Original Articles.

CANCER OF THE CERVIX COMPLICATING PREGNANCY.

BY JOHN T. WILLIAMS, M.D., BOSTON.

FOR permission to examine the hospital records I am indebted to Dr. Charles M. Green, Visiting Physician to the Boston Lying-in Hospital, and Senior Visiting Surgeon for Diseases of Women at the Boston City Hospital; and for the use of the individual cases, to Dr. William L. Richardson, Dr. Charles M. Green, Dr. Franklin S. Newell, Dr. Howard T. Swain and Dr. Leo V. Friedman, in whose care they were.

Cancer of the cervix, while by no means a common complication of pregnancy, nevertheless occurs with such frequency that every obstetrician with a wide experience must almost inevitably encounter it.

The literature, while somewhat voluminous, consists for the most part of reports of isolated cases or small series. The first comprehensive articles were those of Chantreuil in 1872, and Cohnstein in 1873. As these were written before the introduction of asepsis, and the work of Freund, Porro and Sanger made possible the development of modern methods of treating the condition, they possess at present only an historical interest.

The literature of the early period is well summed up in the thesis of Bar, published in 1886. His statistics, while not obtained under modern conditions, with analysis can be made to furnish some material of value still.

In more recent times the best articles have been those by Theilhaber, 1894; Noble, 1896; Hense, 1901; Grimoud, 1907; and Sarwey, 1908.

The following is a brief report of seven hitherto unpublished cases, four from the Boston Lying-in Hospital and three from the Boston City Hospital.

CASE I. Entered the Boston Lying-in Hospital April 14, 1889, on the service of Dr. Richardson. Thirty-one years old. VIII gravida.

Previous labors: Two normal and three operative; the last, two years before admission, delivery by version. Two miscarriages, stage of pregnancy unknown; the last in June, 1888, with considerable hemorrhage.

After this miscarriage she menstruated only once before becoming pregnant again. Quickening on Nov. 1. In December there was a short period of flowing, not excessive in amount. The first week in March she flowed again, this time passing several clots.

On March 30, she had a sudden profuse hemorrhage. April 7 she passed a few clots, and began to have severe paroxysmal pain in the right abdomen, which lasted up to her entrance to the hospital.

Examination at this time showed a large cauliflower growth, arising from the anterior lip of the cervix, and nearly half filling the vagina. The fetus presented by the vertex, O. D. P.

The patient was vomiting constantly, anemic, weak and emaciated. Labor began soon after admission, and after eight hours and forty minutes she delivered herself of a 6½-lb. child without difficulty. The post-partum loss of blood was not abnormal.

Both mother and child made normal convalescences and were discharged in two weeks.

CASE II. Entered the Boston Lying-in Hospital, Nov. 9, 1891, also on the service of Dr. Richardson. Twenty-eight years old. II gravida. Previous labors normal. The diagnosis of cancer of the cervix had been made three months before she became pregnant.

The pregnancy had been attended throughout by a constant foul bloody discharge. When about arrived at term, the membranes ruptured and uterine contractions commenced immediately and continued with varying frequency up to her entrance to the hospital, four days later.

On admission the os was found to be rigid, dilatation two inches. The cervical region was occupied by a fungous mass which extended well on to the posterior vaginal wall. The fetus presented by the vertex, position O. L. A. The fetal heart was audible and regular.

The contractions were weak and ineffectual during the evening of admission. About midnight the patient had a severe chill, after which the temperature was 105, the pulse 170, and the fetal heart was no longer heard.

Under ether the os was dilated manually, and the patient then allowed to come out. A few hours later she delivered herself of a stillborn child, weighing 7 lb. There was no post-partum hemorrhage.

After delivery the cervix sloughed extensively and the patient died on the eleventh day, from absorption.

CASE III. Entered the Boston City Hospital, Dec. 26, 1903, on the service of Dr. Green. Forty-one years old. XI gravida. Previous obstetric history: Seven normal labors and three miscarriages, the last pregnancy having terminated in an accidental miscarriage at two months, in February, 1903.

On entrance she was between eight and nine months pregnant, and gave a history of almost constant flowing for ten months. During the last few weeks the vaginal discharge had borne a distinctly foul odor. For three weeks she had suffered from backache, and she had lately lost considerable strength, but there had been no loss of weight.

On examination the cervix was found to be the seat of a malignant process, extending slightly on to the vaults. The broad ligaments appeared to be only slightly involved. The fetus was alive, of average size and presented by the breech.

On Jan. 7, 1904, Cæsarean section, followed by abdominal total exirpation of the uterus, was performed by Dr. Green. Drainage was secured by passing a wick from the pelvis into the vagina, and the abdomen was closed tight.

The patient recovered well from the operation, but developed a suppurative process in the pelvis, where the malignant disease had been removed, which was followed by a phlebitis, and cutaneous abscesses over various parts of the body. The patient ran a long-continued irregular temperature. Her general condition slowly failed and death ensued about two months after the operation.

The child weighed 6 lb. 8 oz. at birth, and was discharged well.

CASE IV. Entered the Boston City Hospital April 21, 1904. Service of Dr. Newell. Twenty-one years old. III gravida. Previous labors normal; last, one year before admission.

The patient noticed nothing wrong until six months pregnant, when she began to be troubled with backache. Early in the eighth month she had a slight hemorrhage. A week later, the hemorrhage recurred and she was seen in the Out-Patient Department of the Boston Lying-in Hospital by Dr. Friedman, who discovered a cauliflower growth springing from the left side of the cervix, with extension of the malignant process to the vaginal wall and broad ligament. She was at once sent

to the Boston City Hospital, where she delivered herself of a 6-lb. living child after a short normal labor.

There was no abnormal hemorrhage after the birth of either the child or the placenta. Her temperature after delivery was 102, but gradually dropped to normal during the first few days of the convalescence.

Mother and baby were discharged well on the twentieth day. Examination by Dr. Friedman at this time showed very extensive malignant disease of the cervix, involving both broad ligaments.

CASE V. Entered the Boston Lying-in Hospital Aug. 12, 1906. Service of Dr. Swain. Age, forty-two. IV gravida. Previous labors normal; last in 1904.

The patient had been in labor about six hours on entrance, and the membranes had ruptured eighteen hours before labor began. The contractions were feeble but regular. Abdominal examination revealed a pregnancy at term, with a large baby in the O. L. A. position. The fetal heart was 160, regular and strong.

On vaginal examination there was discovered a malignant process on the left side of the cervix, involving slightly the left broad ligament. The os admitted only a finger tip. There was very little hemorrhage, so the patient was allowed to go on in labor, and made steady although slow progress. After she had been in labor about sixteen hours the fetal heart suddenly rose to 186 and became extremely feeble.

Dr. Swain was notified, and came at once to the hospital. Preparations were made for immediate delivery. The os was found to be two thirds dilated; the cord pulseless. Under ether, dilatation was quickly completed and the patient delivered by internal podalic version of a 10-lb. child which could not be resuscitated. Following delivery there was considerable bleeding and the placenta was extracted manually, after which, except for a slight ooze from the cervix, there was no further trouble.

The patient made an excellent convalescence, flowing only a little, and was discharged on the fourteenth day. The cancer was found at the final examination to have grown rapidly during the puerperium and the left broad ligament had become densely infiltrated.

CASE VI. Entered the Boston Lying-in Hospital Oct. 29, 1908, on the service of Dr. Newell. Age, thirty-three. IV gravida. Previous labors normal.

Throughout the entire pregnancy the patient had had periods of flowing, occurring nearly every month, which she had ascribed to menstruation, although knowing herself to be pregnant. Labor began at term and was accompanied by considerable flowing. After seven hours in labor the patient entered the hospital and was seen by Dr. Newell, who found an inoperable carcinoma of the cervix, extending to the vaginal walls and involving both broad ligaments, bladder and rectum. The os was dilated to about two inches. The fetus was alive, and presented by the vertex, O. L. A.

Under ether, dilatation was completed manually, without laceration or hemorrhage, and the patient was delivered of an 8-lb. living child by internal podalic version. The uterus contracted poorly, and after removing the placenta it was packed, and all bleeding was then controlled. The patient made an afebrile convalescence, and, with her baby, was discharged on the fourteenth day. The growth extended rapidly during the puerperium.

CASE VII. Entered the Boston City Hospital, May 6, 1908. Thirty-four years old. VII gravida. Previous labors normal.

During the entire pregnancy she had flowed slightly at intervals of not more than a week, a few days each time. On the morning of May 6, labor began, and in the evening she was delivered by version outside the

hospital, and sent in by her physician for hemorrhage. She was seen by Dr. Friedman, who found an extensive cauliflower growth involving both vaginal vaults and both broad ligaments. The hemorrhage had ceased. After running a temperature ranging from 101 to 102 for a week, which gradually came down to normal, she made a good convalescence and left the hospital with her child, which had been born alive and weighed 6 lb. 6 oz. at birth.

The frequency with which cancer of the cervix complicates pregnancy is estimated in the following table of statistics reported by different observers, and including 16,333 patients, delivered in the Boston Lying-in Hospital up to Jan. 1, 1909.

Author.	No. of Labors.	No. of Cancers.
v. Winckel,	20,000	10
Stratz,	17,832	7
Sutugin,	9,000	2
Glockner,	26,000	17
Orthmann,	4,028	6
Doederlein,	5,001	7
Sarvey,	2,287	4
Boston Lying-in Hospital,	16,333	4
	100,481	57

Thus it is seen that out of 100,481 pregnancies 57 were complicated with cancer of the cervix, or about one in every 1,762.

I have been able to find 605 cases reported in the literature, 446 of these having been published since 1886.

The frequency with which pregnancy complicates cancer of the cervix, I have attempted to estimate by the following table, which includes 3 pregnancies among 250 cases of cancer of the cervix on the gynecological service of the Boston City Hospital.

Author.	No. of Cancers.	No. Pregnant.
Stratz,	1,034	12
Olshausen,	479	12
Pfannenstiel,	282	7
Glockner,	974	17
Hensius,	327	1
Orthmann,	116	6
Wertheim,	600	6
Boston City Hospital,	250	3
	4,062	64

From this it appears that pregnancy was met with about once in every 63.5 cases.

As would be expected, cancer being most frequent between the ages of thirty-five and fifty, and pregnancy between twenty and thirty-five, the complication of the two is most common on the borderline between these periods, and we find that out of 200 cases in which the age was stated, 133, or 66½%, were between thirty and forty.

But the complication may be met with even earlier, 27½% occurring at or before thirty, and 7 were under twenty-five. Case IV of our series, twenty-one years old, is the youngest to be found in the literature.

The complication appears almost to be confined to patients who have already borne children, as in the entire literature I have been able

to find only eight reported cases in primigravidæ, those of Döderlein, Olshausen, Outrepoint, MacDonald, Bar, Russell, Bernady and Lepage.

The influence of cancer on conception has been the subject of considerable dispute. Cohnstein believed that not only was cancer of the cervix compatible with conception, but that it actually predisposed to it. The opposite view has been taken by other writers.

That conception is possible, at least in certain cases, was conclusively demonstrated by Case II, as well as by similar ones reported by Varnier, Leinzinger, Carstens, Spencer, Montgomery, Cohnstein, Gonner, Frommel, Wellponer, Savory, Bourgeois, Spathe, Mauriceau, and Boivin and Dugès, in which the carcinoma had been recognized before the occurrence of conception. In several of these, some palliative operation (amputation of the cervix, curettage or cauterization) had previously been performed. Presumptive evidence also in favor of the view that conception may take place in spite of cancer of the cervix is furnished, first, by cases in which the duration of the symptoms is longer than the period of gestation, and, secondly, by the occurrence of early pregnancy associated with advanced cancer. It may be definitely stated, therefore, that even extensive carcinoma of the cervix does not make pregnancy an impossibility.

As to the frequency with which conception takes place with a pre-existing neoplasm of the cervix, Cohnstein, estimating the duration of the malignant process by the length of time during which the patient had experienced symptoms, concluded that in at least 17% of his cases the cancer had antedated the pregnancy, while Sarwey believes that it does so in the vast majority of cases.

That cancer in any way favors conception there has been no proof, and there seems to be no reason why it should. According to Winter, the factors which tend to prevent conception are general weakness from cachexia, distortion of the cervical canal, chemical changes in the cervical secretion (Hofmeier) and changes in the endometrium. If these factors are absent or only slightly marked, conception is possible. If one or more of them exists in a marked degree it becomes impossible. In estimating the effect of the neoplasm on pregnancy, the older statistics are of greater value than later ones, having been collected at a period when, radical operations not being done, pregnancy was allowed to go on to term if it would. In the cases collected by Bar, excluding those in which miscarriage was induced, or followed operative procedures on the cervix, 109 went to term, 2 overtime, and in 28 pregnancy terminated prematurely. In other words, miscarriage or premature labor occurred in about twenty per cent. Bar is usually quoted as giving this percentage as 33, but this figure includes those patients in whom miscarriage was induced, or followed attempts at removal of the growth, manifestly giving an

erroneous estimate of its frequency under natural conditions.

The factors which predispose to interruption of pregnancy, according to Sarwey, are anemia, loss of strength, associated inflammatory process in the endometrium, extension of the disease to the mucous membrane of the body, and infiltration of the lower segment. A phenomenon which sometimes occurs is that of missed labor. At or about term there is the onset of more or less feeble, irregular uterine contractions, which produce no dilatation. These persist for a longer or shorter time, become weaker and finally stop. Missed labor is followed by the death of the fetus, which is retained until the mother dies or delivery is effected by artificial means. The most remarkable case was that of Menzies, in which missed labor occurred at term, and pains continued at intervals until the patient's death, seventeen (lunar) months from the date of conception. At autopsy, the fetus was found to be mummified, and all the liquor absorbed. Other cases have been reported by Oldham, Pfannkuch, Miller, Playfair, Chantreuil, Lieven, Beigel, Labhardt and E. Fränkel. When labor does occur at term the contractions are, as a rule, weak and ineffectual, and labor is likely to be prolonged. The three cardinal dangers are from sepsis, hemorrhage and rupture of the uterus.

The influence of carcinoma of the cervix on labor will be more fully discussed under the head of treatment.

The influence of pregnancy on carcinoma is generally believed to favor a rapid development of the neoplasm. Pinard and Varnier are almost alone in dissenting from this opinion, basing their claims upon the occurrence of cases where carcinoma having been diagnosed during one pregnancy, the patient later became pregnant again, such cases having been reported by Pinard, Varnier, Bourgeois and Savory. The vast majority of observations, however, show that carcinoma spreads with great rapidity during pregnancy. Among them may be quoted the classical experiment of Zweifel, who, putting a suture into the edge of the carcinomatous area in the vaginal vault, found that in two weeks the process had extended two fingers' breadths beyond it. Simpson saw in three months a cancer invade the entire cervix, the rectum and bladder. Galabin described one, beginning at the fifth month of pregnancy, which had become inoperable at term; Constantino a case considered operable at five months, dead of cachexia at seven. In the face of these and many similar observations, the cases of Pinard and the others must be considered as merely instances of a slow-growing type of carcinoma.

Cohnstein tried to distinguish between cancers arising during pregnancy and those which had existed previously, and stated that the former grew more rapidly, but other authorities have been unable to confirm his observations. Therefore, we may say, on the strength of the vast majority of reported cases, that cancer of the

cervix grows with increased rapidity during pregnancy. This is due to increased vascularity, to increased activity in the tissues dependent upon pregnancy, to dilatation of the lymphatic system, and partly to the comparative youth of the patients. Observations also show that this rapidity of growth continues during the puerperium (*vide* Cases IV, V and VI).

The symptoms of cancer of the cervix during pregnancy differ only quantitatively from those in the non-pregnant. The chief symptom is hemorrhage, which is aggravated by the vascular condition of the tissues. As in the non-gravid uterus, it may take the form of irregular periods, constant flowing or occasional severe hemorrhages. It is almost never slight in amount, however. Vaginal discharge other than hemorrhage, curiously enough, does not seem, according to the statements of the majority of observers, to be especially affected by pregnancy. Pain, on the contrary, is more marked, and begins earlier. It is not uncommon for dull or sharp, irregular, transitory pain in the lower abdomen to be one of the first symptoms, and it usually recurs at intervals throughout the entire pregnancy. Vesical and rectal symptoms occur when either organ is invaded, and, as the march of the growth is more rapid during pregnancy, they occur earlier. Owing to the greater demands on the system, and the more rapid strides of the disease, cachexia is met with more commonly, and is more pronounced than in the non-gravid.

The diagnosis of carcinoma of the cervix arising during pregnancy should not be difficult, providing the patient seeks advice. In the first two or three months, unfortunately, the hemorrhage is too often mistaken for an irregular period, and no attempt is made to see a physician until the hemorrhages have become severe. In the later months of pregnancy, however, the patient is more likely to seek advice promptly upon the appearance of unusual bleeding. When pregnancy develops in a pre-existing carcinoma, the increased severity or the earlier onset of the symptoms often leads the patient to consult a physician sooner than she otherwise would. If the practitioner makes it a rule to investigate thoroughly any unusual hemorrhage or discharge from the genital tract, especially during pregnancy, the condition should usually be easily recognized. The conditions for which it is most likely to be mistaken are placenta previa, miscarriage and perhaps hydatidiform mole. The diagnosis in any case must be made by vaginal examination, which should always include inspection of the cervix through a speculum. In advanced cases the characteristic cauliflower growth, irregular and indurated, presents a marked contrast to the usual soft, velvety cervix of pregnancy. Early in the disease the diagnosis is more difficult, and necessitates the histological examination of sections taken from any indurated, eroded or vegetative areas which may be disclosed upon inspection. The diagnosis of pregnancy in a case of cancer of the cervix is impossible before

the end of the third month, as up to that time the uterus is no larger than it may be in an uncomplicated carcinoma.

The prognosis of carcinoma during pregnancy, as a result of the increased rapidity of the growth, is naturally rendered even more grave than in the non-gravid. This is partially offset, however, by the greater promptness of the patient in seeking advice during pregnancy. That it is by no means hopeless is shown by the number of cases which have remained well for several years after a radical operation.

The subject of treatment naturally resolves into the consideration of the operable and the inoperable cases. Up to about 1880, practically all cases were simply allowed to go on to term, and, if spontaneous delivery was not accomplished after a long period in labor, they were delivered by artificial means. In a few cases amputation or cauterization of the cervix was resorted to, more in the hope of facilitating delivery than of effecting a cure of the disease. Although vaginal hysterectomy had been performed for carcinoma sporadically for over three centuries, it was not until after the description of Freund's method of abdominal hysterectomy, in 1878, and the unfavorable reports of those who tried it in the succeeding years, that vaginal hysterectomy became popularized. Bar, in his thesis, written in 1886, does not mention a single case in which it was performed on a pregnant uterus. The earliest cases which I have been able to find are those of Kottbus and Greig Smith, both published in 1887.

The first Cæsarean section followed by abdominal hysterectomy for carcinoma was performed by Gonner in 1879, and the first deliberate hysterectomy by Freund's method on a pregnant uterus by Spencer Wells, in 1881.

Excluding such operations as high amputation of the cervix as palliative, in spite of the brilliant results of Spencer, we have at the present day the choice of the following methods for the removal of the cancerous pregnant uterus.

1. Vaginal hysterectomy.
2. Cæsarean section, followed by abdominal hysterectomy, after Freund or Wertheim.
3. Abdominal hysterectomy after Freund or Wertheim.
4. Cæsarean section, followed by supravaginal hysterectomy and removal of the stump through the vagina (Fehling, Zweifel).
5. Cæsarean section followed by vaginal hysterectomy (Olshausen).
6. Combined hysterectomy after Mackenrodt.

That the immediate removal of a uterus, the seat of a cancer which is operable without regard to pregnancy, offers the only hope of a cure is agreed by practically all gynecologists and obstetricians, except those of France. The attitude of the latter is admirably summed up in the words of Bouilly, "*Une femme enceinte qui a un cancer de l'utérus, est perdue, quelle que soit la conduite que l'on tiendra.*" Acting upon this belief, the school of Lyon alone dissenting, they advocate awaiting the end of pregnancy and

delivering by Cæsarean section in the interests of the child, followed by a Porro, or, if there still seems a chance for cure, a complete, hysterectomy.

In a case first seen just before the period of viability, the question must arise whether one is justified in waiting a few weeks before operation in the interest of the child. With the experiment of Zweifel in mind, and the knowledge that the child obtained will be, at best, premature and feeble, together with the fact that the patient almost always will have other children living, it must be concluded that such delay is not justifiable. Of course, the Roman Catholic belief must be respected, and one may delay operation on that account.

The choice of the various methods of radical operation and the technic of their performance must vary with the period of pregnancy. In the first half of gestation, only vaginal and abdominal hysterectomy need be considered.

There have been reported, in all, 59 vaginal hysterectomies performed before the fifth month, in four of which the uterus was emptied before being removed. Out of the number there was one death from sepsis and one from anemia, the latter being practically moribund before operation. Twenty-eight are known to have recurred. Two cases, those of Landau and Winter, were reported well after thirteen and eight years, respectively, and 18 were reported well from one to four years after operation. Nineteen were operated upon by one of the abdominal methods. There were two deaths, one at the hands of Wertheim himself. In the other, the uterus was opened and emptied before being removed, and there was also an injury to the bladder. Four cases recurred, three after a Wertheim operation and one after a combined vagino-abdominal hysterectomy. Three done by Wertheim's method were well when seen one to two and a half years afterward.

In the second half of pregnancy the greater size of the uterus, and, in the last two months, the interest of the child, have resulted in the invention of a number of different methods. In general, these may be considered under the heads of vaginal, abdominal, and combined. Vaginal hysterectomy in the second half of pregnancy necessitates the preliminary delivery of the child. Previous to 1895, when Acconci performed the first vaginal Cæsarean section upon a carcinomatous uterus, delivery was effected either after forcible dilatation or deep cervical incisions, or by the induction of labor with bougies or bags. The latter procedure has little to recommend it. The results have certainly been good, seven reported cases without maternal mortality; nevertheless, the loss of valuable time and the increased opportunity for infection serve to condemn it as unsurgical. Forcible dilatation has been rarely used, where it has been intended to remove the uterus, merely because delivery can be more quickly affected by other means. Deep cervical incisions were merely the progenitor of vaginal Cæsarean sec-

tion, and their use has been abandoned for the performance of the latter.

Vaginal Cæsarean section appears to its best advantage when performed for carcinoma with the intention of removing the uterus. The chief objection to it, of extension of the incisions in delivery, can be disregarded, and the danger of uterine rupture in subsequent pregnancies is absent under these circumstances. I have been able to find reported 53 vaginal Cæsarean sections followed by vaginal hysterectomy, with four maternal deaths. The fetal mortality in the last two months of pregnancy was 34%; but taking only the cases operated at term, 16 $\frac{2}{3}$ %. Sufficient time has not yet elapsed for a final determination of the end results of this procedure, but out of 12 patients whose condition one year after operation is known, 8 have suffered recurrences. Four have remained well from sixteen to thirty-three months. Cæsarean section, followed by abdominal hysterectomy, was performed 46 times, with 32 deaths up to 1896. Since that time, out of 24 cases there have been only 4 deaths. In the latter series all the children were born alive except two, which were macerated, but four perished within a few days from prematurity or inanition. Abdominal hysterectomy, which is the method of choice before the fetus is viable, has been performed fifteen times, with one death.

The end results of abdominal hysterectomy in the second half of pregnancy, by means of the earlier procedures, were far from satisfactory. Out of 10 cases, in which the final result of abdominal hysterectomy without excision of the parametrium or dissection of the glands is known, 8 have recurred. One was well at the end of a year, and another after three years. The Wertheim operation is still of too recent introduction for a final determination of its value, but Wertheim has reported cases well five and three years after operation; Wertheim and Stone, a case each well after one year. Fochier and Commandeur alone have reported a recurrence. Cæsarean section and supravaginal hysterectomy, followed by removal of the cervix through the vagina, was advocated by Zweifel in 1892 and Fehling in 1897, with the idea that a more complete removal of the growth involving the vaginal walls could be obtained in this way. There have been reported 11 cases in which it was performed, with 4 maternal deaths. Of the 7 surviving, the ultimate result is known in 5, and of these 4 recurred, while 1, operated by Zweifel himself, remained well when seen over seven years afterward. Cæsarean section followed by vaginal hysterectomy, as recommended by Olshausen, has been reported only twice, with two recoveries, in neither of which was a recurrence present at the end of two years. Combined hysterectomy, after Mackenrodt, has been performed during pregnancy five times without a maternal death. In one case it was combined with Cæsarean section with the birth of a living baby, and in the other four it was done before the period of viability. The

end result is known in only two cases which promptly recurred. Thirty-four patients have been operated upon within the first month following term labor, or spontaneous or induced miscarriage, 29 times by the vaginal route without mortality, 3 times by the combined route with one death (from sepsis in a case performed twenty-four hours after delivery), and once, successfully, by the abdominal route. The end results of the abdominal and combined operations are not stated. Of the vaginal hysterectomies, 13 were performed at term with 7 recurrences; 3 remaining well eight and three-fourths years (v. Ott), five and three-fourths years (Olshausen), and one year (Bernius); and 3 unknown. Eight performed after miscarriage resulted in only two known recurrences; 6 remaining well over periods of eight years (Glockner, Theilhaber and Winter), seven and one-half years (Olshausen), three and one-half years (Mackenrodt), and two and one-half years (Olshausen).

To summarize: Taking the entire number of cases operated upon during pregnancy, vaginal hysterectomy was performed 112 times with an immediate mortality of 5.3%. The ultimate results, so far as known, 60 cases, show 3.3% well over five years, no return of the disease in from one to five years in 36.6%, and recurrence in 60%. Abdominal hysterectomies can be best discussed by considering separately those done after Wertheim's method and those by less radical procedures. Of the latter, excluding those performed prior to 1896, I have found 25 reported, out of which there were 6 deaths, 24% mortality. The end result was known in 11 cases, in which 2 were well after one and three years respectively, while 9, or 87%, suffered from recurrence.

After the Wertheim operation, on the other hand, which was performed 33 times, there was only one death. The time is still too short since its introduction to determine the end results in a large series. Out of 11 cases, however, 1, reported by Wertheim himself, was well five years later, and 6 more were free from recurrence when seen after from one to three years, making 63.6% presenting no sign of return a year or more after operation. The method of Fehling and Zweifel on theoretical grounds has the disadvantages of increasing the danger of infection and cell implantation, and of being complicated. The mortality of 36.3% and the end result of 80% of recurrences certainly bear out the theoretical objections. The results of Mackenrodt's operation in the few cases in which it has been tried are not such as to warrant great expectations from its use.

Abdominal Cæsarean section followed by vaginal hysterectomy has not been performed a sufficient number of times upon which to form any opinion from a practical standpoint. Theoretically, it should give no better prognosis for the mother than vaginal Cæsarean section followed by vaginal hysterectomy, and no better for the child, and not so good for the mother,

as Cæsarean section followed by Wertheim's operation. The weight of evidence in the comparatively small number of cases yet recorded is thus strongly in favor of the Wertheim operation, preceded by Cæsarean section if the child is viable. It has had the lowest primary mortality and has been followed by the smallest number of recurrences. Cæsarean section, of course, offers the best prognosis for the child.

The other abdominal methods have given results poorer, not only than Wertheim's operation, but also than vaginal hysterectomy, both in immediate mortality and final outcome. The various combined methods have been tried only in a few cases and with unsatisfactory results.

The general question of vaginal versus abdominal removal of the uterus for cancer is still under dispute, and the final decision of this must of necessity influence the treatment of cancer of the cervix during pregnancy. That the condition is by no means so hopeless with either method of treatment, as claimed by Bouilly and others, is, I think, apparent, and with earlier diagnosis and improvement in technic even better results may be expected.

In taking up the consideration of the treatment of inoperable cases, let us first go back to the much-quoted statistics of Bar, and, remembering the conditions under which they were produced, analyze them. Out of 33 spontaneous deliveries at term, he found 9 maternal deaths. Excluding four macerated feti he found a fetal mortality in 27 cases, in which the data was given, of 30%. Of the 9 mothers who died, sepsis was the cause in 5, rupture of the uterus in 2, cachexia and eclampsia in 1 each. In not one of these 9 was the duration of labor less than twenty-four hours. Similarly, in the cases with stillborn babies, it had lasted in each from one to six days. Bar also collected 5 cases dying undelivered in labor, 1 from hemorrhage, 2 each from rupture of the uterus and sepsis. Of the cases of rupture, 1 occurred during the fourth pain, the other after twelve hours in labor. The 2 dying of infection had been in labor two and five days respectively. In 32 forceps deliveries he found 9 maternal deaths, 7 from sepsis, 1 from shock and 1 from cachexia, and a fetal mortality of 25%, excluding macerated children. With version, even worse results were obtained. In 16 cases there were 7 maternal deaths and not a single baby was born alive. Six cases necessitated destructive operations with five deaths. The statistics covered a period during which the method of conducting labor was to allow it to continue indefinitely, unless some urgent reason arose to terminate it, often after several days. They were also collected before the days of asepsis. It is not, therefore, to be wondered at that the prognosis was considered to be very gloomy for both mother and child.

Noble, in the next ten years, representing the early period of asepsis, was able to collect 66 cases delivered through the vagina with only 9 maternal deaths. During the same period there

were performed 24 conservative Cæsarean sections, among which there were only 7 recoveries, and 9 Porro operations, 5 of which were successful. Since 1896, including the cases cited here for the first time, I have found 31 delivered through the vagina, with a maternal mortality of 13% and fetal of 38%; 10 conservative Cæsareans with 2 deaths; and 12 Porros with 7 deaths. The fetal mortality of the cases delivered abdominally was zero.

From the consideration of these statistics, it may be concluded that, under modern conditions in inoperable cancer of the cervix, given a fetus at term and alive *in utero*, the best procedure is that of conservative Cæsarean section, before the onset of labor, in the interest of the child.

The Porro operation can be unreservedly condemned. Far from decreasing the liability to sepsis by removing the uterus, it increases the danger by bringing the growth into closer relationship with the peritoneal cavity.

When the child is apparently dead, as is frequently the case, or where labor begins prematurely, labor should be allowed to proceed as long as there is progress and then completed, if necessary, by artificial means.

It has been the experience of obstetricians who have delivered patients with inoperable cancer of the cervix that manual dilatation is not particularly difficult. It is easier when there is only a part of the cervix involved, leaving considerable normal muscle.

It is probable that inertia of the uterus plays a greater part in prolonging labor than cervical rigidity, for if the pains were of normal strength the friable tissue would tear and allow the passage of the fetus.

The choice of artificial methods of dilatation favors either the use of bags or manual dilatation. Vaginal Cæsarean section is impracticable where there is extensive involvement of the cervix, because of the anatomical difficulties of the operation and the danger of hemorrhage. When the cervix is very hard or very friable, deep incisions after Dührssen's method may result in more symmetrical and consequently less extensive laceration.

CONCLUSIONS.

1. Cancer of the cervix does not prevent conception, and in a large percentage of cases antedates the pregnancy.
2. Cancer of the cervix, as a rule, grows with great rapidity during pregnancy and the puerperium.
3. While the prognosis of cancer of the cervix is more grave during pregnancy, it is not hopeless.
4. When an operable cancer of the cervix is discovered during pregnancy, no matter at what period, immediate operation is indicated.
5. Up to the present time statistics favor the Wertheim operation, preceded by Cæsarean section if the child is viable.
6. In inoperable cancer with a living child at term, conservative Cæsarean section is the

method of choice. If the child is dead, or premature, a subpubic delivery will give the best result.

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THE CLASSIFICATION OF THE MALARIAL PLASMODIA.*

BY CHARLES F. CRAIG, M.D.,
 Captain, Medical Corps, United States Army.

FROM the discovery by Laveran of the malarial plasmodia to the present time, much attention has been devoted by zoölogists to the classification of these parasites, and many differing opinions have been advanced concerning their exact zoölogical position, and their division into genera and species. Laveran, believing in the unity of all malarial plasmodia, proposed the name "*Oscillaria malariae*" for the parasite infesting man, but later accepted Osler's name of "*Hematozoon*." In 1887, Metchnikoff placed these organisms among the *Sporozoa*, and proposed the name "*Hematophyllum malariae*" for the malarial parasite of man. Danilewsky created a division in the *sporozoa* which he called the *hemosporidia*, and in this division placed the malarial plasmodia. The genus *plasmodium* was created by Marchiafava and Celli, in 1885, and while, from a biological standpoint, the name is unfortunate, the law of priority in nomenclature requires that it be retained and that the parasites of malaria described as infesting man be all placed in this genus. Therefore, at the present time, it is conceded by all zoölogists that the parasites causing the malarial fevers of man belong to the Protozoa; order *Sporozoa*; sub-order, *Hemosporidia*, and genus, *Plasmodium*.

Although there is now no disagreement among investigators regarding the generic position of malarial plasmodia, there is still much uncertainty regarding the division of the parasites into species. Laveran and his followers believed that the parasite producing malaria in man is a polymorphous organism, varying very greatly in morphology under different conditions of environment, and that, as Laveran says, "There does not exist a constant relation between the forms under which the hematozoa appear in the blood and the clinical manifestations of paludism; one can only say that certain forms of the parasite are more often seen in certain cases, the crescents, for instance, in relapses, and in malarial cachexia." Some of Laveran's followers even claim to have observed interchangeability of the various species which have been described, but their observations still await confirmation.

The existence of distinct species of plasmodia associated with equally distinct types of malarial fever has been abundantly demonstrated by many careful observers, and the work of Marchia-

fava and Bignami, Celli, Grassi and others, has resulted in the separation of several species of malarial plasmodia, differing in their morphology and life-history, as well as in the effects which they produce in man when blood containing them is inoculated directly or through the bite of infected mosquitoes. The great weight of evidence to-day, both morphological and experimental, is in favor of the existence of at least three species of malarial plasmodia, the tertian, quartan and estivo-autumnal, and these species have been accepted by nearly every investigator of the malarial fevers, although considerable uncertainty exists regarding the plasmodia causing the estivo-autumnal fevers, which have been placed by many observers in one species, while others believe that two species are concerned in the etiology of these fevers. The Italian authorities, together with nearly every investigator who has studied malaria in the tropics, have subdivided the estivo-autumnal plasmodia into at least two species, the quotidian and the tertian, and much has been written regarding the differentiation of these species and their specific characteristics. Some authorities believe in the existence of a pigmented and unpigmented quotidian plasmodium, and thus divide the estivo-autumnal plasmodia into three species, the tertian, and the pigmented and unpigmented quotidian plasmodia.

Personally I have no hesitation in stating that the estivo-autumnal plasmodia are divided into two distinct varieties: one, the tertian, being the type species; while the other, the quotidian, is a subspecies of the former. I have seen no evidence which leads me to believe in the existence of an unpigmented quotidian species, although I have examined the blood of thousands of patients suffering from estivo-autumnal infections.

Before suggesting a new classification of the malarial plasmodia, which is the purpose of this paper, several of the classifications proposed for these parasites will be briefly considered, as they have all been adopted at various times, and many are still adhered to by writers upon these fevers.

Grassi and Feletti's classification.—These authors placed all of the malarial parasites in two genera, *Hemameba* and *Laverania*. In the genus *Hemameba* they mention four species of malarial parasites as occurring in man: *Hemameba malariae* (quartan), *Hemameba vivax* (tertian), *Hemameba precox* (pernicious), and *Hemameba immaculata* (pernicious).

In the genus *Laverania*, they placed the crescentic parasites, giving them the specific name "*Laverania malariae*," but in this case neither the generic or specific name can stand, as both were founded upon the belief that the crescents were a distinct species of plasmodium.

Mannaberg's classification.—Mannaberg divides the malarial plasmodia as follows:

1. Malarial parasites that sporulate, but do not form *syzygies* (crescents).

(a) Quartan plasmodium. (b) Tertian plasmodium.

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