urine. Death of the patient prevented further observation.

Case No. 5883, female, acute yellow atrophy of liver, following salvarsan injection. One day before death the icterus index was 210, and bile was present in the urine.

Case No. 6771, female, cholecystitis, with common duct obstruction. The patient was admitted to the hospital on November 9, 1921, with considerable jaundice. On November 10, the icterus index was 92 and bile was present in the urine. On November 17, the icterus index rose to 120. The patient was operated upon November 19, and died on the following day.

CONCLUSIONS

The icterus index is of value in determining the presence of jaundice, and offers a more delicate and accurate means of ascertaining the increase or decrease of jaundice than does any clinical or laboratory test now generally in use.

I wish to thank Dr. De Witt Stettin, attending surgeon, for suggestions which led to the consideration and development of this problem and Adolf Bernhard, who is in charge of the chemical laboratory, for having given me valuable assistance in working it out.

A PATHOGNOMONIC SIGN OF INTRA-UTERINE DEATH[1]

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DEATH of the fœtus *in utero* is a sufficiently common occurrence to justify the presentation of any additional diagnostic aids that may be discovered. Heretofore the history, together with the subjective symptoms and the physical signs, have been the factors utilized to arrive at a diagnosis of intra-uterine death. Laboratory tests have been unsatisfactory.

In regard to the past history, syphilis, either in the father or mother, chronic nephritis in the mother, or habitual death of the fœtus from unknown causes, are the suggestive points. The patient may or may not complain of malaise with bad taste in her mouth, feeling of weight in the abdomen, nausea and vomiting, breast changes, failure to feel life, or discharge of blood or clear fluid from the vagina. The attendant may or may not note changes in the blood pressure, a slight rise in the body temperature, or a subnormal cervical temperature, stationary weight and stationary or diminished height of the fundus of the uterus, or possibly may elicit crepitation in the fœtal head bones by vaginal or abdominal palpation.

The last sign is practically the only positive diagnostic sign existing at present. In the Women's Clinic of Stanford University we have, during the past few months, made positive diagnoses of intra-uterine death by the aid of X-ray pictures of the fœtal skull, and from a review of the literature this seems to be an original observation.

It seems that very shortly after intra-uterine death, the brain tissue shrinks, which produces a typical overlapping of the fœtal skull bones. This overlapping of the fœtal skull bones seems to be pathognomonic of the condition of the intra-uterine death and gives a picture quite different from the overlapping produced by molding.

With the X-ray, the decreased size of the fœtal head from post-mortem shrinking can be determined because the cranial bones remain nearly the same size and shape. As the head shrinks, the bones overlap at times to an astonishing distance. The radius of curvature of the shrunken head becomes obviously smaller than that of the unchanged cranial bones. When both the above changes are noted in the X-ray picture it seems justifiable to conclude that the child is dead and such has been our experience in the X-ray study of 21 babies *in utero*. In this series, 3 babies were dead and presented the typical findings; 18 were alive, of which 17 showed no changes in the X-ray picture of the fœtal head and the suture lines. One baby showed marked overlapping of the skull bones due to molding caused by a long first stage of labor, but in spite of this overlapping, the skull

[1] Read before Society of the Alumni of the Sloane Hospital for Women, April 28, 1922.

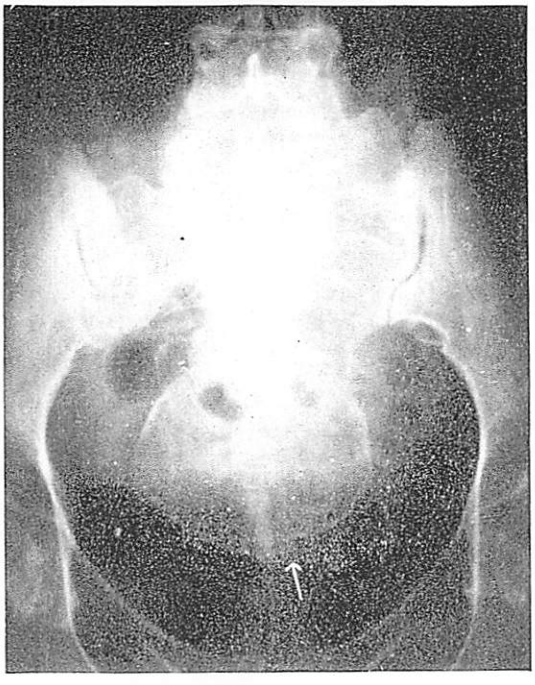

Fig. 1. Shows fœtal skull of dead baby. There is extreme overlapping of the fœtal skull bones (see arrow) and the skull surface is seen to be much larger than the bulk of the skull contents.

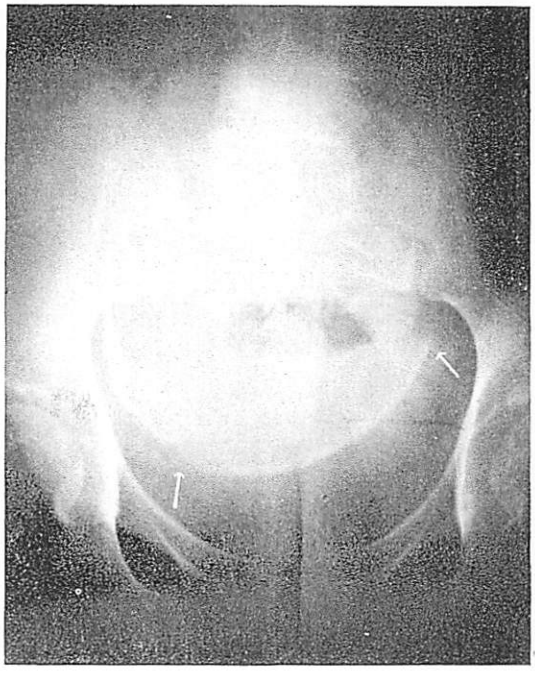

Fig. 2. Shows overlapping of skull bones with marked shrinking of skull contents (see arrows). The skull bones show no evidence of pressure.

bones showed no disproportion in relation to the bulk of the contents of the skull.

The following are the histories of the three patients with intra-uterine death:

CASE 1. Mrs. B., Clinic No. 97829, age, 42, gravida 1, para-0, registered in the Women's Clinic, Stanford University School of Medicine, August 22, 1921. She complained of amenorrhœa since May 13, 1921; no nausea; occasional headaches; pains in lower abdomen.

September 16, the fundus measured 14 centimeters above symphysis. The pelvis was normal. Labor was due, by Naegle's rule, February 20, 1922. Patient felt life on October 12. Blood pressure: 130–80.

December 13, she complained of pains low down in pelvis. She had not felt life since December 2 and thought her abdomen was getting smaller. She had a constant salty taste in her mouth. Blood pressure: 138–94. Fundus 18 centimeters above symphysis.

December 19, fundus 21 centimeters. No fœtal life. Head could be felt by bimanual examination and thought to feel soft. Patient vomited every morning. She entered hospital. Hospital history states that patient has had measles, scarlet fever, and diphtheria. Appendectomy had been done three years ago. Blood pressure: 125–85. No fœtal heart heard. Braxton Hicks contractions were present, but no fœtal movements were noted. Fœtal head could be felt above cervix, but did not give the characteristic hard feel.

Fundus measurements were as follows:

	Centimeters
September 16, 1921	14
November 30, 1921	18
December 13, 1921	18
December 20, 1921	18

December 20, 1921, X-ray picture of uterine contents showed overlapping of the fœtal skull bones with apparent shrinkage of the skull contents (Fig. 1). A diagnosis of intra-uterine death was made and labor was induced December 22 with Voorhees bags. She was delivered of a dead baby December 23. The liquor amnii was dark and dirty looking. The head was soft, showing beginning maceration. The legs and feet and parts of body were macerated. The fœtus had apparently been dead for some time.

Examination of the placenta showed many white infarcts; otherwise normal. The Wassermann was negative. Blood count: 4,024,000 red cells; hæmoglobin, 85 per cent; leucocytes, 7,000; polymorphonuclears, 69 per cent; lymphocytes, 25 per cent.

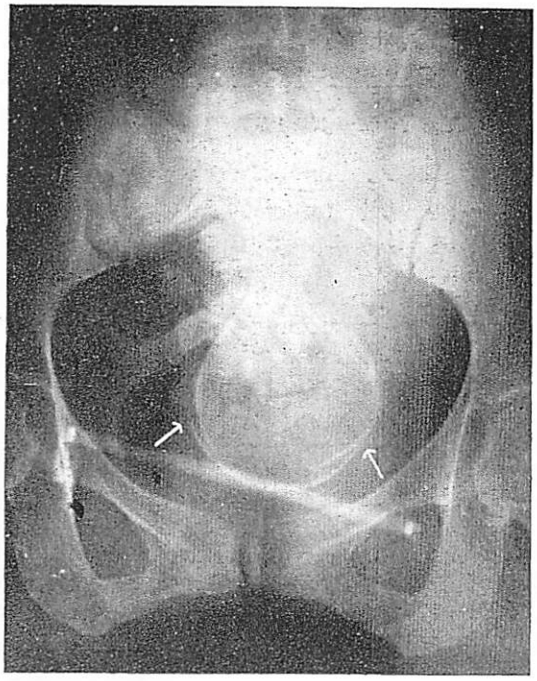

Fig. 3. Shows fœtal skull of dead baby. There is marked overlapping of the fœtal skull bones (see arrow) with some disproportion between surface of skull bones and skull contents.

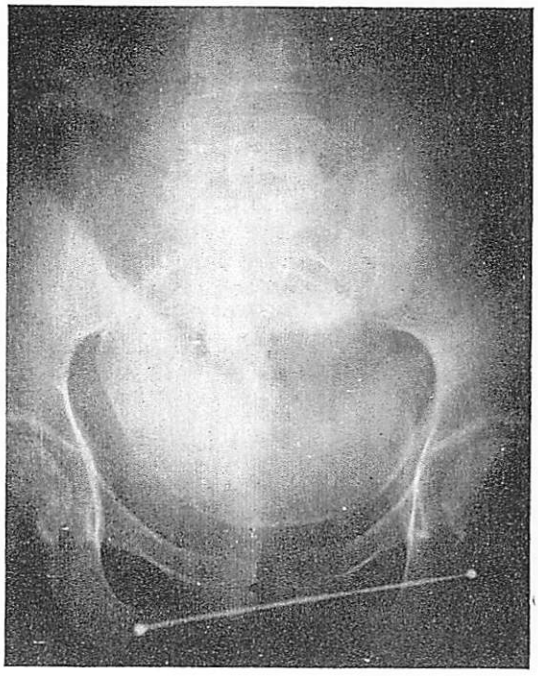

Fig. 4. Shows the fœtal skull of normal pregnancy.

The urine was normal except that specific gravity varied from 1026 to 1008.

Autopsy on the baby showed definite widening and irregularity of the epiphyseal line of the rib and femur. The lungs showed definite fibrous thickening of the septa of the alveoli, otherwise negative. Diagnosis: congenital syphilis.

CASE 2. Mrs. T., Clinic No. 74294, age 29, gravida 2, para-1, registered in Clinic September 21, 1921. December 30 her blood pressure was 144–90. She had been delivered by Cæsarean section on May 10, 1919, of a live baby because of eclampsia with marked œdema, granular casts, and blood pressure of 210–140.

January 13, 1922, her blood pressure rose to 160–100. Headache and œdema of legs. She entered hospital. Labor was due March 22. Fundus measured 22 centimeters above symphysis. Fœtal heart was heard in right lower quadrant. Patient left hospital February 3 with a blood pressure of 145–100, to be observed by the Social Service Department.

February 23 re-entered hospital with blood pressure of 140–85, no toxic symptoms, fundus measuring 21 centimeters. Fœtal heart could not be heard, and an X-ray picture of the abdomen was taken. This picture showed the typical findings of intra-uterine death (Fig. 2).

Shortly after returning from the X-ray Department, the membranes ruptured with a discharge of a quantity of dark coffee-colored, amniotic fluid. A dead baby was delivered with easy low forceps, and immediately after labor patient's blood pressure was 130–82.

Examination of placenta showed white infarcts with signs of infection in the placenta; otherwise normal. Wassermann was negative. Blood examination showed 4,120,000 red cells, hæmoglobin 90 per cent, 10,400 white cells, 76 per cent polymorphonuclears, 20 per cent lymphocytes. Urine examination showed a low specific gravity with light cloud of albumin but no casts.

Autopsy on the baby showed definite widening and irregularity of the epiphyseal line of the rib and femur. Diagnosis: congenital syphilis.

CASE 3. Mrs. A., Clinical No. 100933, age 38, gravida 2, para-0, registered in Clinic December 9, 1921. Last menstruation was April 1. She gave no history of infections. She has had some swelling of feet and hands during present pregnancy. Married 20 years; spontaneous abortion at 4 months 10 years ago. Heart and lungs negative. Breasts large. Fœtal heart faintly heard in left upper quadrant. Child lying in occipitolaevo-anterior position. No engagement of presenting part. Fundus was 33 centimeters above symphysis. Pelvic measurements were normal. Labor was due January 8, 1922.

December 20, fœtal movements were very active. Blood pressure, 174–88.

January 4, 1922, because of hypertension, patient was given castor oil and quinine, but no labor pains resulted. Blood pressure, 146–80. Fundus was 33½ centimeters above symphysis. Fœtal heart sound in right lower quadrant, strong, regular, rate 140.

January 27, patient entered hospital with blood pressure of 150–90. Fundus 29½ centimeters above symphysis. Fœtal heart could not be heard. Janua y 28, fœtal heart could not be heard; no fœtal movements. Braxton Hicks contractions present. Blood pressure 140–85. Bimanual examination of fœtal head gives an impression of crepitation in the skull bone, but this is not distinct.

Fundus measurements have been as follows:

December 9, 1921	33
December 20, 1921	33½
January 26, 1922	29½
January 29, 1922	29

X-ray picture of contents of uterus shows a well-grown fœtus with head floating. There is a little shrinkage of the head as evidence of overlapping of the sagittal suture (Fig. 3). Diagnosis: intra-uterine death of fœtus.

January 30, spontaneous labor began and patient was delivered of a dead baby.

Examination of placenta was normal. Wassermann negative for both husband and wife. Examination of blood shows hæmoglobin 75 per cent, 9,250 white cells, polymorphonuclear 66 per cent, lymphocytes 24 per cent. Urine examination normal, except for a slight trace of albumin.

Autopsy on the baby showed very marked widening and degeneration of the epiphyseal line of the rib and femur. Diagnosis: congenital syphilis.

CONTROLS

The fœtal skull *in utero* has been studied by means of X-ray pictures in 27 patients with normal pregnancy. In no instance can there be seen any overlapping of the fœtal skull bones or any diminution in the size of the skull contents (Fig. 4).

One patient with normal pregnancy had rupture of the membranes with beginning labor. She had a long first stage of labor lasting 43 hours, due to rigidity of the cervix, but was eventually delivered of a live baby. An X-ray picture taken late in the first stage of labor shows marked overlapping of the fœtal bones, but there is no sign of diminution of the skull contents. This overlapping can be easily differentiated from that produced by intra-uterine death (Fig. 5).

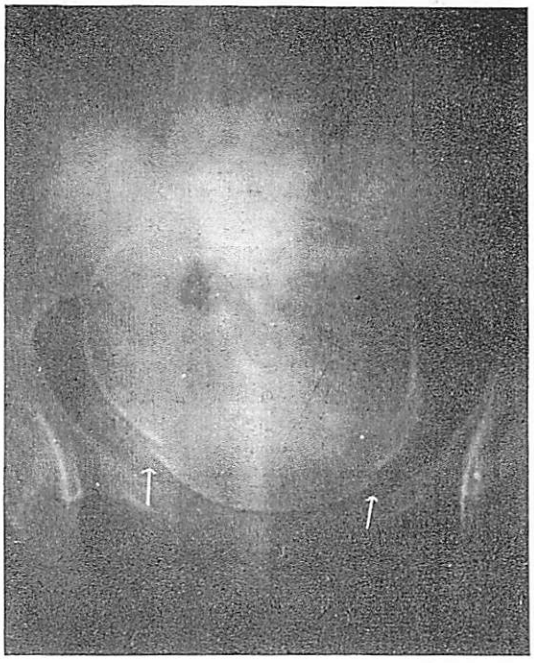

Fig. 5. Shows the fœtal skull of live baby with overlapping of skull bones (see arrows) due to long first stage of labor. There is no diminution of the skull contents as shown by the bulging of the skull bones between the lines of suture. The right pubis indents the coronal suture.

CONCLUSIONS

From a study of fœtal skulls with the X-ray in 31 cases of pregnancy, it has been found that with live babies the fœtal skulls appear normal except for the effect of labor which produces an overlapping of the skull bones. In three cases of intra-uterine death, the X-ray picture showed the marked overlapping of the skull bones with distinct signs of shrinkage of the skull contents.

From these facts we believe it is justifiable to state that shrinkage of the skull contents with overlapping of the skull bones can be demonstrated with the X-ray, which gives a pathognomonic sign of intra-uterine death.

Thanks are due to Dr. Hans von Geldern, resident in obstetrics and gynecology, for assisting in the study of these cases, and to Dr. R. R. Newell, assistant roentgenologist in the Stanford School of Medicine, who made the photographs and interpreted the X-ray findings.