

On haemoptysis, especially when fatal, in its anatomical and clinical aspects / by Vald. Rasmussen ; translated from the Hospitals-Tidende by William Daniel Moore.

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HÆMOPTYSIS,

ESPECIALLY WHEN FATAL,

IN ITS

ANATOMICAL AND CLINICAL ASPECTS.

BY DR VALD. RASMUSSEN.

TRANSLATED FROM THE "HOSPITALS-TIDENDE,"

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HÆMOPTYSIS,

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ALTHOUGH Hæmoptyses, or the hæmorrhages occurring through the air-passages, have from the earliest period attracted the general attention of medical men, as the very name Hæmoptysis, derived from Galen, testifies, it is nevertheless a fact that the source of these hæmorrhages, the absolute demonstration of the vessel or vessels whence the blood has come, has almost entirely escaped the observation of investigators, and the discussion of this point has therefore been almost exclusively confined within the uncertain domain of hypotheses. One of the most eminent clinical physicians of our time, Walshe,¹ has consequently, not altogether without reason, in treating of pulmonary phthisis, in which hæmoptysis most frequently occurs, indicated the precise demonstration of the ruptured vessel from which the blood has issued, as a desideratum.

Before I proceed to detail my own investigations in this direction, I shall give a short sketch of the views of the principal writers on pulmonary hæmorrhages in general, and especially on their sources.

The earlier literature is rich in reports of profuse hæmorrhages, and in many of them the quantity of blood brought up borders almost on the incredible, as 30 pounds in three hours (Rhodius). As to the source of the hæmorrhages, however, only rare and imperfect information is given, which is the more unfortunate, as in some writers indications are met with of circumstances similar to those which form the basis of the following essay. Thus varices are spoken of by Gilibert² as the cause of hæmoptysis and phthisis:

¹ Diseases of the Lungs, translated into Danish by J. Blicher, Copenhagen, 1861, p. 518.

² Adversar, p. 64. Quoted by J. Frank, Prax. Med. pars ii., vol. ii., sect. 1, p. 418, and elsewhere.

“Varices pulmonum sunt principium hæmoptysis et phthiseos; has etiam scalpello occupavi.” Morgagni¹ says that, in the dissection of individuals who had died of hæmoptysis, he has seen tubercles with dilatation of the surrounding vessels. De Haën² says he saw an aneurism open into a cavity. Portal³ states that he has observed ruptured vessels from the lymphatic glands opening into the bronchi. J. Frank⁴ mentions a case where, in the dissection of a young man who had died during an attack of hæmoptysis, on injecting the pulmonary artery, he found that the injected mass had penetrated into a cavity.

While the earlier writers in general sought the cause of pulmonary hæmorrhages in rupture of larger vessels, observers in the present century began, supported especially by the authority of Laennec, to assume the existence of an exudation (diapedesis) of blood from the bronchial mucous membrane in those cases where no ruptured vessel was demonstrable; and this view has been maintained to our own day, modified only by the altered anatomical requirements, capillary hæmorrhages being substituted for exudation.⁵

What most essentially contributed to this change in the general opinion as to the source of the hæmorrhages, was the discovery that the vessels in the condensed tissue surrounding the cavity are obliterated. Baillie⁶ was the first to call attention to this condition, in which he saw an effort of nature to prevent hæmorrhage. Laennec⁷ demonstrated this by injections, and found at the same time that the trabeculæ which so frequently traverse cavities enclose obliterated vessels, which in rare cases, though usually only partially, may remain open. J. F. Meckel's⁸ injections confirmed Laennec's,

¹ Quoted by J. Frank, *loc. cit.*, and in the Dict. des Sciences Méd., but without a reference; the matter is not mentioned in his De Sedib. et Causis Morborum. It is scarcely possible that Morgagni can have instituted very profound investigations in this direction, as he states (epist. xxii. artic. iii.) that he avoided and dreaded the bodies of those who had died of phthisis to such a degree that he never, even in advanced age, touched them.

² Quoted by J. Frank, but unfortunately incorrectly; it is scarcely to be found in his Ratio Medendi.

³ Dict. des Sciences Méd., art. Hémoptyse, p. 319.

⁴ *Loc. cit.*, p. 420, note.

⁵ That diapedesis may in fact take place is shown, however, by Cohnheim's recent experiments on venous stasis (Virchow's Archiv, bd. 41, p. 220); after tying the femoral vein, he saw the red blood-corpuscles exude from the congested capillaries, whose walls were intact; probably this exudation takes place through Edmansson's openings, yet the quantity of blood exuded in this mode must of course be only comparatively small, and is without importance in reference to hæmoptysis.

⁶ The Morbid Anatomy of some of the most important Parts of the Human Body, London, 1793, p. 45. Baillie, as well as J. F. Meckel, mentions, however, that Stark had previously observed that the vessels are closed by coagulated blood.

⁷ Traité de l'Auscultation Médicale, 4me édit., p. Andral, Paris, 1837, p. 185.

⁸ Handb. d. pathol. Anat., Theil ii., Abth. ii., Leips., 1816, p. 375.

but showed that vessels without constriction of their cavity may pass in a cord-like form from one wall of the cavity to the other. Schroeder van der Kolk's¹ injections proved that the closing takes place from the smaller branches, and gradually extends to the larger. This obliteration of the vessels was subsequently confirmed by several, as Guillot, and the correctness of the observation was generally recognised; in accordance with this, most writers, with the exception of Rokitansky, assume that the hæmorrhage in the rare cases in which it comes from a cavity is due to erosion of such a non-obliterated vessel passing through the cavity. We shall at greater length refer to some of the more important writers.

Laennec² states that it is not impossible that a branch of the pulmonary artery or varices of the pulmonary veins may give rise to hæmorrhage, though he brings forward no regularly described case. Considerable, nay even fatal, hæmorrhages arise from rupture of a vessel passing through a cavity, as well as by the bursting of an aneurism of the aorta into the pulmonary passages. Most cases of slight or moderate hæmorrhage proceed from the bronchi by an exudation of blood from the mucous membrane of the latter. More violent hæmorrhages from the pulmonary parenchyma are due to pulmonary apoplexy.

Andral³ enumerates three sources of pulmonary hæmorrhage:—
1. From the bronchi, bronchial hæmorrhage, only in one case without coexistent pulmonary tubercles; he was not, however, in a position to demonstrate the starting point of the bleeding; the mucous membrane is stated only to present simple signs of bronchitis, and to be pale. 2. Pulmonary apoplexy. 3. From a cavity; such cases are however, on the whole, rare, and Andral has only once been able to point out the vessel from which the blood came; it was found in this case enclosed in a trabecula passing through the cavity; the vessel was eroded, and contained a little decolorized coagulum.

In opposition to Andral's view of bronchial hæmorrhage as the most frequent cause of hæmoptysis, which is that which has found most adherents, some authors assume that the hæmorrhages in phthisis—for it is only in this disease that the explanation meets with difficulties—stand in a more or less direct relation to tubercular deposition. Thus, according to Engelstedt,⁴ the expectoration of blood depends not so much on the tubercles as on the altered collateral circulation in the inferior and not yet condensed portions of the lung, whose vessels remain distended with blood, and may therefore easily burst, when an exciting cause, as a fresh deposition of tubercle, a blow on the chest, etc., occurs. Of six individuals who

¹ *Observat. Anatom. Patholog.*, fasc. i., Amstelod., 1826, pp. 75 *et seq.*

² *Traité de l'Auscultat Méd.*, 4me edit., p. Andral, Paris, 1837, p. 81.

³ *Clinique Méd.*, t. iv. pp. 165 *et seq.*

⁴ *Phthisis, en anat.-klinisk Undersøgelse* (an Anatomico-Clinical Investigation), Copenhagen, 1853.

died shortly after expectorating blood, no trace of hæmorrhage was met with in or around the cavities; only in one per cent. did the hæmorrhage cause death.¹ In two instances non-obiterated, cord-like vessels were found passing through the cavity. Walshe looks upon hæmorrhage from the bronchial mucous membrane as exceedingly rare; according to him, molecular rupture of the capillaries of the parenchyma is the cause of hæmorrhage in tuberculosis, with the exception of the very rare cases where a vessel of more considerable size is perforated.

Rokitansky is certainly the only writer who describes cases such as those constituting the subject of the present essay. According to him, hæmorrhages during the course of phthisis are in the commencement rare and scanty; at a later period they are copious and frequent, and then proceed from branches of the pulmonary artery situated in the condensed walls of cavities, especially of bronchiectatic cavities, and in isolated cavities with aborted tubercles. The vessel becomes exposed partly by fresh deposition of tubercles, partly by a necrotic process in the wall of the cavity, so that it comes to want its accustomed support; it is soaked with the contents of the cavity, becomes thereby macerated, jelly-like, and soft, and at last bursts into the cavity. This takes place either by the formation of a split-like fissure in the vessel, or by the separation of a portion of the vascular wall giving rise to a round hole. Very frequently this is preceded by an aneurismatic dilatation of the vessel in towards the cavity. A preparation is mentioned as a rare case, where, in the wall of an immense cavity, a large branch of the pulmonary artery is found exposed to a certain extent, bulging in towards the cavity, and opened on a level with the bulging, a piece of the vascular wall of the size of a pea having separated, with the exception of a very small spot, so that a convex-concave lid is formed over the cavity.

Niemeyer's theory of pulmonary hæmorrhages, which is moreover quite that of Andral, I shall hereafter take occasion to state, and shall now mention only the most recent phthisiological work of Hérard and Cornil² which relates to hæmoptysis. The authors suppose that where, during the course of chronic phthisis, blood is expectorated, this is due to ruptures of small capillary vessels from little fungous excrescences in the walls of recent cavities; from cavities of longer standing no blood can come, as the vessels are obliterated in their immediate circumference. We are, they say, on the whole much more inclined to believe that the hæmoptysis is due to a fresh deposition of tubercles, which undergo the same changes as in the parts of the lungs first attacked. The authors indeed mention violent hæmoptyses, but no case where death occurred

¹ Louis (*Recherches sur la Phthisie*), among eighty-seven cases of phthisis, saw hæmoptysis only four times in the last days before death, and of these only two were to any considerable degree; there was no fatal case.

² *De la Phthisie Pulmonaire*, par Hérard et Cornil, Paris, 1867.

as the result thereof. On the whole, they do not give one positive contribution to the anatomy of the hæmorrhages. In chronic pneumonia hæmoptysis is, according to them, a symptom of the last period (ulceration), while in tuberculosis it occurs in the commencement of the disease.

The cases in which patients have died during violent hæmoptysis, and which form the basis of the following sketch, amount in all to 11, and fall into two groups:—1. Cases where the hæmorrhage proceeded from rupture of a vessel running in the wall of a cavity; and, 2. Cases where it was due to rupture of an aneurism of the aorta into a bronchus, or into the pulmonary tissue itself. The first group comprises eight cases; the second, three. Hæmorrhagic infarctions (pulmonary apoplexy), pulmonary gangrene and cancer of the lungs, in the course of which it is well known that hæmorrhages, though in general not profuse ones, also occur, are not unfrequently met with in the Municipal Hospital (Kommunehospitalet), but have never been attended with such considerable hæmoptysis as to cause death, and they have consequently not been the subject of anatomical investigation.

I.—HÆMORRHAGES FROM A CAVITY.

These are due partly to ruptures of small sac-like aneurisms, developed on branches of the pulmonary artery, running in the walls of cavities, partly to dilatations (ectasias) of similar vessels with operculated rupture. These two forms occur with equal frequency—each of them, namely, in four cases.

The Aneurisms.—The size of these varies considerably, from that of a walnut to that of a pea and under; they are formed by the dilatation of a vessel in contact with the inner wall of the cavity, the part of the vascular wall touching the cavity at the point of contact being dilated, while the remainder lies firmly embedded in the condensed vascular wall. The form of the aneurism is at the same time given as sacculated with a tolerably uniform transition between the walls of the aneurism and those of the vessel, without any proper neck (*A. sacciforme verum*). The surface of the aneurism is smooth; only in one case where it was very large (as a walnut) was a small bulging of the size of a pea met with. In its cavity most frequently only freshly coagulated blood is found, and only in one instance, that just now mentioned, were the well-known, firm, decolorized, adherent coagula met with.

The walls are of various thickness. In aneurisms which have not burst, they are thickened, often two or three times thicker than the rest of the vascular wall; and when these, as was always the case, are small, the aneurism forms only a slight, dome-like dilatation on the vessel. In general, and invariably when the size is more considerable, the walls are however thin, only slightly or not

at all exceeding in thickness the vascular walls, and are particularly attenuated up towards the apex or point of perforation. Both forms may occur side by side (4th case). In some instances considerable fatty degeneration of the wall of the aneurism was met with, exhibiting itself as segregated and confluent, yellow, sharply-defined points; a circumstance to which I shall hereafter revert, when speaking of the causes of rupture.

The rupture takes place always at the most prominent point of the sac, and there is usually formed an irregularly fissure-like rent, rarely exceeding in width two or three millimètres, most frequently it is only large enough to allow the knob of an ordinary probe to pass. In the opening adhere loose, dark coagula, which are more rarely firm and somewhat decolorized. The edges are attenuated, yellowish, though the colour is often difficult to recognise on account of the imbibition of blood; but under the microscope distinct fatty degeneration, especially of the muscular coat, is visible.

The number of the aneurisms varies. In general only one is met with; in one case two were found close to one another; in another there were so many as four, two and two close one to another on the same branch. The vessels on which the aneurisms were located were on an average from one to three millimètres in width.

CASE 1.—*Aneurisma ruptum et ectasia rami arter. pulmonalis in cavernâ bronchiectaticâ; Pneumonia chronica; Bronchitis; Arteriosclerosis art. pulmonalis (levi gradu); Cyanosis renum.*

H. T. Wulff, aged 64, was admitted on the 8th May 1866 into the second division of the Municipal Hospital. In 1853 he had cholera, but had never suffered from any other serious illness. For many years he has every spring had some cough, which has passed off toward summer, and never gave him further inconvenience. During the last month the cough has been a little more persistent, though without causing any pain in the chest, but his general health has suffered a little. Six days ago he expectorated, during a fit of coughing, which was at the same time accompanied with vomiting, four or five ounces of blood, some of which was coagulated, while the remainder was dark and fluid; previous to this he had no abnormal sensations in the chest; he cannot state whether it was the cough or the vomiting which gave rise to the expectoration of blood. A similar attack, during which a much smaller quantity of blood was brought up, took place the day before yesterday.

On admission the patient was found to be strongly built for his time of life; his expression was natural. He complains only of pain in the head during the cough, which is rather frequent and troublesome, and accompanied with a scanty, viscid, and coloured expectoration. The tongue is moist, and is but slightly furred; there has been no nausea or vomiting for the last six days. Pulse 80, full; appetite slight; sleep for the last few nights has been

disturbed by the cough. On examining the chest, the sound on percussion is found to be rather dull in the clavicular, infra-clavicular, supra-spinous, and in the upper part of the infra-spinous regions, and expiration is there rather prolonged; over the rest of the chest nothing abnormal is met with, but the respiration is on the whole rather feeble.

On the 9th, about six or seven ounces of dark, cherry-coloured, fluid blood, containing some coagulated lumps, and mixed with a quantity of mucus, were coughed up. The pulse was 80, and was very full. The patient was bled to twelve ounces, and was put upon a solution of watery extract of *secale cornutum*.

10th.—The patient felt relieved immediately after the bleeding, but towards night the cough returned, when a couple of ounces of expectoration mixed with blood were brought up.

11th.—The expectoration is again to-day freely mixed with blood. The patient had but little sleep at night, having been disturbed by the cough. Pulse 84, less full; syrup of acetate of morphia, one drachm three times a day.

12th.—Slept well, cough considerably less, but the expectoration, which has a characteristic bronchiectatic smell, is still mixed with blood. Pulse 84, full; appetite good.

On the afternoon of the 13th a violent fit of coughing came on, with expectoration of about twelve or thirteen ounces of light-coloured blood. The sanguineous expectoration continued more or less until the afternoon of the 16th, when, after being awoke from sleep, the patient got a violent fit of coughing, ending in profuse hæmorrhage, during which thirteen or fourteen ounces of blood were brought up. The attack lasted about ten minutes, at the end of which time the patient died.

Dissection.—Some cadaveric rigidity. Body strong and in good condition; subcutaneous fatty tissue everywhere abundant. Muscles of the natural appearance. Heart flaccid, covered with fat at the base and on the right side; in the pericardium was a small quantity of bloody fluid. The endocardium was strongly soaked with blood, as was the commencement of the aorta, where were some slight sclerotic changes. The valves were healthy, the muscular structure pale, opaque, slightly streaked with yellow, especially in the papillary muscles. The left lung was attached by old adhesions to the thorax; it contained air throughout, was somewhat coloured. In the apex were slight and circumscribed thickenings of the pleura. Only in the larger bronchi was there a small quantity of partly fluid blood. The right lung was in the apex very firmly adherent to the thorax; the two laminæ of the pleura were completely adherent to one another, so that the lung could be separated only with difficulty and not without injury. On section, the upper lobe was found to be in its greater and posterior portion condensed, almost completely void of air, especially superiorly. The surface of section was smooth, of a grayish yellow colour, with

pigment abundantly scattered over it; no lobular structure was perceptible, but in several places the yellowish coloration was seen to proceed from numerous small yellowish points (alveoli). About the middle of the posterior obtuse margin, and close to this, separated from the thickened pleura only by a thin, highly-coloured, condensed layer of pulmonary tissue, was a cavity rather larger than a walnut, filled with dark fluid or slightly coagulated blood. From the outer wall of this cavity projected a tumour about the size of a nut and of the shape of a bean. In the middle of the surface turned towards the cavity, was found a tolerably soft, pale red sanguineous coagulum, on removing which the subjacent part of the tumour appeared of a deep yellowish colour, and with a small perforation, through which only the button of a fine probe could pass. The opening was of irregular form, torn, and to its margins adhered loosely coagulated blood. This opening led into a cavity, which, on slitting up the pulmonary artery, proved to be an aneurismatic lateral dilatation of a branch of this artery, containing only a small quantity of freshly coagulated blood, without a trace of denser fibrinous deposit. The wall of the aneurism was attenuated, especially towards the perforation, and the yellowish colour occupied almost the whole of the outer surface, only close to the wall of the cavity was the colour somewhat reddish, though here and there studded with small, point-like yellow spots. The branch of the pulmonary artery leading to the aneurism was immediately in front of the latter, when slit up, six mm. in width; it was continued through the condensed wall of the cavity, but was so small on the other side of the aneurism, that only a horse-hair could be introduced into its cavity. In the trunk and some of the larger branches of the pulmonary artery, but by no means in all, were found small whitish yellow, sharply circumscribed points and spots, though only of small size, individually scarcely as large as the head of a pin, but here and there placed close together. In the vessel leading to the aneurism, as well as in its undilated wall, the inner parts were found perfectly healthy. On closer examination of the vessels leading to the cavity, it appeared that one, which when slit up measured scarcely three mm., ran in the upper wall of the cavity, somewhat above the aneurism; it projected there as a perceptible whitish yellow cord. When slit up its calibre was seen rather strongly arched in towards the cavity, especially in the middle, and the corresponding wall was thickened, whitish yellow, while the opposite one had its natural appearance. A larger bronchus, which was only four centimètres removed from the principal bronchus, terminated in the fundus of the cavity; it did not indeed pass continuously into the walls of the cavity, but neither was the transition abrupt. There was no other cavity but that just mentioned. The other parts of the lung were everywhere permeable to air; the surface of section was highly sanguineous, thin blood flowing abundantly from all the divided bronchi.

Nowhere were there traces of miliary tubercles, either in the lung or in the pleura. The mucous membrane of the bronchi was soaked with blood, thickened with abundant viscid mucus. The bronchial glands were scarcely swollen, and were strongly coloured. The stomach, as well as the transverse and ascending colon, was rather distended with air. The spleen was of the usual size, its parenchyma was of a brownish red colour, the follicles were few. The kidneys were of the usual size, rather rigid; the capsule was easily separated; their surfaces were smooth, of a dark red colour, as was the surface of section in both substances, though mostly in the cortical. The papillæ were pale; there was some papillary catarrh. The glomeruli were highly congested; the urinary canals were scarcely altered. In the stomach there was nearly a pint of bloody fluid; the mucous membrane was highly tinged with blood, but was otherwise unchanged. The liver was of the ordinary size; from the surface of section blood oozed abundantly from the larger branches of the vena portæ; the parenchyma was of a light reddish colour, and of a tolerably natural appearance. The intestinal canal was healthy.

CASE 2.—*Aneurisma rupt. art. pulmon. Phthisis cavernosa (Bronchiectasis, Pneumonia chronica, Peribronchitis). Ulcerationes tuberculosæ ilei et cæci; Cyanosis renum et hepatis.*

Christ. Peter Carlsen, aged 34, labourer, was admitted to the Third Division on the 6th February 1866. Has for many years been subject to shortness of breathing, but otherwise enjoyed good health. Last summer he was under treatment in this hospital for hæmoptysis. A couple of months ago he began to cough more, and a fortnight since he felt a pain in the right side of the chest, particularly marked on deep inspiration. The cough at the same time became worse, and was often attended with vomiting. For the last week he has kept his bed, having altogether lost his strength. His appetite is slight, he sleeps but little, and during sleep perspires copiously. Bowels regular.

The examination of the chest gives a dull sound on percussion in the first intercostal space on the right side, also from the fifth rib downwards, where it passes into the hepatic dulness. Respiration is bronchial in the right infra-clavicular region, and is accompanied with some few subcrepitating râles; in the infra-mammary and lateral regions it is feeble. Posteriorly the sound on percussion is dull over the entire of the right side, the dulness increasing downwards and becoming total in the middle of the infra-scapular region. Respiration is very weak throughout the entire lung, but is still audible down to the base of the latter. The sound on percussion in the left side of the chest is not altered; over the whole of the left lung scattered subcrepitating and sonorous râles are heard. The liver does not extend beyond the margin of the ribs. Pulse 120.

On the 8th, the expectoration was streaked with blood; at the

right nipple there was a distinct friction sound. On the night of the 4th of March the patient began to expectorate red fluid blood; and in the afternoon of the 5th, during a fit of coughing, violent hæmoptysis came on, in the course of which the patient died.

The post-mortem examination took place on the 7th, in the forenoon. Cadaveric rigidity; body moderately emaciated; subcutaneous adipose tissue atrophic. Muscles pale, but very powerful. The heart contracted, of the usual size; the valves as well as the muscular structure healthy. In the cavities much fluid blood, and a few soft fibrinous coagula. The left lung is somewhat adherent along the posterior obtuse edge, but the apex is free. On section, a cavity is seen about the size of a pigeon's egg, filled with coagulated blood, situated in the middle of the upper lobe, four centimètres from the apex and three from the obtuse edge; it has tolerably smooth walls, though here and there they are somewhat uneven, and is invested with a grayish mass, capable of being scraped off. The wall is formed of condensed, coloured pulmonary tissue, about a quarter of a centimètre in thickness. An undilated bronchus is continued into the wall. On removing the contents of the cavity with a stream of water, a sac almost as large as a walnut is observed projecting from the outer wall of the cavity into the same. On the most prominent part of this sac some more solid dark coagula are adherent, which, on careful removal, are found to conceal a slit-like opening two or three mm. in length, with deep yellow attenuated and torn edges. On slitting up the sac it is seen to contain only a small quantity of freshly coagulated blood; the inside is smooth, blood-coloured; only inferiorly and posteriorly is a slight depression met with, corresponding to an external prominence as large as a pea, and only this is distended with firm, pale, yellow coagula. On slitting up the pulmonary artery a branch of the latter is seen, about one mm. in diameter, to open into this sac, which is formed by dilatation of the side of this vessel looking towards the cavity, while the other lies firmly in the wall of the cavity; a somewhat smaller branch opens superiorly into the sac, lying in the same axis as the inosculating one. Moreover, there are found in this lung, not merely in the apex, but also over the whole of the upper lobe, numerous miliary tubercles, partly scattered, partly collected into small groups, often of lobed or laminated structure, projecting on the surface of section, of a whitish colour, most frequently with a perforated or dark-coloured centre. The pulmonary tissue is everywhere pale and permeable to air, only superiorly towards the hilus is there some solidification, especially along the larger vessels and bronchi. In the lower lobe the tissue is congested with blood; miliary tubercles occur only in a very scattered and isolated manner. In the pleura a few traces of miliary deposition are seen. The mucous membrane of the bronchi exhibits a moderate, fine vascular congestion; in some places are small, partly cylindrical, partly diffuse, dilatations. Nothing abnormal is discovered either in the

other branches of the pulmonary artery or in the main trunk. The right lung is everywhere firmly adherent to the diaphragm. In the apex is a cavity about the size of a goose-egg, which reaches to the thickened pleura, or is separated from it only by a thin, highly coloured layer of fibrous tissue, which in general circumscribes it; into the cavity open, in many places, eyelet-hole shaped bronchi, and on slitting up these, many are seen to run a serpentine course, and to be dilated, with bands projecting between the dilatations, while others are natural with respect to their cavities. The mucous membrane is everywhere dark and uniformly red. The cavity contains a small quantity of chocolate-coloured fluid; the walls are uneven, in several places with pit-like, blind, eyelet-hole shaped depressions. The remainder of the lung is permeable to air, is congested with blood, and presents scattered miliary tubercles. The bronchial glands are highly swollen and coloured. In the throat and œsophagus, as well as in the larynx and trachea, is a large quantity of fluid or loosely coagulated blood; the mucous membrane is highly soaked with blood. Only on the under surface of the epiglottis are some swollen follicles. The spleen is about double its usual size; its capsule is thickened; its parenchyma is tolerably firm, of a pale red colour; the follicles and trabeculæ are in the usual number. The kidneys are firm, rigid; the capsules are easily separable, the surfaces are of a diffuse dark red colour; the surface of section is similar, the pyramids somewhat darker; the glomeruli are highly congested, the canals of the cortical substance exhibit only a slight opacity. The mucous membrane in the pelvis is natural. The liver is large, firm; its parenchyma is dark red; the central parts of the acini are slightly depressed; the peripheries are slightly loaded with fat. In the gall-bladder is a little thin, yellowish bile. In the stomach is a large quantity of loosely coagulated or cherry-coloured fluid blood. The mucous membrane is healthy, imbibition excepted. In the urinary bladder is a small quantity of turbid urine. In the small intestine the mucous membrane exhibits a light rose-red colour in the upper part; further down small round or elongated ulcers, with reddish swollen edges, and evident miliary deposition in the fundus, are met with. The ulcers occur only in a scattered manner, scarcely exceed the size of a four-skilling piece, and are all situated in the Peyerian patches; in other places yellowish tubercles of miliary size are seen. In the cæcum only a couple of elongated ulcers lying across the intestine are found; the rest of the large intestine is free. The mesenteric glands are slightly swollen.

[Having given two of the author's cases nearly *in extenso*, as examples of the accuracy with which his observations are reported, I shall be obliged in the remainder of his paper, in consequence of the length to which this translation would otherwise run, to confine myself to his general remarks, adding only the headings of his cases.—W. D. M.]

CASE 3.—*Pneumonia dissecans acuta ; Pneumonia chronica ; Aneurismata arteriæ pulmon., unum ruptum ; Hæmorrhagia pulmonalis. Anæmia et Œdema cerebri.*

Bertha Nielsen, a widow, aged 50, admitted on 19th February 1866. The patient, who had usually enjoyed good health, was seized on the 16th with shivering, pain in the left side of the chest, and cough, with expectoration at first rusty and afterwards whitish. On 7th March the expectoration became decidedly bloody, and continued more or less so until the afternoon of the 23d, when, having previously felt very well, she was attacked with a fit of coughing, during which the blood gushed from her nose and mouth, and she died in the course of a few minutes.

CASE 4.—*Phthisis cavernosa pulmon.; Aneurismata arter. pulmonal., unum ruptum in Cavernam. Hypertrophia cord. dextr. Peribronchitis, Bronchitis, Laryngitis, c. Ulc. tuberc. Cyanosis renum.*

E. H., aged 48, resident in the General Hospital for nearly two years with chronic pulmonary phthisis. She was suddenly seized on the 14th November 1867 with violent hæmoptysis, which speedily proved fatal.

Ectasias are smaller aneurismatic dilatations of vessels, running in the walls of cavities. They occur under two forms: first, as cords of different lengths on the inside of the cavity, which on being slit up exhibit a slight dilatation of their calibre in towards the latter, with corresponding thickness of the walls; occasionally the thickness even becomes so considerable that the calibre of the vessel is at all events apparently diminished, so that we cannot properly speak of an ectasia. This form is the rarest. In the eight cases, which constitute the immediate basis of our description, it was observed only once in combination with a ruptured aneurism. I do not, however, mean to say that these ectasias are absolutely rare, but only in relation to hæmorrhages; thus, I have often seen them in the walls of cavities where no hæmorrhage had taken place during life. The second form is more frequently observed, in which the vessel comes in contact with the wall of the cavity only in a limited locality. In such a locality there is developed a rather oblong prominence, sometimes as large as a bean, though most frequently only as large as a pea, due partly to a dilatation of the calibre of the vessel, partly to a thickening of its wall. The perforation takes place always in a peculiar mode, a V-shaped slit forming in the wall of the vessel, whereby a kind of valve or lid-shaped flap is developed. The angle formed by the slit may be more or less acute, its sides shorter or longer, and the lid formed as the result thereof more or less easily movable. The rupture occurs in general in the boundary between the vessel and the wall of the cavity, and the apex of the lid lies always in the direction of the current of the blood. While

the walls of aneurisms proper are always thin at the seat of perforation, this is not invariably the case with the lid-shaped ruptures, as the lid is sometimes even remarkably thick and of fibrous consistence, so that its point, especially when at the same time the angle of the slit is large, can be raised only to a slight degree. But, as a rule, the lid forms a tolerably thin easily movable flap, of rather yellow colour. The vessel forming the ectasia is, as in the aneurism in general, empty or filled with freshly coagulated blood.

CASE 5.—*Phthisis cavernosa (Pneumonia chronica, Peribronchitis, Bronchiectasia). Dilatio aneurismatica rami arter. pulmonal. perforat. (c. operculo), Hypertrophia cordis dextr. Nephritis interstitialis.*

Severin Peter Johnsen, aged 49, a labourer, was brought into hospital immediately after the occurrence of hæmoptysis, but died before admission to a ward, on the 28th December 1866.

CASE 6.—*Phthisis cavernosa c. Hæmorrhagia ex arteriola aneurismat., operculo rupta. Tubercula pleuræ; Hypertrophia cord. dextr. Cyanosis renum et hepatis.*

Juliane Kisling, aged 42, a patient in the third division of the Municipal Hospital, on the morning of the 20th October 1867, after having taken her tea as usual, and her condition not having altered essentially to all appearance from that of the previous days, sank suddenly back in the bed, and died in the course of a few minutes without any perceptible tracheal râle, and without any hæmoptysis.

CASE 7.—*Phthisis cavernosa pulm. dextr. Aneurisma parvum, operculo ruptum, arteriæ pulmonal. Hæmoptysis.*

Maren Andersen, aged 51, a widow, admitted to the General Hospital on 18th October 1866. Never had hæmoptysis until the afternoon of 20th October 1866, when, at half-past four, during a fit of coughing, a gush of blood suddenly came on, and proved fatal in the course of fifteen minutes.

CASE 8.—*Phthisis cavernos. pulmonum. Pneumon. chron. interstit. (et caseosa, Bronchiectasia). Hæmorrhagia e perforat. arteriolæ pulmon. c. operculo. Cyanosis lienis, renum, et hepatis. Hypertrophia ventric. dext. cord. Ulcerat. tub. intestinorum.*

Marie Nielsen, aged 28, admitted on the 25th of May 1864, having long suffered from chronic thoracic symptoms. On the 30th July, at 9 o'clock in the morning, very violent hæmoptysis suddenly set in, with symptoms of suffocation, and within ten minutes the patient was *in articulo mortis*.

Cavities.—Without in this place entering more fully into the so much debated question of the relation of miliary tubercle to chronic pulmonary phthisis, which I believe I am so much the more justified in omitting, as the detailed reports of the dissections are

presented in as far as possible an objective form, I shall only summarily state the occurrence of miliary tubercles in other organs than the lungs. In the eight cases tubercles were met with only in four in other organs—namely, in the intestinal canal, in two; in the larynx, in one; in the pleura, in one. In one other case there were yellow tubercles in the intestine, but without any characteristic miliary form.

In the four cases in which no trace of miliary deposition was found in other organs, in three (the 1st, 3d, and 7th cases) even the so-called peribronchitic depositions were wanting, and only one lung was attacked—in two instances the right, and in the third the left. Under such circumstances the affection must undoubtedly be designated as chronic pneumonia, with bronchiectatic cavities. In the fourth (the 5th case) a similar condition was met with in both lungs, but at the same time there were fresh lobular pneumonic infiltrations, peribronchitis, and yellow tubercles in the intestine. In the cases in which miliary tuberculosis had supervened, this was only to a slight extent, and in such instances also the cavity retained its bronchiectatic character—that is to say, we had a cavity of greater or less size, surrounded by a more or less broad belt of condensed pulmonary tissue, into which a varying number of bronchi opened with eyelet-hole orifices. It may therefore be stated, quite apart from the existing contest respecting tuberculosis or non-tuberculosis, *that every cavity in the lungs whose walls are formed by condensed pulmonary tissue, containing non-obliterated vessels, may be the seat of aneurisms or aneurismatic dilatations with consecutive ruptures*; most frequently it is, however, perhaps those cavities whose walls are formed only of condensed tissue a few millimètres in thickness, directly adjoining permeable tissue, which belong to this category.

The size of the cavity does not stand in any relation to the formation of the aneurisms; the latter may occur in the very largest, and in very small ones. Thus we have, in our fourth case, a cavity almost as large as an ostrich's egg, with two closely adjoining aneurisms of the size of peas; in our second we have a cavity of the size of a pigeon's egg, with an aneurism as large as a walnut. Where, as is often the case, we have many cavities of different sizes, and possibly all filled with blood, the source of the latter may be found in a very small aneurism, which may easily be overlooked, as in our 5th case, where the aneurismatic dilatation was discovered in a cavity of the size of a nut.

Of changes in other organs, hypertrophy of the right side of the heart was met with four times. I shall content myself with noting this fact, as I do not find myself in a position, at least for the present, to contribute anything to the explanation of the circumstances under which this hypertrophy arises, or to state why it is found in some cases, while in others apparently quite similar it is wanting. In the four cases large cavities were discovered; but, at the same time, there were tuberculous affections in other organs (larynx, intestinal canal, pleura). In seven cases the hæmorrhage

proceeded in four instances from the left, and in three from the right lung.

With reference to sex, five were females, and three were males. The ages were: in two, between 28 and 34 years; in five, between 42 and 51; in one, 64 years.

Formation of the Aneurism.—We have in a very few cases found slight atheromatous changes—that is, small patches of fatty degeneration—in the inner coat of the pulmonary artery; but even these are met with chiefly in the main trunks, and never in the branches immediately adjoining the aneurism. We have, therefore, no reason to seek the cause of the formation of the aneurism in changes in the artery itself. Everything would, however, indicate that the development of the aneurism stands in a definite causal relation to the formation of the cavity.

Rokitansky is, as we have seen, the only writer who, although rather summarily, speaks of aneurismatic bulgings in the walls of cavities. He looks upon the dilatation as caused partly by the want of support to vessels in the progressive ulceration, partly by the imbibition of the wall of the vessel, which becomes soft, jelly-like, and finally bursts. According to my observations, there is no doubt that the want of support is one of the chief elements in the formation of the aneurism; softening such as Rokitansky mentions I have never seen, as is sufficiently evident from the description, but fatty degeneration. That this may stand in a certain relation to, and possibly be dependent on, an influence derived from the contents of the cavity, I would not absolutely deny; but when side by side with such an aneurism we may find another, which also has been exposed to quite the same influence as the first, but whose wall is considerably thickened and very strong, it seems to me to be more reasonable to refer the starting-point of both these changes, both the fatty degeneration and the thickening, to the wall of the vessel itself independently of its surroundings; that, notwithstanding the contents of the cavity, this may even develop vigorous life, the considerable amount of hypertrophy decidedly proves. From a more theoretical stand-point, it may perhaps seem suitable to parallelize these two changes in the vascular wall with the two processes proceeding side by side in the wall of the cavity—the formation of connective tissue and the ulceration; but direct observation does not admit of such an assumption. The thickening, or, as it may properly be called, the compensating hypertrophy, consists in fact in an hypertrophy of the coats of the artery, especially of the muscular coat, not in a development of connective tissue such as takes place in the wall of the cavity,—for which reason also the surface retains its natural smoothness, and the fatty degeneration has its seat in the normal elements of the artery, and is not an ulceration of newly-formed connective tissue. It is, however, hard to say why the vessel in some cases develops an energetic activity to ward off the threatening danger, while in others it remains passive.

The defective support of the wall facing the cavity acquires still greater importance from the fact, that the rest of the vessel lies impacted in a firm unyielding connective tissue, consequently, as the second principal element in the formation of the aneurism, we have the increased intravascular pressure. This must, particularly during a fit of coughing, be very considerable, on account of the thereby augmented determination of blood to the lungs; but even under quieter circumstances it is increased, partly because so many vessels in the condensed pulmonary tissue are obliterated, partly because, especially in the larger aneurisms, the efferent branch is very small, and is speedily lost in the condensed tissue—a fact which we have repeatedly had occasion to confirm. Finally, it deserves to be mentioned, that the aneurism is sometimes formed on the most prominent point of a vessel running in a curve, but most frequently both the afferent and the efferent branches lie in the same plane. Ruptures would, moreover, certainly occur more frequently if the vascular wall were not greatly thickened by a compensating hypertrophy; but that even this is not always sufficient to resist the strong intravascular pressure is seen from our 6th case, where the thickened firm vascular wall was removed layer by layer.

A remarkable circumstance in these aneurisms is the absence of coagula, even in those which attain the size of a walnut. As to the smaller ones, which form only a dome-like dilatation of the vessel, this is easily explained; not so, however, with regard to the larger ones. Yet it must be remembered that the aneurisms never have any proper neck, so that their contents stand in tolerably free connexion with the current in the vessel. It is perhaps also possible that by filling the cavity with air, the blood may be expelled from the aneurism when its wall is thin and yielding.

Although the views here stated rest exclusively on my own observations, it will not be uninteresting to compare with the latter the few cases to be met with in foreign literature; they amount, so far as I have been able to ascertain, to only three rather brief communications, which I therefore reproduce *in extenso*. It is remarkable that although the cause of the formation of these aneurisms, cavernous pulmonary phthisis, is so universally met with, and common to all nations, all the three reports are from England, which, as is well known, is distinguished among many other things by its richness in aneurisms.

[The papers referred to by the author are a letter by Dr Fearn to the editor of the *Lancet* (Derby, Jan. 1, 1841), *Lancet*, 1840–41, vol. i. p. 679, describing a case of aneurism of the pulmonary artery; a case of phthisis, fatal hæmorrhage by the rupture of a small aneurism on a branch of the pulmonary artery, under Dr Cotton's care (*Medical Times and Gazette*, vol. i., 1866, No. 811, for January 13); a paper by Dr Peacock, in the *Edinburgh Monthly Journal*, vol. iii., describing a case brought by him before the Anatomical Society of Edinburgh, where he exhibited, in 1843, the right lung of a man,

aged 29, who died suddenly after violent hæmoptysis. The present communication is so very long, that I must refer to the original sources for the observations referred to.—*Translator.*]

Thus, in Fearn's case, no coagula whatever were met with, although the aneurism had attained the size of a nutmeg. In Cotton's no coagula were found in one part of the aneurism, but in the ruptured portion there was an adherent, partially decolorized, coagulum. It is possible that both in these and in my own cases a small coagulum may have slipped away during the rupture, and so have escaped our observation.

Fatal Hæmoptysis in a clinical point of view.—We have already seen from the anatomical description, that aneurisms and ectasias may form at every stage of cavernous pulmonary phthisis, if there be found only condensation of the pulmonary tissue surrounding the cavity without obliteration of the vessels. Thus are excluded the forms of phthisis clinically designated as florid, and anatomically as gelatinous, scrofulous pneumonia, as catarrhal lobular pneumonia with caseous change. This is, of course, not the place to give a sketch of the clinical progress of pulmonary consumption, nor to attempt to bring our individual cases under the various subdivisions into which writers have of late years, with more or less success, endeavoured to separate the formerly compact nosological idea of phthisis. For this purpose, moreover, the cases are too few, and for it an independent clinical material would be necessary, which I have not been in possession of. I shall therefore confine myself to more practical remarks.

Hæmoptysis due to aneurism or to an ectasia of a branch of the pulmonary artery usually occurs suddenly without either the patient or the physician having the slightest suspicion of its impending supervention; and this is true, as has several times been stated, both in those cases where physical examination has shown only a slight condensation in one of the apices of the lungs, and in those where large cavities are met with in both lungs. During a fit of coughing or violent bodily effort blood rushes from the nose and mouth, and the patient dies most frequently in the course of a few minutes with tracheal râle and asphyxia; in rarer instances he sinks back pale as a corpse on his pillow with slight râle; and in still rarer cases, especially those in which, in consequence of extensive destruction of both lungs, considerable dyspnœa has occurred, so that he wants power to bring up the blood, he dies indeed suddenly, but without hæmoptysis, and it is only on dissection that we find the trachea and bronchi filled with blood.

Of our eight cases, death took place suddenly in five, and among these are found all the four in which we met with ectasias with operculated rupture, and only one with aneurism. But hæmoptysis does not always occur so violently and cause so abrupt a termination of life. In some cases it assumes a remittent character. The

patient gets more or less, but always copious, hæmoptysis, consisting at one time of dark coagulated or fluid, at another of bright and frothy blood. Each hæmorrhage is ushered in by a violent fit of coughing, and after this is arrested the ordinary expectoration is for some time infiltrated with blood; finally this becomes quite free from blood, until, in general after the lapse of a few days, a fresh hæmoptysis sets in. If the patient is not much exhausted by his pulmonary disease, he may in the interval regain his strength very well, notwithstanding the considerable loss of blood; if, on the contrary, he be in a more advanced stage of his disease, he rapidly becomes anæmic, and often dies directly of anæmia, as the last hæmoptysis, although not more considerable, or even less than the preceding one, at length brings death. Such a course, with remittent hæmorrhages, obtained in the other three of our eight cases, and these specially deserve our attention.

In our first case we see a man aged 64, strong for his time of life, who had for many years suffered from cough in the spring, disappearing towards summer. A month before his admission into hospital the cough became persistent, without, however, particularly troubling him; he then suddenly got for the first time moderate hæmoptysis, which returned after the lapse of a couple of days. He then applied at the hospital. The cough became more frequent, more troublesome, interfering with sleep at night; the expectoration lost its bloody character, and became scanty and viscid. His general health was good, his pulse 80. Objective examination disclosed signs only of slight solidification in the apex of the right lung. The hæmoptysis returned at intervals of from two to five days, and on the sixth, in the course of fifteen days from the first attack, the patient succumbed. This result is certainly very striking. We have grown up in the opinion, which also accords with that entertained by the first clinical physicians of the present day, that the hæmoptysis in itself has nothing to make us uneasy, and that it scarcely ever is the direct cause of death, but that the danger lies in the ulcerative process in the lung, of which the hæmorrhage is only the expression. We were therefore led to form a comparatively favourable prognosis, although the increasing cough and the hæmoptysis, according to the view hitherto generally received, indicated the development of latent phthisis. We might, however, if we adopted the theory taken up anew by Niemeyer, as to the relation of hæmorrhage to pulmonary consumption, have anticipated a rapid development of the phthisis. The calculations did not, however, hold good; the patient succumbed to the hæmoptysis alone. Dissection exhibited only a circumscribed alveolar and interstitial pneumonia, and in this a bronchiectatic cavity with a ruptured aneurism of the size of a nut, and any other source of the hæmorrhage must be entirely excluded; there was no trace of any tubercular affection, nor was there any pneumonic infiltration proceeding from the hæmorrhages.

In our second case we have an ordinary phthisis, already tolerably far advanced, with intercurrent pleuritis. This latter had quite disappeared, when the patient in a fit of coughing began to bring up red fluid blood, which in the course of rather more than twenty-four hours increased to profuse hæmoptysis, of which he died.

The third case is rather an isolated one, and it was not until we had learned more accurately to recognise this formation of aneurisms that we were on the whole in a position to propose any probable explanation of it. A woman aged 50, stated to have previously enjoyed good health, was admitted into the hospital with all the signs of acute pneumonia in the left superior lobe, though accompanied with a whitish, moderately viscid expectoration. In the course of this, and after the general symptoms had perceptibly diminished, copious bloody expectoration, with dark coagula, set in nineteen days after the commencement of the disease, accompanied with increasing dyspnœa, but without fever or pain in the chest. Violent hæmoptysis returned almost daily, or at very short intervals, and seventeen days after the first occurrence of the hæmoptysis the patient died in a profuse attack of it. On dissection the left lung was found attached to the thorax by old adhesions of connective tissue, strongest at the apex. In the upper lobe of the left lung was a large cavity filled with blood; among this were loose pieces of pulmonary tissue in a state of red and gray hepatisation, and the wall formed of broken-up pulmonary tissue; the cavity was traversed by numerous branches of the pulmonary artery, and on two of these were two aneurisms on each, close to one another, one of which had burst; the inferior boundary of the cavity was formed of pulmonary tissue in a state of chronic pneumonia.

In this certainly unique and interesting case we had most probably one, or perhaps two, central cavities of a bronchiectatic nature in the upper lobe of the left lung, surrounded by condensed pulmonary tissue. From the wall of this cavity the aneurisms were developed in the usual mode, but this circumscribed chronic pneumonia with bronchiectasis did not particularly inconvenience the patient. When in the surrounding hitherto healthy pulmonary tissue an acute croupy pneumonia arose, the pre-existing chronic pneumonia became dissecting, or, if we will, gangrenous, as happens in rare cases, for one or other reason, perhaps on account of the disturbances in nutrition. The following points are in favour of the development having taken place in this mode: the form of the aneurism, which in all was sacciform with a lateral dilatation of the vessel, just as we have seen it in the other cases; the thickening of the walls of the aneurisms, which decidedly indicated that they must have existed for a long time; the size of the cavity in proportion to the included pneumonic portions of lung, which seemed to lead to the supposition of the pre-existence of a cavity; the inferior boundary of the cavity, which was evidently formed of

condensed pulmonary tissue; finally, the chronic pleuritis in the apex of the lung may be mentioned. It is possible that the hæmorrhages may in part have proceeded from the dissecting pneumonia, and that only the last fatal one was derived from the ruptured aneurism. This question cannot be decided, for hæmorrhages may proceed also from such a pneumonia, as occurred in a well-marked case communicated a couple of years ago by Lector Reisz; but, on the other hand, we have also seen that such an intermittent hæmorrhage may be due exclusively to a ruptured aneurism. Some reasonable objection may, however, be made to this explanation: thus, I may mention the absence of the signs of chronic pneumonia, for the journal states that the patient had previously enjoyed good health; but what I lay still greater stress upon is, that the dissection did not exhibit firmly condensed pulmonary tissue, but only recent pneumonic, although the possibility that this may have been brought up with the copious bloody expectoration, and so have escaped observation, cannot be denied. Nevertheless, these objections do not appear to me to be so important as to shake the explanation above given, as it is supported by certain well-established facts.

In our three cases of aneurisms, therefore, death occurred not suddenly, but was preceded by hæmorrhages with greater or less remissions, and it consequently becomes a question which deserves to be considered, whether the anatomical investigation gives us any basis for the elucidation of this circumstance. It is evident that when a portion of the vascular wall is raised like a valve by the strong pressure of the blood, a profuse and fatal hæmorrhage may be the final result; and that the same may be the case with an aneurism which bursts at once, when it does not contain plugging coagula. We have, however, not been in a position to exhibit such firm decolorized coagula, but we have already stated that such may possibly have escaped through the perforation. On the other hand, we have in one case, and precisely in that (the first) where the remitting hæmorrhages occurred in the most characteristic form, found a condition which may possibly have some signification—namely, fatty degeneration of the wall of the aneurism. It occurred in small distinct points, and first became diffuse towards the seat of perforation; it is therefore possible that, before the more extensive rupture, very small openings formed through which the blood made its way, but in smaller quantity, into the cavity, and there got time to coagulate, until a fresh violent fit of coughing loosened the plugging coagulum or produced a new rupture, and so gave rise to fresh hæmorrhage. As the matter at this moment stands before me, I do not find myself in a position to give any more satisfactory explanations of these remitting hæmorrhages in aneurisms in the walls of cavities, but will await the result which coming investigations directed more precisely to this point shall give.

This peculiar, and in a practical point of view important, circum-

stance is scarcely purely accidental, as one might, from the limited number of cases here spoken of, be inclined to suppose; for if we include the two cases by other writers, above communicated, we find the same. In Fearn's case, violent hæmoptysis occurred from the 12th to the 19th December; then a long remission took place until the 25th, on which day the fatal hæmoptysis suddenly supervened. The aneurism, which was as large as a nutmeg, burst with a fissure, but contained no coagula. In Cotton's case, where the patient was in the last stage of phthisis, after previous moderate hæmoptysis, a very violent attack suddenly supervened; thereupon came a remission of three weeks' duration, when the hæmoptysis was repeated with the same violence, and proved fatal. The ruptured aneurism, which was in size less than a pea, contained an adherent, but only partially decolorized coagulum, while the other, which was separated from the first only by a slight constriction, did not contain coagula. The description of this coagulum, taken along with the total absence of any coagulum in the second aneurism, placed under precisely similar circumstances, decidedly indicates that the clot was not formed previously to the rupture, but that it proceeded from the last hæmorrhage, three weeks before death. This case seems, therefore, to be in favour of the explanation given above.

These instances, consequently, show decidedly that we must be cautious in our prognosis, when we have a profuse hæmorrhage before us, for even if it diminish or entirely disappear it may return, and in a few moments prove fatal. Upon this point I shall quote the following words of Fr. Hoffman, which seem to have been long forgotten: "In illa gravi et vera hæmoptysi, qua, ob ruptum majorem arteriæ pulmonalis ramum, magna sanguinis copia per brevia intervalla erumpit, caveat medicus ne promissis de restituenda sanitate sit dives, nisi fluxus sanguinis intra triduum convenientibus remediis compescatur."¹ The cases communicated by us show, however, that even if the hæmorrhage stops in the course of three days, we can by no means be easy. I believe that we must be the more cautious, as we are clinically scarcely in a position to distinguish an hæmoptysis due to rupture of a vessel in the wall of a cavity from another occurring during the course of pulmonary phthisis, and which may possibly have another cause. One of Niemeyer's pupils, Bürger,² has, as well as Niemeyer himself in the last edition of his manual, thought that the blood brought up, which proceeded from a branch of the pulmonary artery, must be absolutely dark, as this artery contains in fact the most venous blood in the whole body. Now since, as is well known, all observers are agreed that the blood in hæmoptysis is almost always of a light

¹ Fr. Hoffman Opera Omnia, t. ii. sect. i. cap. ii. Genevæ, 1748, p. 205.

² Ueber das Verhältniss der Bronchial und Lungenblutungen zur Lungenschwindsucht. Tübingen, 1864, p. 18. (On the relation of Bronchial and Pulmonary Hæmorrhage to Pulmonary Consumption.)

red, they see in this a proof that the blood in the vast majority of instances proceeds from branches of the bronchial arteries (broncho-hæmorrhagic); or, at all events, from the pulmonary veins, and only in extremely rare cases, where the blood is then dark, from an eroded branch of the pulmonary artery. This reasoning is, however, entirely theoretical, and they do not support it with a single anatomical fact; for, in the only example which they quote, the dissection, as I shall subsequently take occasion to show, by no means gives reliable information as to the source of the hæmorrhage. In our cases, where the hæmorrhage evidently proceeded from the pulmonary artery, the blood was most frequently of a light red colour; in a couple of cases (the first and third), it was alternately dark and light; in Fearn's case it was dark. This circumstance ought not, therefore, to be advanced as a certain diagnostic sign. The colour of the blood depends most probably on the rapidity with which it is brought up, and the quantity of air with which it is mixed. That it is precisely highly venous blood which rapidly takes up oxygen is shown by Alex. Schmidt's¹ recent experiments upon the blood of asphyxiated animals, in which he found that this, although in a different degree from the various organs, contains a substance which rapidly takes up and combines with the oxygen.

If we now ask what importance and extent we ought to award to these aneurisms and ectasias of vessels running in the walls of cavities, as the source of pulmonary hæmorrhages in general, this question is of course difficult to answer from the data hitherto made available. I can state only that, during the last two years, since I have had my eyes opened to these conditions, I have always been able to demonstrate the rupture of a vessel in the wall of a cavity in the mode described; while I earlier have made some post-mortem examinations in which I could not point out the source of the hæmorrhage, but in all these cavities were found, so that I have no doubt that it has had the same origin as in the later cases. Vessels enclosed in trabeculæ passing through a cavity ruptured by ulceration, I have never seen; but of course I do not venture to deny their existence, which is confirmed by too many reliable observers. As to the frequency of the fatal hæmoptyses occurring in this mode, they took place in the Municipal Hospital, during the last two years, in the following numbers:—

In 1866, among 79 dissections of phthisical patients, four times, or 5 per cent.

In 1867, among 104 dissections of phthisical patients, once, or 0·9 per cent.

There thus appears a considerable difference in the two years; but, rightly considered, these statistics do not prove much, for patients do not apply to the hospital on account of their aneurisms, and it is a mere chance if the rupture takes place during their stay

¹ Sächs. acad. Sitzungsberichte. Math. phys. Classe 1867. Centralbl. f. d. med. Wissenschaft, 1868, No. 3.

in the house. The sudden death which carries off the majority of these patients causes them only exceptionally to come upon the dissecting table, as death, even if they seek the hospital, most frequently occurs before they reach it.

That profuse and fatal hæmorrhages always proceed from cavities, appears to me, according to my observations, to be a legitimate conclusion. We have seen that a cavity of the size of a nut may give rise to fatal hæmorrhage, and that the cavity may be still less is probable, or at all events possible; but that such a cavity may be overlooked, and has been overlooked, especially formerly, scarcely any one will deny; for this kind of investigation requires great patience and perseverance.

The cases where copious hæmorrhages occur in apparently healthy individuals, and even cause death, and in which no changes are found in the lungs, ought, I believe, to be received with great caution. From what has been above brought forward, I can therefore by no means agree with Niemeyer when he thinks it improbable that cavities should be overlooked, and that it would be very strange if hæmorrhages from small overlooked cavities should be more frequent than from larger ones. This last is only a theoretical argument, and is quite without importance in presence of the certain demonstration that the occurrence of hæmorrhage is entirely independent of the size of the cavity.

Another question which naturally presents itself is, whether more considerable hæmorrhages, which do not cause death, and indeed after which the patients may even live for many years without any particular annoyance, may depend upon anatomical conditions similar to those we have met with in the fatal cases. The material in our hands affords no information in this respect; but as the question as to the source of pulmonary hæmorrhage has hitherto been all but confined to the domain of hypothesis, there can be the less hesitation in forsaking the beaten track of observers, as we have certain palpable facts on which to rest.

As we, in fact, in a certain number of cases of chronic pulmonary phthisis in its different stages, have established as the proximate cause of death a rupture of an aneurismatic dilatation of a vessel running in the wall of a cavity, it is not merely probable, but is even indubitable, that such aneurismatic dilatations may occur in another greater or smaller number of cases without giving rise to hæmorrhage, as in this instance death occurs before the rupture of the aneurism can take place, in consequence of the advanced nature of the consumption. We have, moreover, with ruptured aneurisms, found others which were not ruptured, and in many cases, without previous hæmorrhage, met with dilated, thickened vessels on the inside of the walls of cavities. The percentage of the aneurismatic dilatations may therefore really be fixed much higher than has been stated above; although I cannot give this proportion decidedly, I nevertheless believe that this conclusion is on the whole justified.

On the other hand, it is also probable that the aneurisms may be much smaller than we have observed in the fatal cases, and further, that the vessels on which they are developed may be less. Hence there is, it appears to me, nothing to hinder the assumption, that very small aneurisms may burst and give rise to a hæmorrhage which stops, partly on account of a spontaneous formation of thrombus in the ruptured vessel, partly on account of a defective escape through the cavity, whose eyelet-hole bronchial orifices may easily be obstructed, either by inspissated secretion or by swelling of the mucous membrane, thus giving the blood time to coagulate in it. Similar conditions may still more easily be supposed to be capable of taking place in those instances where the hæmorrhage proceeds from the eroded vessels situated in the walls of the cavity or passing through the latter; and such cases may, to judge from the statements of writers, be much more frequent than those described by me.

Such an explanation takes at least its starting point from undoubted anatomical facts, and seems to me, at least so far as the more violent pulmonary hæmorrhages are concerned, more satisfactory than that generally received respecting bronchial hæmorrhages. It is indeed curious that in our time, when so much prominence is given to anatomical investigation, so theoretical a view should be so strongly retained. The hæmorrhages cannot come from cavities, it is said, because the vessels in the walls and their immediate neighbourhood are obliterated, consequently they must come from elsewhere, and then most probably from the bronchi. But it is a fact that no one has been able, with the least probability, to demonstrate the place where the hæmorrhage has occurred in the bronchial mucous membrane; but, on the contrary, in every case in which the source of the hæmorrhage could be pointed out, it has always been a ruptured vessel in a cavity. Nevertheless, on the strength of the theory respecting the obliterated vessels, this only certain source has been reduced to a pure accident, to a rare exception, from which no conclusion whatever ought to be deduced respecting pulmonary hæmorrhages in general. To this only certain observation, the origin of pulmonary hæmorrhages from cavities, whose frequency, according to the cases above communicated, seems to have been much undervalued, I believe we ought to adhere; and in the revision, to which the whole subject of phthisis is at present subjected, the vessels also ought to be included. It is often easy, even by simply slitting up the vessels with scissors, to satisfy one's self that the vessels in some cases pass into the walls of cavities, especially in those cavities where the wall is very thin, and immediately adjoins the permeable pulmonary tissue. That the vessels are very rare, or are perhaps even altogether wanting in the highly condensed, almost cartilaginously hard, slate-coloured indurations surrounding old cavities, is undoubted; but we ought not from this to deduce any conclusion respecting cavities in general. I do not find myself in this place in a position to give decided

information on this point, which can be supplied only by comprehensive and careful injections; but I believe that the anatomical facts which are here brought forward afford strong proof of the necessity of instituting such investigations.

According to these views, therefore, pulmonary hæmorrhages, or at least the more violent ones, come to stand in a more remote relation to tuberculosis than has hitherto been admitted; indeed, are related to it properly only so far as chronic pneumonia with bronchiectasis is so frequently connected with tuberculosis. This is also the reason why even copious hæmorrhages in general do not affect patients except by the loss of blood, as chronic pneumonia with bronchiectasis is not, as such, attended with direct danger to life.

I do not, however, mean to say that we can explain every parenchymatous pulmonary hæmorrhage as proceeding from a cavity. In the more florid forms of phthisis this is certainly due to a breaking up of the infiltration. Nor is it probable that the slighter hæmorrhages, which occur in the commencement of chronic consumption, proceed from cavities; in this case I should be rather inclined to refer them to capillary pulmonary vessels, which have been perforated by reason of the development of tubercle in their adventitious tunics; but, as I have said, positive data in this direction are entirely wanting. I have on the present occasion been anxious only to give to hæmorrhages from cavities a much greater importance and extension than has hitherto been done. As it may possibly be objected that, in many cases of chronic phthisis, cavities are not met with, I will state my belief that this is an opinion which more careful investigation will not confirm; for it is, at least according to my observations, extremely rare in examining the bodies of phthisical patients not to find cavities, small though they may be, if the investigator will only not be satisfied with seeking them in the apex and in a single longitudinal section through the lung.

It cannot be expected that from the above materials, based exclusively upon cases which have terminated fatally, any direct advantage should result for treatment; but I believe that the facts here brought forward show the necessity of taking, if possible, still greater care than hitherto in every more considerable pulmonary hæmorrhage; and especially of employing suitable means, and, best of all, narcotics, to allay the fits of coughing, and to procure the patient in general the greatest possible quiet, so that the thrombosis in the ruptured vessel may have time to form. This, in connexion with a cooling regimen, is certainly the principal thing; and the different remedies, as digitalis, secale cornutum, acetate of lead, oil of turpentine, etc., to which recourse is usually had, are probably rather injurious than beneficial.

[The author appends the history of a corroborative dissection which he had an opportunity of making while engaged in writing the foregoing. The case was that of a student aged 17, both of whose parents had died of phthisis. Having himself laboured for some

time under the same disease, he died suddenly of hæmoptysis. In the upper half of the left lung were found cavities of various sizes, all of which, as well as the bronchi, even the smallest, were filled with freshly coagulated blood. On the inner wall of the largest of these cavities was found a projecting ledge, in the base of which ran a branch of the pulmonary artery of the size of a barrel of a small quill, giving off a smaller branch which ascended to the upper margin of the ledge, where a lid-shaped rupture had taken place.]

II.—HÆMORRHAGES FROM A RUPTURED ANEURISM OF THE AORTA.

Of the twelve cases of fatal hæmoptysis which form the basis of this essay, the source of the hæmorrhage was, in three, a ruptured aneurism of the aorta. The rupture occurred once in the ascending aorta and the arch, twice in the descending thoracic aorta. The perforation took place once into the right principal bronchus, once into the left, and once into the left lung.

As to the hæmoptysis due to a ruptured aneurism of the aorta, most writers are contented with stating that it is profuse, and that it rapidly causes death. Lebert¹ who, in the 83 cases analyzed by him, met with rupture into the bronchi fifteen times, states that the profuse and rapidly fatal hæmoptysis is indeed the most frequent, but that in some cases also it may occur in the last two or three days before death in several violent attacks. Such violent attacks of hæmoptysis took place in one patient even three weeks before death.² The violence of the hæmorrhage depends in this instance, as in aneurisms in general, upon whether the rupture of the organ concerned takes place with a single large rent, or with one or more small openings, or upon whether the coagula enclosed in the aneurism are in a condition to offer a greater or less resistance to the pressure of the blood. Only in one of our three cases did the hæmoptysis occur suddenly and produce immediate death, and in this case coagula were completely wanting. In this, our first observation, the aneurism presented itself during life with all its characteristic signs, so that the diagnosis was beyond all doubt. The patient, a man aged 35, was comparatively well immediately before the rupture, which occurred just as he was about to go to bed, during a fit of coughing, and the quantity of blood brought up amounted to one or two quarts. On dissection, the ascending aorta and also the arch were found uniformly dilated; the boundary of the descending aorta was sharply defined. The walls of the sac-like dilatation thus

¹ Virchow, Handb. d. spec. Pathologie u. Therapie, 5 Bd. 2 Abth., 1855, p. 24.

² Slight attacks of hæmoptysis frequently occur during the course of aneurisms of the aorta, without any rupture having necessarily taken place into the air-passages, as they may be due exclusively to disturbances of the circulation in the lungs, produced by pressure of the aneurism. Thus, the celebrated English surgeon Liston, during the space of eight months, frequently brought up small quantities of blood.

formed were uneven, thickened, yellowish, of almost cartilaginous firmness, only here and there studded with some small calcareous plates, especially in the ascending aorta; in the arch the walls were thinner, and in some places small flat, soft, rather decolorized coagula adhered to the wall, but elsewhere the whole sac was free from these. The inner side of the sac was found adherent to the root of the left lung, especially to the posterior surface of the left principal bronchus, and the sac had burst into the latter with an irregularly torn opening with highly attenuated yellowish edges, and capable of admitting the point of the little finger. The adjoining larger bronchi as well as the trachea were filled with blood. The left lung was everywhere firmly attached to the thoracic wall by thick membranes of connective tissue of long standing. It was almost devoid of air, with numerous fresh lobular pneumonic infiltrations, which in the apex of both lungs presented a lardaceous appearance, while the intervening tissue was strongly condensed, slate-coloured, with some small smooth-walled cavities. The right lung was permeable throughout, except in the apex, where a slate-coloured condensation of more than the size of an egg was met with, but without the formation of cavity. Nowhere in the lung or in any other organ was there a trace of miliary deposition.

It is a generally received opinion, which is looked upon by almost all writers as correct, that aneurisms in general, but especially those of the aorta, do not occur together with pulmonary tuberculosis, and this opinion is supported even by Rokitansky's¹ ample experience. Lebert, however, states that tuberculosis was met with three times in his 83 cases. We have already, in the foregoing observation, seen chronic pneumonia with and without bronchiectasis, and a recent catarrhal pneumonia occur together with an aneurism of the aorta; but as an undoubted case, though not of tuberculosis in the modern rigorous acceptation of the term, yet of well-marked pulmonary phthisis, the following deserves to be communicated:—

Aneurism of the descending thoracic aorta, with perforation of the right bronchus; bronchial and pulmonary hæmorrhage, slight pulmonary emphysema, hæmorrhage from the stomach and intestines. Cavernous pulmonary phthisis (Chronic pneumonia, Bronchiectasis, Peribronchitis).

H. P. V. Jensen, a musician, aged 39, suffered for about twenty years from cough and dyspnoea, not so severe however as to prevent him taking part in the first Schleswig war, where he received a gunshot wound through the nates, opening the rectum, for which he was under treatment for nearly a year. Three years before his admission, which took place on the 3d April 1865, he had hæmop-

¹ Handb. d. patholog. Anat., 2 Bd. 1856, p. 333. This statement of Rokitansky stands, however, in striking opposition to another (*l. c.*, p. 330), where he mentions a rare case of the rupture of an aneurism of the aorta into a tuberculous cavity.

tysis, though not to any very considerable extent. In January 1865 he was for three weeks under treatment in hospital for the same symptoms. On 1st and 2d April, the latter returned with some violence. On the 7th, very violent hæmoptysis set in, and was arrested by the employment of the ordinary means. It returned, however, in the evening, and terminated fatally. [The author details the post-mortem appearances at full length, and proceeds to make the following remarks:—]

In this instance, the signs of chronic pulmonary phthisis completely masked the aneurism, which, as is frequently the case, especially with aneurisms of the descending aorta, did not reveal its presence by any more prominent symptom,—for even the pains in the back, which may often cause the existence of aneurism to be suspected, were also wanting. The dyspnœa was indeed very considerable, amounting even to orthopnœa; but was, during life, readily explained by the complication with severe bronchitis. As to the hæmoptysis, which clinically was necessarily placed in connexion with the established pulmonary phthisis, the careful post-mortem examination leaves us in doubt whether it proceeded both from the aneurism and from the cavity discovered. With respect to the hæmoptysis which occurred three years before, only conjectures can be formed; but it is probable that this proceeded from the cavity, and the later hæmoptysis from the aneurism, the softness of whose coagula permitted the blood to ooze through.

In our third case, a large aneurism of the descending thoracic aorta was met with in a man aged 45, attached by strong adhesions to the posterior surface of the upper lobe of the left lung, and opening, in a circumscribed situation, into the lung. The latter had thus become highly infiltrated with blood, which was met with also in the bronchi and trachea. At the same time there was exudative pleuritis on the right side, and incipient granular atrophy of the kidneys. There were very violent and increasing attacks of dyspnœa, and the hæmoptysis was present during the four days preceding death, at first in a moderate form, subsequently it was very violent.

In conclusion, I shall make some further remarks, although of a more aphoristic nature, and directly elicited by Niemeyer's work,¹ recently published and quoted in this Journal, namely, on the relation between hæmoptysis and phthisis.

It is well known that, until the time of Laennec, hæmoptysis was looked upon as one of the most frequent causes, though far from being the sole cause, of phthisis, and the so often repeated proposition, "*Pus sanguinem sequitur*," can be traced back to the Aphorisms of Hippocrates. Laennec described this theory as an inconsiderate application of the so frequently misused axiom, "*Post ergo propter*." He does not recognise any other phthisis than that due to tubercles, and hæmoptysis is for him an undoubted sign

¹ *Klinische Vorträge über die Lungen-schwindsucht, mitgetheilt v. Dr Ott.*, 2 Aufl., 1867; *Hospitalstidende*, 1867, Nos. 37, 38, 39, and 40.

of the presence of tubercles, and one of the first symptoms by which the tuberculosis reveals itself. This view of the relation of pulmonary hæmorrhages to pulmonary consumption has obtained general acceptance, and is still, in the present day, that adopted by the most eminent clinical physicians in all countries, if, instead of tuberculosis¹ in Laennec's specific meaning, we substitute pulmonary consumption. The other view has, however, been again embraced by Niemeyer, who sees in hæmoptysis one of the most frequent causes of phthisis.²

According to Niemeyer, after an attack of hæmoptysis, signs of a more or less violent irritation of the lungs and pleura almost constantly set in. Clinically the latter manifests itself, nearly without exception, on the second or third day after the hæmorrhage, by increase of temperature and acceleration of the pulse, disturbed general health, stitch in the side, and the well-known physical signs of pleuro-pneumonia. The usual result of this, however, is resolution, and the patient is often convalescent after the lapse of even a few days; but in other cases the subjective and objective symptoms increase, and a well-marked florid phthisis, derived from the fact that the blood remaining in the bronchi and cells has given rise to pneumonia, with caseous metamorphosis of the retained blood and products of inflammation, is gradually developed. Niemeyer rests chiefly on a single anatomical investigation. This case was that of a man, aged 32, who was greatly reduced with tertiary syphilis, and had signs of cavities and of solidification in the apex of the left lung. He recovered very well under the use of iodide of iron, cod-liver oil, and nourishing diet, especially milk, when he suddenly got one night profuse hæmoptysis. For the next two days he was tolerably well, except that he was very weak; the physical signs were as before, only that a finely vesicular râle was heard over the whole of the left lung. On the third day the patient complained of lancinating pains in the region of the left nipple, where a friction sound was heard. The pulse and temperature were increased. Nine days subsequently, a slighter hæmoptysis came on, and now a florid phthisis was rapidly developed, to which he succumbed in four weeks from the first attack of hæmoptysis.

¹ This view of a phthisis ab hæmoptoe (Morton) is, however, adopted also by Andral (*Clinique Méd.*, t. 4; Paris, 1834, p. 36) in certain cases where hæmoptysis suddenly occurs in hitherto healthy individuals, and is followed by signs of phthisis. The hæmoptysis is explained by a congestion of the lung (*Apoplexia pulm.* Laennec), and the tubercles are developed partly by reason of the disturbed nutrition in the affected parts of the lungs, partly by reason of predisposition. A German clinical physician, too, who would deserve to be mentioned in a German work, Schönlein (*Algem. u. spec. Pathologie und Therapie*, 2 Bd. 2 Aufl., 1832, p. 126), mentions phthisis among the results of idiopathic pneumorrhagia; he leaves it undecided whether the extravasated blood becomes the starting point for the formation of tubercle or not; in hæmoptysis in scrofulous individuals, at all events, this result can scarcely be doubted. Among other results, pneumonia also is mentioned, though only in its first stage.

² *Loc. cit.*, p. 51.

On dissection a slight hæmorrhagic, pleuritic exudation was found on the left side; in the apex of the left lung was a cavity as large as an egg, with considerable shrinking of the surrounding tissue; on the inside of this was a large arterial branch, "whose walls are considerably thickened, its cavity somewhat diminished, but not closed; no opening or erosion is demonstrable." The whole of the inferior lobe was filled with infiltrations from the size of a pea to that of a nut, lying close together, and partly confluent; the intervening permeable tissue constituted only about one-fourth of the whole tissue. On the surface of section the infiltrated parts exhibited a distinctly granular appearance, were of a red, gray, or grayish red colour, just like croupy pneumonia in a state of transition from red to gray hepatisation. In the centre of many of these foci the tissue was coloured yellow, in others it was at the same time caseous, dry, firm, and sharply contoured. Directly beneath the pleura lay numerous yellowish transparent cavities, about as large as peas, in the midst of a caseous tissue, and evidently formed by recent decay of caseous infiltrations. A medium-sized bronchus, which ran down towards the outer inferior margin, was filled with a tough puriform mass, constituting, through an extent of two inches, a firmer puriform plug, giving the whole bronchus the appearance of a vein plugged with a thrombus; it was adherent to the wall, where the branch of the air-tube ran through the infiltrated tissue; the wall was here considerably thickened and firm, the mucous membrane on the adherent part was as if diphtheritically infiltrated, so that after the separation of the plug there was loss of substance; in the finer ramifications the plug passed into a puriform fluid. In the apex of the other lung was a small cavity of longer standing, and in several places there were peribronchitic nodules, but nowhere in the lungs or other organs were there tubercles.

This case appears to me, however, not to be a very convincing one. First, as to the anatomical conditions, Niemeyer ought to have fully shown that the hæmorrhages proceeded from the large cavity; for they cannot possibly have been derived from the greatly thickened vessel described as running in its wall. According to the view I have given of the pathological anatomy of pulmonary hæmorrhages, I should incontestably have been most inclined to seek the starting point of the bleeding in the cavity; but this cannot be proved by the dissection, and I do not see how Niemeyer will be able to refute the assertion, that the hæmorrhage in this instance may have been derived from the decay of smaller pneumonic infiltrations,—these have in fact, as the record of the post-mortem examination distinctly shows, a very different standing, the greater part being recent, red or grayish, a smaller part having already fallen into detritus and forming cavities; for that hæmoptysis may arise in the course of a caseous pneumonia with the formation of cavity, can scarcely be denied, and that at least the last attack of

hæmoptysis in the case stated has had this origin, appears to me even to be most probable.

I shall next dwell for a moment on the peculiar thrombus formation in the bronchi, which was, however, met with only to a slight extent. This is a circumstance which has scarcely been before observed, but which cannot possibly be overlooked by any conscientious investigators, and it must therefore undoubtedly be considered as extremely rare, and most probably depending on peculiar circumstances in the concrete case. In general, the blood remaining in the bronchi after an attack of hæmoptysis is brought up in the course of some few days, intimately mixed with the ordinary expectoration; that this did not happen in the instance before us, may depend partly on the considerable languor and debility of the very much exhausted patient; but its presence seems to me to be with equal probability explicable from the fact that, previously to the hæmorrhage, an incipient infiltration of the lung existed, preventing the blood being discharged as usual; an infiltration which was very extensive, corresponding to the cavities and caseous parts met with on dissection, and that therefore it could not be clinically demonstrated.

While, therefore, in Niemeyer's case it must remain doubtful whether the hæmorrhage proceeded from the large cavity, or was due to the breaking-up of older scattered pneumonic infiltrations, we have, on the other hand, among our own observations, a number of cases in which, for a long time before death, there were abundant hæmorrhages, whose source we have anatomically shown to be a ruptured vessel in the wall of a cavity. This case seems therefore to be necessarily specially adapted to show this peculiar irritative effect of the blood, supposing that such actually exists. We shall consider this case more closely from this point of view. In our first case we have a chronic pneumonia, with a bronchiectatic cavity in the apex of one lung, from which, in the course of a fortnight, with a few days' interval, six copious hæmoptyses took place. After none of these attacks did we observe during life the slightest trace of this consecutive pleuro-pneumonia occurring "almost without exception,"—the general health was undisturbed, the pulse 80. On dissection we found no trace of any pneumonic infiltration. I attach special importance to this case, because it is not complicated, like Niemeyer's, in which there were found old solidifications with cavities, old and recent pneumonic infiltrations and peribronchitis, and because the source of the hæmorrhage was anatomically demonstrated to be entirely independent of any other destructive process in the lungs. Here, therefore, we have an opportunity of seeing the blood develop its irritative effect pure and simple. Neither in our third case did we find, after abundant hæmoptysis during seventeen days before death, any secondary pneumonia. In our second case of an aneurism of the aorta in connexion with chronic pulmonary consumption, where both old and recent hæmoptyses

occurred, we found nothing of the kind, nor in Fearn's and Cotton's cases, notwithstanding the copious hæmoptyses. I may here mention also an older case, which is not included in this review, because the source of the hæmorrhage was not discovered, but which, nevertheless, deserves mention in connexion with this subject. It is that of a man, aged 46, who for about a year had laboured under consumption, during which he had several times expectorated blood. On admission into hospital on the 28th September 1864, he was very much exhausted, and had signs of large cavities in the apex of each lung. On the 1st October he coughed up four ounces of blood, and almost every day afterwards until the 13th October, when the fatal hæmoptysis came on, he brought up considerable quantities of blood, even as much as a pint. His pulse was 84, his general health was unchanged, except that he had considerable debility. On dissection, large cavities were found in the apices of the lungs, miliary tubercles in the lungs and pleura, alternating hæmorrhagically-infiltrated and emphysematous lobules, but no trace of any pneumonic infiltration.

If we look next to the second factor in this condition,—the pneumonic infiltration,—it is clear enough, as Niemeyer himself states, that, together with chronic solidifications or ulcerative processes in the apices of the lungs, catarrhal pneumonias with caseous metamorphosis extremely frequently occur. But recent catarrhal pneumonias also frequently coexist with these older affections, and spread over greater portions of the lung, with reddish or reddish gray, in some parts perhaps even yellowish coloration, and a cribriform rather than granular surface of section. These may occur—nay, do so even most frequently—without any previous hæmorrhage. Even in the limited number of cases made use of in this paper, we have an example of this, namely in our first case of a ruptured aneurism of the aorta. Here we have old solidifications in the apices of both lungs, in the left combined with bronchiectatic cavities; in the same lung, and also in Niemeyer's case only in the one lung, numerous recent pneumonic infiltrations, which in the apex had already assumed a lardaceous appearance. In these cases, hæmoptysis had never occurred previously to the rupture of the aneurism which instantaneously caused death. It is worth observing what a large part the accidental may play in a single example; for, if the hæmorrhage from the aneurism had, as in our second case, preceded death by some time, this instance might have been quoted as a striking proof of the correctness of Niemeyer's theory.

When we thus find, as a frequent complication of chronic solidification in the apices of the lungs, with or without the formation of cavities, both old caseous and recent and diffuse pulmonic infiltrations, without any hæmorrhage having previously occurred; and, on the other hand, in a not very small number of cases, in which abundant hæmorrhages have for a long time preceded the fatal

hæmorrhage, have neither clinically nor anatomically observed the slightest trace of pneumonia,—I believe that we cannot be careful enough in our conclusions as to the mutual relations between hæmoptysis and pneumonia, if we wish to escape the rock *post ergo propter*. When, therefore, Niemeyer with so much vehemence casts it in the teeth of Laennec, that his doctrine rested on a very weak foundation, and was based upon theoretical reasoning, I believe that the same reproof may with equal justice be turned against himself, for he at once, with a theoretical dictum, decides the question which above all requires to be solved,—the anatomical foundation of the hæmorrhages,—setting up as almost the exclusive cause of the hæmoptysis a broncho-hæmorrhage, depending on a supposed brittleness (hæmorrhagic diathesis) in the arteries of the bronchial mucous membrane, and does not take into account that precisely the acute caseous (tubercular) pneumonia itself may undoubtedly be the cause of the hæmorrhage. Fully appreciating the interesting and talented views of the gifted clinical physician, I do not, however, believe that on this point he has satisfied the rigid requirements of our day for anatomical and clinical observation, or has on the whole laid so firm a foundation that any lasting structure can be reared upon it. A single observation, even if it were much more convincing than it really is, is quite too dependent upon the accidental, to admit of any general conclusion being drawn from it. “*Ex paucis experientiæ manipulis ad axiomata generalia intempes- tive transcendunt,*” says Baglivi (*De Praxi Med.*, lib. i., cap. iv., § 2) of the physicians of his day; and these words may perhaps find their application in the subject before us, but of course completely separated from their other connexion.

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