

Original Articles.

SUDDEN DEATH BY THE RUPTURE OF THORACIC ANEURISMS PREVIOUSLY UNRECOGNIZED.¹

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THE autopsy-room of a hospital is specifically dedicated to the study of morbid anatomy. Its air is heavy with the effluvia of disease, decay and death. Its ministering spirits, with erudite touch and penetrating vision, search out the secrets of nature. Infection, inflammation and degeneration render here their final account. The pathologist supplies the closing chapter in the natural history of diseases whose earlier incidents are written in the clinical records relating to the living patient. The first and the last observations upon the human subject, in connection with his fatal illness, sometimes fail to connect harmoniously, and the ward bed and the marble slab sometimes present details which do not blend. Nevertheless, the aid which clinical medicine derives from the anatomical amphitheatre of the hospital is too obvious to need elucidation. The aphorism of Dr. Holmes that, while pathological anatomy teaches a great deal, "it is, after all, like inspecting what is left of the fireworks on the morning of the fifth of July," is less true to-day than when he wrote it. Histology and bacteriology now lend their effective aid to the grosser methods of observation, and pathology co-operates heartily with clinical medicine in the advancement of medical science.

But the autopsy-room of the City Hospital of Boston has not exhausted its usefulness, great as that service is, by discovering and recording the anatomical appearances which the hospital patients bring to the dead-house after a period of observation in the wards. Through the courtesy of the trustees, and with the indulgent and cordial assent of the pathological department, autopsies are made here upon the bodies of such victims of crime or such subjects of sudden and suspicious deaths in the southerly portion of Suffolk County as require an official medical examination. It thus happens that many interesting medico-legal problems are presented here for solution. The privileges bestowed upon the medical examiner by the hospital place him under continued obligation. It is in recognition of this debt and of the very great help in the medical examiner's work which it implies that he accepts the invitation to contribute to these pages.

In fulfilment of this design, I have selected from notes of autopsies performed by me at the hospital a series of cases of thoracic aneurism. These cases are all instances of sudden death. Their subjects have this in common, that the disease of the aorta which ended life so suddenly had not been suspected or recognized or been made the occasion of medical observation or treatment. In this respect they illustrate a rule about which all writers are agreed, that a large number of aneurisms declare no sign of their existence, and that they are revealed by the post-mortem examination only. They show how imperceptible and with how little injury to health may be the growth of even a large aneurismal tumor. Finally, they are examples of the usefulness of autopsies in

¹ This paper will appear in the Boston City Hospital Reports, Sixth Series.

determining accurately the causes of tragically sudden death, and in taking the obscurity out of cases which are too often dismissed with a convenient expression like "heart disease" or the more objectionable but equally convenient phrase, "heart failure."

CASE I. Josephine S., aged thirty-seven, a hard-working charwoman, entirely free from disabling disease though a moderate user of alcoholic drinks, was found dead, lying in a natural attitude on the outside of her bed, with her outer clothing removed. She was last seen alive twenty-three hours previously. Her body when discovered was cold, and rigor mortis was fully developed. Her acquaintances supposed her to be a healthy woman.

Autopsy.—The body was spare but not emaciated. The countenance presented no suggestion of a painful death. The surface was pale.

When the sternum was lifted the left pleural cavity was found filled to its fullest capacity with yellow serum and dark-red, firm blood-clot, the whole mass measuring two quarts. This blood had escaped from a rupture in the inferior wall of an aneurism of the aortic arch. The aneurismal tumor projected posteriorly opposite the fourth, fifth and sixth dorsal vertebrae, and had eroded the vertebral bodies and intervertebral cartilages in this region to the depth of a quarter of an inch at the deepest, leaving the general surface roughened and irregular. The aneurismal sac was ovoid in shape, and measured four inches long, three inches wide, and one inch and a half thick. Within it were masses of firm coagulum, with dry, shaggy layers of fibrin.

The rupture was at the lowest part of the sac. The opening was valvular, from above downward. Externally it appeared as a rent in the aneurismal wall just below the root of the left lung, the lesion being irregularly crescentic, with the concavity downward, and with an opening at its uppermost part admitting a large probe.

The heart was normal. The left lung was compressed, dry and pale; the right lung was of normal volume, and moderately reddened. The other organs showed nothing noteworthy.

CASE II. John J., aged forty-three, intemperate and shiftless, had not been heard to complain of any ailment until the morning of the day of his death. At this time he procured from a druggist a "plaster for his chest." About three hours later he was seen on the street, looking so distressed that an acquaintance remarked upon his appearance, and J. replied, "I am sick." Presently he went into a store and sat down; he quickly became stiffened in a convulsion, was rigid and unconscious, breathed stertorously, gasped a few times and died, the whole transaction occupying but a few minutes.

Autopsy.—The surface of the body was very pale; there were scarcely any lividities of the skin. The mucous surfaces were blanched. Cadaveric rigidity was pronounced.

The heart was healthy and empty. The lungs were normal, though rather anemic.

In the abdominal cavity were sixty-six fluid-ounces of mingled fluid blood and blood-clot. The source and course of this hemorrhage were found to be as follows: At the junction of the transverse and descending portions of the aortic arch there was a projecting aneurism, with thin walls, the tumor being the size of an English walnut. This outgrowing sac had ruptured at its outer

part, and the escaping blood had dissected its way inside the sheath of the aorta, leaving a blood-stained track in the posterior mediastinum. It had then torn through the diaphragm between the aorta and the esophagus. It had then turned to the right, across the cardiac end of the stomach posteriorly, and here, tearing away the peritoneum of the stomach over a surface two inches by three inches, it had broken through and discharged into the general peritoneal cavity.

All the organs of the abdomen were structurally healthy. The brain was pale and wet.

CASE III. Winifred M., aged sixty-five, a homeless wanderer, depending on street alms and the poor hospitality of her acquaintances to keep her from starvation, was not known to be the subject of any disease, although she had been heard once to make an allusion to her "heart" as the seat of some indefinite disorder. On the day before her death she was on the street from morning till night, and returned to her temporary lodging in her usual health. Her bed was prepared for her on the floor, and she went to sleep at ten o'clock. In the night she shifted her bed from the corner of the room to the middle; and here at 7 A. M., she was found dead without any indication of distress in her attitude or countenance.

Autopsy. — The body was emaciated. The surface was pale, with some cadaveric lividities upon the dependent parts.

When the sternum was removed, the pericardium was observed to be distended, bulging outward, and freely exposed; it contained ten fluid-ounces of blood, fluid and clotted. The heart was moderately and symmetrically enlarged; its muscle was readily crushed by finger pressure. The aortic valves were moderately thickened at their free border, but were competent. The mitral valve was normal.

The aorta, beginning at a point near its origin, was dilated; the enlargement was rather greater on the upper or convex border, was fusiform in shape, without sacculation, and in size and contour resembled a lemon. The wall of the dilated artery was thinned to an appreciable degree; and the intima, not only of the arch, but of the entire thoracic portion as well, showed large patches of atheroma, some of them with calcareous plates.

Immediately to the right of the innominate artery, on the upper curve of the transverse part of the arch, there was a rent in the intima of the aortic wall, transverse in direction, and one inch long; the edges of the rupture were irregularly indented, but the general direction was linear and straight. The situation of this internal rent was above the line of the pericardial attachment. But the blood, instead of forcing its way directly out at this point, had dissected a passage backwards and downwards, along beneath the outer coat of the artery, and had found its entrance into the pericardial enclosure, through a longitudinal rent an inch and a half long, and two inches below its rent of exit through the inner coat of the aorta. The tissues between the two ruptures were infiltrated with blood.

Both pleural cavities were obliterated by old pleuritic adhesions. Both lungs were engorged. There was no blood in the bronchi.

There was no sign of disease about the abdominal or pelvic organs. The brain was normal in appearance.

CASE IV. Joseph F., aged seventy-five, was alive and well at 6.30 A. M., when his room-mate left him

at home. He had been out of doors through the previous day, and was not known to have any ailment. At 1 P. M. he was found dead on the floor of his bedroom. He was in a kneeling posture, with his forehead resting on the floor in front of him. His trousers were down about his thighs.

Autopsy. — The body was spare. Rigor mortis was fully developed. The face was livid.

The pericardium was distended and bulging, showing a dull purple color through its wall. It contained twelve and a half fluid-ounces of blood, fluid and clotted, the clot being soft and of a dark color.

The heart was normal in appearance; its valves were all competent and in healthy condition.

The aorta was dilated; its intima was thickened and roughened from the semilunar valves to the iliac bifurcation, the result of atheromatous degeneration.

Just above the anterior coronary orifice, in the ascending portion of the aortic arch, there was an aneurismal sac projecting outward and to the right, and having a cavity of about the size and shape of a large olive. At the outer aspect of this small sac was a crescentic, valve-like rent, extending downward into the pericardium. The external lesion in the outer coat of the vessel was curvilinear, three-quarters of an inch long. The orifice through which the blood escaped through the intima was irregularly rounded and of the about the size of a pea.

The lungs were injected. The spleen was softened almost to a condition of diffluence; it was small, dark-red, and adherent to the adjacent tissues by the products of former inflammation. The stomach and intestines were normal. The liver showed the appearances of fatty infiltration. The kidneys represented chronic interstitial inflammation. The brain was unnaturally moist.

CASE V. Leodegar M. L., aged fifty-one, was found dead in his room in a hotel, lying back against some pillows on a lounge, one foot on the lounge and the other hanging off its edge. An hour and a half previously he had walked up the three flights of stairs leading to his room, and seemed in his usual good health and spirits when he entered the hotel office.

He was the subject of a lateral curvature of the spine, and to his acquaintances this appeared to be his only disability. It was ascertained from one his intimate friends, however, that for many months he had had pain in his shoulders and in the right sub-clavicular region, to such a degree that he had talked of sudden death as a possible termination of his trouble. The last evening of his life he had seen a well-known and experienced physician who gave him some advice of a general nature, but did not entertain the idea of any serious organic disease.

Autopsy. — The body was emaciated. The countenance indicated distress. There was a marked lateral curvature of the spine in the dorsal region, which gave also a "pigeon-breasted" deformity to the sternal region.

When the sternum was removed, the pericardium was observed to be prominent, distended and elastic, showing dark contents through its translucent wall. It contained sixteen fluid-ounces of blood, fluid and clotted. The source of this hemorrhage was found to be a minute rupture in the wall of an aneurism of the ascending and transverse portions of the aortic arch. This portion of the artery was enlarged to about twice its normal size; its intima was rough and thick. From

the outer and upper part of the ascending section a secondary projection was found, the result probably of a former rupture of the aortic wall. The wall of this smaller sac was relatively thin, and was lined with loose, rather dry clot. At its upper border, as close as possible to the pericardial line, was a minute orifice, hardly admitting the head of a small probe. The size of the sac was that of a large apricot.

The heart was firmly contracted and empty; its structure was normal. There was no effusion of blood outside the pericardium. The lungs were injected; in other respects they were normal. The spleen and kidneys were reddened. The other organs were healthy in appearance.

CASE VI. John H. H., aged fifty-one, ran to catch a train which was about to start. He entered a car and took his seat. Presently he was observed to be ejecting blood copiously from his mouth; his death quickly followed. It was learned from his kindred that he had been ailing many months with some obscure symptoms which represented "heart disease" to him; but he had not been incapacitated for the performance of his daily duties. He himself had anticipated sudden death.

Autopsy.—The body was sparsely nourished. The surface was pale. Post-mortem rigidity was pronounced. Dried blood was in the nostrils, on the mustache and beard, and on the lips and teeth.

On raising the left lung, a firm adhesion was found posteriorly, near the apex, tying the lung to the spinal column and the adjacent ribs, over a surface two inches in diameter. When the heart, lungs, esophagus, and aorta were removed together, this area of adhesion was found to be a portion of the wall of an aneurism of the thoracic aorta, involving the lower section of the descending portion of the arch as well. The aneurism consisted almost wholly of the dilated arterial walls, much thinned; there was no deposit of fibrinous layers within it. The lining surface was rough from atheroma, with projecting calcareous plates. The part next to the spine, where the adhesion was found, had eroded the bodies of the vertebrae to a slight extent. Just in front of this eroded space, the aneurism had ruptured in a forward and upward direction into the upper lobe of the left lung. At the point of rupture, the wall was thinner than elsewhere. The rent was irregular and somewhat stellate in shape, and admitted the tip of the finger. The size of the aneurismal cavity was about that of an orange.

The entire arch of the aorta was considerably dilated, and its intima was roughened and thickened. The aorta below the aneurism also showed atheromatous changes, without dilatation.

The heart showed no change whatever from the normal condition, in size, thickness of its walls, color of its muscle, or state of its valves. Its cavities were empty, and its left ventricle was contracted.

The left lung at the point opposite the aneurismal rupture showed an excavation half an inch deep and of irregular periphery; all around this the tissues were infiltrated with blood, giving an engorged appearance to the entire upper lobe, and, to some extent, the upper part of the lower lobe also. There was no blood in either pleural cavity. The right lung was somewhat reddened. The trachea and bronchi contained blood, and there were about four fluid-ounces of clotted blood in the stomach.

The other organs showed nothing noteworthy.

CASE VII. An unknown woman about sixty years old, presenting the aspect of a homeless street-beggar, was seen to stagger across Atlantic Avenue and to drop helplessly upon some store steps. She was bleeding from the mouth. She was insensible when the bystanders reached her, and presently she died. The front of her dress was blood-stained, but the evidences of very profuse hemorrhage were wanting. The body was not identified, and therefore all knowledge of her health previous to her attack on the street is lacking.

Autopsy.—The following appearances were the only ones of immediate interest: The upper portion of the thoracic aorta, just below the arch, presented an aneurismal dilatation of the size of a large orange; it was located opposite the bifurcation of the bronchi. Portions of the wall were very thin, while other parts were much reinforced by layers of fibrin. The aneurism had ruptured into the bronchi. There was no blood in the pleural cavities. The lungs were engorged, and the bronchi and trachea contained frothy blood. The heart was enlarged, the hypertrophy being chiefly on the left side. The aortic valves were thickened, and behind them were small calcareous plates of great density. The aorta was dilated just above the valves, and at one point in the ascending portion the walls had yielded, forming a depression one inch in diameter and a quarter of an inch deep. The intima of the aorta throughout its extent was thick and rough.

CASE VIII. Michael F., aged seventy-seven, was seen to topple over as he was in the act of crossing Park Square at 10 o'clock A. M. Medical attendance was immediate, and the man was placed in an ambulance and transferred quickly to the City Hospital. On his arrival he was in a state of profound collapse. He gave his name and address, but no other facts. He died at 10.45 A. M., three-quarters of an hour after the seizure. His family stated later that they had had no knowledge of any disability of which he was the subject.

Autopsy.—The body was spare, and its surface was pale and exsanguine. The pericardium, prominent and bulging when first exposed, was found to contain a pint and a half of fluid blood and soft clots. The heart was moderately enlarged, and its left ventricle showed a thickened wall; its valves were normal.

The arch of the aorta was much dilated, its lumen being expanded into a cavity of the size of a large lemon. In the descending portion of the arch, just behind the pulmonary artery, there was a transverse rent in the intima, two and a half inches long, linear, straight, but not penetrating into the pericardium; the most careful exploration failed to discover any communicating opening, and the conclusion was that the leakage seemed to be by filtration through the outer layer of the aorta's wall. The inner coat of the aorta was thick and rough, and the lumen of the artery below the arch was narrow and irregular. The tissues in the posterior mediastinum and in the posterior parts of both lungs were fully infiltrated with blood; the lungs elsewhere were edematous. About a pint of thin, bloody serum was found in the pleural cavities.

The spleen, pancreas, stomach, and intestines were normal. The liver represented passive congestion. The kidneys were typical specimens of chronic interstitial inflammation.

CASE IX. Chipman H. S., aged thirty-seven, was admitted to the City Hospital about 10 o'clock p. m., January 20th, at the request of a physician who stated that the man was suffering from paraplegia, in some way connected with two doses of a poisonous drug prescribed by an irregular practitioner. It appeared from S.'s story that he had not suffered any disability until the forenoon of that day; at this time his "legs gave out" and he sank to the floor of his room. He said he had great pain in his back, not localized, but general. There was also an account of vomiting and of the passage of bloody matter in his dejections, and this lent some aid to the theory of poisoning.

At the hospital a loud souffle was heard over the heart. The man was restless, very thirsty, and disinclined to talk. Toward morning, January 21st, he sank into a stupor and had some equivocal convulsive movements. He gradually failed, and died at 12.05 p. m., that day. The hospital diagnosis was not conclusive, but cerebral hemorrhage seemed the probable condition.

Autopsy.—The body was well nourished and of good muscular development. Cadaveric lividities were more than ordinarily pronounced on the lateral and dependent parts.

The heart was hypertrophied without dilatation. Its valves were all in normal condition. The myocardium was pale but firm. The aortic arch was dilated moderately and displayed old endarteritis. The aorta below the arch and to within five inches of the diaphragm was normal. At this point, just above the diaphragm, there was an aneurism of the size and shape of a large kidney. Its anterior wall was adherent to the posterior surface of the lower lobe of the left lung. Its posterior wall was the exposed and eroded bodies of the eighth, ninth and tenth dorsal vertebrae; the necrosis of these bones had gone so far as to leave upon the front and left side deep excavations into which the forefinger could easily be laid, leaving a thin shell of denser bone at the upper and lower margins, with the intervening cartilages in place. Around this bony destruction the aneurism was firmly attached to the bone at either side. The contents of the sac consisted of laminated and rather dry, easily broken blood-clots, brownish-red in color, through which ran a tortuous blood canal of the size of the finger.

The lungs, spleen, stomach, intestines and liver were healthy. The kidneys were injected. The brain was of normal appearance.

The spinal cord was taken out from behind. The vessels of the dura were injected throughout the dorsal region. The body of the tenth dorsal vertebra, in front of the dura, was carious and dark-red. The ninth vertebra showed less change. There was a marked excess in the spinal fluid, fully distending the cavity of the dura. The vessels of the pia were fully injected, especially along the anterior surface of the cord. In the anterior and left lateral columns of the cord, near the affected vertebrae, there was a marked degree of reddening, in contrast with the color above and below; but the consistence of the cord was normally firm.

CASE X. Patrick J. S., aged thirty, a tailor by trade, had been ailing many months with an obscure pain in his right side; and, also, at times, with what he had called "neuralgia of the heart." He had

received medical treatment for "liver complaint." He had kept at his work, without interruption, up to the hour of his death. The first symptoms of his approaching end were pallor and great dyspnea. He entered a liquor store, where he was known, and sat down "panting for breath." A carriage was called, and the man was placed in it and started for the City Hospital. He died on the way.

Autopsy.—The body was lean. There was rather more than the usual degree of cadaveric lividity.

The left pleural cavity contained ten fluid-ounces of thin, red fluid. Both lungs were, in general, gray in color, and were thoroughly edematous and sodden. The right lower lobe and left upper lobe were injected more than other parts; but the reddening was very moderate in degree. The pericardium contained five fluid-ounces of straw-colored serum. Both ventricles were firmly contracted; their walls were not thickened. The several valves were normal.

An aneurism projected from the anterior wall of the aorta, immediately above the semilunar valves. Its size was that of a small orange. Its wall was translucent at its most projecting part; elsewhere it was lined with friable coagula, or masses of fibrin, and was opaque and thickened. The orifice of entrance to the sac, seen from within the aorta, was one inch above the right semilunar valve, and appeared as a round aperture through the wall of the vessel; the opening admitted the tip of the forefinger.

The aneurism was so located that it overlay and nearly obliterated the lumen of the pulmonary artery just above its origin at the heart. The aortic arch was moderately dilated, and its intima was thick and uneven.

The other organs of the body displayed nothing noteworthy.

In addition to the features which the foregoing cases have in common (the suddenness of their termination and the fact that the development of serious aortic disease had never been discovered or treated), these deaths suggest some points of special interest, among which the following may be deemed worthy of mention:

(1) The rupture of an aneurism of the aorta, although it sometimes has physical exertion as its exciting cause (Cases V and VI), does not of necessity require such a cause (Cases I, III, VIII).

(2) The pericardium, more often than other cavities, receives the escaping blood; and, in these cases, it is not the amount of the hemorrhage which kills, but the inhibition of the heart's action, by compression of the cardiac walls, in a sac filled to distension with blood (Cases III, IV, V and VIII).

(3) Deaths by aneurismal rupture, although deserving the description "sudden" are not instantaneous; an appreciable interval (Case VI), and, sometimes, a very considerable period, elapses between the attack and its termination (Cases VII and VIII).

(4) A death by aneurismal rupture is not generally a painful one (Cases I, III); although it may leave evidences that it is so in some cases (Cases IV and V).

(5) The escaping blood in an aneurismal rupture does not always follow the line of least resistance (Case II); and, sometimes, it makes a devious dissection to reach an outlet (Cases III, IV).

(6) Its small size and fusiform shape do not give

an aneurism immunity from sudden rupture (Cases II, III, IV, VIII).

(7) An aortic aneurism is not necessarily an affair of advanced life (Cases I, II, V and VI).

THE ANTITOXIN TREATMENT FOR DIPHTHERIA.¹

A CLINICAL REPORT.

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THE object of the present paper is to report the results of the treatment of diphtheria by antitoxin in a series of cases in my recent service in the contagious wards of the City Hospital. This service comprised the two months of December and January. Through the enterprise and liberality of the trustees a supply of antitoxin was secured about December 12th, and the first injection was made on that date. The first twenty injections were made with the solution prepared under the direction of Behring and Scherer, and the remainder were with the product of Dr. Gibier, from the Pasteur Institute in New York. Most of the former series were made with the "No. 1" strength, of which ten cubic centimetres, the dose usually given, contains 600 immunization units. In a few cases the No. 2, representing 1,000, and the No. 3, representing 1,500 antitoxin normals, were used. The Gibier product was furnished in two strengths, marked 1-50,000 and 1-80,000, the latter of course the stronger, as one part was supposed to immunize an animal of 80,000 times its weight against what would be to it a fatal dose of diphtheria toxine. Dr. J. L. Morse, who made some tests of this material found that a specimen marked 1-80,000 actually immunized a guinea-pig of 11,500 times its weight against ten times its fatal dose of toxine.

The treatment, other than antitoxin, employed in the cases to be reported, was frequent feeding, alcohol, iron and cardiac stimulants as required. Locally, irrigation was practised with normal salt solution, or diluted Dobell's solution, whenever it could be done without provoking great resistance from the patient. When violent resistance was encountered which seemed to exhaust the patient's strength, irrigation was omitted.

Before passing to the consideration of the antitoxin cases it is worth while to say a word regarding the cases which were treated during the same interval without antitoxin. This latter group, rejecting all which did not show the Klebs-Löffler bacillus, comprised 40 cases. The reasons why antitoxin was not employed in these cases were as follows:

In nine cases, lack of serum; that is, in nine cases which were suitable for treatment the material was not at hand. Of these, three died.

In six cases, lateness in the disease. In these the patients had been ill five days or more when they came under treatment, and in the scarcity of the material it seemed wise to withhold it in favor of more promising cases. It is to be noted that it was the lateness and not the gravity of the disease which governed this selection. Three of these patients died, and three recovered.

In five patients antitoxin was withheld because they entered moribund. All these died within two days of entrance.

¹ Read before the Boston Society for Medical Improvement, February 18, 1895.

In two cases, antitoxin was withheld because of a negative report from the bacteriologist on the first examination, although the second examination showed the diphtheria bacillus. Of these two cases one died. A corollary of this is that in cases clinically diphtheria it is not well to wait for a bacteriological verdict before using the remedy, and so to lose valuable time.

In 18 cases the remedy was withheld because of the mildness of the disease and the probability that the cases would recover without antitoxin. They all did recover.

On the whole it may be said that the group of 40 cases represented rather less than the average gravity of the disease. The deaths were 12, or 30 per cent., and the recoveries 28, or 70 per cent. Three of the deaths were intubation cases, and no intubation in this group recovered. It may be said in passing that there were five other non-antitoxin cases which had laryngeal membrane and failed to show the diphtheria organism, of which two recovered without operation, two with operation, and one died after operation.

The average duration of the residence in the hospital of the 28 non-antitoxin diphtherias which were discharged well, was fourteen days.

Turning now to the group of antitoxin cases, I have to report 80 cases of diphtheria treated by this remedy between the dates above mentioned. As a matter of fact, 91 cases which would clinically be classed as diphtheritic received injections; but I have excluded from the list all who failed to present the bacteriological evidence of the disease. In reality, I believe some of them to have been, notwithstanding the negative report of the bacteriologist, true diphtheria; and their inclusion would of course raise the percentage of recoveries of the treatment. For example, among the 11 cases were two of membranous laryngitis, intubation and recovery, and two children with membranous throats, one of them septic, who had brothers or sisters in the hospital at the same time, with undoubted diphtheria, a fact strongly presumptive of the diphtheritic nature of the membrane in the other children.² In order, however, to disarm criticism, I exclude all these cases; and we have left 80 patients clinically and bacteriologically suffering from diphtheria. The cases represented rather more than average severity, especially during the earlier part of the series. In view of the scarcity and expensiveness of the material, such cases only were selected for treatment as were of sufficient gravity to make it reasonably likely that they would prove to show the diphtheria organism.

Of these 80 patients, 13 died, a mortality of 16 per cent. A study of these fatal cases may be of interest and profit, and I will therefore briefly describe them. As to the first two, there is considerable doubt as to whether they should be considered deaths due to diphtheria, though I have included them in the list.

CASE I. G. B., male, age six. Entered December 9th. Injected December 12th, on the seventh day of his illness. Membrane disappeared in two days, but returned. Reinjecting December 18th. Contracted scarlet fever December 21st, from which he died Jan-

² Of the occasional failure of bacteriological evidence of diphtheria, I would cite an instance in one child (Mullaney), who had membrane on both tonsils and palatine arch, and a nasal discharge. Two cultures from the throat showed pure staphylococcus aureus; two from the nose also failed to show the diphtheria organism; and, finally, a fifth culture, twelve days after entrance, showed for the first time the Klebs-Löffler bacillus, and that in the nose only. This patient is living at the present writing, twenty-two days after his first injection, but is not yet well. He is, however, the only one of the non-fatal cases which is not convalescent.