ON
SOME OF THE EFFECTS
OF
PRIMARY CANCEROUS TUMOURS
WITHIN
THE CHEST.

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Received Jan. 27th.—Read May 24th, 1859.

CANCEROUS tumours in the chest have long been divided into two classes—secondary cancerous tumours and primary cancer.

Secondary cancerous tumours, the result of cancer originating in a remote part of the body, are common, and are usually multiple and scattered through both lungs.

Primary cancer within the chest is comparatively rare, and usually forms a single compact nodular mass, commonly occupying the mediastinum, and invading to a greater or less extent one of the lungs—in the great majority of instances, the *right*—the other lung remaining uninfected.

Secondary cancerous tumours scattered through the lungs have no special tendency to set up inflammation in any of

the neighbouring tissues, and are often found of considerable size with the pulmonary tissue immediately surrounding them perfectly healthy.

Primary cancer, when it involves the mediastinum and root of one lung, leads to adhesion of that lung to the pleura costalis, and, in the end, to suppurative and destructive inflammation of the tissue of the lung where it is not invaded by the cancer.

It is to the particulars of some cases of this kind that I desire to call the attention of the Society to-night.

CASE 1.—Henry O—, a railway clerk, æt. 31, was admitted into King's College Hospital on the 9th of October, 1847.

He stated that his health was good till May, 1846, when he was laid up with what was considered pneumonia of the lower lobe of the right lung.

From that time he had shortness of breath on exertion, and was in the habit of spitting up in the morning a little clear phlegm.

In February, 1847, he was again laid up for a time with pain in the lower part of the right chest.

Six weeks before his admission to the hospital, he was taken again with sharp pain in the right side and between the shoulders, and became weak and languid. On admission to the hospital, though according to his own statement he had fallen away much in flesh and strength, he was still in tolerable general nutrition.

He complained of pain between the shoulders, almost constant while he was sitting up, and of occasional pain in the lower part of the chest. He had slight cough, and the matter expectorated was tinged with blood.

The right side of the chest was everywhere duller on percussion than the left, but more especially so in the lower part.

The respiratory murmur was quite inaudible over the lower two thirds of the right lung, and was very faint in the upper third.

The liver was felt extending some distance below the margins of the ribs. The pulse was 128, the inspirations 26, in the minute. He had very little appetite, a furred tongue, and costive bowels.

The pain between the shoulders was somewhat relieved by a blister, and his condition in other respects slightly improved after his admission to the hospital, but the symptoms remained essentially the same.

The pulse ranged from 120 to 132; the inspirations from 24 to 32. He spat up daily a small quantity of phlegm, which was generally tinged with blood.

On the 10th of November there was much œdema of the right side of the chest and face, and soon afterwards the superficial veins of the chest became enlarged and conspicuous. The vesicular respiratory murmur was faint, but distinctly audible, in the upper part of the right chest. The cough was very slight, and the matter spat up continued to be tinged with blood.

On December 15th it was noted that the left side of the chest was dilated, as was supposed, from the extra duty thrown on it by the deficiency of breathing in the right lung. The superficial veins of the abdomen were becoming enlarged and tortuous, like those on the right side of the chest. On the left side of the chest behind, a single enlarged tortuous vein was seen.

Up to this time the cough had been slight and the expectoration scanty.

On the 20th of December the cough had become much more troublesome, and a coarse crepitus was heard under the right clavicle.

On the 22d a loud, superficial rubbing sound was heard over the cardiac region. The expectoration was still scanty.

The friction sound in the precordial region continued to be audible up to the 31st, and was not noticed subsequently.

All this time the œdema on the right side of the chest continued. The superficial veins on the right side of the

chest behind became more and more enlarged and tortuous. The patient constantly grew weaker and more anæmic; and on the 6th of February left the hospital at his own desire.

On the 17th of February he was readmitted, in a state of orthopnœa, much more pallid and wasted than when he left, and with his body and extremities covered with purpuric spots. He expectorated a yellow puriform matter.

The right side of the belly, and the right and front of the chest, were covered with enlarged tortuous veins.

Over the precordial region a rubbing sound was heard. He died the next day from apnœa.

On examination of the body, the lower part of the right chest was found occupied by a white cancerous mass firmly adherent to the ribs and diaphragm. This cancerous mass extended in form of a cone up the mediastinum, its apex being on a level with the clavicle. The left boundary of the tumour was very irregular, posteriorly extending over the bodies of the vertebræ to the left side, displacing the aorta, which was firmly attached to it.

It penetrated the superior vena cava in nodular or globular heads, half filling its cavity and projecting into the right auricle. The root of the right lung was quite inclosed in the mass, and the large bronchi were penetrated by the cancer, and were narrowed but not closed by it.

The right lung was everywhere firmly adherent by thickened pleura to the walls of the chest. The place of the upper lobe was almost occupied by a large cavity half filled with pus. The rest of the lung not invaded by the tumour was a gray hepatized mass, containing small pockets of pus.

The outer surface of the pericardium was covered with recently effused lymph, and the layers of the pericardium were glued together by an effusion of lymph. The heart itself appeared to be healthy.

The left lung and its root were in no way implicated in the disease, and the texture of the lung was quite healthy.

In this case a cancerous tumour, occupying the lower lobe of the right lung, and extending up the mediastinum so as to embrace the root of the right lung, led to universal adhesion of that lung, by thickened pleura, to the walls of the chest; to almost entire destruction of the tissue of the lung not invaded by the cancer; and, lastly, to an effusion of lymph on both surfaces of the pericardium.

CASE 2.—F. S—, a compositor, æt. 20, was admitted into King's College Hospital on the 14th of July, 1858.

He stated that he was quite well till Whit-Monday, the 24th of May preceding, when he took cold, as he imagined, from having rowed hard in the rain on the River Lea. A few days after this he felt pain on the right side of the chest behind, near the right shoulder-blade. This was soon succeeded by pain in front of the chest, near the right nipple. These pains ceased at the end of a week, and he had no further particular ailment till the 3d of July, when œdematous swelling of the face came on, with much vascular fulness, so that on any exertion his face became of a purple colour, and, to use his own expression, he was obliged to rest while the flow of blood to the face went down.

The œdematous swelling of the face continued. It was greatest on his rising in the morning, and subsided after he had been sitting up some hours. In spite of these ailments his appetite continued good, and he followed his occupation.

On his admission to the hospital, the 14th of July, there was œdematous swelling of the face, the hands were purplish, and the veins on the surface of the chest were enlarged. It was evident there was some obstruction to the course of the blood through the descending cava; and an examination of the chest led to the conclusion that this obstruction was caused by a tumour in the upper and anterior part of the chest. No unusual pulsation existed in that region, and no morbid *bruit* attending the movements of the heart could anywhere be heard.

He complained of occasional headache and nausea, but

his appetite was good; his pulse was 72—76. He made no complaint of cough, and slept well.

He suffered chiefly from the swelling of the face and neck, and from the venous distension of the face on any exertion.

No marked change occurred in his symptoms, and on the 7th of August he left the hospital.

On the 25th of September he was readmitted. The chest was then covered with enlarged tortuous veins, communicating with three or four superficial epigastric veins, which ran comparatively straight to the pubes. He had difficulty of breathing, and a husky voice; was troubled with cough; and spat up frothy mucus, often tinged with blood, and mixed occasionally with tough, puriform masses. A coarse crepitus was heard over the whole of the right lung. The respiratory murmur on the left side was somewhat harsh, but no crepitus was heard except quite at the base behind.

On the 1st of October he was taken with vomiting after eating a few grapes, and from this time onwards was much harassed with vomiting.

His condition now got gradually worse. The cough became more frequent and irritable; he expectorated abundantly viscid, frothy mucus, mixed with greenish puriform masses, and had a good deal of fever, the pulse being usually from 100 to 108. It was noted that there was no irregularity of the pupils. Creasote, chloroform, and other medicines were given to stop the vomiting, but with only partial success.

On the 22d he could not lie back on account of dyspnœa. During the following night had several spasmodic attacks of difficulty of breathing; and in the morning of the 23d he died—from dyspnœa.

On examination of the body, a yellowish-white (cancerous) tumour was found to occupy the anterior mediastinum, reaching almost to the sternum anteriorly, but separated from it by a little loose tissue, in which a few enlarged glands were lodged. The tumour was a firm,

gristly, nodular mass, about four inches long, and rather more than three inches in width. About two thirds of the mass was situated to the right of the middle line, and it invaded for about an inch in depth the tissue of the right lung.

The right lung was everywhere firmly adherent, so that it was with difficulty removed from the chest. It was granular, of a reddish-gray colour, tore readily, and the torn or cut surface had scattered over it small spots of yellow matter, which, under the microscope, proved to be pus, with some débris of the pulmonary tissue. In several places the destruction of the pulmonary tissue was so complete that small vomicæ had formed, two or three of which were of the size of a small walnut.

The left lung, which was quite free from adhesion, was much congested and strewed with points of pulmonary apoplexy—the size of pins' heads—but was everywhere crepitant.

The pericardium contained about half a pint of sero-sanguineous fluid. The heart was small and contracted. The valves were healthy.

On dissection, it was found that the superior vena cava, the whole of the right innominate vein, and a small portion of the left innominate vein, were involved in the tumour. The superior cava was so narrowed, that only a No. 1 catheter could be passed through it. At the termination of the superior cava, the cancer projected about half an inch into the pericardium, the parietal layer of which was there reflected over the tumour. The terminal part of the vena azygos was also involved in the tumour, and quite obliterated by it. The descending vena cava was much dilated, but otherwise healthy.

The right branch of the pulmonary artery also passed through the mass, and was very much narrowed by it. The trunk of the pulmonary artery and the left branch were free.

All the pulmonary veins passed below the tumour, and were not involved.

The cancerous mass rested on, and was intimately connected with, the ascending and transverse portions of the arch of the aorta, evidently narrowing them, but not penetrating their coats. The innominate artery passed through the mass, but was not obstructed by it. The left carotid and subclavian arteries passed to the left of the tumour, and were not involved.

The right pneumogastric nerve passed through the substance of the mass, entering it about the level of the upper margin of the sternum, just before giving off the right recurrent. The right phrenic nerve was not traced.

The left pneumogastric and phrenic nerves passed to the left of the tumour, and were not involved.

On opening the trachea and bronchi from behind, it was found that the cancer had penetrated the anterior part of the tube, from half an inch above the bifurcation to half an inch down the right bronchus, projecting as a nodular mass on the inner surface of the tube. A smaller cancerous nodule projected into the left bronchus, just below the bifurcation.

The calibre of the right bronchus was considerably narrowed by pressure from without, and by the cancer projecting within it. The glands situated at the bifurcation of the bronchi were enlarged.

There was no cancerous mass apart from the tumour in the lung itself.

In this case the cancerous tumour involved the root of the lung, but had invaded the pulmonary tissue only to a slight extent. The lung was found firmly adherent to the pleura costalis, and the tissue everywhere granular and friable, having scattered through it small collections of pus, mixed with débris of the pulmonary tissue. If the poor man had lived a short time longer the destruction of the lung would evidently have been as complete as in the former case. The tumour involved the pneumogastric nerve where it forms behind the right bronchus, the posterior pulmonary plexus. The right branch of the pulmonary

artery also passed through the tumour, and was much narrowed by it. The pulmonary veins were free.

CASE 3.—W. W—, a coachman, æt. 63, was admitted into King's College Hospital on the 15th of March, 1848.

According to his own account he had general good health till October, 1847, when he became gradually affected with a dry, husky cough, and some shortness of breath. These ailments did not lay him up, but they continued, and the shortness of breath grew gradually worse.

He had no other particular ailments till three weeks before his admission to the hospital, when swelling of the face came on, with much vascular fulness on his stooping or leaning forward. From the commencement of his illness he had suffered no pain in the chest, experienced no difficulty of swallowing, and never lost his voice.

On his admission to the hospital there was slight œdema of the face and great distension of the jugulars—the face becoming almost purple from congestion on his leaning forward. He had a frequent, dry, husky cough.

On examination of the chest there was no projecting tumour discoverable, and no undue pulsation anywhere. There was dulness on percussion in front of the chest on the right side, and very slight vocal vibration, as compared with the opposite side, especially between the second and third ribs, and from the sternum to a vertical line through the nipple. Over the same space the respiratory murmur was scarcely audible, but both sounds of the heart were loud—louder than in the corresponding space on the opposite side.

Over the right scapula there was almost complete absence of vocal vibration.

Respiratory murmur was heard distinctly just below the right clavicle and in the lower part of the right chest. Breath sounds loud on the left side of the chest.

No morbid "bruit" was heard over the heart or the large arteries. No difference in the pulse of the two sides. No

difficulty of swallowing. Voice tolerably clear. No enlarged glands in the axilla or above the clavicles.

He was in a state of tolerable nutrition for his time of life; had a very good appetite. Pulse 74; respirations 22.

After admission to the hospital the venous distension of the neck and face increased, and on the 3d of April he began to spit blood.

On the 4th of April he spat up half a spitting-basin full of blood. He was in consequence bled from the arm to twelve ounces. The blood drawn was not buffed or cupped.

The spitting of blood ceased for a time.

On the 5th it was noted that the cutaneous veins in the lower part of the chest in front on both sides were distended and varicose.

On the 7th he expectorated bloody mucus, and had become hoarse. Pulse 104 (on sitting up, after coughing), regular; respirations 27.

The chest and arms, as well as the neck and face, were slightly œdematous.

The minute veins on the surface of the chest on both sides had become varicose and conspicuous; but he was still quite free from pain.

Soon after the last notes were taken his face became enormously congested; he complained of cold and shivering, and went to bed in a very exhausted state. During the night he coughed incessantly, and could only rest with his head supported in the sitting posture. He had no fresh spitting of blood, and died from asphyxia at 9 a.m. the following morning.

On examination after death the right pleura contained a pint and a half of serous fluid. The whole of the upper lobe of the right lung was firmly united to the pleura costalis; the middle and lower lobes were free from adhesions. When the upper lobe was dissected out it presented the appearance of a white solid tumour, but, on cutting through it, this appearance was found to be owing to an enormously thickened pleura.

The included lobe was condensed and solid, but had the colour natural to pulmonary tissue.

Behind the right bronchus, immediately below the bifurcation, was an irregular scirrhus mass, about the size of a small apple, apparently originating in the bronchial glands, almost surrounding without constricting the right bronchus, and surrounding the descending vena cava, and encroaching on it so much that, for about half an inch, it was not larger than a small goose-quill. There were a few extremely minute cancerous tubercles in the upper lobe, especially in the immediate vicinity of the tumour.

The middle lobe of the right lung was flaccid and atrophied. The lower lobe sound.

The left lung free from adhesions and sound.

The heart sound. The aorta large, presenting on its inner surface much atheromatous deposit.

The aorta and the large branches springing from it were not involved in the tumour.

There was no cancer in any other part of the body.

In this last instance the tumour, which was smaller than in the preceding cases, formed an irregular scirrhus mass, almost surrounding but not constricting the right bronchus. The changes in the lung were also less extensive than in the preceding cases. The upper lobe of the right lung was firmly adherent to the wall of the chest. The pleura covering it enormously thickened, and the lobe itself condensed and solid. The middle and lower lobes of the lung were free from adhesions. The middle lobe flaccid and atrophied, and the lower lobe sound. The inflammatory disease caused by the tumour was confined to the upper lobe of the lung.

A case very similar to those I have just related is recorded by Dr. Sims in the eighteenth volume of the 'Medico-Chirurgical Transactions.'

The patient, a baker, æt. 43, died under the care of Dr. Sims, in the Marylebone Infirmary. The cancerous mass,

in this instance, was extensively attached to the right lung and pressed upon the posterior part of the right auricle. The right bronchus, with several of its subdivisions, passed directly through it. Dr. Sims thus describes the condition of the lungs.

Right lung.—Pleura much thickened. This lung occupied a considerable space, for the augmented contents of the thorax had encroached upon the cavity of the abdomen. A great proportion of it was consolidated, apparently in consequence of old hepatization; in some parts the substance crumbled on the application of gentle pressure—this portion was of a dark or dusky-red colour; there was pus in a few small cavities in the section. A small portion was comparatively healthy, and in degree fit for the purposes of respiration.

Left lung.—"The left lung was free from adhesion, and the pleura of natural appearance." "This lung was considerably indurated in some parts, which, on being cut into, consisted of extensive red hepatization. On a careful examination of the lung it was found to be quite free from the morbid growth contained in the other cavity of the thorax; the larger vessels and the bronchi were not engaged in the disease."

The tumour embraced the descending cava, and penetrated its coats.

The right branch of the pulmonary artery passed through the tumour and was much dilated, but retained its texture.

One of the right pulmonary veins passed into the centre of the tumour and was there lost.

In all the preceding cases a primary cancerous tumour in the chest involved the root of the right lung, and remarkable changes, of inflammatory origin, were found in the chest. These changes consisted, in the order of their frequency, of—

1. Firm adhesion of the lung to the walls of the chest by thickened pleura.

2. Inflammatory condensation of the lung, where it was not invaded by the cancer, proceeding in three of the cases to more or less disorganization of the pulmonary tissue and the formation of pockets of pus.

3. In one of the cases—the case in which the tumour had attained the greatest size and spread furthest towards the left side—adhesion of the pericardium and an abundant effusion of lymph on its outer surface.

The extent of change in the lung in the different cases was greater as the tumour was larger, and involved more completely the root of the lung; and in all the cases the left lung was free from adhesions and presented no other changes than those which result from recent congestion.

It is obvious from these circumstances that the diseased condition of the right lung was the result of the cancer, and the question arises, by what agency did the cancer produce it?

Cancer has no direct tendency to cause inflammation of the surrounding tissues, and secondary cancerous tumours, scattered through the lung, are generally surrounded by perfectly healthy pulmonary tissue.

In the cases which form the subject of this paper, the cancer evidently impaired the nutrition of the tissues of the lung, because it involved the root of the lung, and thus interfered with the office of the blood-vessels and nerves on which the function of the lung and its healthy nutrition depend.

The changes of inflammatory origin can hardly be attributed to obstruction of the blood-vessels of the lung caused by the tumour. Obstruction of the pulmonary and bronchial arteries might cause gangrene or atrophy of the lung, which have been observed as part of the morbid changes in such cases, and obstruction of the pulmonary veins might cause hæmorrhage; but neither of these conditions is a probable cause of the thickening and adhesion of the pleura, and of the inflammatory destruction of the lung which coexisted with the tumour in the cases related above.

Unfortunately, a careful dissection of the blood-vessels of

the lung was not made in all the four cases, but in two of the cases (Case 2 and the case recorded by Dr. Sims) the pulmonary arteries and veins were traced.

In one of these cases (Case 2) the pulmonary artery was much contracted, but the pulmonary veins were free. In the other case the pulmonary artery, though involved in the tumour, was dilated rather than contracted, and one of the pulmonary veins was involved and lost in the tumour.

The condition of the blood-vessels was reversed in the two cases, but the condition of the lung, as regards the points to which I have called attention, was the same.

The inference from these circumstances that appears most probable is, that the thickening and adhesion of the pleura, the suppurative inflammation of the pulmonary tissue, and, in one of the cases, the inflammation of the pericardium, resulted from the tumour involving and destroying all or great part of the nerves with which these several tissues are furnished. In one of the cases (Case 2) the right pneumogastric nerve, where it forms the posterior pulmonary plexus, was traced into the centre of the tumour; and in all the other cases the situation of the tumour was such that it must have embraced this plexus of nerves, and in some of the cases the anterior pulmonary plexus as well.

It is the property of cancer to invade and destroy all tissues within its reach; and when a nervous thread passes through the centre of a hard and compact cancerous mass, its continuity must be there severed as completely as if it had been divided with the knife.

More than a century ago it was remarked—first by Parfour du Petit—that division of the sympathetic nerve in the neck causes inflammation of the conjunctiva and contraction of the pupil of the same side. Dr. J. Reid showed, in 1839, that in dogs the same influence on the eye is exerted by destruction of the superior cervical ganglion.

In 1823-4 it was ascertained, by the experiments of Fodera, Mayo, and Majendie, that division of the fifth nerve within the skull causes inflammatory destruction of

the eyeball; and soon afterwards cases were published in which similar destruction of the eye had resulted from disease involving and destroying the fifth nerve in the same situation; but, as far as I know, no corresponding results have hitherto been traced to destruction of the nerves in other parts of the body. The probable reason of this is that, from the frequent anastomosis of the nutritive nerves, it is difficult entirely to cut off from most organs the nervous influence which they serve to transmit. The lung resembles the eyeball in this, that all the nerves which supply it are comprised at its root in a very small space. The pulmonary nerves cannot well be divided in direct experiments, but they are almost necessarily destroyed by a large and compact cancerous tumour, which involves the root of the lung and surrounds the bronchus.

Another instance of inflammatory disease, probably caused in the same way, is occasionally met with in the gall-bladder, in cases in which a cancerous tumour exists in the portal notch of the liver.

I could cite from my own experience and that of others several cases of cancer of the liver, in which suppurative and destructive inflammation of the lining membrane of the gall-bladder existed, and in which there could be little doubt that the diseased condition of the gall-bladder was caused in some way or other by the cancer.

The nerves of the liver are comprised in two sets: one set, derived from the solar plexus, enters the liver at the portal notch; the other set, consisting chiefly of branches of the phrenic, passes into the liver along the hepatic veins.

The nerves of the inner coats of the gall-bladder appear to be all derived from the solar plexus, and pass from the portal notch to the gall-bladder in threads, accompanying the cystic duct, so that a small cancerous tumour there situated might, by destroying the continuity of these threads, deprive the inner coats of the gall-bladder of all nervous influence.

Whether the suppurative and destructive inflammation of

the gall-bladder, in the cases I have referred to, was caused or not by loss of such influence, must, in the absence of more minute details than are recorded respecting them, be a matter of doubt; but the cases are so interesting, in relation to the effects of cancerous tumours involving the root of the lung, that I shall perhaps need no apology for cursorily referring to them in this place.

There can be no doubt that the inflammatory destruction of the eyeball from disease involving the fifth nerve within the orbit is not a solitary fact in pathology; and that, on investigation specially directed to this point, other analogous instances will be found.

P.S.—Primary cancer involving the root of the lung is a rare disease. The three cases related above are the only instances of the kind that have fallen under my observation in King's College Hospital since it was first opened for the reception of patients in 1840. The disease is, however, so peculiar in its effects, that, as was shown by Dr. Stokes in an admirable paper on this subject published in the 'Dublin Journal of Medical Science' for 1842, a diagnosis of it may sometimes be made with much confidence. The elements of diagnosis consist—

1. In the signs that give evidence of the existence of a tumour.

2. In the absence of strong pulsation and of the morbid "bruits" that usually attend aneurismal tumours.

3. In the occurrence of hæmoptysis and other signs showing that the lung is involved in the disease.

4. In a distended and varicose condition of the superficial veins of the chest.

(A cancerous tumour usually affects the venous circulation and the nutrition of the lung more than an aneurismal tumour of the same size, because it grows into and blocks up the veins, and converts into cancer the other tissues which it embraces in its growth.)

5. When the disease occurs in a person under thirty, the age affords an additional presumption that the tumour is not an aneurism.