

lated* that but 27 such cases—007 per cent.—occurred out of 36,508 wounds in the army of the Potomac from the Rapidan to the James, 1864. In the Crimea (Longmore) of 4,434 wounds recorded, 15 wounds of arteries, or .03 per cent. of the whole, came under observation. The

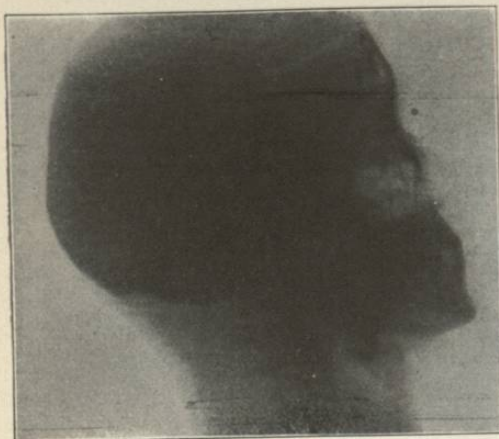


FIG. 2399.—Radiograph. Case of G. W. G.—, showing leaden slug lodged in base of tongue. The ball entered behind the left ear. Radiograph taken fourteen months after injury. Remote effects: left hemiparalysis of tongue, also loss of taste on left side; loss of hearing in left ear; left optic neuritis; partial ankylosis of lower jaw and painful deglutition.

wounds in those days were inflicted by a leaden bullet prone to deformation. There has been much speculation on the part of experimenters as to what would be the effect of the new military rifle upon blood-vessels. We are now in a position to give some facts that have been gathered from the actual conditions in war. Whether the percentage of deaths from fatal primary hemorrhage on the field has increased must still remain doubtful. The superior velocity of the new bullet, its direct course through tissues, and pointed form, increase the chances of its wounding vessels in its path. On the other hand the smaller calibre of this missile, its tendency to preserve its shape unaltered, and the simpler bony lesions which it inflicts, diminish the likelihood that any of the blood-vessels will be wounded by secondary projectiles—either portions liberated from its own substance or fragments of bone to which the bullet itself had communicated its own momentum.

Of fourteen hundred wounded among the United States forces at Santiago by the Mauser bullet there was no instance of a wound of a large vessel requiring ligation on the field. While we have no figures to quote from the South African war, Makin† informs us that “deaths from external primary hemorrhage were rare.” Those that recover from injury to blood-vessels form a very interesting class to the surgeon on account of the primary, secondary, and recurrent hemorrhages; as well as on account of the various kinds of aneurisms that are apt to occur in their clinical history. The lesion present in any of these conditions may be contusion or laceration without perforation, partial or complete perforation causing complete division of the vessel. Of the fourteen hundred wounded above mentioned there is no note of either recurrent or secondary hemorrhage. The femoral, the external iliac, and the ulnar were each tied once for diffuse aneurism, the radial and subclavian were tied twice for the same cause, and there were five cases of gangrene that were caused by an injury to blood-vessels and that required amputation. That secondary hemorrhage should be absent in the clinical record of these cases points to the great boon that asepsis has conferred upon the

* REFERENCE HANDBOOK OF THE MEDICAL SCIENCES, first edition, vol. VII, p. 18.
† *Op. cit.*

wounded in war. In the days when the surgeon welcomed the appearance of “laudable pus,” no wounded patient was considered to be safe from secondary hemorrhage so long as his wound remained open to suppuration” (Longmore). Disintegration of the arterial coats from septic arteritis was the main cause of secondary hemorrhage in the pre-antiseptic era, and now that we exclude suppuration almost entirely by clean surgical methods we are in a position to appreciate the frequency of secondary hemorrhage from other causes. These causes are in a measure peculiar to gunshot wounds, and they are more apt to be seen in military practice. A projectile, some of its fragments, or spicula of bone, may injure the external coats of an artery at the time of the injury without causing immediate hemorrhage. A few hours or days later, in transport, when rest to the part cannot be secured, hemorrhage occurs by breaking down of the inner coat, unconnected with suppuration. Makin (*op. cit.*) mentions a number of cases of this kind in his South African experiences. He saw only two cases of acute traumatic gangrene, both following gunshot fract-



FIG. 2400.—Lodgment of Mauser 7 mm. Bullet (Long Range) in the Brain. Recovery. Private J. G.—, 1st Nebraska Volunteers, wounded at Mariboa, P. I., March 27th, 1899. A 7 mm. bullet entered the forehead 2 cm. above the orbital ridge and 3 cm. to the left of the median line, passed directly backward and downward, and lodged about on the tentorium, well within the skull. He was carried one mile to a field hospital, and reached Manila twelve hours after the injury. Complete loss of consciousness for several hours; gradual return to consciousness. In bed four weeks. Primary healing of wound. Returned to quarters June 13th, 1899, cured. First few days of illness were marked by severe pain in head, nausea, and vomiting. More or less pain existed for some weeks, increased by mental or physical exertion, but gradually disappeared. Returned to San Francisco with his regiment in August, quite well. Radiograph taken August 20th, 1899. No history of paralysis other than a slight weakness of right arm and leg, now nearly gone. Some confusion of ideas and slowness of expression existed for a time, but no convulsions or epileptiform seizures occurred. No loss of vision of left eye, but slight ptosis, diplopia, and photophobia were present. Senses of smell and taste more acute on the right than on the left side. Reflexes active; sphincters not involved. Entered mail service, and went back to Manila on duty.

ure of the thigh. Among the very interesting features of his experience may be mentioned the number of traumatic aneurisms observed “and most frequently of all, perhaps, aneurismal varices and varicose aneurisms. The statement is made of the increase of the number of aneurisms from gunshot wounds in direct ratio to diminution

in the size of projectiles employed.” We should not forget that our knowledge of the occurrence of traumatic aneurisms with the large calibres was obtained in pre-antiseptic days. We have reason to believe that suppuration, which was so universal in gunshot wounds at that time, played a marked rôle in terminating the cases long before the lesions of vessels referred to had time to develop—say in death from secondary hemorrhage, in ligation of vessels on the proximal side, or in amputation.

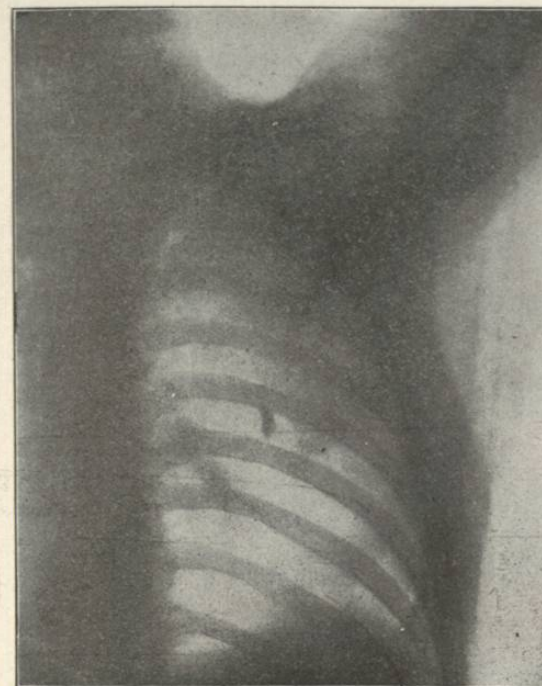


FIG. 2401.—Radiograph Showing Mauser Bullet, Deformed by Ricochet, lodged in Right Back opposite Seventh Intercostal Space.

Until we learn the frequency of aneurisms from the effect of the larger calibres under our present methods of wound treatment, we are hardly in a position to estimate their relative frequency from the smaller calibres under the same conditions.

Injury to nerves has been referred to under Remote Effects of Gunshot Wounds.

Wounds of Joints.—In point of gravity, until recent years, gunshot wounds of the larger joints like the knee and hip, ranked next to those of the larger cavities. For the civil practitioner antisepsis has upset all the statistics of former times, and for the military surgeon antisepsis and the use of armored bullets have operated to make joint wounds among the most humane in war. That this should be so was appreciated by all the military surgeons who entered the experimental field with the new military rifle long before it was put to actual test in battle. As already stated, the destructive effects in a gunshot wound are measured by the velocity of the projectile and the resistance it encounters. The spongy structure of the epiphyseal ends of bones offers a minimum of resistance compared to the compact substance of the diaphyses, and for that reason the lesions of joints even with the high velocity weapons at the proximal ranges are very limited (Figs. 2403 to 2409). The tendency of the armored bullet in passing through the joint ends of the long bones is toward a clean-cut perforation. Fig. 2405 shows that even close by, the tendency to inflict a perforation remains the same. At the remote ranges or from ricochet, when the projectile has lost its balance, it is apt to make an irregular impact, in which case the bone suffers more or less comminution. The joint wounds in-

fllicted by the old leaden bullet of larger calibre are always serious because the projectile meets enough resistance to flatten, thereby increasing its sectional area; the wounds of entrance and exit are larger, rendering more likely the introduction of septic matter; the comminution and fissuring in the bone are more extensive; and, the remaining velocity being always less, the ball is more apt to lodge. If we take as an example wounds of the knee joint as observed in previous wars and compare them with those which occurred in the Spanish-American war, the value of the modern treatment as well as the more favorable lesion inflicted by the jacketed bullet, in point of economy to the State, in saving life and limb, is very striking. A study of all the gunshot wounds of the knee, in war, in which the bones were implicated, gives a mortality of 57.3 per cent.* The Surgeon-General's Report for 1900 records “24 injuries implicating the knee joint, 1 proved fatal . . . after amputation of the thigh. The missile was removed in 4 cases, and amputation was performed in 1 case, the patient recovering.” The character of the missile in this group of 24 cases is not stated, but we know that the large majority of the bullets were fired from reduced-calibre rifles. Of 17 cases of gunshot wound of the knee joint reported by the Surgeon-General in 1899, from the Santiago campaign, 14 were returned to duty, and 3 were invalided.

Wounds of the Long Bones.—The injuries inflicted upon the diaphyses by the jacketed bullet do not make so favorable a showing because of the great resistance which compact bone offers to the projectile on impact. At close range the bone is finely comminuted, bone sand being driven into the channel wound and in all directions. The wound of entrance is about the calibre of the bullet, whilst the wound of exit is much larger, showing explosive effects. The bony fragments are apt to be detached from their periosteum and fissures extend vertically above and

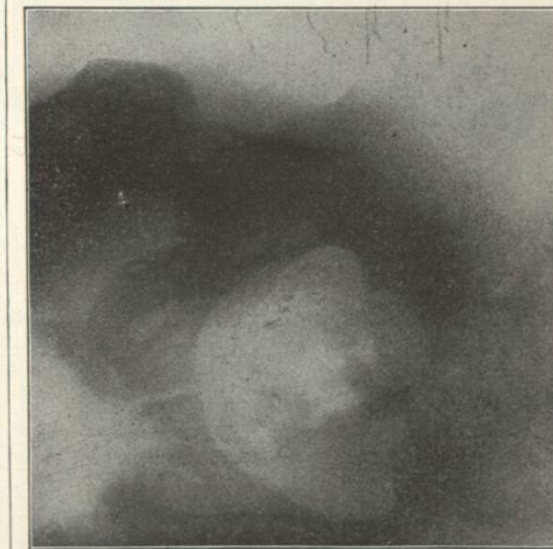


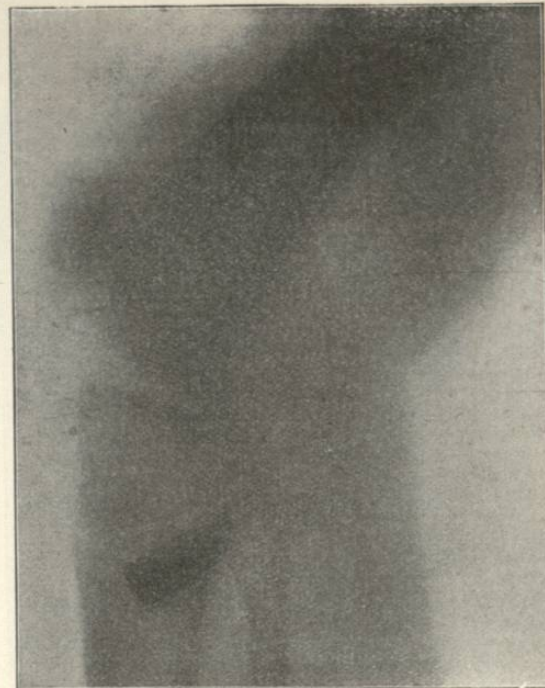
FIG. 2402.—Radiograph. Case of T. H.—, showing Mauser bullet lodged above and posterior to the hip-joint. Wounded July 1st, 1898. Radiograph taken October, 1901. The ball entered base first, passing through upper left arm and entering body opposite sixth rib in the mid-axillary line; it passed down to position seen in radiograph.

below the area of comminution. In the mid ranges the fragments of bone are larger and are still attached to the periosteum; the explosive effects are absent and the fissures longer. Guttering of the bone and complete perforations without solution of continuity are not infrequently seen; subperiosteal fractures with little or no tendency to displacement of fragments are also not un-

* “Wounds in War,” W. F. Stevenson, Colonel-Surgeon, British Army.

common. The results of the treatment of gunshot fractures in the shaft of the long bones bring out more forcibly the value to be credited to our present method of wound treatment than do those which are obtained in

five hundred and seventy-six gunshot fractures of the femur in the Civil War gave a mortality of 46.2 per cent., upper third 49.7 per cent., middle third 46.1 per cent., lower third 42.8 per cent. Of 43 cases reported in the an-



FIGS. 2403 AND 2404.—Radiographs from two different directions. Fig. 2403, antero-posterior view; Fig. 2404, lateral view. In case of E. K.—, showing gunshot wound of knee with ball lodged in tibia. Wounded October 23d, 1899, by a Remington bullet which had ricocheted. Distance about 250 yards. The ball entered outer aspect of knee joint 1 cm. above the articular surface, passed down and in through the joint, and lodged in the tibia. Remote effects: chronic arthritis of the joint with weakness and partial ankylosis. The bullet was removed in May, 1900.

any other class of wounds. As stated before, the destructive effects of the old and new bullet are alike severe, and the so-called humane factor so constantly observed in wounds inflicted by the small calibre in other regions is absent in, for instance, the case of the femur. Six thousand

annual report of the Surgeon-General, United States Army, for 1900, in which 16 are known to have occurred from small-bore bullets, 11 were returned to duty, 5 died, and the remainder were discharged from the service, a few still remaining under treatment. It is apparent, therefore, that

TABLE IV.—NUMBER, REGIONAL DISTRIBUTION, AND MORTALITY OF GUNSHOT WOUNDS IN THE WOUNDED WHO CAME UNDER TREATMENT IN THE AMERICAN CIVIL WAR AND THE SPANISH-AMERICAN WAR.

	Seat and character of injury.	Number of cases.	Per-centage.	Per cent. of all wounds.		Re-coveries.	Deaths.	Undeter-mined results.	Per cent. of fatality.
Civil War	Head—								
	Flesh wounds	7,739	64	3.14	4.9	6,573	2,676	2,480	28.93
Spanish-American War	Fractures	4,350	36	1.76			18	2	26.00
	Flesh wounds	40	56	2.74	4.86	42			
Civil War	Fractures	31	44	2.12					
	Chest—								
Civil War	Non-penetrating	11,996	59	4.87	8.23	13,921	5,373	970	27.85
	Penetrating	8,268	41	3.36					
Spanish-American War	Non-penetrating	61	54	4.18	7.82	101	13	0	11.40
	Penetrating	53	46	3.64					
Civil War	Abdomen—								
	Non-penetrating	4,748	56	1.93	3.43	3,455	3,293	1,600	48.80
Spanish-American War	Penetrating	3,690	44	1.50					
	Non-penetrating	20	31	1.37	4.39	35	29	0	45.31
Civil War	Penetrating	44	69	3.02					
	Upper extremities—								
Civil War	Flesh wounds	54,801	62	22.29	35.68	8,090	5,608	2,095	6.54
	Fractures	32,962	38	13.39					
Spanish-American War	Flesh wounds	289	67	19.84	29.44	426	1	0	.0023
	Fractures	140	33	8.91					
Civil War	Lower extremities—								
	Flesh wounds	59,139	68	24.06	35.15	73,665	11,813	935	13.82
Spanish-American War	Fractures	27,274	32	11.09					
	Flesh wounds	432	77	29.69	38.57	555	9	0	1.60
Civil War	Fractures	130	23	8.91					

the general mortality has dropped from 46.2 to 11.1 in favor of antiseptics. At the present time the death rate of this class of wounds increases as the injury nears the greater trochanter, just as it did in the preantiseptic era. From the Anglo-Boer war, Makin reports 32 fractures of the shaft of the femur. Of these 18.7 per cent. needed amputation, 15.6 per cent. were fatal. The missile noted was principally the jacketed bullet from the Mauser rifle.

Wounds of the Head.—Gunshot wounds of the head are usually divided into flesh wounds and fractures. The latter are necessarily very fatal. In the Civil War the fatality among all head wounds that reached the hospitals was 28.93 per cent. The fatality of the same class under similar conditions in the Spanish-American war was about the same, 26.09 per cent. The figures concerning the relative number of the two are shown in the preceding table.*

The figures illustrate the frequency of glancing shots with the slow-velocity leaden bullet of the Civil War as compared to their infrequency with the high-velocity steel-jacketed bullet in present use. The latter as a rule travels in a straight line from the point of impact, being seldom deflected from its course by resistant bone. The relative increase in the number of fractures from the use of the modern military rifle augments the fatality in head wounds, so that the humane features attributable to this weapon already referred to do not apply to wounds of this region. These results were foretold by the experimenters before the opportunity to observe the effects of the new arm in the actual conditions of war had presented itself.

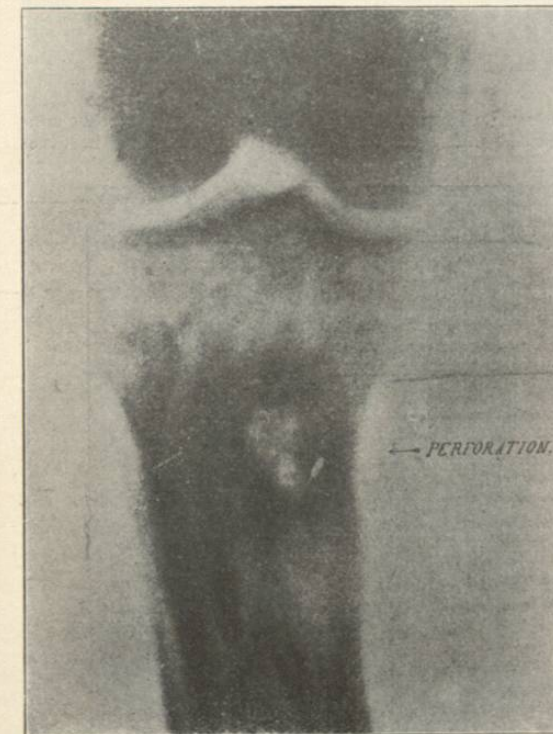


FIG. 2405.—Radiograph. In case of W. K.—, showing perforation of upper end of tibia. Wounded June 25th, 1899, by a Krag-Jørgensen bullet at a distance of 10 feet. The fracture extended up into the knee joint, as shown by the escape of synovial fluid after injury. Radiograph taken six months after injury. Remote effects: slight weakness and pain at site of wound.

Stevenson (*op. cit.*), writing in 1897 upon the proportion of flesh to fractured wounds of the skull, states as follows: "In future wars the proportion will be very different."

* Borden: "Military Surgery"; Prize Essay, Proceedings Association Mil. Surg., 1900.

Omitting indirect and grazing hits, almost every bullet which hits the skull, up to a range of 2,200 yards, will perforate it, and at about 2,900 yards they will penetrate and remain lodged. The destruction produced in the skull and brain by modern bullets is so extreme, even at long ranges, that comparatively few patients will survive



FIG. 2406.—Case of Lodged Bullet in Knee Joint. A cavalry man was shot by a ricochet bullet which passed through the left thigh and into the right knee joint, where it lodged. When admitted two days later he was found to be in the second week of typhoid fever. The bullet was removed six weeks after injury. The adhesions were broken up. Result: the joint became perfectly sound and useful. (From "A Civilian War Hospital.")

long enough to reach the field hospital for treatment, and for the large majority of those who do, treatment will be unavailing."

Concerning the results in the Anglo-Boer war, Makin (*op. cit.*) states: "injuries to the head formed one of the most fruitful sources of death both upon the battlefield and in field hospitals." He mentions some "sensational immediate recoveries" among head wounds, and they doubtless were of the character of those noted by us in the Santiago campaign, viz., oblique perforations of the skull cap involving the brain tissue at a limited depth. The gunshot fractures about the base and those running deeply through the brain from base to vertex or vice versa were uniformly fatal. Of 68 cases of gunshot fracture which were reported in the Surgeon-General's Report for 1900, and which occurred during the two preceding years, 54.4 per cent. ended fatally as against 59.2 per cent. out of 2,514 cases noted in the Civil War. Unlike wounds of other regions those of the head, unless properly treated at once, undergo suppuration, a fact which is not surprising when the amount of dirt overlying the scalp is considered. The surgeons in the Cuban and South African campaigns are unanimous in recommending early and free exploration of all cases of fracture of the skull by gunshot. The aim should be to relieve pressure and to rid the wound of all dirt and loose pieces of bone as soon as possible.

Wounds of the Spine.—Gunshot injuries of the spine are the most fatal in war hospitals. Their gravity increases as the wound approaches nearer to the head.

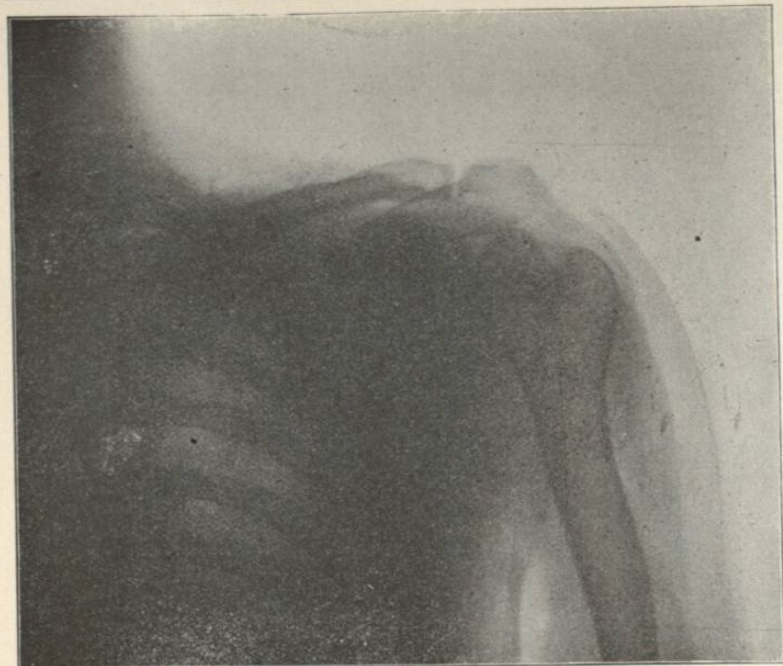


FIG. 2407.—Radiograph in Case of L. E. K.—, Showing Gunshot Wound Involving the Shoulder Joint. Wound inflicted by a Mauser bullet at a distance of 6 feet. The ball passed directly through the shoulder joint, grooving the upper end of the humerus and emerging over the inner border of the scapula. Remote effects: paralysis of deltoid muscle and general weakness and impaired nutrition of the arm.

Otis, in the records of the Civil War, places the mortality in the cervical, dorsal, and lumbar regions at 70 per cent.; 63.5 per cent.; and 45.5 per cent., respectively. The fatality increases if the injury involves at the same time

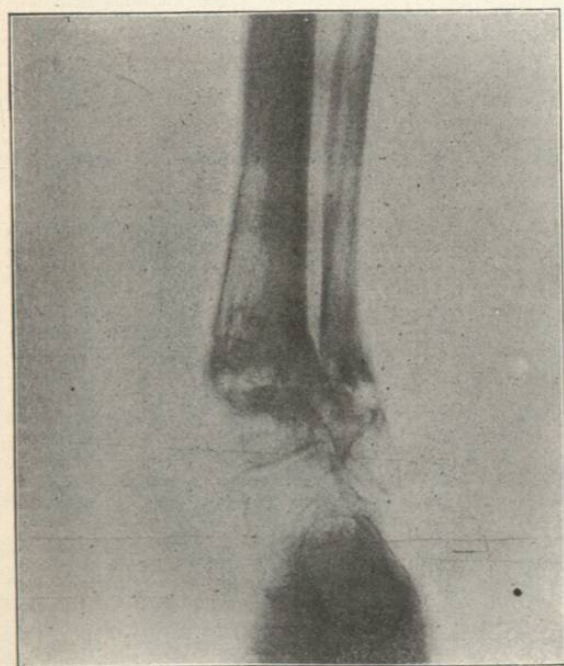


FIG. 2408.—Radiograph, showing track of bullet through lower ends of tibia and fibula. Wound was caused by a Mauser bullet February 24, 1901, at a distance of 100 yards. The fracture extended down into the ankle joint. Remote effects: osteomyelitis of fibula; partial ankylosis of ankle; unable to bear any weight on foot. Radiograph taken nine months after injury.

any of the organs in the neighboring large cavities. If the spinal column alone is injured the gravity of the case will depend upon the fact whether or not the cord is also implicated. In fractures of the body or laminae, the cord is nearly always involved, and, sooner or later, the termination is in death. Injuries of the spinous and transverse processes are less likely to be attended with lesion of the cord, and this class therefore constitutes the bulk of recoveries among the wounds of the spine. Beyond the fact that the foyer of comminution is more restricted, as a rule, with the small-calibre bullets, wounds by them are as severe in their results as those from the large calibres of olden times. When the spinal medulla is implicated, Makin, in his experiences in South Africa, states that "the cases were proportionately the most fatal of any in the whole body of the wounded who left the field of battle or field hospital alive."

Wounds of the Chest.—The loss of life in battle from penetrating gunshot wounds of the chest, inflicted by bullets of the larger calibres, has been very great, varying between 62.5 per cent. in our Civil War and 91.6 per cent.

among the French troops in the Crimea. When we consider the subsequent mortality from secondary involve-

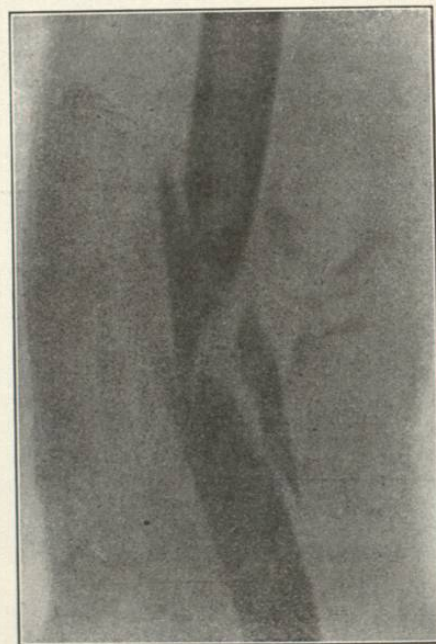


FIG. 2409.—Comminuted Fracture of the Humerus. Range about 300 Yards. The wound track took a directly antero-posterior course. Impact rectangular. The musculo-spiral nerve was completely divided. The plate affords a good example of the so-called "butterfly" fracture. Two long doubly wedge-shaped lateral fragments, and pointed extremities to both main fragments, are shown. The fracture healed well, with the deposition of a large mass of provisional callus. The musculo-spiral nerve was united by suture some three months later. (See Butterfly fracture, Fig. 2365, caused experimentally.) (Makin.)

ments like pneumonia, pleuritis, phthisis, etc., the mortality in the end is little less if any than that recorded in penetrating wounds of the head and spine. Happily, the humane features of gunshot wounds inflicted by the steel-clad bullets, as foretold by the experimenters, have already been satisfactorily shown in the Spanish-American and South African wars. If we recall the factors that

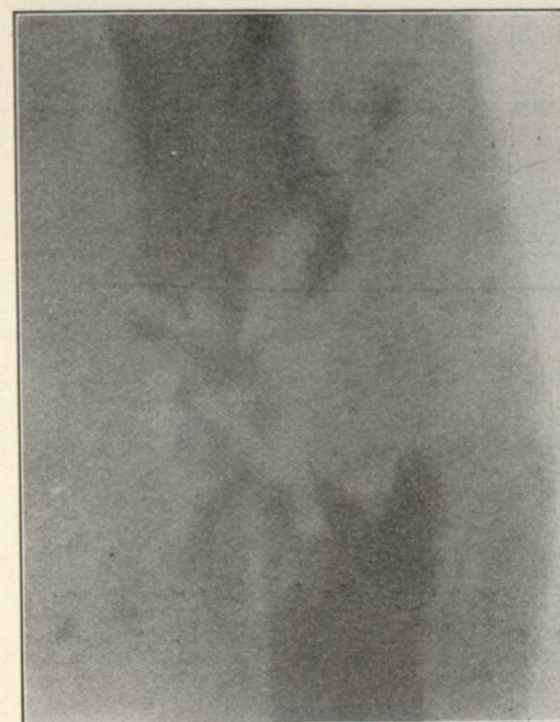


FIG. 2410.—Comminuted Fracture of the Humerus. Range 50 yards. Velocity extreme. Impact somewhat oblique. The bullet entered anteriorly about three inches above the elbow crease. The wound of exit was on the inner aspect of the arm and explosive in character; it still measured four inches by two inches three weeks after the injury was received. The wounds suppurated locally, but at the end of six weeks fair union of the bone had taken place and the wound of exit had contracted to a sinus. The musculo-spiral nerve was concussed, but not divided. The skiagram was taken three weeks after the reception of the injury. (Makin.)

are correlated to destructive effects in wounds—viz., velocity, sectional area, and resistance on impact—we find that the last two factors (sectional area and resistance) favor a limited amount of destructive effects. Since the Crimean war the calibre of the military rifle has been reduced nearly one-half. As to resistance, the lung, composed of elastic tissue and filled with air, invites but little lateral displacement; hence the great diminution in the mortality of this class of wounds. Of 198 cases of penetrating gunshot wounds of the chest (reported by the Surgeon-General of our army) which occurred during the years 1898 and 1899 in Cuba, Porto Rico, the Philippines, etc., 55, or 27 per cent., ended fatally. As to the results in South Africa, where the experience of the medical department was much larger, Makin states that "wounds of the chest furnished the most hopeful class of the whole series of trunk or visceral injuries. Cases of *wounds of the heart and great vessels*" [the italics are ours] "afforded the only exceptions to an almost universally favorable course, both as regards life and the non-occurrence of serious after-effects." Notwithstanding the favorable outcome of chest wounds, as inflicted by the new armament, it should be borne in mind that the clinical history of these cases is apt to be accompanied by complications like hæmorrhax and pythorax. The apparently trivial nature of the wound, in the majority of those who

lived to reach the field hospitals, was exemplified at the Reserve Divisional Hospital at Siboney, in men who, though shot through and through a few days before, could be kept prone in bed only by the most watchful care over them of the nurses. Doubtless a number of the sequelæ observed afterward in these men* was due to imprudence on the part of the patients in disregarding the instructions to keep quiet.

As relating to this point it may be stated that Makin observed in South Africa, in the early part of the campaign when the patients were treated near the place of battle, and required but little subsequent transportation, that hæmorrhax occurred only in probably thirty per cent. of cases. Later on, when it became necessary to transport the wounded for much greater distances—requiring in some instances journeys of two or even three days,—at least ninety per cent. of these patients "suffered with hæmorrhax of varying degrees of severity." In referring to the only case of empyema seen by him during the whole campaign, he informs us that it followed the

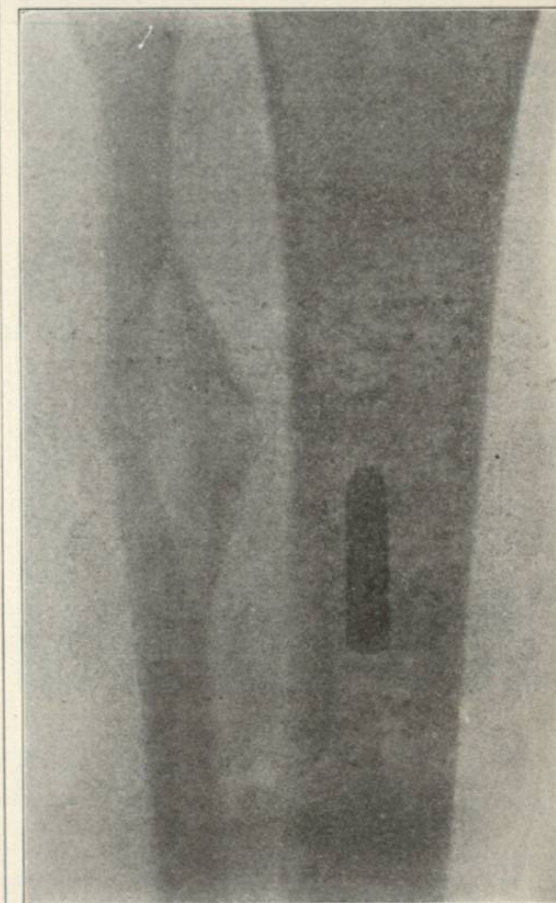


FIG. 2411.—Spurious Perforation of the Fibula. Moderate range about 1,000 yards. The injury was caused by an 8 mm. bullet, which entered base foremost and lodged in the calf. The fracture is really an incomplete stellate form, two well-marked transverse fissures extending from the point struck. The position of the bullet suggests its entry into the limb base foremost, and, as it is retained, a low velocity may be assumed. (From Makin's "Surgical Experience in South Africa.")

removal of a lodged bullet, and that the additional wound doubtless proved the source of infection because of the difficulty of maintaining asepsis in wounds treated under

*Greenleaf: "Gunshot Wounds of the Lungs." N. Y. Med. Journal, vol. lxx.

such questionable surroundings as one encounters in the field. The moral which he draws from the circumstance is one to which we have already adverted—remove no lodged missiles in the field save for exceptionally good reasons.

Wounds of the Abdomen.—Penetrating gunshot wounds of the abdomen, under the expectant plan of treatment,

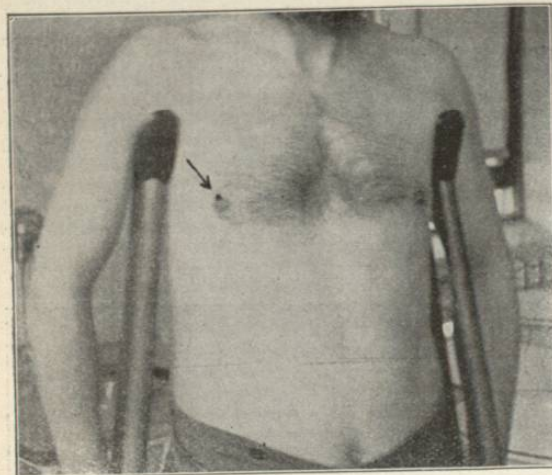


FIG. 2412.

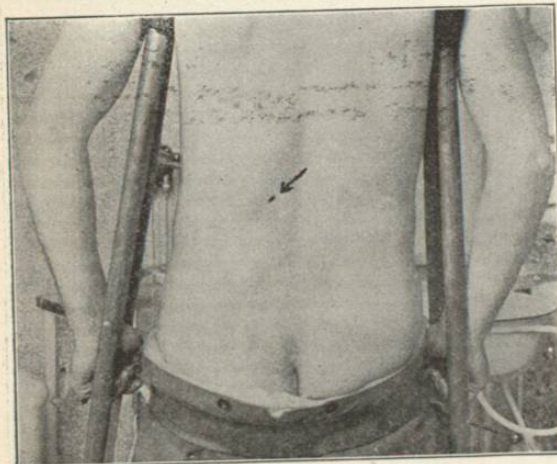


FIG. 2413.

FIGS. 2412 AND 2413.—2412, Wound of Entrance; 2413, Wound of Exit. A. F. — wounded in battle of Calamba, P. I., July 30th, 1899, by a Mauser bullet at a distance of 250 yards. Bullet passed through lung and liver, and injured spine. Remote effects: partial paralysis of left leg and neuritis of nerves of lower leg.

were the most fatal of the regional wounds in both military and civil practice; the mortality ranging between ninety-five and ninety-nine per cent. Under a wise selection of cases and the employment of expert technique in operating, the statistics of fatality have been reduced by nearly a half in civil hospitals, while on account of unavoidable causes the death rate in military practice, in the field, still remains very high. In civil hospitals, where one finds all the modern conveniences and comforts to promote the well-being of the wounded, and where, further, the surgeon, almost from the moment of the receipt of the injury, holds absolute sway over his surroundings, the mortality, as shown by Grant's* statistics of operative cases, amounts to 52.5 per cent. in a series of 253 cases. Morton, of Philadelphia, reports 138 deaths

* Va. Medical Semi-Monthly, January 12th, 1900.

after operation, or a mortality of 58.9 per cent., out of 234 cases collected from various sources in this country and Europe. Coley's statistics show a death rate of 53.8 per cent. in a series of 39 cases operated upon during the first twelve hours after injury; and a mortality of 77.2 per cent. in 22 cases operated upon at a later period. In military practice, in the conditions that obtain in active campaign, as already stated, the mortality has been very large, the death rate in the Crimea for the French and English troops being respectively 91.7 per cent. and 92.5 per cent. In our Civil War the fatality reached 90 per cent. When we remember that in many of those who are thus reported to have recovered, the abdomen was in reality not perforated, we are forced to the conclusion that

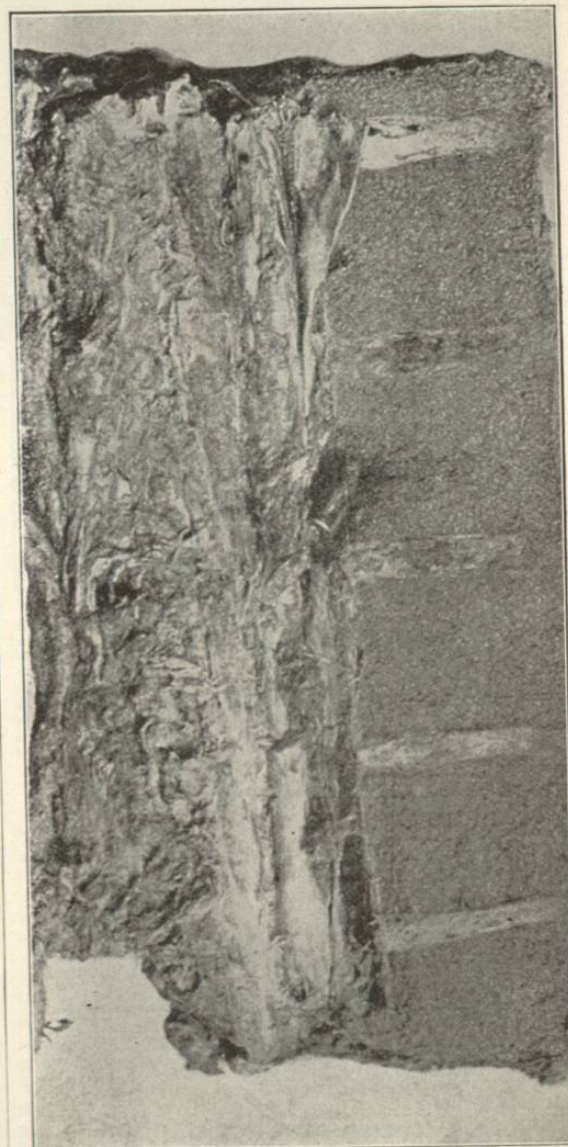


FIG. 2414.—Portion of Spinal Column, Showing a Lodged Bullet which had Divided the Spinal Cord. (Makin.)

the high mortality given would probably have to be made still higher if it had been possible to consider only perforative cases.

The encouraging results obtained in civil hospitals gave the military surgeon hope that his results might be

nearly as good. These expectations, as the sequel shows, were not realized. Of 116 cases reported in the Annual Report of the Surgeon-General of the army for 1900,—cases which occurred in the Spanish-American war and during the Philippine insurrection,—there were 81 deaths, or a

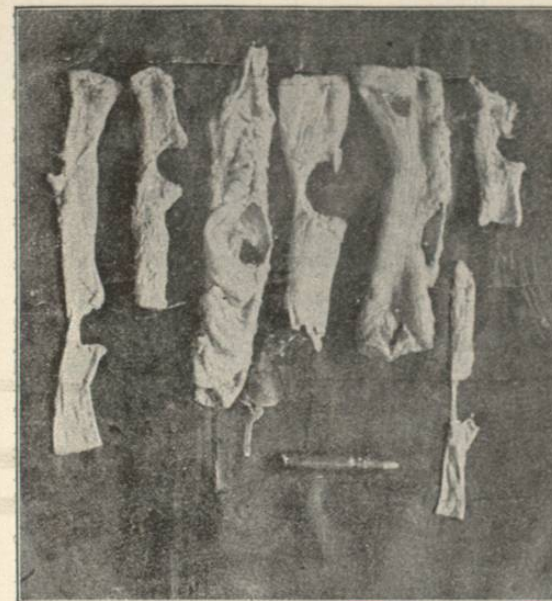


FIG. 2415.



FIG. 2416.

FIGS. 2415 AND 2416.—The lesions of the intestines were inflicted on dogs by the .30 calibre Krag-Jørgensen bullet at 300 yards. (Griffith.)

mortality of 70 per cent. The evidence of perforation was doubtless based upon the position of the apertures and the course of the ball in a straight line between these. It is fair to state that, of the 30 per cent. who recovered, the large majority sustained no injury to the intestine. The experiences of Makin in South Africa lead him to the belief that perforating wounds of the small intestine are very fatal—"every patient in whom the condition was certainly diagnosed died." The table given below includes only those cases which survived longer than twenty-four hours, upon six of whom he operated. It will be seen that the prognosis varies largely with the anatomical structure involved in the perforation. It should be noted that of the ten cases of possible perforation of the small intestine there were ten recoveries, a fact that goes to show that in all probability few if any of them were perforative cases at all; and that, of the five cases of perforation of the "small intestine certain," death was the result in every instance. As far as prognosis is concerned,

TABLE V.

Viscus wounded.	Number of cases.	Localized secondary suppuration occurred.	Recovered.	Died.
Stomach certain.....	2	..	1	1
Stomach possible.....	1	..	1	..
Small intestine certain..	5	0	10	5
Small intestine possible..	10	0	10	..
Large intestine certain..	8	4	4	4
Large intestine possible..	4	..	4	..
Bladder certain.....	3	3	1	2
Bladder possible.....	1	..	1	..
Liver.....	6	..	6	..
Kidneys.....	6	..	4	2
Spleen.....	3	..	2	1
Total.....	49	7	34	15

* Op. cit., p. 448.

gunshot perforation of the small intestine, without operative interference, is as fatal to-day on the field of battle as it was during the Crimea. Some rare cases of recovery with few symptoms, cited by Makin, make it difficult to conceive how a projectile could plough its way

through the abdomen from one flank to the other without cutting the intestine. Several cases of this kind were seen at Siboney from the line near Santiago, and they go to show that the small-calibre bullet is likely at times to traverse the intestinal area without inflicting injury of a fatal kind. Aside from the small sectional area of the bullet which would favor such an occurrence, it has been suggested that the intestinal lesion is apt to be minimized by fasting. The men before Santiago had been on scant rations for one week, and the remarkable recoveries among abdominal wounds were at the time attributed to the empty condition of the alimentary canal. We know by experimentation that the reverse condition would have been highly favorable to the infliction of extensive lesions. Resistance, among the three factors which conduce to destructive effects,—the other two being velocity and sectional area of the projectile,—is not confined to the compact substance of bone. The most extensive explosive effects are met in cavities filled with fluid or semifluid contents. Griffiths'* experiments upon dogs on the Fort Leavenworth range demonstrate that when all the conditions are favorable, the intestines will show rents varying from two to eight inches in their continuity. Men on the field of battle so wounded do not live to reach the relief stations; they die as a rule where they fell, from shock and internal hemorrhage. In gunshot wounds of the abdomen the vital question at issue is whether or not the wound is perforating in kind. If the evidence points with reasonable clearness to a wound of the former character, the treatment resolves itself into a coeliotomy either for the purpose of exploration or for that of remedying the injury done to the abdominal organs. Whether surgical aid of the latter kind is to be practised will largely depend on the confidence and skill of the operator and the nature of the environment. As stated before, owing to the unpropitious character of the latter, laparotomy on the field or in field hospitals in war has thus far been limited, and the results, when the

* Proceedings of the Association of Military Surgeons, 1893.

practice has been carried out, have been anything but encouraging. Of the three laparotomies done at one of the advanced hospitals before Santiago, the mortality was one hundred per cent. In order to accomplish successful abdominal work in war it will be necessary to use a great deal of forethought, so that the operators may not be hampered by the endless difficulties that are apt to occur in active campaign. It is possible to conceive of a field hospital so thoroughly equipped with material and personnel, and so favored by the condition of the weather, that in it a laparotomy may be performed with about the same safety as is experienced in a civil or fixed hospital. So far, the idea of establishing such a hospital has not been acted upon seriously. The subject is one replete with possibilities.
Louis A. La Garde.

GURJUN BALSAM.—Wood Oil. A viscid, copaiba-like turpentine, obtained from half a dozen or more majestic Asiatic trees of the genus *Dipterocarpus*.* The "balsam" is collected by making deep "boxes" or gashes in the trunk of the tree, scorching them, and fitting a bamboo spout to their lowest parts. The yield is very great, and the drug forms quite an important article of commerce in the East. It is officially recognized by the Indian Pharmacopœia, and extensively used there as a substitute for copaiba. In other countries it is considerably used to adulterate the latter drug.

It is an intensely fluorescent, thick liquid, of a mild, terebinthinous odor, and a bitterish, aromatic taste. By transmitted light it is of a deep sherry color, and perfectly transparent; by reflected light it appears opalescent and greenish-gray. It is soluble in chloroform and the essential oils, but not completely so in alcohol. It consists of thirty or forty per cent. of a mild-smelling essential oil associated with a composite resin, composed of a crystalline *gurjunic acid*, and an amorphous portion. As it is collected from several different trees, its appearance, and also probably its composition, are subject to considerable variation.

Uses.—In India and Asia generally as a substitute for copaiba in the treatment of gonorrhœa, etc., and as a varnish. It is occasionally to be got in this country, but is prescribed only as a novelty.
W. P. Bolles.

GUTTA PERCHA.—The inspissated milk-juice of *Palauquium Gutta* (Hook. f.) Burck (fam. *Sapotaceæ*). (No longer official in the United States.) This remarkable substance is admitted into the pharmacopœias of most countries on account of the elastic varnish which can be made from it, and of its value in the making of plastic splints in surgery. The plant is a large tree growing, now or formerly, in many parts of Southern Asia, and in the great islands of the Pacific. Gutta percha was first brought into European use in 1842, having been previously employed by the aborigines in the manufacture of knife and weapon handles. From the vicinity of Singapore, where it was previously abundant, from Penang and other accessible places, the tree has been practically exterminated by the wasteful method of collecting its valued product. It still exists, however, in abundance in the Malay peninsula, whence most of the gutta percha now comes, in Borneo, Sumatra, and other places. The method of collection is as follows: The trees are felled and the bark is stripped off, when the milky product beneath it collects upon the surface of the wood, and is scraped off and put into a hollow leaf or other convenient receptacle. This juice quickly coagulates upon exposure to the air, and the putty-like curd is moulded while yet soft into blocks or cakes of various sizes and shapes. It is of a light or medium brown color, often gray upon the surface, sometimes, when nearly pure, white or ash-colored, of a peculiar rubber-like odor, and a rather flexible consistence at common temperatures. At something above 120° F. it becomes very plastic, and may be moulded into any shape and welded, resuming its hardness upon

*The following are mentioned in the Pharmacographia: *D. turbinatus* Gaertn., *D. incanus* Roxburgh, *D. alatus* Rox., *D. zeylanicus* Thw., *D. hispidus* Thw., *D. crispulatus*, and several others.

cooling. Ordinary gutta percha is an impure substance, containing inevitably, by the method of its collection, a considerable amount of coarse admixture of vegetable tissue, chips, etc., besides the residues of the evaporation of portions of the liquid juice, imperfectly separated from it in coagulating. It is soluble in chloroform, turpentine, carbon disulphide, etc., but not in water, alcohol, acids, or alkalis. Its purification may be effected by solution in one of the above, or by mixing with hot water and straining. The sheets, in which form it is generally sold for surgical use, are made by rolling it while hot between cylinders.

The principal portion, seventy-five per cent. or so, of good gutta percha, consists of an amorphous white mass or powder having the general properties given above, named *gutta*. It contains, further, from fourteen to sixteen per cent. of *alban*, a light flaky powder soluble in boiling alcohol, and from four to six and a half of *fluavil*, which is rather more soluble than either of the above (*Payen*).

Gutta percha is employed in medicine only on account of its physical properties. A nine-per-cent. solution of it in chloroform, with ten parts of carbonate of lead added mechanically to carry down coloring matters and impurities, is an excellent protective varnish for abrasions, excoriations, and small wounds, to be used in the same way as collodion. In sheets, from one-eighth to one-fourth of an inch thick, it is to be had of the instrument makers as a splint material. For cases in which there is a good deal of irregularity of surface to be fitted, as in fractures of the jaw, the bones of the thumb or great toe, or the metacarpal or tarsal bones, it is very useful; also in making splints that must be often taken off and reapplied. The form of the splint should be cut about one-fourth larger each way than the desired splint, as it shrivels when softened and when thrown into water at a temperature of about 130° or 140° F. or more. The limb having been prepared by adjusting the parts, shaving, bandaging, etc., as required, the softened splint is laid on the part and quickly moulded by the fingers to the desired form. A bandage where necessary is then applied, and cold water poured over all. When hardened the gutta-percha splint may be taken off, trimmed, and permanently reapplied. If it is desired to piece or weld the gutta-percha, it should be softened by dry heat, as over a lamp or gas. The fingers may be wet while handling it. Its use in submarine cables and other electrical apparatus is very extensive.
W. P. Bolles.

GYNÆOLOGICAL EXAMINATIONS.—**HISTORY.**—A proper history is a necessary preface to the diagnosis of every gynæcological case. It should not of necessity be lengthy, but certain facts in the life history of the patient, peculiar to her sex, which may have an especial bearing upon the condition of the female organs, should be carefully inquired into.

We will pass over the points common to all histories and simply emphasize those having a gynæcological bearing. The menstrual history should be thoroughly ascertained. The age at which the menses first appeared; the duration of the flow; the quantity and character; if accompanied by pain, whether it develops before, during, or after the flow; the regularity of the periods; and, finally, the history of the menopause—these are all subjects for inquiry.

In judging the condition of the menstruation as to duration, quantity, and regularity, it is well to remember that in this respect every woman is a law unto herself, and she must therefore be judged according to her own standard. But, her habit in this respect having once been established, she should not deviate from it.

The history of her pregnancies should be thoroughly investigated, as about two-thirds of all patients coming to the gynæcologist can trace their sufferings from a miscarriage, a difficult labor, or an abnormal puerperium.

Pain in some form or other is the most prominent gynæcological symptom, and is usually responsible for the patient's seeking the aid of her physician. The pain

may be in the form of headache, backache, pelvic tenesmus, or a sensation of bearing down; or it may be referred to some particular part of the pelvis. Its character and location should be carefully ascertained. The condition of the bowels is a very important point for inquiry, as so many of the troubles in this class of patients are due to pelvic congestion induced by chronic constipation and irregular habits of going to stool.

Any bladder symptoms should be noted, especially burning or pain on micturition and frequency of the act, as they may be an indication of gonorrhœa, a disease which is now recognized as one of the most potent factors in the etiology of gynæcological cases.

The character, quantity, etc., of any discharge should be determined. Finally, the presence of those symptoms known as neuroses, of a reflex character, should be recognized.

For the details of more extended history-taking the reader is referred to such works as those of Kelly, Reed, and Montgomery, the "American Text-Book of Gynæcology," etc. For ready reference, speed, and accuracy, we believe that the card-catalogue system, used in conjunction with outline diagrams of the various pelvic planes, in which it is possible graphically to note the size, situation, and shape of growths, displacements, etc., is of especial value in recording gynæcological cases. Rubber stamps of diagrams of the pelvis and abdomen have been devised by Dr. R. L. Dickinson, of Brooklyn, and their utility is testified to by many eminent gynæcologists (see Fig. 2417). Whatever system of history-taking is adopted it should be strictly adhered to, as routine habits will undoubtedly guard against error.

The novice will do well to remember, if he wishes to avoid embarrassment both to himself and to his patient, that all subjects of a delicate nature should be approached in an open, frank manner, devoid of subterfuge or insinuations of any kind, and coupled with the kindness and dignity of manner befitting a gentleman.

That the patient will submit to an examination should be taken as a matter of course, as at the present day most women know that such a procedure is a necessity and are prepared accordingly.

ANÆSTHESIA.—In virgins it is desirable when possible to examine under anæsthesia, for as a rule, a first examination of such patients is very unsatisfactory, and therefore productive of no positive diagnosis. Nitrous oxide is an ideal anæsthetic for such a case.

If it is possible to avoid it, a vaginal examination should not be made in *virgines intactæ*. In the majority of cases a rectal examination will answer all purposes. The method of recto-abdominal palpation to be used will be described later.

Not infrequently in married women, if there happens

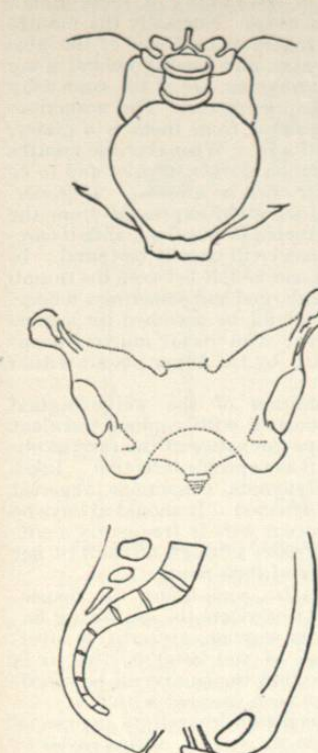


FIG. 2417.—Outline Diagrams for Recording Displacements, Growths, etc., in History-Taking.

to be an unusual rigidity of the abdominal muscles or a superabundance of fat, it is desirable to employ an anæsthetic, especially when the advisability of an operation is dependent upon an accurate diagnosis. When an examination is decided upon it should always be carried out in a thorough manner, and this necessitates that a systematic plan of procedure should be followed.

NURSE.—Whenever possible, a third party should be present, not only for the comfort of the patient, but as a protection to the physician from the malicious charges which the records show are by no means uncommon. If the physician can have a nurse at his disposal, this plan is by far the best, as the ready assistance and soothing influence of a trained female assistant go far toward rendering the ordeal less trying to the patient, and enable the physician to conduct his examination with much greater facility. When a nurse is not available, a female friend brought with the patient may often be of great assistance in holding a speculum, etc., but there will be many occasions when the general practitioner will have to conduct his examination unaided. While an assistant is certainly desirable, she is by no means indispensable.

TABLE.—The question as to what is the best table for gynæcological examinations is one that is often asked by the novice. The simpler the table the better. A costly complicated table or chair is not at all necessary, and a great many gynæcologists work with one of the simplest construction. An ordinary solid table, four feet long, two feet wide, and two and one-half to three feet high, will answer for all ordinary purposes. The foot of the table should be raised about two inches, and should be fitted with foot-rests. An extension arm or leaf attached to the right-hand corner is of great utility when employing Sims' position, as it allows the legs and feet of the patient to have a proper support, when the buttocks are drawn to the edge of the table.

A valuable adjunct, in the writer's opinion, is a pair of Edebohls' leg-holders.* They consist of two perpendicular rods that are attached to the corners of the table and have slings at their upper ends. The feet being fastened in the slings, are elevated to such an extent that the thighs are flexed upon the abdomen and rotated outward. This insures the greatest amount of relaxation of the abdominal muscles, and successfully prevents the approximation of the patient's knees. It is therefore of especial value in nervous patients.

Placing the Patient upon the Table.—If a nurse is not available, the physician should understand how properly to place the patient upon the table, so that he may not appear awkward or render the ordeal unnecessarily embarrassing. A screen should always be at hand, behind which the patient is instructed to retire in order to loosen all tight clothing about her waist, and especially to unfasten her corsets.

In all cases the patient should empty her bladder before going on the table. This is a detail that is frequently neglected, and it is the cause of an unsatisfactory examination in many instances. It is likewise of advantage that the lower bowel should be emptied, and when possible the patient should be instructed to take an enema before coming to the physician's office. The patient should be first placed in the dorsal position to permit of the bimanual examination. A stool or chair is placed at the foot of the table and the patient is directed to stand upon it, while the physician holds up a sheet between the patient and himself. She is then instructed to lift up all her skirts behind and sit down upon the edge of the table. She next lies down and the sheet is thrown over her, while her feet are adjusted in the foot-rests. The folds of the sheet are then wrapped about each leg so that there is no part exposed but the vulva.

THE EXAMINATION.—The examination for purposes of diagnosis should consist of two parts—the first without instruments, and the second with instruments. It may be possible to arrive at a diagnosis by the bimanual touch

*New York Jour. of Gyn. and Obstet., January, 1896.