transparent to x rays, whilst paste—imitation diamonds—was quite opaque. It is thus possible to make use of them for the purposes of differential diagnosis, but some very startling uses have been made of them in the past two years. Many cases of attempts at smuggling have been thwarted, and x rays have occupied an important part in locating contraband material. Rubber has been detected hidden in bales of cotton waste, and mine cases and asphyxiating bombs have been found with their help in the personal luggage of a traveller. In other directions industrial uses have been made of the rays. Flaws have been detected in steel casings, defects in insulating material detected, porosity revealed in copper. One of the largest commercial applications of the x ray is at a certain tobacco factory, where the cigars are made and packed in boxes, and the boxes are exposed to definite doses of x rays. The result is that the tobacco beetle larvae, which are so small that they cannot be seen and which are very destructive to cigars, are destroyed without any damage to the cigars.

The Limitations of X-ray Diagnosis.

In medicine there is just a tendency to rely too much upon x -ray diagnosis, and, indeed, to expect too much from an x -ray examination. The limitations of this method must be remembered. Many radiologists undoubtedly try to read too much from x -ray plates and screen examinations, are too much inclined to over-estimate the diagnostic possibilities; in this respect they have been encouraged to some extent by those who refer the cases, and who expect to have a definite opinion and diagnosis in return. As I have already pointed out, in many cases of intrathoracic disease, kidney stones, and stomach cases, the diagnosis by x rays is so striking, so apparent, that nothing more is required. Perhaps in a still larger number of cases the x -ray points, without being absolutely diagnostic, are of the greatest assistance and aid to diagnosis, and the radiologist best performs his duties as regard these cases when he reports his facts and points out their significance, but does not venture on dogmatic diagnoses without knowing something more about the case. This leads me to another point. At the present time there is a great deal, a very great deal, too much sending of cases of all kinds to the x -ray department before proper and systematic examination of such cases has been made in the usual ways. I am sure that no case should be sent for an x -ray examination until it has been thoroughly and completely investigated in other ways and a definite diagnosis suggested. I regret very much that it has almost become a routine at the Royal Infirmary for stomach cases to come down to the department very soon after admission, and without a single note in the case sheets. This is a bad system from every point of view—bad for the physician or surgeon in charge of the case, bad for the students, and bad for the x -ray department. Whilst instancing the stomach cases as bad offenders in this manner I do not intend my remarks to be limited to them.

Many of you students will eventually become practitioners in remote country districts at home, or in remote districts in many parts of the world, often far from all possibilities of having x -ray examinations made. You will not be able to have the radiographs and the expert opinion of the radiologist to lean upon. You will have of necessity to make your diagnoses without this aid. It therefore behoves you now—and your teachers should see to this—that you do not learn the habit of a casual examination of a patient and then the immediate resort to the x -ray room. I am convinced that no case, however simple, should be allowed to be sent from the out-patient or casualty department to the x -ray department until a complete and thorough examination has been made, and a definite conclusion as to the diagnosis arrived at and put in writing. After the x -ray examination the case should be re-examined with the x -ray findings known, and comparisons drawn. In the same way no case should come down from the wards until full examination and full notes have been made. Unless this is done we are going gradually to slip into loose methods of examination, and students will not acquire the routine of methodical examination, will not recognize the real value of physical signs, and will fail to acquire the great art of deductive diagnosis without which the successful practice of medicine and surgery is impossible.

Teaching of Radiology.

I have said nothing as to the teaching of radiology, but this is a large subject in itself. The time is rapidly approaching when this subject will have to be added to the curriculum, when the unfortunate student, already said to be overburdened with lectures, classes, and subjects, will have perforce to imbibe a certain amount of knowledge of x -ray diagnosis and treatment before he goes up for his final examination.

To my mind, the whole subject of medical and surgical teaching and examination requires drastic overhauling. I believe you are taught how to perform the most intricate surgical operations, the most special of special operations on the eye, ear, and throat; you are taught about the most rare diseases which mankind is heir to; you may be examined on these operations and diseases—about operations which probably none of you will ever perform, as to diseases which probably none of you will ever see. On the other hand, any knowledge of radiology, a subject which you are, so to speak, up against every day of your professional career, is not insisted upon, and you are neither taught it nor are you examined upon it. I take it that at the present time, if an examiner either asked you any question as to radiography or showed you a radiograph and asked you to interpret it, you would be entitled to say that it was not any part of your examination work—although very possibly an answer of this kind would not be wise. However, if such a thing happened, you may take it from me that, with few exceptions, the examiner will know just about as much, or even less, than you—he has never been taught any radiography either.

There is a prevalent idea abroad that a radiologist is a mere photographer, and that any medical man can interpret radiographs. Never was there a greater mistake. The technique of plate-taking can be easily acquired by anyone; the more experienced one has become in the interpretation of radiographic findings the more conservative one becomes, and the more guarded in expressing dogmatic opinions. The examination of the thorax and abdomen can only be carried out by duly qualified, and especially qualified, medical men. I came across a case the other day in which clinically there was an obvious fracture of the upper end of the fibula; the ankle had also been injured, but radiographs showed no fracture in this region. The eminent surgeon whose case it was, was addressing his students; he could not understand why the radiograph of the knee did not show the fracture of the fibula—it showed how unreliable x -ray evidence could be, etc. The eminent surgeon, unfortunately, was looking at the plate of the ankle-joint, and did not know it was not the knee-joint. This is a fact—I need scarcely say that he was not a Liverpool surgeon.

In conclusion, I would urge each one of you that whilst you make a point of attending the x -ray department and become acquainted with its routine and with the general scope of its work, you do not also, especially in your student days, rely too much on this method of diagnosis to the exclusion of the development of those faculties of observation and deduction which are so important to a successful practitioner of medicine and surgery.

LIGATION OF THE INNOMINATE ARTERY FOR TRAUMATIC ANEURYSM OF THE CAROTID.

By COLONEL THOMAS SINCLAIR, F.R.C.S., A.M.S.,
CONSULTING SURGEON, BRITISH EXPEDITIONARY FORCE, FRANCE.

SINCE the successful ligation of the innominate artery by A. W. Smyth, of New Orleans, in 1864, this vessel has occasionally been tied, though not so frequently as to render uninteresting a description of a recent case. It may also be desirable to record it as a contribution to the statistics of military surgery in the present war.

An officer, aged 20, was shot, on August 24th, 1916, in the lower part of the right anterior triangle, the bullet issuing close to the superior angle of the scapula on the same side. He lay out for thirteen hours, during which time he bled so profusely as to saturate his tunic and necessitate dressing four times.

He was admitted to a casualty clearing station on August 25th, 1916, and though he recovered speedily from shock, he showed marked anaemia. A traumatic arterial aneurysm

formed in the lower part of the common carotid, which was treated expectantly for some days, but the rapid daily enlargement compelled operation on the fourteenth day. By this time the aneurysm had attained the size of an orange, filling up the interval between the clavicle and the upper border of the thyroid cartilage, extending across to the line of the common carotid of the left side and overhanging the subclavian on the right. Its approximate measurements were $4\frac{1}{2}$ in. in breadth by 4 in. in height. Hoarseness developed in the later days, pointing to pressure on the recurrent laryngeal nerve. The respirations were 24; the temperature varied from 100° to 101.8° , and the pulse from 100 to 112. Both entrance and exit wounds suppurated moderately.

Operation.

The artery was exposed by a rectangular incision in the mid-line and along the clavicle. After detachment of the sternal head and part of the clavicular head of the sterno-mastoid and partial division of the sterno-hyoid and sterno-thyroid muscles, it was found that no space was available between the clavicle and the aneurysm. Therefore, one and a quarter inches of the inner end of this bone were resected. The apex of the lung, with its uninjured pleura, appeared in the dissection. The inferior thyroid veins and the larger veins were retracted without damage; in fact, no artery or vein was clipped or ligatured throughout the operation. The innominate artery was found behind the middle of the manubrium, and in tracing it upward it became apparent that the common carotid was so incorporated in the aneurysm that the placing of a ligature upon it was impracticable, and therefore the innominate was tied with a single strand of No. 4 thirty-day catgut. The muscles were repaired with catgut sutures and a small drain tube left in for forty-eight hours.

The question of a distal ligature was now debated in obedience to the commonly accepted principle that the wounded artery should be doubly ligated and the contents of the sac turned out, or the sac excised, but these measures were advisedly omitted in this instance lest a copious bleeding from the sac in a markedly anaemic subject, or the prolonging of an already lengthy operation, should jeopardize the patient. It was felt that a distal ligature should be placed on the carotid some days later, should the progress disappoint. Fortunately, the need for this step did not arise.

The subsequent course was uneventful: no septic changes from the original bullet track were propagated to the operation wound; and the patient was evacuated to the base on September 16th, 1916.

Three months after operation (December 13th, 1916), an examination of the patient showed that no cerebral deterioration had resulted; his mental functions were normal. The vision of the right eye was perfect, though the vessels in the fundus were slightly reduced in size. There was no giddiness or disturbance of equilibration. The thrill, bruit, and pulsation could not be detected, and the aneurysmal swelling had entirely disappeared. A degree of muscular atrophy and the absence of the end of the clavicle rendered this examination more easy and convincing. Radial and ulnar pulses had not returned at the wrist; the circulation and sensation in the hand were good, but some feebleness with stiffening at the fingers remained, due, probably, to the prolonged disuse of the extremity rather than to tropho-neurotic changes. No doubt massage and exercises will remedy this temporary disablement. A satisfactory pseudo-arthritis had formed with the first costal cartilage, and active shoulder and elbow movements were good.

The chief anxieties, apart from the immediate risks at the time of the operation, are secondary haemorrhage, septic complications in the neck and chest, embolism, and cerebral softening from ischaemia. Disastrous cerebral changes, which may begin in forty-eight hours or be delayed for a fortnight or longer, are more likely to arise in patients over 40 with arterio-sclerosis; but acute anaemia from recent haemorrhage may render even young persons liable. Detachment of emboli may, of course, occur under any condition, or at any age, but in the case here recorded the acceptance of some extra risk in this respect by omitting a distal ligature of the carotid, which shuts off useful reflux circulation through subclavian branches, was considered justifiable, in the expectation that the cerebral ischaemia might be rendered less profound and sudden in a very anaemic subject.

Surgeon-General Sir George H. Makins, in his admirable paper on "Vascular lesions in war," lays it down that, "In certain conditions a proximal ligature at the seat of election suffices to cure a false aneurysm; but the method is uncertain, and should not be adopted in any situation where the sac and the opening in the vessel can be dealt with locally." In a later paragraph, dealing with carotid aneurysms in particular, he says: "Still I think the more extensive operations must be used with judgement, since they are obviously more risky procedures if a large sac is present."

It is noteworthy that cerebral complications are more frequent after ligation of the common carotid than after ligation of the innominate artery. Delbet estimates their

incidence at one-fifth and Jordan at one-fourth under modern surgical technique. Burns of Memphis in 1908, in a record of fifty-one innominate cases with eleven recoveries, speaks of six dying from shock, six from cerebral complications, and the balance from septic wound infections and secondary haemorrhage.

Various methods of exposing the innominate artery have been devised: Trephining the manubrium; vertical splitting of the manubrium; clipping away the upper margin of the manubrium, with resection of one or both sterno-clavicular joints—even the first costal cartilage has been resected; temporary displacement of the clavicle; resection of the sternal end of the clavicle. The last-mentioned plan was adopted and gave ample access. It was deemed better than temporary displacement of the bone, which, by its dangerous traction on the aneurysm and the subsequent difficulty of retaining it on replacement in its old socket, did not commend itself in this instance.

Major Gask, Captain Chubb, and Captain Manford kindly assisted at the operation, and took charge of the case after it; and the later treatment in London was carefully supervised by Mr. Laming Evans.

EARLY TREATMENT OF COMPOUND FRACTURE OF THE LONG BONES OF THE EXTREMITIES.

By BASIL HUGHES, CAPTAIN R.A.M.C.(T.F.).

THE early treatment of compound fracture of the longer bones of the extremities forms a large and important branch of military surgery. Upon what is done for men suffering from such wounds in the hours immediately following their infliction depends to great extent their subsequent utility, and often their life.

There are points of difference between these fractures and compound fractures seen in civil life. In the latter there is not the same quality of damage to bone and the soft parts, and we have not the same type of infection to deal with. Further, in civil life men are not injured under the conditions which obtain in war.

In the case of a man wounded in action, we must consider (a) fatigue; (b) shock (specially in fractures involving the femur); (c) local tissue stupor; (d) infection.

Fatigue is a powerful predisposing cause to wound infection and to other trench ailments. I have pointed this out in connexion with "trench feet" and "trench pyrexias." Life in trenches under the conditions that exist there, with lack of sleep, are potent causes in producing trench fatigue. It is noticeable how rapidly rigor mortis occurs in men killed in the trenches.

Shock.—With severe wounds of soft parts, specially the thigh with fracture of the femur, shock is immediate and severe. It is not necessarily associated with loss of blood. It is much increased by motor transport if the limb is not securely immobilized.

Local Tissue Stupor.—This condition is brought about in the muscles and other soft structures as a result of injury caused by a piece of shell. The naked-eye appearance of such tissue is characteristic. The muscle looks dry and lifeless, it is quite insensitive, does not bleed when cut, and does not contract when stimulated. This tissue, though not dead, is very apt to die, and while in this stunned state is very prone to infection. If a tourniquet be applied to the limb above such tissue, or if antiseptics be used, gangrene is almost certain to ensue. Under these conditions, if necessary, a limb can be amputated quite painlessly. This I have done on more than one occasion in the trenches, and the cases have done well.

Infection.—All shell wounds are bound to become infected, whatever care be taken. This statement is clear to those of us who have had experience in the front line. Predisposing causes are fatigue, exposure to wet and cold, nerve strain, and tissue stupor. The bacteria most to be feared are: (a) *B. perfringens*, (b) Vincent's bacillus, (c) *B. tetanus*, and (d) *Streptococcus faecalis*.

It is therefore important as early as possible to follow out the rules applying to open wounds—namely: (1) Prevent further infection; (2) get rid, as far as is possible, of infection already carried in; and, in cases of fracture, a third may be added: (3) Prevent what infection has