uniformity, it was decided to draw the vapour/air mixtures from the inhaler with Starling's respiration pump, readily available at the various centres.† This pump has an extremely rapid "inspiratory" phase: owing to this characteristic feature, the concentration obtained from inhalers built for human respiration was fairly high, although the ventilation was never above 4 litres a minute, and usually only 2 litres a minute.

In most of the experiments no spontaneous respiration was present; the lungs were inflated by the pump which "inspired" the vapour/air mixture from the inhaler. When the animal was breathing spontaneously the pump was used to keep reservoir bags made from "polythene" film filled with the required mixture. In the latter arrangement low resistance non-return and expiratory valves were used between reservoir bag and animal, which was usually intubated with a cuffed endotracheal tube.

The inhalers were calibrated similarly to those used in the clinical trials. The ventilation rate of the pump was varied between 19 and 26 a minute; the stroke volumes were chosen between 50 ml. and 200 ml. For this range the vapour strength depends mainly on the minute volume (stroke $\times$ rate) and appropriate calibration charts were worked out. Actually the change in concentration for certain control positions was quite small when the minute volume was increased by 50%; thus at 1.6 vol.% there was practically no change, while an initial output of 2.2% (v./v.) was raised to 2.6% (v./v.) by this increase in minute volume.

The inhalers were equipped with thermocompensators, but in order to ensure a high degree of accuracy all calibrations were carried out by immersing the inhaler in a thermostat bath kept at 70° F. (21° C.).

If the inhalers were used normally with varying ambient temperatures, there was a slight decrease in concentration with rising temperature.

An output of 1.50% (v./v.) at 60° F. (15.5° C.) decreased to 1.32% when the temperature rose to 72° F. (22.2° C.). Similar variations occurred for other positions of the concentration control.

REFERENCES

- Bryce-Smith, R., and O'Brien, H. D. (1956). *British Medical Journal*, 2, 969.
Epstein, H. G., and Macintosh, R. R. (1956). *Anaesthesia*, 11, 83.
Foster, C. A. (1957). *Lancet*, 1, 1144.
Hill, E. F. (1957). *Brit. J. Anaesth.*, 29, 12.
Hillard, E. K. (1957). *Ibid.*, 29, 39.
Imperial Chemical Industries Ltd. (Pharmaceuticals Division) (1956). Fluothane Technical Data Sheet No. 1: December 4, 1956.
Johnstone, M. (1956). *Brit. J. Anaesth.*, 28, 392.
Macintosh, R. R. (1955). *British Medical Journal*, 2, 1054.
Raventós, J. (1956). *Brit. J. Pharmacol.*, 11, 394.
Riker, W. F., and Wescoe, W. C. (1951). *Ann. N.Y. Acad. Sc.*, 54, 373.
Robertson, J. D., Gilles, J., and Spencer, K. E. V. (1957). In press.

Owing to the slackening demand for labour, the number of disabled persons placed in employment dropped from 114,000 in 1955 to 89,000 in 1956, according to the Annual Report of the Ministry of Labour and National Service for 1956. And the number unemployed rose by 5,000 to approximately 43,000. On the other hand, the unbroken decline since 1949 of the number of severely disabled unemployed continued, the figure being less than 3,600. The size of the Disabled Persons Register continued to contract slowly. The number of registered disabled persons at the end of October, 1956, was 785,500, compared with 818,600 in 1955 and with the peak of 936,000 in October, 1950. In all, over 7,800 men and women, who were judged to be likely to undertake employment under ordinary conditions, completed industrial rehabilitation courses in the Ministry's fifteen industrial rehabilitation units. Of these about 80% either obtained jobs or began courses of training within three months of leaving the units. In addition, nearly 300 blind persons completed courses arranged by the voluntary associations concerned. Over 3,700 disabled men and women, including nearly 200 blind persons, completed vocational training courses. It became possible for Rempoy Ltd. gradually to increase the number of severely disabled persons employed by the company at its 90 factories from just over 6,000 to more than 6,200.

† "Ideal" variable stroke pump. C. F. Palmer Ltd.

PLACENTOGRAPHY IN MANAGEMENT OF PLACENTA PRAEVIA

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Postural and soft-tissue placentography has been found a reliable and convenient method of determining radiologically the site of the placenta *in utero*, and its clinical use helps considerably in lessening the maternal and foetal hazards associated with placenta praevia. The safe and simple technique merits widespread application, with resulting changes in the management of abnormalities of placental implantation.

The pioneer work of Reid (1949a, 1949b), Stallworthy (1951), and Hartley (1954) established this technique in Great Britain. Their methods have been applied clinically at other centres, and excellent results have been obtained at the London Hospital (Percival and Murray, 1955). In the light of this work we wish to present our experiences in the clinical sphere and discuss the indications and advantages of soft-tissue placentography.

Radiological Technique

We have made no innovations in technique, but have followed closely that which Hartley (1954) developed at St. Mary's Hospitals, Manchester. This method employs low kilovoltages combined with high speeds of exposure, together with a broad abdominal compression band to reduce the size of the abdomen and obtain adequate immobilization of mother and foetus. No special x-ray apparatus is required, and the wedge-shaped aluminium filter devised by Reid (1949a) has not been used.

The examination is performed at any stage after the 32nd week of pregnancy, and the patient needs no preparation except for emptying her bladder. Though many patients attend the x-ray department direct from the antenatal clinic and receive no preliminary bowel preparation, the diagnostic quality of the films is usually adequate. Three routine films are exposed: recumbent antero-posterior, erect lateral, and recumbent soft-tissue lateral; and a semi-reclining lateral when indicated.

The method used is based on two principles; firstly, the direct visualization of the soft-tissue shadow of the placenta; and, secondly, the position of the presenting part, under the effect of gravity, in its relationship to the pelvic brim. To these must be added the direct demonstration of calcification of the placenta. The frequency with which such calcification can be seen is impressive. We have reviewed all the films in the series, and found that 32 out of 80 cases (40%) show calcification, either coarse or fine, when examined on the screened illuminator with high-intensity spotlight as recommended by Hartley (1954). Demonstrable calcification is important because placental location can be stated as a fact and not as an inference. Hartley (1954) has studied the x-ray appearance of full-term post-partum placentae. He found that 30% showed gross or medium calcification, 30% showed minor calcification, and 40% showed only faint or no calcification. He states that all cases showing gross or medium calcification can be demonstrated at placentography, and so can some cases showing a minor degree of calcification; this has been well borne out by our experience.

Clinical Experiences

We have analysed our experiences in the use of placentography in one maternity unit during the years 1954 and 1955. The statistics from the maternity unit (Table I) during this period show the material available, and placentography was performed on 80 cases. All these were under the care of one obstetrician, who maintained the closest collaboration with the radiologist. Despite the safety and convenience of placentography we do not advocate its indiscriminate or routine use but rather its employment in those cases where the question of placenta praevia arises in the differential diagnosis during the antenatal period. Every effort to avoid any undue irradiation of the foetus should be made, so long as this is compatible with its safe delivery.

TABLE I.—*Maternity Unit Statistics for 1954 and 1955*

Total deliveries	1,888	
" stillbirths	46	(21 per 1,000 live births)
" perinatal deaths	58	(31 " "
Breast chills	85	(4.5% of total deliveries)
Surgical inductions	285	(15% " " " ")
Forceps deliveries	106	(5.4% " " " ")
Caesarean sections	84	(4.5% " " " ")
Placentographies	80	(4.3% " " " ")

Clinical Indications for Placentography

The primary indication for the performance of placentography is the clinical suspicion of the presence of placenta praevia. This condition is fraught with such potential danger to both mother and foetus that early and reliable diagnosis is most important. The cases where placenta praevia may be suspected fall naturally into two groups—those with and those without ante-partum haemorrhage (Table II). There were 24 cases with ante-partum haemor-

TABLE II.—*Clinical Indications for Placentography*

Indication	No. of Cases	Cases of Placenta Praevia
Ante-partum haemorrhage alone ..	6	2
" " " and recurrent unstable lie ..	2	0
Ante-partum haemorrhage and high head or breech ..	14	7
Ante-partum haemorrhage caused by surgical induction ..	2	0
Recurrent unstable lie or transverse lie ..	21	10
Vertex or breech with high presenting part ..	27	3
Failed external cephalic version ..	4	1
Transverse lie in labour ..	1	1
Foetal distress " " ..	1	0
Previous classical caesarean section ..	1	0
Not recorded ..	1	1
	80	25

rhage, and nine of these proved to have the placenta lying praevia. Six cases were x-rayed on account of ante-partum haemorrhage occurring without any other complication and without displacement of the presenting foetal part clinically, and two of these were anterior placenta praeviae. They were both of first degree, and both were safely delivered vaginally. Amongst the 16 cases of ante-partum haemorrhage combined with displacement of the presenting part there were seven cases of placenta praevia, five of which were of major degree and were delivered by caesarean section.

Placenta praevia will be suspected in all cases of ante-partum haemorrhage, but it is equally important that it should be suspected in the absence of ante-partum haemorrhage, and that the suspicion should be confirmed or rejected. Thus placentography was performed on 21 cases because of the recurrent instability of foetal lie which was noted at the antenatal clinic, and 10 of them were placenta praevia. In 17 patients the foetal lie had been transverse at some stage after the 32nd week of gestation and some of the patients had had external cephalic version performed. Another large group comprised those cases where the presenting part, whether vertex or breech, was unexpectedly high and free, above the pelvic brim, and placenta praevia was found in three of 27 such cases x-rayed.

Placentography may be performed occasionally when placenta praevia is not suspected. There was one patient who had had a classical caesarean section performed pre-

viously under primitive conditions abroad after she had been in obstructed labour. Some anxiety was felt concerning the integrity of her uterine scar, but her management was facilitated by the x-ray appearances of a postero-fundal placenta away from the previous scar.

Placentography Predictions and Results

The site of placental implantation on the uterine wall which was predicted by placentography has been compared with the actual site found at delivery whenever this has been possible. The available methods for determining the actual placental site are not always entirely satisfactory. The most reliable information is obtained whenever caesarean section is performed; otherwise it can be obtained by vaginal examination under anaesthesia when appropriate, by intrauterine palpation during the third stage of labour, or by careful inspection of the placenta and membranes after delivery. In every case the total blood loss at delivery is carefully measured. If the placental site found or inferred by any of these means differs from the site predicted by placentography, then the x-ray findings are classed as incorrect.

The correlation between the placental sites predicted by placentography and those found at delivery is shown in Table III. Placental implantation confined to the upper segment was reported in 57 cases—55 proved correct and 2 (Cases 1 and 2) incorrect.

TABLE III.—*Placental Sites Predicted by Placentography*

Prediction	No. Correct	No. Incorrect
Upper segment	55	2
Placenta praevia of first degree . .	9	2
" " " major " . .	11	1
Totals	75	5

Case 1.—This patient was seen in consultation in a nursing-home because of a transverse foetal lie in the early first stage of labour. Placentography performed in labour showed a calcified placenta in the antero-fundal position. The placenta was said to have been found, at emergency lower segment caesarean section, to be posterior in the upper segment, with some encroachment on to the lower segment. A review of the x-ray films again showed a strongly calcified anterior placenta, and so it is most probable that the operative record is in error, as can happen when writing the record of an emergency operation in the small hours of the morning.

Case 2.—This booked patient had a recurrent unstable foetal lie when seen in the antenatal clinic, and had a transverse lie at the 35th week of pregnancy. Placentography was carried out at the 35th week after very gently turning the foetus into a vertex presentation, and was reported as follows: "Placenta anterior in the upper segment. Foetal head displaced anteriorly for unknown reason." The patient was subsequently admitted with an antepartum haemorrhage, and at examination under anaesthesia was found to have a posterior placenta praevia of second degree; this finding was confirmed by lower segment caesarean section. This mistake, which was in one of our earliest cases, was due to inexperience in interpreting the radiographic appearances. The correct diagnosis of posterior placenta praevia was obvious on reviewing the films without knowledge of the outcome of the case. This was the one major error in the whole series of 80 cases.

Placenta praevia of first degree was predicted on investigation of 11 cases—nine were correct and in two (Cases 3 and 4) the exact degree of placenta praevia was incorrectly estimated.

Case 3.—A primigravida presented with a transverse foetal lie at 37 weeks of gestation. A very gentle attempt at external version was unsuccessful, and placentography, performed with the foetus lying transversely, was reported as posterior placenta praevia of first degree. The transverse lie persisted until term, when an elective lower segment caesarean section was effected without vaginal examination. The placenta was a posterior praevia of second degree. The original estimate was known to be uncertain on account of the transverse lie at the time of the x-ray examination.

Case 4.—A multipara was referred for consultation because of a slight red "show" at the 38th week of pregnancy. Abdominal palpation showed that the head was mobile and free in the abdomen and prominent anteriorly, and pressure backwards on

the foetal head on to the sacral promontory caused slowing of the foetal heart. Posterior placenta praevia was diagnosed clinically, and placentography was reported as showing a posterior placenta praevia of first degree. The patient was admitted to hospital for observation and a recurrent unstable foetal lie was noted until term. Examination under anaesthesia revealed a posterior placenta praevia of third degree, and this was confirmed at caesarean section.

In the whole series there were 12 cases in which a major degree of placenta praevia was reported on placentography, and 11 were proved correct at caesarean section. In one patient (Case 5) the x-ray report was erroneous.

Case 5.—A multipara had a high and free foetal head at term, and placentography purported to show an anterior wall placenta of probably second or third degree praevia. The patient was admitted to hospital, and the foetal head gradually became more and more deeply engaged without any ante-partum haemorrhage. Vaginal delivery was accomplished easily with a blood loss of 12 oz. (340 ml.). Inspection of the placenta and membranes was inconclusive.

Placenta Praevia

In the complete series of 80 patients there were 25 cases of placenta praevia. Placenta praevia of first degree occurred in 11 patients, of whom 10 were delivered vaginally with a blood loss in each case of 8 oz. (2207 ml.) or less, and one patient was delivered by caesarean section for foetal distress.

Major degrees of placenta praevia were found in 14 patients, all of whom were delivered by lower segment caesarean section. Elective operations were performed on six of these patients in whom no ante-partum haemorrhage had occurred at all, and on 11 patients without any examination under anaesthesia. Only three patients with major placenta praevia were submitted to examination under anaesthesia; once because an upper segment placenta had been predicted but ante-partum haemorrhage had later occurred (Case 2); once because placenta praevia of first degree had been predicted by x-ray examination (Case 4); and once to confirm a prediction of posterior placenta praevia of third degree. Examination in this last case provoked an instantaneous torrential haemorrhage, and this could have been avoided had we followed our present custom and acted on the radiological findings.

The results at delivery in the 25 cases of placenta praevia were satisfactory, for there were no maternal or foetal deaths. Indeed, in the whole series of 80 patients, which included a large number of obstetric abnormalities, there were no maternal, foetal, or neonatal deaths. The success of conservative measures in avoiding the hazards of prematurity can be illustrated by the birth weights in the 25 cases of placenta praevia; they averaged 7 lb. 2 oz. (3.2 kg.) and only two babies weighed 5 lb. 8 oz. (2.5 kg.) or less. The average birth weight of the other 55 cases with upper segment placentae was 7 lb. 9 oz. (3.4 kg.).

Discussion

Radiography for the location of the placenta is a technique only recently evaluated and adopted in Great Britain. The results obtained in those centres which have developed it have been remarkable for their consistency and accuracy. Despite these successes the technique has not been used universally, because many obstetricians distrust it. In a recent discussion of the problem Donald (1955) stated: "This is a method which has been employed with varying success during the last twenty years, although there are few who regard it as sufficiently reliable." From the practical point of view, most obstetricians are of the opinion that, however interesting this method of location may be, the results cannot be trusted, and it is felt that no stay in hospital is likely to be curtailed or dispensed with as a result of radiological investigation. This may indeed be the opinion of most obstetricians, but we disagree with it completely. From the practical point of view, it is our experience that the results of this essentially practical technique are sufficiently reliable and can be trusted.

The accuracy and reliability of placentography without the use of contrast media are remarkably high. Even when all borderline and doubtful cases are labelled as misdiagnoses the number of mistakes is small. Considering that the x-ray films are usually taken several weeks before term, when the lower uterine segment is incompletely developed, and when the relationship between the junction of the upper and lower uterine segments to the level of the bony pelvis is uncertain, the results are closely correlated to those found at term or at birth. Hartley (1954) reported an accuracy rate of radiological diagnosis of the placental site of 98% out of 365 cases in one year, and over 99% out of 351 cases in the following year. Percival and Murray (1955) recorded an accuracy rate of over 96% in a series of 275 cases, which included 50 instances of placenta praevia. We have obtained an accuracy rate of 94% in our series of 80 cases containing 25 placentae praeviae. Other larger series were mostly routine examination of antenatal patients, and slightly better results can be expected with a higher proportion of upper segment placentae, which are easier to visualize. We have here shown that placentography on definite clinical indications can yield useful results.

Placentography is not fool-proof and does not give "penny-in-the-slot" machine answers. The radiographic technique must be careful and exact, but it is not time-consuming, needs no expensive or complex equipment, requires no special preparation of the patient, and its routine performance can be left to a radiographer schooled in this method. The technique is not more difficult to master than the technique of x-ray pelvimetry, and any department which can produce reliable pelvimetric results should be capable of reliable placentographic results. Patients may have placentography and pelvimetry examination combined when indicated.

Interpretation of the film requires practice and judgment, and close co-operation between the radiologist and the obstetrician. The films are examined when completely dry both before an ordinary viewing-box and before a screened illuminator with spotlight, to look for calcification. Placental calcification lends precision and certainty to the radiological location and should therefore be sought in every case.

The accuracy of the radiological location of the placenta is greatest when it is sited in the upper segment, and it is not possible to achieve the same degree of accuracy in placenta praevia. Difficulties in interpretation rarely arise with placentae which are wholly upper-segment, fundal, or cornual in their siting, whether they are implanted on the anterior, lateral, or posterior uterine walls. Most difficulties occur in assessing the exact lower edge of the placenta and the precise degree of praevia. In some cases greater accuracy is obtained by repeating the lateral films at a later stage of pregnancy.

Whitehead (1953) examined 525 cases where placenta praevia was suspected clinically. He predicted 455 upper segment placentae, all of which predictions proved to be correct; and 70 cases of placenta praevia, 9 of which were not confirmed. In this series 23 cases were confirmed as placenta praevia and in 20 the degree of encroachment on to the lower segment was correctly estimated.

The obstetrician who selects cases for placentography must eliminate so far as possible any factors prejudicial to accurate radiological assessment. Patients with marked hydramnios are unsuitable for placentography. Donald (1955) has asserted that the multipara with a lax abdominal wall is also unsuitable; we do not think this is true, as over half of our series were multiparae. An undiagnosed soft-tissue pelvic tumour is a possible source of error in interpretation of the films, and the obstetrician may have to exclude this clinically. But a positive x-ray diagnosis of soft-tissue tumour is possible when the mass is large enough to displace the presenting part from its normal relationship to the pelvic brim and at the same time a clearly separate placental shadow is visible (Reid, 1952).

Clinically, placentography is required in all cases of ante-partum haemorrhage where the patient's condition permits

the examination. Even if the haemorrhage occurs in a patient known to have pre-eclamptic toxæmia, placenta praevia cannot be discounted. Ante-partum haemorrhage from the placental site in a case of placenta praevia may be due to partial separation consequent upon the taking up of the lower segment, or due to toxæmic accidental haemorrhage or to non-toxæmic causes of accidental haemorrhage (Bender, 1953). The timing of the initial haemorrhage in placenta praevia is very variable. Even if the bleeding occurs before the 28th week of pregnancy, it must be regarded as suggestive of placenta praevia, and placentography should be performed after the 32nd week, when location is more certain than earlier in the gestation. Also, although cases of ante-partum haemorrhage may be divided into those associated with and those without clinical displacement of the presenting foetal part (Table II), placentography should be performed in all cases. Significant degrees of placenta praevia may be found without clinically obvious displacement of the presenting part. On the other hand, cases of ante-partum haemorrhage with gross foetal displacement of the presenting part will contain a significant number of normally sited placentae. All these factors emphasize how inaccurate is the clinical diagnosis of placenta praevia contrasted with the higher degree of accuracy of placentography.

Great as is the value of placentography in all patients with ante-partum haemorrhage, its value is greater still in the diagnosis of placenta praevia before ante-partum haemorrhage has occurred. Here it is that clinical methods of diagnosis are most defective, and the correct use of placentography constitutes a major advance in the management of these cases. Clinically, the suspicion of placenta praevia is commonly aroused by cases of unexplained instability of lie, or unexpected lack of engagement of the presenting part in the pelvic brim, in the absence of disproportion. Especially important are cases of transverse or oblique foetal lie in the last six weeks of pregnancy. We found 8 placentae praeviae in 17 cases of transverse lie (47%). Stevenson (1951) studied by placentography 52 cases of transverse or oblique lie, and found the major causes to be placental implantation either wholly at the fundus (46%) or wholly in the lower segment (44%). Our experience closely tallies with that of Stevenson. The relationship thus shown of the effect of placental implantation on foetal lie is remarkable and certainly deserves careful consideration in each case. Interpretation of the films in cases of transverse lie is sometimes difficult, but in most cases a correct answer can be obtained. Occasionally it can be facilitated by the obstetrician very gently performing external version, with the patient lying on the x-ray table, in an endeavour to ensure a longitudinal lie at the time of the exposure.

The modern management of placenta praevia has been developed to achieve the greatest safety for both mother and child. Stallworthy (1951) has declared that an ideal standard to be aimed at would be no maternal mortality and less than 10% foetal wastage. The greatest maternal hazard is haemorrhage, and the greatest foetal hazard is prematurity. The initial haemorrhage in placenta praevia may occur at any period of gestation until the first stage of labour, and may vary in amount from a slight red "show" to a sudden loss of pints of blood.

Placentography affords a safe and accurate diagnosis of the absence of placenta praevia, and a safer and more accurate diagnosis of the presence of and the degree of placenta praevia than has hitherto been available. The x-ray diagnosis is becoming reliable after the 32nd week of pregnancy, and consideration of the x-ray diagnosis and the clinical features will enable the optimal time, place, and mode of delivery to be decided.

The advent of placentography has modified the management of ante-partum haemorrhage and placenta praevia. Before term, all patients in whom placenta praevia is suspected are x-rayed whether or not bleeding has occurred. This and other series show that accurate diagnosis of upper segment implantation can be made by placentography, and this reduces the number of patients retained in hospital, and

indeed some may be judged safe and suitable for domiciliary delivery. If placentography confirms the presence of placenta praevia, then the patient is retained in hospital and compatible blood is cross-matched in readiness. If the films indicate a major degree (types 3 and 4) of praevia, then all vaginal examinations are eschewed and vaginal examination under anaesthesia is not performed. A planned elective lower segment caesarean section is carried out in the 38th week, or before if bleeding necessitates it. In anterior placenta praevia, the uterine incision is placed so as to minimize trauma to the placenta and reduce haemorrhage from mother and baby (Russell and Warrick, 1955).

If the x-ray report discloses a posterior placenta praevia of first or second degree, the patient is admitted to hospital and observed closely, for this siting is dangerous, and may occasion compression of the cord (Stallworthy, 1951). The final assessment of these cases depends on clinical findings, and vaginal examination under anaesthesia plays no part. If disproportion at the pelvic brim is present, elective caesarean section is performed. If foetal distress develops during engagement of the foetal head in the pelvis, the administration of nasal oxygen and emergency caesarean section are required. If the foetal head engages fully without any irregularity of the foetal heart, vaginal delivery at term will be awaited, but throughout labour a constant watch for foetal distress must be maintained.

If the radiologist reports an anterior placenta praevia of first or second degree, careful daily assessments will be made in hospital of the engagement of the foetal head in the pelvic inlet. In many cases full engagement will occur spontaneously and a successful vaginal delivery will result. But, if the foetal head does not engage in the pelvis, vaginal examination under anaesthesia is made to ascertain the exact lower edge of the placenta and whether or not the head can be made to engage; the alternative treatments of immediate caesarean section or rupture of the membranes will depend on the result.

The revaluation of vaginal examination under anaesthesia has been one of the benefits of the use of placentography. The traumatic haemorrhage which vaginal examination may provoke in major degrees of placenta praevia may be torrential and deadly to both mother and foetus. Experience has shown that there is no place for this manoeuvre where the clinical suspicion of major placenta praevia has been confirmed by placentography. There is equally no place for examination under anaesthesia where radiology shows posterior placenta praevia. This leaves only two indications for vaginal examination under anaesthesia; firstly, the appraisal of minor degrees of anterior placenta praevia where the radiograph fails to define clearly the lower edge of the placenta, and the foetal head does not engage in the pelvis; and, secondly, the elucidation of cases of ante-partum haemorrhage admitted at term or in labour where the diagnosis is in doubt and placentography is inexpedient. Even in the latter cases vaginal examination is best avoided if abdominal palpation reveals a transverse lie or obvious displacement of the presenting foetal part.

Summary

Radiography provides a safe, convenient, and efficient method of locating the site of placental implantation.

A series of 80 cases is presented in which placentography was performed for clinical reasons, with an accuracy rate of placental location of 94%. There were 25 cases of placenta praevia, of which 14 were delivered by caesarean section. There was no maternal, foetal, or neonatal mortality in the whole series.

The clinical indications for the performance of placentography are discussed. Among others, a significant relationship between transverse lie and placenta praevia is mentioned. The value of placentography in the conservative management of the varieties of placenta

prævia is discussed. Stress is laid on the avoidance of vaginal examination under anaesthesia in cases of major degrees of placenta prævia.

Placentography is of the greatest importance in the diagnosis of placenta prævia before the occurrence of ante-partum haemorrhage and will permit definitive treatment.

The exclusion of placenta prævia by placentography in cases of ante-partum haemorrhage makes it possible to send some of these patients home to await delivery, thereby saving hospital beds.

We wish to acknowledge the help given by the radiographers, midwives, and resident medical officers of Solihull Hospital, who have all greatly assisted in the care of these cases.

REFERENCES

- Bender, S. (1953). *J. Obstet. Gynaec. Brit. Emp.*, **60**, 508.
 Donald, I. (1955). *Practical Obstetric Problems*, p. 216. London.
 Hartley, J. B. (1954). *Brit. J. Radiol.*, **27**, 365.
 Percival, R. and Murray, S. (1955). *Lancet*, **1**, 1045.
 Reid, F. (1949a). *Brit. J. Radiol.*, **22**, 81.
 — (1949b). *Ibid.*, **22**, 557, 643.
 — (1952). *Postgrad. med. J.*, **28**, 445.
 Russell, J. K. and Warrick, C. K. (1955). *Lancet*, **1**, 785.
 Stallworthy, J. (1951). *Amer. J. Obstet. Gynec.*, **61**, 720.
 Stevenson, C. S. (1951). *Ibid.*, **62**, 488.
 Whitehead, A. S. (1953). *Brit. J. Radiol.*, **26**, 401.

CYSTICERCOSIS OF THE BRAIN

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Cerebral cysticercosis has been known for many years. Ramler is said to have described a case in 1558, and in 1650 Paracelsus came to the conclusion that the epileptic fits of one of his patients were due to this condition. Nowadays it is rare, the highest incidence being in India and South America.

Here is reviewed a personal series of 65 cases seen at the Postgraduate Institute of Medicine, Bucharest, during the years 1935 to 1955. The patients came from all over Rumania.

Aetiological Factors and Associated Cerebral Disease

Cerebral cysticercosis is commoner after the age of 20 (see Table). Of our 65 patients (37 males and 28 females), 23 were under 30. Changes in the mucous membrane of

Age Distribution of 65 Cases of Cerebral Cysticercosis

Age Group (Years)	No. of Cases	Age Group (Years)	No. of Cases
0-	2	30-	16
10-	4	40-	15
20-	17	50-	11

the alimentary tract and a diminished gastric acidity are recognized as being two of the most important factors that determine infestation with cysticerci. In the patient's personal history there may sometimes be a record of taeniasis. This was so in six of our cases. Neurological symptoms appeared shortly after the intestinal disturbance, and in such cases auto-infestation is almost certain.

Cysticerci are usually found limited to a single organ, and only exceptionally in several. In 90% of our cases the cysticerci were limited to the brain; a second tissue besides the brain was affected in only 10%—muscles (4%), subcutaneous tissues (4%), retina (2%). Cysticercosis may co-

exist with a primary or metastatic brain tumour, with syphilis, or with cerebral injuries. One of our cases had a primary glioma of the brain stem, and in two cases there were multiple cerebral metastases of pulmonary origin; in one case there was associated syphilis (four patients had a positive blood Wassermann reaction); in one patient who died from a cerebral injury cysticercosis was discovered at necropsy.

Clinical Manifestations

The duration of symptoms prior to admission to hospital varied from a few weeks to several years. Twenty-three of our cases were admitted less than six months after the onset of symptoms, 19 between six and twelve months after onset, and 23 more than a year after. In one-third of our cases the onset was sudden, while in the remainder it was gradual. In about two-thirds of our cases the course of the disease was intermittent.

Clinical symptoms arise solely from the presence of cysticerci within the nervous system. They depend both on the number of parasites and on their precise loca-

FIG. 1.—Microscopic view of an intracerebral cysticercus, showing hooklets. (Reproduced by courtesy of D. Bagdasar, F. Bagdasar, and I. Bazgan from *Bull. Soc. med. Hôp. Bucarest*, 1935, **17**, 6.)

tion within the brain. Such other factors, as whether the cysticercus is alive or dead and the tissue reactions within the brain (cerebral oedema, arachnoiditis, ependymitis), are also of importance.

Onset

Symptoms of the initial stage of cysticercosis comprise: (1) early and very intense signs of intracranial hypertension; (2) epilepsy; and (3) a pseudomeningeal reaction. Fifty-two of our patients had signs of intracranial hypertension at the onset, usually headache and less often vomiting. In 26 cases epileptic seizures were the first symptom, occurring either alone or associated with headache. Very often epilepsy remains the only symptom of the disease for quite a long time, the case then perhaps being regarded as one of idiopathic epilepsy. In five of our patients the onset consisted in only mild and transient meningeal symptoms, which sometimes recurred.

When fully developed, cerebral cysticercosis may give rise to a syndrome of marked intracranial hypertension, as occurred in 56 of our cases. Headache, vomiting, vertigo, and changes in the optic disks are the chief manifestations. Headache was found in all 56, either alone or, as in 29 cases, associated with vomiting. Depending on the number and location of the cysticerci, headache may be slight (when there are few parasites), severe (when there are many), intermittent (when there are parasites within the ventricles), or continuous. Vomiting was always associated with headache. Fundal changes were found in 39 cases, 35 showing papilloedema and 4 secondary optic atrophy.

Mental disturbances, due to involvement of the brain as a whole and mostly confusional in type, may accompany intracranial hypertension. They occurred in eight of our cases, being met with equally in cortical and basal cysticercosis.