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FROM

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AORTA AND SUPERIOR VENA CAVA.[1]

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There is, perhaps, no pathological condition whose symptoms are usually more characteristic than are those of obstruction to the normal flow of blood in the superior vena cava. Such a condition may be brought about by compression by tumors or aneurisms, by inflammation and consequent thrombosis of the vein itself, by rupture of an aneurism of the aorta into the vena cava, by penetration of a malignant growth into the vessel, or by bands of inflammatory tissue constricting it from without.

The characteristic symptoms consist in intense œdema and cyanosis coming on rapidly or slowly, and limited to the upper half of the body; together with such secondary symptoms as would naturally follow these conditions. It is difficult to conceive of any cause suddenly operating to bring about obstruction, yet failing to produce these effects. Only when the cause operates very slowly does it seem possible that the symptoms may be slight, or even absent, the collateral circulation having become established.

Rupture of an aneurism of the arch of the aorta into the superior vena cava, one of the causes referred to, is so rare an occurrence that we have been interested in looking into the history of the affection, in connection with a case occurring under our own observation, with the hope of determining whether there exist any symptoms which would permit of a diagnosis during life.

[1] Read before the Association of American Physicians, May, 1890.

The following history of the case is imperfect in some points, owing to the patient's slight knowledge of English, as well as to the difficulty which he experienced in talking on account of the great dyspnœa from which he suffered:

Tak Sing, Chinaman, aged forty-eight years. Was admitted to the Hospital of the University of Pennsylvania, September 22, 1888. His parents are both dead, of causes unknown. Nothing else can be elicited in the way of family history. He has been a cook on a man-of-war, and since 1876 has been working in a laundry. Although on close questioning he says he has noticed numerous small varicose veins over his thorax for four months, he claims that he has always been a healthy man until four weeks ago. At this time he had been working very hard in his laundry, and sleeping in a cold, damp cellar for several nights, after which he was attacked by a severe pain in the chest, which prevented him from sleeping. He was also unable to lie down at night, presumably from dyspnœa. He noticed that his neck and shoulders were swelling, the left side being more swollen than the right. After this the chest became swollen, and he says that his feet were so likewise. The notes of the case make no reference to the condition of the arms. It could not be positively determined whether œdema first appeared at this time, or whether some had existed four months before, at the time the varicose veins of the chest were first noticed.

A week before admission he began to have difficulty and pain in swallowing, and could only take milk and soup, and occasionally a fragment of meat. A Chinese physician was summoned from New York, who applied the moxa to both sides of the neck, the shoulders, and the elbows, but his condition continued to grow worse. Three days ago a watery discharge from the left ear began. He has had no trouble in emptying his bladder, though he has passed less urine than usually. He has had some cough with expectoration since he was first taken sick.

When first examined by us he was found suffering from extreme dyspnœa, and complaining greatly of a burning sensation about the chest; but whether this was felt internally or on the surface of the skin could not be discovered. He sat erect or leaning forward in bed, entirely unable to lie down, and able to sleep but little. The eyes were suffused, the temporal veins congested, the tissues of the face cyanosed and very œdematous, the tongue clean. The neck was symmetrically and very greatly swollen, pitting and tender on pressure. No enlarged glands could be detected in it. The tissues of the chest were everywhere œdematous, giving the impression that the patient was a stout man. The surface of the thorax was covered with numerous small varicose veins. The arms, forearms, and hands were œdematous, and somewhat cyanosed. The pulse was small, well filled, and the tension possibly slightly increased.

The œdema ceased entirely below the thorax, without any sharp line of demarcation, and the hips and legs were those of a slightly built man. The feet were cold.

The astounding contrast between the size and appearance of the upper and lower part of the body would have been ludicrous had not the extreme distress of the patient removed any feeling but that of pity.

The supra-condyloid and inguinal glands were distinctly enlarged.

The examination of the lungs was unsatisfactory on account of the extreme œdema of the subcutaneous tissues. The respiration was costo-abdominal and symmetrical. Anteriorly the right side seemed everywhere duller than the left, but there was no impairment behind. Vocal resonance was normal. Numerous fine mucous râles could be heard during inspiration over both bases posteriorly, though more on the right side, and with slightly prolonged and bronchial expiration. In front on the right side there were a few fine râles, heard chiefly on inspiration, and the respiratory murmur was feeble. Auscultation of the left lung showed nothing amiss. The determination of the cardiac dulness was also unsatisfactory on account of the œdema, but it appeared to extend from the third rib downward, and laterally from the right border of the sternum to the nipple-line. The apex-beat was in the normal position, and was rather forcible. A thrill could be felt over the apex and base. Auscultation at the aortic cartilage revealed a loud, musical murmur of a very peculiar character, reminding one of the sighing of the wind. Being loudest and highest-pitched with the cardiac systole, it died away very considerably during the diastole, and lowered its pitch by several tones, to rise again both in volume and pitch with the next systole. It was thus *continuous*, and had a distinctly venous quality, although unlike a venous hum in that it was distinctly rhythmic. The systolic portion of this murmur was transmitted very distinctly under the right clavicle, and, indeed, everywhere over the right chest, both in front and behind, and also into the vessels of the neck and down the arm as far as the elbow. It could be heard faintly and distinctly at the pulmonary and xiphoid cartilages, but not at the apex. The abdominal organs appeared to be normal.

Dr. C. M. Hay, at that time Resident Physician to the Hospital, made careful notes at short intervals during the time the patient was under observation, and abstracts from some of these show the course of the disease:

Sept. 25. The patient's condition is practically unchanged. Nitroglycerin has been given several times without effect, but he now appears to feel better after purgation with elaterium.

26*th*. Urine is acid, highly-colored, quantity small, albumin in moderate amount, specific gravity 1022. No casts, blood, epithelium, or pus.

28*th*. In spite of the elaterium and pilocarpine the œdema and cyanosis are more extreme. The patient sleeps very little, and breathes with considerable difficulty, and has attacks of coughing. The pulse is weak and irregular; that at the right wrist appears stronger than, though synchronous with, that at the left. The œdema, however, interferes with an accurate examination. The murmur is the same as at first. Respiration on the right side is fainter than on the left, and the percussion on this side seems everywhere duller.

30*th*. General condition the same. He complains of great burning in the throat and chest, especially on swallowing his whiskey.

Oct. 1. Expectorated this morning about a tablespoonful of blood-stained mucus. Swallows considerable food, but with pain and diffi-

culty. The chief complaint still is of the burning pain in the chest, aggravated by swallowing whiskey. There is a faint systolic murmur heard at the apex, and probably transmitted to this spot. The venous murmur at the aortic cartilage and under the clavicle is plainer, and the loudest portion of it almost synchronous with the first sound of the heart.

3*d*. The œdema is greater. The left arm is more cyanosed and œdematous than the right, being ½ inch greater in circumference at the elbow.

5*th*. Dropsy and cyanosis of the upper half of the body still greater, the swelling being more marked on the left side of the face and neck, and in the left arm, than on the right side. The left forearm measures 1 inch more than the right. No œdema of the lower part of the body. The patient still complains of intense burning pain after each dose of stimulant. He is subject to attacks of stupor of short duration, and at times is very irritable.

6*th*. The œdema is still greater in the left arm, but the right arm is much less swollen than it was a week ago. The œdema of the chest is slightly better. The right side of the chest anteriorly is still duller on percussion than the left. Posteriorly there is no material difference. No evidence of pleural effusion. Respiratory sounds normal on both sides. The venous murmur is of the same character as before, but is of a little lower pitch, and is loudest at the end of inspiration. The patient has for a week been taking iodide of potash, tincture of nux vomica, and tincture of digitalis; also codeia and pilocarpin p. r. n., and dry cups over the chest at intervals.

9*th*. There is to-day some œdema of the scrotum.

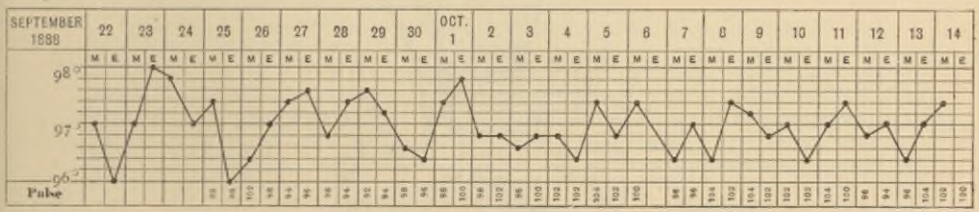
10*th*. Condition worse. Cyanosis very extreme. Swelling of the scrotum has disappeared.

12*th*. Dyspnœa more marked, and respiration labored and noisy, expiration being especially prolonged and stridulous. There is undoubtedly an area of percussion-dulness on the right side, extending downward to the upper border of the third rib, and transversely toward the left as far as the left edge of the sternum. The respiration on the right side is much louder and fuller than on the other, but in other respects there is nothing worthy of note. The heart-sounds cannot be distinctly heard on account of the noisy respiration, and the venous murmur is not heard either at the aortic cartilage or under the right clavicle. Examination of the throat made by Dr. Reeves shows the half-arches of the palate covered with a muco-purulent secretion, and the larynx filled with the same. There seems to be a partial paralysis of the right abductor muscles, but the difficulty attending the examination renders the observation uncertain. There are diffuse redness and extreme congestion of the whole of the interior of the larynx, with a diffuse œdema of the larynx and trachea. The patient being in great agony, dry cups were to-day applied with marked relief. The presence of occasional stupor and of irritability is still noticed, and in a few instances he has seemed to be wandering in his mind, though it was not possible to determine this with certainty.

13*th*. The expectoration is distinctly more frothy and serous, and less purulent than during the preceding week, and contains to-day slight traces of blood. The patient breathes with much difficulty.

14*th*. The œdema has increased greatly in the entire upper half of the body. Respiration is stridulous and very labored, but has been relieved slightly by dry cupping. Numerous large and small mucous râles are audible throughout the chest, especially on the right side.

15*th*. At about noon, yesterday, blood oozed from the conjunctiva, and the sputum was tinged with blood. At 5.30 P. M. he had an attack of choking, and expectorated with great difficulty about f℥ij of bright, arterial blood. At 6 P. M. he became very drowsy, and gradually grew more stuporous and unconscious. The pulse began to fail, the cyanosis became almost black. Cheyne-Stokes respiration developed and continued until death at 8.45 P. M.

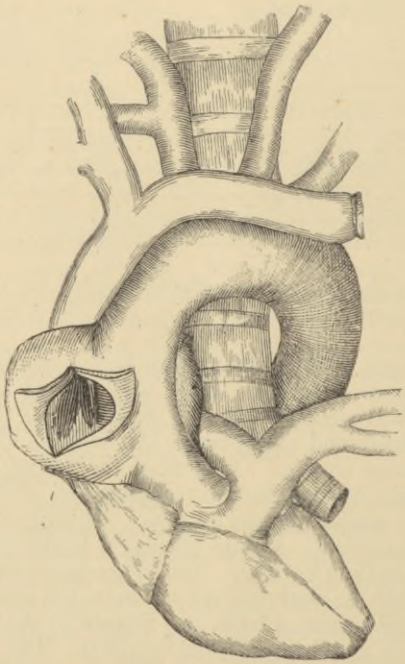


The temperature throughout the disease tended to be subnormal, as shown in the accompanying chart. Only once did it reach an elevation of 98° Fah.

Autopsy three hours after death: Man below medium height. No rigidity or ecchymoses. Cyanosis much less marked than during life. Upper half of the body œdematous. No œdema below the waist. Lower extremities emaciated and shrivelled. On incision through the skin there is profuse venous oozing. On opening the thorax the tissues of the anterior mediastinum appear matted together, and everywhere œdomatous. Pericardium contains about an ounce of bloody serum. Heart as a whole not hypertrophied. Valves normal. Right auricle large, and its walls look thicker than normal. The index-finger enters the superior cava from the auricle for slightly over an inch, but then is tightly compressed. The inferior cava admits two fingers to the first joint. The coronary arteries are pervious and not calcified. The aorta is a little dilated, and 1½ inches from the aortic valves is an orifice the size of a half-dollar on the postero-lateral aspect of the convexity of the arch. This opening looks into an aneurismal sac projecting to the right and posteriorly, and of the size of an orange (see figure). The tissues around the sac are thickened. It is bounded on the right by the right lung, which it compresses, and to which it is adherent. Posteriorly it lies against the trachea and œsophagus and the right bronchus. The sac has everywhere thin walls, and is full of dark, moderately firm, non-laminated coagula.

The subclavian and innominate veins are pervious. At the junction of the right internal jugular and right subclavian veins is a globular thrombus the size of a large pea, lying behind one of the valves. The upper part of the superior cava is much thickened, and is compressed by the aneurismal sac, which lies directly upon it. At its termination in the venæ innominatæ it does not admit the tip of the little finger passed into it from above, and this narrowing continues throughout the course of the vein to a distance a little over 1 inch above the auricle. A

probe passed through the vein from above enters sometimes into the auricle, sometimes directly into the aneurismal sac. The œsophagus is tightly compressed by the aneurism, and the trachea is flattened in a lateral direction from the right side. The aneurism laid open shows within it and passing through it the thickened and compressed superior vena cava, and in the wall of the latter an irregular erosion ¾ inch in length in a vertical direction, beginning about 2 inches above the aneurism, and involving one-half of the circumference of the vein. The edges of this opening are irregular but smooth, and unoccupied by coagula.



A probe passed from the right auricle enters the aneurismal sac through the same opening. Just above the bifurcation of the trachea, at the point where this tube is flattened, there is an erosion of the cartilage, and possibly a small though not discoverable communication with the aneurism, since much blood is present in the trachea and bronchi. The recurrent laryngeal nerves are uninvolved. The lungs show extensive fibroid adhesions to the costal pleuræ on both sides, especially at the bases. There is no pleural effusion. The bases of the lungs are collapsed. At the apex of the right lung there is a cavity the size of a marble. The kidneys are distinctly fibroid, and the capsule slightly adherent and thickened. The brain reveals nothing of importance. The azygos vein does not appear to be dilated. The opening of the vein into the vena cava lies above the commencement of the constriction, and cannot be discovered.

An extended search through medical literature has brought to light only 28 cases of this lesion, including one (Case XVIII.) in which the

symptoms were quite typical, but in which recovery took place. With our own case the total number, therefore, equals 29. Brief abstracts of the salient features in the clinical histories of these cases are as follows:

CASE I.—Reported by Beevor. *Lancet*, 1832–33, i. 800, and ii. 63.
Previous history: Not given.
Symptoms following the rupture: Enormous turgidity and varicose condition of the veins over the chest, which inosculated freely with the epigastric veins, etc. Œdema of the head and upper extremities [and chest?]. Auscultation revealed the presence of an aneurism. Man very rapidly sank, and latterly had terrified notions about his situation, thinking he was among thieves, men of blood, murderers, etc.
Duration of symptoms following rupture: Not stated.
Autopsy: An aneurism of aorta, capable of holding a pint of fluid; had produced interstitial absorption of sternum. Vena cava quite impervious for ½ inch, beginning 1 inch above right auricle; and just above the obliteration was a rent in the coats, which led directly into the enlarged aorta beneath. The azygos greatly dilated; entered cava just above the point of obstruction. At entrance of left subclavian [innominate?] was another and larger rent leading also into the aorta, and constituting a second communication between arterial and venous systems. Heart normal.

This case is quoted by Peacock (*Trans. Path. Soc. Lond.*, xix. 127) as identical with the following. They are, however, distinct, as the first, with autopsy, was reported March 5, 1833, while the second patient did not die until August 4, 1833.

CASE II.—Reported by Thurman. *Med.-Chir. Trans.*, 1840, xxiii. 323. See also *Lancet*, 1832–33, ii. 666.
Previous history: Coachman, aged forty-one; intemperate; much exposed to wet and cold. For a long time cough, dyspnœa, and palpitation.
Symptoms following the rupture: For a few days pain in neck and shoulders, replaced by swelling and purple color of face, then, in a few days, of chest, especially on right side, and of right arm. Clusters of veins, almost varicose, over chest and back. Pulse 100, rather hard. Sense of weight and stiffness over shoulders. Dizziness, stupor, confusion of mind. Dulness on percussion, distinct impulse, and vibratory murmur under right clavicle and to right of upper part of sternum. Same murmur, not so loud, over right carotid and origin of aorta. Some crepitation over both sides chest behind, especially above. Œdema became extreme; spread to left arm, and slightly to ankles and scrotum some days before death. Cough worse; dyspnœa finally extreme; expectoration difficult and tinged with blood. Toward end delirium almost constant.
Duration of symptoms following rupture: About 2 months.
Autopsy: Heart large; ventricles dilated; valves normal. A diffuse, true aneurism of ascending aorta, size of fist, commencing with pericardium and extending for 1½ inches above the valves, principally on right side. Vena cava behind aneurism; a round perforation ¼ inch across and with smooth edges, ½ inch above entrance of azygos vein, opened into sac. Lungs crepitant. Pleural adhesions both sides.

CASE III.—Reported by Reid. *Edinb. Med. and Surg. Journ.*, 1840, liii. 95. Specimen also studied by Thurman. *Med.-Chir. Trans.*, 1840, xxiii.
Previous history: Tinsmith, aged thirty-five; intemperate; long been subject to palpitation.
Symptoms following the rupture: After lifting heavy weight had uneasy sensation in chest as though something giving way. Soon œdema and lividity of upper part of body, and confusion of mind. When examined after three

weeks showed great œdema and lividity of arms and chest, and especially of face and neck. Conjunctivæ injected. Much dyspnœa; some cough and difficulty of deglutition. Urine scanty. Heart's impulse strong; apex depressed. Double bellows-murmur over cardiac and sternal regions, especially upper part of latter; the systolic portion more prolonged, the diastolic shorter and sharper. Extended dulness over heart and upper part of sternum. Later œdema increased, with slight swelling of scrotum. Orthopnœa; delirium; died suddenly.

Duration of symptoms following rupture: 4 weeks.

Autopsy: Aorta at origin suddenly dilated, forming aneurism size of fist, limited to sinuses of Valsalva. Projected into anterior and left part of right auricle, and here it had termination of superior vena cava stretched over its outer surface. This portion of the auricle and the termination of cava communicated with sac by two oval openings with defined, rounded edges. Would barely receive tip of little finger. Cava pervious, but must have been compressed by the aneurism. Heart hypertrophied; left ventricle dilated; valves healthy; pericardium universally adherent. About a quart of serum in each pleural cavity. Lungs compressed, small; contained considerable blood and frothy serum.

Though this is really an instance of perforation into the right auricle, the superior cava was involved as well, and the case may, therefore, with propriety be included here, particularly as the symptoms were purely those of rupture into the cava.

CASE IV.—Reported by Young. *Edinb. Med. and Surg. Journ.*, 1841, lv. 63.

Previous history: Gentleman, aged fifty-six; temperate; well until attack of rheumatism. In a year another attack, and at same time loud, ringing cough lasting some weeks.

Symptoms following the rupture: Some months later, without premonitory symptoms, suddenly taken at night with deep blackish-purple color and great swelling of face, neck, and chest as far as second rib. Veins of forehead and temples very prominent. Headache. No dyspnœa. Next day respiration rather difficult; great restlessness; headache persisted. Pulse small and compressible. Over middle of sternum an impulse stronger than that over heart. No thrill or murmur anywhere. Chest had become œdematous, which hindered percussion being employed. Dyspnœa became excessive, and great dysphagia developed; both apparently due to swelling in neck. Respiration bronchial in back, with râles. No further examination of heart, probably on account of excessive restlessness. Patient talked incoherently. Death.

Duration of symptoms following rupture: About 2¾ days.

Autopsy: Livid color almost entirely gone, and œdema much less. Pericardium adherent to sternum. Heart not hypertrophied; valves normal except aortic, which was thickened, and orifice dilated. Aneurism of ascending portion and of arch, holding 1½ pounds. Vena cava stretched over sac and adherent to it; a perforation in vein over ¼ inch in length, with retracted, thin, and irregular edges, and situated at about the level of the entrance of azygos vein; opening into right wall of aneurismal sac.

CASE V.—Reported by Law. *Dublin Med. Journ.*, 1842, xxi. 433.

Previous history: Man, aged forty-two; always well up to onset of the symptoms.

Symptoms following the rupture: Took a morning walk, and, not feeling well, lay down; face suddenly became swollen and dark purple. When seen next day, face, upper part body, hands and arms deeply livid; face, neck, upper part chest very much swollen. Suffusion and serous infiltration of eyes. Veins of neck hard and cord-like. Heart-sounds heard beyond ordinary limits, especially toward right subclavicular region; in other respects heart normal. Examination of lungs negative. Repeated examinations of heart

and lungs gave no other results. No pain; but distress, discomfort, oppression. Very feeble pulse at wrists; strong in femorals. Subjective symptoms increased. Intellect became torpid, but no coma, and patient died suffering.

Duration of symptoms following rupture: 6 days.

Autopsy: Aneurism size of small orange from posterior and right side of ascending aorta. Beginning 1 inch above its entrance into heart, the walls of the vena cava were thickened for about 1 inch, and closely approximated by the pressure of aneurism. At this point was an unobstructed circular perforation about 2 lines in diameter opening into sac. Partial adhesion between opposite sides of vein. Aortic valves normal.

CASE VI.—Reported by Cossy. *Archives Gén. de Méd.*, 1845, ser. 4. t. ix. 33.

Previous history: Woman, aged forty-five; began fourteen years before to have slight attacks of palpitation and oppression. These gradually increased in intensity and duration. Finally palpitations became painful, but did not interfere with her work.

Symptoms following the rupture: Without further premonitory symptoms woke one morning with dizziness and some swelling, and violet color of face and right arm. Two hours later extreme dizziness, and consciousness lost for several minutes. By evening face and arms greatly swollen, the right more than the left. Swelling increased. Examination ten days later showed face, arms, and neck much swollen and intensely violet; right arm larger than left. Chest not affected. Giddiness; sense of painful tension in head; continual noise in right temple and ear. Numerous veins outlined on face; none seen on arms. A distinct shaking of chest with heart's impulse, but without heaving or thrill. Heart seemed enlarged. A very loud, long, widely diffused, rasping, systolic murmur heard with maximum intensity under sternal end of right clavicle. Here complete dulness on percussion, but no pulsation or thrill. Posteriorly murmur loudest in right infra-spinous fossa. Above internal half right clavicle a pronounced systolic pulsation and thrill extending into vessels (veins) of neck of this side only. Radial pulse feeble, narrow, synchronous on two sides. Dry cough; slight dyspnœa; no râles. Dulness and feeble breathing behind on right side below. Later veins of forehead and the jugulars became a little more prominent. Sleepiness and then coma developed.

Duration of symptoms following rupture: 11 days.

Autopsy: Brain very pale. Hydropericardium. Hydrothorax both sides. Heart hypertrophied; valves normal. An aneurism size of hen's egg situated on convex portion of ascending aorta below origin of innominate. Vena cava on its posterior wall and adherent to it. A perforation 9 mm. high and 5 mm. broad, situated 15 mm. below entrance of innominate vein, opened into aneurismal sac. Cava only 26 mm. wide here, but below, at entrance of azygos, was 55 mm. wide. Azygos not dilated.

CASE VII.—Reported by Mayne. *Dublin Quart. Journ. Med. Sci.*, November 1, 1853, 257.

Previous history: Woman, aged fifty; laborious work. Well until forty-fourth year. Then dyspnœa, cough, and palpitation on going up stairs began. Had had since then several attacks of severe oppression, relieved by venesection. Symptoms grew worse, prevented regular work. Stooping especially bad, as it produced dyspnœa and swelling of eyelids, face, and hands.

Symptoms following the rupture: While stooping suddenly felt as if strangled; persistent, intense feeling of suffocation; giddiness; remarkable change in color of face; breathing greatly embarrassed; absolute orthopnœa. Examination next day showed deep plum color and great œdema of face, neck, shoulders, and upper part thorax. Veins enormously distended, and in many places varicose. Eyes seemed starting from head, and showed extensive sub-conjunctival œdema. Occasional short cough without expectoration. Pulse jerking, like aortic regurgitation. Dulness on percussion

bounded by left edge of sternum and line from sternal third of right clavicle to within 1 inch of nipple. A very strong heaving systolic impulse in second and third right intercostal spaces; vastly greater than at apex. Over impulse a very distinct thrill, and a remarkably loud, single, systolic, widely-diffused superficial bruit; maximum at second right costal cartilage; so loud that heart's action could not be accurately explored. Respiratory murmur inaudible over upper part right chest in front. No râles anywhere. Purring tremor felt in right subclavian and internal jugular veins. None in left. Temporary improvement followed venesection; then obstinate vomiting, stupor, drowsiness, delirium, convulsions, death.

Duration of symptoms following rupture: 8 days.

Autopsy: Congestion and œdema of parts supplied by superior cava. Right internal jugular nearly as large as small intestine. Serum in brain cavities. Lungs healthy; their mucous membrane very vascular. Heart healthy. Aneurism of aorta in shape of enormous dilatation occupying entire arch and about 2 inches of descending portion. Right and left innominate veins and superior cava adherent to surface of sac. Left innominate and cava considerably constricted where adherent; but below, from point of entrance of azygos, cava of normal size. Opening size and shape of shirt button-hole on right side of sac into vena cava; its edges sharp and irregular, as if recently made.

Case VIII.—Reported by Goupil. *Thèse de Paris*, 1855, No. 50, vol. vi.

Previous history: Cavalry officer, aged fifty-eight; always some shortness of breath, which had increased during last twelve years. Odema of lower extremities at times for several years.

Symptoms following the rupture: After fit of anger lost consciousness. This followed by violent palpitation and excessive dyspnœa, with rapidly-increasing œdema, cyanosis, and dilatation of veins of upper part of body. At base and at right side sternum a soft, prolonged, systolic murmur, and a stronger and harsher diastolic murmur. Suffocative attacks, restlessness, headache, and attacks of fainting developed. Pulse rapid, small; heart's action violent; death.

Duration of symptoms following rupture: 1 month.

Autopsy: Left ventricle hypertrophied. No disease of valves. Aorta atheromatous; became dilated immediately above the valves. An aneurism, size of hen's egg, began 5 cm. above the valves, and, projecting backward and to right, pressed on right auricle, superior cava, right bronchus, and pulmonary artery. Vena cava compressed; and just below entrance of azygos vein an oval perforation into aneurism, 35 mm. in circumference, with irregular, red, eroded edges. The portion of vena cava below the entrance of azygos flattened and much smaller than above. Azygos vein dilated. Double hydrothorax. Lungs compressed.

Case IX.—Reported by Tripier. *Thèse de Paris*, 1863, p. 63. Quoted by Peacock. *Trans. Path. Soc.*, London, 1868, xix. 140.

Previous history: Travelling merchant, aged fifty-five; temperate; always well except occasional dizziness.

Symptoms following the rupture: Taken suddenly at night with vertigo and dyspnœa, followed by very marked swelling and lividity of head, neck, face, arms, and upper part trunk, with distention of veins. Nothing remarkable about respiration. Sounds of heart normal; but 3 cm. from right side sternum beneath clavicle was dulness, pulsation; soft, feeble systolic murmur. Pulse small and frequent. Great agitation, followed by delirium and lapsing into coma, with increased evidences of obstruction of venous circulation. Death.

Duration of symptoms following rupture: 15 days.

Autopsy: Aneurism, large as fist, egg-shaped, projected to right and posteriorly from aorta above the valves. Adherent to pulmonary artery and to vena cava. Vena cava, though flattened and contracted where in contact with aneurism, was permeable throughout, and again expanded below. A

perforation into aneurism of button-hole shape, 2 cm. long, situated 2½ cm. from commencement of vein. Its edges slightly broken, and very fine and close together. Fluid in pericardium. Slight hypertrophy of heart. No disease of valves. Great congestion of membranes and substance of brain.

Case X.—Reported by Eastes. *Med. Times and Gaz.*, 1864, i. 393. See also report by Gull. *Lancet*, 1864, i. 409.

Previous history: Arsenal laborer, aged thirty-four; cough and dyspnœa more or less since Crimean war, and carrying load always caused cough and soreness across chest.

Symptoms following the rupture: About five weeks before seen, face, neck, and right arm began to swell and grow purple; left arm slightly so. Dyspnœa much worse, especially on exertion. Examination showed great cyanosis and œdema of upper half of body; veins of thorax engorged; cough severe, with frothy sputum. Decided dyspnœa; no dysphagia. Pulse small, regular, weaker on right side. Diastolic thrill over right side chest. A soft, whizzing, and very distinct murmur of venous character over aorta; diastolic at commencement of arch, but both diastolic and systolic, but chiefly the former, passing upward and over middle of arch. Maximum intensity at third right costal cartilage. The murmur had a continuous churning sound, like that in enlarged vessels in thyroid gland. No sound in right side neck. Percussion normal. Coarse crepitation at bases, both lungs posteriorly; bronchial breathing at right side in front. Dyspnœa, cough, and œdema increased. Erysipelatous inflammation set in. Death.

Duration of symptoms following rupture: About 7 weeks.

Autopsy: Aneurism, size of fist, on right and posterior wall of ascending aorta; its mouth extending from 1 inch above valves to innominate. Superior cava lay in front of sac. At its back part, just above auricle, was a perforation into sac, size of lead-pencil and with smooth edges everted toward the vein and evidently not recent. Aorta atheromatous. Heart of natural size. Lungs crepitant; much mucus in the tubes. Fresh pleuritic adhesions between right lung and pericardium. Recent pericarditis with effusion.

Case XI.—Reported by Gallard. *L'Union Méd.*, 1865, xxvii. 564.

Previous history: Basket-maker, aged sixty; always well except for attacks of oppression with cough at times, terminated by abundant expectoration.

Symptoms following the rupture: Suddenly in middle of night extreme difficulty in breathing and a violet coloration of face. When seen next day very marked cyanosis of face, neck, arms, and upper part of trunk, with some coldness and œdema. Cyanosis became intense. Injection and some chemosis of eyes. Subcutaneous veins swollen without pulsation. Œdema of entire upper half of body developed, alike on both sides. Dulness extendng under sternum to under right clavicle, and a vibratory tihrill over dulness. A widely-diffused systolic and diastolic murmur; its maximum intensity under right clavicle at the position of the dulness, where it was strong and rasping. Weak at apex; heard under clavicles and in carotids; heard down back. Its maximum intensity in back was at right of fourth dorsal vertebra. Pulse same force in two radials. Voice a little rough; respiration frequent, labored, a little noisy. No dysphagia. Next day unconscious; stertorous; very great œdema; general coldness; insensibility of skin and mucous membranes; feeble, rapid pulse; death.

Duration of symptoms following rupture: About 2 days.

Autopsy: Ascending and transverse portion of arch very much dilated. The ascending portion had sacculated aneurism. Vena cava compressed and adherent between aneurism and arch of aorta; so narrow that a uterine sound could hardly pass. Perforation into sac, size of a silver 20-centime piece, situated just below entrance of azygos vein. A clot contained in aneurism obstructed it and projected through it. Trunk of azygos slightly flattened, compressed by calcareous gland. Innominate and azygos veins voluminous and engorged. Aorta atheromatous. Nothing to note in heart.

CASE XII.—Reported by Hayden. *Dublin Quart. Journ. Med. Sci.*, 1866, xli. 434.

Previous history: Mason, aged thirty-three; intemperate; always well; strained himself in lifting heavy stone, and felt acute pain in dorsal region and could not work for some days. Two weeks later felt sudden faintness and a weakness in limbs; passed off in few minutes. About this time seen at hospital, and slight hoarseness and cough noticed.

Symptoms following the rupture: In three weeks more seen again, and presented the symptoms of the lesion. Deep cyanosis and œdema of entire upper part of body down to diaphragm. Conjunctivæ injected with dark venous blood. Especially face and neck deep purple. No thrill in veins of neck. Chest covered with tortuous veins in groups. Temperature of upper half body low, and man complained of chilliness in that part. Pulse small, regular, rapid. Cough and expectoration. Respiration 24. No dysphagia. Percussion less resonant to right of sternum from clavicle to nipple, and respiration feeble here and down to infra-spinous fossa behind. Elsewhere loud, with muco-crepitant râles. Præcordial dulness increased; impulse strong; no thrill; apex behind ensiform cartilage. Over base double murmur; the systolic coarse, loud, maximum intensity at junction of third right costal cartilage, with sternum, heard in carotids, diffused over chest, especially on right side, also heard in right infra-spinous fossa. The diastolic murmur confined to region of base, heard over lower portion of sternum; replaces second sound. A feeble impulse and thrill felt at seat of maximum intensity of systolic murmur to right of sternum. Engorgement grew worse; some difficulty in swallowing; slight delirium, then drowsiness. Death quiet.

Duration of symptoms following rupture: Over 10 days; not over 3 weeks; exact time uncertain.

Autopsy: Lungs hyperæmic, œdematous. Pericardium entirely adherent to heart. Heart and valves showed nothing of importance. Aneurism as large as apple of moderate size, with opening into it from aorta about ½ inch above valves. Compressed right branch of pulmonary artery, right bronchus, and vena cava. Vena cava pressed forward and outward by it; occluded from entrance into auricle up to ½ inch below entrance of azygos vein. The opposite sides of intima of cava at its opening into auricle were partially adherent, probably congenitally, leaving one passage on each side; the one admitting a probe, the other the little finger. Three perforations existed from the sac into the cava; one the size of a three-penny piece, the others much smaller. Their edges were thin, jagged, and bordered by red areolæ on the lining membrane of the vein.

CASE XIII.—Reported by Jacoby. *Berlin. klin. Wochenschr.*, March 28, 1870, 158.

Previous history: Railway employee, draughtsman, always been well except hemidrosis of upper half body; did not know whether of lower half of body as well. First symptom a hindrance of motion in neck and some swelling there. Next day same.

Symptoms following the rupture: On this second day, as he leaned over his drawing, had sudden sense of being unwell; blueness and swelling of face and neck developing in course of two days. On third day intense blueness with œdema, and coldness of upper half body; sharp, zigzag color-line of demarcation at lower part of thorax; scleræ dark bluish-red; jugular veins prominent, very full. Sweat over whole upper part body. Radial pulses isochrônous, small, compressible; left pulse much weaker than right. No dyspnœa at first, but sense of oppression. No pain. Percussion and auscultation of lungs normal. Heart's impulse feeble. No pulsation or thrill in upper part chest. Loud buzzing murmur of greatest intensity at position for listening to aortic valves; loudest with systole, but continuous; and lasting, though not so loud, through diastole; widely diffused over chest. Not heard behind to left of vertebral column over the aorta. Not heard in femorals; faint in carotids. Besides murmur, two normal sounds could be

heard at apex. Œdema increased; very little urine voided; dyspnœa developed, then orthopnœa. Some roughness of voice. Very somnolent. Death with symptoms of slow carbonic dioxide poisoning.

Duration of symptoms following rupture: 7 days.

Autopsy: Cyanosis largely disappeared; cutaneous ecchymoses both sides thorax; œdema persistent. Double hydrothorax. Nothing characteristic in lungs. Heart small; valves normal. Large saccular aneurism of ascending aorta, 9 cm. broad in widest part. Lining of sac atheromatous, uneven, and with numerous small aneurismal dilatations in the wall, of size of pea to that of walnut. Aneurism evidently an old one. Vena cava, at about its entrance into auricle, narrowed to size of crow's quill, and closely adherent to one of the little aneurisms of the size of cherry; and a slit-like perforation 4 lines long with smooth edges opened into this. A colorless old clot projected through it from the sac, and thus still more narrowed lumen of cava. Shortly above this very narrow part cava resumed normal size. Bronchi, œsophagus, and trachea not compressed.

Case XIV.—Reported by Farrington. *Phila. Med. Times*, January 3, 1874, 216.

Previous history: Woman, domestic, aged sixty-one; moderate indulgence in alcohol; no venereal history; rheumatism seventeen years before, otherwise always well. About a year previously small tumor appeared right side of chest near sternum. No cause known unless it was repeated straining in lifting clothes-baskets. In about two months sharp pain down arm to elbow; sometimes in chest in region of tumor. These pains persisted. Voice hoarse for eighteen months No cough; no dyspnœa.

Symptoms following the rupture: After great excitement there developed intense cyanosis and great dyspnœa. Extremities cold; pulse small, rapid, short, sharp; no difference between the two sides. Pulsating tumor with dulness and thrill, extending 3 inches to right of sternum from second to fourth rib. Also double murmur, with greatest intensity over this region, transmitted into vessels of neck; diastolic portion loudest. Systolic murmur at apex also. Lungs normal. Symptoms persisted with great restlessness and an attack of vomiting.

Duration of symptoms following rupture: About 15 hours.

Autopsy: Aneurism, size of apple, from junction of ascending and transverse portions of arch, projecting forward and to the right. Vena cava compressed by aneurism, and in the wall of the vein, at junction of innominate veins, was a transverse slit, ½ inch in length, communicating with aneurism. Aorta showed chronic endarteritis. An aneurismal sac in descending aorta, pressing on upper lobe left lung. Heart not hypertrophied. Aortic valves thickened and slightly insufficient.

Case XV.—Reported by Bonnarel. *Thèse de Paris*, 1875.

Previous history: Coachman, aged fifty-six; intemperate; always well until eighteen months previously, when an attack of dyspnœa necessitated rest from work for a time. Since this occasion respiration been somewhat oppressed.

Symptoms following the rupture: Without known cause dyspnœa greatly increased and cyanosis appeared. When seen after eight days exhibited orthopnœa; face, neck, upper extremities, and upper part trunk cyanosed, more on right than left side; small vessels distended, especially on nose and cheeks. Face and upper extremities [and thorax?] œdematous. No œdema of lower part trunk or lower limbs. No pain. Voice harsh. No venous pulsation in swollen jugular veins. Left radial pulse weaker than right. Apex-beat lower than normal; no thrill. A strong, not harsh, systolic, blowing sound heard with maximum intensity at inner part first right intercostal space. Heard also over base; also posteriorly along spine. Respiration scarcely audible on right side. On left side sibilant râles. Dyspnœa and cyanosis increased; death.

Duration of symptoms following rupture: 16 days.

Autopsy: Entire arch aorta, particularly ascending and transverse parts, enormously dilated; 35 cm. its greatest diameter. Displaced vena cava and right phrenic nerve and the lungs somewhat, especially the left. Flattened right bronchus slightly. The dilated aorta presented several secondary aneurismal dilatations, one of them size of egg. Vena cava remarkably elongated; its walls intimately adherent to those of aorta. A slit-like perforation, 1 cm. long, opened into aorta about 13 cm. above the aortic valves. About 5 mm. above this was another perforation, round, 6 mm. in diameter, with ragged edges. Heart hypertrophied; valves normal. Some fluid in pleural cavities.

CASE XVI.—Reported by Schnaubert. *Ejened. klin. Gaz.*, St. Petersburg, 1881, i. 81, 105.

Previous history: Butler; aged forty-two; moderate drinker; never syphilis; fifteen years ago kicked in chest by horse, but soon recovered; three years ago asthma and palpitation, which soon disappeared.

Symptoms following the rupture: After great exertion at nocturnal conflagration had chill; then sense of heat in head, dysphagia, swelling of face and neck. Examination two days later showed head, neck, arms, and chest down to third rib bluish-red and considerably swollen. Veins distended, but not pulsating. Mucous membrane of mouth and throat purple and conjunctivæ injected. Some difficulty in swallowing. Vomited several times. Dulness on percussion, extending from middle of sternum to 3 cm. to right of its right edge and down to fourth rib. No pulsation in any part of chest. Loud, rasping, double murmur over area of dulness and over sternum; less distinct posteriorly over centre of left scapula. Radial pulses equal. Respiration rather stertorous; 24 in the minute. Some somnolence. Noises in the ears. Temperature in the axilla 36° C. Later, cyanosis and œdema reached to lower ribs. Murmur was sometimes absent, sometimes only systolic or diastolic, sometimes double. Dulness extended somewhat. Hydrothorax developed. Œdema reached to hips and penis. A slight pulsation at times felt in region of subclavicular dulness. Dyspnœa; hallucinations; increasing cyanosis; delirium; death.

Duration of symptoms following rupture: 5 weeks.

Autopsy: Aneurism, size of hen's egg, starting about 5 cm. above aortic valves and extending toward right. Compressed right branch of pulmonary artery and the vena cava. Was adherent to right lung. Vena cava greatly distended; but about 5 cm. above the heart much narrower, compressed by aneurism, and filled with thrombus. In centre of compressed portion was a circular perforation, ½ cm. in diameter, opening into sac. Compact, adherent thrombus in right jugular. Right auricle and ventricle distended. Lungs œdematous. Bloody mucus in bronchial tubes. Hemorrhagic erosions in stomach.

CASE XVII.—Reported by Halla. *Zeitschr. f. Heilkunde*, 1882, iii. 122.

Previous history: Smith; aged sixty; always healthy; severe work.

Symptoms following the rupture: Suddenly, while lifting iron, developed cyanosis and œdema of upper half of body. Left arm swollen before the right. Jugular veins dilated; dense network of dilated veins on thorax; some dyspnœa; drowsiness; more or less dysphagia. When seen after sixteen days exhibited extreme cyanosis and œdema of upper half of body, with irregular line of demarcation in region of navel. Dense network of veins on chest. Eyes prominent. Some slight œdema of genitals and upper part thighs, and some dyspnœa and dysphagia. No tumor visible on chest. A diffuse, weak, systolic trembling without thrill felt from under right clavicle to right nipple; stronger than apex-beat. Very marked thrill on left side of neck, especially above left clavicle; weaker thrill on right side neck. A percussion-dulness extending about 3 fingers' breadth from middle line toward sternal end right clavicle, and joining the cardiac dulness extending nearly to right nipple-line. A very loud, sharp, blowing, systolic murmur heard with greatest intensity over aortic cartilage, widely diffused, prolonged into diastole. Two

normal sounds at apex. Aortic and pulmonary second-sounds present. A very loud systolic murmur heard above and below left clavicle; weaker murmur in carotids and under right clavicle, and in last position was loudest during expiration. Left pulse slightly smaller than right; both show influence of respiration. Respiration anteriorly vesicular, weak on left side; posteriorly rough and broncho-vesicular except right upper part, where was vesicular. Tongue swollen; voice hoarse; paralysis of right posterior crico-arytenoid, with œdema of larynx. Later, double hydrothorax; catarrhal and œdematous swelling of bronchial mucous membrane; increasing œdema, dilatation of veins, dyspnœa, dysphagia, and cyanosis; expectoration tinged with blood; chemosis of conjunctiva of right eye; increasing laryngeal œdema and stridor; oozing of serum from skin. Temperature had been subnormal; urine scanty, no albumin. Death after short sopor.

Duration of symptoms following rupture: 30 days.

Autopsy: Aneurism of aorta, larger than fist, beginning 3 cm. above valves and reaching to innominate artery, projecting to right; interior atheromatous. Contained several small dilatations. Vena cava behind and to right of aneurism; its whole length, except lower 2 cm., as well as about 3 cm. of left innominate vein adherent to sac. Cava compressed, the greatest narrowing being just below entrance of azygos vein. 1 cm. above azygos was a slit-like perforation, 7 mm. long, with smooth, rounded edges, opening into aorta. At this point cava began to widen again.

Case XVIII.—Reported by Damaschino and Lavin. *La France Médicale*, 1882, i. 805, 819.

Previous history: House-painter; aged fifty; always healthy. Twenty-two years before had strained himself lifting; felt sense of oppression in chest for some hours, but always well since.

Symptoms following the rupture: Suddenly, after stooping and lifting weight of 150 pounds, his friends noticed that his face was blue. No pain, oppression, or palpitation. Cyanosis spread to whole of head in a few hours. By next morning, face, neck, and right arm swollen. By afternoon, left arm also, and he felt constriction in throat, and general feebleness. By evening, all upper part body exhibited venules. In five days a little roughness of voice, and veins of face, arms, trunk, including subcutaneous abdominal veins, commenced to develop. When seen six days after onset there was cyanosis of skin and mucous membrane, œdema of upper portion of body, distention of veins, and development of network of venules. Both arms very œdematous, especially right. Upper part thorax slightly prominent, especially right side. Apex-beat feeble in sixth interspace close to sternum. Cardiac dulness seemed enlarged, but œdema prevented accurate determination. On right side a dulness from middle of clavicle to fourth interspace, extending about 3 fingers' breadth to right beyond sternum. A thrill at upper part right side, reaching above clavicle. A centre of pulsation in third interspace at right edge of sternum and a second centre at apex, not so well marked. In second interspace to right of sternum a rough, systolic murmur and a blowing, diastolic murmur, the two being almost, but not quite, continuous. 3¼ cm. below middle of right clavicle was a very intense and actually continuous murmur, with systolic reinforcement. It was remarkable, especially during the reinforcement, for the peculiar sonorous and vibratory character. It was transmitted with the same characters to the base of the neck and even to the lower part of the thorax posteriorly on the right side. It disappeared at the right border of the vertebral column, and here could be heard in contrast the double aortic murmur first described, with the same characters as heard at the centre for this murmur at the base. Pulse regular. A double murmur heard in femorals. Axillary temperature normal, though the patient complained of feeling cold. Lungs normal. Cough and some bloody expectoration. No palpitation or pain. Some vertigo and oppression on walking. Patient improved, and after being under observation nearly one month the œdema disappeared entirely from the face, arms, and neck, and almost from the trunk, and there was but very faint

cyanosis when at rest, though it returned on quick motion. All the veins of trunk, upper extremities, and roots of thighs very greatly developed.

Duration of symptoms following rupture: Patient left hospital practically well, in the condition described, with collateral circulation well established.

CASE XIX.—Reported by Glasgow. *St. Louis Cour. of Med.*, 1884, xi. 407, and 1885, xiii. 1.

Previous history: Physician; aged fifty-seven; previous good health, except for several accidents. For some months, dyspnœa on unusual exertion.

Symptoms following the rupture: On lifting a man he felt sudden rush of blood to upper part of body. Face and hands swollen and purplish. No dyspnœa or pain. Soon entire upper part body swollen, œdematous, and cyanosed. General enlargement of superficial veins, with spots of ecchymoses. Eyes half closed; pulse soft, full, jerking like that of aortic regurgitations. Dulness over sternum for 3 inches in breadth, and from second to fourth ribs. Strong heaving impulse here, with exquisite thrill, especially at right edge of sternum. Double murmur heard at aortic cartilage and transmitted over sternum and præcordium; diastolic portion ended musically. Over rest of chest only single systolic murmur could be heard; this audible in larger arteries, even in brachial. Appreciable pulsation in liver, and distention of large superficial veins of abdomen. A second examination, after somewhat over a month, showed remarkable improvement in everything except an increased percussion-dulness and occasional great swelling of legs. Soon after this great dyspnœa on exercise began to develop, hydrothorax and general œdema appeared, dulness of aneurism increased greatly, but impulse could only be felt in third interspace to left of sternum. Systolic bruit faint; respiration feeble. Finally, there was increasing œdema, greatest on left side face, neck, and chest; marked cyanosis and dyspnœa. Death.

Duration of symptoms following rupture: 7 months.

Autopsy: Lungs engorged; large amount of fluid in pleural cavities. Heart enlarged; right auricle enormously dilated; left ventricle hypertrophied; valves healthy. Globular aneurism, 4¾ inches in diameter, occupying first portion of arch, extending to innominate artery. Compressed left innominate vein and pulmonary artery. Walls of aneurism atheromatous. A perforation, size of goose-quill, into vena cava situated at upper right side of sac; closed by a thick plate of laminated fibrin. Superior cava greatly dilated; the opening into aneurism immediately below entrance of innominate veins. Azygos vein greatly enlarged. Inferior cava greatly distended.

CASE XX.—Reported by Wetterdal and Wallgren. *Upsala Läkarenförenings Förhandlingar*, 1884–5, xx. 325.

Previous history: Man; aged thirty-four; always done hardest work without difficulty. Probably had had syphilis, but not certain. Used alcohol to excess.

Symptoms following the rupture: Suddenly, while putting forth violent exertion, had a chill; felt a sense as of something sticking in throat; general sense of soreness in thorax; headache. In half-hour blueness in face and hands, and dizziness. On reception into clinic that afternoon patient complained of dyspnœa and severe headache and dizziness on sitting up. Face, arms, and upper part trunk very cyanotic, with a well-defined line of demarcation at lower part thorax. The larger veins much swollen. Great œdema of the cyanotic portions, with distention of the veins. Cardiac dulness not enlarged. No abnormal dulness in chest, and no heart-murmurs or abnormal pulsation. No pulsation in jugular veins. Above right sterno-clavicular articulation and toward right external jugular vein was a booming sound with cardiac systole. Radial pulses isochronous. Dyspnœa, headache, and œdema rapidly increased. Ten hours after admission gave sudden cry and died.

Duration of symptoms following rupture: Less than 24 hours.

Autopsy: Sacculated, fist-sized aneurism of ascending aorta, closely adherent to superior cava. In vena cava 4 cm. above heart was a perforation

into aneurism 7–8 mm. in diameter; its edges sharp, a little swollen, and inverted toward vein. Lungs œdematous.

Case XXI.—Reported by Turner. *Transactions Path. Soc. London*, 1885, xxxvi. 148.

Previous history: Man, aged forty. History of venereal disease; always hard work; no sudden strain or assignable cause.

Symptoms following the rupture: Disease began with dyspnœa. When seen after seven weeks there was dyspnœa; much swelling of upper parts; face dusky; superficial veins enlarged, especially over chest. Loud to-and-fro *bruit* over aortic valve and apex; obscure pulsation over upper part sternum; evidence of pressure on right bronchus; some huskiness of voice and contraction of right pupil. Death from increasing pulmonary obstruction.

Duration of symptoms following rupture: 23 weeks.

Autopsy: The ascending aorta much elongated, with a large sacculated aneurism projecting toward the right. Probably was a dissecting-aneurism originating in a transverse rupture of the vessel. Mouth of aneurism on convexity of vessel extending from ¾ of an inch above free border of aortic curtains upward 2–3 inches. Sac had compressed, closed, and finally passed through the vena cava, completely separating its proximal and distal portions and projecting between them. Distal portion looked like a short arterial trunk given off from aneurism near its upper border. There was free passage of blood from sac into vein. Aorta quite atheromatous. Aortic valves calcareous; orifice stenosed. Mitral valves thickened. End of trachea and right bronchus compressed by aneurism. [Right?] lung congested, œdematous, and adherent to chest-wall. Much effusion in left pleural cavity. [Proximal portion of vena cava probably pervious, as it is not stated to the contrary.]

Case XXII.—Reported by Shannon. Report of Surgeon-General of Army (U. S.), 1886, p. 101.

Previous history: Sergeant. No history of previous trouble, except that for few days had had slight dizziness on stooping.

Symptoms following the rupture: At once, after great excitement, felt a terrible rushing of blood to head. Vision grew dim, strength failed, had to be assisted to room. Could talk. Face very blue and swollen; ears especially cyanosed; eyes protuberant, with bloody tears; varicose, greatly distended and pulsating jugulars. Respiration only a little accelerated and noisy; constant effort to clear nostrils; voice like one with bad cold in head. Neck swollen, finally extremely engorged. No blueness or swelling of arms. Vomiting at times. Heart regular, normal. A murmur at second right costal cartilage with second sound; heard at first examination, but repeated auscultation afterward failed to find it again. Respiration somewhat bronchial and noisy. Pulse full, soft. No unconsciousness or paralysis at any time. Not even stupid until near end. Thirst constant. About two hours after first commencement had severe pain between scapulæ lasting until death. Patient lay down; later effort to rise produced some dyspnœa. All symptoms next increased in intensity. Finally, terrible attack laryngeal dyspnœa ended in death.

Duration of symptoms following rupture: 6 hours.

Autopsy: Cyanosis of face disappeared shortly after death. Lungs congested. Old adhesions of limited extent of pericardium to aorta. No pleural adhesions. A true aneurism of aorta extended from just above coronary arteries to innominate artery, where it became fusiform, and continued in transverse aorta to and including the opening of left subclavian artery. Aneurism 8 inches long on total convexity, 3 inches deep, 3½ inches wide, involved chiefly right upper posterior part of vessel. In posterior wall a small lacerated opening apparently recently torn, leading into distal portion of vena cava close to innominate veins. Proximal portion of vein obliterated in sac-wall, except ½ inch nearest to heart, which was patulous but narrowed. Left superior intercostal size of either innominate vein. No œdema of glottis found. Heart normal.

Case XXIII.—Reported by Christianu. *Spitalul. Bucuresci.*, 1887, vii. 74.

Previous history: Saloon-keeper, aged sixty-one; intemperate; never syphilitic; previously always well. For some time cough, which became worse two weeks before seen; occurred in paroxysms which threatened suffocation; of late accompanied by severe pain in chest and swelling of neck. Examination showed some cyanosis and swelling of face, neck, thorax, and upper extremities. Swelling elastic rather than like œdema. Livid patches containing distended veinules. No murmurs; pulse strong, not accelerated. Respiration not accelerated; no dyspnœa. Dulness under right clavicle to third interspace and from middle line of sternum to 4–5 cm. to right of right sternal border. Some subcrepitant râles in lower part lungs. After three weeks somewhat improved and left hospital.

Symptoms following the rupture: Returned in two days with symptoms much aggravated and with orthopnœa. In one week more systolic murmur present, best heard in the region of the aorta, and in three days more both systolic and diastolic murmur, best heard in right supra-spinous fossa. Tremor of chest-wall, with thrill in third and fourth interspaces in front. Cyanosis, œdema, and dyspnœa increased and became extreme. Eyes projected and were bloody. Systolic murmur became so loud that could be heard on simply approaching ear to chest. Finally, restlessness, delirium, cyanosis of whole body, stertorous respiration, great œdema of nostrils, death by suffocation.

Duration of symptoms following rupture: 16 to 18 days.

Autopsy: Heart hypertrophied. Aorta and large vessels atheromatous. Aneurismal dilatation size of goose-egg from origin aorta up to transverse portion of arch. Vena cava adherent to sac, compressed, and a small perforation 1 cm. in diameter, with irregular edges, connected the vein and the aneurism. Azygos vein much dilated. Lungs, liver, spleen, and kidneys congested.

The exact time of the rupture in this case is not clear. If it occurred two weeks before the patient was first seen, the duration of the acute symptoms would be about seven and a half weeks. The fact that improvement occurred, and especially the possession of irregular edges by the perforation, as though it had been recently formed, indicate that the rupture most probably took place at the time the great aggravation of symptoms with the development of orthopnœa occurred.

Case XXIV.—Reported by Gulliver. *Transac. Path. Soc. London*, xxxviii. 1887, 120.

Previous history.
Symptoms following the rupture.
Duration of symptoms following rupture.
} [This was simply a card pathological specimen, unattended by clinical notes.]

Autopsy: Arch of aorta much dilated and diseased. At top of ascending portion was a circumscribed aneurismal dilatation which communicated with superior vena cava by a circular perforation size of goose-quill. Left internal jugular entirely closed by a clot, and the innominate at its termination had its lumen entirely obliterated by the pressure of the aneurism; and its opening into the vena cava was quite invisible. Cava elongated, being stretched by the aneurism.

Case XXV.—Reported by Arkle and Bradford. *Brit. Med. Journ.*, 1888, ii. 1387; *Transac. Clin. Soc. London*, 1889, xxii. 69.

Previous history: Shoemaker, aged sixty-one; never rheumatism or syphilis; winter-cough for last six years; always well in other respects. Twenty months previously began to have pain in right mammary region of a dull, aching character; also dyspnœa, worse on the least excitement.

Symptoms following the rupture: About nine days before entering hospital seized with pain and swelling in neck. In a few days considerable swelling

of right arm. On admission was an almost black cyanosis of face, most marked on right side. Head and neck œdematous on right side, but little on left. Right arm greatly swollen and pitted. Chest slightly œdematous, especially on right side. Left side chest and left arm but little swollen. No œdema of lower portion of body. Some dilated veins along borders of sternum, and a ring of them horizontally around base of thorax. Respiration labored, accelerated. Paroxysms of coughing in which cyanosis was much increased. Some impairment of resonance in right infra-clavicular region in second and third interspaces, reaching the edge of the sternum. Visible pulsation in these interspaces. Numerous bubbling râles over chest. A thrill over the dull area, and a loud murmur. This murmur peculiarly harsh, continuous; loudest in systole; gradually diminishing in diastole; audible all over right infra-clavicular region, but maximum intensity in second right interspace some 2 inches from sternum. Apex in sixth interspace outside nipple-line; systolic murmur here not conducted into axilla. Aortic second-sound inaudible at base and apex. Cyanosis increased. Died suddenly.

Duration of symptoms following rupture: About 10 days.

Autopsy: A sacculated aneurism involved whole of ascending and greater part of transverse portion of arch; projected upward and to right; was flattened from before backward. Sac displaced right lung and reached surface of chest in second and third right interspaces. Superior vena cava lay behind aneurism and was compressed by it. About 1½ inches from commencement of vein, just above spot where it passed through pericardium, was a perforation into aneurism; diamond-shaped; ¼ inch in diameter, with distinctly rounded edges. No appearance of any recent tear or rupture of any kind. Aortic valves insufficient; other valves normal. 1½ pints fluid in right pleural cavity, rather less in left.

Case XXVI.—Reported by Kraus. *Prag. med. Wochenschr.*, 1888, 119, 130.

Previous history: Revenue officer, aged fifty-two; sixteen months previously began to suffer from cardiac asthma, with dyspnœa and pain in region of heart and in left arm. In following month noticed that neck and region of chin were swollen, and felt as though mucous membrane of throat was swollen. Respiration was through all this decidedly, though varyingly interfered with, though the attacks of asthma were less prominent. Gradually veins of neck swelled, and cyanosis of face developed. Six weeks before symptoms of rupture appeared the chest became œdematous and exhibited bluish spots and distended veins.

Symptoms following the rupture: Suddenly there occurred very severe attack of dyspnœa amounting to orthopnœa; palpitation of heart; præcordial anxiety; very deep cyanosis. Was brought on same day to hospital in this state. While under observation exhibited rapid, shallow, noiseless respiration, with attacks of dyspnœa; pulse small and rapid, but slower during asthmatic attacks, alike in both radials. On face, neck, and upper part thorax cyanosis, elastic œdema, and dilatation of veins. Eyes prominent. Noise in ears. Left arm œdematous, and later right arm also; hand and fingers not cyanotic. Lower half body not affected; no sharp line of demarcation. An indistinct pulsation to right of sternum from second to fifth rib; no distinct dulness here; a thrill from third to fifth rib on right side, which later disappeared and then returned. Apex-beat could not be distinctly located. Rough, blowing, systolic murmur, with maximum intensity in second right intercostal space; rather widely diffused, and heard in carotids. Examination of lungs negative, except some dulness in lower portion with faint bronchial breathing here and a few râles. Cyanosis, œdema, and attacks of dyspnœa varied, but finally grew worse. Œdema of larynx; of genitals; and slightly of upper parts of thighs. Sopor; hallucinations; unconsciousness; death.

Duration of symptoms following rupture: 40 days.

Autopsy: About 2 quarts fluid in each pleural cavity. Lungs congested; œdematous; lower portion atalectatic. Mitral and aortic valves a little

thickened; lateral leaflets of latter adherent to each other. Dilatation of whole ascending aorta beginning a finger's breadth above valves. 3 cm. above sinus of Valsalva of posterior leaflet was a secondary sacculated aneurism size of walnut; projecting from posterior and right side; in intimate contact with root of right lung, and displacing vena cava to right. Vena cava fused with sac and entirely obliterated for 4½ cm. above heart; above this much dilated. About opposite entrance of greatly dilated azygos vein were two smooth-walled perforations from cava into sac; the one the size of a pea; the other that of a hemp-seed.

The author believes that the rupture took place some time before the acute symptoms developed, and claims that the character of the perforation shows this beyond doubt. Other cases which we have abstracted prove, however, that the smoothing of the edges of a perforation takes place very rapidly, and that there is consequently no reason to believe that the rupture did not occur at the time at which the sudden increase of the symptoms would indicate.

CASE XXVII.—Reported by Sisley. *Lancet*, 1889, i. 1184. See also note by Ewart. *Lancet*, 1889, ii. 312.

Previous history: Laborer, aged thirty-five; temperate; scar on penis; rock-fever at Gibraltar; no history of accident. For some months cough, but no shortness of breath. Eyelids were puffy and face somewhat swollen on returning from work in evenings. This condition only seen at night, and had always disappeared by morning.

Symptoms following the rupture: On one occasion went to work, but, not feeling as well as usual, went into hospital for advice; though not considering himself seriously ill. Face and neck were deeply cyanosed; eyelids puffy and ears almost black. Arms slightly cyanosed; rest of body natural color. No pain; no paralysis. Mental state clear, but was drowsy. Pulse full, regular. Respiration not noisy or accelerated. Double murmur over middle of sternum; nothing else abnormal on physical examination of chest. After venesection a venous pulse was observed in jugulars and cephalic veins. Face and arms became gradually more cyanosed; respiration difficult and noisy, with expiratory stertor. Became more drowsy, and finally comatose. Died about two hours after admission.

Duration of symptoms following rupture: Less than 12 hours.

Autopsy: Saccular aneurism ¾ inch above posterior leaflet of aortic valve. Sac measured about 1½ inches in transverse diameter, and 2 inches from above downward. Was in contact with vena cava and right auricle. Vena cava quite patulous. Immediately above its entrance into right auricle was an opening into aneurism. This of irregular form, a little smaller than a sixpence, and with ragged edges projecting slightly into vein. Aortic valves not thickened. Right ventricle slightly hypertrophied. Lungs congested.

CASE XXVIII.—Reported by Gairdner. *Lancet*, 1889, i. 1233.

Previous history: Laborer, aged forty-four. For two years been conscious of slight degree of pulsation in neighborhood right sterno-clavicular region, which caused him no concern.

Symptoms following the rupture: Experienced a sensation as of something giving away near heart. No pain, but faintness and cold sweat lasting ten minutes; never recurred. Swelling of face and right arm followed, but had considerably diminished in degree when first seen after one week. At that time exhibited very marked cyanosis; general anasarcous swelling of upper half body; some dilatation of small superficial veins all over front, especially in lower sternal region, extending thence to præcordial, right hypochondrial and right manubrial regions. Veins of hands distended, especially on left side. Very loud and characteristic murmur heard all over front of chest, but having mainly the distribution of aortic double murmur. The ventricular-

systolic element loudest at base, and diastolic element at least relatively loudest toward lower sternum. Some displacement of præcordial dulness downward and toward the left. Another and distinctly abnormal dulness, easily demarcated from the præcordial, occupied entire manubrium of sternum, and extended both to right and left; but its limits in former direction were difficult to state, owing to anasarca. Appreciable, but not very definite, pulsation in jugular fossa. A faint tracheal quality in respiratory murmur, as heard at upper sternum. Pulse rapid, decidedly stronger in right wrist than in left; in latter not abnormal, but in former had character of unfilled arteries. Pupils normal. But little cough. No signs of laryngeal implication. Respiration without difficulty at first; finally stertorous, but was no dyspnœa.

Duration of symptoms following rupture: 15 days.

Autopsy: Transverse portion of arch of aorta generally dilated, but with two more localized aneurismal dilatations; one extending to right, other to left. The first of these compressed superior vena cava and was adherent to it, forming a round bulging into interior of vein, corresponding to middle and upper third of this vessel. On summit of bulging a rounded perforation, ¼ inch in diameter and 1¾ inches below origin of innominate vein.

Case XXIX.—Reported by Pepper and Griffith in this communication.

A review of the salient features of these cases and of the one now reported shows that in many instances the diagnosis is easily possible during life, while in others it is perhaps impossible. A correct diagnosis was, in fact, made by Mayne and by Glasgow, in their respective cases (VII. and XIX.). Gull, in the case reported by Eastes (X.), recognized an abnormal intra-thoracic venous communication, perhaps with an aneurism; and Gallard in his first case (XI.), as well as in that reported by Bonnarel (XV.), diagnosed an aneurism of the aorta, and discussed the probability of there being a communication between it and the superior vena cava. Damaschino and Lavin made, with apparent reason, the diagnosis of the affection in their case of recovery (XVIII.).

The recognition of the presence of varicose aneurism of the aorta and superior vena cava may be based upon the following principal symptoms, deduced from a study of the different reported cases:

1. *Cyanosis, œdema, coldness, and distention of the veins of the upper part of the body, with other evidences of obstruction to the circulation of blood in the tributaries of the superior cava.* These symptoms have been present to a greater or less degree in all the reported cases of which clinical histories are given, and their diagnostic indications are evident. No lesion could produce such a condition, with its peculiar localization, except some great obstruction to the course of the blood in the superior cava. The thorax, however, does not always share the lividity and œdema of the head and arms; this variation depending solely on the position of the perforation or of the compression. If, namely, the obstruction in the cava is situated below the point of entrance of the azygos vein, the chest will share in the venous congestion; if, on the other hand, the obstruction is above the azygos vein, the removal of blood from the chest-wall is not interfered with, and no œdema develops. In certain

cases the reason for the absence of thoracic œdema is not entirely clear, and often depends on the lack in the published report of a sufficiently detailed statement regarding the exact position of the obstruction in the cava. When the thorax is involved, there is sometimes a sharp line of demarcation between the upper affected and the lower unaffected portion of the body, marked by the numerous small varicose veins around the lower part of the thorax. It has happened more than once that a patient has shown a greater degree of œdema on one side than on the other. This condition may be produced in several ways. For example, in the case of Arkle and Bradford's (XXV.) a long-standing obliteration of the left innominate vein had allowed the establishment of the collateral circulation, so that the sudden rupture of the aneurism produced œdema almost limited to the right side. A similar unilateral œdema and cyanosis of the upper portion of the body would be produced by communication of an aneurism with the left innominate vein, as seen in the case reported by Chabond (*Lyon Méd.*, 1873, No. 26; *Virchow-Hirsch Jahrsb.*, 1873, II., 147). Another case illustrating differences in the swelling of the two arms is that of Cossy's (VI.). In this the opening into the aneurism from the vena cava was situated close to the bifurcation of the cava, in such a position that the blood-current was directed into the right innominate vein, producing consequently much greater swelling of the right arm. In some other instances the causes of the slight differences observed are not apparent. When death has very rapidly followed the rupture of the aneurism there may have been no time for œdema and lividity of the arms to develop. This was the condition in the case reported by Shannon (XXII.), in which only the face and neck gave evidence of the change. The onset of the symptoms in this instance was extremely sudden, and death occurred in six hours.

The cyanosis is probably not due to the admixture of arterial and venous blood; otherwise we should see it well marked in cases of rupture of an aneurism into the pulmonary artery. It depends simply on obstruction from compression by the aneurism, and from the backward pressure of the arterial blood into the vein. In the patient of Christinu's (XXIII.) the whole body finally became cyanosed.

Slight œdema has in some instances been witnessed in parts of the lower portion of the body, though always secondary to that above. Thus, in Thurman's patient (II.) there was slight œdema of the ankles and scrotum, and in Schnaubert's (XVI.), Halla's (XVII.), and Kraus's (XXVI.), of the genitals, hips, and upper parts of the thighs. In the case of Glasgow's (XIX.) there finally developed general œdema. Œdema of the lower portion of the body in these cases is due, according to Halla, to the overfilling of the inferior cava through the necessity which it is under of receiving a large part of the blood belonging to the superior cava. This same passive congestion explains the scanty secre-

tion of urine which has been noted in a number of instances. In a considerable number of cases large amounts of fluid have been found in both pleural cavities, while in other instances there was none. The difference undoubtedly depends largely on whether or not the circulation in the azygos vein is interfered with.

Besides the cyanosis and œdema, dyspnœa may be present, either from the outset or later in the disease. In our own case it was intense, as it was in a large number of others. In others, again, it was absent, or slight, or not referred to by the writer. Thus in Cossy's patient (VI.) it was slight, and in Gairdner's (XXVIII.) nearly absent, and it does not appear to have been well marked in the case of Hayden's (XII.). It is not at all essential that dyspnœa be present, as it is in the event of rupture of an aneurism into the pulmonary artery. Its development depends on various factors, such as double hydrothorax with consequent compression of the lungs; œdematous swelling of the mucous membrane of the nose, pharynx, trachea, larynx, and bronchi; œdema of the lungs; pressure by the tumor on the respiratory tube; over-filling of and consequent irritation of the nerve-centres with venous blood. In Shannon's case (XXII.) death was directly due to an attack of extreme laryngeal dyspnœa.

Still other symptoms indicating venous obstruction may be seen. Cough is a frequent and natural attendant on the dyspnœa, and râles of various sorts are often heard. There was sometimes expectoration, and not infrequently it was tinged with blood, as, for example, in the case of Thurman's (II.), Halla's (XVII.), Schnaubert's (XVI.), and of Damaschino and Lavin's (XVIII.). In our own case a considerable pulmonary hemorrhage took place, due, probably, to an erosion of the trachea by the aneurism. Thurman claims that the dyspnœa, cough, and other evidences of pulmonary congestion, witnessed during life or after death, are due to the circulation through the lungs of an admixture of arterial and venous blood, and the resulting irritation by it of the bronchial mucous membrane.

In some cases there has been difficulty in swallowing, probably due either to pressure of the aneurism on the œsophagus, or, in other instances, no doubt, to the excessive distention of the tissues of the neck with serum. Bloody tears were seen in Shannon's patient (XXII.), and blood oozed from the conjunctivæ in our own case, and in that of Christianu's (XXIII.). A not infrequent symptom as the end approaches is a marked tendency to sleepiness, and, finally, coma. In some cases delirium was present before the coma developed. Attacks of faintness have also been reported, as in the case of Goupil's (VIII.). In a few instances (IV., IX., XIV., XXIII.) excessive restlessness was noted. Headache, too, is naturally present at times. In Kraus's case (XXVI.), and in that of Schnaubert's (XVI.), there was noise in

the ears, and in Cossy's patient (VI.) annoying and persistent noise in right temple and ear, a sense of painful tension in the head, and giddiness. Giddiness was observed in a number of other cases. Convulsions were uncommon, though they occurred shortly before death in Mayne's patient (VII.). Pain in the chest was sometimes observed, and in some instances was among the first symptoms appearing. Coldness of the upper portion of the body is a very common symptom. The temperature-chart of our own patient is an illustration of this fact.

2. *The suddenness of onset of the symptoms.* With the recognition of impeded return of blood through the superior cava the diagnosis is by no means made. Obstruction to the flow of blood in the cava from various other causes may, as already stated, produce the same symptoms. Still, the comparative suddenness of their development in cases of varicose aneurism constitutes a most valuable diagnostic sign. This rapid development was seen in all the cases in which the mode of onset is reported. Sometimes it was exceedingly abrupt. For example, in the case of Shannon's (XXII.) the symptoms were intense, and immediately followed a degree of excitement. Young's (IV.), Tripier's (IX.), and Gallard's (XI.) patients were suddenly taken during the night with very severe symptoms of the rupture. The patient of Law's (V.) became cyanosed and swollen without any premonition while lying down after a morning walk. Cossy's patient (VI.) woke in the morning with evidences of the rupture; Mayne's (VII.) was stooping; Jacoby's (XIII.) was leaning over his drawing; Farrington's (XIV.) had just been brought from the clinic in a state of great excitement; Halla's (XVII.) Damaschino and Lavin's (XVIII.), and Glasgow's (XIX.), were lifting heavy weights; Wetterdal and Wallgren's (XX.) was also putting forth violent exertion. In certain other cases no history of at least such a very sudden and alarming beginning is given, and sometimes it clearly was absent. Thus, in the case reported by Sisley (XXVII.), though the onset seemed to have been sudden, the patient was not aware of any great change in his condition. How long a time was actually required for the symptoms to develop in Eastes's case (X.) is not stated, nor is it entirely clear in the cases of Christianu's (XXIII.) and Kraus's (XXVI.). In Thurman's patient (II.) several days seem to have been needed for the swelling and cyanosis of the face to become apparent, and the same is true of Arkle and Bradford's patient (XXV.). In Hayden's case (XII.) it is not stated that there was any sudden onset so far, at least, as known to the patient. In our own case it could not be ascertained with just what rapidity the symptoms arose, but it is certain that they were not long in developing.

It is quite evident from a study of these cases that there is no instance reported in which there is an account of simply a very gradual increase

in the gravity of a previously existing condition. Only a few days at the most were necessary for the characteristic symptoms to appear.

The rapid development of symptoms is not, however, absolutely pathognomic of rupture of an aneurism into the vena cava, although it renders the fact of its occurrence extremely probable; for, although simple compression of the cava is usually slow in its onset, the symptoms may exceptionally make themselves known with comparative rapidity. A case is reported by Dujardin-Beaumetz (*Gaz. Heb. de Méd.*, 1879, 2 s., xvi. 19–23,) in which extreme venous congestion was produced in the course of ten days, the cause being compression of the superior vena cava by an aneurism, and the development of a clot in the greatly dilated azygos vein, in which the collateral circulation had previously been carried on. He admits that he has been unable to find any other case recorded in which the symptoms came on so rapidly. There is an instance, however, reported by Duchek (*Prag. Vierteljsch. f. Prak. Heilk.*, 1854, xli. Also *Handb. spec. Path. u. Therap.*, 1862) in which rapid development of the symptoms of obstruction was probably due to the sudden production of a thrombus in the cava. The rapid formation of a dissecting-aneurism could also by compression quickly produce symptoms of venous obstruction.

In many cases symptoms indicating a degree of obstruction had existed for months or years before the rupture took place. Sisley's patient (XXVII.), for example, had had for some months swelling of the face, which came on after the day's work; and in Mayne's case (VII.) swelling of the eyelids, face, and hands, and dyspnœa, were produced by working. Gairdner's patient (XXVIII.) had been conscious for two years of pulsation in the right side of the chest. In Kraus's patient (XXVI.) there had been for sixteen months very evident and persistent œdema of the neck and throat, and later cyanosis as well. Dyspnœa, cough, and palpitation, and sometimes pain, had been noticed in a large number of cases. In Farrington's patient (XIV.) there had been for a year a small tumor in the right chest, presumably an aneurism. In our own case the previous existence of dilated veins upon the thorax was the only indication of the earlier presence of the aneurism. The existence of such symptoms, followed by a rapid and great increase in their severity, or by the accession of new symptoms, would indicate that some great and sudden change had taken place in the condition of the thoracic viscera—the most probable being, of course, the rupture of an aneurism. Many cases begin without previous symptoms. These would equally point to some great change in the thoracic contents.

3. *Evidence from physical examination of the presence of a tumor in the thorax, and the probability that this is aneurismal.* No reference is had here to the murmurs found, as these will be discussed separately. If the presence of an aneurism is confirmed in this way, in addition to the

indications already described, the diagnosis of rupture into the superior cava becomes greatly strengthened. In our own case the physical signs discovered in the chest were for the most part inconstant and contradictory, owing to the interference presented by the great œdema of the thoracic walls. One symptom, however, was nearly always observed, viz.: a degree of dulness below the right clavicle and under the upper portion of the sternum. A review of the reported cases shows that a percussion-dulness, occupying this same region, was frequently present. Not uncommonly this centre of dulness exhibited a thrill, usually systolic in time, though in one case (Case X.) diastolic. Thrill could sometimes be felt elsewhere, also. Thus, in Mayne's and Cossy's cases (VII. and VI.) a purring tremor could be felt in the internal jugular and subclavian veins on the right side. A pulsation was present over the centre of dulness in many instances, but absent in more. Mayne (VII.) and Glasgow (XIX.) describe it as strong and heaving, and in most of the cases where it could be felt at all it was well marked, and oftener stronger than the cardiac impulse. In some cases, as in those of Hayden's (XII.), Turner's (XXI.), Kraus's (XXVI.), and Schnaubert's (XVI.), it was indistinct or feeble. In Farrington's patient (XIV.) there was a distinct pulsating tumor visible to the right of the sternum from the second to the fourth rib. In our own case neither thrill nor pulsation could be felt. Mayne (VII.) and Glasgow (XIX.) describe the pulse as jerking, like that of aortic regurgitation, and consider it an additional proof that an aneurismal tumor is present. Gairdner (XXVIII.), also, refers to the pulse as that of unfilled arteries. In a number of instances it is reported as small and feeble, but there appears to have been nothing characteristic about it. It is sometimes stated to have been stronger in one wrist than in the other. Undoubtedly the difference has depended upon the varying degree of œdema of the arms, or some such factor, since aneurisms of the ascending portion of the arch would not produce this inequality. A venous pulse, as seen in the case of Cossy's (VI.) and of Sisley's (XXVII.), is a very valuable indication of the presence of a varicose aneurism. The existence in any case of such well-recognized symptoms of aneurism as dulness on percussion, thrill, and pulsation, together with the symptoms previously described, render the diagnosis very probable.

There remains to consider the last of the evidences of varicose aneurism:

4. *The existence of a murmur characteristic of a communication between an artery and a vein.* When this murmur is present the existence of a varicose aneurism becomes practically a certainty. Thurman first explained the nature of this murmur as occurring in spontaneous varicose aneurisms of the aorta, and dwelt upon its diagnostic importance, though

it was not present in the case of aneurism of the aorta and superior vena cava reported by him (Case II. of this series, IV. of his own). Its extremely loud and distinct character is due to the small size of the opening. The chief feature of the murmur is that it is *continuous*, this being due to the fact that the passage of blood from the aorta into the cava is a continuous one. During the systole the pressure is at its height, and the sound is consequently loudest and highest pitched. During the diastole the current from the artery to the vein depends on the elasticity of the arterial system acting upon the contained blood. The murmur is, therefore, still audible, though continually growing fainter and lower pitched, until the next systolic intensification. A perfectly typical murmur of this nature was present in our own case. It was also observed in the cases of Eastes's (X.), Jacoby's (XIII.), Arkle and Bradford's (XXV.), and Damaschino and Lavin's (XVIII.). In the first it is described as a soft, whizzing, very distinct murmur of a venous character, both diastolic and systolic, with its maximum intensity at the third right costal cartilage. It constituted a continuous churning sound, like that heard in the enlarged vessels of a thyroid gland. In Jacoby's case there was a loud, continuous, buzzing murmur, loudest with the systole, and heard best at the second right costal cartilage. In the case reported by Arkle and Bradford the continuous murmur was peculiarly harsh, loudest in the systole, and heard under the right clavicle, though the maximum intensity was in the second right interspace about 2 inches from the sternum. Finally, the diagnosis made by Damaschino and Lavin depended largely on the perfectly continuous murmur, heard loudest 3½ c.m. below the middle of the right clavicle. It was very intense, and had a systolic reinforcement, and was remarkable, especially during the systole, for its peculiar sonorous and vibrating character.

A continuous murmur would seem almost necessarily to owe its existence to a varicose aneurism. Neither a simple aneurism nor any form of valvular disease could produce the continuous sound, since there would need be a short interval between the systolic and diastolic portion. In our own case the peculiar continuousness of the murmur was noted, as well as the fact that its quality was distinctly venous. The effort was made to explain it on the ground that there existed an aneurism of the aorta pressing upon the cava and producing a murmur in it; and that during the cardiac systole the aneurism expanded and the pressure became greater. Consequently, the pitch of the murmur was elevated, since the lumen of the vein was made more narrow. This explanation was, we admit, fanciful, and, as the event showed, faulty. In fact, it was impossible that it could have been correct, since the increased pressure during systole would have diminished the intensity of the murmur, even though it elevated the pitch. That the peculiar continuous

murmur is pathognomonic of a varicose aneurism was recognized and maintained by Thurman. Mayne and Cossy equally urge its diagnostic value, though showing by their own cases that the symptom is not an essential one. In each the murmur was systolic only, which the writers explain on the ground that the very marked disease existing in the arterial walls interfered with the arterial contraction during the cardiac diastole, and in this way produced the absence of the diastolic part of the murmur. In fact, in several other cases (VI., VII., IX., XV., XVII., XXVI., and probably II.), only a systolic murmur could be heard, and in still more (III., VIII., XI., XII., XIV., XVI., XIX., XXI., XXIII.), there was a distinctly double murmur, with an interval between the two parts. It is therefore evident that the continuous murmur is not an essential symptom of varicose aneurism, though such a valuable sign when present. The maximum intensity of the murmur, of whatever nature, was nearly always on the front of the chest, in the neighborhood of the first portion of the arch of the aorta, or over the abnormal centre of dulness. The only exception was the case of Christianu's (XXIII.), in which the maximum intensity of the double murmur was situated in the right supra-spinous fossa.

The method of the production of these different murmurs in the different cases is not at all clear. Sometimes they may have been due to the passage of blood through the perforation, audible only during a portion of the cycle; at other times they may have been produced in the aneurism or in diseased aortic valves. It is a noteworthy fact that in certain instances the signs of aneurism were very meagre. In the cases, namely, of Young's (IV.), Law's (V.), Wetterdal and Wallgren's (XX.), and Sisley's (XXVII.), there was neither thrill, dulness, nor murmur discovered, and in the last three no pulsation. Shannon's patient (XXII.) exhibited a diastolic murmur at the first examination, but after this no physical signs of aneurism could be found. In the case reported by Beevor (I.) no description of the physical examination of the chest is given, and that reported by Gulliver (XXIV.) was only a card pathological specimen, unaccompanied by clinical details.

Autopsy.—Little need be said under this heading since the most important character—the perforation—was, of course, present without exception. The shape of the perforation in the different cases was slit-like or more circular; its size never very great—half-inch or so in length or in diameter—and sometimes quite small. In some cases the edges were irregular and ragged, but oftener they were to a certain degree smooth, showing that in a comparatively short time after the rupture this smoothing can take place. In Glasgow's case (XIX.) the perforation was found closed by a thick plate of laminated fibrin. A fact worthy of note is that in nearly all the cases it is directly stated that compression of the cava existed as well as perforation. In Turner's case

(XXI.) the cava was completely divided by the aneurism, so that the distal portion looked like a short arterial trunk given off from the aneurism at its upper border. In our own case the production of this separation was well under way when the patient died. In Reid's case (III.) the perforation involved also the upper part of the right auricle, at the position of entrance of the superior cava. Another most important feature bearing on the production of murmur in aneurism in general is, that in only 5 cases (IV., XIV., XXI., XXV., XXVI.) is disease of the aortic valves described.

Diagnosis.—Enough has been said about the characteristic symptoms. There is no condition with which the disease could be confounded except that of remarkably sudden obstruction of some other nature to the passage of blood in the vena cava, and such cases are almost hypothetical. From other varicose aneurisms of the aorta the diagnosis is easy. Rupture of an aneurism into the right ventricle or right auricle would produce general cyanosis and œdema. Rupture into the pulmonary artery could not produce the characteristic localization of œdema and cyanosis. The murmur would be heard at the left edge of the sternum instead of at the right edge. The dyspnœa would probably be intense, and symptoms of engorgement of the lungs would eventually be followed by general anasarca, as in mitral disease.

Prognosis.—As the reported cases show, the prognosis is most unfavorable. Death has supervened in every case but one. In Shannon's patient (XXII.) only 6 hours elapsed before the fatal issue; in the case of Farrington's (XIV.) 13–15 hours; in that of Wetterdal and Wallgren's (XX.) less than 24 hours; and in that of Sisley's (XXVII.) less than 12 hours. On the other hand, patients may live days, weeks, or even months. Our patient lived 7 weeks; that of Kraus's (XXVI.) 40 days; that of Thurman's (II.) 2 months; that of Turner's (XXI.) 23 weeks; that of Glasgow's (XIX.) 7 months. In this last case the patient, after one month, seemed about to recover; then grew worse, and died. The patient of Damaschino and Lavin's (XVIII.) was living and practically well at the time the report was published. Although the murmur remained the same, collateral venous circulation had become established about one month after the onset of the symptoms, and œdema and cyanosis had about disappeared. The permanent recovery in this case, and the temporary improvement in Glasgow's case, indicate that the disease is not necessarily fatal, though the favorable chances are very slight.

Treatment.—This has proved useless. Venesection is the method which has been most frequently employed, but never with permanent benefit. Cupping, wet or dry, and free purgation may be employed. The strength should be sustained as far as possible, in the hope that the collateral circulation may become established, if the perforation be not too large, or that the opening may become closed by a thrombus.

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