reported more than one hundred years ago, remains the only one in which there is a clear history of operation for strangulation, though one or two others have been recorded in which this complication has occurred.

CASE OF STRANGULATED LUMBAR HERNIA.

By G. H. HUME, M.D.,

Surgeon to the Royal Infirmary, Newcastle-on-Tyne.

THE following instance of this rare form of hernia occurred in the practice of Drs. Skrimshire and Brumell, of Morpeth, with whom the case was seen on April 24th. The patient was a gentleman, 68 years of age, who had always been constipated, and suffered from frequent attacks of spasms. Latterly he had shown marked evidence of cardiac failure in an extreme blueness and coldness of hands and feet, and in dyspnoea on exertion. For fifteen years there had been a lump in his left side, usually about the size of a fist, but frequently becoming larger; it never altogether disappeared. On more than one occasion it had become enlarged and painful, with symptoms of obstruction.

When seen, the tumour was as large as a child's head. It occupied the left lumbar region between the crest of the ilium and the last rib. Symptoms of strangulation had been present for two days, and operation was urged, but consent for this was not obtained till the following morning.

A slanting incision was made from the crest towards the ribs. After the skin and subcutaneous tissues, a thin muscular layer—the anterior portion of the latissimus dorsi—was cut through. Immediately underneath was the sac. This when laid open was found to contain anteriorly a coil of small intestine, inflamed and granular; next another coil of small intestine, quite gangrenous; and most posteriorly the sigmoid flexure which had become twisted on itself. The sac communicated with the general peritoneal cavity by a slit-like aperture, and across the neck were stretched two tense cords, which were the agents in producing strangulation. When these cords were divided it was easy, after separating some adhesions, to return the sigmoid flexure and the most anterior portion of the small intestine into the peritoneal cavity. The gangrenous coil was resected to the extent of thirteen inches, the cut ends of the bowel being reunited by Lembert's stitches of fine silk; and this portion of the intestine also was replaced. The sac was then stripped out of its bed, and cut away at the neck. The margins of the peritoneal opening were united by a continuous suture of strong catgut.

The patient rallied fairly well, but sank somewhat suddenly twenty-four hours after the operation.

So far as the disposition of parts could be ascertained during the operation, it seemed to be as follows: The hernial protrusion had taken place in front of the quadratus lumborum, and had expanded but not pushed through the anterior portion of the latissimus dorsi. When the sac was separated from its bed it seemed to have lain between this muscular layer and the aponeurosis of the transversalis. The rupture did not appear to have protruded through the triangle of Petit, as is stated to be the rule in cases of lumbar hernia. Unfortunately, the opportunity was not allowed of ascertaining by *post-mortem* dissection the exact relation of parts.

THE Lords Committee on the Water of Leith Purification Bill, which consists of the Duke of Westminster, the Earl of Arran, Lord Colchester, Lord Sherborne, and Lord Sandhurst, were considerably startled by the production in the committee-room of enormous tampers filled with rather strongly-smelling samples taken from the bed of the river Leith, and produced with the view of showing how dangerous such material was to the public health. The members of the Committee quickly arrived at the conclusion that they were likely to be equally dangerous to their own individual health.

SPLENECTOMY IN SPAIN.—Splenectomy was recently performed for the first time in Spain by Dr. Mas, of Valencia. The patient was a woman, the mother of several children, who had a hydatid tumour of the spleen as large as a foetal head. The organ was completely removed, and the patient made an excellent recovery.

BEQUEST.—The late Mr. George Dawes, of The Hall, Smethwick, who died on August 18th, 1888, has bequeathed £1,000 to the Queen's Hospital, Birmingham.

EXPERIMENTS ON LIGATURE OF THE INNOMINATE BY A MEDIAN INCISION WITH REGARD TO THE FAILURE HITHERTO OF THE LIGATION IN CONTINUITY FOR ANEURYSM OF THE SECOND OR THIRD PART OF THE RIGHT SUBCLAVIAN.

By WALTER G. SPENCER, M.S.

(From the Laboratory of the Brown Institution.)

ANEURYSMS of the second and third part of the right subclavian artery are a cause of great suffering to the patient, and, except in a few cases in which medical treatment and direct pressure have been successful, they have terminated fatally.

Their occurrence is not infrequent. We find in the published *Surgical Reports of St. Bartholomew's Hospital* that in the ten years, 1877-86 inclusive, there were in the hospital 8 cases of subclavian aneurysm as compared with 35 cases of popliteal aneurysm, the average number of in-patients being about 6,250. Of the 8 cases, seven died in the hospital; the eighth was unrelieved. One case, an aneurysm of the third part, was injected with perchloride of iron (2 drachms) on three days in succession. A consecutive aneurysm formed and burst on the twelfth day after the first injection. Two of the cases were treated by amputation at the shoulder-joint. Mr. Holden removed the arm for an aneurysm of the second or third part of the subclavian, which was threatening to burst. The sac of the aneurysm became inflamed, and blood leaked from it into the tissues around. Death took place on the thirty-seventh day from pleurisy and bronchitis. The other case was under Mr. Willett's care whilst I was one of his dressers, and I have his permission to make use of the notes which I made at the time.

A man, aged 30, had noticed the disease, after a strain, about nine months before. Medical treatment was employed for six months, and then Mr. Willett tried to ligature the third part of the subclavian, it being hoped that the aneurysm was more axillary than subclavian. When the deep fascia was divided, a pulsating swelling bulged and filled the whole of the subclavian triangle, and, although some of the fibres of the scalenus anticus were also divided, it was found to be impossible to get to the proximal side of the aneurysm. The arm was then amputated at the shoulder. The wound healed; but the aneurysm increased slowly until the patient's death fifteen months after the operation. He suffered pain during all this period, and at times the pain was apparently agony. It was combated in part only by morphine, of which he took 2 to 3 grains daily before the end. The aneurysm had filled the whole round of the shoulder, from the scapula forwards; the clavicle had been fractured and eroded so that only the two ends remained, and the same may be said of the upper two ribs; the third rib was eroded to a less extent. The aneurysm had involved the upper part of the chest, pushing before it the thickened pleura. The innominate and the first part of the subclavian artery as far as the thyroid axis were quite healthy; at this point the aneurysm commenced.

The innominate is, as a rule, healthy in patients who have died from these aneurysms; but Mr. Holden's case was an exception, for the innominate was found to be atheromatous and dilated to the size of the aorta. Subclavian aneurysm is about three and a half times more common on the right side than on the left, and on the right side about six times more frequent on the third part than on the first.

The ligature of the innominate has been employed because other means have failed to rid the patient of a painful disease and the certainty of a fatal termination. The operation has appeared to the surgeons who have undertaken it to be Hunterian in its characters, and the success of the Hunterian ligature to other arteries has led to its application to the innominate. I shall show in tabular form how nearly the operation has been a success, and that it holds out a considerable promise of cure when the result on the aneurysm is noted in those cases in which the artery has been tied.

¹ Poland, "Report on Subclavian Aneurysm." *Guy's Hosp. Rep.*, vols. xv, xvi, xvii. Barwell, *Ashhurst's Internat. Encyclop. of Surg.*, 1883, vol. iii, p. 506, art. "Aneurysm."

It is important to consider the opinion arrived at by the surgeons who have themselves done these operations. Many of those who have tied the first part of the subclavian agree with Liston,² who had ligatured that vessel twice, but would never do it again. Those, on the other hand, who have tied the innominate, although unsuccessfully, state that it is a good operation, which they would undertake again, and which they believe will eventually succeed.

I propose first to describe the method by which I have succeeded experimentally in ligaturing the innominate; to place in a tabular form the more important of the cases which have been operated upon; and, thirdly, to draw conclusions from these two series of facts.

Experiments.—Macaque monkeys (*macacus sinicus* and *macacus rhesus*) have been used because their arteries appear to bear the same relation to one another as in man, and the relation of the arteries to the surrounding parts is the same. The ligature of the innominate in these monkeys may be exactly imitated on a still-born foetus at term.

Method.—Ether was used as the anæsthetic, and 5 per cent. carbolic acid and the spray freely throughout. The ligature of Chinese twist silk which had been kept in 5 per cent. carbolic acid was boiled in that solution before being used. The wound was made as if for deep tracheotomy—a vertical incision in the middle line down to the upper border of the sternum, and, at the lower end of this, a transverse one through skin only in order to obtain retraction of the muscles more easily. The deep fascia between the two sterno-mastoids was divided in the middle line, the sterno-hyoid muscle and the sterno-thyroid likewise separated along the middle line from the muscles of the opposite side. These muscles were now retracted so as to get behind the sterno-thyroid, whilst the fascia in front of the trachea and the inferior thyroid veins were not touched. Behind the sterno-thyroid, at its outer border, is the carotid sheath, which was opened on its inner side about half-an-inch above the origin. A ligature was passed round the artery and tied tightly. The carotid artery then forms an exact guide to the innominate by following its inner side until it reaches the right border of the trachea. The sheath was separated sufficiently at this point to see that the ligature was placed below the point of bifurcation of the carotid and subclavian. The fascia between the artery and the sternum was hooked forwards. In following along the inner border of the carotid to the innominate no structure is met with, and no vessel divided. The left innominate vein was never seen, it lies below; and, if it crossed higher up, it would be in a plane of fascia anterior to the artery, and might be hooked forwards against the sternum. Of course the depth of the wound was behind the manubrium, and the instruments had to be sloped, and the light to come from beyond the head. The ligature was passed from without inwards and tied tightly. On releasing the retracted muscles they came together, so that no cavity was left in the deeper parts of the wound. The skin was exactly united, and a dressing of carbolic gauze and collodion applied.

Three experiments were made precisely after this method. The animals presented no shock. The wound healed by first intention before the animal pulled the dressing off. All that was found after the operation beyond the loss of pulsation in the right carotid and right subclavian was that two of the three were disinclined to use the right upper limb for some time after, but the right upper limb appeared to be as strong as the left. The right face and upper limb were equally warm with the left. The animals were killed at five weeks, ten weeks, and twelve weeks respectively after the operation, and the first one was injected. The result in the three was found to be identical. There was an almost imperceptible scar in the skin, the intermuscular septum consisted of a thin linear scar, which contained a little blood pigment, and was connected with the scar tissue around the arteries. There was a spindle-shaped mass of scar tissue extending from below the innominate ligature to above that of the carotid, surrounding the bifurcation and the commencement of the subclavian. This mass was united to the sheath of the right sterno-thyroid and sterno-hyoid muscles on their under surface. The tissues around were normal; the left innominate vein was below and anterior, the internal jugular and the vertebral external. The sheath of the pneumogastric nerve was adherent to the scar tissue opposite the level of the carotid ligature, but the nerve was quite free; as it crossed the subclavian artery it was entirely beyond the scar. The recurrent laryngeal nerve and the sympathetic were normal. The terminal filament of the descendens

noni running in the carotid sheath, and in one case a cardiac branch of the sympathetic, were alone the structures involved in the scar. One monkey was injected from the abdominal aorta. The anastomosis was complete; the right upper limb as it happened was rather better injected than the left. The injection only entered the commencement of the innominate, the carotid to a short distance below its bifurcation, and the subclavian to a point just internal to the origin of the vertebral. The rest of the arteries were filled with the injection. The spindle-shaped mass of scar tissue was firm, the silk ligatures could be felt through it in the same position as when applied, firmly occluding the arteries. The innominate was slit up. It was found to be firmly closed by scar tissue on the proximal side of the ligature at the place where the internal coat had been cut through. Below this was a decolorised clot firmly adherent to the walls, which lower down became looser and coloured, tapering towards the commencement of the artery. The subclavian at its origin was closed by scar tissue, outside which was a decolorised firmly adherent clot, and outside this a looser coloured clot tapering and ending just before the origin of the vertebral. The carotid on the distal side of the ligature was closed by scar tissue, and above this was firmly plugged by a decolorised clot for half its length, beyond which until near its end it contained coloured clot.

In another monkey I varied the method by using a catgut ligature which had been kept in carbolic oil, and was soaked for twenty minutes in 5 per cent. carbolic acid, but only the innominate was tied, and not the carotid. The animal died on the seventh day of hæmorrhage. The ligature had perfectly occluded the artery on the proximal side; there was a small hole on the distal side just opposite the bifurcation, and both carotid and subclavian were patent. This is exactly the way in which so many of the patients operated upon have died. The cause of the hæmorrhage must have been either the catgut ligature, which I took all care to render aseptic, or it must have been due to the carotid being left patent, and a flow of blood from the subclavian into the carotid close to the distal side of the ligature have set up the ulceration in the vessel wall.

In another monkey I tied the carotid tightly, but the innominate was compressed by the ligature without cutting through the internal coat. The circulation soon became fully re-established in the brachial, causing a return of pulsation. On examining the artery, the condition as regards the scar around the ligature was the same as in the three cases above described, but the innominate and subclavian freely communicated, a groove on the outer coat of the innominate, at the site of application of the ligature, being apparent, but the internal coat was uninjured. There was no clot in either innominate or subclavian, whilst the carotid was closed from its commencement.

Of the cases of ligature of the innominate artery for subclavian aneurysm, eight terminated fatally within the first few days, the cause of death apparently being septic inflammation, and in one cerebral apoplexy in twenty hours. Of the case referred to by Dupuytren we only know that it died of hæmorrhage. The rest of the cases I have placed in a tabular form, *q.v.*

I wrote to Professor Durante, of Rome, and he most courteously replied to me in English, and I transcribe the letter as I received it, since the case is not yet known.

“Rome, January 9th, 1889.

“Dear Sir,—I have thought best to send you the history of the case as it appears in the records of the clinic. Giovanni Savini, *employé*, aged 45, from Viterbo, presents in the right supra-clavicular region a tumour of the size of a large apple, limited externally by the external margin of the trapezius, internally by the internal margin of the sterno-cleido-mastoid, and below by the clavicle. The tumour pulsates, is covered by healthy skin; when touched, it fluctuates, and is somewhat reducible; the pulsation is expansive and isochronous with the cardiac beats; to each pulsation corresponds a sharp prolonged *souffle* in diastole, followed by a somewhat lengthy pause. The corresponding radial pulse gives 80 movements, the left 88. The right arm, as regards development and nutrition, is perfectly identical with the left. The man has an excellent constitution, the thoracic and abdominal organs are very healthy; the heart is within its physiological limits, and presents no appreciable increase in its cavities. In so much as regards remote anamnesis, we have nothing neither directly nor collaterally; no slight illness that has direct relation to the actual disease. About two years ago the patient began to note a tingling in the right thumb; the tingling gradually spread to the other fingers, the forearm, the arm, and the shoulder; the patient felt a

² *Practical Surgery*, fourth edition, 1846, p. 201.

Ligature of the Innominate.

Name, Place, and Date of Operation.	References.	Sex.	Age.	Incision.	Vessels Tied.	Material, Position, and Date of Falling Off of Ligature.	Course of Wound.	Termination.	Result of Ligature on the Innominate.	Result of the Ligature on the Aneurysm.
Mott, V., New York, May 11th, 1818	Mott's <i>Velpéau</i> , 1851, vol. ii, p. 307	M	57	Division of right sternal muscles, angular skin incision	Innominate	Round silk, $\frac{1}{4}$ in. below bifurcation, 14th day	Suppuration; hæmorrhage on 9th, 23rd, and 26th days	Death, hæmorrhage, 26th day	Neither proximal nor distal end occluded	Shrunk to small size, so that no deformity of shoulder; several coagula in the sac (See plates of tumour and skin incision; also of the parts after death).
Graefe, Berlin, March 5th, 1822	Letter to Macleod from Wagner, <i>Lond. Med. and Phys. Journ.</i> , 1823, xlix, p. 475; Graefe and Walther's <i>Journ.</i> , 1822, Bd. iii, Hft. iv, p. 599; <i>op. cit.</i> , 1825, Bd. iv., Hft. iii, p. 587	„	30	Insidesterno-mastoid, and outside sterno-hyoid and sterno-thyroid; carotid followed	„	About 14th day	Suppuration; one hæmorrhage after 14th day; sac suppurated; spat blood and pus	Death, exhaustion, 68th day	Proximal occluded by clot from origin upwards	Aneurysm apparently cured.
Bland, Sydney, March 26th, 1832	<i>Lancet</i> , 1832-1833, vol. i, Oct. 20th, 1832 p. 97	„	31	Sterno-mastoid divided, sterno-hyoid and sterno-thyroid separated	„	Double thread, tight, close to bifurcation	Suppuration; hæmorrhage 17th and 18th days	Death, hæmorrhage, 18th day	Solid plug for $\frac{1}{4}$ of proximal end; carotid also firmly occluded; hæmorrhage from distal side of ligature	On 3rd day tumour reduced $\frac{1}{2}$; no pulsation until 17th day, then some return of pulsation, apparently with inflammation of the aneurysmal sac.
Lizars, Edinburgh, May 31st, 1837	<i>Lancet</i> , 1837, vol. ii, p. 445; 602	„	30	Sterno-hyoid and sterno-thyroid divided, not sterno-mastoid	Innominate and thyroidea ima	17th day	Suppuration; hæmorrhage 19th, 20th, and 21st days	Death, hæmorrhage, 21st day	Clot proximal short distance; carotid clot for short distance; subclavian patent; hæmorrhage distal side of ligature	Aneurysmal tumour collapsed and full of coagula, as also the subclavian beyond the aneurysm.
Gore, Bath, Sept. 24th, 1856	<i>Lancet</i> , 1878, vol. ii, p. 119	„	52	Mott's incision	Innominate	Hemp	Suppuration; hæmorrhage 17th day	Death, hæmorrhage, 17th day	Firm clot, proximal partially plugging artery for $\frac{1}{4}$ in.; carotid plugged up to bifurcation; ligature had partially cut through the artery	Fusiform aneurysm, subclavian; axillary and upper part of brachial much reduced in size, filled by firm coagulum.
Cooper, San Francisco, Sept., 1860	<i>Gaz. Hebdom.</i> , 1861, p. 612	„	—	Mott's + removal of inner end of clavicle and upper part of manubrium	„	—	Suppuration; hæmorrhage 32nd, 33rd, and 34th days	Death, hæmorrhage, 34th day	Hæmorrhage believed to be on distal side	—
Smyth, New Orleans, May 15th, 1864	1st part, <i>Americ. Journ. Med. Sc.</i> , n. s., vol. iii, 1866, p. 280; 2nd part, <i>Thomson, Dublin Journ. Med. Sc.</i> , 1876, 3rd series, vol. lxii, p. 482	„	32	Mott's	Innominate and carotid	Innominate, $\frac{1}{4}$ in. from bifurcation, carotid 1 in. from origin, 17th day	Suppuration; hæmorrhage 15th, 16th, 17th, 34th, and 52nd days; ligature of vertebral 52nd day	—	In 1875 innominate received injection to point of ligature, there reduced to bundle of fibrous tissue; subclavian impervious to origin of inferior thyroid	No trace when shown at Medical Association 5 years later; recurred in 1874; ligature of int. mammary October 4th; sac opened and ligature attempted on March 5th, 1875; death April 6th; aneurysm supplied by intercostals through subscapular and axillary.
Bickersteth E. R., Liverpool, May 7th, 1868	<i>Med. Chir. Trans.</i> , vol. lvi, 1873, p. 129	„	40	„	Innominate	Direct compression, May 5th, ligature above and below point of compression	Suppuration; hæmorrhage 7th and 8th days	Death, hæmorrhage, 8th day	From aorta to ligature filled with firm, closely-fitting plug of fibrin; hæmorrhage distal side of highest ligature	Aneurysm diminished in size; quite filled by firm laminated clot; subclavian beyond aneurysm, and first part of axillary nearly, but not quite, filled with clot; plate given.
Mott, A. B., New York, Aug. 13th, 1868	Letter to Wyeth, Prize Essay, <i>Trans. Americ. Med. Assn.</i> , vol. xxix, 1878, p. 168	„	—	„	Innominate and carotid	20th day	Hæmorrhages	Death, hæmorrhage, 23rd day	—	Aneurysm burst into pleural cavity.
Thomson, Dublin, June 9th, 1882	<i>Brit. Med. Journ.</i> , 1882, vol. ii, p. 722	„	29	„	Innominate	Broad ligature (ox aorta) applied with moderate firmness, 18th day	Suppuration; hæmorrhage 30th and 38th days	Death, hæmorrhage, 42nd day	Chink not occ. by ligature through which blood passed; coats not divided; perforation $\frac{1}{4}$ in. on distal side of ligature; subclavian and carotid blocked by clot	Laminated clot, passive clot in process of becoming laminated; cavity in centre contained $\frac{1}{4}$ oz. of blood.
Banks, W. M., Liverpool, Feb. 26th, 1883	Jacobson's <i>Operat. of Surg.</i> , 1889, p. 537; <i>Proc. Med. Chir. Soc. Barr. Med. Journ.</i> , 1885, vol. i, p. 230; also letter to author	„	50	„	Innominate and carotid	Kangaroo tendon, broad, not dividing coats	Healed by first intention	—	<i>Post mortem</i> ; innominate patent	Pulsation commenced to return the same evening; aneurysm rapidly increased; ligature of 1st part of subclavian 67 days after; on 4th day aneurysm small, hard; no pulse. (Death; hæmorrhage at subclavian ligature on 37th day.)
May, Birmingham, March 27th, 1886	<i>Lancet</i> , 1886, vol. i, p. 1064	„	30	„	Innominate	5 or 6 strands of catgut about middle of artery, not dividing internal coat	Aseptic until hæmorrhage 14th, 15th, 16th and 17th days	Death, hæmorrhage, 18th day	Chink not occluded by ligature; hæmorrhage from both sides of ligature	Aneurysm very large; became smaller and harder after ligature; small amount of laminated clot; large amount of passive clot, but none where branches of subclavian opened.
Durante, Rome, Mar. 25th, 1887	Letter to author	„	45	„	Innominate, carotid and vertebral	—	Aseptic then septic hæmorrhage 12th and 15th day; cerebral embolism 15th day	Death	Hæmorrhage distal side of ligature	Saccate aneurysm collapsed, containing coagula of various consistence.

particular sensation of weight in the arm, and an unusual weariness; then he felt vague pains, increasing daily in frequency and strength; the pains took a shooting character, spreading from the subclavicular region to the corresponding thumb and index. His doctor's diagnosis being "writers' cramp," he tried, without benefit, the appropriate remedies. Only a month ago the patient noticed the gradual development of the tumour, in consequence of which he was received into this institution on March 20th, 1887.

"**Diagnosis.**—Saccate aneurysm of the right subclavian between the scaleni.

Treatment.—March 25th. Ligature of the innominate trunk, of the vertebral and primitive carotid. Classical incision of Mott. Reunion of wound by first intention, with a small drainage tube at the inferior angle of the wound. March 26th. All proceeds in the most satisfactory manner. No circulatory disturbance; the right arm is indolent, the temperature normal; no general reaction. March 29th (fourth day of operation). The first dressing is changed, the line of incision is completely united; a small quantity of serous secretion exudes from the drainage tube; the drainage tube is shortened, the temperature continues to be normal. April 3rd. The dressing is changed for the second time. The wound is perfectly united. The drainage tube is removed. April 6th. The temperature rises to 39.5° C. in the evening. On removing the dressing, dense pus, coloured with blood, is seen exuding from the drainage aperture. It is disinfected, and the drainage tube replaced. April 7th. The wound is dressed morning and evening, and disinfected with corrosive sublimate. In the evening the temperature rises to 40.1° C. April 8th. In the morning, hemiplegia of the right side, which disappears in half an hour, leaving paralysis of the facial and tongue. After a little while, a remarkably full tracheal rle begins. In the afternoon, blood flows from the drainage tube, and is checked by a moderate but prolonged digital pressure. The temperature is lowered, sensation is diminished. The tracheal rle is much increased during the night, and most intense the following day. April 9th. Death in the afternoon (sixteenth day of operation).

"From the microscopical examination, made twenty-four hours after death, resulted: Nothing remarkable in the abdominal organs; slight hypertrophy of the left ventricle; diffused fatty degeneration of the great vessels. Near the ligatures the arterial walls appear almost completely dried, without the slightest traces of vasa phlogistic reaction. A small coagulum, near the common carotid, above the ligature. The aneurysmal, saccate, collapsed tumour contains coagula of various consistence. The brain presents an embolic softening of the left caudate nucleus.

"Trusting, dear Sir, that the above will supply you [with the information you desire, I remain, yours faithfully,

"FRANCISCO DURANTE."

From the foregoing experiments and cases I wish to draw three conclusions.

1. **The Incision, and the Characters of the Wound.**—Mott's incision has been followed more or less closely in nearly all the operations, and the insertions of the sternal muscles into the sternum and the inner part of the clavicle have been divided to a greater or less degree. The divided muscles retract, and they leave a cavity when the skin is closed, and since it is impossible to keep in apposition the deeper surfaces of the wound by pressure, a cavity is left. This fills with blood-clot, and from the cut ends of the muscles much oozing takes place. The record of the cases shows how easily the blood-clot breaks down when a sinus has been kept open too long by the constant drainage of discharge from the edges of the cut muscles. In this way septic changes gain access to the ligature. Now in the ligature of every other artery division of muscles is carefully avoided from the above reason, and the operations for the ligature of other large vessels are so planned as to allow muscles superficial to the artery to be retracted, and not divided. The ligature of the common and external iliac forms no exception, because the retracted peritoneum returns and covers the site of the ligature, and so no cavity is left, to say nothing of the important difference in drainage in the two cases. The wound which has been made for ligature of the innominate resembles rather an amputation wound, with the further disadvantage that the ligature is placed at the most dependent part. Therefore the great necessity appears to be that the ligature should be completely buried by immediate union of the depths of the wound.

I have described in my experiments the application of the ligature at the bottom of a wound in which no vessel had been divided; the wound was left perfectly dry, and then the muscles

returned to their position, so that there was left neither cut muscles to cause oozing, nor cavity for the discharge to collect in. I need hardly say that I could not use a drainage tube in monkeys, because I was obliged to aim for healing by the first intention under a single dressing. This incision, indeed, has been used in two cases; Pirogoff³ in 1856 used it, and the ligature was applied correctly; unfortunately, the patient died in forty-eight hours of acute septic inflammation. Professor Annandale⁴ also used a median incision for the application of compression by means of a drainage tube; a sinus was formed by the drainage tube, and fatal hmorrhage took place from the point on the artery where the drainage tube had been in contact.

The point for application of the ligature is immediately to the right of the trachea; of course this point is behind the manubrium, but if a line be drawn along the upper margin of the manubrium and the clavicle, the shortest distance from such a line to the site of ligature must be by the median incision. Even with Mott's incision it is necessary to first find the carotid as a guide to the innominate. It is not unimportant, further, that the median incision is at the greatest distance from the aneurysm, the inner part of which has encroached upon the wound made by Mott's incision in some cases; for instance, in Mr. May's case the nearness of the aneurysm prevented the union of all the wound by suture. The median incision avoids the use of a drainage-tube except superficial to the muscles; in so many of the cases which have lived the longest the wound has been reduced to a sinus, not draining well, and hence the hmorrhage. Certainly Smyth's case was done by Mott's method, but it lacked one element of success, namely, that it did not strike out a path which might safely be followed by those coming after; for in his case distal hmorrhage took place, from which the other cases had died, but his brilliant ligature of the vertebral saved the patient. Mr. Banks has been the first to obtain primary union by Mott's incision, but unfortunately the artery was not tied sufficiently tight to obliterate the vessel, so that as far as the effect on the subclavian aneurysm, the innominate artery cannot be said to have been ligatured. Neither by Mott's nor the median can the artery be tied if it is abnormally short.

2. **The Ligature.**—The ligature must be aseptic. The cases all show that a ligature which has to come away, such as might be applied to the femoral or carotid, cannot be used for the innominate. A silk ligature can be rendered more thoroughly aseptic than any other, in the way which I have described, without injuring its strength, and being aseptic, it will remain quiet in position without relaxing. The ligature should be drawn tight to divide the internal coats. All recent experiments agree in showing that the more antiseptic a ligation, the less the amount of coagulum, and the more has dependence to be placed upon the scar tissue which ensues on dividing the internal coat for closing the artery. The broad ligature, not dividing the internal coat, is a refinement which has been successfully employed for ligaturing arteries that were quite easily tied previously by the older method; but the object in running the risk of ligaturing the innominate is that the artery should be firmly secured once and for all. From the position of the vessel, it is impossible to cut down upon it and tie it again if the first does not succeed. Further, in the three cases of Professor Thomson and of Messrs. Banks and May, the vessel was not fully ligatured. In Professor Thomson and Mr. May's case a chink had been left between the folds through which blood passed, and both patients died from hmorrhage at the site of ligature; and in Mr. Banks's case the aneurysm was unaffected, and continued to increase, the innominate not being closed; so that, neither as regards the broad ligature itself, nor the result on the aneurysm, does it appear to be superior even to the old silk ligature which had to come away, for in using this latter the innominate was firmly closed, and the aneurysm in process of cure in many of the cases if distal hmorrhage had not carried off the patient. Mr. Ballance's method may be a better one still.

3. **The Carotid should be Tied in Addition.**—A thrombus is then formed in the proximal end of the carotid, which extends to the bifurcation, and thus aids a thrombus in forming in the first part of the subclavian as far as the vertebral; otherwise the blood flow will pass from the subclavian to the carotid close by the distal side of the ligature of the innominate, and so the operation will lack one of the important characteristics of a Hunterian ligation.

³ Pirogoff, *Grundzge der Kriegschirurgie*, Leipzig, 1864, s. 459; *Klinische Chirurgie*, Heft III, s. 43.

⁴ Annandale, *JOURNAL*, 1886, vol. 1, March 13th.

The ligature of the vertebral from Mott's incision must only make the wound deeper still, and if the deeper parts of the wound do not heal by first intention, the ligature of the vertebral in addition will not arrest hæmorrhage from occurring. Smyth ligatured the vertebral fifty-four days after the innominate, but he did so by the usual operation for the ligature of that artery, which does not divide muscle nor leave a cavity. The *arteria thyroidea ima* is said to be present in one in ten cases. It was present in Lizar's case, and must of course be tied if it arises from the innominate or the proximal side of the ligature.

Fig. I.—The photograph has been made from the right side. The clavicle was cut through, and also the first rib; the inner third of the clavicle was then drawn across towards the left with the manubrium, the veins were cut away. The under surface of the sterno-mastoid attached to the inner third of the clavicles is exposed, also the under surface of the sterno-hyoid and sterno-thyroid muscles. The innominate artery coming up from the thorax enters the mass of scar tissue from which the subclavian and the carotid pass. The pneumogastric and sympathetic, where in contact with the subclavian artery, are quite free. The position of the ligatures buried in the scar tissue is marked. The scar tissue is attached to the under surface of the sterno-hyoid and sterno-thyroid muscles, and is drawn upon somewhat by the pulling over of the clavicle.

Fig. II.—The photograph is also from the right side. The upper part of the manubrium, with the sterno-hyoid and sterno-thyroid, was turned up and detached from the scar tissue closely adherent to the under surface of the muscles. The innominate artery is seen to be crossed by the left innominate vein some distance below the site of ligature, the vein being quite free. Also the internal jugular, the pneumogastric and the sympathetic nerves are free where they are in contact with the subclavian. The innominate enters the scar tissue and the carotid and subclavian leave it. The subclavian is to be seen as far as its vertebral branch.

St.m., sterno-mastoid; Cl., clavicle at its junction with the manubrium. St.hya., sterno-hyoid; St.th., sterno-thyroid; Tr., trachea. N.png., pneumogastric; N.symp., sympathetic. I.A., innominate; Lig.i.A., point of ligature of innominate. S.A., subclavian artery; V.A., vertebral artery. R.c.A. & L.c.A., carotid, right and left; Lig.c.A., ligature of carotid artery. R.i.V. and L.i.V., right and left innominate veins. S.V.C., superior vena cava.

It has been often argued before that such experiments do not apply because animals differ from men, although no definite dif-

ference is assigned. A former opponent of the application of experiments on the ligature of arteries in animals to man supported his argument by saying that the kidney or spleen could be removed in animals but not in man. The successful experiments on animals in these last two instances have directed the way to successful extirpation of a diseased kidney or spleen in man. The monkeys were certainly young adults in perfect health, but amongst the thirteen cases in the table, six range between 29 and 32 years.

Smyth's case may be said to have been cured for a time, for five years after the operation he was shown at a medical association meeting, and it was generally agreed that the cure was complete; however, the aneurysm did recur at the end of ten years. Besides this, we have the cure progressing in other cases at the time of the patient's death. When we think of the hopeless character of these subclavian aneurysms, and their most painful course, there can be little doubt that other surgeons will, in the future, be influenced to repeat the operation by the prospects of cure which former operators have almost attained.

For success the *sine quâ non* must be a ligature completely buried, to get which I believe I have shown that three things are necessary:

1. A median incision, not dividing muscles, and not requiring a drainage tube in the depths of the wound.
2. A perfectly aseptic ligature, drawn tightly.
3. The ligature of the carotid at the same time.

REPORTS

ON

MEDICAL & SURGICAL PRACTICE IN THE HOSPITALS AND ASYLUMS OF GREAT BRITAIN, IRELAND, AND THE COLONIES.

GLASGOW WESTERN INFIRMARY.

A CASE OF FETID EMPYEMA IN WHICH THE PUS WAS TEEMING WITH DEAD MICRO-ORGANISMS: RECOVERY AFTER REMOVAL OF A PIECE OF RIB AND FREE ABLUTIONS OF THE PLEURAL CAVITY.

(Under the care of Mr. A. ERNEST MAYLARD.)

[Reported by Dr. ROBERT ANDERSON.]

THE patient, a man aged 27, was admitted into the Western Infirmary on March 1st, 1889, suffering from breathlessness and cough, accompanied with pain. His present illness commenced about seven weeks previously with slight stitch on the right side, which was worse on taking a deep breath. This pain remained for two or three days, and then passed off, but returned about a week afterwards. The pain was in the same place, but much more intense. He remained in bed for three weeks, and at the end of that time he felt well. He then went out, and on the following day all his symptoms returned worse than before. He took to his bed again, where he has remained ever since. During his second and third attacks he was unable to lie on his right side on account of the pain and oppression in breathing. He gained most ease by being propped up in the sitting posture. His family history is good, and he himself has always enjoyed fairly good health.

Present Condition.—The patient is pale and thin. His breathing is rapid (40 per minute). He can lie only on the right side; if he tries to lie on his back or on his left side, he becomes very breathless. Pulse 134, soft. Tongue dry, very red, smooth, and glazed. The breath has a peculiar sweetish odour. His bowels are very loose, moving four or five times a day. Heart normal. The right lung is dull up to the clavicle. Behind, the dullness extends up to the spine of the scapula; above this the note is clear. The vocal fremitus is well marked in the upper half, and even at the base there is a faint trace. On the left side the fremitus is very marked. Respiratory murmur is very faint at the base, tubular in the upper part. Vocal resonance weak at the base, exaggerated at the upper part. Right side at nipple level measured 18 inches; left, 17½ inches. Movement of right side almost in abeyance.

On March 2nd the chest was aspirated, and 83 ounces of a very fetid purulent fluid removed. The temperature has always been over 101°, but it varies very little in the morning and evening. Urine contains no albumen.