THREE LECTURES ON CANCER OF THE SCROTUM IN CHIMNEY- SWEEPS AND OTHERS.

Delivered at the Royal College of Surgeons of England.

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LECTURE I.—SECONDARY CANCER WITHOUT PRIMARY CANCER.

MR. PRESIDENT AND GENTLEMEN.—Several years ago, in the course of a correspondence on the subject of the cancer statistics of the United Kingdom, Dr. William Ogle asked me on what authority I had somewhere made the statement that chimney-sweeps' cancer had become less frequent in this country. I replied that a general impression prevailed among us that such was the case, and quoted in favour of this impression several of the leading textbooks of surgery. Dr. Ogle gave me to understand that the statistics of the Registrar-General did not support this view, and, in the Supplement to the Forty-Fifth Annual Report (1885, p. 56) he drew special attention to "one cause of death.....as being notoriously common among chimney-sweeps.....namely, cancer."

A year or two later, in working up the material for a book on *The Operative Surgery of Malignant Disease*,¹ I discovered that although a general impression prevailed that sweeps' cancer is not so malignant as epithelioma of many other parts of the body there was really no trustworthy material at hand from which the later results of operations for the radical treatment of the disease could be ascertained. And I discovered further that very little new information on this singular disease had been furnished by surgeons or pathologists in this or any other country during the last 50 years or more.

These circumstances first led me to take more than a passing interest in cancer of the scrotum. And, if more had been wanting to stimulate my interest, it might perhaps have been found in the fact that the first account of chimney-sweeps' cancer was written by Mr. Pott, to whose memory every surgeon of the hospital with which I have the honour to be connected looks with reverence and respect; and the second account was written also by a surgeon to St. Bartholomew's Hospital, Mr. Henry Earle.

At the first I intended merely to collect as much information on the results of operative treatment of cancer of the scrotum as the hospital records would afford; but in looking up these records curious facts became apparent, some of which seemed to have an important bearing on the general pathology of cancerous disease, and I soon determined to discover all that lay within my reach upon the subject so far as my powers and the time at my disposal would permit.

The literature relating to chimney-sweeps' cancer presents three important statements which deserve the gravest attention. The first is to the effect that the disease is seldom seen in any other part of the civilised world except Great Britain; the second that it is becoming more and more rare in Great Britain; the third that it is a comparatively mild malignant disease. One of these statements had received so rude a shock from the national statistics that it seemed desirable to test the truth of each one of the three and to see on what foundation each had been built. For there were none but the barest assertions in most of the works which were before me, often appearing to rest on a mere report of a conversation between the author and some more or less distinguished foreign surgeon.

The statement of the rarity of the disease in other countries is only suggested in the early English works on cancer of the scrotum. It is distinctly made in the works of foreign authors, and is mentioned in later English literature as if there could be no doubt of its truth. In the quotations which I make, it will be convenient to put all the statements into

English for the sake of uniformity, but the references will be given so that the accuracy of the translations may be in every instance verified. Mr. Earle in 1832² is reported to have said: "However, it was well known to be peculiar to those countries where coals were used as fuel." Sir James Paget in 1853³ speaks of "its comparative frequency in England, especially in the large towns, while in other countries where soot is abundant it is hardly seen." Vidal (de Cassis) speaks of chimney-sweeps' cancer as "this affection, which is met with far more frequently in England than in any other countries of Europe."⁴ Nélaton, in an account of a case of cancer of the scrotum (not in a sweep) says: "This malady, relatively pretty common in England, is so rare in other countries in general, and in France in particular, that very many surgeons have never had the opportunity of observing a case."⁵ Albert says: "Carcinoma of the scrotum is known under the name of chimney-sweeps' cancer. It occurs frequently in English chimney-sweeps."⁶ Billroth and Winiwarter in 1883 say: "In England epithelial cancer occurs tolerably frequently in the scrotum of chimney-sweeps."⁷ Agnew in 1881 speaks of the affection having been prevalent in Great Britain at one time, but that he had never seen a case in the United States.⁸ And Satterthwaite, in the *Reference Handbook of the Medical Sciences*,⁹ speaking of cancer of the scrotum, says that it rarely occurs in this country (that is, the United States), but: "in England, where it appears to have been common among chimney-sweeps, it has been called chimney-sweeps' cancer."

That this statement of the rarity of the disease in other countries is correct, I think there can be no doubt. For several countries, it rests on no better authority than the bare statement of the surgeons attached to large hospitals in the principal towns, an authority which would not serve if the statements were modified, for they would amount then merely to a kind of idea that the disease is less common or more common in one country than in another. But the statements are absolute and positive to the effect that the writers had either never seen a case of cancer in a chimney-sweep, or that a single case had been observed in the course of many years, that this case had been shown to other surgeons, and was the only case which any of them had observed. It would no doubt be more satisfactory were it possible to prove these statements by the aid of statistics of the hospitals on the Continent and in the United States, but this can only be done to a limited extent. Statistics such as are published by many of the general hospitals in London are not to be found in most Continental countries, and I am not aware that the American towns are in the habit of presenting them year by year. There are, however, excellent detailed statistics for some of the large hospitals abroad, and their figures on this matter are convincing. In the K.K. Allg. Krkhs. at Vienna, during the eleven years between 1874 and 1884 inclusive, there was only one case of cancer of the scrotum, but not in a chimney-sweep. In the Rudolf-Stiftung in the same town in the fourteen years 1873 to 1886, there was not a single case. In the K.K. Allg. Krkhs. at Prague, in the course of the nine years between 1877 and 1885 inclusive, there only occurred one case of cancer of the scrotum, whether in a chimney-sweep or not I do not know. In the annals of the great Charité Krkhs. at Berlin during the eight years from 1878 to 1885, there was not registered a single case.

In the statistics of the hospitals of Paris for the year 1861 no case of cancer of the scrotum is recorded.

In the Reports of the City Hospital of Boston, U.S., during the five years (1881-2, 1882-3, 1883-4, 1886, 1887) there occurred but one case of cancer of the scrotum, but I do not know whether the patient was a sweep.

For comparison with these statistics, the statistics of some of the London hospitals may be taken. In four hospitals—Westminster, St. Thomas's, Middlesex, and St. Bartholomew's—in the year 1884, five cases of cancer of the scrotum occurred in chimney-sweeps. In the year 1881 the statistics of University, St. Bartholomew's, Middlesex, Westminster, and St.

² *London Med. and Surg. Journal*, i, 6.

³ *Surg. Path.*, ii, 464.

⁴ *Traité de Pathol. externe*, 5th edition, v, 222, 1861.

⁵ *Mon. des Hôp.*, 1855, iii, 185.

⁶ *Lehrbuch der Chirurgie*, iii, 547, 1882.

⁷ *Chirurgische Path. and Ther.*, 12th edition, Berlin.

⁸ *Surgery*, ii, 525.

⁹ *New York*, 1885, i, 774.

¹ J. and A. Churchill, 1887.

Thomas's give a total of four cases. And the number of patients in these hospitals, as I shall have occasion to show by-and-by, cannot be compared with the numbers in some of the hospitals abroad whose statistics have been quoted. It may further be remarked that the hospitals given above have not been specially selected, and that the years are taken at random, and are not picked years in any sense of the word.

I do not know who is responsible in the first instance for the statement that chimney-sweeps' cancer has become much less frequent in Great Britain; but the earliest notice of it which I have found is in the first edition of Holmes's *System of Surgery* (1864), where Professor Humphry says: "It is much more common in this country than in others; but it appears to be on the decrease here, perhaps owing to the more general use of machines." It occurs, as might almost naturally be expected, in Holmes's smaller *Surgery*. In the first edition of Bryant's *Surgery* (1872) the author says: "Cancer of the scrotum is a rare affection compared with what it was some years ago when sweeps ascended flues." In the ninth edition of Erichsen's *Surgery* (1888) it is said: "This disease is much less common now than it was formerly, when 'climbing boys' were employed instead of machinery for the sweeping of chimneys;" but this remark does not occur in the eighth edition, which appeared four years previously. The decline of the disease is thus made a part of the teaching of medical students, for these are works which are very generally read for examinations.

So strongly has this impression gained ground that I asked one or two of my colleagues at the hospital whether they thought there were fewer cases of chimney-sweeps' cancer now than fifteen or twenty years ago, and the reply was, "Certainly; they were quite frequent when I was a student, but one scarcely ever sees a case at the present time." In order to ascertain how far this was true, I consulted our hospital statistics, and found that since the foundation of the statistical tables and the registrar's notes—a period of twenty years—there have been thirty-nine different cases of cancer of the scrotum under treatment in the wards, and that twenty-nine of the thirty-nine patients were chimney-sweeps; that scarcely a year had passed without a case of chimney-sweeps' cancer; and that the number of cases during the last ten years was quite as large as the number during the preceding ten years. Further, it was interesting to remark that there was scarcely a single member of the surgical staff, surgeons or assistant surgeons, who had not had at least one case under his own personal care. The statistical tables of other London hospitals to which I had access told a similar tale—that there has never been a time during the last eighteen or twenty years in which cases of chimney-sweeps' cancer have not been observed, and that the frequency of the disease, so far as tables tell, is much the same as it was at the time when these tables were first made.

I have already referred to the correspondence with Dr. William Ogle and to the Supplement to the Forty-Fifth Annual Report of the Registrar-General. At page 56, under the heading "Chimney-sweeps," attention is drawn to the generally high mortality among this class of workers. Two hundred and forty-two deaths had occurred among them during the three years 1880, 1881, 1882, and of these no fewer than forty-nine were attributed to cancer. Dr. Ogle calculated from the figures which came before him that "the liability of chimney-sweeps to malignant disease is about eight times as great as the average liability of all males." And he proceeds to say: "These figures scarcely support the belief expressed by some authorities that improvements in the art of sweeping and habits of sweeps have caused this disease to be comparatively infrequent among them." Of course the scrotum was not the part affected by cancer in all these cases: only twenty-three of the forty-nine deaths were attributed certainly to cancer of the scrotum, penis, testis, and groin. Thirteen of the patients died of cancer of the lip, face, orbit, palate, neck, stomach, and liver. But, in the remaining thirteen cases the organ affected is not stated, so that we may be sure that a large proportion of these patients suffered from cancer of the scrotum.

I know of no other definite sources from which the relative frequency of chimney-sweeps' cancer in this country can be ascertained. These numbers lend no colour to the theory of the decline of the disease; they tell only that it has occurred

with a certain regularity during a long period of years. And if anyone will take the trouble to converse with the sweeps themselves, especially with the lesser master sweeps, he will find that most of them can tell of some sweep, a friend or member of their family, who has died of cancer of the scrotum within the last few years or who is even now suffering from the disease.

There has seldom been seen a more curious illustration of the steady growth and progress of a false impression than this in relation to the decline of chimney-sweeps' cancer. One is irresistibly reminded by it of the growth of a slander or of that entertaining winter evening game in which the players sit in a long row and the first tells in a whisper to the second some short tale or anecdote. The second repeats it to the third, still in a whisper, and the third to the fourth, and so on through the row, until the last player tells it aloud, to the infinite amusement of the whole, who can scarcely recognise in the garbled version the story as it left them each in turn.

It is very probable that the whole story of the decline of chimney-sweeps' cancer originated in the mere expression of a belief uttered by Professor Humphry in the *System of Surgery*, who only said, "it appears to be on the decrease here." This has been taken up and repeated by one person to another, from book to book, until it has become a definite statement, of the truth of which no one expressed a doubt until the force of figures impelled Dr. Ogle to inquire on what authority it rested. It is quoted in the works of foreign authors. Busch, of Bonn,¹⁰ speaks of the disease as having become very rare even in England. Kocher, of Bern,¹¹ says it has greatly diminished in frequency in England; and von Langenbeck,¹² in the discussion of a paper on tar cancer by Volkmann, goes so far as to say it has completely disappeared from England. More curious still are the various theories which have been advanced from time to time to account for the decline of the disease. By some it is attributed to the law which has prohibited the use of "climbing boys." Others consider that the use of machinery for the cleaning of the chimneys has produced the change. Some attribute it to the cleaner habits of sweeps. One surgeon, Mr. Lawson, in an article in the *Lancet* "On the Probable Cause of the Diminution of Chimney-sweeps' Cancer," has traced the improvement to "the depreciation in the value of soot," which is so great that the men are no longer employed as formerly in sifting it through a sieve, owing to which there was constant friction between the soot-covered clothes and the scrotum. But, perhaps, the most curious reason of all which I have found is that given by Agnew, of Philadelphia, who says that the disease has almost entirely disappeared "since the introduction of coal for the purpose of heating dwellings."

The only ground on which the belief in the decline of the disease could reasonably rest would be the proof that it has been at some period within the last hundred years (during which it has been observed) a frequent malady. So far from this having been the case, the very contrary would appear from the writings of the first authors who treated of the disease. Earle, in 1823,¹³ said: "Fortunately, it is one of comparatively rare occurrence, when it is considered how many are exposed to the application of the poison, if I may be allowed to use so strong an expression." Sir Astley Cooper, in 1830,¹⁴ thought there must be some circumstances which predispose to the occurrence of the disease. For there are many sweeps, and comparatively few are attacked by the cancer. Dixon, in 1850,¹⁵ said: "It is sometimes supposed that chimney-sweeps' cancer is a common affection, but it would appear that this is not the fact, if the number of cases admitted in certain hospitals in a given time is taken as a criterion. At St. Thomas's, for instance—an institution so placed as to be the likely refuge of a great many chimney-sweeps thus affected (he is speaking of the old hospital)—the number of applications has been particularly small." These statements are the more important because they represent the experience of three surgeons attached to large London hospitals in which cases of

¹⁰ *Lehrbuch der Chirurgie*, ii, 242, 1869.

¹¹ *Deutsch. chirurg.* Lief. 50b, 1887.

¹² *Verh. deut. Gesellsch. f. Chir.*, iii.

¹³ *Med-Chir. Trans.*, vol. xii.

¹⁴ *Observations on the Structure and Diseases of the Testis.*

¹⁵ *Lancet*, vol. i, p. 337.

chimney-sweeps' cancer have occurred with as great frequency as in any other hospitals in London.

I have devoted time to this question of the supposed decline of the disease because I regard it as essential to a thorough appreciation of the various problems connected with cancer of the scrotum that the ground should be cleared of the various impressions, true or false, which prevail regarding chimney-sweeps' cancer. The impression of its decline rests on no evidence whatever. The evidence which can be adduced all shows that it never was of frequent occurrence, and that it occurs with as great frequency now as ever in the institutions in which records have been preserved, and during the period over which those records extend. Of its relative frequency in proportion to the increase in the number of chimneys and the probable increase in the number of persons employed in sweeping chimneys, nothing can be said. But the foundation of new hospitals, general and special, and the improvement in the character of the Poor-law infirmaries, where many operations are now performed, afford space for such a relative increase without rendering it necessary for the older hospitals to show a larger number of cases of the disease than formerly.

The third question of the comparatively mild nature of the disease may be answered by referring to a paper which I published in vol. xxv of the *St. Bartholomew's Hospital Reports*, 1869, p. 193, on the further history of cases of cancer of the scrotum which had been under treatment in the hospital during a long period of years. The measure of success which had attended these operations led me to believe "that the prospect afforded by removal of uncomplicated cancer of the scrotum is very hopeful," that "cancerous affection of the glands need not deter the operator from removing the primary disease and the glands with it if they are within reach of even a severe operation," and that "operations for recurrent disease may be undertaken with a far better prospect of success than is usually offered by such operations."

Notwithstanding its comparatively mild nature, there is not the least doubt that the disease is cancer. Its life-history is that of commencement in the form of a wart or warts on the scrotum, which are so common and so constant a precursor of the cancer that the "soot wart" is as well known as the "soot cancer." The warts may exist for years, and some sweeps are covered as to the scrotum with soot warts, not one of which need become cancerous. But in the course of time, probably owing to some especial irritation, one of the warts grows slowly larger, becomes more prominent and at the same time more deeply fixed, and its centre ulcerates. At this period it is probably decidedly cancerous, although it is difficult to be sure of the moment at which the actual change from the innocent papilloma to the malignant carcinoma takes place. Commencing on the surface of the scrotum, the cancer may remain during a long period scrotal, and may spread slowly along the skin. On the other hand, it frequently penetrates more deeply until it reaches the tunica vaginalis and even the testicle, which may be laid bare and in time destroyed. The primary disease seldom, in these days of early operations for cancer, exhibits the same terrible aspect as it appears to have done before the days of chloroform, when it sometimes destroyed everything between the anus and the pubes, and resulted in a horribly foul and offensive sore, against which no treatment availed.

Secondary affection of the groin glands is frequently observed, but is often long delayed. In some cases the first enlargement of the glands is simply due to irritation, not to the formation of cancer in them; for their subsidence has been so frequently noted after the removal of the primary disease that it has been almost an axiom of the operative surgery of the disease that enlargement of the groin glands should not contraindicate a radical operation, and that the glands should not be removed if their enlargement has been of short duration. On the other hand, their malignancy in many cases is proved by the steady progress of the glandular disease, the deep ulcers which form in them in the course of time, the character of these ulcers, and the fact that death has occurred in several, if not in many, cases from the advance of the ulcer into the femoral or iliac artery. Death may be long delayed, even in cases in which the progress of the disease has not been stemmed by operation. But in the course of

time the patient's strength is slowly wasted by pain and profuse discharge from ulcers in the scrotum and groins, and he dies worn out by the disease. Of the occurrence of secondary deposits other than those in the glands little is known. Few of the patients die in the general hospitals, and in these few cases either no examination has been permitted after death or it has so happened that no secondary cancer has been found. I take it that, as is the case with similar cancers of some other parts of the body—notably the lower lip and tongue—secondary disease, with the exception of secondary affection of the glands, is not common. That it may take place, however, I cannot doubt, for I have found an observation by Mr. Travers of the examination of the body of a sweep who had died of recurrent cancer of the scrotum and what I believe to have been numerous cancerous nodules scattered on the surface of the peritoneum,¹⁶ for Mr. Travers concludes his account of the case thus: "It was remarkable that the testicles, though exposed and shrunken, were not affected by ulceration; on inspection, the entire peritoneal surface was found studded with the small white tubercle of scrofula."

The continuous invasion of contiguous tissues, the steady progress of the disease from bad to worse in spite of every treatment save removal, the secondary affection of the lymphatic glands, the similarity of the ulceration of the glands to that of the primary disease, all tell plainly the cancerous nature of the disease, even if there were not the further proof afforded by the microscope. From that we learn not only that it is cancer, but that the structure is that of the great family of skin cancers, squamous-celled carcinoma or epithelioma.

It is needful to be thus precise in furnishing the proofs of the cancerous nature of the disease on account of certain peculiarities which it exhibits. Two of them are of especial interest: the affection of lymphatic glands years after the successful removal of the primary disease, and the affection of the groin glands without primary disease of the scrotum or neighbouring parts. The first peculiarity is very interesting. I have met with records of two or three such cases in surgical literature, but it will be better to describe one which happened in the hospital.

C. C., 48 years old, a chimney-sweep, was admitted into St. Bartholomew's Hospital in 1878. At the age of 28 years a soot wart had been removed from his scrotum. At the age of about 35 years a second wart or cancer had been successfully removed. In 1873, when he was 43 or 44 years old, my colleague, Mr. Baker, removed an epithelioma the size of a walnut from the left side of the scrotum. The disease penetrated so deeply that a portion of the tunica vaginalis was of necessity removed, and the testis was exposed. There was no enlargement of the lymphatic glands at that time. When he was admitted into the hospital in January, 1878, he was suffering from a large mass of adherent glands in the left groin, from which offensive liquid discharged through several openings. He was quite sure that the enlargement in his groin was of not more than two months' duration; he certainly had not noticed it till then. The scrotum and adjacent parts were examined with the greatest care, but the closest scrutiny failed to detect any wart or ulcer or any unnatural induration of the healthy scars. The case was not considered suitable for operation, so the patient was discharged.

Similar examples of late or deferred affection of the lymphatic glands may occasionally be met with in connection with primary malignant disease of various parts of the body, for example, the mamma. But they appear to occur with unusual frequency in association with primary cancer of the scrotum, when the number of recorded cases is compared with the general frequency of cancer of the scrotum. They are difficult to understand on the generally accepted theories of secondary affection of the lymphatic glands. When glands which could not be felt, even on the most careful examination, at the time of the removal of a primary cancer become cancerous, as they frequently do within a few months of the operation, and without any recurrence of the primary disease, the explanation which occurs to most of us is that they were already impregnated with cancer before the operation was performed, but that they were not obviously enlarged. Even if the enlargement of the glands does not become ap-

¹⁶ *Med.-Chir. Trans.*, vol. xvii, p. 346, 1832.

parent for many months, it is still comprehensible that the cancerous disease had been slowly advancing during the whole period, but that its course had been very slow, like the course of many cases of primary cancer. But when the glandular enlargement is deferred for several years, and there has been no recurrence of the primary disease or renewed affection in or about the seat of the primary disease during the whole of this long period, it is much more difficult to accept this simple view. It is, of course, possible that cancerous disease, or a something which is capable of inducing cancerous disease, may lie latent during a long period of time, and I believe many facts might be adduced in favour of this view. But I am more inclined to account for these and similar cases by means of a theory which I shall advance in connection with the second peculiarity to which reference has been made—of the affection of the groin glands without primary disease of the scrotum or neighbouring parts.

I have met with the records of three cases of this rare condition, and, by a rare good fortune, they are described by competent observers. The first is recorded by Sir James Paget in the *Medical Times* of 1852 (new series, vol. 414), but much more fully in the first edition of his *Surgical Pathology* (ii, 447), and the description is so excellent that it must be quoted at length.

"I have seen one example of primary epithelial cancer in lymphatic glands which I will relate, both for its own interest and because it illustrated many of the foregoing statements. The patient, who was in St. Bartholomew's Hospital last summer, was a sweep, aged 48. His skin was dusky and dry, and many hair follicles were enlarged by their accumulated contents; but he had no appearance of cancer or wart of any kind on the scrotum or penis, yet his inguinal glands were diseased, just as they commonly are in the later stages of scrotal soot cancer. On the right side, over the saphenous opening, a cluster of glands formed a round tuberos mass, more than an inch in diameter. It felt very firm, heavy, ill-defined, and as if deep set. Over its most prominent part the skin was adherent and ulcerated, and a soft dark growth protruded through it. Above this mass were three glands, enlarged but not hardened. On the left side, below the crural arch, one gland was enlarged to a diameter of half an inch and hard, and four others felt similarly but less diseased. All these were movable under the skin.

"The disease had been observed in progress for fifteen weeks, having begun in the right groin as a hard lump under the skin, like those which were now in the left groin, and which had commenced to enlarge somewhat later. The ulceration in the right groin had existed for a week. I removed all the glands that seemed diseased. The chief mass, from the right side, appeared, on section, lobed, soft, greyish, mottled with pink and livid tints. The same changes, but with increased firmness, were seen in the largest gland from the left side, and the material pressed from both these (a turbid, grumous, and not creamy, substance) contained abundant epithelial cancer cells. The other glands were not evidently cancerous, but, during the healing of the operation on the right side, a gland, which I had thought it unnecessary to remove, enlarged and became hard; it was destroyed with chloride of zinc, and then the wounds healed soundly."

The other two cases were under the care of Mr. George Lawson, who thus speaks of them in the *Lancet* of 1878, ii, 576:

"Chimney-sweeps' cancer, as a rule, originates in the skin, but to this there are occasional exceptions. In two cases which I have had under my care in the Handel Ward, Middlesex Hospital, the disease started in the glands in the groin, the skin became adherent to the infiltrated glands, and then ulcerated. The ulceration extended, and each patient died from hæmorrhage caused by the ulceration involving the main vessel, in the one case the femoral, and in the other the external iliac artery." This statement is confirmed by the more detailed relation of one of the cases, and an account of the healthy condition of the scrotum.

It is quite curious, considering the great importance of these cases, and the light which a study of them may throw on certain difficult questions in the pathology of cancer, how little attention they have attracted. Thiersch alone, of the various authors I have examined, mentions their occurrence, and assumes that the glandular enlargement was secondary

to an actual epithelioma of the scrotum, which had not ulcerated, and which lay beneath the surface of the integument—in fact, to an overlooked primary disease.¹⁷ He refers, of course, only to the case described by Paget, for the other cases had not then been published. In some circumstances this explanation might be accepted as reasonable, but, to us here, it would appear really impossible. The importance of the first case as an example of primary epithelioma of the glands was fully appreciated by Sir James Paget. The patient was a chimney-sweep, so that a primary affection of the scrotum was suspected and sought for with the greatest care, but there was not even a wart on the external organs of generation to which the suspicion of primary epithelioma might have been attached; and the cases of Mr. Lawson afford the strongest confirmation of the possibility of the occurrence.

Excluding the possibility of such malignant disease of the external generative organs as is apparent to sight and touch, even when directed with the greatest care by the most skilful eyes and hands, it must be admitted that the affection of the glands in these cases may have been secondary to a primary disease in some other part of the body. The lower extremity and the rectum present themselves as possibilities. The lower extremity is, however, really not tenable; primary malignant disease in such a situation could not have been overlooked, and the disease of the glands in both groins is not consistent with the supposition. The rectum is almost as improbable. The groin glands are seldom affected in such case, and certainly not until the disease is so far advanced that the bowel disease forms the most prominent trouble so far as the patient is concerned.

Again, there is the question of a simultaneous or almost simultaneous affection of glands, such as occurs in some cases of sarcoma, but there is really nothing in these cases in common with cases of general sarcomatosis.

In the absence of an evident primary source from which the lymphatic glands could have been affected, the possibility of primary cancerous affection of the glands must be taken into account. Such cases are not of very unusual occurrence under the terms lymphadenoma (Hodgkin's disease), lympho-sarcoma, and primary sarcoma of lymphatic glands. We are familiar with such primary malignant affections of the glands of the neck, the mediastinum, and the axilla; therefore the possibility of their occurrence in the groin must not be overlooked. But the conditions of those and of the disease in question are so different that it is well-nigh impossible to conceive that they have anything in common. Their course is usually slow, they are prone to affect many glands in different regions of the body, they seldom break down and ulcerate, and rarely if ever cause death by opening a large blood vessel. And, above all, they are lymphatic or sarcomatous diseases, while this disease of the groin glands was carcinomatous.

But now the question naturally presents itself—Why should not these have been cases of primary epithelioma of the lymphatic glands? It is true that we know little or nothing of such an affection. I have found no instance of it in the *Transactions* of the Pathological Society. Works on pathology and tumour diseases are for the most part silent on it. But that is not a reason why the disease should not exist. Last year, at the Royal Medical and Chirurgical Society, Mr. Walter Spencer, in a most interesting communication, showed how the soot particles may be found in the interior of the cells, and suggested that their presence there might afford a possible explanation of the pathology of the very class of cases we are considering. I examined Mr. Spencer's sections with great care, and was convinced of the correctness of his observations. But when I came to consider how they could be applied to these cases of epithelioma of the lymphatic glands I was forced to admit that the reasons against the adoption of this theory are stronger than those in favour of it. I shall presently give reasons for believing that soot, if it is in any way the cause of the occurrence of cancer, acts only as a predisposing cause, merely as a mechanical or chemical irritant. It is quite conceivable that such an irritant should induce the occurrence of malignant disease in internal organs, and in organs of very different structures, provided it can reach them. But it is wholly inconceivable that it should induce in these different organs the occurrence of a variety of malignant disease which

¹⁷ *Der Epitheliakrebs*, S. 66, Leipzig, 1865.

does not naturally occur there—of squamous-celled carcinoma, for instance, in the interior of a lymphatic gland. The thing is so inconsistent that I was forced to reject the theory as untenable. Every circumstance concurs to the belief that the affection of the groin glands in these cases was secondary not primary.

Here, then, we are brought face to face with a cancerous affection which is not primary, inasmuch as it fulfils none of the essential conditions of primary cancer; which presents all the characters of a secondary affection, but for which no primary source can be discovered. More than this, it presents the characters of an affection which is not only secondary, but is secondary to a particular variety of cancer occurring in a definite situation in the near neighbourhood. So decidedly, indeed, were the characters of the glandular disease similar to those which are observed in cases of secondary affection of the groin glands in connection with sweeps' cancer of the scrotum, that the resemblance at once struck Sir James Paget, and a close examination of all the conditions of the case confirmed the first impression.

I scarcely venture to suggest it—and yet I believe it is the case—that we have here to do with a cancerous affection of the glands which is secondary to a primary cancer which has never had any existence. The mere statement appears to imply an absurdity. But the facts of the cases which have been recorded are so clear, and the contingencies which depend on the acceptance of this explanation are so weighty, that I am fain to attempt to make good the theory.

Before doing so, it will be well to draw attention to one or two points in relation to the pathology of cancer. Cancer (the term is employed here in its widest sense, and is applied to every kind of malignant tumour) is sometimes regarded as a mere disorderly reproduction of elementary tissues. But this offers a very incomplete conception of the disease. It is disorderly only in the continual tendency to produce new tissues, and in the many varieties of form which the new elements, especially the cells, present when compared with the natural elements of the part in which it occurs. On the other hand, it is so orderly in the arrangement and grouping of the elements that each variety of cancer is as distinguishable as are the various normal tissues. These characters are reproduced in the secondary tumours, often so faithfully that it is difficult to distinguish sections of the primary and secondary growths. And, more than this, what may be regarded as accidental characters of the primary growths, such as organisation, degeneration, hæmorrhage, may occur with equal frequency and to an equal degree in the secondary growths.

It is evident, then, that the elements of the cancer, or of the part in which the cancer originates, have become endowed with other and more potent properties than a mere tendency to active reproduction—the power, namely, to arrange themselves in certain definite groupings, and the power to reproduce similar groupings of elements in any near or distant organ to which they chance to be conveyed, and in which the conditions are sufficiently favourable to their maintenance and development. So strong are these acquired powers that the transferred elements of the primary disease are not only enabled to reproduce faithfully the groupings of the primary disease, but they are wholly incapable of producing any other than these groupings, with trivial modifications.

With regard to the manner in which the transference of the primary disease to the lymphatic glands is effected, two theories seem reasonable—first, that portions of the primary tumour are conveyed through the lymphatics to the glands; secondly, that some foreign organic element, which has perhaps been instrumental in inducing the occurrence of the primary disease, has travelled through the lymphatics into the tissues of the glands.

Of the possibility of the first method of transference there can be little doubt. What may be described as a coarse conveyance of cancer through the lymphatics may be observed from time to time. In such cases the growth of the disease in the lymphatic glands is practically continuous with the primary disease; but, in the majority of cases, the conveyance through the lymphatics must be assumed. The closest investigation, even by the most accomplished observers, fails to discover even an occasional cancer cell or recognisable part of a cancer cell in the lymphatics between the primary disease and the secondary affection of the glands.

Nevertheless, the absence of ocular demonstration is no real obstacle to the acceptance of the theory. It is only needful to assume that minute portions of the primary disease pass from time to time, or have passed with the lymph, into the glands, and that they are capable of full development and of reproduction, and that they carry with them the new powers which have been acquired by the elements of the primary disease.

At the first sight the second theory seems more attractive than the first, for it renders the comprehension of the primary disease more easy, but there are certain difficulties in accepting it. An organic element, such as the organisms on which various diseases are believed now to depend, enters the body from without under favourable circumstances, excites the tissues of the part in which it settles to the development of the variety of malignant disease to which they are liable, and in doing so itself undergoes such modification that when it is conveyed to other parts of the body where it is capable of inducing the occurrence of cancer, it is only able to induce the occurrence of the particular variety of cancer which was excited in the part of the body primarily affected. I have in my mind Dr. Hunter's bodies, Gussenbauer's molecules, and the newly-discovered objects in cancer—psorosperms. The difficulty in accepting such a theory is, to my mind, the admission that such an organic element, even endowed with very great powers, should have the power, not merely of exciting the tissue elements to active reproduction, but of forcing the tissue elements of one series to assume the characters and grouping proper to the tumours derived from another and wholly different series, for instance, of forcing the elements of connective tissues to assume the characters and grouping of epithelial tissues or of tumours derived from epithelial tissues.

The same argument applies to the view that the transference is accomplished by the agency of a liquid—a cancer juice wholly devoid of even microscopic solid particles.

Whether we accept the first or the second of these theories is of little consequence, provided it is understood that the particles of the primary cancer possess the powers of development, of reproduction and grouping in the midst of tissues of various kinds and origins; and that the supposed organic element, in its passage through the tissues first affected, has been modified in such a manner as has been suggested.

Now I would venture to go one step further and to suggest that the tissues of a part like the scrotum may be affected in such a manner, either by long-continued irritation of a particular kind or by the admission to them of an organic element, that cancer ought to have been induced. But, owing to certain causes, among which probably great resistance of the tissues attacked plays an important part, the cancer, so to speak, aborts. In spite of this, it is quite conceivable that the elements of the affected tissue may have acquired powers which they are not able to exert *in loco*, and may exert them as soon as they have been transferred to a more favourable soil. Or that the exciting organic element, passing through the tissues where it might have excited cancer, but where the cancer has aborted, has been so modified that, when it reaches the tissues of the neighbouring lymphatic glands, it is capable of inducing there the occurrence of cancer, but only of the particular variety of cancer which would have occurred in the tissues primarily attacked. The cancer of the glands in such case is secondary, inasmuch as its variety and its very occurrence depend on the character and influence of the tissues in which the primary cancer has aborted; it is primary only in the circumstance that it is the first visible manifestation of cancer in the individual attacked.

If we accept this explanation of the occurrence of cancer in the groin glands of chimney-sweeps who have never suffered from obvious cancer of the genital organs, we may employ the same theory to explain the occurrence of many curious growths whose existence has hitherto been a puzzle. Some years ago an innominate bone, containing in its interior a cylindrical-celled carcinoma, was exhibited at the Pathological Society, and in 1886 a "cylindrical-celled cancer of the humerus" was exhibited by Mr. Jonathan Hutchinson, jun.¹⁸ In both cases the occurrence of the tumour was explained on the supposition that it was secondary to an undiscovered ma-

¹⁸ Path. Trans., xxxvii, 379.

lignant disease of some part of the body; I would suggest rather that these tumours were secondary to a primary disease, which, for some reason, had aborted; and, in the same way, may be accounted for some of those cancerous affections of the glands of the neck which have all the characters, general and microscopical, of secondary tumours, but for which a close investigation fails to discover any primary source.

Returning to the cases of long-deferred affection of the lymphatic glands, some of them may be explained on the same theory, and it may be assumed that the glandular affection has no direct relation to the previous cancerous disease of the scrotum, but is secondary to a fresh attack which has failed as a primary disease. On the other hand, it may be assumed, if the occurrence of cancer depends on the presence of a foreign organic element, that this has lain dormant until its action has been excited by some fresh cause, or the resisting power of the part is lessened.

It will be noticed that the title of these lectures is "Cancer of the Scrotum in Chimney-sweeps and Others." To limit the study to cancer of the scrotum in chimney-sweeps alone would be to study a very small part of a very large question. In this larger field, the first point which strikes the student is how rarely the scrotum is the seat of cancer, except in persons who are engaged in sweeping chimneys, or in some kindred employment. In proof of this let the statistics of the hospitals of Berlin and Vienna be examined. In the Rudolf Stiftung at Vienna, in the fourteen years 1873 to 1886, there were 363 males with malignant disease, but there was not one case of cancer of the scrotum. In the annals of the Charité Hospital at Berlin in the eight years from 1878 to 1885 inclusive, there did not occur a single case of cancer of the scrotum, yet the number of males under treatment for cancer in those eight years was 466. In the Allgemeine Krankenhaus at Vienna, in the eleven years from 1874 to 1884 inclusive, there occurred only 1 case of cancer of the scrotum, namely, in the year 1883. And this is the more remarkable when the enormous number of cases of malignant disease of all parts of the body admitted yearly into this hospital is taken into account. It amounted to from 460 to 750 cases in each year, a total in the eleven years of 6,759 cases of malignant disease, of which about 2,400 occurred in males. Take, further, the statistics of the Allgemeine Krankenhaus at Prague, during the nine years between 1877 and 1885 inclusive, where about 40 men with malignant disease are admitted every year. In the year 1879 there occurred 1 case of carcinoma of the scrotum, which may be compared with about 360 cases of malignant disease in male subjects. In the City Hospital of Boston, in five odd years of the decennium 1880 to 1890, there occurred 1 case of cancer of the scrotum. I do not know the number of cases of malignant disease admitted during these five years, but the total number of males under surgical treatment in the hospital was within 15 of 10,000. Well may van Buren say, "Cancer of the scrotum in this country is a rare disease."¹⁹ Of the occurrence of cancer of the scrotum in the Paris hospitals I can only give the statistics of the year 1861, in which there was not a single case.

In the English hospitals, on the other hand, the disease has been comparatively common. Thus my own hospital alone (St. Bartholomew's) has, in the course of twenty years, treated within its wards thirty-nine different patients with cancer of the scrotum. I cannot give the exact number of cases of malignant disease treated during the same period, for in the earlier volumes of the statistics they are scattered through the tables, but the number treated in the surgical wards was about 3,200, of which about 1,500 occurred in males; so that it may be taken that about one case of cancer of the scrotum occurs in every forty cases of malignant disease in males treated in the surgical wards of the hospital. In the Middlesex Hospital, in the course of the sixteen years from 1867 to 1882 inclusive, the statistical tables show that there were twenty cases of cancer of the scrotum under treatment in the wards, and that the total number of cases of malignant disease in the surgical wards during the same period was 2,147. Probably at least two-fifths of these patients were males, so that the proportion observed in the wards of this hospital agrees closely with that observed at St. Bartholomew's Hospital. At St. George's Hospital, again, nine cases of cancer of the scrotum were treated in the wards in the ten years from

1869 to 1878, and there appear to be from thirty-five to sixty cases of malignant disease in the surgical wards in the course of each year.

Cancer of the scrotum is, however, not so much more common in England than in other countries, if the cases of the disease occurring in chimney-sweeps be separated from the rest. The mere statistics do not tell the trade of the individual sufferers from disease, but the notes attached to the tables often furnish information on this point. Of the 39 patients treated in St. Bartholomew's Hospital, I found that 29 were actually engaged in chimney-sweeping, 5 or perhaps 6 in another employment which appears to predispose to the occurrence of cancer of the scrotum, and that only 4 or 5 other persons outside these employments had been admitted with cancer of the scrotum into the hospital in the course of twenty years; 5 of the 9 patients in St. George's Hospital were certainly chimney-sweeps, and some or all of the other 4 may also have been sweeps for all there is to tell to the contrary; and a large majority of the 20 patients in the Middlesex Hospital were also certainly sweeps, but I have not the exact numbers before me.

From these various figures it may safely be averred that the tissues of the scrotum are not in the least disposed to the occurrence of cancer. Nay, I would go so far as to say that they offer a very considerable resistance under all ordinary circumstances to the occurrence of cancer. For the skin of the scrotum, by reason of its position, its frequent change in tensity, its exposure to injury and various evil influences, its tendency to collect and hold every kind of dirt between its folds, and the caking of dirt and sweat in every part, might naturally be regarded as a part of the surface of the body which ought to be peculiarly liable to the occurrence of cancer.

Seeing, then, the comparative frequency with which cancer attacks the scrotum in chimney-sweeps, the inference is strong that there is something in the trade of a sweep which modifies the skin of the scrotum to such an extent as to render it liable to the occurrence of cancer. Nay, more, the modification is so decided and of such a kind that the integument of the scrotum is not merely predisposed to the occurrence of cancer, but is more predisposed to it than the integument of any other part of the body. The statistics of cancer furnished by English and foreign authors on the relative liability of persons engaged in various employments to cancer of different parts of the body do not show that sweeps are more liable than other persons to cancer of the face, the lip, and the general surface of the body. And the statistics of the Registrar-General, which afford the most reliable information in this respect, because they deal with all the deaths of chimney-sweeps during a period of three years, show that of 36 deaths from cancer, in which the part of the body affected is noted, only 1 patient died of cancer of the lip and 2 of cancer of the face, while 23 died of cancer of the "scrotum, penis, testis, groin." (The remainder died of cancer of the stomach and the liver (7) and palate (1). And if these 23 cases had been accurately analysed, it would almost certainly have been found that the primary disease was of the scrotum in at least 18 or 20 of them. This enormous preponderance of cancer of the skin of the scrotum is the more striking when it is compared with the single case of cancer of the lower lip, a part of the surface of the body which is above all others, in men, predisposed to cancer.

THE death of M. Pravaz, the inventor of the hypodermic syringe, which bears his name, is announced in the French newspapers.

THE REARING OF IMMATURE INFANTS.—M. Strauss has submitted to the Paris Municipal Council plans for the construction of an annexe to the Maternity Hospital, where premature and weakly infants can be reared with the aid of incubators. Before *couveuses* came into use the mortality among six months' children was 100 per cent., now it has fallen to 84. Seven months' children formerly died in the proportion of 61 per cent., now the death-rate is 50 per cent. Among eight months' children the mortality, which used to be 22, is now 11.20 per cent.; among those of eight months' and a-half the death-rate has fallen from 12 to 4 per cent. M. Strauss's report was adopted and a sum of 59,100 francs (£2,364) voted for the purpose indicated.

¹⁹ *Dis. of the Genito-urinary Organs*, 1874.