FATAL HÆMOPTYSIS:

THE STATISTICS OF THE LAST FIFTEEN YEARS OF
THE CHEST HOSPITAL, VICTORIA PARK;

WITH

REMARKS UPON PROFUSE NON-FATAL HÆMOPTYSIS.

BY

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(Received November 11th, 1884—Read February 24th, 1885.)

It is an opinion now generally expressed that fatal pulmonary hæmorrhage has for its cause, with but few exceptions, some gross lesion of the pulmonary vessels, viz. either ruptured aneurysm or erosion.

It is remarkable, however, how little there is in literature beyond the record of isolated cases to support this, as I believe, quite correct conclusion. The present paper is a contribution to the subject based upon the post-mortem evidence of the past fifteen years at the City of London Chest Hospital. Dr. Douglas Powell¹ has published similar observations extending over some years at the Brompton Hospital. The only other original paper of importance I am acquainted with is that by Dr. Vald Rasmussen.²

¹ 'Transactions of the Pathological Society,' vol. xxii.

² Translated by Dr. Moore, in 'Edinb. Med. Journ.,' vol. xiv.

Although I have not introduced into the present statistics cases which I have met with in other places, the general conclusions I draw, other than statistical, are so framed as to include the experience gained from these other sources.

The statistics deal entirely with fatal cases of pulmonary hæmoptysis. After discussing these I shall consider what light is thrown by them upon cases of profuse pulmonary hæmoptysis which have not proved fatal.

By the term pulmonary hæmorrhage I wish to exclude all cases of hæmoptysis due to the rupture of a large vessel into the trachea or larger bronchi, as in the course of thoracic aneurism or new growth, and to speak only of those cases in which the hæmorrhage has its source in some portion of the lung tissue, *i.e.* of hæmoptysis in its usual limited sense.

The cases number 26, 20 males and 6 females.

	<i>Age.</i>						
	15-20	20-25	25-30	30-35	35-40	40-50	50-60
Males .	2	2	4	2	2	3	4 ... 19
Females	3	1	1	0	0	1	0 ... 6
Totals .	5	3	5	2	2	4	4 ... 25

In one of the 26 the age is not given, and although the numbers are too small to justify any absolute conclusion, this table seems to show that there is no special liability at any particular age.

The earliest case was in a lad of 16, and the latest in a man of 53.

Sex.—It is noteworthy how much more frequent these cases seem to be in men than in women, in the proportion of 20 to 6 or $3\frac{1}{3}$ to 1.

This may be associated with the fact that the male has a greater power of resistance to phthisis than the female, or, in other words, that the disease more often becomes chronic in the male. To this point attention will be drawn again later.

The condition of the lungs.—Phthisis was in all cases present, and was clearly the primary cause. Cavities were always found and cavities not of recent date, but with thick fibroid walls, and ribbed or crossed by coarse trabeculæ, such as are found usually in the most chronic forms of phthisis.

Both sides were similarly affected, though not to equal degree, in 16 cases, while in 9 one side only was excavated, the opposite lung being in the condition of complementary emphysema, or, as it is often called, of compensatory hypertrophy.

These very chronic cavities seem to constitute a group of phthisis quite apart from the other and more ordinary form. In these the disease develops very slowly, often insidiously, so that there may be perhaps no history of any previous illness, and death sometimes occurs quite unexpectedly from hæmoptysis in patients who have been thought, and have appeared, in good health. Indeed, in this class of cases profuse hæmoptysis seems to be the risk most to be dreaded.

In other words, profuse hæmoptysis generally occurs in chronic phthisis, or from chronic cavities, very rarely in the subacute, and possibly never in the acute form of the disease.

Cause of hæmorrhage.—The source of the hæmorrhage was found in 16 cases out of 25, and proved to be aneurysm in 11, and ulcerated vessel in 6.

In the cases in which I have myself made the examination I have only twice failed to find the source, and one of these cases of failure is not included in the present number.

Too much stress must not be laid upon the term used, for ruptured aneurysms sometimes look like ulcerated vessels, especially when, by the force of the blood-stream, the whole or nearly the whole of the sac has been torn away, and I further observe in the post-mortem notes of recent years that aneurysm is a term more commonly found than ulcerated vessel, while in some of the earlier

notes the diagnosis of ulcerated vessel has the explanation added, "No saccular dilatation found," but for the reasons given the explanation is hardly adequate.

In my own cases I have only once or twice seen ulcerated vessels among many cases of aneurysm, and Rasmussen says that he has himself never met with an ulcerated vessel as distinguished from aneurysm. The difference is therefore probably in most cases rather one of terms than of reality.

The side.—The hæmorrhage came from the left side for certain in 11 cases, and with probability in 5 more; and from the right side for certain in 6, and with probability in 3 more. So that the left side is more often the source of the hæmorrhage than the right in the proportion of 16 to 9, or nearly 2 to 1.

When the chronic excavation before referred to is limited to one side it appears to be also most frequently on the left side, in the proportion in the present cases of 6 to 2. I know of no other statistics on this point, but this conclusion quite agrees with other observations of my own.

It does not, however, necessarily follow that the source of the hæmorrhage is found upon the side most affected, or if so in the most diseased part of it.

The seat.—Any chronic cavity, whatever its size, may be the source of the hæmorrhage, from a small single cavity—the only spot of disease, it may be, in the lung—not larger than a filbert, to an enormous cavity, produced by the complete excavation of the whole lung.

The cavity from which the hæmorrhage came was in the upper lobe 9 or probably 10 times, in the middle lobe twice, and in the lower 7 times, and of these last it was found 6 times in the apex of the lower lobe. In two cases the whole lung was excavated.

In the majority of cases, therefore, the hæmorrhage came from the upper lobe. The next commonest source was the apex of the lower lobe, or in the middle lobe. The lower part of the lower lobe is an unusual position.

The favourite seat, therefore, is the middle of the lung laterally, and near the periphery, whether in the lower part of the upper lobe, or the upper part of the lower. This is also the spot at which perforation most frequently occurs in pneumothorax, and it is interesting to associate these two facts together.

Aneurysm of the pulmonary artery.—Rasmussen, in his paper, draws a distinction between aneurysms, *i.e.* definite sacs or pouches, and ectasias or dilatations. I do not think it desirable or necessary to make this distinction, for the two classes are differentiated by no fixed characteristics, and there is every transitional stage between the one and the other, so that it is simpler to regard them as different degrees of the same affection, and to speak of them all as aneurysms.

These aneurysms spring always from a branch of the pulmonary artery, sometimes from one of the main divisions, but more often from a medium-sized branch, though frequently at only a very short distance from the origin of the smaller branch from the main trunk, so that a bristle may pass quite easily at once into the main vessel. These facts are of importance, I think, as bearing upon the origin of these aneurysms. They develop, as a rule, in the longitudinal axis of the vessel, away from the main trunk and into the lung-cavity.

They are usually found upon a trabecula which forms a more or less prominent ridge in the walls of the cavity; sometimes, though rarely, upon a trabecula which crosses the cavity, though Rasmussen says that he has never seen this latter position, and it is certainly rare. Occasionally there is no indication of the trabecula, but the aneurysm projects at once from what appears to be the smooth wall of the cavity.

The trabeculæ are the remains of the indurated vessels and bronchi of the lung, and are largest towards the root of the lung. Hence the aneurysms also are found in the part of the cavity nearest to the root. Cavities, therefore, in which aneurysms are being searched for, may be

opened through the pleura, *i.e.* from the periphery, without risk of destroying the aneurysm.

Their *shape* is, as a rule, more or less globular, extending from one side of the vessel. Those of large size have frequently secondary pouches or sacculations upon them, and sometimes look almost like a mulberry. At other times they form more irregularly oval swellings, also with secondary sacculations. This is the condition to which Rasmussen gives the name of ectasias. True fusiform aneurysms are, I think, from the nature of things almost impossible.

They are usually small, sometimes not larger than a pea, only very rarely larger than a Morella cherry, *i.e.* $\frac{1}{2}$ " to $\frac{3}{4}$ " in diameter. Aneurysms as big as a walnut are very unusual. I have exhibited two of this size; one of them, oval in shape, measured one inch and three quarters long and one inch wide. I have never met with a description of a larger aneurysm than this. There is no relation between the size of the cavity in the lung and the occurrence or size of an aneurysm. The cavity may be so small as to be completely filled by the aneurysm, and that too when other much larger cavities are present. In two of the cases recorded here, the cavity was formed by excavation of the whole lung, while the aneurysm was of small size.

Aneurysms are in most cases single. This is remarkable, but instances of multiple aneurysm are recorded by many observers. One of the cases in these tables had several.

With regard to *clotting*, Rasmussen states that pulmonary aneurysms are never found to contain laminated clot. Further observation proves the statement to be incorrect. It is, however, true that they frequently do not. The larger aneurysms generally do according to my experience, and many of the smaller ones may. Dr. Percy Kidd's case is a notable instance of this, for nearly every one of the numerous aneurysms there found was occupied by laminated clot, which in some nearly filled the cavity completely.

Many of the solid lumps found projecting from the

walls of chronic cavities are, I believe, aneurysms, which have become obliterated or cured by clotting, in the same way that aneurysms cure elsewhere, but clotting does not necessarily prevent rupture in pulmonary any more than in other aneurysms.

Clotting often occurs not only in the sac, but also after rupture outside it in the cavity, and this clot, too, is sometimes laminated. The size of the aneurysm thus becomes sometimes deceptive, and it appears much larger than it really is.

This clotting may explain the cases of remittent hæmoptysis, but though essentially a conservative process, whether within or without the sac, it does not necessarily prevent a fatal result.

The seat of *rupture* is generally at the periphery, *i.e.* at a point distant from the vessel from which it springs, but occasionally it is found at the base of the sac, as it were between the sac and the vessel.

The aperture is sometimes small, and may then be easily closed by clotting ; at other times it is irregular and large, and in some cases the whole sac or the greater part of it is torn bodily off, and the rent into the vessel is represented by the origin of the sac. Some of these cases would look very like simple erosion of the vessel. In some of my own cases, I have only been able, on careful examination, to satisfy myself that I had an aneurysm, and not an erosion to deal with.

As in aneurysms elsewhere, the final rupture rarely comes without warning. In most cases there is, or has been within recent periods, some premonitory hæmorrhage. This clinical fact, associated with the known pathology, shows the importance of early and strict treatment of even slight hæmorrhage in chronic phthisis.

Rasmussen draws a distinction as to the access and the amount of hæmorrhage between the two classes which he makes of aneurysm and ectasia, but I do not think so sharp a distinction is warranted either by clinical experience or by pathological observation.

The *pathogenesis* of pulmonary aneurysm is, I think, simple. There is no case recorded, so far as I am aware, of an aneurysm of the pulmonary artery developing in an otherwise healthy lung. It is conceivable that atheroma or syphilitic disease, or some other primary affection of the pulmonary artery might lead to aneurysms, but such conditions are, to say the least, very rare. Hence we are justified in connecting the development of the aneurysm with a pre-existing cavity in the lung as already shown.

The formation of the aneurysm may be attributed :

I. To changes set up in the walls of the vessel, of an inflammatory or degenerative nature, by direct extension from the walls of the cavity.

In nearly all acute inflammatory or rapid cases clotting occurs in the vessels of the neighbourhood, and they are early obliterated. When the process becomes circumscribed, and a chronic cavity is formed, it frequently happens that a vessel of larger size remains unobliterated, and that its coats become subsequently involved in the same fibroid change which had occurred in the walls of the cavity. If the vessel remain patent the blood pressure within slowly distends the fibroid part to form a pouch.

The growth of the aneurysm is still further aided by :

II. The want of support upon the side towards the cavity, so that this side of the vessel is not only the weakest in itself, but also the direction of least external resistance.

It is, moreover, not unusual to find the vessel from which the aneurysm springs constricted or even perhaps completely obliterated peripherally, a condition which tends still further to promote the formation of aneurysm, by making the same spot also the point of maximum pressure from within.

These facts explain the association of aneurysm with chronic cavities only.

Ulceration of vessels.—Where a cavity is of more recent formation and has not passed into the chronic stage, or

where in a chronic cavity ulceration has set in, the change in the walls of the vessel are of a more acute character. They too may become involved in the ulceration, and after considerable thinning may rupture. But in most cases this is prevented by clotting within, and the vessel is quickly obliterated. This is so common in phthisis that occlusion of vessels has been regarded as one of the most characteristic features of the disease. If this were not so, hæmorrhage ought to be even more frequent than it is, and fatal hæmoptysis one of the commonest causes of death. The contrary is, however, the case. The percentage of deaths from hæmoptysis in phthisis is small, probably not more than 1 or 2 per cent. of all the fatal cases. My own statistics give about 1·5 per year, or about 2 to 2·5 per cent. of deaths from all causes in phthisis.

Although the pulmonary artery is the vessel usually affected in both aneurysm and ulceration, still the pulmonary vein may be attacked. I have met with one case of this kind in which the death was due to ulceration of a branch of the pulmonary vein, but it is the only case I know of.

In conclusion, aneurysm being a thing of slow growth, can arise only in chronic cases. In early phthisis hæmorrhage is probably due to ulceration or erosion of vessels, but this is rarely copious and very seldom fatal, for phthisis as a rule seals the vessels as it invades them.

When hæmoptysis leads to death, it does so in one of two ways, either by frequent recurrence of hæmorrhage and gradually increasing exhaustion, as occurs in similar recurrent hæmorrhage from other parts, or suddenly in a few moments. To this latter group the name of suffocative hæmoptysis is given. Occasionally, however, the sudden result is due to cardiac syncope, though as a fact this more frequently occurs as the final cause of death in the cases belonging to the first group, *i.e.* where death is the result of exhaustion.

The question now arises : " Are the causes of profuse pulmonary hæmoptysis the same in the non-fatal as in the fatal cases ? "

To this question an affirmative answer must, I think, be given without hesitation, and for the following reasons :

1. Cases recover which can in no way be distinguished clinically from those which die.

2. In cases which have lingered and finally died from exhaustion (remittent or intermittent hæmoptysis) the two lesions described, viz. aneurysm or ulceration, have been found.

3. We have sufficient pathological evidence that pulmonary aneurysms may, like aneurysms elsewhere, spontaneously cure, and though it may be urged as an objection that if this were true, cured aneurysms should be frequently found in cases of phthisis, I do not think the objection of much weight, for they are often not looked for, and even when looked for carefully are not easy to find, while it is possible that many of the firm fibrous masses frequently found and described in chronic cavities, and of which no very satisfactory pathological explanation is usually forthcoming, may be really aneurysms obliterated and cured. Several such cases have been recently described.

4. The evidence is still stronger in favour of the cure of ulcerated vessels. In acute phthisis the vessels are at once considerably involved, and the wonder is not that profuse hæmoptysis occasionally occurs, but that it is not much more frequent. It is prevented, we know, by the thrombosis and obliteration of vessels which advance *pari passu* with the disease, and the same process continues also in chronic phthisis, in which, as is abundantly proved, ulceration of vessels is very rarely the cause of fatal hæmoptysis.

Nor are the cases of phthisis ab hæmoptoë, *i. e.* those cases in which profuse hæmoptysis is the first or earliest recognisable symptom of the disease, necessarily opposed

to the present views of hæmoptysis, for it is well known that disease may exist in the lung which no physical examination can detect, and that it is often of a latent, insidious or chronic kind, and that aneurysms have been found in such cases.

The doctrine of phthisis ab hæmoptoë can hardly I think be accepted except in the sense of post and not propter hæmoptoem; and though it is true that after hæmoptysis destructive lesions may advance with great rapidity in the lung; it is, however, equally true that the hæmorrhage sometimes not only does no harm but may even seem to do good.

It would carry me beyond the scope of this paper were I to bring forward evidence from the clinical records of cases to establish each of these assertions, but upon the answer given to these questions will depend largely the methods of treatment we pursue, and as rational therapeutics must rest upon the basis of correct pathology their importance is self-evident.

Date.	Name and reference.	Age.	Sex.	Cause of hæmoptysis.				Condition of lungs.	Side most affected.	Cavity from which hæmorrhage came.		
				Ulceration.	Aneurysm.		Rupture.			Side of chest.	Size.	Position.
					Aneurysm.	Number.	Size.					
1870	John Parker (Dr. Ward, P. M. R., ii, 205)	28	M.	—	—	1	Small walnut, artery = $\frac{1}{16}$ diam.	Chronic phthisis in both; many irregular cavities, with fibroid walls	Right	Left	Pul-let's egg	Middle third of lower lobe
1871	Henry Barnes (Dr. Birkett, P. M. R., iii, 11)	41	M.	? Ulceration; "no saccular dilatation found"	—	—	—	Chronic phthisis of right upper lobe, with complementary emphysema of rest of right and whole of left	Right	Right	Large excav.	R. upper lobe, upper and inner part
1872	James Kelly (Dr. Andrew, P. M. R., iii, 18)	36	M.	? Ulceration; ditto	—	—	—	Chronic excav. of upper part of both lungs, with great fibroid induration	Equal	Left	Large excav.	Upper lobe
"	John Baxter (Dr. Bennett, P. M. R., iii, 43)	52	M.	? Ulceration	—	—	—	Phthisis of both sides, with soft-walled cavities and caseous masses	—	Right	—	—
"	Arthur Wilson (Dr. Andrew, P. M. R., iii, 60)	17	M.	? Ulceration	—	—	—	Large chronic cavity in right upper lobe; recent caseous change in left	Right	Right	—	Upper lobe
1874	Edwin Cordery (Dr. Peacock, P. M. R., iii, 86)	30	M.	No source found	—	—	—	Large cavity in left apex, walls not very fibrous; rest of left and also right contained caseous masses and a few small cavities	Left	? Left	—	Apex

		19	F.	No source found	—	—	—	Chronic excavation in left upper lobe, with recent caseous change in rest as well as in right lung	Left	? Left	—	Upper lobe
"	Sarah Smith (Dr. Andrew, P. M. R., iii, 88)											
1876	Thomas Smith (Dr. Birkett, P. M. R., iii, 139)	53	M.	No source found	—	—	—	Chronic phthisis; both lungs in a condition of slaty induration, with cavities with fibroid walls	—	? Right	—	Probably from middle lobe
"	Geo. Carpenter (Dr. Birkett, P. M. R., iii, 151)	27	M.	No source found	—	—	—	Cavity with fibroid walls in left apex; right emphysematous	Left	Left	—	Probably apex
"	Joseph Larman (Dr. Birkett, P. M. R., iii, 152)	21	M.	—	Aneurysm	1	Hazel nut	Extensive excavation of upper two thirds of left lung; right emphysematous	Left	Left	Walnut	Middle of apex of lower lobe, just below pleural septum
"	Emma Harris (Dr. Andrew, P. M. R., iii, 167)	17	F.	—	Aneurysm	Several	Small	Left lung converted into one large cavity, with several aneurysms upon trabeculae; right lung also contained several cavities with fibroid walls	Left	Left	Whole lung	—
"	Susan Bissett (Dr. Peacock, P. M. R., iii, 172)	44	F.	Ulceration; aperture partly occluded by clot	—	—	Irregular	Phthisis, with recent mischief in both lungs, most advanced in left; in apex of left a large cavity; empyema on right side	Left	Right	Pigeon's egg	Middle lobe

Date.	Name and reference.	Age.	Sex.	Cause of hæmoptysis.					Condition of lungs.	Side most affected.	Cavity from which hæmorrhage came.		
				Ulceration.	Aneurysm.		Rupture.	Side of chest.			Size.	Position.	
					Number.	Size.							
1878	Joseph Wood (P. M. R., iv, 73)	?	M.	Ulceration	—	—	Irregular	Chronic excavation in left apex; right lung emphysematous	Left	Left	—	Apex	
1879	Thomas Waldie (P. M. R., iv, 153)	50	M.	—	Aneurysm	1	Irregular	Chronic excavation of both apices, most in left	Left	Left	—	Up. lobe, outer part	
1880	John Harrington (P. M. R., iv, 190)	38	M.	—	Aneurysm	1	Half torn across	Complete excavation of left lung, with emphysema of right	Left	Left	Whole lung	—	
1881	James Doyle (P. M. R., v, 1)	27	M.	—	Aneurysm	1	Irregular	Excavation of whole upper lobe of left, with chronic induration and cavities of lower lobe; complementary emphysema of right	Left	Left	Cherry	Apex of lower lobe	
"	Agnes Pyman (P. M. R., v, 27)	20	F.	Source not found	—	—	—	Chronic excavation of right upper lobe; complementary emphysema of left lung	Right	Probably left	—	—	
"	Mary Ford (P. M. R., v, 48)	19	F.	Source not found	—	—	—	Chronic induration, with fibroid walled cavities in both	Left	Probably left	—	—	
1882	Sarah Payne (P. M. R., v, 72)	29	F.	—	Aneurysm	1	—	Chronic cavities in both lungs	Equal	Right	Small	Apex of lower lobe	

1883	John Ashley (P. M. R., v, 103)	55	M.	Source not found	—	—	—	Chronic cavities, with fibroid walls in both apices; largest left	Left	Left	Large	Apex
"	Alfred Vickery (P. M. R., v, 105)	26	M.	— Aneurysm	1	Small cherry near base	Irregular	Large chronic cavity in left apex; smaller ones in upper part of lower lobe; chronic induration of right lung, but no cavities	Left	Left	Small	Apex of lower lobe
"	George Thrussel (P. M. R., v)	40	M.	Source not found	—	—	—	Chronic phthisis of both	Equal	Probably right	—	—
"	Bartholomew Haye (P. M. R., v)	34	M.	Source not found	—	—	—	Chronic excavation of left upper lobe; chronic cavities of smaller size in right	Left	Probably right	—	—
"	Geo. Macarthy (P. M. R., v)	40	M.	— Aneurysm	1	Oval, 1½" by 1" in axis of vessel	Irregular	Chronic excavation of right upper lobe; chronic cavity in apex of lower lobe; complementary emphysema of left lung	Left	Left	Tan-gerine orange	Apex of lower lobe
"	Thomas Whittingham (P. M. R., v)	16	M.	— Aneurysm	1	Small cherry	Small and irregular	Numerous small chronic cavities in both lungs, largest in apex of left	Left	Left	—	Apex

(For report of the discussion on this paper, see 'Proceedings of the Royal Medical and Chirurgical Society,'
New Series, vol. i, p. 350.)