No mention of caliper in wounds of Rader - Lee Reman - 4-04

Better effects of concave balls on lower more severe than adullter seems to think
Gunshot Wounds.
Gunshot Wounds.
David Palmer Esq.
Penang, East Indies.
31st March 1863.
The subject which I have selected and of which I propose treating, is of great practical and theoretical interest. To those who propose to enter the public services of the Country it is especially important, but even to those who intend to pursue the more peaceful walk of private practice it is not without interest, for they are liable at any moment to be called upon to treat a case of Gun-shot wound occurring in their civil professional careers. Happening as Gun-shot Wounds generally do in men of robust health and good constitution, they afford us
us most favourable opportunities of observing the destructive or reparative process which follows mechanical injury.
In treating of Gun-shot wounds I intend speaking in the first place of simple wounds of the soft parts, and lastly of injuries of the more important structures. Gun-shot wounds are in character more or less confused and lacerated, and always followed by extensive inflammation and sloughing. The amount of injury varies; for instance, a musket ball may merely graze the part, inflicting only a bise, or it may either enter a part of the body and lodge, or it may perforate. The amount of contusion sustained by the force and velocity of a Ball has been well explained by Sir Charles Bell in a simple illustration consisting of three circles one within the other, for he says "I shall suppose that the innermost of the circles corresponds to the diameter of the Ball, the substance occupying the
the innermost circle is forced aside, and is condensed into the space between the internal and second circle, and consequently it is mashed and destroyed. It is at the same time evident that the substance occupying the space between the second and third circle must by recoil of the deadened substance be displaced with a force of percussion proportioned to the velocity of the ball. This portion of the substance being congealed or rendered paralytic requires some time to recover its vital powers, but when it does react and inflame, the inflammation is in degree corresponding with the violence of the injury which has been sustained."

Let us now examine a Gun-shot wound of the soft parts inflicted by a musket bullet. We have in the first place a round orifice with the edges depressed and inverted with a slight discoloration of the skin indicating the entrance of the ball, and
If the ball has passed out we have the aperture of exit with its edges erect and ragged and usually larger than the aperture of entrance. Concerning the dislocation, Dr. Will, Assistant Surgeon 63rd Regiment, in an interesting and excellent paper, read before the Medico-Chirurgical Society, remarks, that about an hour or so, around the aperture of entrance slight redness begins, which gradually extends to about two inches in circumference. After a time this colour changes to a tinge of blue or greenish black, and presents the appearance of a severe bruise with a small wound of the integuments with its edges still inverted. But when the injury has been sustained from a short distance the aperture of entrance is comparatively larger than that of exit, though having lost the smoothness of its edges, and assuming a more lacerated character. These wounds are seldom attended by purpura primary hemorrhage except when large.
large vessels are divided, and the smaller vessels are closed being bruised and torn, but from the form of the wound it occasionally happens when there is no appearance of bleeding, there may be considerable hemorrhage taking place internally. The first thing to be done in such injuries is to arrest the hemorrhage, if any, which may be effected by various methods such as pressure and cold, but if these should fail, ligation of the vessel must be resorted to. This can be done either by tying the main trunk, or by securing the wounded vessel above and below the bleeding point. Should the vessel not be completely divided it is proper to complete the division.

The pain occasioned by these wounds is in some instances inconsiderable, the part being deadened from the effects of the contusion, in cases are recorded of men who have been perfectly unaware of their having sustained any injury when they were really severely wounded.
wounded. The shock to the system is singular and peculiar, being generally present in a greater or less degree; but it is not always the case that in very severe and dangerous wounds the amount of shock is very great. Mr. Mill mentions, that in cases which came under his notice of comparatively slight injuries, the shock to the system seemed to point out that the wounds were more serious than they really were. The body is pale, and flushed with a cold clammy perspiration, faintness and nausea, with confusion of ideas, and tremor of the whole frame prevails, which tremor terrifying to behold may be allayed by the administration of wine, spirits, or opiates, and also by the tenderness and consideration of the surgeon and his assurance to the sufferer of his freedom from danger.

There is a peculiar condition of the muscular textures accompanying the wound of the soft parts, which was first
just pointed out by Mr. Guthrie, where the
wound in the left part, begins to swell
and becomes painful and where the
muscles undergo apparent softening
from inflammation. This inflammation
says Mr. Guthrie commences about 10
days after the receipt of the injury
and in consequence of which Pyaemia
often supervenes, and rapidly destroys
the patient. A case of this kind is
described by Mr. Spence, where the
Patient received a wound, from a
charge of small-shot, in the calf of
the leg. a good number of the pellets
were removed, and the patient pro-
gressed favourably for some time.
When suddenly the limb began to
swell, and became exceedingly tense.
Pyaemia set in, and carried off the
Man. On making a Post-Mortem
examination the Castre enemies was
found in that peculiar softened state
described above. This state has been
compared to the appearance of a part
becoming gangrenous.
Treatment of Simple Wounds

We must in the first place thoroughly examine, and wash the wound with cold water, and extract any foreign bodies that may be present, such as pieces of dress, and particularly bullets if they are situated within reach. In suitable localities, such as the extremities, uniform pressure may be applied along the track of the wound in order to induce, or rather to give it the chance of union by the first intention. Mr. Guthrie considers in patients of sound constitution, a piece of lint dipped in oil, to be the best application, at first, in order to prevent irritation of the part, with slips of adhesive plaster to keep the lint in position. Then a compress of lint, kept constantly wet and cool with cold water to be placed over it. In the treatment of the present day, the oiled lint is not so much in vogue as it once was, and the application of cold water alone is now the general treatment.
treatment. The object in using cold water is in some measure to prevent inflammation, and at the same time to allay and subdue it if present. Should the inflammatory symptoms run high, however, Purgatives, Depletion, occasional Emetics, and low diet are the most important remedies which we must have recourse to: and should Erythema have set in, tepid water dressings must accordingly to the feelings of the Patient, be substituted. For the cold applications.

Course and Lodgment of Balls

The courses which balls are frequently found to take are very singular. A Ball after penetrating the skin may often have its course changed by impinging against a bone in consequence of which it is hindered from further ingress. The scalp outwardwards is stopped by the elasticity and density of the Integra-

ments.
ments, while any convex surface or unequal density of a part may serve to turn a ball from its course. Thus a ball may strike the head and instead of entering the skull, may rebound from the bone and pass between the scalp and cranial bones, either with or without depression of the latter, or it may pass right through the body.

They have sometimes been found to traverse the body merely beneath the skin, and also to perform a complete circuit so as to pass out of, or to be lodged near to, the same orifice at which they had at first entered. Thus Dr. Hennehn describes a case which occurred to a friend of his in the Mediterranean Sea, the ball which struck about the Hyoid cartilage was found lodged at the orifice of its entrance, having gone completely round the neck, and was prevented from falling out, as I have said before, by the elasticity and density of the surrounding integument. He also adds...
adds that this percutaneous route of bullets is of frequent occurrence especially when they strike against the ribs or the muscles of the abdomen. The tract of the ball in such cases may be indicated by a local or discoloration of the skin which Mr. Hunter compares to a blush, and it is generally attended with an emphysematous cracking. But a still more remarkable route for a ball to take, is that after penetrating the thorax or abdomen, to traverse the internal contents of these cavities from one point to another, and only grazing the pleura and peritoneum, without injuring the contained viscera. A case of this nature is recorded by Toussacq in which a ball passed round the interior of the thorax without wounding the lungs.

Wounds of Thorax

Wounds which penetrate the thorax and which
do not more or less injure the contained viscera are comparatively rare, but they have been found only to have detached the pleura from the varieties of the thorax and not to have opened into the pae itself. A case of this sort has been recorded by Dr. Clift of the College of Surgeons of London where he says that a large shell shot entered the chest of an officer on the left side, traversed the posterior surface of the sternum and passed out on the opposite side, merely detaching the pleura from the rib without pene-
trating it, and the patient ultimately recovered.

In all injuries penetrating the thorax, the greatest danger present is that from internal hemorrhage, which is indicated by an extreme sense of faintness, increased difficulty of breathing, a tickling cough, and very frequently bloody expectorations, which latter symp-
tom is exceedingly important in proving that the lung is injured. In superficial wounds of the lungs, blood may be con-
iderably
derably effused without there being any expectoration, but in wounds more deeply situated, Haemoptysis is the result, from the blood finding its way into the larger branches of the bronchial tubes. Hemorrhage may take place from other sources than from the lungs, viz. the Pulmonary artery and the Internal Mammary and Intercostal arteries. Bleeding from the Internal Mammary and Intercostals is exceedingly difficult to detect or arrest, and cases are on record of death from this cause.

When hemorrhage arises from the lungs alone it can be considerably checked by general depletion and thus diminish the quantity of blood passing through the lungs, and also by abstemious diet. The immediate, in wounds of the lungs is either from debility, hemorrhage, or suffocation from the blood flowing into the air cells, or occupying the cavity of the pleura and pressing on the Lung. In some cases, balls or other foreign bodies have been imbedded in the substance of the Lung, and enveloped in an
an adventurous cyst or capsule. A very remarkable case of this kind is on record in which a seaman had a portion of an iron hoof lodged in his left lung for 14 years. There is also a case of Lodgement of Ball in the Lung mentioned by Boyer in which a ball was found and which was known to have been received 20 years before.

Dr. Hennen gives a case by which he shows that a much larger mass than a bullet will pass through the Lung without producing death; for he says, "A soldier of the Guards was wounded at Waterloo between the 3rd and 4th Ribs of the right side. On his arrival at Brussels, he was placed in an Hospital and dressed by Assistant Surgeon Reid of the 25th Regiment, who has favoured me with the Case. Nothing remarkable occurred for the first five days and the only singularity in the appearance of the wound, was its large size, capable of admitting 3 fingers conically placed. Blood and air freely discharged from it. On turning the Man to examine him and renew the dressings, a tumour was
was discovered on the scapula, from which
was extracted his breast-plate, about two-
thirds of it rolled up by the force of the
blow into a figure somewhat resembling
a candle extinguisher, with the musket
ball contained within it, the other third
was broken off, but had also passed thru
the wound and was extracted. This
man survived for three weeks, with great
hopes of his perfect recovery, but on one
sudden gust of passion, to which he
was liable, he one night tore off the
dressings off his wound, and was
found dead the next morning."

Wounds of Abdomen.

These wounds are extremely dangerous,
particularly when they give rise to in-
juries of large blood vessels, to the escape
of the contents of the different visera of
the Abdomen, or to the inflammation
of the Peritoneum.

The symptoms which follow injuries of
of this sort are worthy of special notice, the pulse is weak and feeble, general debility, tension of the abdomen with hiccups and vomiting exist, and I may here mention that these symptoms are all present although the wound does not penetrate the peritoneum. In cases of wounds of the stomach, hiccups and vomiting are the most prominent symptoms. While discharge of the bile with the feces and the urine indicate that the intestines, kidneys, or bladder have suffered to some extent. When no protrusions of the bowels or the discharge of any of the fluids secreted, take place, we are often left in doubt as to whether the wound can have injured any of the organs of the abdomen or not. In wounds which have been caused by a musket ball, protrusions of any of the viscera hardly ever or at any time occur.

The treatment of this last mentioned form of wound is very simple, it is merely to be covered with light dressing.
but whenever balls, or pieces of wadding or any other foreign bodies are lodged and are situated within reach they ought always to be extracted; but too much meddling of the part may give rise to the danger of the patient, and above all, perhaps to inflammation of the peritoneum which, if once it has set in, very little hope can be entertained of the safety of the patient.

Injuries of the Abdominal parietes resulting from shot and shell, even if they do not penetrate, weaken the part greatly and render it liable to the occurrence of hernia.

Under the head of "Injuries of the Abdomen" I shall now confine myself to injuries of some of the most important viscera contained in this cavity, viz. Stomach, Liver, Intestines & Bladder.
Injuries of Stomach.—These injuries are generally fatal, more so when inflicted at its pyloric extremity, or near its blood-vessels, and then they are attended with considerable danger. Wounds of this organ are recognized, firstly, by their depth, lastly and most especially, by hiccup, nausea, and vomiting of blood. Mr. Alcock states that out of about 3000 cases of Gun-shot wound of the Stomach he had only seen one case of recovery from the penetrating of a musket ball.

Dr. Beaumont of America describes the case of a man (Martin) who was accidentally wounded by the discharge of a musket and where the stomach was injured. In his case I dare say is very familiar to us all, and who recovered though the orifice never closed. For he states, "The charge consisting of powder and duck-shot was received in the left side at the distance of a yard from the muzzle of the gun. The content entered posteriorly and in an oblique direction, forward and inward, literally blowing..."
Blowing off the integuments and muscles to the size of a man's hand, fracturing and carrying away the anterior half of the sixth rib, fracturing the fifth, lacerating the lower portion of the left lobe of the lung, the diaphragm and perforating the stomach."

Injuries of the stomach generally become fistulous and remain open. A case is mentioned of this kind where the opening continued open for nine years, and another for twenty-seven years. The treatment in these wounds is the same as those of the abdomen.

Wounds of Liver. When these injuries are deeply situated they are exceedingly dangerous on account of the great vascularity of this organ, and are as fatal as if the heart were implicated. The great danger then is from hemorhagy which we cannot easily arrest by mechanical aid. Slight wounds are extremely trivial particularly if the membrane alone is injured. The symptoms which are
are generally present, are, yellowness of the skin, derangement of the stomach and alimentary canal with great itching. The discharge from the wound is generally yellow and glutinous, and sometimes of the color of bile but of a thin serous consistence. The treatment here is depletion, either at the bend of the elbow, or the application of beeches and hot fomentations also to allay the inflammation, to administer gentle purgatives, and to diminish the ingesta.

**Wounds of Intestine**—These injuries of the small intestine are, for the most part, either at first, or at last, or ultimately fatal, while those of the large intestine are often less dangerous and sometimes heal without difficulty. The signs indicating this class of wound, are, a small and tremulous pulse, paleness of the face and a great tendency to syncope, with bloody evacuations of the bowels and the escape of faeces or of faecal matter.
matter from the wound itself. But if the contents of the Bowels be extravasated within the peritoneal sac, the patient runs a great risk, in fact death is his ultimate. Abstinence and rest are chiefly to be attended to in these cases.

**Wounds of Bladder.** If penetrating that portion of it which is covered by the peritoneum, and favouring the escape of urine into the general cavity of the Abdomen, are most undoubtedly fatal. As it generally happens that the bladder is often full at the time of injury in filtration of that fluid into the adjoining cellular tissue is another source of danger. It is not an unusual circumstance for bodies to be lodged in the Bladder, such as balls, slugs, or fragments of bone, and which often become the nuclei for urinary calculi requiring the operation of Lithotomy for their removal. But if they are small, they often pass out through the urethra. Foreign bodies which have been carried
by a ball into the bladder, if they are small and soft in size are often carried out by the natural flow of urine. Thus Dr. Henlen describes a case in which a soldier received a wound in the region of the bladder from a ball, which carried along with it a piece of the skirt of his regimental coat, corresponding to the line of the bullet, and who passed it out through the urethra while making water. After an injury of the bladder depositions of calculous matter are liable to form and adhere to its internal coat, notwithstanding there being no foreign substance to form the nucleus. Paralysis of this organ, is also a common occurrence and an actual diminution of the cavity of the bladder itself takes place. The principal treatment in these injuries is rest, to obviate the distension and contraction of the bladder, and to prevent the further escape of urine into the surrounding parts. In addition to this the usual antiphlogistic regimens, bleeding, fomentations and gentle laxatives are often requisite.
Injuries of Bones and Joints.

I now intend to speak of a class of injuries which are of the greatest importance on account of their peculiarity and complexity. When a ball strikes the compact dense structure of the shaft of a long bone it is generally comminuted and its vitality is so impaired that necrosis is the most probable result. But if it should come in contact with the head of a bone as that of the humerus and femur, or the articular ends such as the elbow and ankle joints it usually splintens them. Should a ball however strike a bone of cancellated structure the amount of destruction is comparatively slight. It may either tear up the soft tissue without splintering or when its passage is obstructed by some tough substance such as ligament lodge, or it may lodge in the spongy part of the articular end of the bone with comminution, or with or without fracture enter the neighbouring joint.

As I have mentioned before a ball will often fracture a bone without penetrating the
the integuments, and in these cases the diagnosis is sometimes extremely difficult more especially when they occur close to a joint. The principal symptoms here are pain and inability to move the limb, with more or less distortion, but the most important diagnostic which must be attended to is crepitus which is always heard when the limb is handled. Balls often remain lodged for a long period in bones, and sometimes the cancelli of the bones break down and admit of their moving up and down. They are known to have been impacted and given rise to no constitutional disturbances for upwards of twenty-five years. But in the majority of cases intense inflammation with extreme pain with profuse suppuration and irritative fever supervenes, the removal of the foreign body is had recourse to as the only chance of recovery.

In all cases of fracture the most serious are compound, more especially those resulting from gun-shot wound, which must be of the severest form when we consider
consider the complication attending the injury; so therefore we cannot wonder why in the majority of cases primary amputation must be had recourse to, and that in the less severe most particular care and attention is demanded.

The bones are either broken transversely or in an oblique direction, or are fractured into two or more different pieces, or again as in the forearm or leg only one of the bones is injured whilst the other is unharmed and serves as a splint to keep the parts in situ.

The shock here seems to implicate the whole system on account of the sources of irritation being more numerous and more complicated. From injuries of the bone the neighbouring joints become more or less diseased, and this is easily accounted for by the fact that the articular cartilage having no bloodvessels of its own is chiefly dependent for its supply on the bloodvessels in the cancellated structure with which it is intimately connected, so that now when the bone is injured, the cartilage, being deprived...
proved of its nutrition, ulcerates, and disease of the joint is set up.

I am now led to speak of injuries of joints which are always exceedingly dangerous and incur great risks to life and to the limb so affected. When a ball penetrates a joint the local symptoms here indicated are most acute and rapid in their appearance. The synovial cavities are affected with intense inflammation, effusion into the general cavity of the joint takes place, with tension and diffuse swelling attended with rapid ulceration of the car-
tilage and diffuse abscesses forming in the surrounding soft tissues. The constitutional disturbances present are intense irritative fever, profuse perspiration with sharp attacks of diarrhoea, which of course tend greatly to weaken the patient. The result in these cases as regards saving the limb have been almost entirely favourable, and Dr. Spence remarks that of the many cases which he has seen and treated particularly those where the symptoms were of a most acute char-
acter, he has never seen a case where a cure was
was accomplished without anaphloysis of the injured joint.
Cases are on record where musket bullet have passed through large joints such as the knee without injuring the articular surfaces, and when the patients have been successively cured with a useful limb but these occurrences are exceedingly rare.
When the synovial sac is very largely opened the symptoms do not appear to increase but rather to lessen as we learn from some cases. One of the most remarkable of this sort is recorded by Dr. Wood of Huntington where a knee joint was extensively opened into and a greater portion of the patella blown away by the discharge of a musket. The patient in this case recovered under the application of poultices without a single unfavourable symptom with a very useful limb, and where the joint is active moved instead of the patella, and he was able to walk about without the help of a stick or crutches.
Treatment of Injuries of Bones and Joints

In the treatment of bones and joints we must first determine whether the cases absolutely demand primary amputation, or whether there might be a chance of saving the limb so as to render it useful to the patient.

Excision of the heads of bones used to be practiced by Percy, Larrey, and Guthrie, in order to supersede amputation, but it was never generally adopted. Sir Charles Bell highly approved of this operation for he in some few cases either wholly or partly removed the shattered portion of the bone.

But Dr. Hennen advises it only as a secondary operation for he thinks the surgeon may then be better able to judge how far the vitality of the bone has been impaired and to draw his conclusions.

Resection or excision of diseased joints as a substitute for amputation had also been long practiced but from the complicated nature of the operation, few Surgeons adopted it and therefore it fell into disuse.

All honor and credit is due to Professor Syme for re-establishing excision especially that
at the Elbow Joint.

In slight injuries of joints attempts have been made to treat the inflammatory action, and to attain ankylosis of the joint, which has been everywhere successfully procured, and in the severer forms to have recourse to primary amputation. In all cases of Gun-shot wounds of the Shoulder and Elbow admitting of conservative measures, primary excision ought to be performed and the result will be quite as successful as that of primary amputation.

In Bauden's experience as to the Shoulder, that out of 11 cases of primary excision, 10 recovered, 1 death - of 13 submitted to expectant treatment on account of being less severely wounded, 8 died from exhausting suppuration, 4 survived with fistulous openings. 3 Cured by secondary selective Excision of the Shoulder in most cases prompts of the formation of a new joint of a gingly-mind character, little impairing its movement.

For Mr. Bauden confirms this statement by mentioning that one of his patients had subsequently
subsequently fought a duel with swords and actually wounded his adversary.
The experience of Stromeyer and of Dr. Cimmarck of Hild during the war in Schleswig-Holstein has been equally important as to the advantages of resection of the Elbow Joint.
Dr. Cimmarck states that out of 40 resections of the Elbow Joint only 6 died, 1 required secondary amputation for gangrene of the forearm, if the rest, some were anchylosed, and this he seems to attribute to the period of operation.

As regards cases where balls are deeply lodged in bones such as in the head of the Fidia, or the condyloid portion of the Lumer, they ought to be removed if they are a source of irritation and pain and that must be performed in such a manner as to be without danger to the joint. All wounds in the neighbourhood of joints are to be carefully examined at the very first before the swelling has taken place, but even later, when the ball can be felt from the original wound, there is no difficulty in extracting the foreign body by enlarging the wound in the soft tissues.
textures, and also that in the cancellated texture of the bone by means of a gouge. Of course the earlier this is accomplished so much the less danger incurred to life, and the probability of secondary disease lessened.

And now, I have accomplished the task allotted to me. That it has been very imperfectly performed I am well aware; but I trust that kind indulgence will be extended to me, and I feel sure that it will be the more readily granted, when the great extent and difficulty of the subject, which I have attempted to treat, is considered, and my entire want of personal experience in such matters.

David Palmer, R.P.V.
31st March 1863.

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