Essays on the position of abdominal hysterectomy in London / by John Bland-Sutton.

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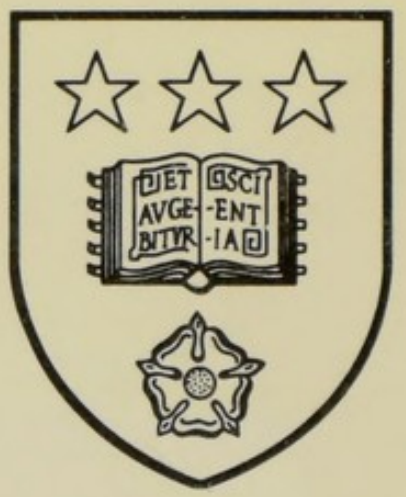
J. BLAND-SUTTON, F.R.C.S.



Uterus in section, with a large fibroid in its neck. The fibroid is in the condition known as "red degeneration" following labour at term. The parts were successfully removed by total hysterectomy.

ESSAYS ON THE POSITION OF ABDOMINAL HYSTERECTOMY IN LONDON

BY

JOHN BLAND-SUTTON, F.R.C.S.Eng.

SENIOR SURGEON, CHELSEA HOSPITAL FOR WOMEN;
SURGEON TO THE MIDDLESEX HOSPITAL

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PREFACE

THIS brochure contains some observations relating to the surgical treatment of uterine fibroids, especially the operations known as total and subtotal hysterectomy. The malicious association of fibroids and pregnancy is considered particularly in relation with the curious change known as "red degeneration." It is gratifying to me that practitioners are becoming familiar with this condition, and some recent publications indicate that my views in regard to its clinical importance are accepted by several capable obstetricians and gynæcologists.

Two essays are devoted to the sequelæ of hysterectomy, such as Injuries to the Ureters and their Treatment, and the important dangers known as Thrombosis and Embolism after Pelvic Operations.

A lecture on the Treatment of Injuries of the Uterus, and one on Adenomyoma of the Uterus and Tuberculosis of the Endometrium are included, for they may serve to call attention to two matters which are rarely considered in text-books of gynæcology, or discussed in obstetrical societies.

J. BLAND-SUTTON.

47, Brook Street, W.;
1909.

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ESSAYS ON THE POSITION OF ABDOMINAL HYSTERECTOMY IN LONDON

ON THE PRESENT POSITION OF ABDOMINAL HYSTERECTOMY FOR FIBROIDS IN LONDON.*

It is surely a triumph of surgical art to improve an operation which in 1896 was attended with such a high mortality that few surgeons performed it, and then only in highly favourable, uncomplicated, and carefully selected cases; yet by 1906 the mortality of this operation in some hospitals in London had fallen to less than 2 per cent. This is the history of abdominal hysterectomy for fibroids in London.

In the year 1896 the results of abdominal hysterectomy for fibroids in eight hospitals in London were as follows:

St. Bartholomew's	7	3
St. George's	1	0
St. Thomas's	5	2
Middlesex	6	1
University College	3	0
Hospital for Women (Soho)	1	0
Samaritan	17	4
Chelsea Hospital for Women	9	1
	49	11

* 'Brit. Med. Journ.,' 1908, ii, 8.

Ten years later, that is, in 1906, the latest returns from the same sources, and the New Hospital for Women, are:

St. Bartholomew's	26	with 4	deaths.
St. George's	8	,, 0	,,
St. Thomas's	40	,, 2	,,
Middlesex	50	,, 0	,,
University College	21	,, 1	,,
Hospital for Women (Soho)	60	,, 1	,,
Samaritan (for Women)	37	,, 2	,,
Chelsea (for Women)	80	,, 1	,,
New Hospital for Women	26	,, 0	,,
	348	11	

In regard to my own results: During the years 1906 and 1907, at the Middlesex Hospital and the Chelsea Hospital for Women I performed abdominal hysterectomy for fibroids on 101 patients; they all recovered.* I performed abdominal hysterectomy in these two hospitals for other morbid conditions and the patients recovered.

The notes concerning the operations in this series have been compared with the hospital books by the Registrars, Mr. Somerville Hastings, F.R.C.S (Middlesex Hospital), and Mr. Stanley Dodd, M.B., M.A. (Chelsea Hospital for Women), and these gentlemen allow me to state that they have verified them.

It will be gathered from a perusal of these statistics that the removal of the uterus by the abdominal route, when it is occupied by troublesome fibroids, has become a fairly safe proceeding, nevertheless, hysterectomy, like all other major surgical operations, is attended with risks, even when it is carried out with all the careful surroundings which form such a prominent feature of modern surgical operations.

* The short notes of the 101 hysterectomies for fibroids, and the subsequent history of the patients are published in the 'Journ. of Obstet. and Gyn. of the Brit. Emp.,' May, 1908.

Setting aside the risks and sequelæ common to operations in general, such as dangers from the anæsthetic, pulmonary complications and the like, there are a few special dangers connected with it which require careful consideration at the hands of those who are daily occupied with this class of surgery. In this communication I shall deal with some of them in detail. I shall also consider the question which is much debated at the present time, namely, the advantages and disadvantages of the two methods in vogue for removing the uterus—subtotal and total hysterectomy—especially in connection with an important matter, the occurrence of cancer in the cervical stump left after subtotal hysterectomy. The fate and value of belated ovaries is also well worth consideration, for some recent writers in America seem to attach little importance to the retention of ovarian tissue.

In addition to careful statements on these matters, which are of high importance for the subsequent comfort of patients, I propose to discuss certain matters concerning the pathology of uterine fibroids in relation to carcinoma and sarcoma, and to some secondary changes which affect them, especially in relation to pregnancy. These observations, more or less of a pathological kind, have become of great value in assisting us in the clinical side of our work; and they have helped to convince even the most experienced that "fibroids," which were commonly supposed to be the most easily recognised species of pelvic tumour, are not only simulated by other tumours, but in the secondary changes to which they are prone, mimic other well-known morbid conditions of the internal pelvic reproductive organs and lead to startling errors in diagnosis.

Gloves.—It is no part of my intention in this essay to discuss details of technique, because the operation of hysterectomy, as a radical method of treating uterine

fibroids, is now practised extensively throughout the civilised world; but I am anxious to put in a plea for the employment of sterilised rubber gloves by those who perform this operation or take any part in it, whether they be surgeons, assistants, or nurses. It not only reduces the mortality of the operation to a minimum, but the unpleasant sequelæ are almost abolished also, especially trouble with the ligatures and sutures.

Celerity in Operating.—Unpleasant sequelæ, and especially that form of sudden death during convalescence which is usually attributed to pulmonary embolism, are more frequent in the practice of those who habitually operate slowly. It is a natural inference that a patient whose operation is completed in thirty minutes by a dexterous and careful surgeon has a better chance of recovery and less liability to post-operative complications than the patient whose operation is performed by one who requires two hours for a simple hysterectomy. Everyday experience teaches that celerity in operating counts in favour of the patient.

Total and Subtotal Hysterectomy.

The great success which followed the use of the short ligature in ovariotomy induced several surgeons to apply the same principle to the cervical pedicle when removing the uterus for fibroids. The result was dismal failure. Matters improved somewhat after Koeberlé introduced the *serre-nœud*, and this continued the safest method until 1892. In the meantime antisepsis had begun to take effect in pelvic surgery, and attempts were made by Bardenheuer (1881), Polk, and other surgeons to avoid the dangerous difficulties connected with the treatment of the stump, by removing the cervix as well as the uterus (total hysterectomy), and some attained an encouraging measure of success. Nevertheless other surgeons (Goffe, Milton, Heywood

Smith and Stimson) felt that the enucleation of the cervix was not always necessary, and sought to find a way of avoiding it. The credit of solving the difficulty fell to Baer, of Philadelphia (1892), for he showed that it is dangerous to constrict the neck of the uterus with ligatures ; it is only necessary to secure the arteries.

Baer's method of supra-vaginal hysterectomy, or, as it is now commonly termed, the subtotal operation, soon supplanted the total method of Bardenheuer. The publication of Baer's paper had great consequences ; it came at a time when the attention of surgeons was centred on improvements in hysterectomy.

The method was promptly tested and adopted in London. The effects of this improvement in technique, in a few years, revolutionised the surgical treatment of uterine fibroids, as the statistics on pp. 1 and 2 amply prove.

The great advantage of Baer's method is its simplicity and safety : but there is a disposition on the part of a few surgeons to prefer the total operation, mainly on the ground that the cervical stump left after subtotal hysterectomy is liable to become attacked by cancer.

Cancer of the Body of the Uterus and Fibroids.— In deciding between total and subtotal hysterectomy for fibroids, the probable presence of cancer requires consideration in another aspect. Many writers in recent years have expressed their suspicions that the presence of a submucous fibroid favours the development of cancer in the corporeal endometrium. Piquand, in 1905, drew attention to this matter, and emphasised what other observers had pointed out—namely, that a submucous fibroid is often associated with changes in the mucous membrane of the uterus, which not only causes excessive bleeding, but sets up inflammatory conditions giving rise to leucorrhœa, salpingitis, pyosalpinx and morbid changes in the endometrium, rendering it susceptible to cancer. His statistics support his

conclusions, for they represent that in 1000 women with fibroids 15 will probably have cancer of the body of the uterus. My own observations support this opinion. This complication is found most frequently between the fiftieth and the sixtieth years of life. If we narrow the ages of the patient and exhibit the liability in its most emphatic form it would run thus—that in patients submitted to hysterectomy for fibroids over the age of fifty years, about 10 per cent. of them will have cancer of the corporeal endometrium.

In 1906 I looked through the case notes of 500 patients who had been submitted to operation for uterine fibroids under my care. Of these 63 patients had attained the age of fifty years and upwards. Among these 63 women there were 8 cases of cancer of the corporeal endometrium, the nature of the disease in each case being verified by careful microscopic examination. Consequently, in performing subtotal hysterectomy for fibroids in women of fifty years and upwards, the surgeon should have the uterus opened immediately after its removal, and assure himself that the endometrium is free from cancer. If there be any suspicion in this direction he should remove the cervix.

As far as I can ascertain, Mann, of Buffalo, was the first to draw attention to the occurrence of cancer in the neck of the uterus after the body of the organ had been removed. He stated in 1893 that he "removed an ovarian tumour and the body of the uterus, by accident, along with it; the cervix was left." The patient recovered. "Six months afterwards cancer developed in the cervix, from which she died."

When cases of cancer, supposed to arise in the stump left after subtotal hysterectomy, come to be critically analysed, they fall into four groups:

1. The disease was present in the neck of the uterus at the time of the primary operation, but was overlooked.

2. Cancer attacked the cervical stump subsequent to subtotal hysterectomy.

3. The fibroid which necessitated the hysterectomy was really a sarcomatous tumour of the uterus.

4. The suspected growth on the cervix is not malignant but a granuloma.

Each of these postulates requires separate consideration. Many observations have been published which show beyond dispute that surgeons have performed subtotal hysterectomy in ignorance that the cervix was already cancerous, and the hæmorrhages of which the patients complained before the operation were due as much to the cancer in the neck of the uterus as to the fibroids. This should serve as a warning that in cases where the surgeon contemplates performing a subtotal hysterectomy he should carefully examine the cervix beforehand; at the time of the operation he should also critically examine the cut surface of the cervix, and if it be in the least suspicious he should remove the whole neck of the uterus. It is necessary to remember that cancer attacks any part of the cervical endometrium, therefore an early cancerous ulcer in the middle of the cervix will run a great chance of being missed by a surgeon who is content with a subtotal hysterectomy.

It is certain that cancer does occasionally attack a cervical stump left after subtotal hysterectomy at such an interval after the operation as to make it certain that the cancer did not exist at the time of the operation. Such a case occurred in my practice. I performed subtotal hysterectomy in 1901 on a woman aged forty-two years, mother of one child; eighteen months later there was a cancerous ulcer on the cervix; the whole of the cervical stump was promptly removed and the nature of the disease established microscopically. At this date (1908) the patient is in excellent health.

In another case under my care I performed total

hysterectomy for fibroids in ignorance that the patient had cancer of the cervix. Some months after the operation cancer recurred in the vaginal vault and scar of the hysterectomy; the neck of the uterus had been preserved by the medical attendant, and on examination the cancer was found. In this instance, although total hysterectomy was performed it had no effect in staying the course of the disease.

It is necessary to utter a caution in regard to the occurrence of cancer of the cervix after subtotal hysterectomy. I removed a uterus containing a large globular submucous fibroid from a barren married woman, aged forty-five years. Six years later she came under my observation with a large granulating and bleeding growth on the cervix uteri. I had no doubt from the naked-eye characters that this was a primary carcinoma, although it surprised me to find it there, especially as the woman had never been pregnant. On my urgent representations she allowed me to remove the cervix. On microscopic examination the suspected cancer turned out to be a granuloma. Two years later the patient was in good health. Polk has recorded a similar experience. These facts show that caution is necessary in accepting reports of cancer of the uterine stump after subtotal hysterectomy.

From a careful study of the question, I have formed the opinion that if a woman with fibroids and concomitant cancer of the neck of the uterus seeks advice on account of hæmorrhage, and the cancer has attacked the vaginal portion of the cervix, the nature of the case will be appreciated. The cases likely to be overlooked are those where the cancer is situated somewhat higher in the cervical canal than usual, so that it is not easily detected by the examining finger, and so low in the cervix that the disease is not exposed when the body of the uterus is amputated in the course of a subtotal hysterectomy. A knowledge of this, as well as the

fact that cancer of the cervix is almost exclusively a disease of women who have been pregnant, should make surgeons careful in performing subtotal hysterectomy for fibroids in women who have had children, in order to assure himself that the neck of the uterus is not cancerous.

Sarcoma.—The most insidious danger which besets the surgeon in dealing with fibroids of the uterus is the occurrence of an encapsuled sarcoma in the guise of an innocent fibroid. I have for some years dropped the name of "myoma" for these common uterine tumours, preferring to apply the term "fibroid" in a generic sense to all encapsuled tumours of the uterus. Every histological condition is found in them, from the hard calcified body looking like a block of coral to soft diffluent collections of œdematous connective tissue, and tumours composed of tissue indistinguishable from that characteristic of a spindle-celled sarcoma.

On one occasion I removed the uterus from a woman, aged forty years, which contained a tumour as big as an ostrich's egg. On section it appeared to be a moderately firm fibroid, with its tissue whorled, as is usual in hard fibroids, and enclosed in a complete capsule. Some months later the patient complained of pain, and on examination a hard mass occupied the floor of the pelvis. A portion of this was excised and submitted to three competent histologists, who reported the growth to be an innocent fibroid. The patient died fourteen months after the primary operation with her pelvis filled with recurrent growth. The tumour was a spindle-celled sarcoma.

Much has been written regarding the sarcomatous degeneration of uterine fibroids. In this matter I have maintained an attitude of active scepticism. My experience amounts to this: The case which I have briefly described is the only example in a thousand cases of hysterectomy in which an encapsuled sarcoma

in the guise of an innocent fibroid has come under my observation, therefore I come to the conclusion that it is an uncommon event, and on turning to the literature of the subject you will find that unequivocal examples are few.

In addition to the liability of the stump left after subtotal hysterectomy to become cancerous, it is stated by some surgeons that the patient is more liable to intestinal obstruction than after the total operation. This objection is easily met, because a perusal of their writings shows clearly that they do not perform the operation properly.

In subtotal hysterectomy performed according to Baer's instructions there should be no stump projecting from the pelvic floor, but merely a thin seam underlying the base of the bladder.

I have dealt in detail with these two methods of hysterectomy, because when it can be performed subtotal hysterectomy is, as a rule, a simpler and much safer operation than total hysterectomy. There are conditions in which it is imperative to remove the whole of the cervix, especially when the canal is very patulous and perhaps septic; when it is large and hard or large and spongy; and especially if there is the least suspicion of malignancy in the cervix or in the body of the uterus.

It must, however, be borne in mind that cancer has attacked the scar left in the vagina after total hysterectomy (Quénu). At the present time the subtotal method enjoys the greatest favour in London, but it should be remembered that where the total operation is most indicated it is often difficult of execution.

Although I have a decided preference for the subtotal operation, especially in spinsters and barren wives, I have performed total hysterectomy in more than 200 women, so that I am in no way blind to its merits.

The loudest advocates of routine total hysterectomy for fibroids are those who have had but a limited experience of the subtotal operation. Their opinions are, therefore, scarcely to be regarded as impartial.

It must also be borne in mind that the ureters are often injured in removing the neck of the uterus. This is a subject which is considered on p. 24.

The Fate and Value of Belated Ovaries.

The only improvement of any importance made in Baer's operation of subtotal hysterectomy concerns the ovaries. These Baer removed with the Fallopian tubes; but in 1897 I advocated at the Obstetrical Society, London, that they were of great value to the patient, and pointed out that their conservation, when healthy, spared the patient the annoyance of that curious vasomotor phenomenon known to women as "flushings," which is the only obtrusive sign of the menopause.

It is now admitted by those surgeons in London who have had much experience in hysterectomy for fibroids that the immediate results of preserving at least one healthy ovary in this operation are admirable, especially in women under forty years of age, for the retention of an ovary is of striking value "in warding off the severity of an artificial menopause" (Crewdson Thomas).

Although I have left one or both ovaries in the performance of abdominal hysterectomy for fibroids in more than 300 patients, in only two instances have I found anything detrimental in the practice. In these two patients it was necessary to remove one of the ovaries subsequently. Since 1906 I have modified the method by leaving only one ovary, even when both were healthy, and find that the immediate good consequences of the operation are in no way impaired. There is reason to believe that whatever good effects follow the practice of leaving a belated ovary (that is,

an ovary divorced from the uterus and left in the pelvis) they are temporary, for in the course of a few years the ovarian tissue disappears and the patients experience the usual symptoms of the menopause. It is possible that the rate of atrophy of the secreting tissue of a belated ovary depends on the age at which a patient is submitted to hysterectomy.

In 1898 I performed subtotal hysterectomy on a woman, aged thirty-one years, for fibroids, conserving the right ovary. Nine years later (1907) I operated again for intestinal obstruction and found this ovary healthy and functional, for a ripe corpus luteum was visible on its surface. Even a portion of an ovary, if it contain follicles, will maintain menstruation.

In performing abdominal hysterectomy for fibroids there are three points which require consideration in the interests of the patients, and they depend mainly on the conservation of a healthy ovary. These three points relate to (*a*) the patient's comfort in securing freedom from flushings; (*b*) if she be married, her marital relations; and (*c*), if single, her nubility.

In regard to marital relations in women with a belated ovary nothing trustworthy is forthcoming, but I believe the retention of an ovary is an additional factor in promoting domestic bliss. The question of nubility is interesting. I am able to state that spinsters who have had subtotal hysterectomy performed with conservation of one ovary have subsequently married and lived happily with their husbands; and I am of opinion that the preservation of the vaginal segment of the neck of the uterus is an important factor, as it leaves the vagina intact, and though such women are sterile they are certainly nubile. Without overstating the case it may be said that a belated ovary is a very precious possession to a woman under forty years of age, whether she be married or single. Some experienced observers maintain that an ovary is valuable to any

woman who menstruates, even at the age of 50 years, the persistence of menstruation being obtrusive evidence that the gland is functional.

In regard to the fate of such ovaries, in the present condition of our knowledge it may be stated that—

In a woman under the fortieth year of life a belated ovary remains active and discharges ova.

An ovary belated after the fourth year of life atrophies, and menopause symptoms will often ensue in the course of a few months after the operation. The retention of an ovary minimises the menopause disturbances, and they are never so acute and prominent under these conditions as they are when the menopause is induced by the sudden and complete removal of all ovarian tissue.

Experimental evidence obtained from rabbits proves that the removal of the whole uterus has no deterrent effect on ovulation, and it does not prevent the occurrence of œstrus and ovulation at periodical recurring intervals.

There is no necessity to appeal to experiments on animals in this matter, as clinical observations on women are most eloquent in proclaiming the great value of a conserved ovary when the uterus is removed on account of troublesome and dangerous fibroids.

In reference to the value of ovarian tissue after hysterectomy for fibroids, attention should be drawn to a modification of this operation known as the Abel-Zweifel method, by which a small segment of the menstrual area of the uterus is left as well as one or both ovaries: this permits menstruation to continue in a subdued form.

Doran has particularly studied this method and practised it, but I cannot express any opinion as to its value, never having had the courage to perform it.

My aim in performing hysterectomy for fibroids is to abolish as completely as possible the menstrual area

of the uterus, and up to the present my efforts have been successful, and I have no complaint from any patient that this disagreeable phenomenon has manifested itself, although I have been at great pains by my own exertions, as well as by the efforts of those who have been associated with me in my hospital work, to keep in touch with women who have been so unlucky as to require such a serious operation as the removal of the uterus.

Uterine Fibroids in Relation to Pregnancy.

Our knowledge of the natural history of fibroids has been increased and rendered more accurate since hysterectomy has been freely practised. The belief that fibroids disappear at the menopause is a bubble that has been pricked by the scalpel. The frequent prolongation of menstruation by fibroids many years beyond the date of the normal menopause is a fact. The suspicion that submucous fibroids predispose to cancer of the corporeal endometrium is likely to become a grim reality; and whilst case collectors are arguing whether fibroids cause sterility, or sterility causes fibroids, we know that women with fibroids often conceive, and that when fibroids and pregnancy coexist it is often a malicious combination.

Obstetricians urge that the dangers of fibroids complicating pregnancy have been exaggerated, but if any one takes the trouble to inquire into the matter he will find them real enough. No one suggests that a few fibroids of the size of acorns or of a golf ball in the wall of the uterus are inimical to successful pregnancy; but when a tumour the size of a fist occupies the neck of the uterus, or grows from the lower segment of the body of the uterus, it is a different matter.

Among the new things which surgical treatment of fibroids has brought to light is a knowledge of that

change to which these tumours are liable, known as "red degeneration" (Fig. 1). This increase in our knowledge of the pathology of fibroids has been extremely useful in diagnosis. Red degeneration is especially liable to occur in fibroids lodged in a pregnant uterus, and it has the extraordinary effect of

FIG. 1.—A gravid uterus in section. The neck of the uterus is occupied by a large fibroid which blocked the pelvis and rendered hysterectomy necessary at the fourth month. The fibroid was in the condition known as "red degeneration."

rendering them painful. One of the most striking features of a fibroid is its painlessness, and equally remarkable are the painfulness and tenderness of a fibroid when in the condition known as red degeneration, but these signs are only markedly exhibited by such fibroids when

associated with pregnancy, and they are a source of many errors in diagnosis. These symptoms are so characteristic that the condition can be diagnosed with the same amount of accuracy as other pathological conditions in the pelvis. When the pain and tenderness are present in a mild degree they will subside if the patient be kept at rest in bed. Red degeneration, even in an extreme degree, in fibroids in a non-gravid uterus causes no pain. It is also curious that a gravid uterus may contain four or five fibroids the size of large potatoes in its walls, yet only one will exhibit this red degeneration and become acutely painful, whilst its companions remain as insensitive as apples.

If those who are interested in this matter take the trouble to read the clinical reports of cases in which abdominal hysterectomy or myomectomy has been performed during pregnancy two facts will quickly assert themselves.

(1) A considerable number of the hysterectomies, particularly those carried out in the early stages of pregnancy, were performed in ignorance that the women were pregnant. The patients, many of them spinsters, complained of the increasing size of the tumour.

(2) Many abdominal myomectomies have been performed on an erroneous diagnosis. A fair proportion of these errors is due to ignorance of the fact that red degeneration, when well established in association with pregnancy, produces pain.

In many instances the pain is sudden and acute, resembling that experienced by patients suffering from an ovarian cyst with an acutely twisted pedicle, or the shock produced by the bursting or abortion of a gravid Fallopian tube.

Although the directions in surgical writings are clear concerning the course to be pursued when pregnancy or labour is complicated by fibroids, the diffi-

culty which confronts the surgeon, when he is face to face with an actual case, is the great uncertainty which often exists regarding the nature of the tumour. Although he may begin an operation under the impression that he has to deal with an ovarian tumour, it may prove to be a fibroid, a tumour of the pelvic wall, a misplaced spleen, a kidney in the hollow of the sacrum, a tubal pregnancy, a sequestered extra-uterine fœtus (lithopædion), or a calcified hydatid cyst. In an unusual case, an experienced surgeon (Olshausen) removed a gravid uterus under the impression that it contained a cystic fibroid which would obstruct delivery. When it was examined after removal, the suspected fibroid proved to be a large sacral teratoma growing from the fœtus.

It sometimes happens that a child is born, and then the uterus extrudes a large submucous fibroid. This so resembles the head of a fœtus that practitioners in several instances have attempted to pull it out in mistake for a twin, and even applied forceps. I described an example in 1898 and have found other records of the same kind.

Many curious errors are made in determining the nature of pelvic tumours even after the abdomen is opened.

Some years ago a woman was submitted to Cæsarean section in a London hospital, because delivery was obstructed by a solid tumour. In the course of the operation, a tumour, being firmly incarcerated in the pelvis by the gravid uterus, was regarded as a sarcoma growing from the pelvic bones, and therefore irremovable. Four years later the woman came under my care at the Middlesex Hospital. The tumour had grown and reached above the navel. I performed cœliotomy, and found it to be a solid ovarian (fibroid) tumour and removed it. The woman recovered.

It is important that the operator should satisfy him-

self as to the nature of the obstructing tumour. Blacker performed Porro's operation in a case of supposed calcified fibroid obstructing delivery. "A week after the operation the wound just above the stump gave way, and a number of hydatid vesicles were discharged, the tumour in reality being a calcified hydatid cyst."

The method of treatment which commends itself to obstetricians in London at the present time, when pregnancy is complicated with fibroids, consists in keeping the patient under observation until the child is viable. In many instances the pregnancy progresses to near term, and the child is born without difficulty. In other women troubles arise which necessitate operative interference. Then the child can be delivered by Cæsarean section, and the uterus with its fibroids removed, either by the subtotal or total method, according to the tendencies of the surgeon in whose hands she falls.

It would greatly help to place the treatment of this complication on a sure foundation if those who practise midwifery would record the cases in which patients with this complication come to grief whilst waiting for the fœtus to become viable.

It is only necessary to study the 'Transactions of the Obstetrical Society of London' to be assured that pregnant women with fibroids do frequently require aid from surgery, and that such efforts are rewarded with success. There is no condition of the uterus which simplifies hysterectomy so much as pregnancy.

In some lectures 'On the Surgery of Pregnancy and Labour Complicated with Tumours,' published in 1901, I drew attention to the marked tolerance exhibited by the pregnant uterus to abdominal myomectomy, and that it was possible to enucleate large and troublesome sessile fibroids from the wall of the uterus without disturbing the pregnancy. On that occasion I published a table of cases showing the good results which follow from the operation.

Since 1900 forty cases of hysterectomy and myomectomy for fibroids complicating pregnancy and labour have been published in the 'Transactions of the Obstetrical Society of London.' These represent a small proportion of the actual cases which happen in London. The records include cases which show that when the uterus contains fibroids, either of the submucous or the subserous pedunculated kind, and the pregnancy goes to term and safe delivery ensues, the patient's risks are by no means at an end, for the necrotic changes sometimes place her life in such grave peril that she is only rescued at the risk of myomectomy or hysterectomy.

In 1901 I expressed the opinion that ovarian tumours give more trouble to parturient women than fibroids; but fibroids have been far more lethal, as they frequently destroy pregnant women from sepsis, and it is useless to urge that antisepsis in midwifery has abolished the dire consequences which often arise when fibroids complicate pregnancy.

I also hold the opinion very strongly that the occurrence of red degeneration in fibroids, when they complicate pregnancy, is a condition which predisposes such tumours to septic infection (see Frontispiece).

The history of hysterectomy, as a radical method of treating uterine fibroids, during the last ten years has been a record of continuous improvement in the hospitals in London. Like all valuable operations, especially those connected with the reproductive organs, hysterectomy for fibroids has had to pass through a probational period of prejudice. To-day no major operation can show so small a mortality, and what is more to the point, no major operation produces such permanent good effects.

Surgery can now enable a wife suffering from "an issue of blood," and spending half her life as a chronic invalid, to become a companion to her husband; or, a spinster afflicted with a bleeding fibroid, and living in

humble circumstances, to earn her own living, and cease to be a domestic incubus.

It is a great gratification to realise that hysterectomy for fibroids occupies in London to-day an established position in surgery from which no misrepresentation can raze it.

ABDOMINAL HYSTERECTOMY WHEN THE UTERUS IS DOUBLE (UTERUS BICORNIS).

Fibroids arise in malformed uteri as well as in those of normal shape. When the body of the uterus is double (bicornate) and the surgeon stumbles upon it in the course of a pelvic operation, he may be puzzled if he is not familiar with the anatomical conditions associated with this malformation.

When the body of the uterus is bicornate, the rectum lies in the middle line of the pelvis; a median vertical fold of peritoneum passes from its anterior aspect through the gap between the uterine cornua, and becomes continuous with the peritoneum covering the posterior aspect of the bladder. The portion of this peritoneal fold which lies between the rectum and the neck of the uterus divides the recto-vaginal fossa into a right and a left half.

This median fold, known as the *ligamentum vesico-rectale*, requires careful treatment or the surgeon will accidentally open the bladder if he divides the fold too far forwards, or injure the rectum when the fold is incised too much posteriorly.

In the case represented in Fig. 2 each cornu is occupied by an interstitial fibroid, and when the abdomen was opened the didelphic condition was at once appreciated. The ligamentum vesico-rectale was then carefully incised across the notch between the two cornua; it was then easy to detach the rectum and the bladder from the cervix and amputate the uterus in the usual manner. The uterine arteries ran on the outer

side of each cornu and gave no difficulty. The ureters were examined and found in their normal position. On readjusting the peritoneum after the blood-vessels had been secured, it was necessary to bring the edges of the ligamentum vesico-rectale into apposition separately. The uterus was completely double; two separate uterine mouths opened into two distinct vaginæ, the septum persisting complete to the vulva.

On another occasion I performed abdominal hysterec-

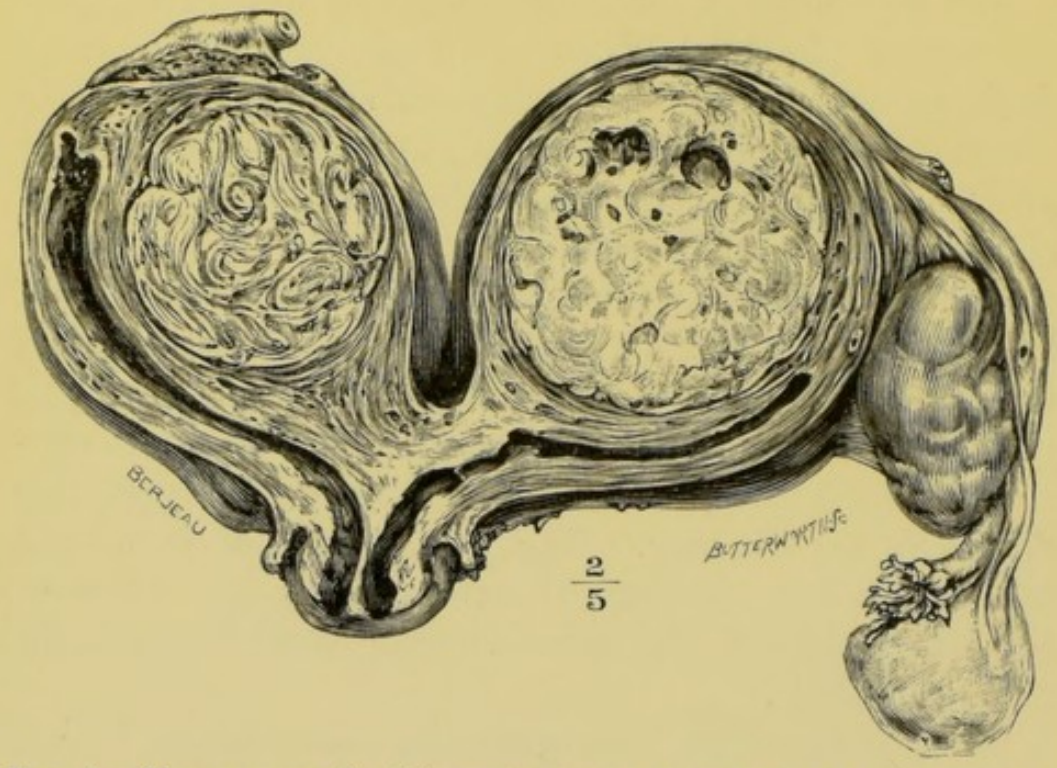

FIG. 2.—The cornua of a bicornate uterus in section; each cornu contains an interstitial fibroid. Removed by subtotal hysterectomy from a woman aged thirty-two years.

tomy upon a woman with a bifid uterus of the variety *uterus bicornis unicollis* for carcinoma. The patient had a suspicious condition of the cervix, and on examination the vestiges of a longitudinal septum were found on the posterior wall of the vagina ; this led me to make a careful investigation of the uterus on the ground that it might be double. This proved to be the case, so I contented myself with the preliminary amputation of the cervix, knowing the difficulty, if not

the impossibility of safely removing the uterus by the vaginal route. The microscopical examination of the cervix indicated the presence of carcinoma, and I subsequently removed the two cornua by the abdominal route. In both instances the patients recovered easily and quickly from the operation. My own experience, as well as a study of some recorded cases, indicates very clearly that malformations of the uterus, especially bicornate uteri, cause more trouble in diagnosis than in technique.

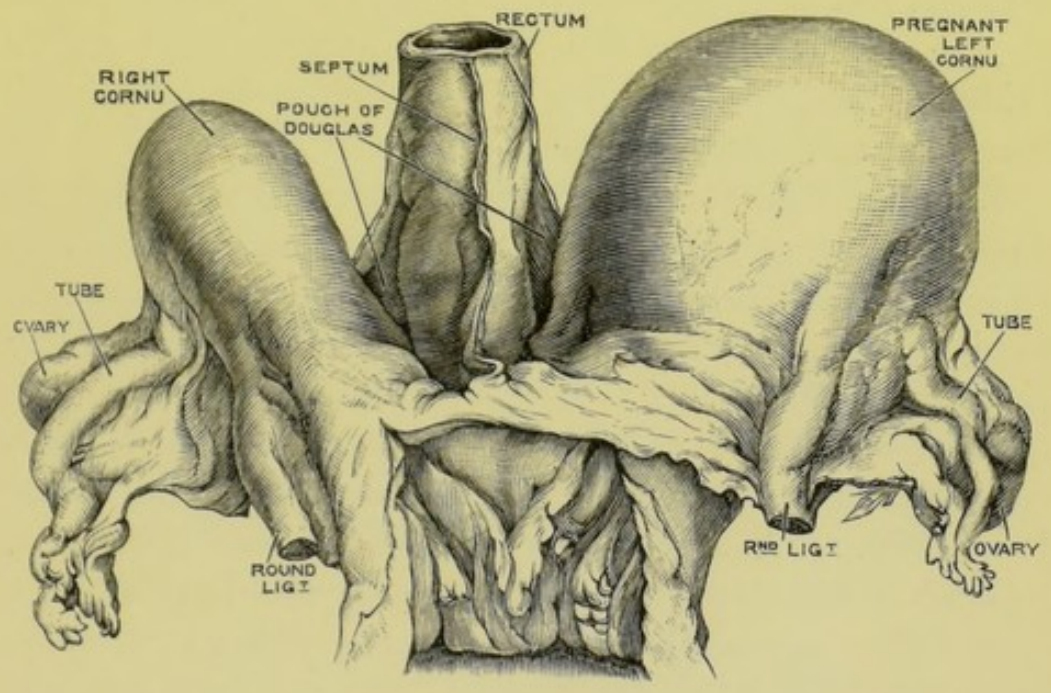

FIG. 3.—A bicornate uterus shortly after delivery at term. The drawing shows the position of the ligamentum vesico-rectale.

The ligamentum vesico-rectale has an interest apart from questions relating to technique, for it very probably stands in some embryological relationship to, and may even be responsible for the production of a bicornate uterus.

SOME OBSERVATIONS ON INJURIES TO THE URETERS DURING HYSTERECTOMY.

British surgical and gynæcological periodical literature contains very little concerning ureteral injuries, but it is only necessary to look into the pages of the 'Zentralblatt für Gynäkologie' to find ample evidence that the integrity of the ureters is frequently sacrificed to modern pelvic surgery.

Blau published statistics from Chrobak's Klinik in Vienna showing that in the interval, January, 1900, to January, 1902, the ureters were injured 15 times; in total hysterectomy 7 times; in the course of ovariotomy on 3 occasions.

In the Middlesex Hospital 212 abdominal hysterectomies for fibroids were performed in the years 1896-1906. A ureter was injured on two occasions. In each instance a total hysterectomy was performed.

Sampson stated that from August, 1889, to January, 1904 (a period of forty months), the uterus was removed 156 times for cancer of its neck at the Johns Hopkins Hospital, Baltimore, and the ureters were injured 19 times. The injuries were of various kinds, such as "ligating, clamping, cauterising, cutting."

In the operation known as the "extended radical operation for cancer of the neck of the uterus," the risk of a ureteral fistula is about 10 per cent.

In subtotal hysterectomy for fibroids the risk of injuring a ureter is not great. Thus Deaver writes that in the course of 250 abdominal hysterectomies he injured the ureter once, but the accident entailed the death of the patient.

I have performed hysterectomy on more than 1000 occasions and injured the ureter once. In this instance the operation was subtotal hysterectomy for a large soft fibroid. The accident entailed on the patient a serious illness and the loss of a kidney.

I have been present on five occasions when an ureter was injured. Four of the operations were for the removal of the uterus, and one was an ovariotomy. Four of the patients died.

The injuries to which the ureters are liable in the course of hysterectomy are as follows:

1. One or both ureters have been included in the ligatures applied to the uterine arteries.

2. One or both ureters have been cut or completely divided with scissors or knife.

3. A segment of a ureter 7 cm. in length has been accidentally exsected.

4. One or both ureters have been compressed by clamps applied to restrain bleeding in the course of vaginal hysterectomy, and subsequently sloughed.

5. Ureters exposed in the course of "radical" operations for cancer of the neck of the uterus often slough.

6. A ureter is sometimes transfixed by a needle and thread when sewing the layers of the broad ligament together in the course of a subtotal hysterectomy.

The most dangerous injury to the ureters occurs in the course of a subtotal hysterectomy, because often it is not recognised at the time of the operation. In such circumstances the urine will slowly leak into the connective tissue of the broad ligament and form an extravasation extending into the loin. In some cases the fluid will leak directly into the pelvis, and a sinus will form in the abdominal wound and allow the urine to escape; this may be the first intimation that a ureter has been injured, whereas when a ureter has sustained damage in the course of a total abdominal or a vaginal

hysterectomy, the leakage of urine into the vagina will quickly apprise the surgeon of the accident.

There is another form of injury to the ureter which should be mentioned. Occasionally a fibroid, but more often a cyst or tumour arising from the base of the broad ligament, will involve the corresponding ureter and carry it upwards in such a way that when the layers of the broad ligament are reflected the ureter will be found crossing the crown of the tumour like a strap. In such a case the pressure has usually exerted a banal influence on the kidney, and it is usually in the condition known as sacculation. In a case under my own care in which I attempted to remove a malignant tumour of the broad ligament, and in which the ureter ran over its upper pole in this way, thinking it was an adhesion, traction was made upon it, and the ureter came away with a portion of the renal pelvis. At the post-mortem examination the kidney was merely a thin-walled sac with purulent contents.

In all cases in the course of an abdominal hysterectomy it is useful for the surgeon to inform himself of the condition of the kidneys. Recently in performing a subtotal hysterectomy one of the fibroids burrowed deeply between the layers of the left broad ligament. When all the bleeding was checked I looked carefully to determine that the ureter was safe and found it kinked by the ligature applied to the corresponding uterine artery: the ligature was at once removed. On palpating the kidneys I found the right kidney small, shrunken and useless. Fortunately the woman recovered.

The method of treating an injured ureter varies greatly, and will depend not only on the extent of the damage, but also on the time at which it is recognised. For example, if the surgeon recognises the injury in the course of the operation he will be able to deal with it at once. This we may term *immediate* treatment. The

more difficult cases are those in which the injury is unrecognised at the time of the operation and only becomes obvious a few days later; the treatment in such circumstances may be called *secondary*.

The primary treatment of an injury to a ureter in the course of a pelvic operation will depend in a large measure on the ability, judgment, and experience of the surgeon, as well as on the extent of the injury. For example, if the ureter be partially divided, the opening may be closed with sutures of thin silk; when the duct is completely divided, the cut ends may be invaginated, the upper into the lower and retained in position by sutures. When five centimètres or more of the ureter have been accidentally exsected none of these methods is applicable; in such circumstances several plans have been tried. Of these the simplest is ligature of the proximal end with the hope of inducing atrophy of the kidney. In several recorded instances this has proved successful. The surgeon who adopts this method should satisfy himself that the patient has another kidney, and that it is, as far as he can ascertain at the time, healthy. Some surgeons who have divided a ureter have promptly removed the corresponding kidney, others have secured the proximal end in the upper angle of the abdominal incision and removed the kidney subsequently. It has been suggested that when a portion of a ureter has been resected and the proximal end cannot be engrafted into the wall of the bladder, it should be turned into the cæcum, or the sigmoid flexure, according to position, and thus preserve to the patient the kidney, and save her the distress of a urinary fistula. This method has not found favour with practical surgeons. In one instance in which a ureter was injured in the course of a hysterectomy it was discovered that the kidney possessed two ureters The surgeon promptly anastomosed the proximal end of the divided

ureter into the wall of the companion ureter, and with success.

The most promising procedure, when the divided ends of a ureter are too widely separated to permit their sutural union, consists in engrafting the proximal end of the cut ureter into the bladder. This is known as uretero-cystoneostomy—an operation which has been made the subject of a valuable thesis by Dr. Lutaud. This thesis appears to have been inspired as a result

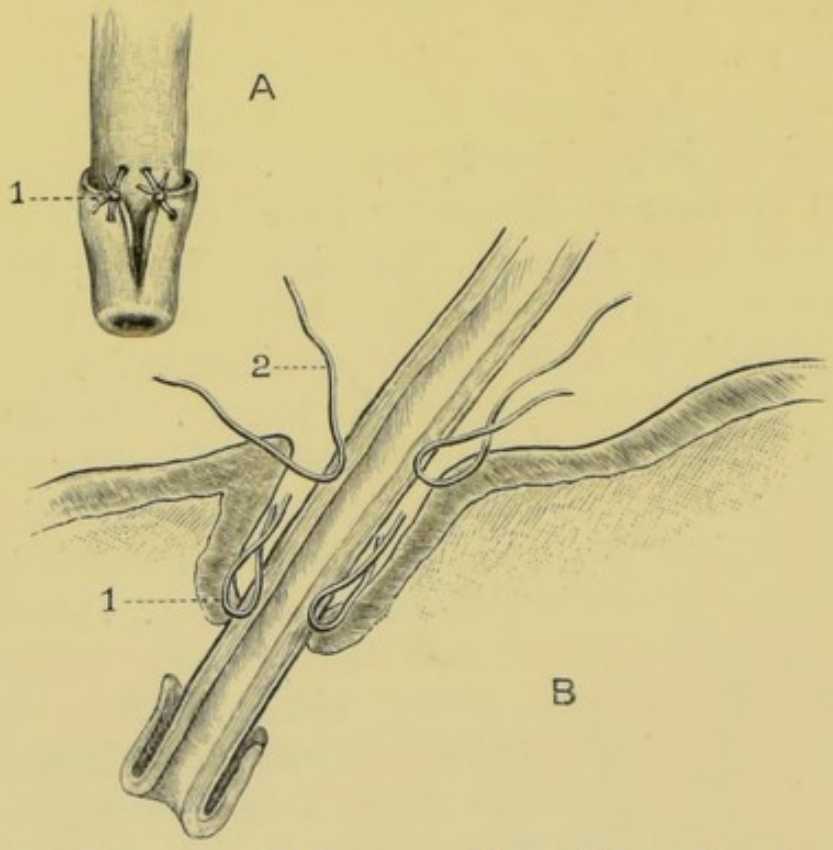

FIG. 4.—A diagram to represent the relation of parts after Ricard's operation of uretero-cystoneostomy (after Lutard). A. The proximal end of the ureter with the mucous membrane reflected. B. The wall of the bladder, showing the mode of fixing the ureter to its walls; 1 and 2, sutures.

of two successful operations performed by Ricard. The principle of this method is as follows :

The abdomen is opened by the usual median sub-umbilical incision, and the peritoneum covering the damaged duct is incised and its proximal end exposed ; the mucous membrane of the ureter is reflected

like a cuff (see Fig. 4). An opening is made in the bladder-wall in a situation convenient for making the junction, and two centimètres of the ureter are allowed to project freely into the vesical cavity, "à la façon d'un battant de cloche." Sutures are inserted at two stages, namely, to secure the ureter to the vesical mucous membrane, and at the muscular coat of the bladder. The sutures should be of thin catgut, and must not perforate the bladder or the ureteral walls. The bladder itself near the junction should be attached by sutures to the adjacent peritoneum to prevent dragging.

Lutard significantly points out that we know little of the subsequent fate of ureters which have been engrafted into the bladder. The immediate results have been successful, but there is good reason to believe that when a ureter has been engrafted into the bladder its walls become sclerosed by chronic ureteritis and its lumen is gradually stenosed. These changes take place slowly, and cause little or no discomfort either in connection with the kidney or the bladder, so that they pass unnoticed.

If the opinion expressed by Lutaud, that the ureter becomes stenosed after uretero-cystoneostomy, is found to be a constant, or even a frequent sequel to the transplantation of a ureter into the bladder, it will cause surgeons to be careful, and not follow too literally the advice given by some writers to the effect that in performing the "radical operation" for cancer of the cervix, if the ureters are implicated these ducts may be divided and their proximal ends engrafted into the bladder.

Lockyer, in removing a burrowing fibroid, wounded the bladder and divided the right ureter: he sutured the vesical incision and removed the right kidney. During the twenty-four hours following the operation there was anuria. The abdomen was re-opened, and

then it was found that the left ureter had also been divided. The proximal end of this ureter was engrafted into the bladder through the wound which had been already sutured. Convalescence was disturbed by a urinary fistula. The woman recovered and reported herself in good health three years later.

It has happened that after nephrectomy for the cure of a ureteral fistula, the sequel of a "radical operation" for cervix carcinoma the remaining ureter became thoroughly blocked by recurrent growth and the patient died from anuria.

In some cases where an injury to a ureter has been overlooked in the course of an operation, many difficulties arise before the true conditions are appreciated. In many instances they soon become obvious; for example, Purcell, in 1898, performed an abdominal hysterectomy and, a few hours later, the patient had complete anuria. The abdomen was re-opened fifty-eight hours after the operation and the distended ureters were easily recognised behind the ligatures applied to the right and left uterine artery respectively. The ligatures were removed, the swellings quickly subsided, and urine reached the bladder. The woman recovered.

When a ureter is injured in the performance of total hysterectomy urine escapes by the vagina, and at first there may be some doubt whether the leak is due to an injury to the bladder or to the ureter. In such conditions the quantity of urine voided from the bladder is compared with that which escapes from the vagina: if the quantities are equal or nearly equal, the leak is in a ureter. When a vaginal leakage occurs a few days after a vaginal hysterectomy, it is probably due to necrosis and sloughing of a ureter, or the duct may have been included in a ligature which has separated by sloughing.

Noble, in 1902, published an interesting series of

injuries to the ureter: one of these is of great value because it proves that a ureter may be accidentally ligatured and give rise to no symptoms:

A woman, aged thirty-three years, was submitted to vaginal hysterectomy for cancer of the neck of the uterus complicated with pregnancy. She died four days after the operation, and at the post-mortem examination the left ureter was found occluded with a ligature. The ureter and pelvis of the kidney were distended with urine.

The urine voided during the four days amounted on the first day to 480 c.c. (16 oz.); second day, 780 c.c. (26 oz.); third day, 1440 c.c. (48 oz.); fourth day 960 c.c. (32 oz.). These quantities would lull suspicion in regard to any patient, but the facts of the case are sufficient to raise suspicions of another kind, namely, that it is possible and probable that a ureter has been ligatured in the course of an operation, and that the patient has recovered, without anyone having a suspicion that such an accident has happened.

As soon as the surgeon clearly establishes the existence of a ureteral fistula he is beset with the necessity of deciding which duct is the seat of damage. Some years ago, when it was the practice to remove the kidney for a persistent ureteral fistula, the decision involved the surgeon in a grave responsibility, for the removal of the wrong kidney could only be regarded as a catastrophe for the patient. Morris has recorded a case in which this actually happened. A woman had total hysterectomy performed for a cervical fibroid by a gynæcologist: in the course of the convalescence a ureteral fistula was recognised, and as this failed to close spontaneously a surgical colleague performed nephrectomy, and next day found to his chagrin that he had removed the kidney belonging to the uninjured ureter. Serious accidents of this kind are less likely to happen now, because the surgeon can avail himself

of the cystoscope and ureteral catheter; with these instruments it is possible, not only to decide with certainty which ureter is injured, but also to determine the position and extent of the damage.

It is important to remember that every ureteral fistula does not require an operation. It is always advisable when it has been clearly established that a woman has a leaking ureter to wait a little, certainly six weeks, for many fistulæ of this kind will gradually close. This is a more important matter when both ureters are leaking. Jonas draws attention to a cystoscopic sign of some value in connection with a unilateral ureteral fistula when there is uncertainty as to which ureter is injured. He performed total hysterectomy for fibroids; on the tenth day the nurse reported the escape of urine by the vagina. The daily output of urine from the bladder, which had averaged 50 ounces, fell to 25 ounces. On cystoscopic examination urine could be seen issuing from the right ureteral orifice; at first the left orifice could not be seen, but on careful watching a movement was detected similar to the contraction of a ureter discharging urine, but no fluid came from the opening. This is known as *Leergehen* (empty contraction), and it indicates that there is a lateral opening but not complete interruption in the continuity of the ureter. Such a case should have an opportunity of healing spontaneously. This happened in Jonas' patient.

Wiebel, from a careful consideration of this matter, states that a ureteral fistula due to necrosis after a radical operation for cancer of the uterus usually occurs in the second week. The earliest day is the seventh and the latest the eighteenth day after operation. The majority of these fistulæ heal in from three to twelve weeks. If a fistula persists for more than three months spontaneous healing is not to be expected.

ON THE TREATMENT OF INJURIES OF THE UTERUS.

Information relating to injuries of the non-gravid as well as the pregnant uterus is widely scattered in periodical literature, and there is no lack of records, for these injuries are common. They fall easily into four groups:

(1) *Gynæcological injuries.*—This group includes perforations by the uterine sound, dilators, curette, or the nozzle of a syringe. In this group we must place cases of accidental introduction of strong antiseptic solutions into the peritoneal cavity.

(2) *Obstetric injuries.*—This comprises such accidents as rupture of the uterus, arising from the use of midwifery instruments, or the operation known as "turning." It will also include the so-called spontaneous rupture of the uterus, due to violent contractions of the organ in obstructed labour.

(3) Injuries to the pregnant uterus, due to falls, kicks from man or other animals; horn-rips of the uterus, bullet-wounds, etc.

(4) Injuries to the gravid uterus in the course of abdominal operations.

The simplest, and certainly the commonest, accident is perforation of the uterus with a sound, ovum-forceps, dilator, curette, or the nozzle of a douching or irrigating apparatus. When the instruments are carefully sterilised and the uterine cavity free from pathogenic micro-organisms, the passage of a sound through its walls is rarely attended with any untoward consequence. A few years ago, when the uterine sound passed into the abdomen through the walls of the

uterus and no evil followed, it was believed by the credulous that the instrument had traversed the canal of the Fallopian tube. This fable is sometimes related now, but I doubt if any practical gyæcologist seriously believes it. When the sound or the uterus is septic, perforation of the organ has been followed by rapidly fatal peritonitis. The walls of the uterus have been perforated by the sound when used by the most experienced practitioners, so that it becomes necessary to advise those who are learning the principles of gynæcology never to employ this instrument in a routine fashion, and when its use is really necessary take every care to make it aseptic, and render the parts of the patient clean with an antiseptic before passing the instrument. A wound made by a dirty uterine sound may prove as lethal as a snake-bite.

On the whole, injuries by dilators come more frequently under notice because they are more obvious at the time they are inflicted. I have been often consulted by junior practitioners who, after perforating the uterine wall with one of these instruments, has asked my advice as to treatment. When the dilator is small and clean and there is no bleeding the case may be left to itself; in one instance it became necessary to open the abdomen for septic peritonitis; and in another a localised abscess formed in the pelvis, and required drainage through an incision in the posterior vaginal fornix. Occasionally very serious consequences follow simple perforations by dilators and curettes, and this has induced one gynæcolgist (G. W. Jarman) to urge that if in the course of dilatation and curettage of the uterus a rupture or perforation of the uterine walls occurs, it is better to perform a cœliotomy and assure one's self of the safety of the patient than to hope that no untoward result will ensue.

A careful study of the effects of forced dilatation of the unimpregnated uterus shows that if the dilatation

is carried beyond No. 8 (Hégar's scale) some tearing of the lateral wall occurs, and often this tearing will extend to, and involve, the serous membrane. When the operator is clumsy, or inexperienced, or both, it does happen that the serous membrane is torn through without being recognised. This is a serious trap, because it was, and probably is still with some practitioners, the custom after dilating the cervical canal to flush the uterine cavity with an antiseptic solution. When there is a hole in the uterine wall this poisonous stuff will leak into the belly. Some years ago a gynæcologist curetted the uterus of a patient and then flushed it out with a quart of perchloride of mercury solution (1 in 5000). To his astonishment none of the solution returned, and on examining the uterus he found a wide rent in the wall: the antiseptic solution had passed direct into the general peritoneal cavity. The patient died in a few hours. This is not an isolated tragedy, but I am full of hope that it is very uncommon; fortunately it can be avoided if the practitioner, when he curettes a uterus, will be content to mop it out, instead of uselessly deluging the endometrium with antiseptic solution.

Cases are not unknown in which nurses in douching lying-in women have unconsciously perforated the soft wall of the uterus with the hard nozzle of the douching apparatus and delivered the poisonous solution direct into the belly.

In many instances in which the uterine wall is torn in the course of instrumental dilatation, the first indication of the accident is the presence of intestines in the rent, and I shall relate to you in the course of this lecture some cases which will prove that *one of the most serious complications of injury to the unimpregnated, as well as to the gravid uterus, is extrusion of the intestines through the rent.*

Some years ago a practitioner started to dilate and

curette a young married woman for dysmenorrhœa ; when the cervical canal was sufficiently dilated to admit a finger something soft was felt in the uterine cavity, and the operator proceeded to remove it ; thinking the mass was fœtal membranes he diligently pulled on them till both hands were full ; one end he cut through and the other he pulled away forcibly. On dropping the supposed membranes into a pail, the doctor found to his horror that the supposed fœtal membranes was small intestine. Eight hours later I was called to the patient, and found her nearly dead from loss of blood. I performed cœliotomy, removed a large quantity of blood from the belly, and secured the hole in the uterus with a suture ; I then found the cut end of the ileum, and sutured it into the cæcum, for the intestine had been torn away at the ileo-cæcal junction. The abdominal cavity contained neither gas nor fæces. A long triangular piece of mesentery required excision and sutural union of the cut edges. The abdominal incision was closed with a single row of sutures and drained. The patient recovered.

On another occasion a practitioner, whilst dilating the cervical canal preparatory to curetting, suddenly forced the dilator through the posterior wall of the uterus at the junction of the neck and body of the organ ; without recognising what he had done he continued to pass the dilators until he had thrust the biggest instrument (No. 20) through the rent. A fellow practitioner who was assisting him, suspecting something wrong, examined the patient, and found small intestine in the hollow of the Sim's speculum which rested in the vagina. I was sent for, and found a large transverse rent on the posterior aspect of the uterus, and as there was free bleeding it seemed to me wiser to perform cœliotomy ; the rent was so extensive as to render subtotal hysterectomy with conservation of the ovaries the safest course.

Extensive injuries of this kind sometimes happen to experienced gynæcologists, and the uterus is exceptionally liable to this injury when dilatation and curetting are performed shortly after miscarriage. One such ruptured the uterus during dilatation, and under the impression that he was removing a soft growth, or secundines, withdrew eight inches of small intestine; he recognised the error and pushed the intestine back through the opening in the uterine wall. The patient recovered and subsequently had two successful pregnancies.

Professor R. v. Braun-Fernwald collected a number of remarkable cases illustrating the frequency with which the uterus is perforated by gynæcologists with sounds, curettes, and dilators. He concluded an interesting paper with this observation: "The dextrous operator may use instruments for which he has a preference; for him the art lies not in the instruments but in the hand."

Heineck, in an industrious and diligent literary research among the medical literature of America, England, France, and Germany from 1895 to 1907 inclusive, collected 160 cases of uterine perforation in the course of intra-uterine instrumentation.

There is another class of gynæcological operation in which the uterus runs great risk of rupture, namely, in that known as vaginal myomectomy. The removal of an extruded fibroid polypus is one of the simplest surgical operations, but when the uterus of a middle-aged spinster contains a sessile, submucous fibroid the size of a walnut, it is not always a simple or an easy matter to extract it. Some years ago I published a case which illustrates this very well. A patient had been duly delivered of her second child; coincidently with the expulsion of the placenta the doctor detected a sessile submucous fibroid protruding at the widely-opened mouth of the uterus. It soon disappeared

within the cavity as the womb contracted, and during the protracted lying-in gave rise to troublesome profuse bleeding. Seven weeks later I was asked to remove the fibroid. In due course the cervical canal was dilated and I found a fibroid somewhat larger than a golf-ball, sessile on the fundus of the uterus. The uterine tissues were soft and easily lacerable. In endeavouring to dilate the canal the largest dilator tore through the uterine wall at the base of the tumour. The slit was wide, the uterus soft, friable, and unsatisfactory. The patient was the wife of a doctor, so I explained the situation to him and with his consent performed vaginal hysterectomy. The patient recovered.

Accidents of this kind are by no means rare, and in attempting to perform vaginal myomectomy when the tumour is large and entirely within the uterine cavity, and especially if the patient is a barren woman, the operator is liable to tear through the uterine wall in the process of dilating the cervical canal, or he will tear a hole in the wall whilst dragging the tumour out of its capsule. In some lucky instances no harm results; in the hands of an experienced man untoward effects are averted by a prompt hysterectomy. In the hands of those who trust to luck after such accidents the patient runs a risk of dying from hæmorrhage, or septic peritonitis, and in pre-antiseptic days the mortality after the operation styled "enucleation of uterine polypi" was very high.

Ruptures of the uterus in the process of instrumental dilatation are rarely reported, but there is no gynæcologist to whom this accident has not happened. J. Jakob, of Munich, wrote a thesis in 1905 on the danger of instrumental treatment of intra-uterine disease. He collected 141 instances of perforation of the uterus; of these 23 died, chiefly through septic peritonitis. Among these injuries, 73 were inflicted with the curette, 19

with the sound, 16 with dilators, 14 with forceps (Ausrumungszangen), and 6 were due to catheters (Spülkather).

Congdon collected and analysed a number of reported cases of injuries of the uterus, and showed the great liability of the intestine to be injured when the uterine wall is torn. It appears that in one instance the physician, with the object of facilitating labour, attempted to eviscerate the fœtus, but he in reality withdrew the small intestines from the abdomen of the mother. In another case bowel was mistaken for the umbilical cord and freely pulled out. In most of these severe cases the patients died.

The treatment adopted with slighter degrees of prolapsed bowel, associated with rupture or tears of the uterus, has consisted in washing the extruded bowel or omentum, returning it, and trusting to the contraction of the uterus to close the rent. In many instances this has proved successful. On the whole the most hopeful method, and certainly that which has furnished the best results when rupture of the uterus, gravid or non-gravid, has been complicated with prolapse and injury of the bowel, is cœliotomy with suture of the rent, or removal of the uterus if the rent be wide. Resection of the injured bowel may sometimes be required.

Sorabji (Delhi) reported a case in which a wide rent in the fundus of the uterus during labour became occluded by prolapsed large intestine. Five weeks later the uterus was curetted and the nature of the accident discovered. Eight days later an attempt was made to relieve the patient by cœliotomy, but the intestines were so firmly adherent to the pelvic organs that nothing could be done. The patient died two days later. The most noteworthy symptoms after the confinement were repeated and prolonged attacks of extreme colic with vomiting and constipation.

Some of the most remarkable injuries inflicted on the

gravid uterus are the consequences of attempts to induce what is known as criminal abortion, especially when the abortion is self-induced. For example, a midwife, aged thirty-five years, mother of four children, but living apart from her husband, was in the third month of pregnancy when she passed a catheter soaked in lysol into the internal os; it slipped, and she lost control of it. The woman died of septic peritonitis. A broken elastic bougie, 13 cm. long, was found in the abdomen under some coils of intestines. Schoenbeck, who reports the case, shrewdly suggests that the bougie was probably introduced by another person.

Some of the most desperate measures are adopted by single women who are pregnant, or imagine themselves pregnant, after illicit intercourse. A young woman about five months pregnant, and in despair in regard to her condition, thrust a knitting-needle into the uterus through the anterior abdominal wall; a surgeon was called in, performed cœliotomy, and luckily found an end of the needle sticking out of the anterior wall of the uterus. He withdrew it, the patient miscarried, but recovered. A patient once confessed to me that she induced abortion on herself by passing a long wooden penholder up the vagina, and when she could not pass it any further with her fingers, sat down on the holder and forced it in. Abortion and a severe illness followed, but she recovered.

In studying a large number of records relating to injuries of the uterus, it is remarkable to find that in some instances a simple perforation will destroy a woman's life in two or three days. In other instances unpleasant or dangerous consequences are long delayed; for example, Petrquin and Foltze reported a case in which a midwife introduced a sound into a pregnant uterus; abortion followed. Four months later a swelling formed at the navel; this was incised, and a uterine sound extracted.

The most extraordinary assault upon a pregnant uterus for the purpose of inducing abortion I have ever read of was perpetrated by a widow, aged twenty-nine years; when in the fifth month of pregnancy she fired a revolver-bullet into the uterus through the anterior abdominal wall. Cœliotomy was performed by Hans Kehr, and the wound in the uterus closed by suture. The patient aborted fourteen days after the operation, but recovered.

A gravid uterus in the later months of pregnancy is a big organ, and, like the abdominal viscera, generally may be severely damaged by blows, kicks from horses or brutal men, butts from animals, such as a calf or a goat, falls upon the belly, or a fall downstairs, or the woman may be run over. The treatment to be adopted in these conditions varies widely with the circumstances. As a general rule it may be stated that the most satisfactory mode of treatment is cœliotomy; this permits a thorough examination of the organ, and facilitates removal of the effused blood. In the last stages of pregnancy accidents of this kind entail Cæsarean section.

Among the most curious injuries of this group are those known as horn-rips: these are cases in which the pregnant uterus is torn open by the horn of a bull. An interesting collection of cases illustrating this accident, under the title of 'Cattle-horn Laceration of the Abdomen and Uterus of Pregnant Women,' is furnished by Robert P. Harris. Even after very severe injuries, in some of which the intestines protruded, women have recovered, and several of the children survived this terrible mode of delivery.

There is another consequence of injury to the gravid uterus which needs mention, and it may be illustrated by an actual case recorded with great care by Leopold:

A woman when near the mid-period of pregnancy injured herself by slipping down the cellar steps.

When she arrived at what she reckoned to be "term," extra-uterine pregnancy was diagnosed and cœliotomy performed. A fœtus of about the fourth month of gestation, enclosed in a thin amnionic sac, was found in the abdomen, and its umbilical cord passed through a rent in the back of the uterus. The uterus and placenta were removed with success. In this instance the uterus was ruptured by the fall, and the fœtus in its membranes slowly extruded into the peritoneal cavity. Cases of this kind in connection with uterine pregnancy are very rare in women. Several similar examples have been carefully observed and recorded in connection with tubal pregnancy. Ehrendorfer has described a similar case in which the fœtus escaped into the abdomen through a rent in the anterior wall of the uterus.

In mammals, such as the cat, rabbit, sheep, and dog, many instances have been described in which mummified fœtuses in their membranes have been found hanging from the omentum, or lying loose in the peritoneal cavity. These "abdominal fœtuses" are due to rupture of a gravid uterus, and the fœtuses in their membranes are slowly extruded through the rent in the uterine wall into the peritoneal cavity, where they become quietly encysted, and are found after death by the veterinary surgeon, an anatomist, or a butcher. These cases were supposed to be examples of primary extra-uterine gestation, but many years ago I gave the explanation described above, and it has been amply confirmed by Pembrey, Bellingham Smith, and Kamann. The condition is known as utero-abdominal pregnancy.

Rupture of the Uterus during Labour.

The uterus is liable, during labour, to be torn as a result of its own expulsive efforts, especially when the transit of

the fœtus is hindered or obstructed by narrowness of the pelvic outlet, tumours, or undue size of the child. This form of injury is called *spontaneous rupture*, to distinguish it from rupture due to instruments, such as midwifery forceps, cephalotribes, etc. The uterus is not unfrequently torn in the obstetric manœuvre known as "turning."

It is well to bear in mind that a previous Cæsarean section predisposes the uterus to rupture in a subsequent pregnancy, and the scar may yield during the pregnancy or at its termination in labour. Other injuries, such as instrumental perforations of the uterus, have also been followed by rupture in a subsequent pregnancy. (Munro Kerr has collected the references.)

It is very important for the practitioner to recognise rupture of the uterus. For example, Jenkins reports a case in which a practitioner performed version without an anæsthetic; he then introduced his hand into the uterus to remove the placenta and his fingers were touching the liver before he realised what happened. There was nothing in the patient's condition to indicate such a serious complication. Hysterectomy was performed, but the patient died three days later. The literature relating to this accident is abundant, and the reports issued from lying-in institutions deal with extensive figures, but unfortunately the reporters are not in harmony on the principles of treatment.

Ivanoff has made a careful study of the results which follow the various modes of treating rupture of the uterus during labour in the Moscow Maternity Hospital, from 1877 to 1903. During this period there were 124 examples of this accident. He comes to the conclusion that surgical intervention gives the best results, as it permits hæmostasis and cleaning of the wound.

There are three methods of dealing with rupture of the uterus:

(1) Treat the patient conservatively, which means at most lightly packing the part with antiseptic gauze.

(2) Performing cœliotomy and stitching up the rent in the uterus.

(3) Hysterectomy, preferably by the abdominal route, as this enables the peritoneal cavity to be cleared of clot.

Total hysterectomy is preferable in such conditions, as the removal of the lacerated cervix is an additional safeguard against sepsis.

The only point in which there is any semblance of agreement among obstetricians is this: In cases of complete rupture in which the fœtus and membranes are extruded from the uterus into the belly cœliotomy is clearly indicated.

Klien (Dresden) published in 1902 a critical study based upon 367 cases of rupture of the uterus published in the preceding twenty years. Of these cases 149 were operated upon with a mortality of 44 per cent.; 198 were not operated upon, 96 recovered and 102 died—a mortality of 52 per cent. Among the un-operated cases some were not treated in any way, and in these the mortality was 73 per cent., whilst those treated by drainage, plugging, and irrigation, the mortality was only 37·5 per cent.

When there is dangerous bleeding Klien advises immediate operation. Lacerations of the vagina make the prognosis unfavourable, and especially injury of the bladder.

During the last ten years hysterectomy has been so much improved and the technique simplified, that the operative treatment of complete rupture of the gravid uterus will be more frequently undertaken in the future than it has in the past, and with every prospect of reducing the heavy bill of mortality at present associated with this grave accident.

All writers agree that the high mortality following

subtotal and total hysterectomy for rupture of the gravid uterus is mainly due to the unsatisfactory condition of the patient at the time of the operation, and the frequent occurrence of sepsis.

Donaldson (1908) reports a remarkable case in which the uterus ruptured during forceps delivery ; 12½ feet of small intestine detached from the mesentery were extruded with the fœtus. Cœliotomy was performed, the detached intestine cut away and the proximal end of the bowel anastomosed into the cæcum. A long rent in the posterior wall of the uterus was closed with sutures. The patient survived the accident ten days, and died from sepsis ; "the entire uterus seemed to be a sloughing mass." Donaldson states that, had he removed the uterus at the time he operated on the intestines, the patient would probably have survived.

Injury to a Gravid Uterus in the Course of an Abdominal Operation.

In spite of every care it has happened on many occasions that a pregnant uterus has been mistaken for an ovarian cyst, the abdomen has been opened and a trocar plunged into the uterus. In some instances a uterus in which the pregnancy has advanced as far as the sixth month has been removed under the impression that it was a large ovarian cyst, and this accident has happened with a pregnant uterus greatly enlarged in the somewhat rare condition known as hydramnios. A pregnant uterus is also liable to be stabbed by an ovariotomy trocar when the condition is complicated with unilateral or bilateral ovarian cysts. The gravid uterus has very thin walls, and occasionally resembles so very closely an ovarian cyst as to deceive an inexperienced operator.

When the surgeon finds that he has injured a pregnant uterus in the course of an abdominal operation

three courses are open to him, each of which has been practised with success by surgeons of renown :

(1) Sew up the incision in the uterus.

(2) Perform Cæsarean section.

(3) Remove the uterus (subtotal hysterectomy).

Several cases have been reported in which injury to a gravid uterus during ovariotomy has terminated fatally, especially when the surgeons followed the plan of sewing up the wound in the uterus.

A careful consideration of the reported cases indicates that the best results follow for the patient when the surgeon performs Cæsarean section, as the following record shows :

Sir Spencer Wells had removed a large, multilocular ovarian cyst from the left side of the patient, when he felt what was supposed to be a cyst of the right ovary. When tapped it was found to be a gravid uterus in which pregnancy had advanced to near the fifth month. Cæsarean section was at once performed and the patient recovered.

Injuries of this kind are rarely likely to happen now, for the clumsy ovariotomy trocar is passing out of use.

Those who are interested in this matter will find a series of abstracts of cases published in my work 'On Surgical Diseases of the Ovaries, etc.,' second edition, p. 396.

Bullet-wounds of the Pregnant Uterus.

These are very rare, and, like rupture of the uterus, liable to be complicated with injury of the intestines; it is for this reason that the canon of surgery applicable to penetrating wounds of the abdomen should be practised in these circumstances, and the patient submitted to cœliotomy. When the gravid uterus is penetrated by a bullet there may be little bleeding on account of the contracting property of the uterine

tissue. In some instances amnionic fluid stained with blood escapes. In operating, the anterior as well as the posterior surface of the uterus should be carefully examined in order to determine if the bullet passed

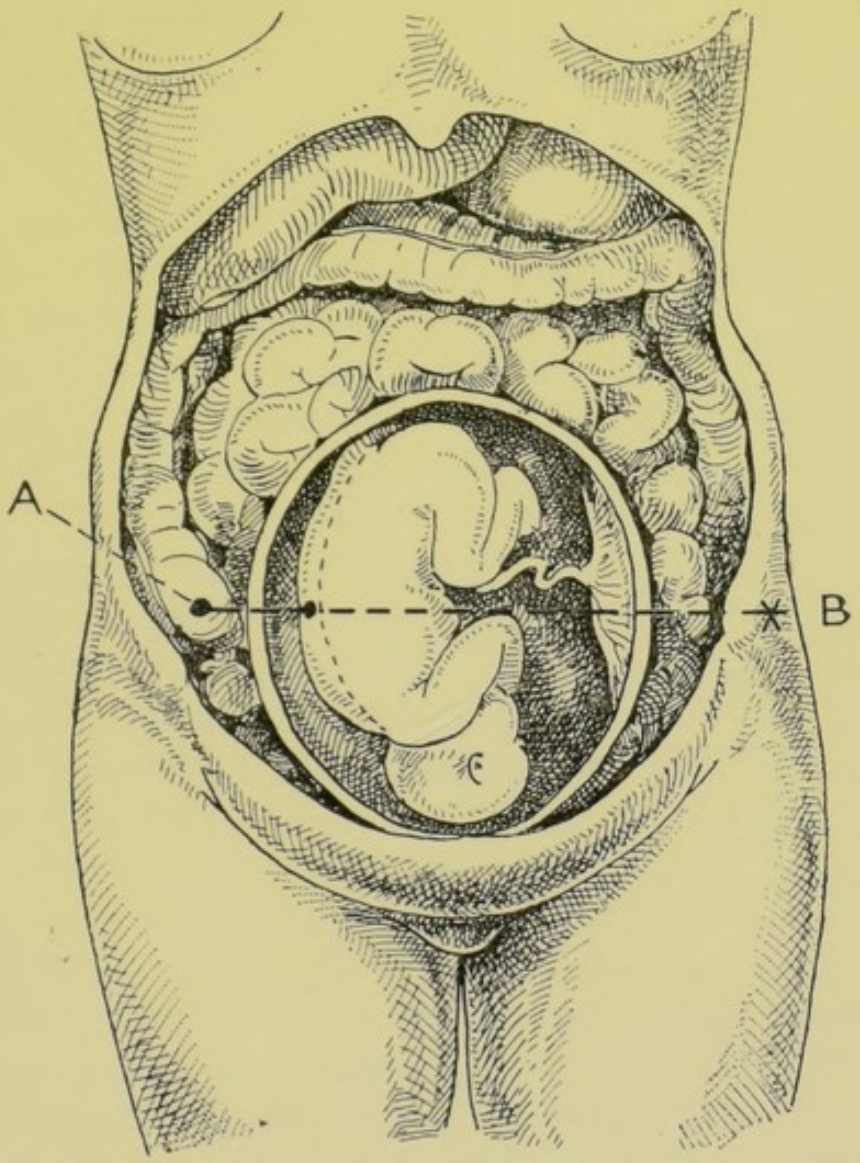

FIG. 5.—A diagram to represent the course of the bullet in Prichard's patient (from a drawing by T. Carwardine). She was aged twenty-eight years, and in the seventh month of pregnancy. The bullet was extracted from under the skin on the left side, four inches behind the anterior superior spine of the ilium. (From the 'Brit. Med. Journ.,' 1891, vol. i, p. 332.)

through this organ. In some instances the fœtus has been injured by the bullet. When free bleeding follows a bullet-wound of the gravid uterus the hæ-

morrhage is usually due to damage of blood-vessels connected with the intestines.

In a case under the care of Albarran, the patient was aged nineteen years and in the fifth month of pregnancy when shot. There were four perforations of the small intestines, and the mesenteric artery was wounded. He resected 20 cm. of small intestine. A loop of umbilical cord protruded through the bullet-hole in the uterus; this was resected and the ends of the cord tied. The patient miscarried a few hours after the operation, but recovered.

Baudet reported a case in which there were four perforations of the small intestine. He sutured the wounds in the uterus and the holes in the bowel; the woman aborted some hours after the operation, but recovered.

In a case under Robinson's care the bullet entered the uterus and penetrated the right shoulder of the fœtus. The patient, who was in the eighth month of pregnancy, quickly miscarried. The bullet was found in the *débris*. The patient not only recovered, but reconceived, and gave birth to another child in the following year.

The best method of dealing with the uterus in such conditions is undetermined. In a case recorded by Prichard a revolver-bullet traversed the uterus, the fœtus, made six holes in the small intestine, and wounded an artery in the mesentery. Hysterectomy was performed, and the holes in the intestine closed with a purse-string suture. The patient died on the sixth day after the operation from peritonitis (Fig. 5).

Punctured Wounds of the Pregnant Uterus with Injury to the Fœtus.

Examples of this kind of injury are rare, but some of the recorded cases are remarkable. Guéniot des-

cribed an injury of this sort which happened to a woman in the seventh month of her pregnancy. She was caught in the abdomen by a long nail in the back of a carriage. The nail penetrated the abdomen, the uterus, and wounded the child in the right infra-spinous fossa. Blood and amnionic fluid escaped. The patient refused surgical aid, and died in great pain sixty hours after the accident.

Guelliot has recorded the details of a case in which a pregnant woman was stabbed in the buttock. The knife passed through the great sciatic notch, penetrated the uterus and the child's skull. The woman miscarried of a dead fœtus next day. The great sciatic nerve was injured, but the woman recovered, though she remained lame.

In a case under the care of Steele a woman, six and a half months pregnant, was stabbed in the abdomen. She recovered, and was delivered of a living male child six weeks after the injury. Large and small intestine protruded through a hole in the child's abdomen; the jejunum had been completely severed by the stab. Steele attempted to deal with this lesion surgically, but the child died.

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ON THROMBOSIS AND EMBOLISM AFTER OPERATIONS ON THE FEMALE PELVIC ORGANS.

Interest in the clotting, or coagulation of the blood when it escapes from the living body, begins in childhood; this phenomenon may be included among our earliest experiences of what, in John Hunter's day, was called the "animal economy." It is a subject to which Hunter gave much time and thought, as may be gathered from a perusal of his well-known 'Treatise on the Blood,' published in 1792.

The literature relating to coagulation of the blood has become overwhelming, but in spite of this the real factors in the production of fibrin remain undetected. The prevailing theory is that founded on experiment by A. Schmidt (1861), who isolated from blood a substance termed fibrinogen, which, in the presence of paraglobulin (fibrinoplastin), with the assistance of a hypothetical fibrin-ferment is able to form fibrin, the structureless substance which is the concrete element in blood-clot. Modern physiological investigation has busied itself to find out the source of the mysterious something which brings about this rapid formation of fibrin in the blood. Coagulation of the blood is certainly a complex reaction and the presence of calcium salts has been proved to be essential. There is good reason to believe that the white corpuscles are the causative agents, and Foster suggests that the destructive explosion of these corpuscles when blood is withdrawn from the vessels leads to the formation

of fibrin. The part played by the platelets remains hypothetical.

In this lecture however we are concerned with thrombosis or the coagulation of blood within the heart and blood-vessels during life. It must certainly have occurred to every thoughtful person to ask, Why does the blood persist as a fluid in these vessels in living animals? This question has never been satisfactorily answered.

From the histological point of view the blood is regarded as a fluid tissue of which the plasma serves for a matrix, and the familiar red and white copuscles as the cellular elements. The chief function of the blood is to nourish the tissues with which it comes in contact and receive from them waste products. In order to do this effectively it is enabled by a remarkable mechanism termed the "circulation of the blood" to traverse multitudinous canals furnished with a peculiar lining, termed endothelium. These canals are known collectively as the blood-vessels. The particular value of the endothelium in the cavities of the heart and blood-vessels has been made the subject of much careful research. It is clear that this cellular lining is not only an essential element of a blood-vessel, but it is in some way very closely concerned in maintaining the fluidity of the blood: indeed Cohnheim states, *that the blood remains fluid in the vessels as long as the endothelium is intact and performs its functions normally.* Subsequent investigators are unanimous in the belief that the endothelium exercises a great influence in maintaining the fluidity of the blood whilst circulating in the vessels; and at least one physiologist is of opinion that endothelium should be regarded as a corpuscular element of the blood. The integrity of the endothelium is often disturbed by disease, but more frequently as the result of injury, including surgical operations in this category. It is the influence of surgical operations

in producing thrombosis, and the disasters which arise in consequence, that will be discussed in this lecture.

The circulation of the blood had been discovered some two hundred and fifty years, and the occurrence of obstructing clot in the big veins and arteries, as well as the formation of coagula in the cavities of the heart, were conditions which had been long known to physicians, surgeons, and morbid anatomists, before it occurred to an observer that many of the clots detected in arteries, and especially in the afferent vessels of the lungs, were not formed in the situation in which they were found after death, but were brought from a distance by the blood current. This transport of clots "through the natural gates and alleys of the body" is known as embolism; and for a knowledge of this important matter we are mainly indebted to the observations and experiments of Virchow.

The early investigators of the causes of thrombosis attributed it to mechanical disturbances of the circulation, alterations in the blood, or lesions of the endothelium lining the walls of blood-vessels and the chambers of the heart. It has been proved that the mere application of an aseptic ligature to a blood-vessel is not sufficient to establish thrombosis. Thanks to Lister's epoch-making researches into the cause of pyæmia, we now realise that intra-vascular clotting of the blood is due to the action of pathogenic micro-organisms, and the toxins which they brew. Although it is true that micro-organisms may enter the blood through the lymph vessels, it is undeniable that veins are the chief channels by which the blood is invaded. The small veins near the infected area are denuded of endothelium and filled with thrombi containing bacteria; the clot extending into the larger veins becomes softened by the micro-organisms exactly as bacteria liquefy culture media; portions are detached by the blood-stream and carried away as septic emboli,

to lodge in distant organs and establish secondary suppurating foci.

My main object in this lecture is to consider more particularly the mode of origin of those clots of blood, which are big enough, when detached from the veins in which they are formed, to plug or occlude the pulmonary artery with fatal effect. Occlusion of the pulmonary artery in this way occurs occasionally as a sequence to almost every kind of surgical operation, and though it is a well-recognised source of danger after parturition, it happens more frequently as a sequel to abdominal operations than under any other condition. When we analyse the circumstances predisposing to this accident it will be found in the majority of cases that sepsis is the prevailing cause. In relation to the jugular system of veins, the part played by infective diseases of the middle ear in producing thrombosis of the lateral sinus which will extend to the jugular bulb and onwards is well-known. It is a matter of common observation that large veins may be thrombosed, and the patient recover although bacteriological examination of the blood proves that it has been for a time colonised by micro-organisms. The observations of Metchnikoff on phagocytosis show that the corpuscular elements of the blood can effectively deal with an invasion of bacteria, and that the final consequences to the individual depend not only on the virulence but also on the dose of the invading micro-organism.

It is also necessary for us to appreciate the fact that thrombosis is in reality a defensive action of the blood. This was shown by M. B. Schmidt in regard to the invasion of the blood by cancer-particles. Cancer-cells enter the blood-stream by implicating veins, or by way of the lymphatics. The behaviour of the blood to cancerous particles is remarkable : when the cells enter the blood they excite thrombosis and the thrombus

contracts upon the cancer cells and may ultimately destroy them (Fig. 6). This defending or prophylactic power of the blood is very important, as it prevents the blood-stream from being colonised.

It is, I know, often stated that cancer-cells establish thrombosis when they effect an entrance into the circulation. This statement requires consideration. When a cancerous patient has arrived at that stage in the disease when thrombosis may be expected, the primary tumour is invariably septic, and the majority of these patients die from septic infections. It is a fact

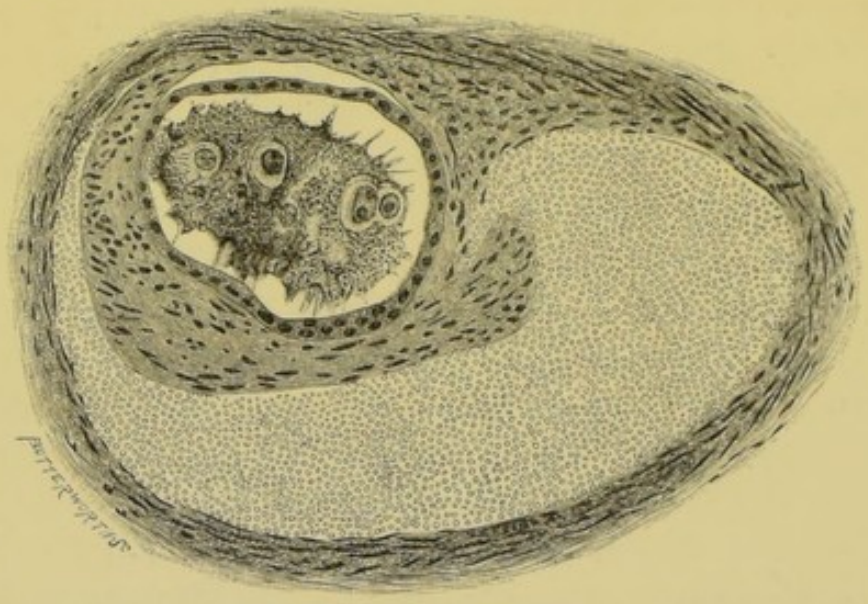

Fig. 6.—A cancerous embolus in a pulmonary capillary embedded in a thrombus (after Schmidt).

that in the late stages of cancer the processes from the ulcerating focus which invade the veins contain pathogenic micro-organisms, and when a fragment enters the blood-stream, the thrombus which forms around it is the result of these minute bodies or their toxins.

When a large outrunner from a malignant non-ulcerated and non-infected tumour of the kidney fills the renal vein and projects into the vena cava, it does not become coated with coagulated blood. I have made many observations of this kind.

It is an established fact that pulmonary embolism is fairly common after hysterectomy for fibroids and for uterine cancer. This is often attributed to altered conditions of the blood as a consequence of the profound anæmia which is produced by the profuse menorrhagia associated with submucous fibroids. When we come to analyse the matter we shall find that sepsis plays a very important part here also. It is now admitted that the very profuse losses of blood associated with uterine fibroids occur chiefly in women in whom the fibroid is not only of the submucous variety, but in many instances the uterus has been making efforts to extrude it. In no variety of fibroid is the bleeding so profuse, or so prolonged, as in patients in whom the fibroid has become septic and often gangrenous. This is also true of cancer, for when this disease attacks the endometrium lining the body of a barren uterus the cancerous mass may enlarge the organ until it is as big as a small cocoanut without causing hæmorrhage, but as soon as the mouth of the uterus becomes dilated micro-organisms gain access to the new growth, then sloughing attended with a free loss of blood is quickly established.

When I began to collect the material for this lecture my chief object was to find out the causes of thrombosis besides sepsis. It is true that pathologists divide emboli into two sets—toxic, or septic emboli, and bland, or aseptic emboli; but a study of the conditions underlying the formation of thrombi in the great veins after pelvic operations convinces me that sepsis is responsible for all. In some instances it is true that the sepsis is of a mild type, and leads to the formation of thrombi which are not colonised with bacilli. I have had such clots carefully examined bacteriologically with negative results, yet there has been evidence in the clinical records of acceleration of the pulse, fever, and exudation.

The lodgment of small septic emboli in the lungs after surgical operations, especially those performed for suppurative appendicitis and inflammatory affections of the gall-bladder, are worth closer attention than they have yet received, for many examples of post-operative pneumonia, usually attributed to ether and chloroform, are really caused by minute septic pulmonary emboli. After all forms of operations on the pelvic organs, including those performed for inguinal and femoral hernia, thrombosis occasionally occurs in the iliac, femoral and saphena veins. It is only necessary to read periodical surgical and gynæcological literature of all countries to find frequent references to this matter; in nearly all statistical tables of any importance relating to pelvic operations, statements are made in reference to the percentage of cases in which thrombosis was recorded in the clinical notes.

I have given careful attention to the subject, and find that post-operative thrombosis is usually noticed about the twelfth day, and its occurrence is intimated by fever, pain in the thigh, quickened pulse, and swelling of the limb. When the signs and history of the cases are carefully considered they will be seen to form three groups: in one the saphena vein is involved, in another the femoral and iliacs, and in the third, the ovarian vein. Each group gives rise to a fairly distinctive set of signs and symptoms.

The first group, that in which the thrombosis is limited to the saphena vein, includes the simplest conditions. The patient complains of pain in the groin and along the front of the thigh; often there are pain and tenderness confined to the calf. In both conditions the tenderness is in the course of the vein. These signs are accompanied by acceleration of the pulse and some fever. As a rule, in this group the symptoms subside in ten or fourteen days.

Post-operative thrombosis of the saphena vein is, according to my observations, usually due to infection from the abdominal incision, and the route of infection is the superficial epigastric veins which open into it near its termination in the femoral vein.

I came to this opinion some years ago by noticing two or three instances in which the saphena vein became thrombosed when the patient had been submitted to an exploratory cœliotomy; in these patients the pelvic organs were examined but not otherwise interfered with. I also saw this complication follow on two or three occasions a simple ventrofixation of the uterus. This led me to study further the influence of the abdominal incision in producing thrombosis of the long saphena vein, and I have reluctantly come to the conclusion that the prime factors in producing the changes in the wound which induce thrombosis in this vein are buried sutures, whether they be silk or catgut. I have made a series of observations on this matter by closing a number of median incisions by means of buried silk sutures, and also a series of cases with through-and-through sutures. However carefully the silk is prepared and with whatever precautions the sutures are inserted with the hands covered with rubber gloves, sterilised by being boiled twenty minutes, now and then a buried suture will give trouble; even in cases in which the buried silk sutures apparently settle down without disturbance there are often trifling rises of temperature which are not encountered when the simple through-and-through method of suture is employed. Moreover, I have discussed this matter with some surgeons who habitually employ catgut for buried sutures, and they candidly express the opinion that the absorption of the catgut leads to elevations of temperature. There is another serious matter associated with the employment of catgut for buried sutures; during the period

of its softening the bonds of union between the apposed surfaces of the incision become softened, and any undue exertion on the part of the patient, such as coughing or straining, will cause them to separate and permit protrusion of the intestine. This is a serious matter, for Madelung, in a valuable contribution, has shown that a large proportion of the patients in whom this accident happens die in consequence. He also points out that this serious post-operation calamity occurs most frequently in the practice of those surgeons who use catgut sutures for bringing together the middle layer of the abdominal incision.

On one occasion I had to reopen an abdomen ten days after an operation had been performed by another surgeon, who had closed the middle layer with catgut sutures. The strands of catgut was swollen, soft, and looked like pieces of vermicelli which had been soaked in water.

In connection with the relation between buried sutures and thrombosis some evidence is furnished by the occurrence of fatal pulmonary embolism after operations for the radical cure of inguinal hernia.

Somerville Hastings collected the fatal cases of pulmonary embolism after surgical operations which occurred in the Middlesex Hospital between 1900 and 1905, both years inclusive. There were fourteen cases, and of these four occurred after operations for the radical cure of hernia. In two of the patients the sources of the emboli were not found, in two the internal iliac veins contained thrombi. The operations in these cases were not performed with gloved hands.

The occurrence of pulmonary embolism as a sequel to operations for the radical cure of hernia is of importance in relation to my contention that the buried sutures are in a measure responsible for it, as this is an operation in which this kind of suture is considered to be of primary importance in closing the external inguinal

opening. A careful study of the clinical history of a long list of consecutive cases shows that the healing is not always ideal, and the buried suture is associated with many suppurating sinuses.

When thrombosis occurs in the iliac and femoral veins after hysterectomy or ovariotomy, this, as a rule, indicates that the infection proceeds from the vessels about the stump, especially the uterine veins. When the clot blocks up the external iliac and femoral veins it leads to solid œdema of the thigh, which gradually extends to the leg. Apart from the danger which ensues from the detachment of a fragment of clot and its arrest in the pulmonary artery, this complication is often a serious matter for the patient, as it entails a long confinement to bed, a tedious convalescence, and the œdema will persist for many months, and occasionally impairs the circulation in the limb for several years, in spite of topical applications, careful bandaging, or judicious massage.

It is possible that in some instances thrombosis arising in the saphena vein may extend into the femoral and iliac veins, but, as a rule, the formation of clot in the saphena vein stops at the valves which guard its junction with the femoral vein.

Thrombosis of the Ovarian Veins.—The ovarian veins not only carry away the venous blood from the ovaries and adjacent tissues, but they have important communications with the uterine veins ; in septic infections of the uterus infective material finds its way into the ovarian veins, as well as into the iliac veins, and we have to realise that thrombosis of the ovarian veins is a sequence to uterine sepsis. These veins also become thrombosed as a sequel to hysterectomy, and a very striking and instructive example of this has been recorded by Dr. T. G. Stevens. A woman died eleven days after a subtotal hysterectomy for fibroids : the symptoms were those of subacute septi-

cæmia. Stevens found at the post-mortem examination that the right ovarian vein was thrombosed from the point where it was ligatured in the pelvis to its entrance into the vena cava. He isolated from the clot in the vein and produced in culture the *Bacillus pyocyaneus*. Stevens also makes the pertinent statement that "the vein could have been easily dissected out, and possibly the fatal result might have been averted."

The fact that bacilli were isolated from the thrombus in the vein is important because it indicates that when these micro-organisms soften the clot, small pieces are detached and discharged with the bacilli they contain into the circulation, and produce the oft-recurring rigors which is such a striking clinical feature of general septic infection supervening upon uterine operations and delivery. The thrombosis of the ovarian veins also serves to explain the failure of certain surgical measures designed for the relief of acute septic infection (puerperal) of the uterus. In this desperate condition efforts have been made to save the patients by removing the uterus either by the abdominal or the vaginal route, but with no encouraging measure of success. In a few instances patients have recovered after hysterectomy, and it is possible that vaginal hysterectomy may now and then be a wise operation in acute puerperal infection, although under such conditions, if the uterus be removed the ovarian veins remain plugged with septic clot from which infected particles will be discharged into the general circulation, although the primary focus of infection has been removed.

The first successful step towards improving the surgical treatment of these conditions we owe to Trendelenberg. This surgeon published in 1902 a paper in which he reviews in an able manner the pathological and anatomical conditions associated with puerperal sepsis and the part played by the internal iliac veins and the ovarian veins in disseminating the

septic material. On these facts he conceived the idea of preventing the spread of infection from the uterus into the general circulation by ligaturing these veins. The patients on whom he first tried this method died—they came under his care too late; but in 1901 a woman with typical puerperal pyæmia supervening on a miscarriage was saved in the following way: Cœliotomy was performed, but it was then found preferable to drain by the vagina. She improved for a time and then the rigors recurred, and Trendelenberg ligatured the right internal iliac vein. After a time the patient relapsed, and to meet this he ligatured and resected 5 cm. of the right ovarian vein. This woman finally recovered in spite of a metastatic abscess which formed on the shoulder. The infecting micro-organism was a streptococcus.

Since the publication of Trendelenberg's paper some brilliantly successful results have been published by other surgeons, including Michels, Bumm, Cuff, and Lendon. In some of the patients it was possible to feel the thrombosed ovarian vein through the abdominal wall.

The ovarian vein can be readily exposed through an incision in the anterior abdominal wall running from the tip of the eleventh rib to the spine of the pubes parallel with Poupart's ligament: the muscles are divided and the peritoneum is exposed but not opened, and gently reflected until the ovarian vein is reached: the vein is then carefully separated from the ureter. About 2 cm. below its junction with the vena cava or the renal vein, as the case may be, it is securely ligatured and divided. The lower section of the vein is isolated towards the pelvis and securely ligatured; the intermediate section is then cut away. The margins of the wound, including the cut edges of the muscles, are united with interrupted sutures, and the space may be drained with gauze or rubber tubing. When the opera-

tion is conducted in this way it is extra-peritoneal. In some instances the thrombosed ovarian veins have been successfully tied through the usual median incision into the peritoneal cavity. In some instances the surgeons have contented themselves by tying the vein and then splitting it up and turning out the clot. The extra-peritoneal operation is not difficult as the parietal tissues are stretched and the connective tissue softened by the pregnancy. The object of tying the veins is to prevent the conveyance of clot with the pathogenic micro-organisms it contains entering the circulation, thereby setting up among other things endocarditis and pulmonary embolism. One of the difficulties in the operation is in coming to a decision whether one or both ovarian veins should be dealt with.

I carried out Trendelenberg measures in a case of acute puerperal sepsis (or metastatic bacteriæmia), and although the procedure was not followed with success the clinical course proved to be of interest. Twelve days after a miscarriage the patient, a woman aged thirty-five years, mother of two children, was seized with fever accompanied by rigors, rapid pulse and abdominal distension. The uterus was curetted and some fragments of placenta were removed; the fever and rigors continued. Forty-eight hours after the curetting she was seized with signs of pulmonary embolism; twelve hours later the signs of embolism recurred.

I saw her in consultation with the medical attendant and had her removed to the Middlesex Hospital. There were physical signs of effusion into the right mesometrium, and she was tender along the course of the right ovarian vein. I exposed the right ovarian vein extra-peritoneally: it was as thick as my thumb, but contained no clot; I exsected three inches of the vein, and then exposed the left ovarian vein in the same way; it appeared normal and was simply ligatured. Fearing there might be pus in the pelvis I made a small

median opening immediately above the pubes, introduced a drain tube into the pelvis and evacuated some ounces of turbid exudation. The immediate results of the operation were excellent: the rigors ceased and the respiratory struggle diminished. For a few days matters looked hopeful; then the temperature rose again and on the eighth day respiratory difficulty recommenced and the patient died somewhat suddenly. At the post-mortem examination the right common and internal iliac veins contained thrombi, and a large thrombus with a rounded apex, as if it had been flushed with the blood-current, occupied the right auricular cavity; a thrombus occupied, but did not occlude the pulmonary artery, and an embolus of some standing was found in a branch of the pulmonary artery in the lower lobe of each lung. The thrombi were examined bacteriologically; *Bacillus pyocyaneus* and streptococcus were isolated from the clots found in the iliac vein, and the streptococcus was found in the thrombus from the heart.

The great difficulty in dealing with this condition is the selection of suitable cases. Experience teaches that acute cases are unsuitable. The best results have been attained in the chronic forms of the disease where the thrombosis was limited. There is great uncertainty in a given case as to the extent of the thrombosis and the number of veins implicated. As has already been mentioned there are two routes for gaining access to the thrombosed vessels—the extra-peritoneal, and the intra-peritoneal. From the experience gained in my case I should in future prefer the intra-peritoneal route (cœliotomy), for it enables the surgeon to deal with the vessels, iliac or ovarian, of both sides as well as allowing a thorough examination of the pelvic organs, and it permits the drainage of any collection of serum or pus found in the pelvis. From a study of the reported cases it is clear that the best results were obtained by cœliotomy. The ligature of thrombosed veins in chronic

puerperal pyæmia promises good results for the future, but it needs further experience to teach us the kind of case in which it is likely to be most successful.

Embolism of the Pulmonary Artery.

Before considering embolism of the pulmonary artery in detail, it is necessary to point out that the pelvis contains two potential reservoirs of blood-clot—the iliac veins, and the ovarian veins. There is also another set of veins in the abdomen which needs careful consideration in regard to thrombosis and embolism after surgical operations; these are the radicles of the azygous system of veins, which finally debouch into the superior vena cava. The occurrence of fatal pulmonary embolism after operations for suppurative appendicitis is by no means uncommon. Every big list of operations on the gall-bladder and its ducts contains cases of sudden death due to the same cause, and the same tragic mode of death occurs occasionally after nephropexy, but is rare indeed after nephrectomy. The azygous vein is probably the route taken by the fatal embolus after operations in the cæcal, renal, and gall-bladder regions.

In considering the mechanics of the occlusion of the pulmonary artery by an embolus there are a few points worth consideration. In the first place this vessel is peculiar in the fact that it has the structure of an artery yet it conveys venous blood to the lung, and, considered as an artery, it has a greater diameter than any other artery in the body, for its average cross measurement is 30 mm., whilst that of the aorta immediately above the sinuses of Valsalva is given as 28 mm.; it is obvious that it requires a large piece of clot to effectually plug it. An embolus which will completely plug this artery comes, as a rule, from such vessels as the superior and inferior vena cava, or from

the right auricular cavity. A thrombus may form in the superior cava and extend into the auricular cavity, or a large clot will arise in the chamber of the auricle primarily, and a piece big enough to occlude the pulmonary artery will break off and be driven through the right ventricle. This was the source of the clot in the specimen depicted in Fig. 7.

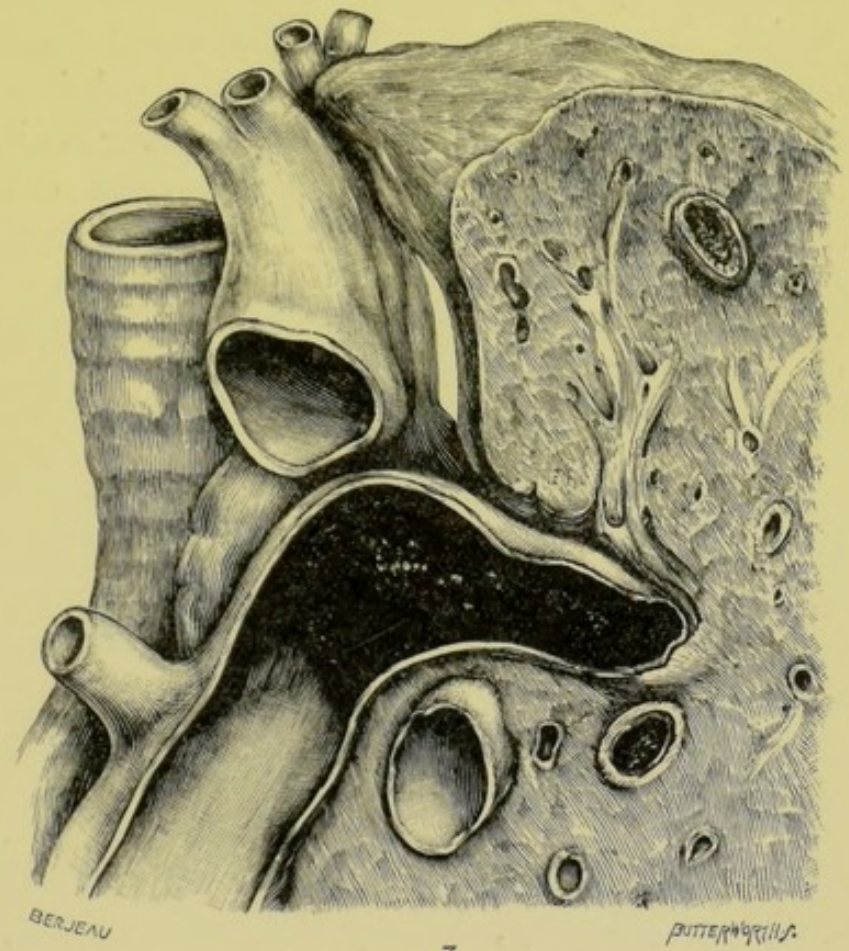

FIG. 7.—The pulmonary artery and adjacent part of the lung and trachea. The artery is completely occluded by a clot derived from a thrombus in the right auricle. (Museum of the Middlesex Hospital.)

Often a specimen comes to hand in which the artery is completely blocked by an embolus, yet a very careful examination of the venous system fails to reveal its source. Some of these cases are explained by the conditions under which thrombi arise. Virchow

pointed out that in thrombosis of the peripheral veins the thrombi do not content themselves with advancing up to the level of the main trunk, but pretty constantly new masses of coagulum deposit themselves from the blood upon the thrombus, layer after layer; the thrombus is prolonged beyond the mouth of the branch into the trunk (Fig. 8). Soon this prolonged thrombus no longer bears any proportion to the original thrombus from which it proceeded. The prolonged thrombus may have the thickness of a thumb, the original one that of a knitting needle. From a lumbar vein, for example, a plug may extend into the vena cava as thick as the last phalanx of the thumb. The detached

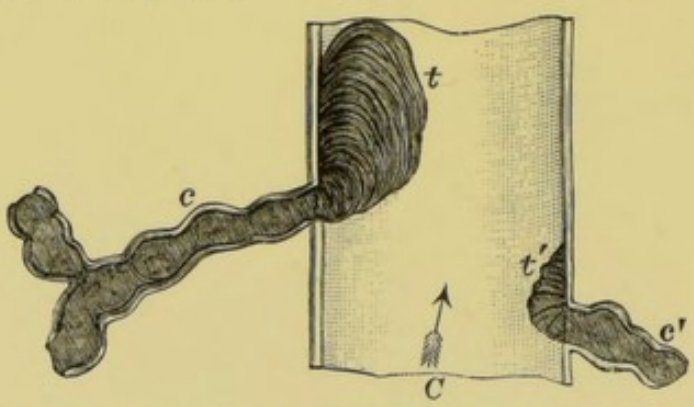

FIG. 8.—A diagram to show the mode of formation of a prolonged thrombus. *C*, portion of vein laid open; *c c'*, veins filled with clot; *t*, prolonged thrombus; *t'*, a clot from which a prolonged thrombus has been detached. (After Virchow.)

head of the thrombus may be broken off, transported to the pulmonary artery, destroy the patient's life, and leave so little evidence as to its origin that the most painstaking dissection after death will be fruitless.

There is another way in which these propagating thrombi behave. Instead of the knob of the thrombus being detached the entire clot will slip out of the venule; when such an elongated thrombus is examined it appears too thin to obstruct a big vessel like the pulmonary artery, but when it reaches this vessel and is doubled up by the blood-stream it serves as an effective plug (Fig. 9).

An embolus too small to occlude the pulmonary artery may lodge on the ridge separating the right from the left branch, becoming what is called a riding-thrombus; such a clot may act as an autochthonous thrombus and induce the "propagation" or formation of additional clot as will fill and fatally occlude the main trunk and both branches of the pulmonary artery as well as many of its subdivisions in the lung.

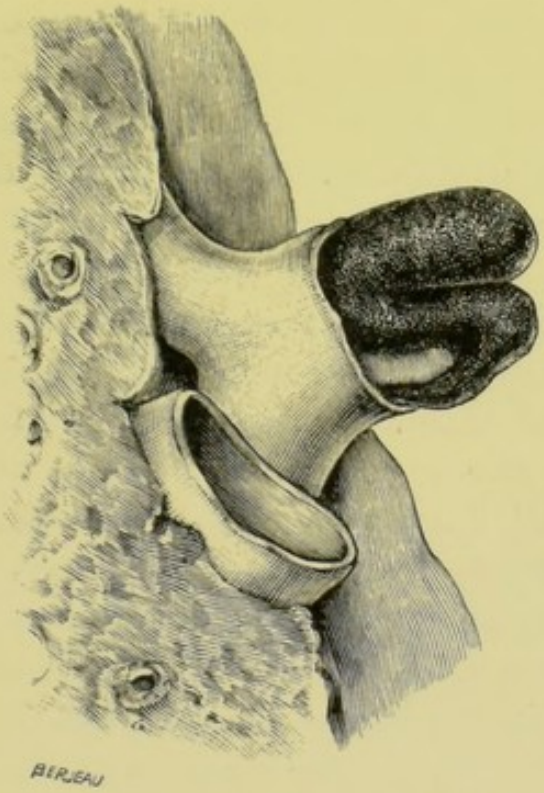

FIG. 9.—The pulmonary artery blocked by an elongated embolus doubled on itself. (After Thoma.)

This rapid thrombosis around an embolus is an interesting matter and is capable of explanation from experimental data. I have already stated that our conception of the coagulation of the blood is based upon the researches of A. Schmidt, who attributed the formation of fibrin to the action of a hypothetical substance fibrin-ferment on fibrinogen and paraglobulin. Schmidt discovered that during coagulation a considerable amount of fibrin-ferment is set free in the blood, so

that blood in which coagulation has already taken place is rich in this substance. Köhler, taking advantage of this fact, devised an important experiment which is thus described by Cohnheim: Ten or twelve cubic centimètres of blood are taken from the artery of a rabbit, and allowed to clot into a solid cake; as soon as drops of serum appear on the surface, the clot is cut up and the liquid expressed through a linen cloth. The fluid thus obtained is filtered, and about 5 or 6 c.c. are slowly and cautiously injected into the jugular vein of the animal from which it was withdrawn. As a rule, before the last drops have been injected there suddenly arises the characteristic opisthotonos: the pupils dilate widely; the animal gasping for air makes painful movements with mouth and nose; the heart labours powerfully, forcibly shaking the wall of the thorax—in short we have the well-known and unmistakable picture of fatal pulmonary embolism. On rapidly opening the thorax as soon as the cornea has become insensible and paralysis of all the muscles has announced the animal's death, the right heart, which still pulsates, will be found full of tenacious matted clot and all the branches of the pulmonary artery packed with red thrombi.

This experiment indicates that a propagating thrombus may be due to the presence in the clot of fibrin-ferment, which directly re-acts on the blood which bathes it. A transported clot or thrombus would have the same effect. At any rate the experiment demonstrates that when a thrombus is formed, it contains the active element for producing more fibrin from the blood with which it comes in contact. This element may be the hypothetical fibrin-ferment, or, with more probability, the micro-organisms, or the toxin produced by them, which caused the primary thrombosis.

The Symptoms of Pulmonary Embolism.—The most constant symptoms of the occlusion of the pulmonary

artery by an embolus are sudden, urgent dyspnœa, great pain in the chest accompanied by agony and fear of death. "Particularly striking is the contrast between the violence of the dyspnœa and the freedom with which the air enters the lungs, and in the absence of pulmonary physical signs" (Welch). As a rule, the face is blue and covered with cold sweat. Death may follow in a few minutes or it may be delayed several hours. The patient remains conscious but suffers severe mental distress. On one occasion I saw a woman within ten minutes of the lodgment of an embolus in the pulmonary artery; she was livid and unconscious, and although she had ceased to breathe, her heart continued to beat regularly and forcibly for five minutes after my arrival, then stopped suddenly.

Occasionally a patient may rally after the most urgent symptoms; then later an extending thrombus or a fresh embolus will cause death. Recovery may occur even in very desperate cases.

One of the most striking facts in connection with the clinical features of pulmonary embolism after operations is its suddenness and unexpectedness. Certainly, when a woman develops an obvious thrombosis of the femoral vein during convalescence from ovariotomy or hysterectomy, we know that she runs a risk of a piece of the thrombus being detached and transported to the lungs, but it is an unusual event in these circumstances. The most tragic cases are those in which there is no suspicion of the existence of clot in the veins.

Some years ago I performed ovariotomy on a lady in whom the tumour had undergone axial rotation; the pedicle was tightly twisted, and the operations was very simple. On the ninth day I removed the sutures and left the patient propped up in bed interested in an illustrated paper, bright and happy. Ten minutes later she was seized with sudden pain in the chest and died almost instantly. I saw her within ten minutes of the

attack and death had occurred so quickly that she had scarely moved from the position in which I had left her.

When pulmonary embolism occurs as a sequel to an operation it may happen at any time from the hour of the operation and onward to the thirtieth day. In the majority of instances it takes place about the twelfth day. The suddenness with which it supervenes is illustrated by the following cases, in addition to the one just detailed:

A patient was attacked "whilst putting on her clothes to leave the hospital." She died in twelve hours (Withrow).

A woman, apparently convalescent after hysterectomy was quitting the hospital; she fell dead in the courtyard from pulmonary embolism (Reclus).

A woman aged fifty-six years underwent hysterectomy for cancer of the uterus. Four weeks after the operation when preparing to go home she "suddenly dropped to the floor whilst crossing the room, gasped for breath and was dead in thirty minutes" (Bartlett and Thompson).

In one remarkable instance a patient complained of sciatic pains seventeen days after vaginal hysterectomy; in order to afford relief the surgeon flexed the patient's thigh on her abdomen and then suddenly extended it. This dislodged a clot and the woman was seized with the symptoms of pulmonary embolism and died in forty-seven minutes. The pulmonary artery was found to be occluded with clot at the post-mortem examination, and the left ovarian vein was thrombosed (Byrom Robinson).

These cases illustrate what most clinical observers have noticed in recording fatal cases of pulmonary embolism, namely, that the detachment and transit of the clot is usually preceded by movement, for example, getting out of bed for the first time after the operation, even sitting up in bed, but more particularly straining

during defæcation. It is of great importance to appreciate this fact, because it has been suggested that the practice of keeping patients strictly confined to bed for two or three weeks after hysterectomy and allied operations is responsible fcr the thrombosis which is the source of the fatal emboli. Some American surgeons act on this suggestion and insist on their patients getting out of bed a few days after such operations. This method does not commend itself to British surgeons. In my own practice I make it a rule even in the most favourable conditions to keep the patients confined to bed for two weeks. No patient is allowed to get up until her temperature has been normal for at least three days.

The Operative Treatment of Pulmonary Embolism.—The fact that the lodgment of an embolus even of large size in the pulmonary artery does not always terminate life in a few minutes led Trendelenberg to attempt its extraction by operation. After careful consideration of the matter he carried out the following operation:

A woman, aged sixty-three years, was seized with the signs of pulmonary embolism, and Trendelenberg raised an osteoplastic flap on the left side of the thorax, exposed the conus arteriosus, and intended to withdraw the clot through a slit in its walls by means of a specially-constructed pump. The patient died from excessive bleeding before the clot could be extracted. The operation was hindered by an adherent pericardium.

He has carried out this operation on a man aged forty-five years. This patient was tabetic and sustained a spontaneous fracture of the femur. One month later he was seized with urgent dyspnœa and signs clearly indicating the lodgment of an embolus in the pulmonary artery. Trendelenberg exposed the heart, opened the pulmonary artery, and by means of polypus forceps

succeeded in withdrawing 34 cm. of clot. The incision in the artery was carefully closed with sutures. The man improved considerably as the result of the operation, but died thirty-seven hours later. At the post-mortem examination the left and right branches of the pulmonary artery contained an embolus.

From the surgical point of view there are no reasons why such a bold example should not be repeated with success.

Since Farina's historic operation (1896) of suturing a stab wound of the right ventricle of the heart, more than a hundred similar cases have been reported in which surgeons have exposed the heart and sutured wounds of various kinds in the ventricular walls; indeed, the practice is now so well established that the text-books of surgery contain instructions as to the best methods of dealing with such injuries. Although it is true that many of the patients succumb to hæmorrhage, broncho-pneumonia, pericarditis, empyæmia, sepsis, pleurisy, or pneumothorax, nevertheless the published statistics indicate that more than a third of the patients have recovered as a result of such operations. In 1906 as many as 102 reported cases of cardiorrhaphy had been collected by C. H. Frazier, of which number 62 patients died and 40 recovered.

In connection with stab wounds of the heart it may be mentioned that wounds of the auricle are more fatal than those of the ventricle, and wounds of the right ventricle are more fatal than those inflicted on the left.

Pulmonary Embolism after Hysterectomy for Fibroids.

Pulmonary embolism occurs much more frequently after abdominal hysterectomy for fibroids than after any other operation, and is especially liable to happen

in women who are profoundly anæmic from profuse and prolonged menorrhagia due to the presence of a submucous fibroid.

In order to afford some notion of the relative liability of patients to this accident after subtotal and total hysterectomy, I have gathered the following statistics, which are interesting, as showing an extraordinary variation in the practice of different operators:

Baldy ascertained that among 366 operations for fibroids in the Gynecean Hospital, Philadelphia, there were 13 sudden deaths attributed to embolism.

Spencer, in 85 total hysterectomies for fibroids lost two patients from pulmonary embolism.

R. Lyle in 8 subtotal hysterectomies had one sudden death. Charles P. Noble in 42 vaginal myomectomies lost two patients—one from septic endocarditis, the other from embolism. In the latter case the fibroid was gangrenous.

In the Middlesex Hospital between the years 1896 and 1906, both years inclusive, there were 212 abdominal hysterectomies performed for fibroids and 3 of the patients died from pulmonary embolism. In each instance the occluding plug in the pulmonary artery was demonstrated post mortem. It is also worth note that another woman with a uterine fibroid was waiting in the ward for operation when she died suddenly from pulmonary embolism; the cause of death was demonstrated post mortem. The left common and internal iliac veins contained thrombi.

Olshausen, from the year 1894 to the end of 1905, performed 366 hysterectomies for fibroids: five of these patients died from embolism.

Bartlett and Thompson published records of 22 post-mortem examinations of patients dying from pulmonary embolism at the Boston City Hospital. Four of the patients had undergone hysterectomy—two for fibroids and two for carcinoma uteri.

Since 1894 I have performed more than 1000 operations of various kinds for fibroids and have lost one patient from pulmonary embolism. This happened in 1900. The patient was forty-five years of age and profoundly anæmic from profuse, prolonged and long-standing menorrhagia. Twelve days after subtotal hysterectomy she asked to be pillowed up in bed; this was done, when she suddenly slipped down the bed in agony and died in fifteen minutes. At the post-mortem examination the right pulmonary artery was found plugged with a thick clot; its origin was not detected.

Probably no amount of care will absolutely abolish the liability of patients to pulmonary embolism after pelvic and abdominal operations, but the thrombosis, which is not only a serious complication in itself, but the forerunner of the graver embolism, is often due to inefficiency in the means taken to procure asepsis. It is a misnomer to speak of the "uncontrollable embolus," but it behoves surgeons to give the most painstaking care to the preparation of ligature material, and to guard their hands, after thorough washing, with sterilised rubber gloves when performing pelvic operations.

To my mind, the greatest step in the advance of asepsis in operative surgery is the appreciation of the fact that the skin of the surgeon's hands is one of the chief infecting agencies which patients risk when they submit to a surgical operation. It is a fact that soap and water aided by antiseptics are incompetent to render the skin of the hands free from pathogenic micro-organisms. *Certainly the chief cause of post-operative thrombosis and embolism is sepsis.*

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ON ADENOMYOMA OF THE UTERUS AND TUBERCULOSIS OF THE ENDOMETRIUM.*

Although the pathological condition of the uterus known as adenomyoma was carefully described in a monograph by Prof. von Recklinghausen in 1896, and two cases were reported by Cullen in the same year and many since that date, this disease has not received in Great Britain the adequate attention its importance demands. Cases have been described by Frank E. Taylor, S. Cameron, Tate, Leitch, Cuthbert Lockyer and myself. One of the reasons, and perhaps the chief, which militates against the recognition of adenomyoma is the necessity for a microscopic examination of the tissue, and as this remarkable change in the endometrium is often associated with fibroids, and the symptoms caused by the disease are identical with those set up by submucous fibroids, the nature of the trouble in the uterus is often overlooked. Nevertheless, the tissue changes in the uterus in adenomyoma, in well-marked examples of the disease, are so characteristic that they cannot be mistaken, and the naked-eye features, though they cannot be relied on without the confirmation afforded by a microscopic examination, are often sufficiently marked to lead the surgeon to suspect the presence of this adenomyomatous change in the endometrium.

The specimen which I use to-day to illustrate my lecture is the best example out of fifteen which have come under my observation in the last five years. The

* 'Brit. Med. Journ.,' 1909, 1.

uterus was removed by the subtotal operation from a spinster, aged forty-three years, on account of rebellious menorrhagia; the organ completely filled the pelvis, and at the time of the operation measured 40 cm. (16 inches) in circumference. When the uterus was exposed through the abdominal incision in the course of the operation (which was undertaken on the impression that the patient's trouble was due to a large submucous fibroid) I was struck by the peculiar vivid redness of the uterus, and the crown of the organ presented a number of short, ragged villous tufts, like soft adhesions. This caused me to remark that I had doubts concerning the nature of the tumour. As soon as the operation was completed I divided the uterus in such a way as to expose the uterine cavity, and on inspecting the cut surface at once realised that this gross enlargement of the uterus depended on changes in the endometrium, and that in all probability we had in hand an exceedingly severe example of diffuse adenomyoma. The parts were carefully hardened, and in due course I made sections through the whole organ. You will find on looking at the parts, as represented in Fig. 10, that the walls of the uterus are thickened in a fairly uniform manner, but when the cut surface is critically examined you can distinguish the new material from the strictly parietal or muscular tissue of the uterus, and although it lacks a capsule, there is, nevertheless, such a marked distinction between the adventitious and the true tissue of the uterus that the naked eye can fairly well define its limits, and it is possible to trace the line of the endometrium over that portion of the new tissue where it bulges towards the cavity of the uterus. The cut surface of the adventitious tissue differs from that presented by the common hard fibroid in another particular, for instead of forming the well-known vortex arrangement, the muscular tissue is disposed in an irregular manner, and on the

freshly cut surface it produces a pattern not unlike that of the fabric known as "watered silk." When this tissue is examined microscopically the harder bundles, as already mentioned, consist of unstriated muscle tissue and connective tissue, and the spaces enclosed by these bundles are filled with the peculiar stroma characteristic of the endometrium, and contain

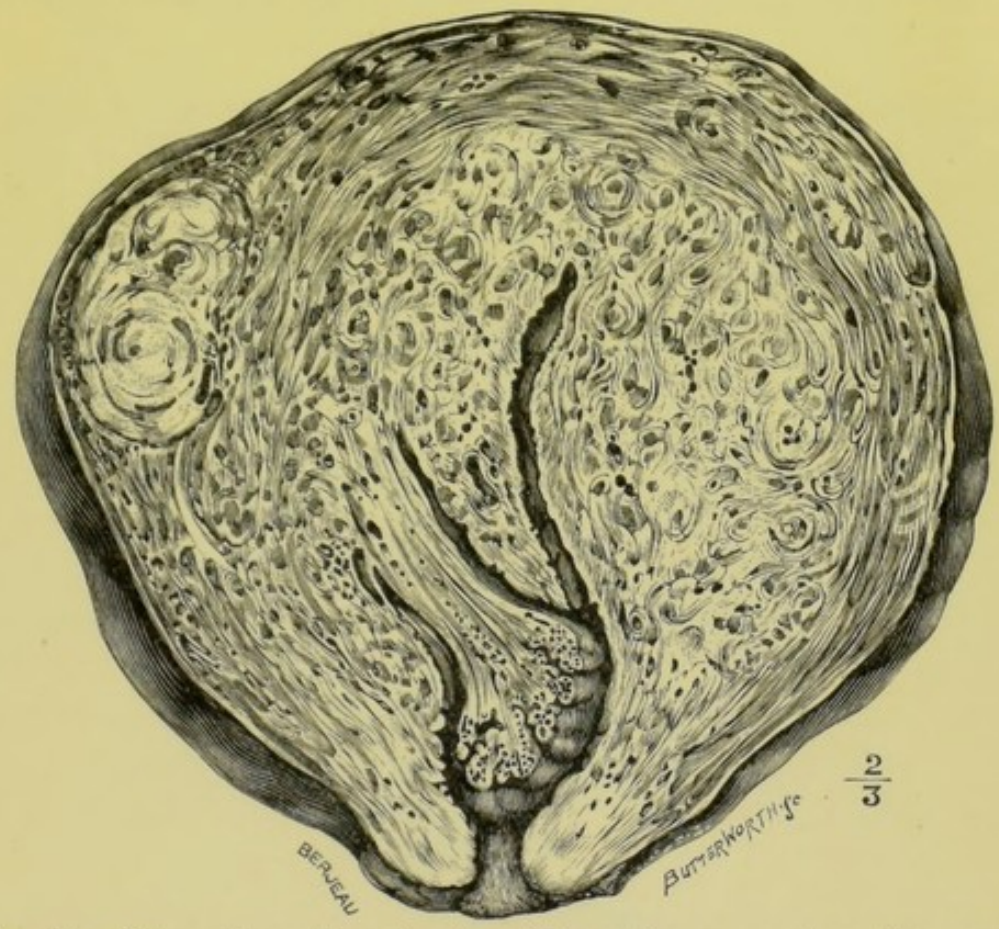

FIG. 10.—Uterus in section showing diffuse adenomyomatous disease. The polypoid process contains glandular elements. From a spinster, aged forty-three years.

gland tubules lined with columnar epithelium of the same type as that which lines the normal tubular glands of the uterus. When isolated sections are examined the glandular elements appear as islands, but when a consecutive series is examined it is easy to observe that the various glandular tracts are continuous with each other, and if the investigation involves a sufficiently large tract of tissue it is possible to follow

up the gland tracts until they become continuous with the normal endometrium.

The example just described shows very well the conditions produced when the endometrium is uniformly involved in the adenomyomatous change. In some cases the disease may be restricted to one wall and produce a local enlargement of the uterus. The

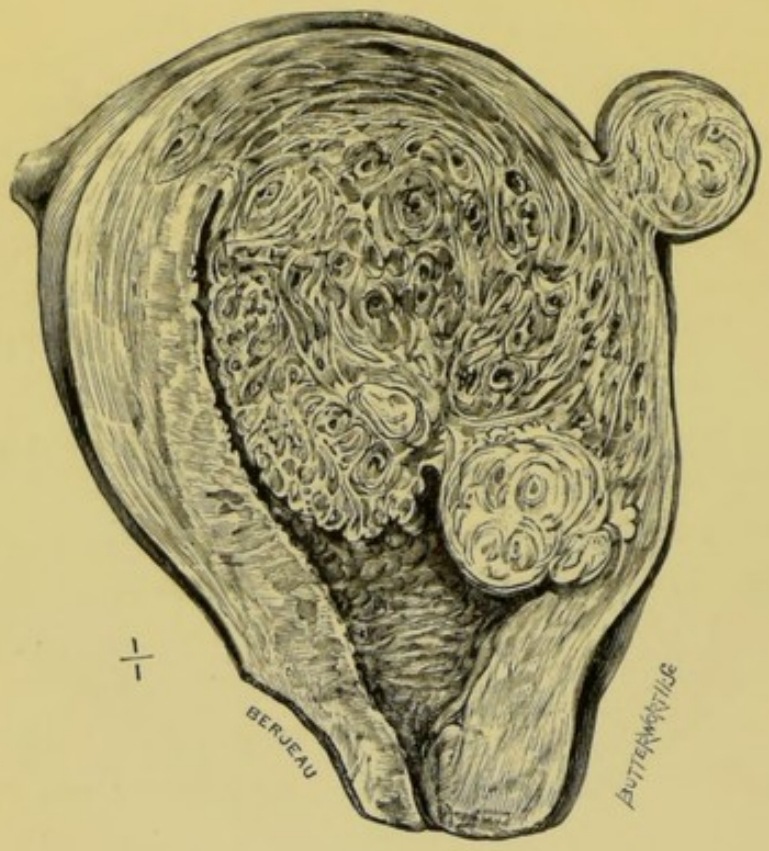

Fig. 11.—Uterus in section, showing a localised patch of adenomyoma in the posterior wall. From a spinster, aged thirty-two years. The gland spaces were cystic and filled with gelatinous material. (From the author's work on 'Tumours.')

specimen represented in Fig. 11 illustrates this very well; here the adventitious mass is formed in the posterior wall of the uterus, and a small nodule which looks like a fibroid projects from the subserous surface of the uterus, and another is embedded in the wall itself. To the naked eye these may be easily mistaken for ordinary hard fibroids, and they often are, but it

occasionally happens when such isolated nodules are examined microscopically, they contain the peculiar tissue characteristic of "diffuse adenomyoma," and they are, as it were, the terminal buds of outrunners from the endometrium which have crept through the muscular wall of the uterus and blossomed under its serous capsule. Pedunculated processes of this kind are more common immediately in the neighbourhood of the

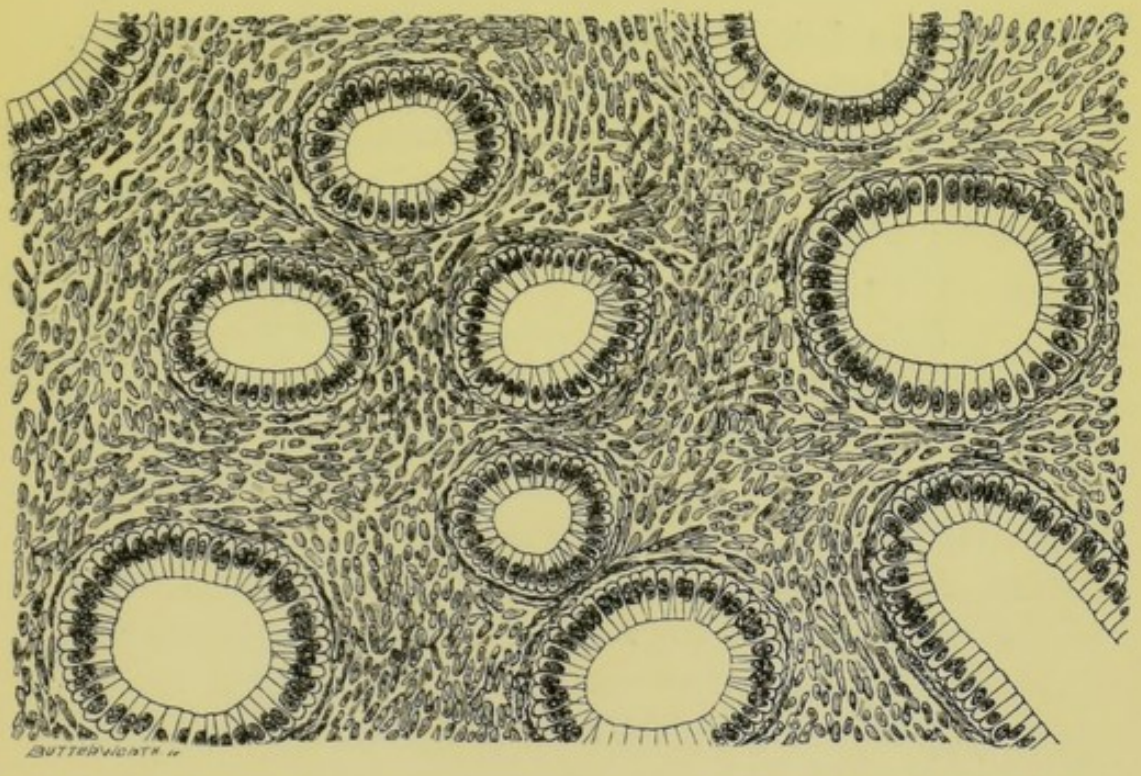

FIG. 12.—A magnified section of endometrium showing the peculiar stroma in which the gland tubes are imbedded.

cornua of the uterus, and this is explained by the anatomical fact that the walls of the uterus in this situation are thinner than elsewhere, because they are tunnelled by the terminal sections of the Fallopian tubes. In reference to this it may be mentioned that the adenomyomatous tissue in the specimen represented in Fig. 10 had involved the endometrium in the left uterine cornu, and had also implicated the mucous membrane of the tube.

The localised patch of adenomyoma which occupied the uterus, represented in Fig. 11, is interesting in another way. When the specimen was first removed and the thick mass divided we could at once discern, even with the naked eye, that the gland spaces in the mass were dilated and filled with colloid material. In some specimens the cystic spaces measure a centimètre or more in diameter.

A sufficient number of uteri affected with diffuse adenomyoma has been examined to show that there is a large variation in the proportions of the two tissues concerned in the pathological formation, namely, the adenoid, or glandular element, and the myomatous tissue. Judging from my own observations, when the myomatous tissue is in excess the uterus will be but slightly enlarged and hard, sometimes very hard. In this condition the surgeon will be apt to regard the change as being due to fibrosis, unless a very painstaking microscopic examination of the uterine wall is made throughout its whole thickness, in order to determine the presence of isolated gland spaces, which in some of these hard specimens lack the usual stroma. I am quite certain that some of the specimens classed as examples of "fibrosis uteri," a diseased condition of the uterus which I described in 1899, were really examples of diffuse adenomyoma. When the glandular elements predominate the uterus is much larger than usual, and the fundus of the organ will sometimes rise high in the hypogastrium, and then the nature of the disease is scarcely likely to be overlooked when the uterus is removed, unless it be associated with submucous or interstitial fibroids.

In some specimens the glandular tissue may so preponderate over the myomatous that a tumour-like mass is produced with tubular spaces lined with a double row of epithelium; such are sometimes erroneously described as adeno-carcinomata. The naked-eye characters of

the organ in such a case further resemble cancer in the fact that polypoid processes project from the free surface of the endometrium into the uterine cavity.

The early investigators of adenomyomatous disease of the uterus, especially Recklinghausen, held the opinion very strongly that these glandular formations could be explained from an embryological standpoint. After an elaborate research Recklinghausen expressed the opinion that uterine adenomyomata, and especially those about the tubal angle of the uterus, were mainly derived from vestiges of the Wolffian (mesonephritic) and the Müllerian ducts. Cullen has studied the disease with great thoroughness, and has worked out more than seventy specimens, a larger amount of material than has fallen to the lot of any other investigator; he believes that the epithelial elements are solely derived from the normal glands of the endometrium. Cullen somewhat picturesquely describes the changes in this way: "In cases of adenomyoma of the uterus we usually find a diffuse myomatous thickening of the uterine muscle. This thickening may be confined to the inner layers of the anterior, posterior, or lateral walls, but in other cases the myomatous tissue completely encircles the uterine cavity. This myomatous tissue contains large or small chinks, and into these chinks the normal uterine mucosa flows. If the chinks are small, there is only room for isolated glands, and where the spaces are of goodly size, large masses of mucosa flow into and fill them. We accordingly have a diffuse myomatous growth with normal mucosa flowing in all directions through it. The mucosa lining the uterine cavity is normal."

There is another side of the question. Now that this disease is more widely recognised, several observers have drawn attention to the frequency with which inflammatory complications of the Fallopian tubes are associated with diffuse adenomyoma of the uterus. It

is true that tubal inflammations are fairly common accompaniments of the ordinary forms of fibroids, especially the submucous variety, but the inflammatory complications of diffuse adenomyoma are not only very frequent, but they are by no means confined to the tubal tissues, they involve the peritoneal investment of the uterus also. This is a matter of great interest, because it may ultimately come to pass that bacteriologists will prove that the tissue-changes which lead to fibrosis uteri and diffuse adenomyoma have a microbic origin. Some important evidence in relation to this view of the disease is afforded by the observations of Archambault and Pearce in New York and by Grünbaum in Berlin. These observers have recorded cases in which adenomyomatous uteri have become infected with tubercle. In both cases the women had a tuberculous focus in the lung, and in Grünbaum's patient a few tubercle bacilli were found in sections prepared from the adenomatous tissue in the uterus. Although tuberculous endometritis is rare the clinical symptoms which accompany it so closely simulate a degenerating submucous fibroid, or a mass of adenomyoma that it is extremely likely to be overlooked. In 1904 I removed the uterus from a spinster, aged 46 years, which was enlarged, and its fundus appeared as a rounded body in the hypogastrium. The patient had become profoundly anæmic in consequence of very profuse and frequently recurring uterine bleeding, associated with an elevated temperature. The irregularity of the hæmorrhages and the fever led me to attribute these troubles to the presence of a degenerate submucous fibroid. In due course I performed subtotal hysterectomy ; the uterus had firm and troublesome adhesions to the rectum and bladder. On opening the uterus, after its removal, we saw at once that the trouble did not depend on a fibroid, but on a rounded unencapsuled mass projecting from its anterior wall into the uterine

cavity ; the diseased tissues extended into the uterine cornua and the terminal sections of the Fallopian tubes. The manner in which the abnormal tissue involved the endometrium is well represented in Fig. 13. I perceived at once that the disease was of an uncommon kind, and Dr. Gabbett kindly undertook the microscopic investigation of the uterus, and found the new tissue to be a tuberculous mass arising in the endometrium. It

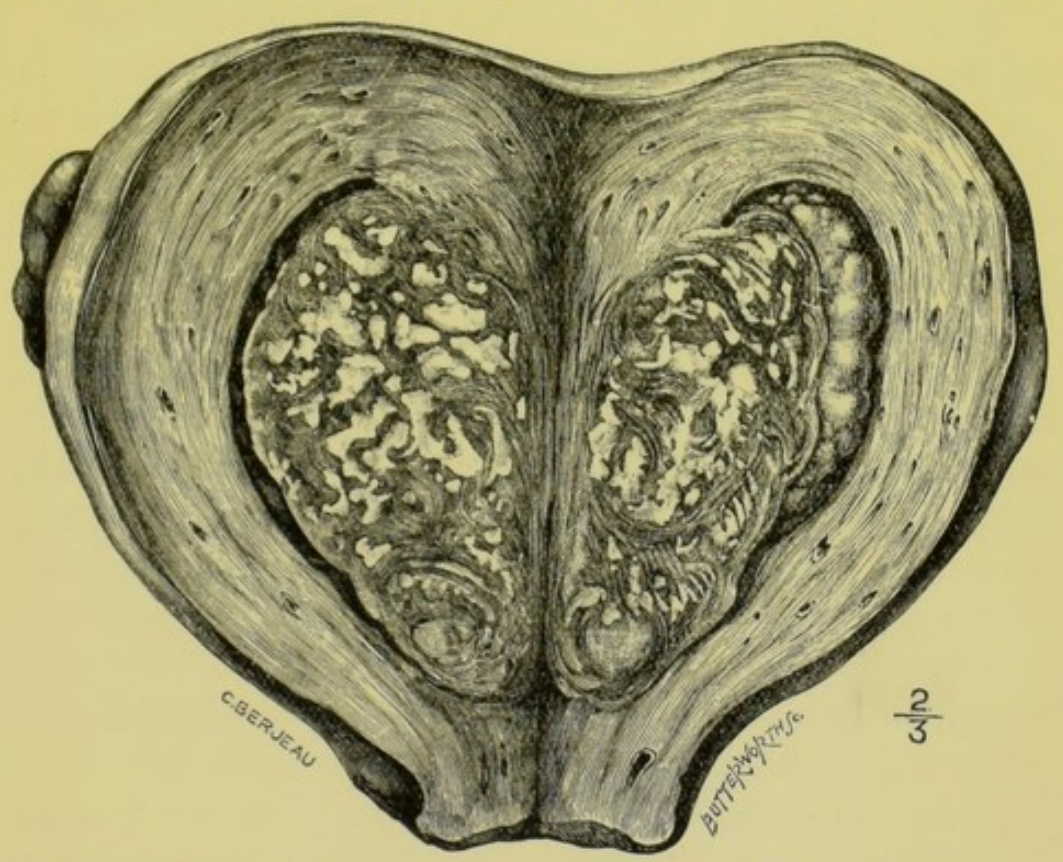

FIG. 13.—Uterus laid open by a vertical incision. The endometrium on the anterior wall is occupied by an unencapsuled mass of tuberculous adenomatous tissue. From a spinster, aged forty-six years. The patient was in excellent health four years after the operation.

contained giant cells, epithelioid systems, and detached pieces of the uterine glands. He also succeeded in finding tubercle bacilli. Reconsidering this specimen in the new light afforded by Grünbaum's observations, it appears to me extremely possible that this was in all probability an adenomyomatous uterus which had become infected with tubercle bacilli.

Cuthbert Lockyer has described in detail an adenomyomatous uterus removed from a spinster aged forty-eight years, in which both Fallopian tubes were tuberculous.

It has been already remarked that this diffuse adenomyomatous disease of the endometrium lacks a specific symptomatology. The leading clinical features may be summed up thus: It is most common between the thirtieth and fiftieth years, but it has been observed in patients of twenty and in women of sixty years. It occurs in spinsters and in barren married women as well as in those who are fertile. In regard to this matter Cullen examined the clinical histories of forty-nine cases of diffuse adenomyoma of the uterus. "Nine patients were spinsters and forty were married; of these six were sterile, two had had miscarriages, and thirty-two had had children." Among the sixteen cases observed by Grünbaum six had borne children. Of the fifteen cases under my own care, seven of the patients were spinsters, and of the eight married women four were mothers, and one had been delivered of fourteen living children.

The symptoms of which the patients complain are profuse menorrhagia, and in severe cases sanguineous fluid may flow from the vagina, sometimes for five or six weeks without intermission. Pain at the menstrual period is fairly common.

On physical examination the uterus is found to be bigger than normal, and in some cases the enlarged fundus may rise high in the hypogastrium. The contour of the uterus may be quite smooth, but in many instances it is irregular. This unevenness may be due to the localisation of the adenomyomatous tissue to one wall of the uterus, or the disease may be complicated by the presence of subserous or interstitial fibroids.

It will be seen that these signs and symptoms are those which commonly accompany a submucous uterine

fibroid, and it is under this impression that operative treatment is most commonly recommended and undertaken. These are also the signs furnished by fibrotic uteri. When adenomyomatous changes in the uterus are complicated by chronic bilateral infections of the Fallopian tubes the nature of the affection is very liable to be overlooked, especially when the uterus is only moderately enlarged.

Occasionally a shrewd and experienced observer may suspect adenomyomatous disease before operation ; even then the use of the microscope is indispensable for its identification.

Treatment.—The only effectual mode of dealing with this disease is removal of the uterus, either by the vagina, or preferably by the abdominal route. Subtotal hysterectomy with conservation of an ovary gives admirable results, immediate and remote. Even in those cases in which the adenomyomatous mass was complicated with tubercle the patients made excellent recoveries, and the condition of these women many months after operation is stated in the reports to have been excellent. It it also worthy of note that no instance is recorded in which hysterectomy has been performed for this disease, and the patient has again come under observation with recurrence.

In order to show the uselessness of drugs in this condition, I will mention the case of a patient who suffered from profuse menorrhagia. An obstetrician of repute, thinking she had a submucous fibroid, recommended her to take thirty drops of the liquid extract of ergot three times each day. She continued regularly to swallow this stuff for fifteen years. The menorrhagia became so profuse that at the end of this time I was asked to remove the uterus. It was adenomyomatous. The prolonged use of ergot had caused the tip of her nose to become blue and dry—indeed, it resembled the nose of a mummy.

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