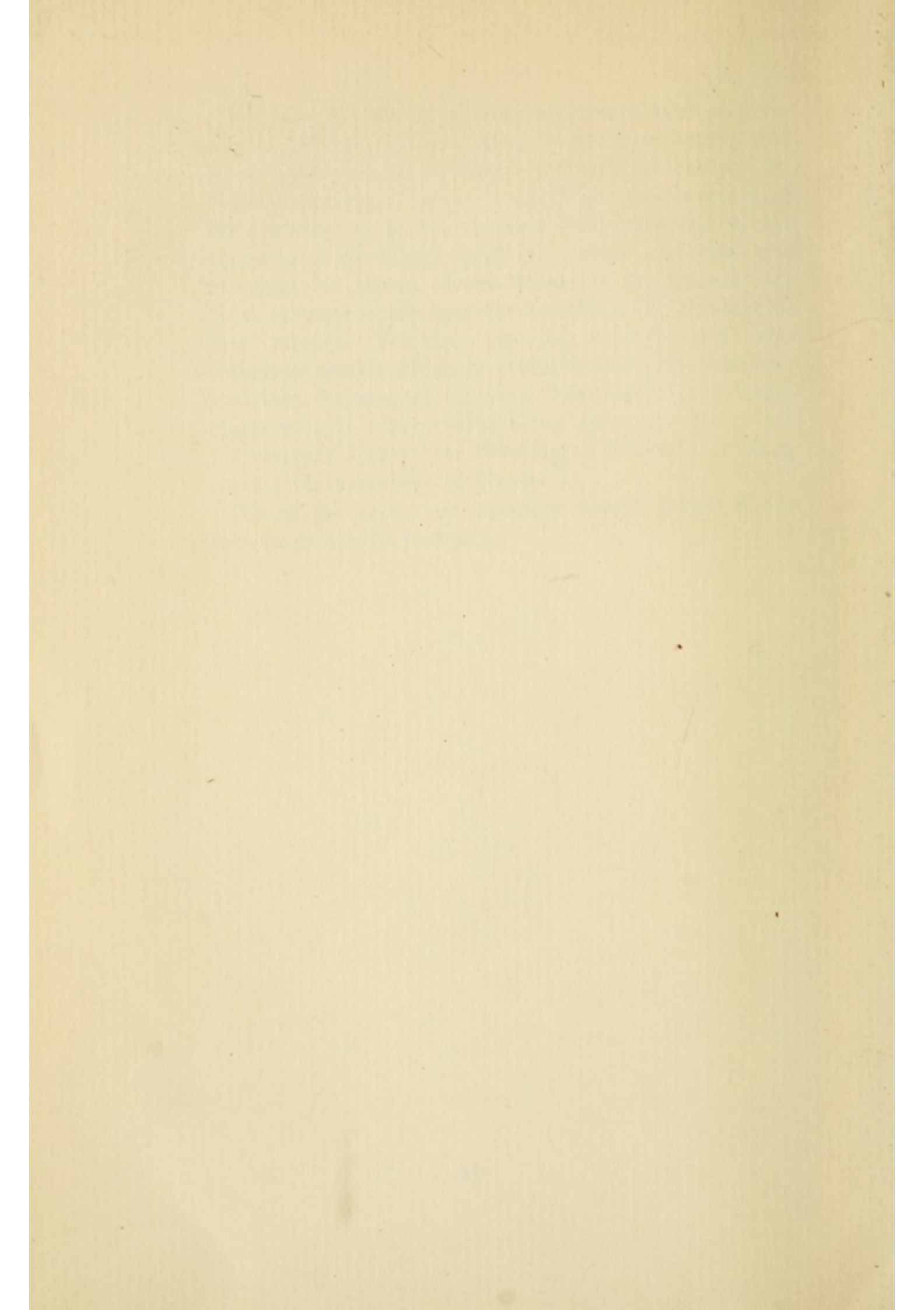
Operative treatment of this type for such Abortions or Miscarriages is practised by the best class of physicians, and when properly performed, the uterine organs are rendered healthy and the interrupted pregnancy cannot be justly blamed for the development of later pelvic trouble.

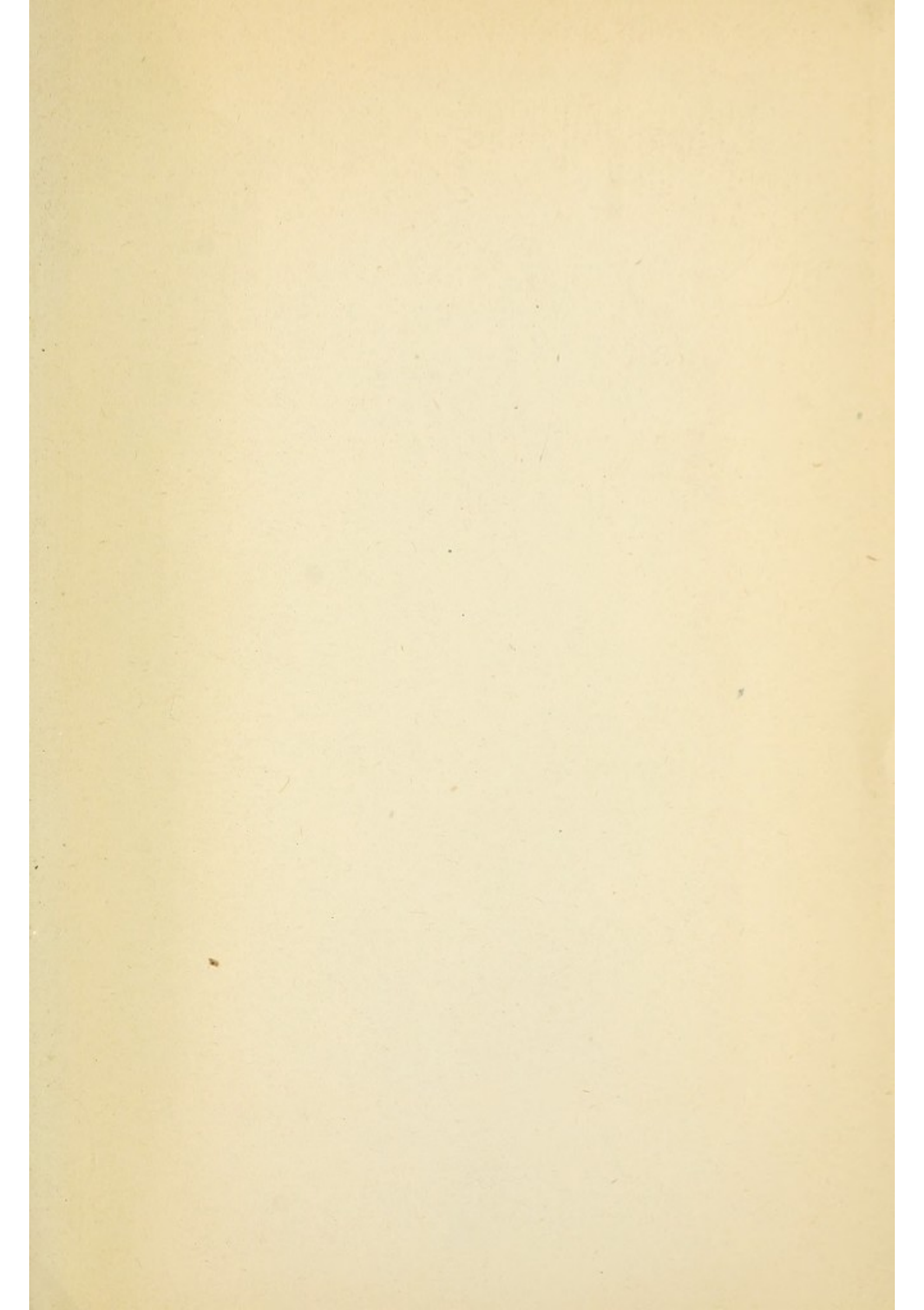
Speaking of the merits of this treatment, Edgar says: ". . . It is a boon to the working classes . . . after instrumentation, the patient may leave her bed on the fifth day . . . not more than half an ounce of blood is lost by instrumentation before the fourth month . . ."

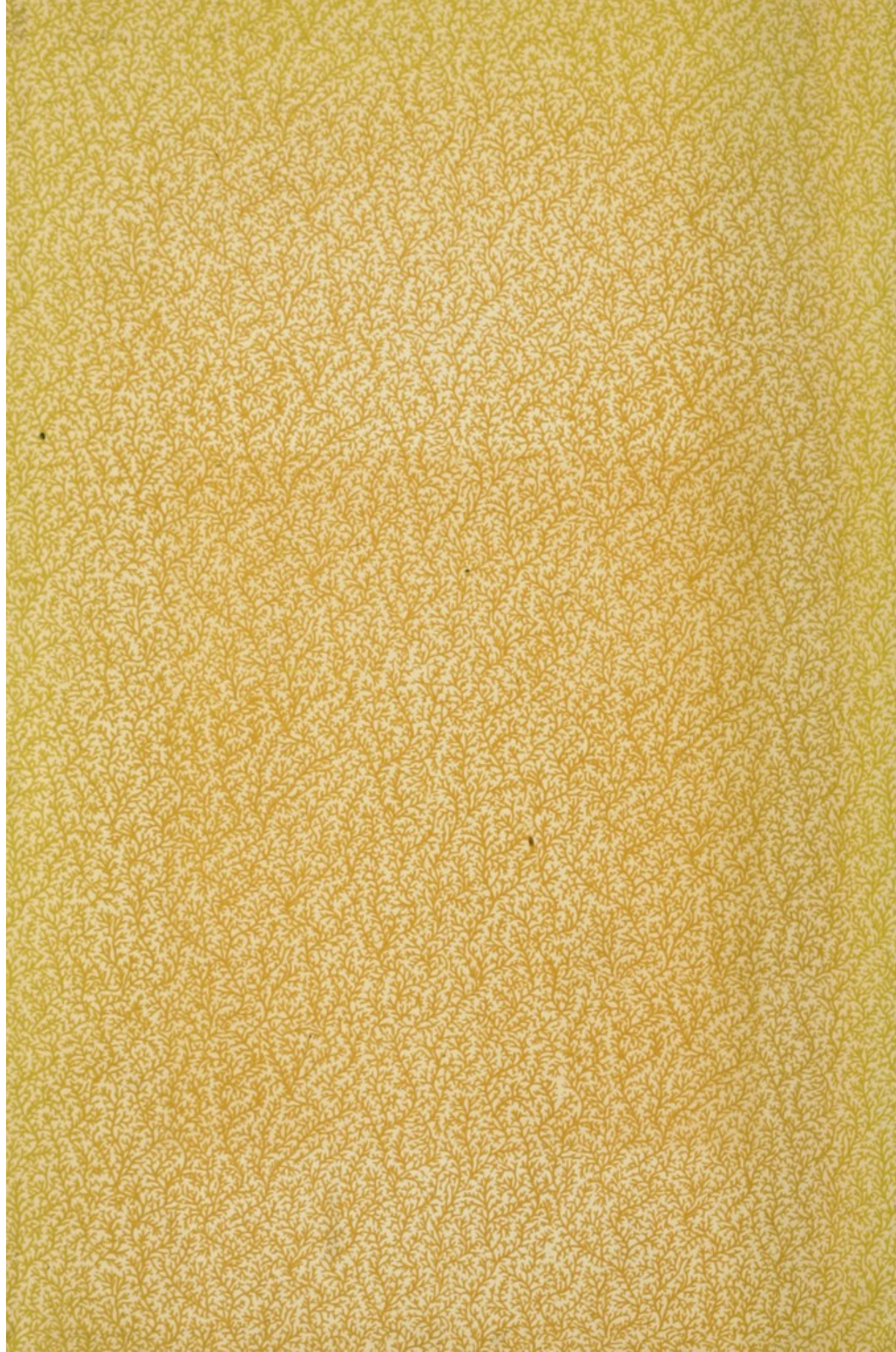
Improperly treated interrupted pregnancies may result in the retention of part of the membranes and these may become infected by germs, leading to blood-poisoning ("Sepsis") or to the involvement of the Ovaries or Tubes (organs lying adjacent to the uterus and connected with it). Such retention also prevents the return of the uterus to the normal size (i. e., a large pear), and the condition of "Subinvolution" ensues. We then have an enlarged and overweighted uterus which is prone to fall into abnormal positions because of its own "bogginess," and hence displacements occur, these being generally downward ("Prolapsed Uterus" or "Falling of Womb") or backward ("Retroversion of Uterus").

All of the above are obviable complications if due care be given the patient.









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