THE ROENTGEN RAY AS AN ADJUNCT IN OBSTETRIC DIAGNOSIS*

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THIS study was undertaken with the object of reviewing and evaluating the use of the roentgen ray in obstetrics in general and more particularly in abnormal conditions during pregnancy. A great deal of excellent work has been done in this field yet I believe that radiography is insufficiently employed in obstetric and gynecologic diagnosis. To contribute our experiences and results and to stimulate those of you who teach and practice obstetrics to make more use of this very important adjunct is my only excuse for presenting "just another paper" on this subject.

That the science of roentgenology enters into and cannot be disassociated from the practice of internal medicine and surgery is a universally accepted fact. That it should be the same in the practice of obstetrics and gynecology is conceded but not generally practiced. The difficulty, up to now, undoubtedly has been due largely to inadequate equipment, fear of injury to the fetus and general ignorance of the value of roentgenology in obstetrics. However, the time is not far distant, if indeed, it is not now upon us, when roentgenology and obstetrics and gynecology must be more intimately associated. This can and will be done provided the roentgenologist and obstetrician work together harmoniously. This will not be difficult for the roentgenologist is always, both by instinct and training, cooperative and consequently there should be no difficulty in developing the proper "teamwork." The obstetrician must take the lead and exhibit the proper amount of enthusiasm, for certainly the roentgenologist cannot be expected to know when roentgenography is indicated in a given obstetric case. It would seem therefore that the future of this very important help in better diagnosis is entirely in the hands of the obstetrician. Do not misunderstand and think for a moment that the x-ray can or should supplant any of our methods of obstetric diagnosis. It should be looked upon only as an adjunct.

In view of our present-day knowledge, the roentgenologist and the obstetrician who understand their problems may proceed without fear of doing harm to the fetus, regardless of the stage of its development. Meticulous care in the exposure at any one sitting is most important. It has been estimated that the usual amount of radiation involved in

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the making of a film of the pregnant uterus is equal to 1/50 of an erythema dose. (Hickey.) Another method of estimating a safe amount of exposure has been figured out for me by Dr. A. L. L. Bell, Radiologist at the Long Island College Hospital and is as follows: with 88 K.V., 30 M. A. and 1 mm. aluminum filter it takes only 23.5 seconds to give the same depth dosage as is obtained with 118 K.V., 3 M. A., and 3 mm. aluminum filter in 2 minutes. We know that the standard for maximum exposure is that amount of radiation which will produce biologic effects. It is also known that 25 radio units (international) will produce such changes in the ovary of the adult. A 23.5 seconds exposure, using 5 inch gap, 30 M. A. and 1 mm. aluminum filter at 10 inch skin distance results in a depth dose of 25 radio units, therefore to be reasonably certain that no biologic effects are produced on the fetus in utero this "dose" should be cut at least in half and preferably more. This means that on the basis of one-half of this "dose" and assuming a 3 second exposure, only three or four films at one sitting could be safely made. Furthermore the effects of x-radiation on tissue in general is exhausted in about three weeks and hence we feel safe in exposing the fetus in utero several times during a given pregnancy, provided the time is properly spaced. With this evidence at hand it at once becomes apparent that such "dosage" is absolutely safe as far as danger to the fetus is concerned. Several investigators, including Warnekros of Dresden, have taken numerous consecutive roentgenograms (18 exposures) of the mechanism of labor, more particularly during the actual delivery, and have noted no ill effects upon the child. I cannot think of a single instance where more than 4 to 6 roentgenograms need be taken during a given pregnancy and certainly this number is within safe limits.

We have taken roentgenograms of 306 pregnant women, a few of which have been radiographed from 4 to 6 times, the average being 2, totaling over 600 films, and we have not seen any abnormalities in the children attributable to the x-rays. Many of the children have been followed up for five years in the pediatric clinic at the Long Island College Hospital and the Methodist Episcopal Hospital and in private practice. Those skeptics who are continually crying out against the diagnostic use of the x-ray in obstetrics should remember these facts. Furthermore, they should remember that all of the proved cases of fetal malformations attributable to irradiation have been in those cases treated with therapeutic doses of x-ray or radium for certain pathologic lesions (uterine bleeding, fibroids, cancer, etc.) and naturally such cases should not be confounded with the type under consideration. We feel sure that no pregnancy, regardless of its stage of development, is damaged by diagnostic roentgenology properly carried out.

Professor Roentgen discovered the x-ray in 1895. In reviewing the literature since that time one finds that the roentgen rays, although rather sporadically, have been used as an adjunct in obstetric diagnosis. Why such a valuable addition to our diagnostic armamentarium has not been more universally used by the obstetrician, as it has been by the surgeon and internist, is difficult to explain. It may be said, however, that obstetrics, during the past twenty-five years, has not made the same outstanding and far-reaching advances as an art that medicine and surgery have. Furthermore, be it remembered that, twenty-five years ago and even today in certain communities throughout our country, almost any person may practice "so-called obstetrics"; whereas to practice surgery one must have had some special training, or at least served an apprenticeship under a qualified surgeon, before "going out on his own." When the public demands this of their obstetricians then the science and the art of obstetrics will have the recognition it well deserves. When this "comes to pass," and it will in a few more years, obstetric diagnosis will be placed on a higher plane and hence every available adjunct will be used for arriving at a proper diagnosis. We shall be doing pelvimetry and cepholometry after the method of Thoms or some modification of this method; diagnosing doubtful pregnancy; and finally when there is the slightest doubt regarding multiple pregnancy, the possible existence of fetal abnormality, faulty or doubtful presentation and position, death of the fetus or pseudocyesis, we shall make a positive diagnosis by means of the roentgen ray. The surgeon has made the x-ray an integral part of his diagnostic equipment and could not possibly continue his work without it. Today a surgeon could not expect to win a suit for malpractice, for example, if he had not employed the x-ray in making a correct diagnosis and carrying out the proper treatment. Tomorrow the obstetrician is likely to find himself in much the same position.

While the work to be presented in this paper does not include pelvimetry and fetal cephalometry, I think it most important and regret that we have been unable to do much with this phase of the subject. We expect to make a report, however, on this work some time in the future. The pelvic inlet can be measured by the x-ray, although up to now the methods in vogue have been so complicated that the average roentgenologist could not, or for the lack of time and proper cooperation, would not assist the obstetrician in carrying out the scheme. At present, however, with the less complicated method of Thoms, this procedure can be carried out without undue labor and loss of time. Furthermore, Thoms' method of measuring the important diameters of the fetal head in utero seems far more simple and practical than any other method heretofore proposed and bids fair to become of inestimable value to the obstetrician. Neither of these meth-

ods need be carried out routinely but in certain doubtful cases much of the guesswork of former years can be eliminated by the use of them singly or in combination.

For the past five years we have been using the roentgen ray in all our obstetric cases where there was any doubt as to the correct diagnosis. In the beginning our technic was faulty and hence we failed many times in obtaining a readable skiagram of the fetus in utero or perhaps of a given maternal pelvic deformity. Persistence, on the part of both the roentgenologist and the obstetrician, developed a better technic and hence a better photographic plate. It is only by such "team work" that this kind of diagnostic work can be carried on with success. Our endeavors have been limited to the diagnosis of the various uncertain conditions associated with the pregnant state.

The conditions in obstetrics for which the x-ray may be used as an adjunct in diagnosis are the following:

Group I.—Those relating to the maternal pelvis: (1) deformed pelves (all varieties); (2) pelvis measurements, especially the superior strait; (3) bony or calcified tumors of or in the pelvis; (4) separation of the pubic symphysis; (5) amount of healing after pubiotomy.

Group II.—Those relating to extrauterine pregnancy: (1) tubal pregnancy; (2) abdominal pregnancy.

Group III.—Those relating to intrauterine pregnancy: (1) diagnosis of pregnancy before other characteristic signs and symptoms appear—pneumoperitoneum method of Peterson—not so important now as we have the Zondek-Aschheim test which is positive in 98 per cent of the cases; (3) early diagnosis of pregnancy from the fourteenth to the twentieth week when for one reason or another a positive diagnosis cannot be made; (3) multiple pregnancy—twins, triplets, etc.; (4) presentation and position of fetus; (5) cephalometry; (6) death of the fetus; (7) monsters, anencephalus, hydrocephalus, double monsters, etc.; (8) spina bifida and other defects in the fetal skeleton; (9) syphilis of fetal bones; (10) hydatidiform mole (by exclusion); (11) fractures of the fetal bones and skull; (12) osteogenesis imperfecta; (13) illegitimate pregnancies where no examination can be made; (14) for the diagnosis of pregnancy, presentation, and position in very large fat women, 200 to 300 pounds; (15) before cesarean section to determine if the child is normally formed.

Group IV.—Those relating to pelvic tumors simulating pregnancy: (1) fibroid tumors of the uterus and pregnancy at or beyond the sixteenth week; (2) myomata uteri simulating pregnancy; (3) ovarian cysts, particularly dermoids.

Group V.—Miscellaneous conditions: (1) spontaneous version; (2) pseudocyesis; (3) mechanism of labor; (4) mode and method of separation of placenta (Warnekros); (5) lithopedian; (6) location of placenta; (7) proof of extrauterine life (Vogt).

Of the conditions enumerated in the preceding paragraphs, those in which we actually used the x-ray to complete or make more positive the diagnosis were the following: (1) early pregnancy fourteen to twenty weeks; (2) multiple pregnancy; (3) presentation and position; (4) hydatidiform mole (made by exclusion); (5) monsters especially anen-

cephalus; (6) fetal death; (7) spina bifida (cervical); (8) pregnancy, presentation, and position and abnormalities in very large fat women (one over 260 pounds); (9) previous to cesarean section to determine if the child is normal; (10) fibroids complicating possible pregnancy; (11) ovarian cysts mistaken for pregnancy; (12) abdominal pregnancy; (13) deformed pelves, without pelvimetry. In every one of these conditions there was some doubt about the correctness of the diagnosis as made by the usual methods in such cases (viz.: history, physical examination, laboratory data and clinical course). This seems

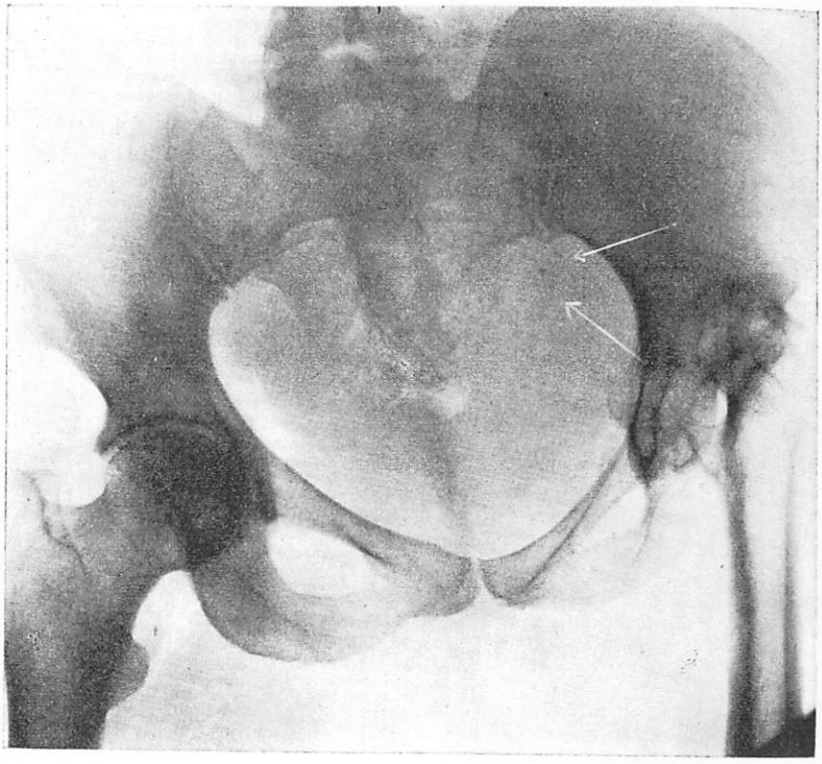


Fig. 1.—Mrs. F., No. 235. X-ray taken to ascertain type of deformity of pelvis. Obliquity due to ankylosis of left hip and adduction of thigh. Left oblique less than right oblique. Also shows early pregnancy of about fifteen weeks, which can be distinctly seen on the original x-ray plate at points indicated by arrows.

to me to be well worth while and highly desirable in any obstetric clinic, private or public.

The main factors which mitigate against positive roentgenograms, especially during the early months of pregnancy, are the thickness of the mother's abdominal and uterine walls; respiratory movements of the mother; the liquor amnii, which is radio-opaque; insufficient density of embryonic bones; later in pregnancy, the circulating blood in the uterus and placenta, which Bartholomew (1921) estimated absorbs about 60 per cent of the rays; and finally movements of the fetus

which blur or duplicate the film and thereby cast some doubt as to the true diagnosis. Because of the presence of these conditions the roentgenologist who wishes to succeed must devote considerable time and meticulous care in taking each film. Such work cannot be delegated to a technician unless well trained in the filming of the abdomen and pelvis during pregnancy. The Potter-Bucky diaphragm is of course absolutely essential and the best superspeed films obtainable are very important adjuncts in securing good roentgenograms.

TECHNIC[1]

Posturing (arranging the patient in the best position) is very essential although not as difficult as other items in technic because it is more controllable. Motion, such as respiration of the mother, is often difficult to control but patience brings its reward. We always take two films, one anteroposterior and one lateral exposure, because diagnostic phases not included in one position will usually be noted in the other and therefore a more correct opinion may be rendered. The following table gives the technic in detail:

All exposures to be taken on Bucky diaphragm.
Tube, 30 M. A., radiator type.
Film, duplitized safety contrast films, used with double screen (Eastman).
Anteroposterior and lateral exposures.
Measurements taken through the greatest diameter of the abdomen and expressed in inches. Lateral exposures are measured separately, and machine setting changed accordingly.
Gap is measured by the point gap method and read in inches.
Time factor is variable, particularly in the higher measurements.
Dark room technic, standard.

Size	*Gap*	*M. A.*	*Time*
6″	3 ″	30	4 sec.
7″	3½″	30	4 “
8″	4 ″	30	4 “
9″	4½″	30	6 “
10″	5 ″	30	8 “
12″	5 ″	30	12 “
14″	5 ″	30	12 “

In the diagnosis of early pregnancy (fourteen to twenty weeks), before the usual signs and symptoms permit of a positive diagnosis, the x-ray is of inestimable value. By its use we were able to make a positive diagnosis from fourteen to fifteen weeks in 15 per cent of our questionable cases, from sixteen to eighteen weeks in 75 per cent and from the eighteenth week to term in 100 per cent.

For example, a widow, forty-four years old with amenorrhea of six months' duration and who had had a diagnosis of a large soft fibroid tumor of the uterus, consulted Dr. G. H. Davis, a member of our staff, who thought she was pregnant, although the fetal heart could not be heard and no fetal movements had been felt by the patient. Since the woman had been a widow for eleven years she became highly indignant at the diagnosis of probable pregnancy, vehemently denying exposure. A roentgenogram revealed fetal bones indicating early pregnancy of about fourteen

[1]Outline of technic contributed by Dr. Geo. W. Cramp, Roentgenologist of the Methodist Episcopal Hospital of Brooklyn.

of fifteen weeks' duration. The woman then admitted exposure three and one-half months previous to the date of her visit to the doctor's office. Some weeks later she reported to her physician that she had had an abortion performed and was "well and happy."

Again a young primipara (Fig. 1) who had an ankylosed left hip resulting from an old suppurating condition, the nature of which she did not know, consulted her physician because she thought herself pregnant. According to the date of her marriage and last menstrual period she should not have been more than fourteen weeks pregnant. Upon examination she was found to be about three and one-half months

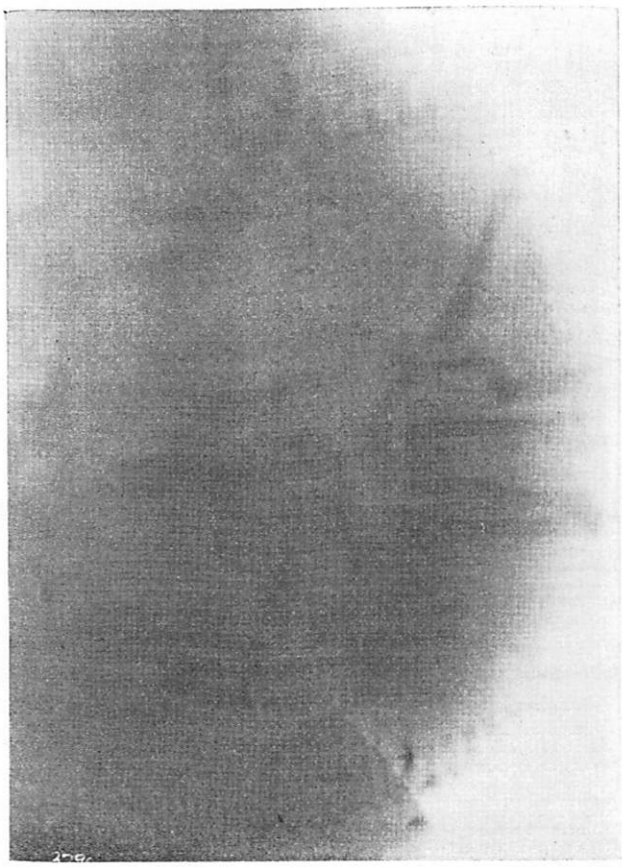


Fig. 2.—No. 3796, Mrs. T. Suspected twins, only one fetal heart heard. Roentgenogram in lateral position required to show twins.

pregnant. The question of her delivery then came up for consideration. A skiagram was taken of the pelvis and fortunately we obtained the desired information regarding the bony pelvis, fetal bones, proving the positive existence of early pregnancy.

These two cases are the earliest films of a fetal skeleton that we have obtained, the pregnancy being not more than fourteen to fifteen weeks' duration, and unless we can improve our present-day equipment and technic, I do not believe it is possible to obtain a readable

skiagram earlier than fourteen weeks and only a small percentage at this age. We took 18 roentgenograms of early pregnancy cases from the prenatal clinic at the Methodist Episcopal Hospital and private cases from eight to fourteen weeks, and in only 3 did we get a readable skiagram and these were from fourteen to fifteen weeks' duration.

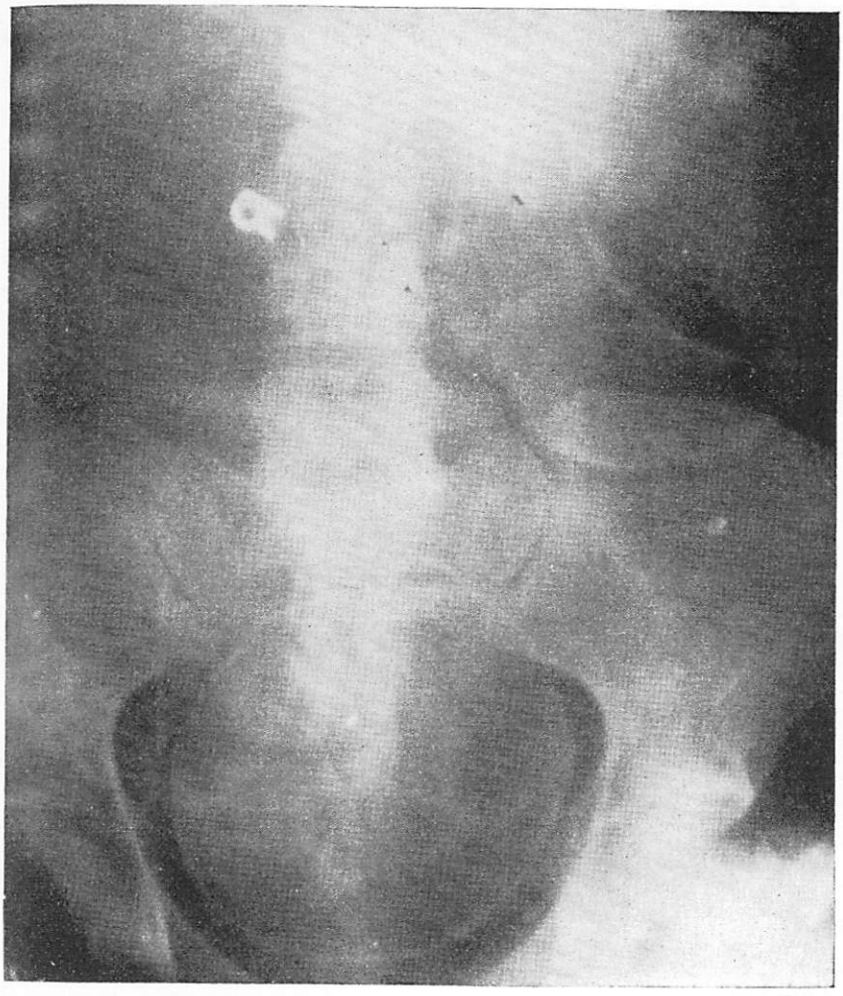
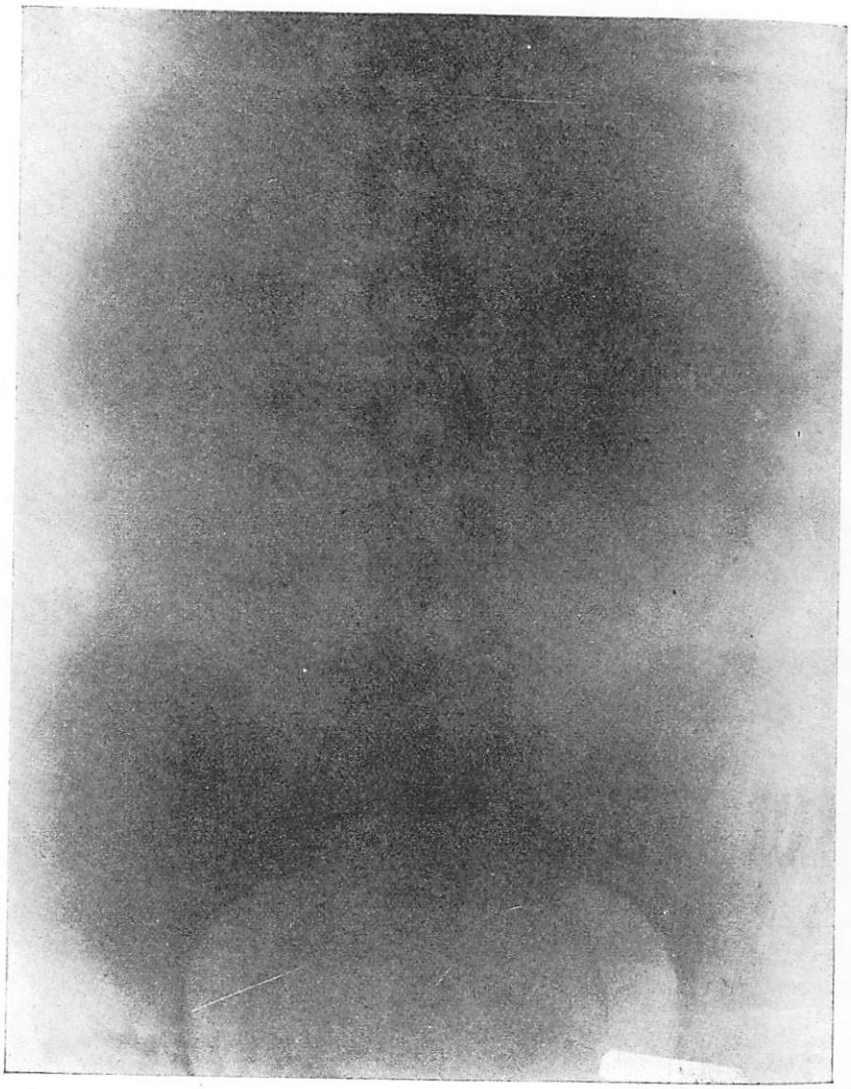


Fig. 3.—Mrs. G. B., x-ray diagnosis of triplets at seven months; delivered at eight and one-half months, all born alive.

In all other conditions associated with the pregnant state in which we employed the roentgen ray as an aid in diagnosis we found it most informative, either positively or negatively. It was probably employed more times for the diagnosis of multiple pregnancy than for any other condition (Figs. 2, 3, 4, and 5). For this it was always positive, since the question of multiple pregnancy does not usually come up for final decision until rather late in the pregnancy. In the

diagnosis of presentation and position one does not need the x-ray very often. Still we used it a number of times for the positive diagnosis of breech and occiput posterior positions particularly in very large fat women. Recently we used the x-ray to make a positive diag-



Figs. 4 and 5.—Mrs. M. G., No. 299. Twin pregnancy, showing value of routine anteroposterior and lateral exposures. Anterior film (Fig. 4) shows merely a head in the pelvis but the lateral film (Fig. 5) shows the other head in the upper abdomen.

nosis of pregnancy as against hydatidiform mole in the following case: a young duo-para was thought to have an hydatidiform mole. She gave a history of pregnancy of about five months' duration and many of the characteristic signs of vesicular mole were present, in-

cluding a vaginal discharge which had persisted for two months (dark and bloody, and sometimes bloody serous) but more recently there had been little if any discharge. There was no doubt about the diagnosis

Fig. 5.

when the skiagram showed a fetal skeleton with positive signs of fetal death. Labor was induced and she was delivered of a dead fetus followed by a large amount of bloody liquor amnii and clots, which

undoubtedly accounted for the uterus measuring seven months in height while the history and roentgenograms indicated only about five months' pregnancy.

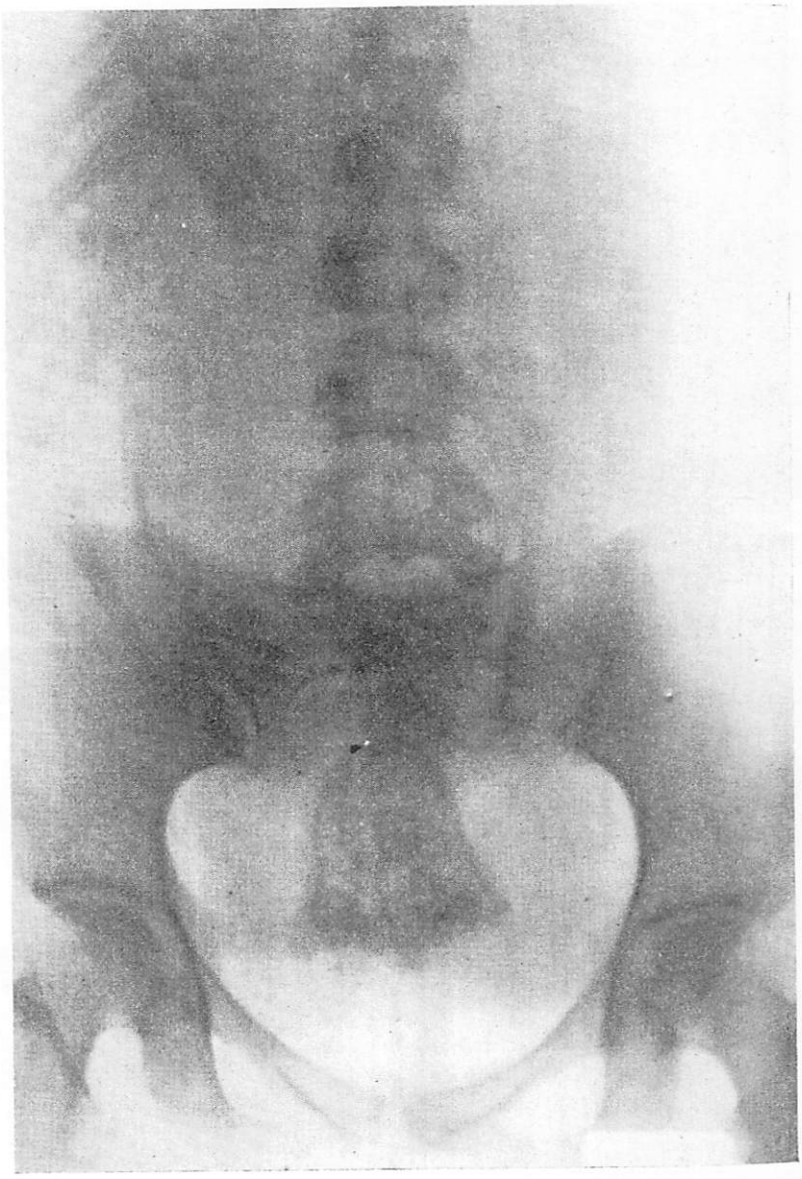


Fig. 6.—Mrs. A. K., No. 218. Anencephalic monster, full term. Moderate polyhydramnios. Note outline of the feet.

In our series the diagnosis of anencephalic monster was made five times before delivery was accomplished, thereby enabling the obstetrician to fortify himself againse criticism by informing the family

(never the patient!) of the presence of a fetal monster. (Fig. 6.) I have personal knowledge of a case of hydrocephalus of such marked degree that the upper abdomen was markedly distended whereas the presenting breech did not unduly distend the lower abdomen. While

Fig. 7.—(A. P.), Mrs. P., No. 50343. Clinical diagnosis of fibroids, operation advised by surgeon. X-ray showed a complicating pregnancy about sixteen weeks duration. Delivered of normal child, 8 pounds. Aug. 20, 1928.

the obstetrician might not have suspected hydrocephalus, he should have suspected that some abnormality of the fetus was likely. At any rate, without a roentgenogram, cesarean section was done and a huge hydrocephalic monster was removed which fortunately died in a few days. Another instance where the x-ray would have saved the obstetri-

cian much criticism is illustrated by the following: a young, wealthy society woman, pregnant for the first time, at full term, had been in labor some twelve to fourteen hours without satisfactory progress.

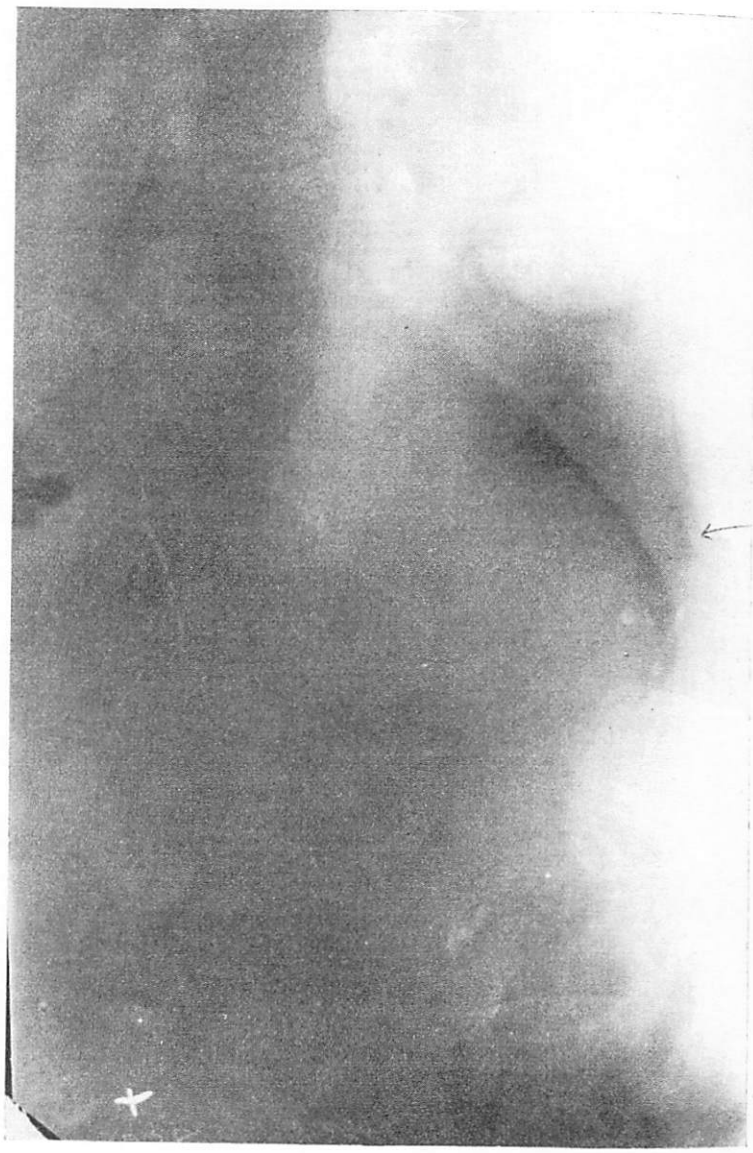


Fig. 8.—Lateral view of Fig. 7. Arrow points to fetal femur.

After a careful vaginal examination and a final survey of the case it was decided to perform cesarean section. This was done and an anencephalic monster was delivered which died in a few minutes. There was considerable consternation and criticism from the family.

A skiagram before the operation would have made a correct diagnosis, the family could have been informed of the true state of affairs before the delivery and cesarean section need not have been performed. The mother was very ill following the operation but finally fully recovered.

Today the surgeon or gynecologist who removes a fibroid uterus that contains a four or five months' pregnancy may well feel chagrined and indeed not be surprised if suit is instituted against him for malpractice. The Zondek-Aschheim test will give positive information in 95 per cent of the early pregnancies while if the pregnancy is be-

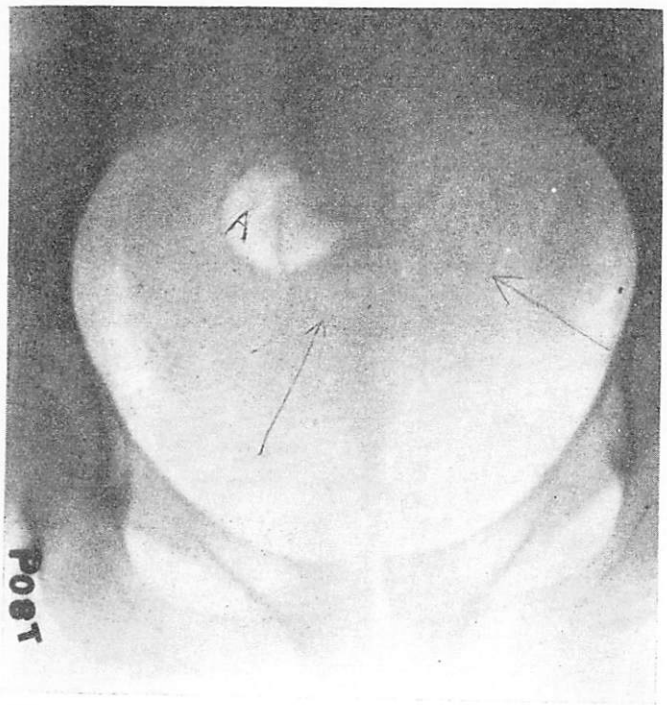


Fig. 9.—Mrs. M. S., No. 69027. Question of pregnancy associated with fibroids of uterus. A calcified fibroid. Roentgenogram also revealed early pregnancy (sixteen to eighteen weeks).

tween the sixteenth to eighteenth week the x-ray will give positive evidence in 85 per cent and beyond the eighteenth week 100 per cent of the cases. In our series we made a positive diagnosis of pregnancy in the presence of fibroid five times (all fifteen to eighteen weeks) and eliminated pregnancy in one where the fibroid tumor was somewhat softened and nodular and about the size of a five months' pregnancy. From the history we did not feel that the patient was pregnant, but from the pelvic examination there was a suspicion of pregnancy due to the softness and compressibility of the uterine mass. A skiagram was taken and reported negative for pregnancy.

This case came to hysterectomy and the ablated uterus did not contain a fetus. Now while I am fully aware of the fact that we might have missed the presence of fetal bones by the roentgenogram in this case, nevertheless a negative roentgenogram added considerable more evidence to the fact that pregnancy did not exist. An instance where the x-ray saved a pregnancy that was very much desired is illustrated by the following case: a thirty year old nulliparous woman, who had been married five years and was anxious to have a child, consulted a well-known surgeon because of an amenorrhea of four months' duration and gradual enlargement of the abdomen. The surgeon diagnosed

Fig. 10.—A. S., No. 77439. Question of ovarian cyst or thin-walled pregnant uterus. Roentgenogram demonstrated presence of pregnancy. (Sixteen weeks.)

fibroids and recommended operation. The patient refused this advice and went to another better known surgeon who recommended the same operation that the first surgeon had offered and again she refused. She thought she might possibly be pregnant and since she was very desirous of a child, she again consulted her faithful and sympathetic family physician who referred the case to us. Examination revealed a nodular fibroid uterus, rather soft in spots, and about the size of a five or six months' pregnancy. No fetal heart could be heard and no life had been felt by the mother. A roentgenogram revealed an early pregnancy and she was delivered Aug. 20, 1928, which made her not

more than sixteen weeks' pregnant at the time the roentgenograms (6 in number) were taken. (Figs. 7, 8.) The child is alive and well today and needless to say the family is highly elated. She has not yet been operated upon for her fibroids. This one case should "sell" the x-ray to every obstetrician and gynecologist. (Fig. 9.)

Another most interesting case in which the x-ray cleared up an uncertain diagnosis was the following: a young woman twenty-five

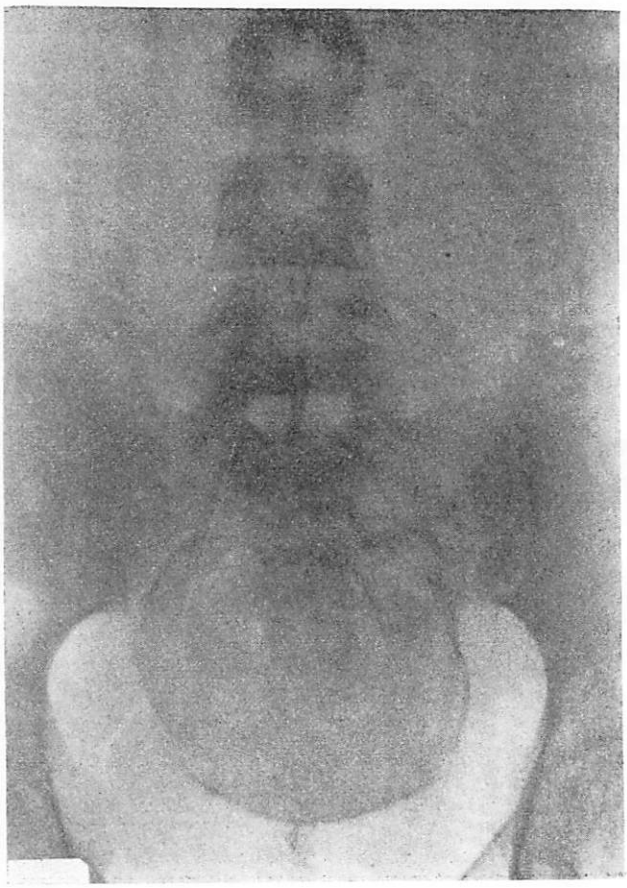


Fig. 11.—Mrs. M. B., No. 5164. Eight and one-half months pregnant. Examined in prenatal clinic May 9, 1930. Fetal heart O. K. Fetal movement present. Admitted to Methodist Episcopal Hospital May 12, 1930, fetal heart not heard, no fetal movements for two days. Roentgenogram showed distinct overlapping of skull bones and bowing of spine. Stillbirth two days later. Diagnosis of fetal death made by the roentgenologist between forty-eighty and seventy-two hours after fetus died. Earliest case in our records.

years old, a "cub" reporter on the staff of a large New York newspaper, was referred to me with a diagnosis of ovarian cyst, for operation. Upon examination I found what I thought was a very thin walled pregnant uterus but no fetal heart could be heard. The pregnant uterus felt very much like an ovarian cyst. However, I informed

the young lady that she was pregnant. She had previously been rather evasive in her history and now became quite abusive because of the diagnosis of pregnancy. To allay the young lady's anger and to fortify myself against possible error, I advised her to go immediately for an x-ray. A roentgenogram showed the fetal bones of an early pregnancy (about sixteen weeks). (Fig. 10.) Faced with positive evidence of pregnancy, she promptly admitted having been exposed.

Fig. 12.—Mrs. F. Abdominal pregnancy. Fetus high up under ribs on right side. A long bone just below right iliac crest with faint outline of small uterus in right side of pelvis, sufficiently strong to suspect abdominal pregnancy with history and physical findings. Positive diagnosis was made from the film. Operation and delivery of a live child.

There is no method by which the death of the fetus in utero can be positively and quickly determined except by the roentgen ray. For this reason we became much interested in the x-ray diagnosis of fetal death because there are many times, particularly in consultation practice, where this positive information is highly desirable both by the patient and the physician. The never-failing skiagram characteristics

of dead fetus in utero are: (1) overlapping of the cranial bones (Spaulding's sign); (2) asymmetry of the fetal head with wrinkling of the scalp, which cannot always be seen on the film but if seen is

Fig. 13.—Mrs. R. B., No. 1098. Breech presentation. Head high, giving distortion in anteroposterior position; might be mistaken for hydrocephalus unless lateral view is taken. Child normal at birth.

corroborative evidence of fetal death; (3) collapsed appearance of the "thoracic cage"; (4) angulation or bowing of the vertebral column ("horse-shoe spine"). Practically every roentgenogram of intra-

uterine fetal death gives the first two signs enumerated above within a few days and if the child has been dead two weeks or longer all four signs are invariably present. We have had occasion to x-ray 17 cases of suspected intrauterine death, in cases where no fetal motion had been felt by the mother for several days or weeks and no fetal heart heard by the physician. All of these cases proved to be dead on deliv-

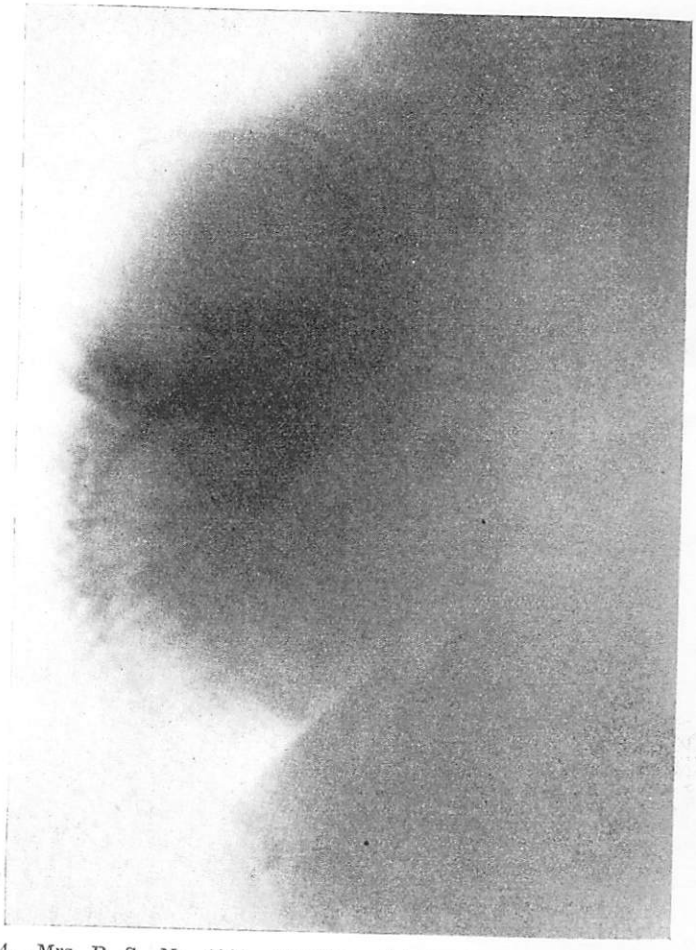


Fig. 14.—Mrs. B. S., No. 4061. Question of twins, large abdomen only one fetal heart heard. Roentgenogram revealed one child. Fetus moved, giving the impression of two heads. Demonstrates need of meticulous care in reading films.

ery. Spaulding's sign is pathognomonic and appears very soon after the death of the fetus, in one of our cases between two and three days. The mother had felt no fetal movements, the obstetrician could hear no fetal heart sounds, and the x-ray revealed overlapping of skull bones. Naturally Spaulding's sign would be of no value in a case in labor with the head engaged. The other signs, which follow Spaul-

ding's sign fairly rapidly (ten to fourteen days), are just as characteristic of fetal death, but as they appear later, it seems fair to say that overlapping of the skull bones is the earliest sure sign of fetal death. I might add before leaving this subject, that the fourth sign of fetal death in utero ("horse-shoe spine" or bowing of the vertebral column) is one that I have not seen mentioned in the literature but one which we have found to be constantly present after ten to fifteen days and of very positive diagnostic value. (Fig. 11.)

The incidence of cesarean section is obviously on the increase and while the morbidity and mortality is considerably less than it was ten years ago there is still room for improvement in certain communities. It is good obstetrics to perform cesarean section when indicated and if the baby is alive and normal there is no operation more satisfactory. Notwithstanding the importance of the child, many of the most careful obstetricians do not use the roentgen ray before cesarean section to determine whether or not the child is normal. This point I wish to emphasize, viz., every candidate for cesarean section should have a roentgenogram before operation. While we have not, for obvious reasons, routinely practiced this in our clinics, we do have a roentgenogram of every case that shows the slightest deviation from the normal and as many others as is consistent with good judgment.

In the very large obese women, with thick pendulous abdomen, the x-ray offers positive evidence of pregnancy, oftentimes before the obstetrician can make a diagnosis by the usual methods. Furthermore, the diagnosis of suspected abdominal pregnancy, as illustrated by Fig. 12, can be positively made by a good skiagram of the abdomen.

Regarding the abnormal pelves, considerable information can be obtained if one has had sufficient experience, by the use of the roentgenogram. There are, of course, many chances for error and since the Thoms' method of pelvimetry is exact and practical it would seem that this method should displace the less accurate one of "comparative measurements with the eye." (Figs. 13 and 14.)

CONCLUSIONS

1. A positive roentgenogram of the fetal skeleton is proof of the existence of pregnancy. This may be added as a fourth positive sign of pregnancy and may be obtained as early as the fourteenth to fifteenth week in 15 per cent of cases, at sixteen to eighteen weeks in 75 per cent and beyond the eighteenth week 100 per cent of the cases.

2. A positive diagnosis of normal and abnormal pregnancy, including many types of fetal abnormalities, can be made by the roentgen ray, provided the pregnancy is at or beyond the eighteenth week. The farther advanced the pregnancy the more positive the diagnosis.

3. A positive diagnosis of fetal death can be made by roentgen ray, apparently within three or four days after death, provided the pregnancy is at or beyond the sixteenth week.

4. A positive diagnosis of pregnancy complicating fibroids of the uterus can be made by the roentgen ray, provided the duration of the pregnancy is sixteen weeks or more.

5. A positive differential diagnosis between pregnancy and other pelvic tumors (soft myoma, ovarian cysts, etc.) can be made by the roentgen ray, provided the pregnancy is at or beyond the sixteenth week.

6. The filming "dosage" herein recommended is perfectly safe for the fetus.

7. Every patient who is a candidate for cesarean section should have a roentgenogram taken to determine the normalcy of the child.

8. A positive roentgenogram may be offered in court cases as proof that pregnancy exists.

9. Finally, it is highly desirable that the obstetrician cooperate with the roentgenologist and thereby help to further develop, simplify and popularize a very important adjunct in obstetric diagnosis.

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(For discussion, see p. 724.)