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THE UNIVERSITY OF MINNESOTA

GRADUATE SCHOOL

Report  
of  
Committee on Examination

This is to certify that we the undersigned, as a committee of the Graduate School, have given William Oscar Ott final oral examination for the degree of Surgery. Master of Science in. We recommend that the degree of Master of Science in Surgery be conferred upon the candidate.

Minneapolis, Minnesota

May 31 1919

M. S. Henderson  
Chairman

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REPORT  
of  
Committee on Thesis

The undersigned, acting as a Committee of the Graduate School, have read the accompanying thesis submitted by William Oscar Ott for the degree of Master of Science in Surgery. They approve it as a thesis meeting the requirements of the Graduate School of the University of Minnesota, and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science in Surgery.

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January 27, 1919.

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THESIS

SURGICAL ANEURYSMS

WILLIAM OSCAR OTT

SUBMITTED TO THE FACULTY OF THE UNIVERSITY OF MINNESOTA  
IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR  
THE DEGREE OF MASTER OF SCIENCE IN SURGERY

June

1919

MOM  
Oct 8

### SURGICAL ANEURYSMS

The material for this paper consists of a study of the cases of aneurysm in which operation has been done at the Mayo Clinic since 1907. Many thoracic and other aneurysms were observed, but only those surgically treated are included in the report. The angiomas and cirroid aneurysms were also excluded because radium is being used either alone or in conjunction with surgery in their treatment.

Number of cases . . . . .	26
Popliteal (1 traumatic, 1 pathologic, 2 arteriovenous) . . . . .	4
Common iliac ( 1 traumatic-saccular, 1 pathologic? 1 traumatic diffuse). . . . .	3
External iliac (traumatic) . . . . .	2
Femoral (traumatic). . . . .	1
Posterior tibial (traumatic?). . . . .	1
Obturator (1 traumatic, 1 pathologic?) . . . . .	2
Aorta (1 traumatic-thoracic, 2 pathologic-abdominal) . . . . .	3
Common carotid (pathologic). . . . .	1
Internal carotid (arteriovenous) . . . . .	1
External carotid (pathologic?) . . . . .	2
Subclavian (1 arteriovenous, 2 pathologic) . . . . .	3
Transverse cervical (pathologic) . . . . .	1
Radial (traumatic) . . . . .	1
Temporal (traumatic) . . . . .	1

The number of cases studied are too few to be of great value in comparing the results of the different methods of treatment, nevertheless, certain facts have been brought out that seem worthy of comment. The reconstructive operation was done on the main artery of the lower extremity in four cases; the artery remained patent and there was good use of the limb in all. Proximal and distal ligation with excision of the sac were done on small, non-essential arteries in three cases, and, of course, no disturbances of circulation resulted.

In the cases in which simple ligation was done many vessels were ligated. The subclavian was ligated twice with no untoward symptoms. Proximal ligation of the first part for aneurysm of the third part resulted in a three year cure in one case. No improvement followed distal ligation of the third part for aneurysm of the second part in one case.

The external carotid was ligated twice, once for aneurysm of the temporal artery with cure, and once in connection with ligation of the right internal jugular on the same side for aneurysm of the right external carotid with cure. This patient also had an aneurysm of the left internal carotid, for which the left common carotid was ligated, and, possibly, an aneurysm inside the skull which involved the lateral sinus on the right. The common carotid was ligated in connection with a diffuse aneurysm of the common carotid with some improvement. The internal iliac was ligated once for aneurysm of the obturator, with a cure.

The choice of operation and time of surgical interference in cases of aneurysm is not easy to determine. This is especially true in cases of recent arterial hematomas, and arteriovenous aneurysms. Makins stated that aneurysmal varices and arterial hematomas do not require early treatment, and in many instances are better left untreated. A reasonable time should be allowed to elapse in the hope of consolidation and spontaneous cure; but if this does not take place, some form of ligation or suture should be done. In arteriovenous aneurysms, Makins prefers usually the quadruple ligation.

The type of operation most desirable, if practicable, is the one that will leave the continuity of the artery intact. Lateral suture, end-to-end suture, or transplantation of a segment of vein are the most ideal. None of the cases in this series were thus treated, and comparatively few instances of such treatment are reported in the recent literature. In only eight of one hundred cases of vascular lesions reported by military surgeons in recent English, French

and Italian literature was it practicable to suture the opening in the vessel. Haberer reported eighty-five cases of circular suture, fifty-five of lateral suture, and fifty-six of the ligation of the main vessel. The reason why arterial suture is rarely done in numerous vascular injuries seen by military surgeons in the present war is because the associated wound is so often infected, which makes secondary hemorrhage and thrombosis likely to occur, and because the vessel is usually badly lacerated. Proximal and distal ligation, or quadruple ligation in arteriovenous aneurysms or injuries of both artery and vein, has not been done by us in the larger surgical arteries, but is still the most common type of operation in the present war for vascular injuries. Endo-aneurysmorrhaphy after the Matas method is probably the operation of choice in the extremities. Halsted prefers partial occlusion or ligation and extirpation when the constrictor cannot be applied, as in the subclavian and iliac arteries. In aneurysmal varices, the placing of an unabsorbable ligation about the point of anastomosis is at times possible. This was done in 1910, in one of our cases by Dr. C. H. Mayo (Case 159911) with excellent results. The technic was again attempted recently (Case 232671) but failed owing to accidental puncture of the sac necessitating incision of the sac and suture of the opening in the artery.

There were no instances of gangrene nor of serious peripheral disturbances, resulting from impaired circulation to the limb, in our series. The incidence of gangrene and residual disabilities following the common practice of ligating the main vessel to an extremity, judging from the reports of military surgeons in the present war, is remarkably low. Makins, however, states that it is quite common, probably more so than the reports indicate. For threatened gangrene, Tuffier has devised a silver tube for intubation of the artery. Four days later proximal and distal ligation is done. This allows time for the

establishment of collateral circulation. Tuffier believes that many limbs are saved in this way.

Peripheral disturbances consisting of paraesthesias, muscular weaknesses, or at times ischemic paralysis (Volkmann's), occur after ligation or operations on the main peripheral vessels, in a considerable percentage of cases. In two of our four cases in which reconstructive operation was done on the lower femoral or popliteal, some residual muscular weakness and paraesthesias were noticeable. Various writers believe that the circulatory disturbances to the limb give rise to a mild or severe grade of pathologic change both in the muscles and in the nerve trunks, similar to those that occur in Volkmann's ischemic palsy. The sensory disturbances are thought to result, at least in part, from the changes in the nerve trunks. The percentage of cases in which <sup>a</sup>slight degree of residual disability persists after ligation of the main artery to a limb is difficult to determine from the reports in the literature but it must be fairly high. It is encouraging to note that in the more recent reports military surgeons are resorting more and more to arterial suture in some form, and other operations that have for their object the preservation of the continuity of the vessel lumen.

TABLE 1.  
OPERATIONS

Operation	Artery	Aneurysm	Results
1. Excision with proximal and distal ligation.	Obturator	Traumatic	Cured
2. Excision with proximal and distal ligation.	Transverse cervical	Pathologic	Cured
3. Excision with proximal and distal ligation.	Radial	Traumatic	Cured
1. Ligation only	Subclavian	Pathologic	Cured 3 yrs. Sudden recurrence. Innominate ligated elsewhere.
2. Ligation only	Subclavian and axillary	Pathologic	No improvement 3rd part subclavian. Death 2 mos. later with attempt at excision.
3. Ligation only	External carotid	Traumatic of temporal	Cured.
4. Ligation only	Internal iliac	Pathologic of obturator	Cured apparently. Later history not known.
5. Ligation only	External carotid	Pathologic	Cured. Later history not known.
6. Ligation only	Right external carotid, and internal jugular. Left common carotid, internal and external jugular	Pathologic	Cured after two months.
7. Ligation only	Common carotid	Pathologic	Improved, decreased swelling and pulsation.
8. Ligation only	Posterior tibial	Traumatic (?) Probably only dilation of artery	No improvement
1. Lead compression clamps to common carotid; later ligation of common carotid and jugular vein	Common carotid	Arteriovenous internal carotid and cavernous sinus	Death 9 days after ligation from cerebral edema.
1. Ligature about base of sac.	External iliac.	Traumatic	Cured. Well after six years.

Table 1 continued.

1. Reconstructive endo-aneurysmorrhaphy	Popliteal	Traumatic	Cured with only slight residual disability 4 mos. after operation
2. Reconstructive endo-aneurysmorrhaphy	Popliteal	Pathologic	Cured six weeks after operation
3. Reconstructive endo-aneurysmorrhaphy	Femoral in Hunter's canal	Traumatic	Cured. Later history not known
4. Reconstructive endo-aneurysmorrhaphy	Popliteal	Arteriovenous	Cured. Some paresthesias after 8 mos. but function good and improving. (Calcareous flakes on artery wall).
1. Compression suture about anastomosis in arteriovenous aneurysm (1 case)	Subclavian third portion	Arteriovenous	Cured. Remarkable rapid disappearance of swelling; able to use arm.
1. Partial excision of sac and suture of opening in artery in arteriovenous aneurysm.	Popliteal	Arteriovenous	Cured
1. Application Neff clamp	Common iliac	Traumatic	Death on 7th day from circulatory disturbance.
2. Application Neff clamp	Common iliac	Traumatic (?)	Some improvement, thrill and some swelling persists after two months.
1. Explorations only	Aorta (thoracic)	Traumatic	Death 7th day from hemorrhage.
2. Explorations only	External iliac	Traumatic; recent rupture	Death in 52 days. Sepsis and repeated hemorrhages.
3. Explorations only	Both common iliacs	Traumatic (?)	No change
4. Explorations only	Abdominal aorta	Pathologic	Death on fourth day from rupture of abdominal aorta.
5. Explorations only	Aorta	Pathologic	No improvement.

## REPORTS OF CASES

Case 1 (25936), a boy aged sixteen gave a history of having been shot in the left thigh five years previously; the wound had healed quickly. One and one-half months previously rheumatic pain in the left ankle, in the knee and in the region of the wound was noted, and the thigh began to swell. On exertion the leg became numb and dull pain extended from the tumor to the inner side of the knee.

Examination showed the tumor the size of a grapefruit, and just above the knee on the inner surface, to be expansile and pulsating. The left anterior tibial pulsation was very faint. There was slight ecchymosis over the tumor. At operation an aneurysm was found of the left femoral artery in the upper end of Hunter's canal. A large superficial artery running over the tumor was evidently making collateral circulation. A reconstructive operation (aneurysmorrhaphy) was done. The opening in the artery was closed with linen sutures. There were no complications and the patient left the hospital on the eighteenth day.

Case 2 (25528), a colored man aged forty-three, gave a history of having had syphilis when a boy, and of pain in the right shoulder and supra-clavicular region for the past six months. Four months previously he had noticed a pulsating tumor above the clavicle, which gradually grew larger. The pain became more severe (intense in the past six weeks), and paraesthesia appeared in the thumb and forefinger.

Examination showed a pulsating tumor in the right supraclavicular region, and somewhat below the clavicle. The radial pulse was weak in the right arm. The mitral systolic murmur was transmitted to the axilla, the aortic double murmur to the aortic area. A ligation was done of the first portion of

the subclavian artery for subclavian aneurysm. The convalescence was uncomplicated; the aneurysm disappeared and the patient remained well for three years when a large aneurysm suddenly developed in the first part of the subclavian. The innominate artery was ligated elsewhere.

Case 3 (3724), a man aged twenty-four, nine years previously had sustained a buckshot wound in the right groin. An attempt was made at the time to remove the shot. The wound healed in seven weeks, but the region over the wound remained tender. Six months previous to examination in the Mayo Clinic the patient noticed aching of the muscles of the right calf when he walked, and for two weeks he had had difficulty in getting about. Three years previously he had had typhoid with phlegmasia alba dolens of the right calf, also ulcers. Since then the right calf had been larger than the left.

Examination showed an expansile tumor just above the groin on the right, with bruit over the femoral artery. The tumor was visible with expansile pulsation. At operation a saccular aneurysm of the right iliac artery was found. The sac was ligated at the base with No.4 catgut. The patient's recovery was uneventful. Six years later he was operated on for right hydronephrosis.

Case 4 (3876), a man aged fifty-eight, gave a history of rheumatic pains in the right arm for the past two years, and for the past two months a pulsating tumor under the right arm after exertion, more marked during the past month; the hand was numb. The patient had a hacking cough, and shortness of breath.

The subclavian, third part, was ligated. The symptoms persisted and about two months later an attempt was made to remove the aneurysm which involved the subclavian and axillary artery. The operation was completed, except the applying of the proximal ligature to the subclavian, when the patient died of respiratory failure, due to a cerebral embolus which was loosened in the

manipulation of the aneurysm, as was shown by necropsy.

Case 5 (3855), a woman patient aged eighteen, five years previously had been injured by a pair of scissors driven into the right ear. She had bled severely, and edema of the side of the face followed. For four years she had had throbbing pain in the right side of the face and back of the eye.

Examination showed dilated blood vessels anterior to the right ear in the temporal region, and extending to the infra-orbital region. Palpable thrill and bruit and visible pulsation were present. The external carotid was ligated for aneurysm of the temporal artery.

Case 6 (33735), a man aged fifty-four, was injured by a fall on two years previously. The injury was followed by dull pain in the right chest, the right chest, the neck, and the shoulders and arm. The arm became completely paralysed four weeks previously; it was cold and swollen. The patient had some dyspnea when lying down.

Examination showed a dullness over the upper right lobe of the lung; the heart sounds were intermittent. At exploration a traumatic aneurysm in the chest, origin unknown, was revealed. The sac was three-fourths inch thick. A gauze drain was inserted. The patient was fairly well for seven days when a profuse hemorrhage from the wound occurred, and death followed. Necropsy revealed a large aneurysm of the aorta.

Case 7 (48801), a man aged thirty-four, had been shot with a revolver two weeks previously; the bullet entered below the knee and came out on the external surface to the middle third of the thigh.

At the time of examination at the Mayo Clinic, a pulsating fusiform tumor the size of a hen's egg, bound down in the popliteal space, was present. Extension of the leg caused pain beneath the knee. A continuous fine thrill with systolic accentuation on auscultation was heard over the tumor. The Matas operation was done, the aneurysm being closed with two rows of chromic cat-

gut. Following the operation the leg slightly swelled, but the swelling almost completely disappeared and the ulcers healed. Four and one-half months after the operation, when the patient was last heard from, he was using the leg; only slight residual disability remained.

Case 8 (51124), a boy aged fourteen, one and one-half years previously had been shot in the right thigh with a 22 caliber rifle. Marked swelling of the thigh followed, with slight fever, but no infection in the wound. The bullet was not located. The patient was in bed two weeks, and the wound healed. When he was able to be up and about he noticed a stiffness in the hip, and he limped slightly. There was slight pain in the knee. One year later pain in the right thigh became severe, and a swelling appeared. The patient had a slight fever, and slight anorexia. Swelling and pain appeared in the groin. There was no particular change in the patient's condition for six months; the pain was constantly worse at night. He had occasional night sweats, and shortness of breath.

Examination showed a scar of the right groin over Scarpa's triangle corresponding to the scar of the entrance of the bullet. A large, hard, firm nodular tumor, extending upward was palpated over Scarpa's triangle. A faint thrill, pulsation and bruit could be detected over the course of the femoral artery in Scarpa's triangle, and transmitted to above Poupart's ligament and down to the lower end of Scarpa's. Morning temperature  $101^{\circ}$ ; afternoon  $100^{\circ}$ . Occasional epistaxis. Hemoglobin 70 per cent; white blood cells 14,000. The patient had lost ten pounds in weight. An exploratory incision revealed an aneurysm of the iliac artery. The old aneurysm which followed the gunshot wound had been recently ruptured, accidentally. The tissues were infiltrated with blood. After the exploration the pain and swelling subsided temporarily. Thirty-five days afterward blood oozed from the wound and the tumor increased in size. The

bleeding and fainting spells continued intermittently during the next ten days. The leg became greatly swollen. The patient died fifty-two days after the exploration.

Case 9 (61582), a man, aged twenty-eight, had been operated on, elsewhere, six years previously for right inguinal hernia. For the past year the patient had had a throbbing sensation in the right abdomen about two inches above the hernial wound. Three weeks previously, and occasionally since, he had had a sharp, stabbing pain above the hernial scar when lifting. Otherwise he felt well.

When the patient was examined, a pulsating mass in the lower abdomen, slightly to the right side, was noted. The pulsation in the right femoral artery was normal; in the left it was absent; bruit was felt over the mass. The lower abdominal veins were enlarged. The right leg was somewhat larger than the left. At operation, an extraperitoneal working incision and an intraperitoneal incision for exploration were made. A saccular aneurysm which started at the beginning of the common iliac artery was found. A Neff occlusion clamp was set on the common iliac one inch above the beginning of the aneurysm; the clamp was closed down to very faint pulsation below. The sac of the aneurysm occupied nearly the entire pelvis and interfered with the circulation in the left leg. The patient vomited for the first twenty-four hours. The pulse was 130 for several hours after the operation and then varied between this and 162. The color of the right leg was good for two days but the pain in it was severe. The patient died, probably of circulatory disturbances, the fourth day after the operation. At necropsy a large saccular aneurysm of the right common iliac artery beginning about 6 cm. below the origin of the common iliac and extending to about the beginning of the femoral was found. The Neff clamp was in place 3 cm. below the bifurcation of the aorta.

Case 10 (74667), a man, aged forty-nine, came to the clinic with a three year history of recurring attacks of pain in the abdomen, which resembled attacks of cholecystitis. These attacks came on every four to six weeks until eight months previously when their character changed, and the pain was located in the left epigastrium, opposite the ninth costochondral juncture and into the back to the left of the spine. The pain in the epigastric region did not seem to be associated with the pain in the back; there was no soreness. The patient had lost thirty-five pounds in weight.

Examination showed some resistance and tenderness over the left epigastrium, with a palpable mass in this region. Doubtful bruit and pulsation were present. At operation an aneurysm two inches in diameter, of the abdominal aorta at the point at which the aorta passes through the diaphragm, and extending down four or five inches, was found. The abdomen was closed without interference with the aneurysm.

Case 11 (71788), a man, aged twenty-two, nine months previously had fallen and struck on his buttocks. For the two or three weeks afterward he had difficulty in walking because of pain about the coccyx. He was treated by osteopathy. One month later a tumor gradually increasing in size was noticed in the abdomen. The patient had spells of indigestion, pain and vomiting accompanied by more or less pain in the abdomen. For the past month he had been free from pain but had a severe diarrhea. He had lost sixty-four pounds in weight.

Examination revealed a large abdominal tumor in the right side, reaching from the epigastrium to below Poupart's ligament, apparently slightly to the left of the midline and to the right of the outer edge of the rectus. There was a deep and marked heaving pulsation the entire length of the tumor. The systolic blood pressure was 145; the Wassermann test was negative. An

exploration was done and an aneurysm from eight to ten inches in length and four inches in diameter, extending out into each common iliac, was found. The tumor was not molested.

Case 12 (76029), a woman aged twenty-six, had been curetted seven months previously, three days after the birth of a child, because she had chills and fever. The fever subsided for five days and then returned. A second curettement was done and the patient became delirious with fever. This subsided, and a painful swelling appeared in the lower left side. Two other curettements were done with continuance of pain and chills. A surgeon was called who operated and found aneurysm (?) of the uterine or internal iliac artery. The hematoma and the wound were drained and the patient recovered quickly.

Examination showed the uterus to be slightly enlarged, with a soft swelling to the left. Pulsation and soft thrill were detected in the mass. The veins were not enlarged; the femoral pulse was equal. The mass extended below and seemed to be next to the vaginal wall on the left. A to-an-fro murmur with systolic accentuation was best heard over the left iliac fossa. At operation an aneurysm about three inches long was found which extended downward from underneath the external iliac vein into the base of the left broad ligament, anterior to and beneath the ureter so that it felt, through the vagina, like an aneurysm of the uterine artery. By compressing the iliac veins it was found that pulsation could be stopped. A ligature was placed underneath the external iliac vein one-half inch from the external iliac artery, and the second ligature was applied one-half inch to the inner side but not completely distal to the aneurysm. The proximal ligature was well approximated to the aneurysm. The cavity was opened by cutting half way across its lumen; it was closed by catgut sutures. Large branches of uterine and vaginal arteries were cut and tied. The round ligaments were cut and the broad ligaments were opened from the top. The ureter was

separated from the mass. The left ovary and tube showed signs of old inflammation. The tube was opened but it was not considered necessary to remove it. Catgut ligatures were applied. The broad ligaments were closed, and the appendix was removed. In this case a rather frequent anomaly was present, in which the obturator artery had its origin in the deep epigastrium; it passed behind the external iliac vein, with the deep epigastric, to a very short common stump. The aneurysm may have been traumatic. The patient had an uncomplicated convalescence. A slight numbness persisted in the left leg for a time, but gradually disappeared.

Case 13 (62336), a man, aged twenty-seven, eleven years previously had had a sudden onset of severe pain above the left knee; the region became red and swollen. The patient was confined to bed for six months. Four months after the onset of the pain an incision was made with the evacuation of pus, but the pain continued. At the end of four months the bone was scraped. The wound healed but the leg above the knee swelled. The patient thought that a large vessel in the leg had been injured, or cut at the second operation. Ulcers had appeared, but they healed in six weeks. Eight weeks previous to examination the patient began to have pain, more severe after standing, in both sides and above the knee.

Examination revealed a varicose condition above and below the knee; the leg and knee were slightly swollen. A rough bruit was felt and heard in the popliteal and adductor regions, with pulsation in the posterior tibia and anterior tibia at the ankle. At operation diffuse dilatation of the entire left femoral artery extending beyond Poupart's ligaments, was found. The incision in the thigh was closed and eleven days later an abdominal exploration (transperitoneal exposure) was done. A Neff clamp with several rolls of catgut, held together with a rubber elastic, was placed on the left common iliac artery at its origin.

The peritoneum was stitched over the clamp. Following the operation a tuberculous abscess developed at the site of the old osteomyelitis scar. This was drained and cleared up. Chills and high temperature had preceded the appearance of the abscess. The patient had improved at the end of two months, but the thrill was still present and also some swelling in the leg.

Case 14 (105740), a woman, aged thirty-nine, following grippé, six years previously had had a dull aching pain in the right shoulder and down the arms. The arm was weak. The trouble came in spells, usually one or two a year, lasting one or two weeks, but more frequent of late.

At examination a movable mass was found, not tender nor painful, in the right supraclavicular space. A diagnosis of supraclavicular glands, was made. Operation revealed an aneurysm of the transverse cervical artery of the right side, which was excised. The patient's convalescence was uncomplicated.

Case 15 (97718), a man, aged sixty-three, one year previously noticed stiffness in stretching and some edema of the left leg, and on examination he found a mass in the thigh. The tumor enlarged gradually and pulsation and pain became marked. For the past four months the right knee had been affected. The pain was worse at night.

Examination showed a large pulsating prominence extending from the femoral region in front, back into the buttocks. No palpable thrill, but bruit over the tumor was noted. The tumor was compressible and expansile. The right knee was flexed, with some swelling and periarticular thickening. The Wassermann test was negative. X-ray revealed blurring of the left hip region, and practical absence of the tuberosity of the ischium and rami. There was an eaten out area in the posterior third of the lower right femur. A transperitoneal operation was done with ligation of the left internal iliac artery for an aneurysm the size of a small grapefruit, on the inner side of the left thigh. The aneurysm

was thought to be in the obturator artery. Thrill was present in the internal iliac, but not in the external. The ureter and peritoneum was pushed to one side and the vessel was ligated at its origin with two heavy, silk ligatures. The pulsation ceased immediately. The condition of the wound was good sixteen days after the operation, when the patient was dismissed.

Case 16 (204134), a woman, aged forty-three, for ten years had had a lump on the left side of the throat which was thought to be due to enlarged tonsils. The patient had had goiter for many years. Three months previous to examination the mass became larger and began to drain. A month later a doctor was consulted who pronounced the condition to be a sarcoma.

Examination showed a protrusion of the left pharyngeal wall. Thrill internally, bruit externally, and pulsation were noted. There was a fusiform swelling of the angle of the jaw on the left without bulging in the larynx. A diagnosis was made of adenoma of the thyroid. At operation an aneurysm of the left external carotid was found. The aneurysm began just at the bifurcation, and it was difficult to separate it from the internal carotid. However, the external carotid was ligated with a double strand of silk and a double strand was passed around the common carotid, in case there should be bleeding; this was removed later. The convalescence was uncomplicated, and the aneurysm was apparently cured when the patient was dismissed from the hospital.

Case 17 (80021), a woman, aged twenty-six, six years previously had begun to have bleeding from the right ear and shortly afterwards she became deaf and noticed what she supposed was a growth in the canal of the ear. One year later she began to have pain in the ear, and an operation was performed to remove the growth. A slight right facial paralysis that existed before operation, now became complete. One year after operation the original symptoms reappeared, with severe pain in the head, throbbing, dizziness and fainting spells.

Occasionally the spells of bleeding from the right ear were severe and lasted several days.

Examination revealed a pulsating tumor in front of the right ear, and one of the left submaxillary and carotid regions. The patient could open her mouth only slightly. A diagnosis was made of an aneurysm of the right external carotid artery, and possible aneurysm inside the skull involving the right lateral sinus, also aneurysm of the left internal carotid extending down to the common carotid. A ligation of the external carotid artery and internal jugular vein on the right was done. Six days later the common carotid artery on the left just below bifurcation was ligated for an aneurysm, which apparently involved both the left internal and external carotids. The external and internal jugular veins were ligated. The patient made an uninterrupted recovery, and was relieved from the pain, throbbing, and pulsation in the side of the head. The bulging was still present in the left side of the neck two months after the operation, but there was no pulsation. There was still a slight discharge from the right auditory canal.

Case<sup>18</sup> (81010), a woman, aged fifty-one, had had attacks of hyperthyroidism seventeen and four years previously. The patient had noticed throbbing in her neck during the last attack, which gradually became worse. An exploration was done for aneurysm of the thyroid and a diffuse aneurysm of the carotid was found. Since then she had had pressure in the neck and a feeling of fullness in the head. For the past six months there had been a dull ache in the right arm. Examination revealed a pulsating aneurysm of the right carotid about the size of an English walnut, an inch above the clavicle. The middle portion of the right carotid was ligated. Some dilatation followed at the site of ligation, and more below. The patient improved. Slight giddiness still persisted but the dilatation decreased, especially at the upper end. The pulsation

persisted.

Case 19 (80527), a man, aged forty-three, two years previously had cut his right wrist with a piece of glass. A swelling appeared and became gradually larger for one year, then remained stationary.

Examination showed a pulsating saccular tumor the size of a pullet's egg, over the radial artery just above the right wrist. The radial artery was cut and both ends ligated. The patient was cured.

Case 20 (94352), a man, aged forty-two, had had a chancre (?) or lesion on the penis nine years previously; no secondaries. Three weeks previously he had noticed a hard pulsating mass in the right popliteal space, the size of a hickory nut. Pulsation was transmitted to the foot. The mass increased in size, more noticeably after he had been standing. He had pain down the back of the leg, and some difficulty of extension.

Examination showed a mass the size of an egg at the right popliteal space, movable with the tissues and with forcible pulsation. Total inhibition Wassermann persisted after three injections of salvarsan. At operation a saccular aneurysm at the right popliteal artery, extending along the artery for about one inch was found. There was sufficient good intima in the sac to warrant the reconstructive endo-aneurysmorrhaphy operation, which was done after the Matas method. At the close of the operation the foot was of good color and the pulse was obtainable in the tibial artery. The leg was in good condition six weeks after operation, when the patient was discharged from the hospital.

Case 21 (72899), a man, aged twenty-seven, gave a history of a chancre fifteen years previously and three weeks previously of a sudden severe pain, worse on sudden movement, across the lower abdomen, which had persisted. The patient was unable to work; he lost ten pounds in weight.

On examination there was a pulsating tumor of cystic feel extend-

ing from just below the level of the umbilicus to just above the left groin. An exploration was done, and an abdominal aneurysm was found on the left side. Following the operation the patient had a sensation of fullness in the abdomen. On the third afternoon and the morning of the fourth day, the pulse became weak and rapid. Fluid suddenly appeared in the abdomen, with other signs of internal hemorrhage. Death occurred on the fourth day. Necropsy revealed a rupture of the abdominal aorta.

Case 22 (80582), a boy, aged sixteen, ten years previously had his right foot stepped on by a horse, but there had been no discomfort from the injury. Four years later a painful enlargement appeared in the arch of the foot. This gradually grew worse, at times confining the patient to bed. Some relief was afforded by an arch support.

Examination showed the left foot to be enlarged and puffy, with apparent engorgement of the veins below the ankle. Occasionally a thrill and bruit synchronous with the pulse, was present over the inner aspect of the tendo Achilles. The right calf measured fifteen inches, the left fourteen; the right thigh eighteen and one-half; the left sixteen and three-fourths; the right knee fourteen and one-half; the left knee fourteen. A ligation was done of the posterior tibial artery and accompanying veins of the varicose aneurysm of the left posterior tibial right ankle. Repeated examinations after the operation showed the condition of the foot and leg to be practically the same as before. In twenty-eight days the bruit, thrill and local perspiration were absent. The varicosities in the arch were still present. The patient was forced to wear an elastic bandage. On re-examination two months after the operation the patient was no better. Blood rushed to the leg when he stood, and it was still swollen. Ten months after the operation the condition in the leg was practically unchanged, but thrill and bruit was not present and the swelling was not so marked. Fifteen

months after the operation the foot was almost normal, but the patient still complained of pain in the leg. Ten days previous to this report, while the patient was removing the elastic bandage, he felt a sensation as of something giving way in the calf of the leg, together with severe pain which persisted. The patient was sent home and told to rest. He returned again in two months at which time a diagnosis of popliteal aneurysm was made, and an operation advised, but not accepted.

Case 23 (141305), a man, aged twenty-nine, had been shot in the left leg in the region of the knee eleven years previously. The bullet was removed. Varicosities had been present since the injury. Seven years later the leg swelled and the veins enlarged, and became ulcerated. The swelling and numbness was less at night, when the patient was off his feet. He had worn a rubber stocking for two and one-half years.

Examination showed an arteriovenous popliteal aneurysm in the lower left popliteal space; varicose veins of the leg, and scars of former operations for varicose veins. At operation a sac two inches long, and irregularly oblong in shape was found. Into this a dilated vein, and also a normal sized artery emptied, above and below, making four openings into the sac. The vein was ligated and the artery reconstructed after the method of Matas. The arterial wall was hard and contained small calcareous flakes. The sac was sutured where branches of the artery were torn off from its friable wall. Following the operation the ulcers persisted for eight months, and there was slight numbness of the leg. Thrill was noted with extreme flexure. On the whole the patient was greatly improved.

Case 24 (159911), a man, aged thirty-five, nine years previously had been shot with a 38 caliber revolver, in the upper right chest. Very severe hemorrhage occurred, and the patient was in a hospital for three months. There

had been more or less constant swelling, and gradual development of varicosities of the left arm. For the past two or three months there had been swelling of the forearm, and frequent cramps, especially when the arm was used. The swelling under the clavicle did not increase.

On examination, the left arm and shoulder were found greatly swollen; the veins in the left axilla and the chest wall were varicosed. Under the left clavicle, four inches from the midline, a soft pulsating tumor the size of a hen's egg was palpated. Thrill was noted and a loud systolic murmur was heard over the tumor. The pectoralis was removed. The subclavian vein was distended to about two inches in diameter, from the sternoclavicular angle out into the arm. The vein was doubly ligated proximal to the subscapular vessels. All the veins which acted as arteries had greatly thickened walls. The superficial vessels were ligated between the sternoclavicular angle and the point of ligation of the subclavian vein. A figure of eight compression suture was placed over the point of arteriovenous anastomosis, which is about one and one-fourth inches from the sternoclavicular angle. Hemorrhage was severe on account of the bleeding from both arteries and veins. Two tube drains were inserted. The arm before operation was about twice the normal size, blue and congested, with veins standing out over the left chest, shoulder and arm. Following the operation there was a marked change; the swelling was reduced one-half during the first twenty-four hours and the condition of the arm improved steadily. The patient was discharged in one month after the operation able to use his arm.

Case 25 (67951), a woman, aged sixty-six, came to the clinic with a history beginning with drooping of the left eyelid, three years previously; in a few months complete ptosis occurred. The eyeball had been paralyzed/ for the past two years. About six months previously the patient had begun to have attacks of pain about the left eye, cheek and head; with constant pounding in

left side of head, the attacks lasting from ten to twelve hours. She vomited every few minutes. In the past few weeks there had been a prickling sensation in the lower jaw, the left side of the tongue and the left side of the roof of the mouth.

Examination revealed complete ophthalmoplegia of the left eye, third, fourth and sixth nerves, and some sensory disturbance of the fifth and seventh nerves. The left eyeball was proptosed; the disks were distinctly hazy. The left vision was 20/40, the right was 20/70. The tonometer showed equal tension in both eyes. The x-ray revealed absence of the posterior wall of the sella turcica. A compression was made, with a lead clamp, of the left internal carotid to a very faint pulsation beyond the clamp. The internal carotid apparently was enlarged to about twice its normal size. Four days later partial occlusion of the left internal carotid, as had been attempted in the first operation, was completed. The clamp had spread so that the lumen opened completely. A hemostat was placed on the clamp and left on. At the third operation, four days after the second, the common carotid was completely occluded by placing a pair of forceps on the lead clamp. The fourth operation, twenty-eight days later, consisted in ligating the common carotid on the left side. The lead clamp had cut entirely through the artery. About one inch on either end was cut and the ends ligated. The jugular vein on the left was divided and ligated. The lead clamp was not found. The patient died nine days after the ligation of the left common carotid, from cerebral edema. Necropsy was not obtained.

Case 26 (232671), a man, aged thirty-eight, fifteen months previously had been shot at close range with a 22 caliber rifle. The bullet entered the thigh four inches above the knee on the median surface, and passed out, posterior to the bone, at a corresponding level on the outer surface. Some hemorrhage had occurred and the patient was in bed for two weeks with the leg greatly

swollen back of the knee. Later the lower leg and foot became swollen. About six months previously the skin had become darkened, and eczematous, and several small ulcers appeared.

At examination the leg presented the typical symptoms of an arteriovenous aneurysm. Just above the external condyle was a soft pulsating swelling, the size of an egg, and in the center of it the wound of exit. Expansile pulsation with a marked thrill and venous hum over the mass, and marked, diffuse swelling of the popliteal space, were present. The dorsalis pedis on both sides were palpable, but the posterior tibial vein at the ankle was not found. The aneurysm was stilled by compressing the femoral artery in Hunter's canal. An oblique posterior popliteal incision was made. The popliteal veins (one inch in diameter) were isolated and separated above and below the anastomosis of the artery to the vein. In passing a ligature around the anastomosis, the sac was pricked, which caused considerable hemorrhage. An effort was then made to ligate with silk, but because the anastomosis was so large, it was impossible to close it in this manner. The sac, which was on the venous side and opposite the opening between artery and vein, was dissected out, and part of it cut away. The opening between the artery and vein, about one inch in length, was closed by suture with catgut. The vein was ligated distally with silk, and without drainage. Following the operation there was complete cessation of pulsation, thrill and bruit, and in twenty-four hours the swelling had greatly decreased. The dorsalis pedis was palpable. The patient was able to use his leg when he was discharged from the hospital fifteen days after operation.

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