inæ of firm fibrin, which become more and more dense and hard, the sac shrinks considerably, and finally lime salts are deposited in the old fibrin. The laminæ of fibrin may be on a level with the lumen of the vessel, causing complete obliteration of the sac. The cases which rupture externally, as a rule run a rapid course, although to this there are exceptions; the sac may contract, become firm and hard, and the patient may live for five, or even, as in a case mentioned by Balfour, for ten years. The cases which have lasted longest in my experience have been those in which a saccular aneurism has projected from the ascending arch. One patient in Montreal had been known to have aneurism for eleven years. The aneurism may be enormous, occupying a large area of the chest, and yet life be prolonged for many years, as in the case mentioned as under the care of Skoda and Oppolzer. One of the most remarkable instances is the case of dissecting aneurism reported by Graham. The patient was invalided after the Crimean War with aneurism of the aorta, and for years was under the observation of J. H. Richardson, of Toronto, under whose care he died in 1885. The autopsy showed a healed aneurism of the arch, with a dissecting aneurism passing the whole length of the aorta, which formed a double tube.

Treatment.—In a large proportion of the cases this can only be palliative. Still in every case measures should be taken which are known to promote clotting and consolidation within the sac. In any large series of cured aneurisms a considerable majority of the patients have not been known to be subjects of the disease, but the obliterated sac has been found accidentally at the post mortem.

The most satisfactory plan in early cases, when it can be carried out thoroughly, is that advised by the late Mr. Tufnell, of Dublin, the essentials of which are rest and a restricted diet. Rest is essential and should, as far as possible, be absolute. The reduction of the daily number of heart-beats when a patient is recumbent and makes no exertion whatever amounts to many thousands, and is one of the principal advantages of this plan. Mental quiet should also be enjoined. The diet advised by Tufnell is extremely rigid—for breakfast, two ounces of bread and butter and two ounces of milk; for dinner, two or three ounces of meat and three or four ounces of milk or claret; for supper, two ounces of bread and two ounces of milk. This low diet diminishes the blood-volume and is thought also to render the blood more fibrinous. It reduces greatly the blood-pressure within the sac, in this manner favoring coagulation. This treatment should be pursued for several months, but, except in persons of a good deal of mental stamina, it is impossible to carry it out for more than a few weeks at a time. It is a form of treatment adapted only for the saccular form of aneurism, and in cases of large sacs communicating with the aorta by a comparatively small orifice the chances of consolidation are fairly good. Unquestionably rest and the restriction of the liquids are the important parts of the treatment, and a greater

variety and quantity of food may be allowed with advantage. If this plan cannot be thoroughly carried out, the patient should at any rate be advised to live a very quiet life, moving about with deliberation and avoiding all sudden mental or bodily excitement. The bowels should be kept regular, and constipation and straining should be carefully avoided. Of medicines, iodide of potassium, as advised by Balfour, is of great value. It may be given in doses of from ten to fifteen or twenty grains three times a day. Larger doses are not necessary. The mode of action is not well understood. It may act by increasing the secretions and so inspissating the blood, by lowering the blood-pressure, or, as Balfour thinks, by causing thickening and contraction of the sac. The most striking effect of the iodide in my experience has been the relief of the pain. The evidence is not conclusive that the syphilitic cases are more benefited than the non-syphilitic. All these measures have little value unless the sac is of a suitable form and size. The large tumors with wide mouths communicating with the ascending portion of the aorta may be treated on the most approved plans for months without the slightest influence other than reduction in the intensity of the throbbing. A patient with a tumor projecting into the right pleura remained on the most rigid Tufnell treatment for more than one hundred days, during which time he also took iodide of potassium faithfully. The pulsations were greatly reduced and the area of dulness diminished, and we congratulated ourselves that the sac was probably consolidating. Sudden death followed rupture into the pleura, and the sac contained only fluid blood, not a shred of fibrin. In cases in which the tumor is large, or in which there seems to be very little prospect of consolidation, it is perhaps better to advise a man to go on quietly with his occupation, avoiding excitement and worry. Our profession has offered many examples of good work thoroughly and conscientiously carried out by men with aneurism of the aorta, who wisely, I think, as the late Hilton Fagge, preferred to die in harness. Other measures to induce coagulation in the sac are electricity, which has occasionally proved successful; the insertion of horse-hair, thin wire, or needles; the injection of an astringent liquid, such as perchloride of iron, into the sac. In a few cases only these have been followed by cure. The fine silver wire pushed through a hypodermic needle is probably the most satisfactory method, and may be combined with electrolysis, the method known as Loreta's. Kerr and Rosenstein, of San Francisco, have recently reported cases in which cure was effected in this way.

Other Symptoms requiring Treatment.—Pressure on veins causing engorgement, particularly of the head and arms, is sometimes promptly relieved by free venesection, and at any time during the course of a thoracic aneurism, if attacks of dyspnœa with lividity supervene, bleeding may be resorted to with great benefit. It has the advantage also of promptly checking the pain, for which symptom, as already mentioned, the iodide of potassium often gives relief. In the final stages morphia is, as a

rule, necessary. Dyspnœa, if associated with cyanosis, is best relieved by bleeding. Chloroform inhalations may be necessary. The question sometimes comes up with reference to tracheotomy in these cases of urgent dyspnœa. If it can be shown by laryngoscopic examination that it is due to bilateral abductor paralysis the trachea may be opened, but this is extremely rare, and in nearly every instance the urgent dyspnœa is caused by pressure about the bifurcation. When the sac appears externally and grows large an ice-cap may be applied upon it, or a belladonna plaster to allay the pain. In some instances an elastic support may be used with advantage, and I saw a physician with an enormous external aneurism in the right mammary region who for many months had obtained great relief by the elastic support, passing over the shoulder and under the arm of the opposite side.

Digitalis, ergot, aconite, and veratrum viride are rarely, if ever, of service in thoracic aneurism.

Aneurism of the Abdominal Aorta.

The sac is most common in the neighborhood of the cœliac axis. It is rare in comparison with thoracic aneurism. The tumor may be fusiform or sacculated, and it is sometimes multiple. Projecting backward, it erodes the vertebræ and may cause numbness and tingling in the legs and finally paraplegia, or it may pass into the thorax and burst into the pleura. More commonly the sac is on the anterior wall and projects forward as a definite tumor, which may be either in the middle line or a little to the left. The tumor may be large and evident, or when high up beneath the pillar of the diaphragm it may attain considerable size without being very apparent on palpation.

The symptoms are chiefly pain, very often of a cardialgic nature, passing round the sides or localized in the back, and gastric symptoms, particularly vomiting. Retardation of the pulse in the femoral is a very common symptom.

Diagnosis and Physical Signs.—Inspection may show marked pulsation in the epigastric region, sometimes a definite tumor. A thrill is not uncommon. The pulsation is forcible, expansile, and sometimes double when the sac is large and in contact with the pericardium. On palpation a *definite tumor can be felt.* If large, there is some degree of dulness on percussion which usually merges with that of the left lobe of the liver. On auscultation, a systolic murmur is, as a rule, audible, and is sometimes best heard at the back. A diastolic murmur is occasionally present, usually very soft in quality. One of the commonest of clinical errors is to mistake a throbbing aorta for an aneurism. It is to be remembered that no pulsation, however forcible, or the presence of a thrill or a systolic murmur justifies the diagnosis of abdominal aneurism unless there is a *definite tumor which can be grasped and which has an expansile pulsation.* Attention to this rule will save many errors. The throbbing or pulsating aorta is met with in all neurasthenic conditions, particularly in women, and it is remarkable with what violence the epigastrium may be driven out with each systole. In anæmia, particularly some instances of traumatic anæmia, the throbbing may be very great. In the case of a large, stout man with severe hæmorrhages from a duodenal ulcer the throbbing of the abdominal aorta not only shook violently the whole abdomen, but communicated a pulsation to the bed, the shock of which was distinctly perceptible to any one sitting upon it. Very frequently a tumor of the pylorus, of the pancreas, or of the left lobe of the liver is lifted with each impulse of the aorta and may be confounded with aneurism. The absence of the forcible expansile impulse and the examination in the knee-elbow position, in which the tumor, as a rule, falls forward, and the pulsation is not then communicated, suffice for differentiation.

The outlook in abdominal aneurism is bad. A few cases heal spontaneously. Death may result from (*a*) complete obliteration of the lumen by clots; (*b*) compression paraplegia; (*c*) rupture either into the pleura, retroperitoneal tissues, peritonæum or the intestines, very commonly the duodenum; (*d*) by embolism of the superior mesenteric artery, producing infarction of the intestines.

The *treatment* is such as already advised in thoracic aneurism. When the aneurism is low down pressure has been successfully applied in a case by Murray, of Newcastle. It must be kept up for many hours under chloroform. The plan is not without risk, as patients have died from bruising and injury of the sac.

Aneurism of the Branches of the Abdominal Aorta.

The *cœliac axis* is itself not infrequently involved in aneurism of the first portion of the abdominal aorta. Of its branches, the *splenic artery* is occasionally the seat of aneurism. This rarely causes tumor large enough to be felt; sometimes, however, the tumor is of large size. I have reported a case in a man, aged thirty, who had an illness of several months' duration, severe epigastric pain and vomiting, which led his physicians in New York to diagnose gastric ulcer. There was a deep-seated tumor in the left hypochondriac region, the dulness of which merged with that of the spleen. There was no pulsation, but it was thought on one occasion that a *bruit* was heard. The chief symptoms while under observation were vomiting, severe epigastric pain, occasional hæmatemesis, and finally severe hæmorrhage from the bowels. An aneurism of the splenic artery the size of a cocoa-nut was situated between the stomach above and the transverse colon below, and extended to the left as far as the level of the navel. The sac contained densely laminated fibrin. It had perforated the colon. I have twice seen small aneurisms on the splenic artery. Of thirty-nine instances

of aneurism on the branches of the abdominal aorta collected by Lebert, ten were of the splenic artery.

Aneurism of the *hepatic artery* is very rare, and there are only ten or twelve cases on record. The symptoms are extremely indefinite; the condition could rarely be diagnosed. In the case reported by Ross and myself, a man aged twenty-one had the symptoms of pyæmia. The liver was greatly enlarged, weighed nearly 5,000 grammes, and presented innumerable small abscesses. An oval aneurism, half the size of a small lemon, involved the right and part of the left branches.

A few cases of aneurism of the *superior mesenteric artery* are on record. The diagnosis is scarcely possible. Plugging of the branches or of the main stem may cause the symptoms of infarction of the bowels which have already been considered.

Small aneurisms of the *renal artery* are not very uncommon. Large tumors are rare. The sac may rupture and give rise to extensive retroperitoneal hæmorrhage.

Arterio-venous Aneurism.

In this form there is abnormal communication between an artery and a vein. When a tumor lies between the two it is known as varicose aneurism; when there is a direct communication without tumor the vein is chiefly distended and the condition is known as aneurismal varix.

An aneurism of the ascending portion of the arch may open directly into the vena cava. Twenty-nine cases of this lesion have been analyzed by Pepper and Griffith. Cyanosis, œdema, and great distention of the veins of the upper part of the body are the most frequent symptoms, and develop, as a rule, with suddenness. Of the physical signs a thrill is present in some cases. A continuous murmur with systolic intensification is of great diagnostic value. In a recent case, after the existence for some time of pressure symptoms, intense cyanosis developed with engorgement of the veins of the head and arms. Over the aortic region there was a loud continuous murmur with systolic intensification.

A majority of the cases of arterio-venous aneurism and of aneurismal varix result from the accidental opening of an artery and vein as in venesection, and are met with at the bend of the elbow or sometimes in the temporal region. The condition may persist for years without causing any trouble. Pulsation, a loud thrill, and a continuous humming murmur are usually present.

Congenital Aneurism.

In consequence of failure of proper development of the elastic coat in many places in the arterial system, multiple aneurisms may develop. In the well-known case described by Küssmaul and Maier, upon many of the

medium-sized arteries there were nodular prominences, which consisted of thickening of the intima and infiltration of the adventitia and of the media, with a nuclear growth which in places looked quite sarcomatous. They called it a case of *periarteritis nodosa*, and Eppinger holds that it belongs to the category which he makes of congenital aneurism. As many as sixty-three aneurismal tumors have been found in one case. In the smaller branches, such as the coronary and the mesenteric arteries or in the pulmonary arteries, there may be numerous elongated or saccular aneurisms varying in size from a cherry to a hazel-nut. These are true aneurismal dilatations, and, according to Eppinger's careful study, consist of the intima and the adventitia, the elastic lamina having disappeared. The condition has been met with in children. Some of the cases, however, have been in adults; but the term as applied by Eppinger expresses, and probably correctly, the deep-seated fundamental error in development which must be at the basis of this condition. The coronary arteries is a favorite situation; a case has been reported by Gee in a boy of seven.