The Lettsomian Lectures

ON

TUMOURS COMPLICATING PREGNANCY,
LABOUR, AND THE PUERPERIUM.

DELIVERED BEFORE THE MEDICAL SOCIETY OF LONDON,

BY

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(Abstract.)

LECTURE II.—OVARIAN TUMOUR COMPLICATING
PREGNANCY, LABOUR, AND PUERPERIUM.*

THE lecturer presented an elaborate table, which we are unable to reproduce, giving particulars of 55 ovariectomies for ovarian tumour complicating pregnancy, labour, and the puerperium; it comprised all the cases he had seen with two exceptions. One of these was that of a woman, referred to below, who died on the third day of the puerperium owing to rupture of a very large cyst; the other was that of a lady with an ovarian tumour as big as a lemon, who had been delivered in 1918 of a living child, and who, as the tumour caused no inconvenience, did not wish to be operated upon. The ages of the 55 patients varied from 20 to 43, the average age being 30. Nine patients were nulliparae at the time the ovarian tumour was present, nine had had five or more children, one had had nine, and three ten. Altogether the 55 patients had had 150 children, an average of nearly three, before the tumours were removed.

ABORTION.

Information as to occurrence of abortion was not noted in 7 cases; the remaining 48 women had had 125 children and 33 abortions. The proportion of abortions to pregnancies was therefore 26.5 per cent.

Of the 55 cases, 40 were not operated on during pregnancy and 15 were. In only 5 of those not operated on during pregnancy, or 12.5 per cent., did abortion occur in the pregnancy preceding the ovariectomy. The rate may have been lower, as the notes leave a doubt about the date of the abortion in one case. In 5 out of 6 cases in which both ovaries were affected abortion did not occur; in the sixth case the notes leave the matter in doubt.

Of the 15 cases operated on during pregnancy 4 aborted (26.6 per cent.).

One had bilateral dermoids removed at the twelfth week; one had bilateral fibroids removed at the fifth week of pregnancy; another had haemorrhage before the operation at the thirteenth week, when a large multilocular cyst was removed; the patient passed a mole twenty-seven days afterwards. The fourth had an acute twist of the pedicle of a parovarian cyst with haemorrhage into the broad ligament; the tumour was removed at the thirteenth week of pregnancy two hours after the twist occurred.

In 10 of the 15 cases operated on (66.6 per cent.) the pregnancy continued and living children were born, but one died shortly after. As 3 of the patients were operated on at term, when the question of abortion does not arise, the true abortion rate for patients operated on before the child is viable is in this series 4 out of 12 cases (33.3 per cent.).

NATURE OF TUMOUR.

The tumour was cystadenomatous in 33 cases (60 per cent.), dermoid in 15 (27.2 per cent.), ovarian fibroid in 3 (5.4 per cent.), and "parovarian" in 6 (10.9 per cent.). Torsion of the pedicle was found 12 times in cystadenomatous tumours, 5 times in dermoid tumours, and once among the "parovarian" tumours, a total of 18 (32.7 per cent.).

Cystadenomatous Tumours.

Of the 33 cystadenomatous tumours 22 were multilocular (in 2 cases papillomatous); 11 of the unilocular tumours may originally have been multilocular. The cystadenomatous tumours were mostly of large size; 3 had ruptured, as noted below. A few were small. The two papillomatous tumours were also multilocular. One case was complicated with hydrosalpinx and another with pyosalpinx and ovarian abscess.

Dermoid Tumours.

Most of the dermoid tumours were small, not more than 10 to 12 cm. in their greatest diameter; the exceptions were a

tumour which contained three pints of pus, another which was as big as an adult head, a third which measured 16 cm. in its longest diameter, and a fourth which was as big as the pregnant uterus at the sixth month, and contained pill-like balls of fat. In 2 of the cases tumours were removed on both sides, and in another a dermoid had been removed from the opposite side thirteen years previously. Thus 20 per cent. of the dermoids were bilateral.

Ovarian Fibroids.

In one case the tumour was small and contained pus; in another it was calcified, weighed 1 lb. 8 oz., blocked the pelvis, and was mistaken for a uterine fibroid before the operation; in the third case the tumours were bilateral—the right tumour weighed 3 lb. 8 oz. and was removed with the rest of the ovary; the left, 1 in. in diameter, was excised and the remains of the ovary stitched up. The patient had a living child in the following year.

"Parovarian" Tumours.

All the parovarian tumours except one, which contained ten pints, were of small size. In one case a subfimbrial cyst on the left side was associated with an ovarian cyst on the right. In only one case (the only case in which the pedicle was twisted) was the corresponding ovary removed.

Rupture of the Cyst.

Rupture of the tumour occurred in 3 cases (5.4 per cent.).

In one of these cases the rupture probably occurred at labour; the tumour was removed a month later. Another had been tapped at a lying-in hospital to relieve pressure; the tumour was removed during labour. The other case was admitted during labour with much free fluid in the abdomen. The cyst was removed twelve hours after labour, and was found, as expected, to be ruptured, but holding 2 gallons of bloody fluid, some of which had escaped into the peritoneum. All these tumours were very large multilocular cysts. The largest ruptured ovarian tumour met with by the lecturer contained 31 pints of fluid. It burst on the third day after an easy labour. The patient had been advised, both before and during pregnancy, to have the tumour removed, but refused. She had been progressing favourably, but when the cyst ruptured became collapsed and was removed in an ambulance to hospital, but died of syncope immediately after her admission. The wall of the cyst was very thin, and looked as if it had been stretched.

Suppuration of the Cyst.

The tumour suppurated in 8 cases; in all the suppuration occurred after delivery.

In one case the tumour contained 2 gallons of fetid pus, and the patient was very emaciated and feverish; in another there were 15 pints of pus. In another case the patient had been delivered with forceps (the child dying on the third day), and the tumour had been tapped twice, 10 pints of pus being evacuated. In another case the child was delivered (dead) with forceps, and the tumour contained 26 oz. of pus. In one case the tumour was small and did not become evident till the uterus had involuted; in another it was complicated with an ovarian abscess and pyosalpinx on the other side. The pedicle was twisted in one case.

Six of the suppurating tumours were cystadenomatous, one was a dermoid; the infection in this case probably was caused by the tapping. The supposed proneness of dermoids to suppurate is due to an error of observation; the liquid fat at the temperature of the body looks very like pus to the naked eye. Examination with the microscope shows its nature. Dermoids very rarely suppurate. They are no doubt more prone to it as a result of labour, owing to the risk of injury when they are in the pelvis. Out of 59 dermoid tumours removed Dr. Spencer only met with suppuration in two cases besides the case mentioned above, and in one of them the tumour communicated with the sigmoid flexure of the colon.

Seat and Position of the Tumour.

The tumour was situated in the right ovary in 23 cases, in the left ovary in 18 cases, in both ovaries in 8 cases, in the right parovarium in 4 cases, in the left parovarium in 1 case, in the left parovarium and in the right ovary in 1 case.

The tumour was incarcerated in the pelvis in 5 cases. In 1 case the tumour was mistaken for a uterine fibroid, Caesarean section was performed, with a successful result to the mother and child. In the other 4, which were all dermoids, the value of treating the obstructing tumour either by pushing it up out of the pelvis or removing it by operation was illustrated. The danger of delivering the child while an ovarian tumour is in the pelvis is illustrated by a specimen exhibited before the Obstetrical Society in 1898, which showed rupture during version after an attempt at delivery by forceps, with a fatal result to the mother.

During the course of labour, the reposition of the tumour is facilitated by putting the patient in the Trendelenburg position under chloroform anaesthesia, a procedure which should always be tried before resorting to abdominal

* Delivered February 16th. The valuable table to which reference is made will be published, with the full text of the lectures, in the *Transactions* of the Medical Society of London.

section. If it is found to be impossible to push up the tumour, the uterus should be withdrawn from the abdomen through a 6-inch incision, which is quite long enough if the uterus be brought out cornerwise. If the child be in good condition the tumours may be removed, and the child delivered by forceps; but if the child's heart sounds are slowed or weak, the child should be delivered as soon as the tumour has been pulled out of the pelvis, and before it is removed; thus the child will be spared some minutes of anaesthesia. It is of great importance that the cervical canal should be dilated before operation for the removal of the tumour, otherwise it may be necessary, after removing the tumour, to close the abdomen, which is done with difficulty, owing to the tension of the abdominal wall. In delivering the child at the end of the first stage it is not necessary to replace the uterus in the abdomen; the forceps may be applied (if possible by a second operator) while the uterus lies on the abdominal wall. If the cervical canal is not dilated, the tumour should be pushed up with the patient in the Trendelenburg position, and removed at a later stage of labour or after delivery.

Adhesions.

Adhesions were found in 26 cases (47.2 per cent.). All the suppurating cases were adherent. Dermoid tumours in which the pedicle was not twisted were free from adhesions except in two instances.

GROWTH OF THE TUMOUR DURING PREGNANCY OR PUERPERIUM.

There does not appear to be any evidence in the cases observed of specially rapid growth of the tumour during pregnancy. Fifteen (27.2 per cent.) of the tumours were dermoids, which usually grow slowly, and do not attain a size which enables the growth to be easily observed, at least by the patient. In one case the left-side dermoid grew in three months from the (estimated) size of a hen's egg to a size of $8.5 \times 7.5 \times 6$ cm.; in another the dermoid tumour, at the third month of pregnancy of the size of a hen's egg, measured $16 \times 10 \times 8.7$ cm. nine months later. It must be remembered that the growth of ovarian tumours, apart from pregnancy, is often rapid. In one case the growth was sudden and rapid, and the cyst ruptured during labour; it contained 2 gallons of bloody fluid, and was removed twelve hours after delivery. In another case the tumour grew so fast that it had been tapped in a lying-in hospital to relieve pressure. These cases of rapid growth are, however, exceptional, and on the whole it appears that pregnancy exercises no special influence in increasing the rate of growth, the evidence pointing usually in the opposite direction. In the puerperium there seems to be a greater tendency to a rapid growth.

In one instance, however, the tumour diminished greatly during ten weeks' observation in the hospital; the patient was also suffering from pleural effusion, of tuberculous origin. A large suppurating ovarian cyst, extending high up into the abdomen, gradually got smaller, until, at the time of its removal, it was of the size of a fist. At the operation adhesions to the omentum, abdominal wall, and intestines were found to encase the tumour, and no doubt the vessels in these adhesions had absorbed some of the fluid in the cyst, thus leading to the remarkable reduction in size. The patient recovered well from the operation, and slowly recovered from the pulmonary phthisis, and was examined by me and found to be in fairly good health twenty-seven years later.

THE RESULTS OF OVARIOCTOMY.

Of the 55 patients submitted to ovariectomy, one died.

In this fatal case the tumour was a dermoid. The patient had been delivered eight months before the operation. She had noticed abdominal pain five months after the confinement. There were no adhesions. The pedicle was not twisted at the time of the operation, but the Fallopian tube was almost divided, possibly as the result of a twist which had become undone. After the operation intestinal obstruction was caused by the adhesion of a coil of small intestine to the stump of the ovariectomy pedicle. The abdomen was opened and the coil separated, but the patient succumbed.

Ovariectomy during Pregnancy.

Of the fifteen ovariectomies during pregnancy twelve were performed during the first half, two were operated upon during labour, and one immediately after Caesarean section at term. In two labour was induced on account of contracted pelvis. All the mothers recovered.

The children (in one case twins) were born alive in 11 cases, but one of the children died soon after birth;

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4 patients aborted; thus, in 5 out of 15 cases the child was lost; thus the mortality rate for the children was 33.3 per cent.; the abortion rate was 26.6 per cent., or, more correctly, 33.3 per cent. (see *ante*). In four other cases seen by the lecturer during pregnancy, and operated on, the mothers recovered and the children survived.

Thus, of the 19 cases seen during pregnancy, all the mothers recovered; and in 15 the children were born alive and in 14 survived, the mortality rate of the children being 26.3 per cent., the abortion rate 21.5 per cent.

The Operation.

The ovariectomy incision was made in or near the middle line, usually through the inner edge of the left rectus muscle. In two cases the transverse Pfannenstiel incision was made: it lessens the exposure of the intestine and the risk of hernia subsequently, but may entail more manipulation; it is only exceptionally suitable for cases operated on during pregnancy. Silk was used exclusively for ligatures and buried sutures. Drainage was employed in three cases. The pedicle was tied with interlocking silk ligatures and stitched over with fine silk. In the later cases isolated ligatures were also placed on the ovarian artery, as first practised by Burd in 1846. The advisability of this practice is shown by Laroyenne's case¹:

The patient died in the second month of pregnancy from haemorrhage from slipping of the ordinary ligature applied at an ovariectomy three months previously; at the autopsy the two ends of the artery were found gaping, the growing uterus having displaced the ligature by stretching the broad ligament.

Fehling² also lost a patient from the same cause; the labour pains, which began on the day following an abdominal ovariectomy near term, after two hours caused the ligature to slip and led to intraperitoneal haemorrhage, for which the abdomen was opened and the pedicle again tied, but too late to save the patient.

Cases of Ovarian Tumour not Operated on.

In the 40 cases not operated on during pregnancy all the mothers recovered from the labour or abortion. In 29 cases (out of 37 in which the fate of the child is given) the child was born alive; in 4 cases the child died as a result of difficult delivery by forceps or version. In 4 (possibly in 5) out of the 40 cases abortion occurred. The mortality rate for the children is 8 out of 37 = 21.6 per cent. The abortion rate is 10 per cent., or possibly 12.5 per cent. (see *ante*).

Etiology of Malignant Change.

The question of the influence of pregnancy in causing malignant changes in ovarian tumours was discussed by Sir John Williams in his Cavendish Lecture. He showed that there was no evidence of such influence. In support of this opinion is the fact that malignant ovarian tumours are rarely found in pregnancy; in my 55 cases there was not an instance, whereas, apart from pregnancy, malignancy is met with in more than 20 per cent. of ovarian tumours. It is noteworthy that in advanced age, in women over 70 years of age, malignant ovarian tumours are also rare. What the cause of this rarity is cannot at present be stated.

After full consideration of the view expressed by Sir John Williams that sterility favoured the production of ovarian tumour, the lecturer expressed the opinion that the evidence was inconclusive, and that the question could not be settled until the frequency of ovarian tumours in large numbers of virgins was known.

SYMPTOMS.

Many patients with an ovarian tumour go through pregnancy without any symptoms arising from its presence, if it is small and does not block the pelvis or become twisted or inflamed. The only way in which such tumours can be diagnosed is by routine examination of the abdomen and pelvis during pregnancy, which ought to be carried out in every case. In advanced pregnancy it is important to examine the lumbar regions, as small tumours may easily escape notice or may be mistaken for renal tumours. Large tumours give rise to feelings of weight and pressure.

If the tumour becomes inflamed or strangulated by twisting of its pedicle, the symptoms are acute and may closely simulate strangulation or necrobiosis of a fibroid, acute appendicitis, or pyonephrosis. The symptoms of rupture will depend upon the nature of the contents; in some cases the accident scarcely gives rise to any other effect than alteration in the shape of the abdomen from

the peritoneal effusion; in others shock, pain, and vomiting ensue. Malignant tumours are fortunately rare; they may cause emaciation and cachexia, and are usually painful, though in some cases there are no symptoms which suggest malignant disease.

DIAGNOSIS.

The diagnosis of pregnancy complicated with ovarian tumour is usually not difficult. In some cases of early pregnancy, where the ovarian tumour is large or adherent, it may be difficult to make out the shape and consistence of the uterus. But in all cases where menstruation is delayed pregnancy should be suspected, and the colour of the vagina, the consistence of the uterus, and the appearance of the breasts should be investigated; the presence of morning vomiting may help in the diagnosis. In the early months the increased width of the uterus may be made out by examining the patient bimanually in the dorsal position with the fore and middle fingers of the right hand on each side of the cervix. In conducting this examination the greatest gentleness should be used; any forcible pressure may easily separate the ovum, an objection which applies to the so-called "Hegar's sign." In the second half of pregnancy the "certain signs" (heart sounds, parts or movements of the child, and ballottement), the contraction of the uterus and the breast changes, usually render the diagnosis of pregnancy easy if care is employed; but hydramnios may render the detection of the fetus difficult even when the patient is placed in the kneeling position, which, causing the fetus to fall to the most dependent part of the abdomen, renders its detection by ballottement easier. It is important to bear in mind the softness of the supravaginal cervix—the physical condition which enables Hegar's sign to be obtained—which may cause the body to be apparently separate from the cervix, and may therefore be mistaken for an ovarian tumour. Occasionally a lop-sided pregnant uterus is met with, which I have known taken for an extrauterine tumour. If the uterus is very thin-walled—and sometimes it feels as thin as an ovarian cyst—the body, or a bulging portion of it, may be mistaken for an ovarian cyst if careless examination is made. Error is avoided by careful bimanual examination in the dorsal position, when under gentle manipulation the uterus will be felt to contract, to become one with the cervix and regular in shape.

In some cases of ectopic pregnancy a doubt may exist as to whether the enlarged uterus is pregnant or not and the tubal swelling is a mole, a haematocoele, or an ovarian cyst; but the haemorrhage which usually occurs in these cases will lead to an exploration of the uterus, which is found to be unimpregnated. The rare coexistence of intrauterine and extrauterine pregnancy must be borne in mind.

The recognition of the ovarian tumour is usually easy, as it ordinarily forms a cystic tumour movable apart from the uterus, on a pedicle which can sometimes be detected under anaesthesia. If the tumour is small it may easily escape notice in the lumbar region or may be mistaken for a tumour of the kidney or gall bladder. Examination under anaesthesia facilitates the diagnosis in these cases. If the tumour is twisted and inflamed it sometimes closely simulates a necrobiotic or strangulated uterine fibroid. Under an anaesthetic its cystic character can usually be made out. Tumours of small size impacted in the pelvis often feel as hard as uterine fibroids, for which they may be mistaken. Rectal examination is of great value in these cases. It must be remembered that uterine fibroids may be as cystic as ovarian tumours, and, on the other hand, ovarian tumours may be solid and are often associated with hydroperitoneum, which is rarely found with uterine fibroids. In some cases the diagnosis cannot be made between these two conditions with certainty, though in a patient under 25 a uterine tumour is very unlikely to occur.

If the tumour be ruptured the symptoms will depend upon the nature of its contents. In some cases the accident is followed by few symptoms; in others, shock, pain, vomiting, and peritonitis rapidly ensue. If the tumour be multilocular the unruptured portion of the cyst can be felt, and there are signs of free fluid in the abdomen. If the cyst be unilocular the only sign is the presence of free fluid in the peritoneum, which should always be suspected to be due to a ruptured cyst if there are no renal, hepatic, or cardiac causes present.

Suppuration of ovarian cysts is indicated by high fever, wasting, tenderness, and occasionally tympanites; a history of tapping or injury during labour is often obtained. Twisted tumours usually give rise to local peritonitis, and to fever, which usually subsides after a few days; a considerable rise of temperature, lasting some days after the acute peritonitis has subsided, will usually indicate that suppuration has taken place.

Malignant ovarian tumours are fortunately rare during pregnancy. They are usually solid, bilateral, and associated with hydroperitoneum and wasting; secondary nodules may be felt in the abdomen and in Douglas's pouch.

TREATMENT.

The treatment of ovarian tumours apart from pregnancy is generally acknowledged to be removal as soon as practicable. When pregnancy exists the matter is not so simple; the interests of the child and the desirability of maintaining the fertility of the mother may justify a postponement of the operation. In the introductory remarks a case was mentioned where this was done. In another patient, from whom a dermoid was removed before the occurrence of pregnancy, the other ovary was found to be cystic, but was not removed, as the patient was childless, with the result that in this case also the patient has since had a living child.

On the other hand, in another case the patient, pregnant for the first time, was operated on for bilateral dermoids at the twelfth week, aborted, and has, of course, remained childless. The tumours were causing no trouble, and were discovered during an examination on account of sterility a few months previously. Had the operation been postponed, in all probability she would have had a child; as it was, she aborted as a result of the operation.

I should like again to direct attention to the results to the child in this series, according as the operation was performed during pregnancy or after delivery. In cases operated on the infantile mortality was 33.3 per cent., the abortion rate 26.6 (or 33.3 per cent. of the cases operated on in "early pregnancy"). In those not operated upon during pregnancy (although sometimes unskilfully treated during labour) the infantile mortality was only 21.6 per cent., and might have been reduced to 10.8 by more skilful treatment during labour; the abortion rate was 10 to 12.5 per cent. Five at least (possibly all) of the six cases of bilateral ovarian tumours unoperated on during pregnancy did not abort; both the cases of bilateral ovariectomy during pregnancy aborted. From these figures it appears that operation during pregnancy involves an increased risk to the child.

The statistics, based on published cases, in McKerron's classical work show that the risk of abortion is least in the early months of pregnancy.

Although the risk to the child of operation during pregnancy should be taken in most cases to prevent the grave consequences which may result to the mother from leaving the tumour till the end of pregnancy, yet in uncomplicated cases of small tumours giving rise to no symptoms in patients who are childless, and particularly when bilateral tumours are present, the operation should be postponed, at least until the child is viable.

The treatment of ovarian tumours complicating pregnancy, labour, and the puerperium has been by some writers considered too much from a surgical standpoint; the obstetrical aspect is not less important and in some cases is the dominant factor. Amongst the nineteen cases which I have personally treated during pregnancy there were three cases of contracted pelvis which necessitated induction of premature labour in two of the cases, and would have done so in the third had the patient not aborted. It is clear that a contracted pelvis may profoundly modify our treatment, and that an obstetric examination of the pelvis should be carefully made in every case. Then the existence of bilateral tumours in patients who have not had children may justify the postponement of the operation in the hope of obtaining a living child, and should lead us whenever possible to conserve some part of the ovary.

SCHEME OF TREATMENT.

The following scheme of treatment was published in 1909 in the *Transactions of the American Gynecological Society*. As I have not seen any reason for modifying it, I reproduce it here with slight verbal alterations.

A. During the First Half of Pregnancy.

Ovarian tumours should be removed wherever their situation and whatever their size.

Exceptions.—The following tumours should not usually be removed:

1. Lutein cysts complicating hydatidiform mole; these often subside spontaneously.
2. Bilateral tumours causing no symptoms, if the patient is childless; or, if operated on, part of an ovary should be left behind.
3. Primary adherent malignant cysts.
4. Secondary malignant cysts.

B. During the Second Half of Pregnancy.

(a) All large ovarian tumours and ruptured, inflamed, and strangulated tumours should be immediately removed.

(b) Small tumours which are in the abdomen or which can be easily pushed up out of the pelvis in the knee-chest or Trendelenburg position should be watched, and if no untoward symptoms arise should be removed either at the end of pregnancy, or towards the end of the first stage of labour, or after delivery.

(c) Small tumours which are incarcerated in the pelvis and cannot easily be replaced in the abdomen may be watched and removed at the end of pregnancy, or, if circumstances will allow, towards the end of the first stage of labour. If the tumours are adherent or solid Caesarean section should be performed.

In all ovariectomies during pregnancy the vessels of the pedicle should be separately tied; the pedicle should be ligatured as far as possible from the uterus, and morphine should be given for the first two or three days after operation.

C. During Labour.

The best treatment is abdominal ovariectomy, immediate in the case of large tumours, at the end of the first stage or after delivery in the case of small tumours. When the operation is performed at the end of the first stage a second operator may deliver the child by forceps while the tumour is being removed. If the tumour be incarcerated in the pelvis and cannot be pushed up in the Trendelenburg position, the uterus should be withdrawn from the abdomen in order that the tumour may be dealt with.

For solid and adherent tumours occupying the pelvis Caesarean section may be necessary. It should not be performed for cystic non-adherent tumours. When labour is advanced and a cystic tumour is impacted in the pelvis, the circumstances may render it advisable to deliver the patient by the natural passages after evacuating the contents of the tumour by incision and packing the cyst with gauze, but the tumour should, if practicable, be removed within twenty-four hours, preferably through an abdominal incision.

Vaginal ovariectomy may be performed in non-adherent cases; but, though simpler in technique, avoiding an abdominal scar, and requiring fewer instruments, it is inferior to the abdominal operation in that there is greater danger from haemorrhage, difficulty in safely tying the pedicle, the necessity of cutting up the tumour, the impossibility of examining the other ovary, and from the presence of the vaginal wound.

Induction of premature labour, forceps, version, and simple tapping of a cyst, as means of overcoming the dystocia produced by ovarian tumour, are absolutely contraindicated.

D. In the Puerperium.

Ovarian tumours should be removed as soon as practicable, when possible within twenty-four hours of delivery. If there is doubt as to the aseptic condition of the uterus, a delay of a week or two may be advisable, unless indications of strangulation or infection of the tumour arise, when the tumour should be immediately removed.

REFERENCES.

¹ *Congrès périod. internat. de gynéc. et d'obst., Genève (1896), 1897, ii, p. 125.* ² Quoted by Criwitz, *Geburtsindernis durch Ovarial-tumoren, Inaug. Diss., 1902.*

THE Carnegie Corporation of New York intends to give five million dollars to the National Academy of Sciences and the National Research Council. Part of the money will be used to build in Washington a home for the two organizations, and the remainder will be placed in the hands of the academy for the permanent endowment of the National Research Council.

THE EFFECTS OF DEFICIENT DIETARIES
ON MONKEYS.

BY

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(Abstract.*)

I.—EFFECTS ON GASTRO-INTESTINAL TRACT.

The experiments recorded were made on monkeys (*Macacus sinicus*) captured from the local jungles. Ten were fed on autoclaved rice, and four on autoclaved rice *plus* butter. Twelve monkeys, fed on rice, bananas, monkey-nuts, milk, onions, and bread, served as controls. The rice (milled) was autoclaved at a temperature of 130° C. for an hour and a half.

An exclusive diet of rice so autoclaved may be considered to be wholly deprived of accessory food factors of all three classes; it is excessively rich in starch and deficient in proteins, fats, and salts. A dietary of autoclaved rice *plus* butter is lacking in accessory food factors of the "B" and "C" classes, while it is ill balanced with respect to proteins, carbohydrates, and salts. The results of these experiments on monkeys confirm those previously recorded in the case of pigeons¹ fed on similar food. They may be considered as applicable in kind, if not in degree, to human beings subsisting, as frequently happens, on food similar in composition to that on which the monkeys were fed.

Loss of Body Weight.

Monkeys fed exclusively on autoclaved rice lost weight at the average rate of 18 grams a day. Those fed on autoclaved rice *plus* butter lost weight twice as rapidly—37.5 grams a day. As the animals were not weighed daily but only at the commencement and at the end of the experiment the averages given are approximate. It is probable that the loss of weight was much more rapid towards the close of the experiment than during its earlier days. The monkeys which received butter died much more rapidly than those which received no butter—the former in an average of fifteen days, the latter in an average of 23.4 days. The sex of the animal appears to have influenced the results to some extent, but the figures are too small to justify definite conclusions on this point.

No observations were made with regard to body temperature and respirations, as the monkeys were too wild to handle. In addition to loss of body weight, the main clinical evidences of disease exhibited by the animals were: progressive anaemia, gastro-intestinal disorders, and progressive asthenia ending in death. No clinical evidences of polyneuritis or of oedema were observed in any.

CLINICAL EVIDENCES OF GASTRO-INTESTINAL DISORDER.

Loss of appetite was mainly due to loathing for the food, accentuated by the gastro-intestinal derangements resulting from the deficient diet. The symptom is an important effect of "vitaminic" deficiency.

Vomiting was observed in four cases. The symptom did not persist for more than two days; the animals so affected refused all food and died rapidly.

Diarrhoea was the most constant symptom. It was present in ten out of fourteen animals. It made its appearance between the fourteenth and the twenty-fifth day of the experiment and persisted. In six cases the diarrhoea continued down to the time of death, in four it merged into true dysentery. The diarrhoeic motions were small, numerous, and pale, resembling pea-soup. Microscopical examination showed the stool to consist mainly of (1) epithelial cells in various stages of disintegration, (2) enormous numbers of bacteria, and (3)—in iodine-stained specimens—a small amount of undigested starch. Amoebae, but without ingested red blood corpuscles, were present in one case. In animals receiving butter in addition to the autoclaved rice large amounts of fatty acid crystals were seen on microscopical examination, and the stools were paler; in two instances they were distinctly frothy, resembling those of sprue.

Dysentery.—In 4 cases out of 10 in which diarrhoea occurred this symptom was preliminary to the onset of

* The full paper will appear in the *Indian Journal of Medical Research*.