A Lecture

ON THE

RED DEGENERATION OF UTERINE FIBROIDS COMPLICATING PREGNANCY.

DELIVERED AT THE MEDICAL GRADUATES' COLLEGE AND
POLYCLINIC, MAY 5TH, 1909.BY JOHN BLAND-SUTTON, F.R.C.S.ENG.,
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OF all the genera of tumours to which women are liable, the uterine fibroid is the most common, and there is no genus of tumours which has such a definite age-distribution. Though the uterine fibroid is such a common tumour, like pregnancy, it only arises during the menstrual period of life, which in Great Britain covers an average period of thirty years, from the fifteenth to the forty-fifth. There is, however, this difference—from the twentieth to the thirtieth year pregnancy is extremely common, the occurrence of a large fibroid uncommon. From the thirtieth to the forty-fifth year women are as liable to grow uterine fibroids as to become pregnant. The interval between the twenty-fifth year and thirty-fifth year of a woman's life may be regarded as the great child-bearing period (Matthews Duncan). It is clear that in the interval between the thirtieth and fortieth years of life there is so much overlapping of the child-bearing period and the fibroid-growing period that the co-existence of pregnancy and one or more fibroids in the uterus ought to be fairly frequent; such is indeed the case (see table). In relation to the frequency of this combination, which, as I shall endeavour to show, is a piece of ill luck for any woman, we have to remember that uterine fibroids are quite as common in spinsters as in married women, and it is a fact that among barren married women fibroids are very common; and although those who practise midwifery cannot come to an agreement as to whether fibroids cause sterility, or sterility causes fibroids, women with fibroids often conceive. Pregnancy under such conditions often goes successfully to term; frequently it is a serious matter for the patient, especially if she be a primigravida who has married late in life and possesses a large fibroid in the lower segment of her uterus, or in its neck.

In this lecture it is my intention to deal with the influence which pregnancy exerts on the fibroids. The baneful effects which fibroids exercise on the fetus, especially those connected with delivery, are for the greater part mechanical, and will not be considered. The dangers to the mother constitute my theme on this occasion.

In order to realize the disturbance which pregnancy induces in uterine fibroids, we should remember that in a normal adult virgin the uterus is on an average 3 in. long, its wall is 1 in. in thickness, and the uterine cavity measures from the "os" to the fundus 2½ in., and the whole organ weighs between 2 and 3 oz. The pregnant uterus at term is about 13 in. long, with walls ½ in. thick; it weighs between 2 and 3 lb.; its capacity varies from 1 to 1½ gallons. At the full period of pregnancy it forms an ovoid muscular bag, the os uteri occupying the narrow end. These weights and measurements afford some notion of the extraordinary changes produced on the uterus by pregnancy.

The uterus differs from all other hollow viscera in the extreme thickness and rigidity of its walls. From the histologist's point of view it would appear to be the last organ in the body whose tissues would yield to an expanding force within, and gynaecologists sometimes appreciate this when they attempt to forcibly dilate it with hard metal instruments.

There are few physiological events so clearly appreciated as the simple, easy, and rapid way in which the uterine walls soften, stretch, and increase in size under the mysterious influence of an embryo growing within it. The changes may be expressed as increased vascularity, multiplication of the muscle cells, and softening of the uterine tissues.

When the walls of the uterus are occupied with fibroids and pregnancy ensues, it is undeniable that these tumours, depending as they do on the circulation of the uterus for nutrition, are often influenced by the altered conditions.

The changes wrought in them by pregnancy have been described by many writers as consisting in the softening and flattening out of interstitial fibroids; also that the tissues of these tumours multiply with the growth of the uterus coincident with pregnancy. Indeed, this supposed active growth of fibroids during pregnancy appeared to receive support by the fact, noted by many writers, that the tissues of fibroids lodged in a pregnant uterus often became red or flesh-coloured; this alteration in colour was supposed to be due to an increase in the muscular tissue of the tumour. Some observers attributed the alteration in colour to increased vascularity of the tumour, and others to actual bleeding into its tissue, and it seems somewhat odd that no one endeavoured to determine the nature of this striking change with the assistance of a microscope. Several surgeons, myself among them, had given some attention to this alteration in the colour and texture of fibroids in the walls of pregnant uteri, and realized they were degenerative changes. I had even taken the trouble to have several examples examined bacteriologically, but with negative results. In 1903 Fairbairn made a valuable communication to the Obstetrical Society, London, entitled "A Contribution to the Study of one of the Varieties of Necrotic Change—the so-called Necrobiosis in Fibro-myomata of the Uterus," which served to focus attention on this subject, and, among other matters, points out that he had failed to find micro-organisms in these red fibroids, and that the red degeneration occurred in fibroids lodged in the unimpregnated as well as in the gravid uterus.

It may be stated at once that the occurrence of red degeneration of fibroids in non-gravid uteri is admitted by all gynaecologists, but it is equally true that the change is more frequent, more extensive, and more intensive when associated with pregnancy.

Another important feature accompanying the red degeneration of fibroids when associated with pregnancy is pain and tenderness. I appreciated this in the first examples of the condition which came under my notice, and have persistently called attention to its clinical significance. Before considering this symptom in detail, it will be useful to describe the alteration wrought in the fibroids when the subject of this change.

The ordinary colour of the common hard uterine fibroid on section is dirty white, or very pale yellow; in many degenerating and necrotic fibroids the yellow deepens. During pregnancy a fibroid may assume a deep red or a mahogany tint. In the early stages a tumour undergoing this change exhibits the colour in streaks, but as the pregnancy advances the whole tumour becomes affected, and in well-marked examples the whole fibroid softens and becomes diffuent. I have known such a softened tumour to rupture its capsule during the puerperium, and the red softened tissue to be discharged from the uterus in shreds (No. 2 in table); the medical attendant regarded this stuff as "retained secundines." In this instance the tissue was the colour of mahogany. Even in this fibroid no micro-organisms were detected in the bacteriological laboratory. This happened in 1901. The failure to find micro-organisms in these degenerating fibroids astonished me, especially as many of them immediately after removal exhale, on section, the peculiar odour of stale or putrid fish. On microscopic examination, the tissue of the fibroid is found to be necrotic, and refuses to stain; the characteristic redness is due to the diffusion of blood pigment through the necrosed tissues.

This softening of the tissue composing a uterine fibroid sometimes takes place with great rapidity, and reduces even the hardest (uncalcified) fibroid to the consistency of soft soap. Recently some new investigations on the nature and cause of this red degeneration have been published by Professor Lorrain Smith and Dr. Fletcher Shaw. They investigated with especial care four examples, of which three were associated with pregnancy, and in which the "outstanding clinical features were pain and rapid enlargement of the tumours." In two of the cases there were also symptoms of toxæmia. A study of the clinical history of the three pregnant women shows that it was chiefly on account of pain that they sought surgical assistance, and in each instance hysterectomy was performed with success. In the non-gravid patient hysterectomy became necessary mainly on account of menorrhagia, but in addition she complained of some interference

with micturition. The chief interest in Smith's and Shaw's communication lies in the opinions they express on the pathology of the change, and in the fact that they isolated from two of the specimens micro-organisms. In one they found staphylococci in the blood vessels and in another diplococci in the spaces round the vessels. These observers also express the opinion that "the chief change found in red degeneration of fibroids consists in thrombosis of the blood vessels." They also state their belief that tumours which have undergone this change "are liable to become infected by septic organisms, and so give rise to acute toxic symptoms."

I was deeply interested in reading an abstract of this paper,* and within a few days the following remarkable case came under my notice:

A primigravida, aged 31, two months pregnant, was suddenly seized with such acute abdominal pain during a railway journey, that she left the train at an intermediate station, and placed herself under the care of a doctor whom she knew. He considered the patient to be suffering from the bursting of a gravid Fallopian tube, and sent for me.

I saw her twenty-four hours after the onset of the symptoms, and found a large tumour, probably a fibroid, occupying the right half of the belly and reaching as high as the liver. I considered that some change had taken place in this tumour consequent on the pregnancy; it was also probable that it might be an ovarian cyst which had twisted its pedicle. The tumour was very tender and the patient very ill, with a pulse-rate of 112 per minute and temperature 100° F. I opened the abdomen; the tumour proved to be a large subserous fibroid with a thick stalk; the uterus was gravid, and as it contained several fibroids the size of golf balls, I removed it. The patient recovered. (Case 19 in Table.)

On examining the big fibroid in the course of the operation I noticed an area of softening about 5 cm. in diameter; it appeared as if acutely inflamed, and there were flakes of lymph over this soft area. On completing the operation I packed the uterus and its tumours into sterilized waterproof material, and on reaching London took it to the laboratory for investigation. When the large subserous fibroid was bisected, a pyriform patch of red softening appeared (looking exactly like an infarcted area) equal in size to one-third the total bulk of the tumour, the remaining tissue of which was very hard. The red area had become so soft that the finger could be pushed in with ease. Mr. Somerville Hastings undertook the bacteriological examination of the red tissue, and he succeeded in obtaining in pure culture *Staphylococcus pyogenes aureus*, and the method by which he effected this is set forth in his own words: "With a piece of iron heated to redness a linear sear some 3 in. or 4 in. long was made on the peritoneal covering of the fibroid. A scalpel sterilized by prolonged boiling was then taken and an incision made deeply into the tissue of the fibroid by cutting along the seared area. The cut edges were retracted, and two small pieces of tissue about the size of peas were removed by forceps and scissors, also sterilized by boiling, from the centre of the fibroid and dropped into two tubes of ordinary peptone broth. These

were incubated at 37° C., and the next day staphylococci were obtained from both tubes. The staphylococci gave the staining and cultural reactions of *Staphylococcus pyogenes aureus*, and the cultures were shown to be pure by being plated out."

The interstitial fibroids showed the red changes in streaks, but no micro-organisms were isolated from them.

From the clinical standpoint red degeneration of fibroids associated with pregnancy is of great importance, and especially its influence in causing them to become tender and painful. It is necessary to emphasize the fact that these two signs—painfulness and tenderness—are only markedly exhibited by "red fibroids" when associated with pregnancy, and they are a source of errors in diagnosis. It is also necessary to state that pain is present only in the early stages of the degenerative process; when the tumour is completely disintegrated it is insensitive. This is illustrated by examples taken from the uteri of women after labour, in which the degenerated fibroid is so soft that the finger can be pushed into it easily and painlessly; but these softened submucous tumours set up profuse bleeding from the uterus and place the patient's life in great peril. This is a matter of some importance, because to my mind it is an explanation of the ready way

in which submucous fibroids complicating pregnancy so readily become septic during the puerperium and entail a long and dangerous illness, which often terminates in the death of the patient unless the nature of the case is recognized and the peril averted by a timely hysterectomy.

A uterus may contain many fibroids in its walls, yet only one will exhibit this red change and become acutely painful whilst its companions remain colourless and insensitive. In one instance a uterus in which the pregnancy had advanced to the end of the second month contained seven fibroids varying in size from a golf ball to a duck's egg; three of them exhibited the red change.

The remarkable feature of the pain accompanying red degeneration is the suddenness of its onset. It is so sudden and severe that it resembles the pain experienced by patients when an ovarian tumour undergoes acute rotation and twists its pedicle, or the shock produced by the bursting (or abortion) of a gravid Fallopian tube. It is true that, in very many instances in which operations have been performed for fibroids complicating pregnancy, they were recommended and carried out on the notion that the patients were suffering from an ovarian cyst which had twisted its pedicle, or rupture of a gravid tube. In 1901 I published a table of 8 cases in which submucous fibroids had been removed from the walls of the gravid uterus on account of continuous pain, and in all the cases the operation was undertaken on an erroneous diagnosis. In many cases the fibroid was regarded as an ovarian cyst which had twisted its pedicle; in some a pyosalpinx; in others a gravid tube which had burst, for it must be remembered that the uterus and one of its Fallopian tubes occasionally become gravid simultaneously (compound pregnancy). It is only necessary to read carefully the "reports" of red fibroids communicated to the Obstetrical Section of the Royal Society of Medicine to learn not only how frequently the change occurs in fibroids complicating pregnancy, but how it produces symptoms which mimic those caused by the axial rotation of ovarian

Fig. 1.—Uterus distorted with fibroids and containing a fetus of four months' development. From a primigravida aged 43. She recovered easily and quickly.

* The complete paper is published in the *Journal of Obstetrics and Gynaecology of the British Empire*, April, 1909.

tumours, or the bursting of a gravid Fallopian tube, so that the most experienced practitioners of midwifery are often deceived.

The condition is being better recognised by obstetricians. It is clear that when a uterus beset with fibroids becomes gravid, the fibroids do not, as some believe, enlarge in consonance with the physiological increase of the normal muscular tissue of the uterus. That some of the fibroids enlarge is beyond doubt, but this is the result of interference with the circulation in these tumours producing oedema and colour change due to haemolysis of the blood, not to a rapid increase of muscular tissue, as so many writers have erroneously asserted. This is another illusion swept from obstetric art by careful microscopic inquiry. The student need only study the conditions which exist in the uterus depicted in Fig. 1 to appreciate the disturbance which the growth of the fetus must have produced in the "constellation of fibroids" by which it is surrounded. I removed that uterus from a primigravida, aged 43, on account of pain, realizing that she was pregnant, and that the acute pain and suffering which caused her to seek surgical aid were due, in all probability, to red degeneration of an interstitial fibroid, which could be felt as a tender uterine prominence in the hypogastric region. One tumour only in this uterus showed the red change; its companions exhibited the usual greyish-white tint common to hard fibroids.

It may interest you to know that even with the knowledge that the occurrence of red degeneration will produce pain, sudden and acute, like that accompanying rupture (or abortion) of a gravid tube, it is easy to make an erroneous diagnosis. The uterus represented in section in Fig. 2 illustrates this very well. I removed it from a primigravida aged 35, who had lived in sterile wedlock fifteen years. After over-running two menstrual periods she had a sudden attack of bleeding and painful seizures, which led the doctor to think that a miscarriage was impending. The bleeding continued, and at the end of three weeks the patient was placed under chloroform with the view of emptying the uterus, but a definite swelling could be felt in the right half of the pelvis which so simulated a gravid Fallopian tube that operative interference was deferred. Eventually the patient came under my care; the signs and symptoms accorded best with tubal pregnancy. Coeliotomy was performed. I found a gravid uterus containing many fibroids. A subserous fibroid as big as a bantam's egg and occupying the fundus of the uterus had swollen in consequence of red degeneration and split its capsule. There had been some bleeding into the abdomen, but nothing serious. The uterus was removed and the patient quickly recovered. The condition within the uterus is worth consideration, for there is a submucous fibroid projecting into its cavity. This tumour shows no degenerative change, but, as represented in the drawing, its capsule is enveloped with a thick layer of decidua.

I am particularly desirous to point out that when pain and tenderness, due to red degeneration of a fibroid, are present in a mild degree, they generally subside if the patient be kept at rest in bed. It is only the very severe cases which call for surgical treatment.

It is perhaps worth mention that a tumour occasionally grows in the ovary, which in its naked-eye characters, and even in presenting a whorled disposition of its fibres, resembles the hard uterine fibroid. The microscopical features of the "ovarian fibroid" are indistinguishable from those exhibited by the common hard uterine fibroid. The ovarian fibroid is also liable to soften, to liquefy, and to

calcify. As such a tumour may be met with at any age, from 17 to 77, it occasionally complicates pregnancy. An ovarian fibroid has been found incarcerated in the pelvis by a gravid uterus; when lying high in the abdomen above a pregnant uterus it has undergone axial rotation and twisted its pedicle, but in none of these adverse circumstances, so far as my experience shows, has red degeneration been observed. This is a matter worth attention from those who get the opportunity of examining such specimens, for if red degeneration is due to thrombosis, an ovarian fibroid with a twisted pedicle would be an ideal condition for its occurrence. I have on four occasions removed an "ovarian fibroid," each of which had been incarcerated by a gravid uterus, but none showed any signs of red degeneration.

In the early part of this lecture I mentioned, in referring to the overlapping of the child-bearing and the fibroid-growing period of a woman's life, that theoretically the coexistence of fibroids and pregnancy ought to be most frequent between the thirtieth and fortieth years. In order to test this I prepared the subjoined table, containing 20 consecutive cases of this unfortunate conjunction, which have come under my care since 1900.

The facts are significant, for the patients, with two exceptions, were primigravidae. These women had in most instances married late in life, or, if they had been married many years, there had been a long interval of sterile wedlock (in one instance fifteen years). The pregnancies, with two exceptions, occurred after the thirtieth year of life. In the case of the two multiparae

Fig. 2.—A gravid uterus in section. The walls were beset with fibroids. The fibroid shown in section is submucous, and its capsule is covered with a thick layer of decidua. From a primigravida, aged 35, and about two months advanced in pregnancy.

Table of Cases in which Fibroids coexisting with Pregnancy caused such Symptoms as to necessitate Surgical Interference.

No.	Social State.	Age.	Month of Pregnancy.	Operation.
1	S.	28	Third	H.
2	M.	36	Puerperium	H.
3	P.	36	First	E.
4	P.	28	Third	E.
5	P.	32	Third	H.
6	P.	33	Seventh	T. H.*
7	P.	35	Fourth	H.*
8	P.	43	Fourth	H.
9	P.	40	Sixth	H.*
10	P.	33	Fourth	E.
11	S.	38	Fifth	H.
12	P.	35	Fourth	H.
13	P.	39	Second	H.
14	F.	44	Fourth	H.*
15	P.	35	Second	H.
16	P.	39	Fourth	H.*
17	M.	45	Puerperium	T. H.*
18	P.	41	Third	H.
19	P.	31	Second	H.
20	P.	35	Second	H.

P., Primigravida. S., Spinster. M., Multipara. H., Hysterectomy. E., Enucleation (abdominal).

* This signifies that the tumour was a cervical fibroid.

the fibroid in each instance caused such severe losses of blood during the puerperium that an operation became an urgent necessity.

I have tested these points by reference to other cases under my care, and the conclusions are confirmed, so there is no reason to encumber the lecture or the reader with a longer table.

My knowledge of this red change in fibroids of the uterus complicating pregnancy is founded on a study of thirty-two examples which have occurred in my practice.

I hold no opinion as to its cause. The presence of micro-organisms in the degenerated tissue is in all probability exceptional; the thrombosis and the infarction theories require more proof. The only facts established in regard to red degeneration of fibroids is its proneness to occur in them when the uterus is gravid. Fibroids so changed seriously menace pregnancy.

ON THE SPONTANEOUS RUPTURE OF CYST-ADENOMATOUS OVARIAN TUMOURS.

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THE main aim of this communication is to urge (1) that the primary cause of cyst rupture in cases of ovarian cyst-adenoma is tumour degeneration (necrosis), (2) that the rarity of cyst rupture in relation to the frequency of tumour degeneration is not inconsistent with the adequate vascular compensation almost invariably supplied by adhesions to the degenerated tumour, and (3) that these adhesions are simply reparative and are not, as generally stated, the result of peritonitis. The innocent leakage through attenuated and thin cyst walls, a common and normal occurrence, is distinguished from the rare rupture: on the absence in the former, or on the presence in the latter, of clinical manifestations is based a working distinction.

Cyst rupture as an appreciable clinical and pathological complication is one of the accidents in a case

of ovarian cystic tumour, and just as in a case of accidental haemorrhage during pregnancy, trauma, or violence in the history of its causation, is almost invariably wanting.

The records from the earlier and darker days of ovariectomy of sixty-six and eighty tappings of an ovarian cyst leave no doubt as to the healing power of the normal cyst wall.

Meredith¹ reported an exceptional result of tapping in a case of his which became famous as evidence of the vital activity and resistance of the peritoneum; in a single woman, aged 47, after one tapping the refilled cyst ruptured and reruptured, into the peritoneal cavity, thirty-four times, and on each occasion with local pain and subsequent diuresis. At the end of a ten years' history the ovarian cyst, containing 21 pints of fluid, was removed with success; only a few filamentous adhesions around the aperture of the original puncture were found during the ovariectomy by Meredith.

Sir Spencer Wells² discussed adhesions after tapping; he stated that they were most frequently absent, and that there were firm adhesions in some patients who had never

been tapped; the mortality table of 500 cases after one to eighteen cyst tappings proved that tapping itself had little adverse influence on subsequent ovariectomy in his hands.

The revival of tapping is not to be desired. Sir Spencer Wells said that during later years he became more impressed with the danger of putrefactive changes after tapping without antiseptic precautions.

In the absence of infective organisms and of loose particles of growth capable of implantation, intraperitoneal cyst rupture—at the time unattended by serious haemorrhage—is of itself a harmless, or almost harmless, pathological process; but, inasmuch as the opening from a degenerated cyst is permanent, the contents continuously dribble without any barrier of defence such as is provided by the haematocele sac around a chronic tubal drip in a case of tubal mole. Hence, free intraperitoneal fluid (hydroperitoneum), devoid of any plastic properties, bathes on all sides the loose tumour.

Elsewhere,³ Dr. T. E. Walker and myself reported on the invariable absence of hydroperitoneum when adhesions were universal, whether with innocent or cancerous tumours and after torsion of the pedicle.

Cancerous tumours as a rule degenerate earlier, and adhesions are, or rupture is, earlier and more frequent than with simple tumours.

Degenerative changes are the common exciting causes of adhesions. Cyst rupture does not occur at the site of adhesions, but through unprotected degenerated areas of cyst wall. In Case 153 in Sir Spencer Wells's table of 1,000 ovariectomies there were, to portions of the tumour, parietal and omental adhesions, and there was, over other non-vascular, central portions of degenerated patches,

demonstrated in the same tumour, a covering of recent plastic exudate.

Where repair from without is defective the degenerated portions of the cyst wall may rupture. This is what had clearly taken place in the four cases of my series.

CASE I.—A. H. A, Probe in Fallopian tube. B, Site of rupture.

CASE I.—The aperture of rupture measured $\frac{3}{4}$ in. by $\frac{1}{4}$ in.; its edges were raised, everted, and adenomatous; the aperture led into a central cyst—half the size of the whole tumour—surrounded by tiers of small cysts; the small cysts contained thick, mucoid fluid. The whole tumour measured 7 in. by 7 in. by 3 in.; necrotic in many areas; two

patches of adhesions to bladder and rectum denoted early degeneration before the tumour—then the size of an orange—ruptured (*vide infra*).

A. H., aged 27; six years married; two children; each born by normal labour.

History.

Menstrual losses recurred fortnightly from the birth of the second child in August, 1906, to August, 1907—that is, for exactly one year; subsequent menstrual suppression continued for 16½ months; epistaxis is stated to have recurred frequently and irregularly during the menstrual suppression. Dr. James Utting of Preston, who sent the patient to me on January 20th, 1909, wrote: "The first abdominal pain, four months after the birth of her second and last child, was attributed to acute peritonitis; several weeks afterwards the abdomen was full of fluid; after tapping the abdomen, the tumour, the size of an orange, was felt; the intraperitoneal fluid reaccumulated with varying rapidity, and once there was a three months' interval between the tappings; latterly the large amount of over 2 gallons has been removed every fortnight or three weeks; the fluid has always been clear, pale in colour, and thin; specific gravity, 1005; only once a little blood was present; the oedema of the legs of a few months ago has not returned." The total number of tappings was fourteen.