characteristic of a rodent ulcer. A year later ulceration recurred, and received energetic x-ray treatment for two years. The appearance of the ulcer changed; its edges became raised and hard. The x-ray officer became dissatisfied, and asked me to excise the ulcer. This was done, and on examination the new ulcer presented the characters of squamous celled cancer. Other surgeons have had similar experience.

I chose this subject for the lecture to-day because of a chance that enables me to show you an unusual example of what is called arsenic cancer.

A woman, aged 60, came under my care in the hospital with a large ulcer just below the left knee; it had the usual signs of cancer of the skin. In shape and position the ulcer so resembled a patch of psoriasis that I instinctively uncovered the right leg to see if there were any patches of psoriasis. The scaly, onion-like patches peculiar to this disease were present on her legs and elbows (Fig. 1). The following story was elicited:

For thirty years she had suffered from psoriasis, and during this period taken more or less continuously arsenic in the form of liquor arsenicalis. In 1913 a pimple appeared at the lower border of a scaly patch on the skin, just below the patella. This pimple gradually became an ulcer that was frequently scraped and cauterized. In spite of this treatment it increased in size; in 1916, when she came under my care, it had become a typical cancerous ulcer as big as the palm. There were enlarged lymph nodes in the groin. On August 23rd I removed the lymph nodes from the groin, ligatured the common femoral artery, resected the upper two inches of the internal saphena vein at its junction with the femoral vein, and amputated the limb through the middle of the thigh.

Tissues from the edges of the ulcer had the microscopic characters of squamous celled cancer, but there were no cell nests. The big lymph nodes from the groin were examined and found free from cancer, but they showed the changes common to nodes enlarged from septic infection. The patient made a quick and satisfactory recovery after the amputation.

Cancer of the skin covering the trunk is unusual, but it is common on the skin of the face and limbs, and always

arises in some pre-existing lesion, especially a chronic ulcer. In the case of arsenic cancer, the order of events is somewhat in this style: Arsenic taken internally for a long time—years—leads to thickening (keratosis) of the skin, especially on the palms and soles. These thickenings crack and allow bacteria to enter and infect the skin; in rare instances these chronic linear ulcers become cancerous. Psoriasis is an intractable skin disease for which arsenic, especially in the form of liquor arsenicalis, was regarded as a specific.

A remarkable case has been reported in which a cancerous ulcer appeared in a patch of psoriasis on the skin of a finger under a wedding-ring. The patient had taken arsenic (R. J. Pye-Smith). It is said that this form of cancer does not infect lymph nodes, and the investigation of inguinal lymph nodes in my patient supports this statement. Let me conclude the lecture with a parable.

The dead trunk of a polarded willow stood in a hedge-row bordering a busy highway. Dust, conveyed by wind, filled a depression in the head of the willow; a gooseberry bush flourished in this scanty soil. It is probable that a bird had eaten ripe gooseberries and then muted excrement containing the seeds in the soil on the crown of the willow. The seed sprouted, took root, became a bush,

and bore fruit. The woman with cancer at the knee had, with great faith, swallowed liquor arsenicalis at intervals for thirty years with the hope of curing her psoriasis, until one day a crack appeared at the edge of one of these curious skin patches, and in a fortuitous way the germs of cancer entered, took root, and led to the formation of a large, stinking, cancerous ulcer. Some day the cause of a cancerous ulcer arising in a patch of psoriasis, a lupus patch, or in a chronic ulcer left by a burn will admit of an explanation as simple as the presence of a gooseberry bush on the head of a dead willow, but of this we may be sure: Many will see more chronic ulcers that have become cancerous than gooseberry bushes growing, and bearing fruit, on the summits of dead willows. There can be little doubt that a better knowledge of symbiosis will enable surgeons to know how chronic sepsis tills the soil in the human body to make it receptive for the germs of cancer.

FIG. 1.—Cancer arising in a patch of psoriasis on the leg of a woman aged 60. (From a photograph by Mr. M. C. Sarkies.)

CASES OF GUNSHOT WOUNDS OF BLOOD VESSELS FROM MESOPOTAMIA.

BY

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(With Special Plate.)

DURING the past eighteen months of the Mesopotamian campaign, twenty-four cases of bullet wounds of large blood vessels have passed through the Colaba War Hospital, Bombay, including three cases treated by operation prior to admission, to which no further reference is made in these notes.

As this hospital has received fully 80 per cent. of all cases of severely wounded British troops, these twenty-four cases probably represent the great majority of wounds of this nature which reached the overseas base in Bombay without previous operative treatment. All these cases were due to bullet wounds, and in this connexion it may be mentioned that the great majority of wounds treated here have

been bullet wounds caused either by the pointed German bullet used by the Turks or the large leaden Arab bullet.

The cases have shown a considerable degree of variety; four were obliterative lesions, eight were arterio-venous aneurysms, nine were diffuse false aneurysms.

The obliterative lesions showed absence of the distal pulses, with no other marked sign of lesion of the vessels in question. One of these was operated on twelve weeks from the date of injury for lesion of the brachial nerve cords; here the axillary artery in its third stage was found to be completely divided, with each end occluded by a firm clot; the axillary vein was thrombosed. There was no local effusion of blood. Another was operated on for lesion of the median nerve in mid-arm, and a similar condition was found, but the ends of the artery could not be detected amongst the scar tissue surrounding the nerve. The other two cases were of wounds involving the superficial femoral artery. One had apparently undergone spontaneous cure from the effect of a tourniquet applied on the field, and left on for forty-eight hours. It had cut into the subcutaneous tissues, leaving a definite scar on the inner side of the thigh, with only gangrene of about half of the great toe as a result. The other showed a very small hæmatoma over the mid-third of Hunter's canal, with no pulsation or bruit, and absent distal pulses.

The arterio-venous wounds included one of the subclavian vessels, one axillary, one common femoral, one superficial femoral, and two popliteal, one peroneal, and one acromio-thoracic; the second and two last were operated on in the hospital; the others were transferred to England under expectant treatment.

All the cases of diffuse false aneurysm were treated by operation in the hospital. Notes on these and the other three cases requiring operation are as follows:

CASE I.—*Traumatic Aneurysm of Right Axillary Artery.*
(Fig. 1.)

Wounded in Mesopotamia. Wound of entry below the middle third of the right clavicle; bullet lodged.

On admission there was a large pulsating tumour under the great pectoral muscle, extending from the middle third of the clavicle into the axilla and over the upper part of the chest wall, internal to the axilla. The shoulder was drawn up, and traction on the arm did not alter the deformity and caused great pain. There was a loud and harsh bruit over the tumour. Compression of the subclavian artery, which could not be carried out efficiently because of the position of the shoulder, caused pulsation and bruit to diminish to a limited extent. Circulation in the hand and arm was sluggish, there was slight oedema, and the radial pulse was absent. Temperature varied between normal and 99.4°. Pain was very severe, and interfered very much with sleep. There was complete right wrist-drop.

As the increase in size within a few days was definite and marked, it was decided to operate without delay.

Operation.

On April 24th, 1916, the third part of the subclavian artery was ligatured as a preliminary measure. Much difficulty was experienced in this part of the operation on account of the upward displacement of the clavicle.

A second incision was made from the middle third of the clavicle to a point over the neck of the humerus, and the line between the great pectoral and deltoid muscles defined. Part of the clavicular origin of the great pectoral was divided, and the muscle strongly retracted inwards. The sac wall was now exposed, and consisted apparently of the much stretched and thinned pectoralis minor muscle and the clavipectoral fascia; the wall burst on gentle manipulation, and a large quantity of clot and fresh blood was removed with swabs and hot water; very severe haemorrhage occurred from the distal end of the injured artery, and much difficulty was experienced in examining the lesion and applying pressure forceps. Firm pressure in the axilla helped temporarily to control the haemorrhage, and the proximal end was caught; traction on this end helped to control the distal end, the wound being somewhat valvular. Ligatures were applied above and below the lacerated area, which involved half an inch of the line of the axillary artery in the second stage. It was an irregular tear without much gaping of the edges. Arterial haemorrhage still occurred and was found to be due to a small included branch; when this was ligatured, haemorrhage ceased. The pectoralis major muscle was sutured and the cephalic vein, which had been injured, was ligatured.

The wound was then closed in two layers, a rubber tube being inserted at the lowest point.

Serous oozing occurred for several days, and a small collection of fluid, which did not escape by the tube, was drained on May 4th. The wound had healed by May 14th and the patient was transferred to England on May 22nd. There was no improvement in the musculo-spiral paralysis.

CASE II.—*Arterio-venous Aneurysm of Right Acromio-thoracic Trunk.*

Wounded in Mesopotamia. The wound of entry was below the centre of the right clavicle; bullet lodged. Wounds healed on admission. There was a pulsating tumour, the size of an orange, felt in line of axillary artery below middle third of clavicle; pressure on subclavian artery caused pulsation to cease and sac to partially empty. The tumour varied in size and tenseness on movement of the upper extremity. There was a soft bruit. The radial pulse was good. There was no nerve involvement. A fortnight after admission a definite increase in size was noticed.

Operation.

On May 4th, 1916, the subclavian artery was ligatured in its third stage. All pulsation in the tumour ceased.

A second incision was made in the interval between deltoid and pectoralis major muscles; the latter muscle was drawn inwards and the pectoralis minor exposed; it was stretched over the tumour. The axillary artery was defined and was found to be uninjured; a much enlarged branch (thoracic axis) was seen to disappear into the tumour, which lay below and internal to the axillary artery. This branch was ligatured and the sac incised. The clot was removed; some of it was organized and some fresh. Regurgitant haemorrhage from the distal end could not be controlled by ligature as the external anterior thoracic nerve was involved in the sac wall. A purse-string suture was tied as close to the bleeding point as possible and caused all oozing to cease. Another pedicle posterior and internal was ligatured. The sac was intimately associated with the pectoralis minor muscle, which was atrophied and spread over the sac wall. It was almost unrecognizable as muscular tissue. The sac was lined with tunica intima. The wound

was closed without a drain. Circulation in the arm and hand remained good. There was no return of the radial pulse. The patient was transferred to England on May 22nd.

CASE III.—*Arterio-venous Aneurysm of Left Axillary Vessels.*
(Fig. 2.)

Wounded in Mesopotamia, January 21st, 1916. The wound of entry was below the left coracoid process, and that of exit near the inferior angle of the scapula.

Wounds healed on admission. History of severe pain from time of injury, with no improvement. Left elbow semiflexed and stiff. Hand contracted, fingers bluish and cold; slight voluntary power of extension at wrist-joint. No other movement in forearm or hand. Distal pulses absent; no sign of aneurysmal swelling in axilla.

Operation.

On February 17th, 1916, operation was undertaken for the relief of pain. Incision along axillary border of left pectoral muscle. An extensive mass of hard scar tissue was found in the line of the axillary vessels at lower border of axilla. The origin of the brachial artery was identified; this did not pulsate. The axillary vein contained a clot near its origin; about two inches above this point a small sac, non-adherent to the surrounding tissues anteriorly, was seen to pulsate. It was disc-shaped, very clearly defined, purplish-red in colour, and about one and a quarter inches in diameter; it was adherent to the wall of the axillary vein, but did not communicate any pulsation to it; its connexion with the axillary artery was not visible, but the pulsation of the latter could be felt an inch above the aneurysm, and pressure here stopped its pulsation. Since a ligature could not be applied to the axillary artery above the aneurysm, a second incision was made in the line of the fibres of the great pectoral muscle; the artery was exposed here—that is, about two inches above the lesion—and a ligature applied. Pulsation then ceased abruptly. The sac lay across the median nerve near its origin. Above and below the sac the nerve was very oedematous. The sac was opened and was found to be lined by tunica intima all through and to contain no openings. On freeing its posterior wall from the median nerve the latter was found to be flattened to the thickness of a finger-nail by the pressure of the sac wall.

While an attempt was in progress to free the ulnar and musculo-spiral nerves from scar tissue, free haemorrhage, apparently unconnected with the aneurysmal sac, occurred from three separate sources deep in the posterior wall of the axilla. It was impossible to control any of these points with pressure forceps, and the patient had lost so much blood within a couple of minutes that it was necessary to pack the axilla and give an intravenous infusion of saline. The upper incision was then closed, the axillary wound roughly sutured over the packing, and the patient returned to bed.

After-History.

Subsequently very great difficulty was encountered in the after-treatment owing to infection of the axilla and repeated secondary haemorrhages. These occurred on the fourth day, when the packing was changed, and on three subsequent occasions during the first fortnight after the operation. A pulsating area deep in the axilla was noticed twelve days after the operation covered by sloughs and recent clot. Daily packing of the axilla with antiseptic gauze plugs, aided by the pressure of wool pads behind the shoulder, was resorted to, the subclavian artery being compressed during the dressing. There was no further haemorrhage, and the pulsating area had disappeared two weeks later. By then the terminal phalanges of the fourth and fifth fingers had become gangrenous, and showed a line of separation. There were superficial sloughs over the inner condyle of the humerus, on the flexor surface of forearm, and over the styloid process of the ulna. There was no power of movement in the upper extremity, and no sensation below the axilla. At the end of April sensation had returned in the arm and over an irregularly distributed area in the upper third of the forearm. There was weak voluntary flexion at the elbow-joint.

The patient was transferred to England in June. His general condition then was excellent. There was still a small granulating area in the axilla. The slough in the forearm had healed. The nutrition of the upper extremity was good. Movement at the elbow-joint was good and improving. The wrist was stiff, and had no voluntary movement; its passive movements were improving. The phalangeal joints were stiff, and there was a tendency to contraction of the fingers. This disability was improving under passive movement and massage, and the hand was plump and well nourished, except where the tips of the fourth and fifth fingers had become gangrenous. Electrical reactions were normal above the elbow-joint. The wrist flexors gave a weak reaction to galvanism; no reaction to faradism.

CASE IV.—*Traumatic Aneurysm of Left Axillary Artery.*
(Fig. 3.)

Wounded in Mesopotamia, April 9th, 1916. Wound of entry over the deltoid muscle in the upper third of the left arm. Bullet lodged, having fractured the shaft of the humerus and penetrated the lung (there was haemoptysis for fourteen days after the date of injury).

On admission the wound was healed. There was a history of severe and constant pain in the axilla and on the radial border of the forearm. There was marked oedema in the hand and forearm and about the elbow. A deep sloughing pressure sore existed over the inner condyle of the humerus. The left arm was completely paralysed. Loss of sensation was complete

below the axilla; there was atrophy and stiffness of the muscles of the forearm. X-ray examination showed an oblique fracture of the upper third of the shaft of the humerus, without comminution.

A marked swelling existed over the anterior surface of the shoulder-joint, limited internally by the outer border of the great pectoral muscle, but diffuse and extending under the deltoid muscle externally; it also filled the floor of the axilla with a tense ball-like mass. There was pitting on pressure over the swelling, which had the appearance of a brawny cellulitis covering a deep suppurating focus. Pulsation could not be detected in any part of the swelling, but pressure on the subclavian artery eased the tension—in the axilla. There was no bruit. The radial pulse was absent.

During the three weeks in which the patient remained in hospital prior to his operation no improvement occurred in his condition, and the swelling did not decrease in size. The pressure sore at the elbow became more extensive and the general condition disimproved steadily from pain and lack of sleep. The temperature varied between 100° F. and 101° F., and the pulse 80 to 90. The shape of the swelling became more definite and pulsation was just visible at the anterior fold of the axilla on May 20th, and was palpable in the floor, which was very tense and painful.

Operation.

On May 24th a crescentic incision from near the inner end of the clavicle to the insertion of the great pectoral muscle was made, and continued deeply in its inner third. The pectoralis minor muscle was freely exposed by separation of the fibres of the atrophied great pectoral muscle; the former was then divided and reflected, exposing the axillary artery fully as far as the origin of the long thoracic artery. During this part of the operation the acromio-thoracic vein was injured, and was ligatured and divided.

Exposure of the third stage of the artery was continued as far as possible distally, until it became buried under the inward projection of the aneurysmal sac, and a ligature was then applied as low as possible—that is, between the long thoracic and subscapular arteries.

The distal part of the incision was then continued deeply. Retraction of the great pectoral and deltoid muscles displayed the anterior portion of the sac wall, which was formed by the spread-out fibres and aponeurosis of the coraco-brachialis muscle. A vertical incision was made in this covering, and, with the aid of strong retraction and partial division of the great pectoral muscle near its insertion, the cavity was exposed. Free haemorrhage was then occurring from the injured artery; the proximal part was seen and clamped, and pressure by tourniquet high in the arm controlled haemorrhage from the distal end sufficiently to enable its identification and control by pressure forceps to be effected. Ligatures were then applied above and below the injury, which was incomplete and ragged, involving half the circumference of the artery. The axillary vein was uninjured. There was no further arterial haemorrhage, and when the cavity, which was very extensive, had been flushed with hot saline the oozing soon ceased.

The patient's condition did not allow of a full examination of the accompanying nerve injuries. The ulnar nerve was adherent to the lower part of the false wall of the sac and matted with clots. The musculo-spiral and musculo-cutaneous nerves were identified and did not show any lesion within the cavity. The median nerve could not be identified.

The wound was closed and drained with a rubber tube at the lowest corner. There was a serous discharge for eight days.

After-History.

The patient's general condition improved rapidly, oedema rapidly disappeared, and pain was relieved. The pressure sore at the elbow improved, and had healed when the patient was transferred to England on about July 4th. There was then no return of power in the arm or hand, but full sensation had returned as far as the elbow-joint. There was a weak reaction to faradism in the wrist flexors.

CASE V.—Traumatic Aneurysm of the Left Brachial Artery. (Fig. 4.)

On April 24th, 1916, this patient was shot through the left upper arm; he stated that the wounds healed in some five days, but that the injury was immediately followed by much local swelling, which went down to the elbow, and subsequently grew less and localized to the middle of the arm.

On May 19th, on admission, the entry wound, 1½ in. below the insertion of the pectoralis major, and the exit wound in the mid-posterior surface of the arm, 3 in. above the elbow-joint, were both healed; a small aneurysm of the brachial artery in the direct track of the wound was present, about the size of a walnut; its pulsation and harsh murmur were both controlled by pressure on the artery above; there was much severe pain in the median nerve area below, and some definite paralysis of the muscles of the first and second digits supplied by the nerve; pulse at wrist could not be felt.

Operation.

On exposure of the aneurysm, on May 25th, the median nerve lay on it, that is, internal to it, and was adherent to it. It was dissected free, and the condition of the nerve appeared good; the brachial artery above and below the tumour was small (about the size of the ulnar artery in the forearm). The sac of the aneurysm was on its outer side, and only a small communication with the artery existed. The artery was ligatured above and below the tumour and the intervening portion removed, including above the aneurysm a small annular dilatation of the

vessel. The remainder of the sac, which was thin, was left, after being emptied of blood clot.

Primary union followed, and the patient's convalescence was only complicated by an attack of catarrhal jaundice, which began ten days after the operation and cleared up in three weeks' time, when he was sent to Egypt. By that time the pain in the median nerve area had become much less, though still slightly present, and the paralysis also had cleared up but for the flexor profundus action in the index finger, which was still mostly absent.

CASE VI.

Wounded in Mesopotamia; penetrating wound of the right arm in mid-third; wounds healed on admission.

There was a small aneurysm in the course of the brachial artery at the centre of the arm, with a distinct pulsation and bruit. Compression of the brachial artery above the lesion caused a reduction in size and cessation of pulsation. There was a slight radial pulse. There was pain in the area of distribution of the median nerve, with paresis of the flexors of the fingers.

Operation.

On May 23rd an incision was made over the tumour, after the application of a tourniquet. The sac was exposed; the median nerve was stretched over it, it was flattened and injected; at the lower part of the wound it was oedematous. The ulnar nerve was involved in scar tissue; it was easily freed and was found to have been perforated by the bullet. The sac of the aneurysm was about the size of a pigeon's egg. The artery had been almost completely severed, and only existed as a thin band in the inner side, along the half-inch of its course that was involved.

The sac was dissected from its bed and the artery ligatured above and below. The sac was in part lined by tunica intima. The median nerve was wrapped in a fascial sheath. The sheath of the ulnar nerve was sutured and adhesions were dissected away. There was no scar tissue amongst the axons. The nerve was wrapped in a fascial sheath. The wound was closed without drainage and healed without complication.

Pain had disappeared completely from the hand when the patient was invalided.

CASE VII.—Traumatic Aneurysm of Right Superficial Femoral Artery.

Wounded in Mesopotamia, November 22nd, 1915. Tourniquet applied at time of injury. Note with patient on arrival stated: "Tourniquet applied for two hours daily."

On admission on January 2nd, 1916, an extensive non-pulsating tumour existed on the inner and anterior area of the upper third of the right thigh, limited above by Poupart's ligament. The wound of entry was 4½ in. below Poupart's ligament in the line of the sartorius; inside, the bullet had been removed from the fascia over the adductor muscles 2 in. below the perineum. There was no infection of either wound. The patient stated that the swelling had commenced when the wound occurred, and had gradually increased for several days. Circulation in leg and foot was good; no oedema of leg or foot. Both anterior and posterior tibial pulses present, but very much modified. There was no bruit over the swelling. Pain was constant, but not severe.

Operation.

On January 13th a slight leakage occurred from the wound on entry during the night; it was decided to operate immediately.

Tourniquet control being impossible on account of the high upper limit of the swelling, the limb was sterilized and emptied as far as possible of blood by a Martin's bandage and elevation. Digital compression was made on the common femoral artery at Poupart's ligament.

The tumour was incised in the line of the vessels, and large masses of old and recent clot removed. Haemorrhage from both ends of the injured vessel still occurred. Exposure of the injured portion of Hunter's canal showed a gross lesion of the artery 1½ in. below the origin of the deep femoral artery. Pressure forceps were applied above and below the injury.

The bullet had invaded the vessel sheath on its inner side, lacerating the inner wall of the artery for half an inch of its length, leaving the anterior and outer wall maintaining the continuity of the vessel, devitalized and irregular, like a piece of torn rag. A small sac, the size of a walnut, and composed of tunica intima, lay to the outer side of the vessel, and had evidently developed as a diverticulum in the main blood cavity from a piece of the lacerated inner wall. It was filled with semi-organized clot.

Ligatures were applied ½ in. above and ½ in. below the limit of the lesion, two included branches being tied. The vein and internal saphenous nerve were uninjured. The cavity was irrigated and closed in layers without injury.

The result was satisfactory. The distal pulses were obtainable within twenty-four hours; no interference with the circulation in the foot or leg occurred. A small haematoma was drained ten days later. The patient was transferred to England on March 6th, 1916; the wound was then healed.

CASE VIII.—Traumatic Aneurysm of Left Deep Femoral Vessels.

Wounded in Mesopotamia. The wound of entry on the posterior and inner surface of the left thigh in its upper third, exit antero-externally at the same level.

A note with the patient on admission stated, "Fracture of femur in mid-third, lesion of great sciatic nerve." Operation was undertaken for relief of pain in foot, scar tissue removed from the great sciatic nerve. The wounds were healed on admission.

On May 2nd, 1916, the pain in the left thigh was very severe and caused insomnia, the pulse was 120, and the temperature 103° F.

On May 3rd examination showed an extensive and tense swelling involving the middle and part of the upper third of the left thigh antero-externally and postero-internally. There was no swelling directly over Hunter's canal. There was much tense elasticity in the swelling with no pulsation and no bruit. Compression of the common femoral artery at Poupart's ligament eased the tension, and looking horizontally at the swelling from the outer side it was seen to rise rapidly on release of the artery. The pulses were present and weak in the anterior and posterior tibial arteries. The patient's general condition was not good; anaemia was intense.

Operation.

Operation was undertaken at once, a tourniquet being employed. The peculiar position of the swelling, with the presence of the distal pulses, suggested that the superficial femoral artery was not involved, but its extensive nature decided an incision over Hunter's canal. This opened into a mass of recent clot lying external to the sartorius muscle. This was cleared away, and examination of Hunter's canal showed that no lesion of the superficial femoral artery had occurred. The great mass of the clot lay external to the canal and extended backwards, lateral to the shaft of the femur.

The intermuscular septum between the vastus internus and the adductor muscles was opened and a mass of fresh clot, almost as extensive as that in front, was evacuated. With difficulty the deep femoral vessels were exposed, and were found to be the cause of the haemorrhage. On loosening the tourniquet, free haemorrhage, 1 in. from the origin of the deep femoral artery, occurred. The vessels were ligatured. Trouble-some oozing from deep in the adductor muscles and from the neighbourhood of the shaft of the femur followed. This was stopped by pressure forceps and ligature. The wound was then closed and drained by a large rubber tube.

After-History.

The patient's condition was critical for some days after the operation, the pulse being poor and restlessness extreme. A small haematoma developed after the tube had been removed. Three days later, when this was drained, the wound healed without further complication, and pain completely disappeared. When the patient was transferred to England some weeks later his general condition was good. Foot-drop remained.

CASE IX.—Arterial Haematoma due to Injury to Branch of Left Deep Femoral Artery.

Wounded in Mesopotamia. The wound of entry was on the outer surface of the mid-third of the left thigh, that of exit through the adductors at the same level. The bullet also traversed the right thigh.

On admission, on May 2nd, 1916, the patient was anaemic and debilitated, with a temperature of 102° F. and a pulse of 100. There was a large and hard haematoma in the inner and upper third of the left thigh. The wound of entry was healed, and the wound of exit granulating, with a serous discharge. The distal pulses were present and weak. There was no bruit and no pulsation over the swelling. Compression of the common femoral artery at Poupart's ligament did not affect its tension. The superficial femoral artery had been ligatured in Hunter's canal on the way home from Mesopotamia.

The temperature and pulse-rate fluctuated for several days after admission, the pain was considerable, and complete rest with elevation of the limb was adopted. On May 15th a slight leakage occurred from the wound of exit and continued for two days with increase of pain. On May 17th a sudden marked increase in tension occurred, with severe pain and blanching of the limb below the knee. The pulse-rate increased to 140.

Operation.

A tourniquet was applied and an incision made over the tumour below the sartorius muscle. Much old and recent clot was evacuated, and haemorrhage was found to be caused by a large branch of the deep femoral artery, which had been severed and projected into the cavity. Ligature of this branch checked haemorrhage completely. There was much local laceration of the tissues, from which free oozing occurred after removal of the tourniquet. The wound was then closed and drained by a tube.

After-History.

The patient's general condition improved rapidly after the operation. There was a free discharge for several weeks, which was found to be infected with *Bacillus pyocyaneus*. There was no further haemorrhage, and the patient was transferred to England with the wound still draining.

CASE X.—Traumatic Aneurysm of Left Superficial Femoral Vessels. (Fig. 5.)

Wounded in Mesopotamia, March 8th, 1916. The wound of entry was near the left adductor tubercle, and that of exit 4 in. above the knee-joint through the biceps muscle.

On admission to the convalescent ward on March 20th there was oedema below the knee, and also drop-foot. There was no swelling in the thigh.

On March 26th the patient got out of bed without leave; some bleeding then occurred from the wound of entry. The same night a swelling developed over the inner and lower third of the thigh, and increased gradually. When seen on March 29th an extensive doughy swelling existed, filling the inner and

posterior area of the lower third of the thigh. There was severe local pain. There was no visible pulsation. The swelling was tense and resilient. There was no bruit. Compression of the common femoral artery at Poupart's ligament relieved the tension considerably, and on sudden release of the artery the swelling was seen to increase in extent when a horizontal view was taken of its outline. Oedema of the limb below the knee was marked; circulation in the foot was poor, return of the blush on the ball of the foot and over the malleoli being slow after pressure. The distal pulses were absent. The patient was in acute pain, with a temperature of 102° and a pulse of 128. There was then no bleeding from the wound of entry.

First Operation.

On March 29th a tourniquet was applied in the mid-third of the thigh. Incision in the line of the sartorius muscle; masses of recent clot were evacuated. The artery lay unprotected in the outer wall of the blood cavity. The vessel wall was severely devitalized for 3 in. above the opening in the adductor magnus. There was an extensive irregular laceration at the centre of this portion. An adherent clot lying behind the artery evidently sealed an injury in the wall of the vein. The artery was ligatured 2½ in. above and just below the injury, three included branches being also tied; one of these was the anastomotic.

On removal of the tourniquet a rush of blood from the injured femoral vein occurred, but soon stopped; the vein was not disturbed. The cavity was packed and drained by a tube in one corner, the remainder of the incision being closed in layers.

After-History.

After the operation the general condition improved, but the leg and foot were dusky and cold. Recovery of the circulation took place except in several local areas, chiefly in the distribution of the external popliteal nerve, and a deep slough subsequently developed in the mid-third of the leg, involving a small portion of the bellies of the peroneal muscles; superficial sloughs developed over the heel, the terminal phalanx of the great toe and the outer malleolus. Apart from those very local areas, circulation recovered in the leg and foot.

The temperature and pulse-rate fell rapidly after the operation, and remained nearly normal. There was a serous discharge from the operation wound for three weeks. The wound had completely healed by May 10th.

An operation was then undertaken for examination of the nerve lesion. There was loss of epicritic sensation on the posterior surface of the leg, and complete loss of sensation below the ankle-joint except over the inner malleolus.

There was no voluntary movement in the foot or toes.

Second Operation.

An incision in the upper part of the popliteal space revealed an extensive lesion of the sheath and fibres of the external popliteal nerve at its origin, with less severe injuries to the sheath and fibres of the divisional point of the great sciatic and the upper two inches of the internal popliteal nerves. A mass of dense and very hard scar tissue involved all three nerves. When the nerves were freed from the scar it was found that the fibres of the external popliteal had been severely lacerated and denuded of sheath; the scar tissue was removed as far as possible, and the injured area wrapped in a coating of deep fascia.

Several nodular masses of scar tissue were removed from amongst the fibres of the great sciatic and internal popliteal nerves, the incisions in their sheaths were closed with fine catgut and the injured areas wrapped in fascia.

The patient was transferred to another hospital (Dehra Dun) for electrical treatment and massage three weeks later. The sloughs were then granulating.

CASE XI.—Traumatic Aneurysm of the Left Superficial Femoral Artery.

Wounded in Mesopotamia on April 15th, 1916, by a bullet passing through the left thigh. The patient stated that the wound was followed at once by marked swelling in the track of the wound and followed by slight increase in size for three days, after which it kept stationary.

On admission, on April 30th, there was a healed entry wound three inches above, and external to, the left patella; the exit wound was on the postero-internal surface of the thigh very slightly higher up, and was represented by a shallow granulating wound the size of a halfpenny. There was a hard fixed swelling on the antero-internal aspect of the lower third of the thigh; pulsation in it was only felt with difficulty, no murmur was heard, and no dorsalis pedis or posterior tibial pulses were felt below, though the circulation in the foot was good. Movement of the knee was impossible owing to the pressure of the tumour; its size was not altered by controlling the femoral artery above, though its pulsation was. No pressure symptoms on nerves were present.

On May 1st the patient's temperature rose from normal to 100° and his pulse from 90 to 120, suggesting possible infection of the aneurysm from the granulating wound of exit.

Operation.

On May 2nd a tourniquet was applied, and an incision in the line of the femoral artery made over the tumour after the granulating exit wound had been treated with pure carbolic acid and gauze covered; it lay posterior to the incision. About a pint of black blood clot was evacuated and the lower end of the femoral artery lay in the wound with a round hole in it the

size of a large pea; suture of the vessel, owing to the possibility of infection of the aneurysm, was not entertained, and the artery was ligatured above and below the wound in it, with a small branch in the intervening portion also. No bleeding followed the removal of the tourniquet; the vein, which lay in the common sheath, intimately connected with the artery, was uninjured, though it did not fill with blood after the removal of the tourniquet.

The wound was drained with a small tube through a counter incision on the outer side of the thigh through the vastus externus aponeurosis.

The circulation in the foot kept well, free oozing from the draining tube of dark blood-stained fluid occurred for a few days. The operation wound healed by first intention, the exit wound of the bullet in fourteen days, and the drainage sinus was nearly healed on the discharge of the patient from hospital for Egypt on May 29th; the knee movements were then good.

CASE XII.—Arterio-venous Aneurysm of Right Peroneal Vessels. (Fig. 6.)

Wounded in Mesopotamia. The wound of entry was over the crest of the right tibia, and the exit was in the mid-third of the leg, posterior surface.

The wounds were healed on admission. A pulsating oval swelling, the size of a large egg, existed over the upper part of the outer head of the gastrocnemius muscle. There was a soft humming bruit, but no thrill.

Pressure on the common femoral artery at Poupart's ligament emptied the sac and caused the bruit to disappear. The anterior tibial pulse was present and normal; the posterior tibial pulse was present but weak. There was no paralysis or other sign of nerve involvement, and no pain, while the circulation in the foot was normal. An x-ray examination showed incomplete fracture of the upper third of the shaft of the fibula with a small separated fragment.

The following increases in the size of the swelling occurred:

Measurement of circumference of leg,	May 3rd ...	11½ in.
"	" May 7th ...	12½ in.
"	" May 10th ...	12¾ in.

This rapid local enlargement of swelling caused operation to be decided on.

Operation.

A diagnosis of arterio-venous aneurysm of the peroneal vessels being made, an incision 4 in. long was made over the tumour in the calf, the deep fascia, outer head of gastrocnemius and soleus muscles being incised before the sac wall appeared. On account of adhesion of the sac wall to the injured area of the shaft of the fibula and surrounding tissues it was impossible to clear it fully. The inner wall was cleared until the posterior tibial nerve and vessels were exposed; it appeared that these were the vessels involved. They were accordingly ligatured proximally. Further dissection showed that the posterior tibial vessels were uninjured, the lesion having involved the peroneal vessels a quarter of an inch from the origin of the artery. These vessels were ligatured proximally. An examination of the sac showed it to be composed of tunica intima; its parietal wall was closely adherent to surrounding structures, and its extent when empty was considerable. A long cul-de-sac passed forwards under the tibialis anticus muscle through the injury in the interosseous membrane. The outer wall of the main sac encroached on the medullary cavity of the injured fibula, the inner wall was limited to the area lateral to the line of the posterior tibial vessels.

On removal of the tourniquet there was free arterial haemorrhage in the outer wall of the sac. This was controlled with difficulty, as the bleeding point lay under cover of the shaft of the fibula. This was evidently the distal end of the peroneal artery.

After-History.

There was troublesome oozing from the deep part of the sac and from the branching veins in the inner wall; as this could not be completely arrested the sac was packed with gauze and the wound closed in layers. Two days later the gauze packing was removed and healing occurred without complication. The patient was transferred to England some weeks later.

SUMMARY.

Treatment of the series of twenty-one cases has suggested the conclusion that bullet wounds of large blood vessels coming under observation on an average four weeks from the date of injury, most frequently show signs of either diffuse false aneurysm or arterio-venous aneurysm, and that the former and more urgent cases can be successfully treated by a local operation at this period, provided that the circulation above can be efficiently controlled, either by tourniquet, digital compression, or, in the case of the upper extremity, by ligature of the main artery at some point above the lesion, thus confirming, as far as experience of this limited series of cases is concerned, the experiences of previous campaigns.

The advantages of the exposure of the vessel at the point of injury as against proximal ligature seem clear, particularly in cases involving the lower extremity. First, it can be definitely ascertained whether the main vessel or a branch is involved. The importance of this is illustrated

by Case ix, where secondary haemorrhage occurred after proximal ligature of the superficial femoral artery; the second operation showed a branch of the deep femoral to be the true cause of the condition. Secondly, all available channels are thus left open for the maintenance of the collateral circulation. Thirdly, the extent of the injury to the vein or neighbouring nerve trunks can be observed and perhaps dealt with.

Operative measures were confined to the cases presenting urgent indications for operation. These indications were:

1. Secondary haemorrhage.
2. Signs of supervening infection.
3. Marked increase in size.
4. Severe pain, due either to (a) tension, (b) nerve involvement.

Most of the cases operated on presented more than one of these indications.

The five cases of arterio-venous aneurysm sent to England without operation showed none of these indications while in hospital; on the contrary, in all but one there was decrease in size to some extent.

The presence of a normal or slightly modified distal pulse has an interesting bearing on the diagnosis as being strong evidence in favour of a lesion not involving the main arterial trunk (Cases ii, viii, and ix). This sign cannot, however, be invariably depended on. In Case vii the anterior and posterior tibial pulses were present, although weak; and a second very interesting case, not in this series, operated on by Captain Harmer, R.A.M.C., in the Freeman Thomas Hospital, Bombay, showed only slightly modified distal pulses, thereby causing considerable embarrassment to the operator. In this case, a diffuse false aneurysm of the axillary artery, there was a good radial pulse; the inference was that a branch was involved. The subclavian artery was therefore not ligatured as a preliminary measure. The operation was successful, and the patient recovered, but haemorrhage was so severe as to be nearly fatal at the time of operation.

Repair of these gross gunshot arterial lacerations by suture was quite impracticable in almost every case; local destruction of half or two-thirds of the circumference of the vessel wall with an area of apparent devitalization extending for a quarter of an inch or more above and below the torn area quite precluded any attempt at suture. The apparently extreme rapidity of the establishment of collateral circulation argues that attempts at repair of the vessel where the limb is healthy is unnecessary, except in the case of lesions above the division of the common femoral artery.

Evidence of the establishment of a free collateral circulation at this date after the receipt of the injury, under what are undoubtedly unfavourable conditions, may here be mentioned as a feature of these cases, as, at a period of one month (the average length of time between the date of injury and the operation), collateral circulation seems to have been fully established in almost every case, and its establishment in a sufficient degree to carry on nutrition of the limb seems capable of taking place at a much earlier date. It is inconceivable that vessels as severely lacerated as those concerned in Cases vii and x can maintain a circulation in their continuity of any appreciable extent.

In spite of the fact that septic organisms were present in the discharge occurring in two of the cases after operation, there was only one case of secondary haemorrhage (Case iii), and in this case the arterial haemorrhage had not been fully controlled by ligature at the operation. Silk ligatures were used in all cases. Free drainage was adopted in every case where the possibility of infection was suspected; the results suggested that the treatment of such conditions on the lines of ordinary septic wound is unattended by any danger.

The frequency of the involvement of the main nerve cords of the limb, either directly by the bullet, or by the pressure of the blood tumour or pulsating sac wall, has influenced the treatment in several cases. In Case iv pain alone was an urgent indication for operation, and in Cases iii, v, and vi the pain due to nerve involvement was the main indication. The severity of the injury to the great sciatic nerve and its branches in Case x probably accounts to some extent for the occurrence of necrotic superficial lesions in this case.

Conclusions.

The conclusions drawn from experience of these cases are:

1. Cases of diffuse traumatic aneurysm require early operation in all cases.
2. Results of operation at the point of the lesion are satisfactory.
3. Fifty per cent. of arterio-venous aneurysms benefit, temporarily at any rate, by delay in operative treatment, considering the known results of operation in these cases.
4. Considering the proportion of obliterative lesions, care in the early treatment and good transport arrangements probably reduce the incidence of diffuse false aneurysms.
5. Where the advent of sepsis is suspected in cases of diffuse false aneurysm, free drainage after operation is unattended by danger of secondary haemorrhage.
6. Efficient collateral circulation is established in most cases of destructive gunshot arterial lacerations within a month of the date of injury.

TRAUMATIC ANEURYSM DEALT WITH BY OBLITERATIVE ARTERIORRHAPHY.

BY

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The aneurysm in the following case was a true traumatic aneurysm. The coats of the artery were wounded by the bullet, and one of two events happened: either the wound healed but the scar subsequently formed stretched, or the outer coats were ruptured, and in course of time the intima, with probably part of the media, bulged through the gap to form an aneurysmal sac.

Pte. R., aged 37, was admitted to the Rochdale Infirmary suffering from septic shell wounds of the back. He had also been wounded in the left arm by a rifle bullet. The missile had entered the posterior and outer aspect of the forearm about 2 in. below the line of the elbow-joint, and, travelling upwards and inwards, had emerged just above the internal epicondyle of the humerus. The patient stated that there had been little haemorrhage from the wound at the time of infliction, and that it had healed within five days. Two weeks after admission a pulsating swelling appeared in the antecubital fossa. As the injury had been caused by a small bore bullet, and the man's general condition, by reason of the septic shell wounds, was very poor, it was considered best to await developments.

At the end of another four weeks, however, the swelling was the size of a hen's egg and still increasing. It was accordingly decided to deal with it by arteriorrhaphy, and a tourniquet having been applied to the arm the sac was laid open and the contained clots turned out. Three openings into it were discovered; one was small, situated on the inner aspect of the sac, and leading upwards and backwards. This was, in my opinion, a common trunk of origin of the anterior and posterior ulnar recurrent arteries. Two larger openings in the lowest part of the sac were distant about $\frac{1}{2}$ in. from one another, and connected together by a deep groove. From them a probe travelled upwards and downwards along the tracks of the brachial and ulnar arteries respectively. A probe sharply bent could be passed into the upper opening and then immediately downwards along the course of the radial artery. Thus the condition was an aneurysm of the highest part of the ulnar artery.

The interior of the sac was well scrubbed with iodine to promote adhesions, a continuous suture of fine chromic catgut on a fully curved intestinal needle was taken, and the smallest opening closed with four points of suture. In a like manner the upper opening was closed and the suture continued along the groove to close the lower opening. Following the recommendation of Matas, the sutures were made to enter the sac wall rather wide of the margins of the openings and the sides of the groove. In this way was produced a firm approximation of as large a marginal surface as possible. The tourniquet was now removed and complete haemostasis seen to have been secured. A second row of sutures was now inserted about half-way up the walls of the sac. The skin flaps had not been dissected at all from the subcutaneous surface of the sac and so were lined with smooth sac wall. Two relaxation sutures were then put in on each side to complete the obliteration and silkworm-gut sutures brought the skin edges into apposition. Recovery was uneventful and the result quite satisfactory.

The only alternative treatment worth discussing in this case is that of excision of the sac. Excision of the sac would have required a much more extensive dissection than simple opening and stitching up from the inside. Further, excision would have, in my opinion, necessitated in this case ligation of the brachial artery at its bifurca-

tion, and so have also obliterated the radial artery as well as the ulnar. The foregoing considerations are, no doubt, not of paramount importance here, but in other situations they might well be of much greater significance.

To state the matter shortly, arteriorrhaphy deals with aneurysm by a comparatively simple method in which the sac is little disturbed and the collateral circulation not interfered with.

REPORT ON 170 CASES OPERATED UPON UNDER SPINAL ANAESTHESIA.

BY

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I VENTURE to publish the following series of cases in the hope that they may be of interest to those who, like myself, are advocates of spinal anaesthesia.

The cases were operated upon by me at the Station Hospital, Lucknow, during 1914 and 1915. The majority were British soldiers, about a dozen were sepoys, three were women, and one a child. The solution used in each case was Barker's stovaine-glucose solution.

For operations upon the abdomen and lower limbs the lateral posture was used for the injection; for perineal, the sitting-up posture. The height of anaesthesia reached in each case was carefully noted and found to be usually the nipple line, although in some cases it extended a little higher.

The average time at which anaesthesia was complete was found to be three and a quarter minutes, the moment of injection being carefully recorded in each case. The duration of the anaesthesia was found to be ample for the cases under consideration, lasting usually fifty to sixty minutes, though in some cases longer.

Three complete failures to obtain anaesthesia occurred, but in each of these I have reason to believe that I was myself to blame for faulty technique, as they were all early cases. No failures occurred in the later cases.

After-Effects.

No serious untoward effects were observed either during or after the injections. A few patients experienced slight dyspnoea during abdominal operations if the anaesthesia reached above the nipple line, but this disappeared rapidly on slightly elevating the shoulders and head.

Slight headache occurred in one or two cases after operation, but was immediately abolished by the administration of phenacetin and caffeine. I believe that this headache is entirely due to unskilful handling of the patient, because I notice that if the patient be moved with extreme care no headache occurs. To minimize the shaking of the patient it is a good plan to have under the body a canvas stretcher upon which the patient can be moved from the table to his bed by the insertion of two bamboo poles—the table having previously been wheeled alongside the bed. If great attention is paid to these details I am sure no headache should ever occur.

Cases.

The total number of cases was 170. The more important were as follows:

Appendicectomy	23	Hernia	23
Removal of loose cartilage	11	Hydrocele	8
Circumcision	14	Varicose veins	11
Aneurysm of popliteal artery	1	Varicocele	20
Amputation of thigh	1	Wheelhouse	1
Haemorrhoids	19	Salpingitis	1

Advantages.

The principal advantages of spinal anaesthesia are the perfect relaxation obtained in abdominal and rectal operations. The portability of the necessary apparatus is also a great advantage, especially under tropical conditions where it is often difficult to obtain an anaesthetist. Shock and respiratory disturbance are also greatly diminished, and this tends to a healthier convalescence. As regards the patient's choice, I have always found that when patients have submitted to both general and spinal anaesthesia they invariably prefer the latter. It was very noticeable that in a regiment soldiers frequently asked to