and then developed superficial gangrene. Progressively and symmetrically they involved the pinnae, arms, forearms, buttocks, legs, and toes (see Fig.).

"Acthar gel," in a dose of 50 mg. 12-hourly intramuscularly, was begun, but two days later the patient went into coma and died on February 8.

Necropsy Findings.—**External Examination:** There was a dark-purple discoloration of ears and face, except for the circumoral area, with ulceration of both ears and cheeks. Dark-purple patches were present in the region of both nipples, on the outer side of both arms, with ulceration of the upper arms, on both buttocks, and on the outer side of both thighs and legs, with purpuric spots at the border.

Circulatory System: A large pericardial effusion was present consisting of clear yellow fluid. **Respiratory System:** The lungs were emphysematous, with a cavity in the right upper lobe approximately 2 cm. in diameter, and an adjacent dark solid area with a hyperaemic border showing central softening. There was no macroscopic evidence of tumour. **Digestive System:** The liver was enlarged (weight 2,326 g.) and extensively infiltrated with pale semi-translucent nodules. These swelled above the cut surface, and were approximately 1 cm. in diameter. **Haemopoietic System:** Lymph nodes around the coeliac axis and at the hilum of the spleen and para-aortic nodes were prominent. Cut surface was mottled, with reddish areas. The spleen (weight 1,162 g.) showed a pale cut surface with prominent Malpighian bodies. **Nervous System:**

Photograph showing skin lesions in the early stages.

An intact berry aneurysm arose from the anterior communicating artery of the circle of Willis. Adjacent to the aneurysm there was brownish discoloration of the arachnoid.

Histology.—**Right Lung:** An old infarct was present with central necrosis and peripheral haemorrhage and infiltration with lymphocytes and polymorphs. Elsewhere there were foci of lymphocytes. **Liver:** Lymphocytic infiltration had occurred and there were many deposits of irregular polygonal-celled trabecular carcinoma with a fine stroma. Mitoses were numerous. The appearances were those of metastases of an aplastic bronchial carcinoma. **Spleen:** Pulp spaces and sinusoids were distended with lymphocytes. **Coeliac Lymph Node:** Germ centres were no longer distinguishable, and the whole node was packed with lymphocytes of adult type. **Skin:** Both superficial and deep corium contained small recent haemorrhages, and in the same situation the veins contained organizing thrombi. The arteries appeared normal. There was no leukaemic infiltration.

Comment

Progress of the skin condition to extensive symmetrical gangrene had occurred as a terminal event, and it is difficult to assess the degree to which this contributed to the patient's death, particularly so when the double pathological condition found at necropsy is considered. Carcinoma, especially of the bronchus, is common nowadays, and

chronic lymphatic leukaemia is by no means rare, so that the association of the two conditions in the case here reported is probably fortuitous. Nevertheless, only 27 cases of carcinoma with leukaemia had been reported up to 1950 (Berk and Movitt, 1945; Even, Vibert, and Oury, 1950). In our case no primary growth was found in the lungs or in any other organ, but the histological appearance of the deposits in the liver was suggestive of primary carcinoma of the bronchus.

We wish to thank Dr. A. R. Kelsall for permission to publish this case.

REFERENCES

- Berk, M., and Movitt, E. R. (1945). *Amer. J. clin. Path.*, 15, 246.
Epstein, E., and MacEachern, K. (1937). *Arch. intern. Med.*, 60, 867.
Even, R., Vibert, J., and Oury, M. (1950). *Paris méd.*, 40, 141.
Sutton, R. L., and Sutton, R. L., jun. (1941). *Introduction to Dermatology*, 4th ed., p. 437. London.

THE EPIDEMIOLOGICAL APPROACH TO OBSTETRIC MEDICINE*

BY

A. M. THOMSON, M.B., B.Sc., D.P.H.

Research Lecturer, Department of Midwifery, University of Aberdeen

The annual report of a well-known teaching maternity hospital says that it had 1,413 admissions during the year 1950. These contributed 1,270 deliveries and 85 abortions. The stillbirth rate was 9.34 per 1,000 (an exceptionally low figure) and the neonatal death rate 17.32. In 31 tables are listed some of the features of numerous abnormal cases. How cases were chosen for admission and how they relate to the community as a whole are not indicated. The clinical detail presented is reduced to a bare minimum and there is no text or discussion whatever. The lay-out and scope of such annual reports are time-honoured, but make it very difficult to extract figures of scientific value. The time has surely arrived when all statistical reports should be drawn up according to the laws of epidemiology. Now that maternity services are organized on a regional basis, the leading hospital in an area might collate data from all sources and prepare reviews illustrating and discussing trends of morbidity and mortality in a defined population.

Maternity records are particularly suitable for systematic surveys because birth and death certification provides an automatic and accurate statistical framework for every administrative area. There is little difficulty, of the kind which arises in the study of chronic disease, in arriving at a biologically meaningful epidemiological "unit." A "maternity"—the cycle of pregnancy, childbirth, and recovery—is easily defined, and takes place in a limited and relatively constant period of time.

The group of maternities to be studied having been defined, the next step is to classify them. To reduce the population to a series of fairly homogeneous groups it is desirable to classify by legitimacy; by the maternity service to which a case has been booked, irrespective of the place of delivery; and perhaps by home address, if it is desired to limit the study to the residents of an area. Multiple maternities should be separated from single.

*Read in the Section of Preventive Medicine and Infectious Diseases at the Annual Meeting of the British Medical Association, Glasgow, 1954.

Most analyses will be carried out on groups of single legitimate maternities, which should be classified by age and parity.

Influence of Maternal Physique and Health

Since reproduction is a physiological function it is reasonable to suppose that maternal physique and health will be an important influence. It is, unfortunately, very difficult to assess health objectively, but a social classification is a useful indirect measure of the way of life of patients which is highly correlated with health and physique. Even better and more simple, it is useful to classify mothers by height. Height is associated statistically with social class and with general health. As one moves down the social scale, the proportion of small women and of unhealthy women increases (Baird, 1952b; Baird and Illsley, 1953). It has been shown that mothers in different height categories experience different rates of foetal mortality, prematurity, and difficult labour (Baird, 1949, 1952a, 1952b). The theory is that mothers who have been brought up in a satisfactory environment will grow to the maximum stature permitted by their genetic constitution, and will be in good general health, whereas those brought up in poor surroundings will be stunted and less healthy.

The Epidemiological Method in an Aberdeen Inquiry

I propose to illustrate the use of the epidemiological method in obstetrics by describing an inquiry made in Aberdeen into the nature and means of preventing unexplained deaths among mature babies. Accounts in greater detail have been published by Baird, Walker, and Thomson (1954), Walker (1954), and Walker and Turnbull (1953).

Prematurity has for long been recognized as a major cause of "unexplained" neonatal mortality. It is not so widely known that many babies which are mature by birth weight—that is, over 5½ lb. (2.5 kg.)—die for no very obvious reason. In a classification of obstetric deaths (stillbirths plus first-week deaths) by clinical cause (Baird, Walker, and Thomson, 1954) we distinguished two "unknown" categories, classified in terms of birth weight into "premature, cause unknown," and "mature, cause unknown." In both, pregnancy and labour were clinically uneventful, and at necropsy only uninformative conditions such as "prematurity," "atelectasis," "anoxia," and so on were found, the underlying cause of death being unexplained. Of 1,008 consecutive obstetric deaths in Aberdeen Maternity Hospital booked cases during the 15-year period 1938–52, 13.7% were classified as "mature, cause unknown."

A comprehensive analysis of these deaths by age, parity, and other factors was undertaken. Since booked hospital cases, especially multiparae, are more or less selected (Baird and Thomson, 1954), a study based on all city maternities, whether delivered in hospital or not, would have been preferable. Information on a city-wide basis has become available only recently, and in a relatively small city obstetric deaths are not numerous enough to permit dependable statistical analysis unless the results of many years are pooled. All stillbirths (not first-week deaths) in the city since 1938 could be classified by clinical cause, but complete information on age and parity was not available. In the booked hospital series, the stillbirth and first-week death rates behaved in relation to age, parity, and social class in much the same way as comparable national statistics, and long experience has shown that booked hospital primiparae at any rate may be regarded as a representative sample of first maternities in general; it was therefore believed that the behaviour of the obstetric death rate was fairly typical of the child-bearing population as a whole.

The "mature, cause unknown" obstetric death rate was 6.3 per 1,000 total births in primiparae, 4.5 in second and third pregnancies, and 4.4 in fourth and later pregnancies. In primiparae, especially, there was a steady rise as maternal age increased—from 2.3 at age 15–19, to 19.0 at age 35 and

over. Obviously elderly primiparae (say 30 and over) form a high-risk group for deaths in this category.

Since the data were compiled from a 15-year series, during which time the overall obstetric death rates had fallen considerably, trends in the "mature, cause unknown" obstetric death rate were investigated in relation to time. In the hospital series this rate behaved rather erratically, and certainly showed no sign of a consistent fall such as had occurred in the rate from all causes. Examination of data for the whole of Aberdeen showed that the "mature, cause unknown" stillbirth rate fell from just over 7 per 1,000 in 1939–40 to slightly under 5 in 1944–5. During 1946–8, the period of the post-war rise in the birth rate, when there were relatively more first births and an increase of average maternal age, the rate rose to the pre-war level, falling again in 1949–51 to about 5 per 1,000 (Baird, Thomson, and Duncan, 1953).

Examination of the hospital data for primiparae by social class and maternal height showed no consistent trends.

"Premature, cause unknown" death rates, on the other hand, show consistent trends in the expected direction by social class and height; the rates fell steadily during the war and showed no post-war rise; the gradient by age in primiparae is not so steep and steady as in the "mature, cause unknown" group, and very young as well as elderly mothers seem to have a relatively high death rate. Excess deaths in the "premature, cause unknown" group seem to be statistically associated with poor social class, small stature, and poor general health and nutrition of mothers; this is by no means obvious in the case of "mature, cause unknown" deaths. Though the two groups no doubt overlap aetiologicaly, the distinction by birth weight—above or below 5½ lb. (2.5 kg.)—seems to be fairly effective in separating deaths of different character.

Obstetric Death Rate in Post-maturity

Clinically, we had the impression that many "mature, cause unknown" deaths took place when pregnancy was prolonged past term (40 weeks) and that death was frequently preceded by foetal distress—that is, marked irregularity or slowing of the foetal heart, or the passage of meconium. To check these impressions statistically it was necessary to have very detailed and uniform notes on the duration of pregnancy and on the occurrence of foetal distress during labour. That recent hospital records sufficed for a fairly accurate analysis shows that an interest in epidemiology has had the useful effect of raising the standard of clinical recording in the hospital to a very high level.

It has been known for some time that the stillbirth and neonatal death rates (especially the former) increase when pregnancy goes past term (Clayton, 1941, 1953; McKiddie, 1949). Analysis showed that the rise in the obstetric death rate in post-maturity could be attributed to two groups of deaths, "mature, cause unknown" and "trauma." The association of these two groups is not unexpected, since if a baby is liable to die without obvious cause it is presumably all the more likely to die if the stress of prolonged or difficult labour is added. Furthermore, it is known that the incidence of difficult labour increases after term.

Analysis of the incidence of foetal distress in labour showed that it behaves similarly to the "mature, cause unknown" death rate, increasing rapidly with maternal age in primigravidae and in post-maturity.

On the basis of these facts an attempt is being made to reduce the incidence of "mature, cause unknown" deaths by (a) routine induction of labour at the end of the forty-first week in all post-mature primigravidae over 25 years of age, and (b) more frequent resort to caesarean section when foetal distress, especially the passage of meconium, is noted during labour. Results to date are encouraging. Epidemiological research has thus pointed the way to a positive method of saving lives when the real cause of death is unknown.

It may be noted in passing that this kind of epidemiological research is possible only if very detailed clinical

information is available, and therefore ought to be undertaken primarily by clinicians rather than by statisticians. Some knowledge of statistical methods is useful, but it is much more important to tabulate accurate information sensibly and to interpret trends with insight than to calculate precisely the vagaries of chance among data which may be neither accurate nor meaningful.

Impaired Foetal Oxygenation

Finally, what is the cause of "mature, cause unknown" death and of foetal distress during labour? The association with post-maturity and the fact that anoxia is a common finding at necropsy suggest that impaired oxygenation of the post-mature foetus may be the immediate cause. This is supported by the work of Barcroft and Young (1945) on animals. Walker (1954) has undertaken a study of the oxygen content of human foetal blood and has found that the percentage saturation—that is, the content in relation to the capacity—falls after term in normal pregnancy, and is unusually low where there is foetal distress and in a second labour in cases in which the first pregnancy ended in a "mature, cause unknown" death. These findings confirm the hypothesis that impaired foetal oxygenation is the main reason for the excess foetal mortality after term; presumably the basic reason has to do with a decline in the functional efficiency of the placenta when pregnancy is unduly prolonged. We have yet to determine whether the high obstetric death rate in elderly primiparae is due to exceptionally low foetal blood-oxygen levels* or to normal levels together with foetuses of low general vitality; it is not due to an unusually high incidence of post-maturity.

Summary and Conclusions

The study of morbidity and mortality statistics requires detailed clinical knowledge and good clinical case records if it is to be most fruitful. Statistics of maternity present many natural advantages for such a study, which should preferably be based on an administrative area. The scientific value of the traditional annual reports compiled by maternity hospitals is extremely limited.

The epidemiological approach in obstetrics is useful in providing insight into the nature and means of prevention of conditions which cannot be fully understood by detailed study of the individual case. Besides providing perspective, epidemiological research in a clinical unit increases precision of clinical observation, improves the quality of case records, suggests fruitful lines of laboratory investigation, and provides the means of checking the results of treatment.

The approach is illustrated by researches into the nature of unexplained stillbirths and first-week deaths in Aberdeen.

I am indebted to Professor Dugald Baird, Dr. James Walker, and other colleagues for valuable help and for allowing me to report these results of team research; to members of the Medical Research Council's Social Medicine Research Unit (Director, Dr. J. N. Morris); and to the Advisory Committee on Medical Research (Scotland).

REFERENCES

- Baird, D. (1949). *Lancet*, 1, 1079.
 — (1952a). *Amer. J. Obstet. Gynec.*, 63, 1200.
 — (1952b). *New Engl. J. Med.*, 246, 561.
 — and Illsley, R. (1953). *Proc. roy. Soc. Med.*, 46, 53.
 — and Thomson, A. M. (1954). *Gynaecologia (Basel)*, 138, 226.
 — and Duncan, E. H. L. (1953). *J. Obstet. Gynaec. Brit. Emp.*, 60, 17.
 — Walker, J., and Thomson, A. M. (1954). *Ibid.* In press.
 Barcroft, J., and Young, I. M. (1945). *J. exp. Biol.*, 21, 70.
 — and Young, I. M. (1945). *J. exp. Biol.*, 21, 70.
 Clayton, S. G. (1941). *J. Obstet. Gynaec. Brit. Emp.*, 48, 450.
 — (1953). *Proc. roy. Soc. Med.*, 46, 91.
 McKiddie, J. M. (1949). *J. Obstet. Gynaec. Brit. Emp.*, 56, 386.
 Walker, J. (1954). *Ibid.*, 61, 162.
 — and Turnbull, E. P. N. (1953). *Lancet*, 2, 312.

THE TREATMENT OF SUBACUTE AND CHRONIC SUBDURAL HAEMATOMAS

BY

R. G. ROBINSON, G.M., M.B., F.R.C.S.

(From the Department of Neurosurgery, Dunedin Hospital, Dunedin, New Zealand)

Wilfred Trotter (1914) recognized that some of the poor results in treating chronic subdural haematomas were due to failure of the brain to expand after their evacuation. This observation has been confirmed many times. The head-down position, intravenous fluids, and drainage of the subdural space have been used to help the brain to resume its volume after removal of the compressing mass. LaLonde and Gardner (1948) showed that better results were got when saline was injected into the subarachnoid space to help the brain to expand. Since then no other series of cases so treated has been reported.

Details of Treatment

It is common practice to seek and treat subdural haematomas by making burr-holes in the skull. There is no value in raising an osteoplastic flap, and it may be detrimental. Improved methods of diagnosis have precluded cases in which a subdural haematoma was a surprise finding at craniotomy for a cerebral tumour.

The making of burr-holes is always done under local analgesia, no matter how restless the patient. The usual site for the initial burr-hole is in the mid-temporal region about 1½ in. (4 cm.) above the zygoma. Further burr-holes may be made in the frontal and parietal areas. The most useful site for the second burr-hole is in the posterior parietal region. While a fluid haematoma can be easily treated through one burr-hole, a clotted haematoma needs multiple explorations. Bilateral burr-holes are always made, as the haematomas are bilateral in many cases. Incision of the dura mater will allow the haematoma contents to gush out. A fine rubber catheter is introduced into the subdural space in all directions and irrigation is carried out gently with Ringer's solution, which is preferable to normal saline. The washing is continued until the returning fluid is clear. In favourable cases the brain will expand to fill the dead space left by evacuation of the haematoma. The skin incision is closed in two layers and no drainage tubes are inserted.

The intrathecal injection of Ringer's solution is used in every case in which the brain does not expand after removing the haematoma. Ringer's solution can be injected into the lumbar subarachnoid space or into the ventricles of the brain by way of one of the burr-holes. Ventricular injection may be difficult if the ventricles are collapsed, and some experience is needed for ventricular puncture. Lumbar puncture is easier, and is safe and effective. When the haematoma is unilateral the towelled patient is not greatly disturbed on being turned from the supine to the lateral position for lumbar puncture. It is unsatisfactory, however, to turn patients with bilateral subdural haematomas. This difficulty has been overcome by operating with the patient in the prone position. The head is held in a cerebellar head-rest, which is adjusted to the patient's comfort, no flexion of the head being needed. No respiratory embarrassment occurs in this posture if the chest is raised on the shoulder-pieces, as the tongue cannot fall back into the pharynx. The lumbar-puncture needle may be inserted before the burr-holes are made. The prone position gives good access to all parts of the head except the forehead. It is satisfactory also for making burr-holes in cases of acute head injury. The patient is in an ideal position if the posterior fossa has to be explored for a haematoma.