

ovum can be watched outside the body of the parent. Thus Bischoff and Leuckhart have both described partial development of ovules which have been placed beyond the possibility of impregnation. Dr. Moquin-Tandon has, more recently (1875), described analogous facts before the Academie des Sciences, among which he gives details of the process of segmentation in the ova of a frog which had been kept in confinement for four months.

There were first noticed two large vertical fissures in the ovule, followed soon by similar horizontal segmentation, and this process of division proceeded further, but in a less regular manner than usual, the yolk spheres multiplying irregularly, and becoming of unequal size, and it was more rapid than in fecundated eggs which were allowed to develop at the same temperature. Only a small number of the ova presented this evidence of commencing development, for the majority died without any sign of segmentation. Sometimes death occurred after the division into two or four segments, sometimes at a more advanced period, but the ovule never assumed the mulberry appearance. The author considers that this incontestably proves that the ova of vertebrata, not impregnated by spermatozoa, may pass through the earliest stage of development in certain conditions, the exact nature of which is at present unknown. It seems to me that we may take this process to be exactly what occurs in the development of the spore of the fern into the prothallus, and the tendency which these unfertilized ovules have to this primitive and ineffectual development is derived from the continuity of descent. In the insecta the process is carried much further, for Balbiani exhibited some eggs of the silkworm moth to the Société de Biologie (1873), which had been deposited before fecundation could have been effected. A certain number of these eggs remained sterile, but others showed signs of development, though in no instance had the larva escaped from the egg. The number of these developing eggs varied extremely according to the species of moth by which they were deposited. The largest number was met with in those which produce several generations per annum. Among 9,000 eggs of a polyvoltine race, 513 developed spontaneously; while of 50,000 of an annual race, 29 only were fertile. M. Balbiani thinks that this enormous difference is probably due to the feeble vitality of the egg in the annual races, a suggestion which cannot be considered in any way as an explanation; neither can his idea be entertained that the parthenogenetic development is to be accepted as proving the hermaphroditism of the egg, for there is no evidence whatever of such a condition. What has been observed by Balbiani is indeed only an attempt to fulfil the

conditions seen in the aphides, where the cell multiplication in the pseudovaria produce a new individual without any sexual congress. Putting these facts along with others observed by Agassiz and Burnette in fish, by Hensen in the rabbit, by Bischoff in the sow, and more especially the remarkable observation of Oellacher, that segmentation occurs in the eggs of fowls kept from the cold, while the eggs are still in the oviduct, I do not think that there is any difficulty in believing that the hypererchetic efforts of the human ovum which result in the formation of those so-called dermoid cysts, are parthenogenetic, and have originated in the early phases of our ancestry. In the human ovary these processes are carried further by an abundant blood-supply.

Sir James Paget has, it seems to me, struck the key-note of the pathology of dermoid cysts when he wrote, "It is, perhaps, only during the vigor of the formative forces in the fetal or earliest extra-uterine periods of life that cysts thus highly organized and productive are ever formed." A most important point in the pathology hangs on this sentence, and can be decided only by a determination of the age at which such tumors are most frequently found. It is, of course, evident that the ages at which these tumors are removed by the operating surgeon cannot be taken into account, as they are of slow growth, and have often been recognized as being present for many years without perceptible increase. They are quite unlike, in this respect, the ordinary adenoid tumors. Their contents even show that their existence must often have been contemporaneous with the life of their bearers; for we find large balls of hair, the result of the epithelial growth and shedding of a nipple-like process not bigger than the tip of one's finger; and in one sac over three hundred teeth have been found, resembling, in many respects, milk-teeth; so that we may reasonably suppose that they were the repeated products of a limited dentigenous area. In one of Mr. Spencer Wells's cases, the preparation of which is in the Hunterian Museum, a piece of bone was found resembling greatly a part of the upper maxilla and sphenoid bones, and containing mature molar teeth. In fact, inspection of the specimen almost carries conviction to the mind that the bone and tooth-sacs were produced at an early, perhaps intra-uterine, period of the life of the patient, and that they grew and matured as she did till the tumor was removed, at the age of thirty-nine.

Dermoid and dentigenous cysts have been so frequently found in children, that it may be suspected that if the histories of all such as are removed by operation could be traced, they would be found to be, as Paget suggests, either congenital or

originating very early in life. Indeed, it seems to me to be impossible that it can be otherwise when we remember how soon after birth all processes of development must cease, and those of growth alone are continued; impossible that new tissues, so strange and displaced, should be developed after the formative powers have ceased to produce new tissues in normal positions. The more we know of pathology, the more we find its processes resemble those of physiology; and it seems to me far more simple to explain the occurrence of dermoid cysts in the ovary by hypererchetic action of an ovum at the time of life when such processes are in vogue in the economy, than at some other time when they have entirely ceased everywhere else. I have already shown that the formation and destruction of ovarian cells goes on from the earliest to the latest times of existence, the degree of their maturity varying with the periods of life. Fully dilated Graafian follicles are often seen in the ovaries of newly born children, containing ova which are minute, transparent, and structureless cells. But let us suppose that, during the developmental period of life, some stimulus be given to one Graafian follicle and its contained ovum, which for want of better knowledge we may call accidental, and that this should lead to the premature maturation of the ovum, so that, were the rest of the organism ready for the process, it might be carried into the uterus and there be impregnated. Let us further suppose that, instead of being destroyed by rupture of the ovisac, it should remain in the ovisac and share alike with the rest of the economy in developmental activity, there could be only one result, and that would be the formation, to an incomplete degree, of those structures which it would evolve in perfection under more favorable conditions.

In support of my supposition, I may draw attention to a description further on of a dermoid cyst which I found in the peritoneum with attachments to its surface, but without connection to either of the ovaries. This tumor was so intimately and so extensively adherent to the peritoneum that I had to leave it, and I had reason to believe it had no ovarian connection. Might not such be developed from an ovum which had escaped from the ovaries in early life, and become attached to the peritoneum, as we know they do in after life, and there have carried on its attempt at parthenogenesis?

The logical conclusion of this view is, that if such an ovum could get into the uterus after its escape, it would develop into a perfect instance of parthenogenesis—a speculation, of course, but no wilder than some of the facts of embryology seemed to us before we understood them. It is in fact quite analogous to the

production of the aphid by a virgin and sexless larviparous mother.

Whatever may be the value of the suggestions I have thrown out, they are certainly consistent with my own clinical experience; for in one case where I removed a dermoid cyst from a young woman, there were many reasons for believing that it had existed long before puberty. The oldest patient from whom I know that a dermoid cyst has been removed is a case of my own, the woman being in her forty-fifth year. The tumor weighed only six and a half ounces, and was full of hair, which had grown and been shed from one little spot of skin not bigger than the tip of my little finger. The amount of hair in the sac, had it grown from a similarly sized area of scalp, would have taken almost a lifetime to grow and be shed. In Mr. Wells's oldest case (38), the tumor had been recognized for eighteen years; and in a case (37) not operated upon, but examined after death, the tumor had been known to be in existence for at least twelve years. The usual age for dermoid cysts to come under the notice of the surgeon is from seventeen to twenty years, and then it is generally certain that they have been long in existence. After puberty, the recurrent congestion of the whole sexual apparatus must stimulate into growth what is in readiness for it after having been developed long previously, as I have suggested in my hypothesis. The results of that development may remain of minute or even microscopic size, until the stimulus of the menstrual hyperæmia so increases them as to make them of surgical importance; just as Hunter's celebrated experiment of the transplantation of the spur of the cock into his comb resulted in an extraordinary increase in length and size of the spur by the altered character of its hæmic nutrition. Occasionally, however, they grow to a large size before puberty.

At a meeting of the Pathological Society of London, on Tuesday, May 5, 1874, Dr. Dickinson showed an ovarian tumor removed from a child, aged ten, at the post-mortem examination. About twelve months previously the child complained of pain in the right side, and lower part of the abdomen, and then a small swelling the size of an egg was noticed. In six months' time this was as large as a small apple. It then rapidly increased. When first seen the umbilical girth was twenty-five inches, and she was in much pain. The diagnosis was difficult, and it was at first supposed to be a malignant growth of the kidney. She was removed from the hospital, and on her return, some months after, the umbilical girth was twenty-seven and one-half inches. She died soon after of peritonitis. A tumor of the right ovary was found, weighing five and one-half pounds. It contained

hair, bones, etc. All the other organs of the body were healthy. The child had never menstruated. An exploratory incision would probably have saved this child's life.

Briefly, then, I believe dermoid cysts to be the result of hypererchetic development of an ovum in fetal or infantile life, growing into a tumor during and subsequently to puberty. They are always invested by the ordinary peritoneal covering of the ovary, beneath which is a more or less thick layer of the nucleated and banded fibrous tissue, which forms the basis of all ovarian cysts. I have seen this layer as thin as tissue paper, and in one old-standing dermoid cyst it was more than an inch thick, and occupied by large plates of calcification. In it are to be found the same almond-shaped nuclei which characterize the stroma of the ovary, only they are sparsely distributed, as I have already said they always are in old tumors. Within this layer the peculiar structures met with in dermoid cysts occur, an arrangement strongly indicative of the method of origin which I have suggested for them. I do not know of any tissue in the body which may not find its representative in them, for Beneke has even found brain-substance. Usually, however, they have an epithelial character, and in some instances show great advance both in development and growth. When skin or mucous membrane is present, all the details of their structure may be made out; and as there is no vasomotor check on the vascular supply, the materials which they secrete normally are often found in vast quantities, as, for instance, hundreds of teeth, and pounds of sebaceous matter.

Another kind of tumor, undoubtedly of ovarian origin, though without the appearance of any relation to the ovary save that of contiguity, has several times come under my observation, and as I have met with no description of a precisely similar case, I am induced to place on record a full description of it. The first case was in a patient, thirty-seven years of age, who was placed under my care by Dr. Blackwood, of Wednesbury, who had attended her in three confinements, the first of which was natural, the second had to be completed by the use of forceps, and in the third version had to be performed on account of obstruction. The last labor occurred in 1869, and after that till the time I saw her, April, 1873, menstruation occurred normally. During that time a protrusion from the vulva gradually formed, and when first seen by Dr. Blackwood it had reached an enormous size, and included the uterus, bladder, and rectum, and it had become perfectly irreducible. Dr. Blackwood also discovered a large abdominal tumor, which seemed to be the cause of the protrusion. I found that this tumor extended to about four inches

above the umbilicus, that it filled the pelvis, and the character of the fluctuation made it apparent that it was a unilocular cyst. It was very much fixed in the pelvis, so that I gave the opinion that it was adherent, and that probably much difficulty would be encountered in its removal, but as its growth had been rapid I advised an exploratory incision. This I made in the usual way on April 27th, but could find no line of demarcation between the peritoneum and the cyst-wall. The latter was very much thickened, and on being cut through it was seen to contain a large number of hairs, not growing into the cyst, as is usually the case, but growing merely in the wall, for not a hair was to be found free on the inner surface of the cyst. The contents consisted of clear serous fluid, in which floated long processes of translucent membrane, exactly resembling the omentum of a foetus; and there was also one long finger-like process of pure fat, encapsuled in serous membrane. The sac was emptied of everything, and attempts were made on every side to discover a division between it and the peritoneal cavity. Above, I dissected till I found that its union with the intestines was so intimate as to render its removal impossible. On each side it seemed to be entirely continuous with the abdominal walls as far as the brim of the pelvis. Below it, the uterus and ovaries were felt to be quite free, so that it was made certain that the tumor was not ovarian, and behind it the intestines could be felt in a cavity which probably extended down to Douglas's pouch. When these details had been made out, it became quite evident that the proper treatment for this anomalous case was to close the wound, save at its lower angle, where a drainage-tube was placed; but before I did so, I removed a fragment of the wall of the cyst in which I had noticed the hairs. I need not give a detailed account of her progress toward recovery, more than to say that the cyst supplicated freely, and that the suppuration slowly diminished, so that in July I removed the drainage-tube. In October there still remained a slight discharge from the site of the drainage-tube, all tendency to protrusion from the vulva had ceased, and it could be felt that the roof of the pelvis was somewhat fixed and the uterus retroverted. The wound also was slightly drawn inward, but there was no other trace of the tumor. The patient now (1880) enjoys robust health, and still menstruates regularly.

Examination of the fragment of the cyst-wall which I removed showed that hairs were growing in it, or at least existed in it, in large numbers, and that they all lay in a direction parallel to the cyst-wall. There were also traces of rudimentary skin structures, as papillæ, fat loculi, and something like glands,

quite sufficient to place this remarkable tumor within the category of dermoid cysts; and in this direction also the serous membrane found within it pointed. What, then, was its origin? In answer to this, only two suppositions can be entertained, the first and least likely of which is that it was an inclusion cyst, similar to that already referred to as situated at the Torcular Herophyli. The other, and I think that which must be accepted, is that it had grown out of a wandering ovum, which, after its escape from its Graafian follicle, had failed to be extruded in the ordinary way, had not died, but had gone on to a hypererchetic development.

We know that ova are sometimes matured in infantile, even in embryonic life, and also that they sometimes undergo this hypererchetic development in the ovary. In adult life, we also know that all the ova which escape from the follicles do not reach the uterus, and it is more than probable that a large number of them escape into the peritoneal cavity, and there wander till they die. As the ovum when impregnated fixes itself at once to the surface with which it is at the time in contact, and there develops, so it is not impossible that one of these hypererchetically inclined ova, having escaped into the peritoneal cavity, there becomes adherent, and grows into such a dermoid cyst as I found in Dr. Blackwood's case. All the circumstances necessary for this coincidence being rare, of necessity its results will be rare; but as our surgical experience of such matters is just, as it were, beginning, such a case as the one I have narrated may not be without a parallel. Certain it is that I have met with no description of an exactly similar instance, though the development of wandering ova into cysts is a possibility recognized by several authors, especially by Boinet. Dr. Lloyd Roberts, of Manchester, has described a similar cystic tumor which he removed successfully, which had no connection with the uterus or ovaries, and which he regarded as a non-fecundated ovule which had dropped into the peritoneal cavity, and there become enormously developed.

I have met with quite a series of cases to which I think no other explanation can be given than such as I have advanced for the case described above. In none of them were there anything like dermoid structures, though in other respects they closely coincided with its appearances, and they had features perfectly in common, more particularly in the matter of their relations to the pelvic and abdominal organs. The series includes six cases, of which I need only describe one, as there was nothing different in any of them, either in appearance, treatment, or result. They were all young women, from fifteen to

twenty-six years of age, and they had all the physical characters of parovarian cysts. When I came to operate, however, I found that between the cyst and the peritoneum there was an absolute adhesion, and when I opened the cyst I evacuated a large quantity of perfectly limpid fluid. The cysts were lined with epithelium, and had a perfectly smooth, glistening surface. They were intimately adherent to the whole of the pelvic surface and also to the posterior abdominal wall. For some two or three inches above the pelvic brim this adhesion extended in a sloping line forward, upward, and outward to a level an inch or two above the umbilicus. From this line of attachment the cysts seemed to be free, and when emptied the intestines pushed down the upper wall into the cyst cavity like a huge pouch. In every one of the cases the uterus and ovaries could be felt, in their normal situation, through the cyst-wall, and, as far as could be determined, perfectly healthy, and independent of the cyst.

They were therefore not ovarian tumors, and they certainly were not of parovarian origin; and the uniformity of their relations makes it, I think, certain that they form a specific class of pathological cysts. In the first case I met with, which was sent to me by Dr. Eshelby, of Stonehouse, some years ago, I tried very hard to remove the cyst, but failing to do so, I inserted a large drainage-tube, keeping it in for some weeks, and in this way I cured the cyst, and the girl now remains perfectly well.

The same history is to be given of the other five cases, and in the last four I have been able to recognize at once the nature of the case, and have therefore made no attempt to enucleate the tumor, but have been content with draining it in the method described.

My impression about these cases is, as I have said, that they are cysts formed by a dropsical distention of an ovule which had not been impregnated and which dropped into the peritoneal cavity and had there become attached and developed.

There is a class of tumors which closely simulate cystic tumors of the ovary which I have seen occasionally referred to in published accounts of operations as extra-peritoneal cysts, and in one case, at least, the description is such as makes it clear that the writer regards the tumor as having been a true ovarian cystoma developed outside the peritoneal cavity. It is, of course, absolutely impossible to accept any such explanation for these tumors, for one cannot see how a tumor of the ovary, or a tumor developed from a wandering ovum, could by any possibility be developed on the outer side of the membrane of the peritoneum. In my own practice I have only seen two cases of extra-peritoneal cysts, and in both of them the operation unfortu-

nately proved fatal. As no *post-mortem* examination could be obtained in either instance, it remains quite uncertain what the exact nature of the tumor really was, though I think I have a satisfactory explanation to give of them.

The first case that I met with was in a lady, aged fifty-six, under the care of Dr. Lamb, of Albrighton, who for twelve months before had complained of abdominal pain and tenderness, and in October, 1880, began to suffer from somewhat serious symptoms, more particularly frequent vomiting and disinclination to take solid food. Some swelling in the lower part of the abdomen was noticed about the same time, this being then regarded as ascitic. The symptoms slowly increased in severity until February 11, 1881, when a consultation was held between Drs. Lamb, Heslop, and Saundby. As a result of this consultation she was tapped and ten pints of fluid were removed, though this was by no means the quantity of fluid in the cavity, because large masses of flocculi obstructed the tube of the trocar, and prevented the complete emptying of the cyst. Some of this fluid was submitted to me for an opinion, and from the facts that it was brown and thick and gave an abundant flaky, yellow deposit which consisted chiefly of pus, I unhesitatingly gave the opinion that it was not ascitic, but a fluid that must have been contained in some cyst cavity, probably a cyst of the parovarium. I saw her on February 13th, when we found that the abdomen was quite as much distended as before the tapping. I therefore proposed an exploratory incision for the removal of the tumor, if it were possible to remove it, although the extremely exhausted condition of the patient gave no very great prospect of success. It was perfectly clear, however, that if left alone nothing but death could be the result, and therefore an operation was accepted by her attendants and relatives.

I opened the abdomen at the usual site, and after cutting through all the layers except the peritoneum I came upon the cyst wall. I opened the cyst and removed about thirty pints of fluid exactly the same as that which had been removed at the tapping, and mixed up with it I found large masses of the fibrinous deposit, which accounted for the failure of the tapping to remove the whole of the fluid. I then proceeded to remove the enormous cyst, which was uniformly attached to the parietal wall on its outer aspect and to the outer surface of the thickened peritoneum on its posterior aspect. The cyst did not dip into the pelvis at all, and the anterior parietal peritoneum did not reach the wall lower than the ensiform cartilage. The intestines and the pelvic organs could be felt through the anterior peritoneal fold, non-adherent and, as far as could be determined, perfectly

healthy. The cyst lay, therefore, entirely between the transversalis fascia on the outer side and the parietal peritoneum on the inner, the peritoneal cavity having been nowhere opened during the protracted and severe operation. The cyst was removed in its entirety, and its inner surface consisted of broken-down mucoid epithelium, infiltrated everywhere with pus, lying upon the basement-membrane, which consisted almost entirely of muscular fibre.

The conclusion concerning the nature of this cyst at which I have arrived is that it was developed from the urachus, a part of which had been occluded at both ends, but during the developmental changes of embryonic and infantile existence had not become obliterated. I entirely fail to see any other possible origin for it, and if my explanation be correct it is very marvellous that this structure should have remained quiescent for fifty-six years and then should suddenly undergo an inflammatory change which developed it into this enormous cyst. The patient went on very well for about three days and then rapidly sank from exhaustion. No *post-mortem* examination was allowed, and therefore I can shed no further light upon it, and as far as I know the observation is unique, although it is perfectly well known, as I myself have repeatedly had occasion to observe, that small cysts of the urachus are opened in abdominal section. I do not know that any such cyst has previously been met with sufficiently large to be of pathological importance.

The second case of extra-peritoneal cyst was sent to me by Dr. Craig, of Stoke-upon-Trent. Here again the patient was almost hopelessly beyond the reach of surgical interference before I saw her. The tumor had been recognized by Dr. Craig in 1878, and then he had recommended her to put herself under my care for its removal. She, however, declined to do so until the middle of last May, and when she arrived in Birmingham she was practically moribund. I happened to be from home when she reached my house, and my servants were under the impression she would never leave the house alive. She was placed in lodgings close by, and I operated upon her immediately on my return, three days afterward. The cyst I found gangrenous and full of pus, with a large mass of broken-down lymph. It was situated entirely outside the peritoneum, which was never opened at all, and it dipped down into the pelvis on the right side only. As far as I could make out, its structure was very much like the other, save that it extended almost entirely on the right side, the peritoneum seeming to be pushed altogether toward the left. Its characters were very much like those of Dr. Lamb's case just described.

She rallied from the operation very well, and for eight days seemed likely to recover, but as soon as the stitches were removed from the wound it reopened and continued to discharge a large quantity of unhealthy brown purulent fluid until her death, seventeen days after the operation. Here again, unfortunately, no post-mortem examination was obtained, and therefore I can say nothing with absolute certainty as to the origin of the tumor, but my belief is that this also was a cyst of the urachus.

In both of these cases I inserted drainage-tubes into the cavity left by the cysts, and I am under the impression these tubes had something to do with the fatal results, though this may not be the case. The explanation of the deaths is of course first of all to be found in the advanced condition of exhaustion in which both patients were at the time of operation, and I think it very likely that a fortunate result would have been obtained in both of them if the operations had been performed earlier in the histories of the cases. Perhaps the immediate cause of death was the destruction of the vitality of the peritoneum, which was associated with the inner wall of the cyst. In both cases the extent of peritoneum denuded from the cyst-tissue, to which it doubtless owed its blood-supply, was very great, and if this important structure died from loss of its blood-supply, it would of course be quite sufficient to account for the deaths of the patients. I think if I should ever have similar cases I should feel inclined to remove a large portion of this denuded peritoneum and trust to a careful arrangement by sutures of the portions left rather than run the risk of what I think may have been the cause of death, for I often find I have to remove in cases of adherent cyst a very large piece of parietal peritoneum, and this is done without interfering in any way with the recovery of the patient.

These cases illustrate very well the unexpected and great difficulties which arise in the practice of abdominal surgery, and how much we have yet to learn in this important branch of our art. They also illustrate the abundant causes we have for regretting that abdominal tumors are often allowed to go so long as to remove any reasonable prospect of success in dealing with them.

Before dealing with the very numerous conditions which simulate ovarian tumors it will be convenient if I now discuss the signs and symptoms by which an ovarian tumor may be recognized; and I may here say at once that the conditions which mimic these tumors are so numerous, and there are so few facts in connection with them upon which implicit reliance can

be placed, that safety is to be found only in the process of reasoning by exclusion; that is, for a proper diagnosis in the case of an ovarian tumor it will be found the best plan, first of all, to make a mental list of all the conditions that it may be, and exclude them one after another until no alternative is left. Any one who habitually follows a converse plan will sooner or later be led into some fatal blunder. Our anxiety should always be, not to prove that a given tumor is ovarian, but to show that it cannot by any possibility be anything else.

It may be said with perfect certainty that from the history alone no ovarian tumor could be diagnosed, so various are the stories told by the patients about their cases. Thus one patient will present herself totally unaware of the fact that there is any tumor, her only sensation being one of discomfort from the swelling, while another may have known for many years of the presence of a small lump which had long remained quiescent, and had taken to enlarging only for a few weeks or months. The rate of increase gives no guide, either in unilocular or in multilocular tumors; for I have removed multilocular tumors which had been in progress for a great many years, and I have removed one of great size from a patient aged sixty-six, which had grown in four months. I have removed, on the other hand, a large unilocular parovarian tumor which had been in existence for more than ten years, and the structure of which showed that it always had been unilocular; and I have removed two unilocular tumors, one of which grew so as to completely distend the abdomen in seven weeks, and another, almost as large, which had not been noticed for more than five weeks.

The details given by the patients as to the region in which the tumors were first observed are often very misleading, and no dependence whatever can be placed on some. One patient, in whom there existed an undoubted fibroid tumor of the uterus, asserted that it originally grew somewhere in the neighborhood of the spleen, and gradually descended to its present uterine situation. Tumors of one ovary are often stated by their bearers to have originated on the side opposite to that from which they are found to grow. One condition which on rare occasions comes under our notice, hydatids of the peritoneum, beginning as it does generally by rupture of an acephalocyst of the liver, presents usually a history of origin at the upper part of the abdomen; so that, when such a story is given with subsequent general enlargement of the abdomen, caution is necessary before excluding hydatids from the possibilities. A tumor which began centrally and remains so is of course likely to be uterine; but this is far from being constantly the rule. I have heard a pa-