

PLACENTOGRAPHY—COMPARING THE RETROGRADE ARTERIAL WITH THE RADIOACTIVE CHROMIUM METHOD*

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Patients presenting with antepartum haemorrhages before 36 weeks of gestation offer a problem in diagnosis and management. If a placenta praevia can be excluded as the aetiological factor and the symptoms abate, the patient may be discharged and allowed to continue her pregnancy with reasonable assurance.¹ Undue restrictions and prolonged hospitalization, with its economic burden to the patient and the authorities, can thereby be avoided. The heavy call on antenatal beds can be partly relieved by confidently demonstrating the implantation site of the placenta.

The clinical methods employed are all inaccurate, and the auxiliary method chosen should therefore provide

maximum accuracy with minimum detriment to maternal and foetal health. Various methods of localizing the placenta are available. Only the radioactive and the retrograde arterial placentography methods are hailed as uniformly accurate and safe, if due regard is given to the radiation hazard. The amount of irradiation by ⁵¹Cr-placentography is quoted as 12-21 millirads to the mother and only 2-8 millirads to the foetus²⁻⁵ when 20 microcuries of ⁵¹Cr tagged to red blood corpuscles has been employed. The arteriographic method has a much higher irradiation dosage, quoted as roughly 1,000 millirads to both mother and foetus,^{4,6} if supine and lateral views are taken.

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MATERIAL AND METHOD

In an attempt to compare the accuracy of the ^{51}Cr and the retrograde arterial methods of placentography, 34 patients with antepartum haemorrhage, encountered at Somerset Hospital over a period of 6 months (August 1967 - January 1968), were subjected to both methods where possible, and the results were compared.

Those patients undergoing caesarean section had the site of placental implantation verified. All other patients had vaginal examinations before delivery to exclude placenta praevia.

Many more antepartum haemorrhages have been encountered over the 6 months, but not all could be subjected to both methods of placentography because of the urgency of the condition.

Methods of Radioactive and Retrograde Arterial Placentography

(i) *Chromium-51 placentography.* Donor blood (20 ml.) is labelled with 100 microcuries of ^{51}Cr . The blood is centrifuged and the plasma replaced with an equal volume of normal saline. This solution is thereafter injected intravenously and 10 minutes is allowed for mixing to take place. A baseline reading is taken over the heart. An average of 20 point-counts of 100 seconds duration each are taken over the uterus using a scintillation crystal probe, attached to a scaler, and using a pulse-weight analyser.⁷

(ii) *Retrograde arterial placentography.* The examination is performed under local anaesthesia, about 1 hour after the intramuscular injection of Omnopon gr. $\frac{1}{2}$ together with scopolamine gr. 1/100. The patient is prepared and draped to maintain sterility. The femoral artery is punctured just below the inguinal ligament with the Seldinger cannula and needle.⁵ The artery should be transfixed after puncturing.^{6,8-10} The cannula is slowly withdrawn with the base depressed. This flexes the anterior wall and stretches the posterior wall of the artery. As the end of the cannula comes through the posterior wall and enters the lumen of the artery, its release causes a distinct click and blood spurts out. The soft end of the guide-wire is passed through the cannula into the femoral artery for a distance, and the cannula is removed. The polythene catheter is fed over the guide-wire up to the skin.

A distance of about 9 in. or 23 cm. is then roughly measured on the polythene catheter. Both catheter and guide-wire are simultaneously passed up the femoral artery. The guide-wire is removed and the polythene catheter advanced to the distance of about 23 cm., which is said to be roughly the distance from the puncture site to the bifurcation of the aorta.^{6,8-14} A stopcock is then attached to the polythene catheter to control bleeding. Blood is prevented from clotting in the catheter by frequent infusion of normal saline. After administering a test dose, 25 ml. of 76% Urografin is injected rapidly by manual force. Three seconds after completion of the injection an exposure is made of the maternal abdomen in the supine position.

In most of our cases one anteroposterior view only was necessary, as compared with the oblique views recom-

mended by other authors.^{9,14,15} The supine position was comfortable for the patient and the operator. If the placenta appeared to encroach on the lower segment on this view, a complete lateral projection was taken. These two views enabled us to stage the degree of placenta praevia with accuracy and to define whether it was in an anterior or posterior position.

To enable us to stage a low-lying placenta with confidence by means of arterial placentography, the lower uterine segment had to be defined.

Definition of the Lower Uterine Segment

The term 'lower uterine segment' is not universally agreed upon. There are various definitions of the lower segment at the viable stage of pregnancy, e.g. the physiological, the anatomical and the more practical metric definition.¹⁶ The metric definition states: 'It is that portion of the uterus which, close towards term, lies within 7.6 cm. (3 in.) of the internal os'. This distance has been confirmed by other investigators^{17,18} and by our own measurements at caesarean section.

No really accurate localization has been made of the internal os in relation to bony landmarks. Until now only one series¹⁹ has been published, where the external os was localized radiologically during the last trimester in 11 normal pregnant women. This was done by means of the application of barium sulphate to the cervix under direct vision. At Somerset Hospital 38 patients between 32 and 38 weeks' gestation were examined radiologically with a metallic clip on the anterior cervical lip, taking supine and direct lateral views. Disregarding their period of gestation, their parity, and the presenting part (vertex as opposed to breech), and even in two cases of multiple pregnancy, good results were obtained (Figs. 1 and 2).

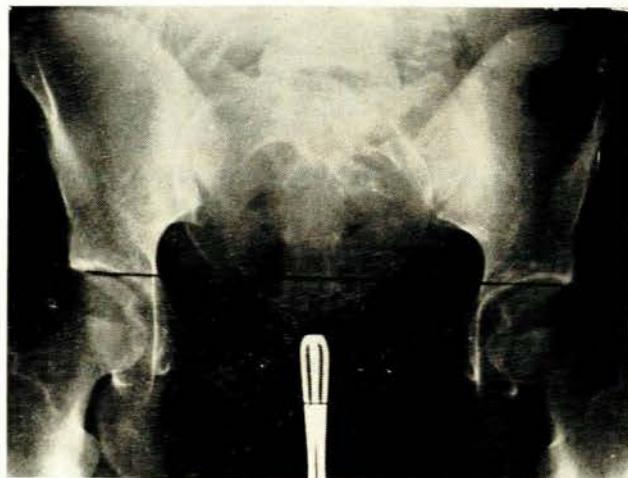


Fig. 1. See text. Anteroposterior view of maternal pelvis with clip on external os.

Anteroposterior film. The external os was fairly regularly situated about 2.5 cm. below the centre of the line joining the upper surfaces of the two femoral heads.

Lateral film. Three lines had to be drawn to obtain the fixed point:

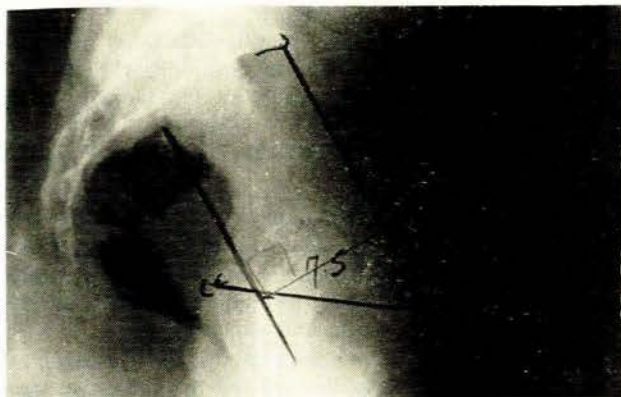


Fig. 2. See text. Lateral view of maternal pelvis with clip on external os.

- (a) A line joining the top of the symphysis pubis to the sacral promontory;
- (b) a line parallel to (a) and 7.5 cm. below it; and
- (c) a line joining the ischial spine to the top of the symphysis pubis.

The external os, as indicated by the clip on the anterior lip, was found to be situated fairly consistently at the point where lines (b) and (c) crossed.

These results are not in exact agreement with those established by the other investigators,²⁰ but our findings are thought to be more precise. Allowing 2-3 cm. for the length of the average cervical canal in the last trimester, one could by inference give a fairly fixed position for the internal os.

Staging of a Placenta Praevia

The isotopic method has the disadvantage of providing only a gross estimate of size and possible position of the placenta,²⁰ and cannot be employed to stage a placenta praevia with accuracy.

In the retrograde arterial placentogram any placental sinusoid visualized within 10 cm. (allowing ± 2.5 cm. for the length of the cervical canal) from these fixed points was regarded as indicating a placenta praevia. The subsequent staging of a placenta praevia was easy.

RESULTS

After delivery the causes of the bleeding were classified as follows: placenta praevia 6, accidental haemorrhage 4 and antepartum haemorrhage of uncertain origin 24.

Proved Placenta Praevia

In 5 patients the diagnosis of placenta praevia was verified at caesarean section. The remaining patient, examined under anaesthesia, was found to have a placenta membranacea and a type 1 placenta praevia.

Of the 6 proved placenta praevias, the diagnosis was correctly made by retrograde arterial placentography in all cases. Even the staging of the praevia was correct in 5. The one patient who underwent examination under anaesthesia was diagnosed antenatally as a type 3 placenta praevia, but was in fact a type 1 with a placenta membranacea.

The same accuracy has, however, not been achieved by the radioactive isotopic method. Only 5 of the 6 patients were correctly diagnosed as a placenta praevia. Staging of the placenta praevia was not possible. The mistake was made in a proved type 3 anterior placenta praevia which was classed as doubtful by the ⁵¹Cr-placentogram.

Accidental Haemorrhage

In order to classify an accidental haemorrhage, a retro-placental clot after delivery was a prerequisite.

As more experience was gained with the interpretation of retrograde arterial placentography, a forecast of an accidental haemorrhage was ventured when there was a smallish placenta which was difficult to outline with the radio-opaque dye. This proved to be correct in 2 of the 4 proved cases of minor accidental haemorrhages. The radioactive studies lacked this advantage.

Unclassified Antepartum Haemorrhage

All these patients had vaginal examinations during labour, and no previously undiagnosed placenta praevia was encountered.

The arterial placentography method predicted the placental site to be in the upper segment of the uterus in 23 patients. In one patient catheterization failed due to a possible abnormality of both femoral arteries. In this patient the Seldinger needle was introduced with ease on each side, but the guide-wire could not be advanced along the length of the artery.

The radioactive method was completely wrong in 2 cases, designating a placenta praevia in both instances. In 3 the result was classed as doubtful, as areas of increased activity were demonstrated simultaneously in the upper and lower segments of the uterus.

DISCUSSION

Placentography is not indicated in all instances of antepartum haemorrhage, nor even in all patients with clinically suspected placenta praevia. These auxiliary methods should generally be confined to those selected patients, from 28 to 36 weeks' gestation, for whom a programme of expectant management is planned.

Scintillation photoscan devices are not yet at our disposal, therefore our 'point-count method' of ⁵¹Cr placentography cannot compare with the reliability achieved by other series,^{2,3,21,22} where an accuracy of 98% or more is quoted. For this reason, recourse was made to the retrograde arterial method of placentography, which unfortunately is more laborious and associated with potential hazards. The results obtained have been extremely accurate, especially after exact radiological definition of the lower uterine segment, as described, was employed.

The comparison between these two methods of placental localization in this series is therefore not really valid and fair. It was nevertheless considered worth while to proceed with this comparison, even if only to stress the value of retrograde arterial placentography.

Our experience with arteriography compares equally with that of all other reports,^{5-7,9,10} where accuracy exceeds 99%. The great benefit of this method is that it enables exact staging of a placenta praevia. This distinct

advantage is not an attribute of radio-isotopic placentography, even in the best reports, where it is quoted as 'providing only a gross estimate of size and position of the placenta',²⁰ which agrees with our experience. After femoral arteriographic placentography, the extremely hazardous and even dangerous vaginal examination in theatre could be dispensed with, especially in the major degrees of placenta praevia.

No complications due to arterial catheterization were encountered at all. The reason for this must presumably be the fact that one is dealing with a relatively healthy vascular system in a young pregnant woman.

Mistakes in localizing a placenta praevia accurately with femoral placentography can be made when the placenta is bleeding. This is due to the fact that the lowermost portion of the placenta has separated, and that area may have ceased functioning. Sometimes these arteries may be in spasm, preventing passage of radio-opaque dye to allow radiological visualization.

A forecast of a major accidental haemorrhage can be ventured when there is a smallish placenta which is difficult to visualize radiologically by the arteriographic method, frequently only displaying a few placental sinusoids. This finding suggests placental insufficiency. In order to study placental function by arteriography, serial exposures, at intervals of at least one second, are required to outline not only the choriodecidual spaces, but also the arteriolar supply and the venous drainage. This line of thought was not pursued, as it inevitably implies high irradiation exposure and would require more sophisticated apparatus to achieve a uniform rate of infusion of the radio-opaque dye, and a room with standardized temperature and humidity to obtain comparable results would be needed.

The initial difficulty has been to define the radiological margins of the lower uterine segment. Larson and Nelp²⁰ applied barium sulphate under direct vision to the cervical os and then obtained radiological views. They were the first to relate the external os in the last trimester of pregnancy to fixed bony points of the maternal pelvis. We followed suit, and our location of the external os on the anteroposterior view seems to agree with their results.

On the lateral view our position is considered more precise. According to Larson and Nelp²⁰ the external os could be situated anywhere on a line 2.4 cm. cephalad from a line joining the greater trochanter to the top of the symphysis pubis. Our location of the external os was definitely at a constant spot, as determined by drawing the mentioned lines. The extent of the lower segment was thereafter assessed as extending for a distance of 10 cm. from the external os. The distance of 10 cm. was obtained by adding the 7.6 cm., which was determined as the actual length of the lower segment as measured from the internal os, to 2.5 cm., the estimated average length of the cervical canal in the last trimester up to 38 weeks' gestation. This estimation agrees with the previously surmised 10 cm. as reported by previous authors.^{8,17} Correction for radiological magnification was initially made, but this always amounted to such a small difference that it was not considered to be of any significance, and has therefore been disregarded.

Enhancement of the accuracy of diagnosis of the cause of antepartum haemorrhage requires auxiliary methods. Isotopic localization has definite desirable features such as simplicity, safety and comfort for the patient, but in our own particular experience arteriography is the procedure of choice when unequivocal placental definition is required.

CONCLUSION

Radioactive ⁵¹Cr placentography has been compared with the retrograde arterial method in 34 cases of antepartum haemorrhage, and the latter technique has been demonstrated to be more accurate and superior.

The external os of the cervix in the last trimester has been relatively accurately demarcated in relation to fixed bony points of the maternal pelvis in 38 cases. The internal os was established to be 2.5 cm. cephalad to the established fixed bony point in the last trimester up to 38 weeks' gestation. These findings facilitated the radiological definition of the lower uterine segment as extending 10 cm. from the relatively fixed external os in the last trimester.

This advantage enabled correct antenatal staging of a placenta praevia when retrograde arterial placentography was employed.

SUMMARY

A comparison has been made of the two available methods of placentography, i.e. radio-isotopic and retrograde arterial, in 34 patients. The femoral arterial method of placentography gave superior results.

A radiological method has been presented whereby the lower uterine segment can be demarcated, thereby enhancing the accuracy of arterial placentography by allowing correct antenatal staging of a placenta praevia.

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