EMERGENCIES IN GENERAL PRACTICE

HOME CARE OF PREMATURE CHILDREN

BY

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The family doctor's action after the birth of a premature child at home is determined by the size and maturity of the child, the type of home, and the help available; for the emergency is not one which the doctor in or out of hospital can manage alone. Help can be of two sorts: there may be a special hospital unit for premature infants, or the local health authority may have a service of specially trained midwives or nurses and provide the necessary equipment. Sometimes organized help is not available, but the house is good, the relatives are eager to help, and the midwife is able to give some extra time. The better the assistance at home the more careful should be the selection of premature infants for admission to hospital. Generally speaking, if a good domiciliary nursing service is operating, infants with a birth weight over 3½ lb. (1.6 kg.) can be cared for at home unless they have significant congenital abnormalities or birth injuries. Infants under 3½ lb. have a slightly better chance of survival if they can be carefully transported and admitted to a good premature infant unit. The "emergency" of the premature child lasts until the child has established a stable temperature, is feeding well, and can be cared for by his parents.

The care of premature children at home is always a matter of co-operation, with the doctor in charge but relying very much upon the wisdom and the experience of the nurse, and she in her turn teaching the parents and family to meet the situation.

In this article I shall deal with the child thought suitable for home care. The infant, though premature, is usually over 3½ lb., is not cyanosed, and after the first 48 hours becomes reasonably active. He has no major congenital abnormalities or evidence of birth trauma. The details of care are discussed in the order in which they must be considered after the child's birth: the character and maintenance of respiration; the preservation of body heat; the risk of spontaneous haemorrhage; the beginning of feeding; the prevention and recognition of infection; the general nursing care and signs of danger.

Character and Maintenance of Respiration

Respiration in the premature infant is different from that in the newborn full-term child. In both, breathing is diaphragmatic and irregular in time and depth, but in the premature infant it is also periodic. A run of diaphragmatic movements is followed by apnoea for 30 seconds or so before breathing again begins. Sometimes there is slight lower-rib recession, but seldom much thoracic movement, and no involvement of the accessory muscles or suprasternal recession, unless there is respiratory obstruction. Because breathing is diaphragmatic and periodic, the abdomen must not be restricted by a tight binder or clothing. In very immature infants the initial breathing is even more primitive—a series of gasps only—and insufficient for survival unless replaced by periodic breathing.

In resuscitation gentleness is of first importance; the infant's pharynx and larynx are cleared with a mucus

catheter, the infant is wrapped loosely in a warmed sheet and placed in a cot. If the baby is slow to begin breathing or if he is cyanosed, then oxygen may be directed on to his face about the nose and mouth. A suitable and convenient apparatus for use in the home is the "sparklet" described by Waller and Morris*; either the face-mask or, if the nurse is familiar with it, the intragastric oxygen method may be used.† The impact of oxygen on the face is a direct stimulus to respiration and also increases the chance of the infant obtaining oxygen during attempts at breathing. Artificial respiration has no place in the resuscitation of premature children. Lobeline, 1/20 gr. (3 mg.), given into the cord or by intramuscular injection, may act as a direct respiratory stimulant.

After respiration has been established oxygen is not required unless the infant again becomes cyanosed or the breathing again becomes embarrassed. Oxygen cannot safely be given at home for long periods, because it is now known that high concentrations are dangerous; regular measurement of the concentration is required if the risk of retrolental fibroplasia is to be avoided. Also, there is no doubt that the role of oxygen in the care of uninjured premature infants has been exaggerated; good results can be obtained without it, and its function as a life-saver is very difficult to estimate.

Warmth: Risk of Bleeding

The premature infant is difficult to keep warm. Immediately after birth he is loosely wrapped in a warmed sheet and placed in a deep box or other container, if possible one with solid sides to prevent heat loss and with a pocketed lining to take hot-water bottles. The bottles are changed hourly in rotation. The room must be warm, between 70 and 80° F. (21 and 27° C.), and the cot shielded from draughts by a screen. The child's rectal temperature should be recorded every eight hours, and, because low temperatures are common, a thermometer reading to 85° F. (29.4° C.) instead of the usual 95° F. (35° C.) is used. The child's temperature takes 24–48 hours to reach 97–98° F. (36.1–36.7° C.), and for several days may be variable. Anything between 96 and 100° F. (35.6 and 37.8° C.) can be regarded as normal. Below 95° F. (35° C.) extra warmth is needed, above 100° F. (37.8° C.) the infant is too hot, and the cause must be found. If the temperature falls below 96° F. (35.6° C.) the child's movements and respirations slow, feeding becomes difficult or stops, and at about 92° F. (33.3° C.) or lower he may become stiff as the subcutaneous fat and muscles harden. This change is reversible without permanent effect, but takes 24–72 hours to disappear. A temperature less than 95° F. (35° C.) for more than 24 hours is certainly an indication for admission to hospital.

The risk of bleeding in the first week is greater in premature than in full-term infants. The commonest site of bleeding is into the lungs, causing sudden intense cyanosis. Blood-stained froth may come from the mouth, and scattered crepitations appear in the lungs. Bleeding into the intestinal tract is evident by melaena or the passage of blood per rectum. A more uncommon but equally dramatic episode can occur with intraventricular bleeding; a child previously well suddenly alters colour, screams, and stiffens, and the

*Waller, A. K., and Morris, D., *Lancet*, 1953, 2, 951.

†The intragastric method of administering oxygen will be described in a later article in this series by Dr. A. P. Norman on "Birth Trauma."

fontanelle becomes tense. Any of these are indications for admission to hospital. The tendency to bleed is related to a low blood prothrombin, and there now seems little doubt that the chance of spontaneous bleeding is reduced if all premature children are given vitamin K. The routine practice here is to give one injection of menadoxime (soluble vitamin K), 2.5 mg., into the muscles of the thigh, but the oral preparation may be given, tab. acetomenaphthone, 5 mg., as a single dose.

Feeding

There are many schemes for feeding the premature child; given care and interest, they are almost all successful. The methods described here are satisfactory in ordinary use both at home and in hospital. Premature birth interrupts growth of the foetus when it is gaining weight rapidly, and the object is to feed the premature child so that he overcomes this disadvantage and reaches the weight he would have been expected to attain if he had been born at term. The following decisions are necessary: when to start feeds; how to feed; what to give and how often; how rapidly the food should be increased; and when vitamins and other supplements should be given.

The best time to begin feeds is when the baby first shows signs of hunger. Watch for sucking or swallowing movements, observe the loss of oedema and the contemporary increase in movement. These signs occur between 12 and 72 hours, and in this time even a small infant of 3½ lb. (1.6 kg.) may lose up to 8-10 oz. (230-280 g.). But this loss of weight when accompanied by increase in activity is not a reason for anxiety. Feeding with a pipette or spoon is now uncommon, as there is a real danger that some of the food may enter the trachea. If, however, the infant is very immature (under 3 lb.—1.36 kg.), or is limp even after the oedema has disappeared, tube-feeding will be needed. This requires experience, and if a prolonged period of tube-feeding is necessary the infant is better in hospital.

The child, unless he is tube-fed and provided the room is warm enough, is best fed outside the cot on the nurse's or mother's knee. A 4-oz. (114-ml.) medicine bottle is suitable, but a Belcroy feeder is much more easily handled. The important thing is to use a small soft teat with a relatively large hole through which the milk can flow easily, but not so fast that the child's mouth is filled faster than he can swallow, as then there is the chance of aspiration. If the hole is too small the child simply becomes exhausted.

For the first day of feeding it is customary, but not necessary, to give water, 1-2 dr. (3.5-7 ml.) three-hourly for seven or eight feeds, but on the second day of feeding milk is started. If the mother is lactating and the infant is lively, he should be put to the breast in the usual way. It is remarkable how small infants can often suckle well, but if he cannot or if the mother's milk has not "come in," then a half-cream sweetened milk made up 1:8—that is, one measure to 1 oz. (28 ml.) of water—is given. Sometimes at the beginning breast milk can be expressed. Neither breast milk nor the reconstituted dried milk are further diluted, for the small infant needs relatively more food than the larger child, and the problem is rather that of giving a feed of adequate food value in a reasonable volume than a diluted feed in a large volume.

Premature infants do not absorb cow's milk fat very readily, but they utilize the protein and the carbohydrate without difficulty. Thus, a half-cream sweetened dried milk is very suitable, for it provides the full protein of cow's milk with added sugar to make up for the calories lost in the removal of the fat (the 1:8 mixture has an approximate composition of 3.5% protein, 2% fat, 7% carbohydrate, and is about 16-18 calories per oz. (28 ml.) of reconstituted feed). National half-skimmed milk is essentially the same without extra sugar, and if it is used one teaspoonful of sugar must be added to each 3 oz. (85 ml.) of feed. As the infant is able to take more the food is increased steadily; for guidance one can say that a baby of 4 lb. (1.8 kg.) or over will take 2 oz. a lb. (125 ml. per kg.) by the seventh day, 2½ oz. (156 ml. per kg.) by the four-

teenth day, 3 oz. (187 ml. per kg.) by the twenty-first day, and up to 4 oz. (251 ml. per kg.) on the twenty-eighth day. The best indication is the child's appetite, and that is judged by observation; to know how much to push any particular infant is a matter of nursing skill and experience. Three-hourly feeds are the best, and at home the 2 a.m. feed may be omitted if the infant will sleep through. Most premature infants of the weights we are discussing have regained their birth weight by the 14th day and increase steadily in the third week. Typical charts of two such infants are given in Figs. 1 and 2. Generally speaking, the more immature the child the slower the gain after the initial loss,

FIG. 1.—Weight gain in relation to food intake of infant under 3 lb. (1.36 kg.) at birth. (Note: 1 lb.=0.45 kg.; 1 fl. oz.=28 ml.)

FIG. 2.—Weight gain in relation to food intake of infant over 3½ lb. (1.6 kg.) at birth.

while an infant weighing 4½-5 lb. (2-2.27 kg.) who may be small and yet almost mature will gain weight rapidly without initial loss.

Vomiting and aspiration is the greatest hazard at this stage. There may be either immediate suffocation or temporary cyanosis and collapse, with sometimes subsequent lung abscess (see below). Vomiting after either tube or bottle feeds, in the absence of intestinal obstruction or oesophageal hiatus hernia, is almost always due to the baby being returned to his cot before his wind has been properly brought up. The commonest reason is inexperienced hurried feeding. Vomiting is not caused by the type or quality of the food, but by errors of technique in the person giving the feed. The essentials in feeding a premature baby are therefore simple: plenty of food, adequate protein, the feeds freshly and cleanly prepared, a bottle with a soft teat, and a patient and careful person to give the feed.

Vitamin and Iron Supplements

At 3 weeks all premature infants require vitamin supplements, and from 6 weeks iron also. Vitamins A and D are best given as one of the many standardized liquid

concentrates. Whatever the preparation used, about 1,000 units of vitamin D are required each day, and with most preparations this gives also a sufficient dosage of vitamin A. Vitamin C is best given as ascorbic acid, as orange juice might cause intestinal colic and hurry; 25 mg. a day is sufficient, though excess is harmless, since it is excreted in the urine. These vitamin supplements can be given in the feeds or separately.

Iron is given in either the ferric or ferrous form; ferric ammonium citrate, 1 gr. for each 1 lb. (143 mg. per kg.) of the infant's weight each day, has the disadvantage that it stains the tongue and blackens the stools, sometimes causing diarrhoea, at others constipation. Ferrous sulphate, 2-3 gr. (130-200 mg.) daily, is colourless but more difficult to dispense and must be fresh. The *National Formulary* ferrous sulphate mixture for infants contains 1.25 gr. (80 mg.) of ferrous sulphate to the drachm (3.5 ml.) and will keep satisfactorily.

Infection

Infection is a continuous threat. Most are caused by *Staphylococcus aureus* and are carried to the infant either on the hands or in the noses of those caring for him or visiting him, or in the bottles or teats used for feeding. Everyone with a "cold" or other upper-respiratory infection, or with skin sepsis, should be forbidden to approach a premature child. Careful feeding preparation is required, and the hands must always be washed before feeding the child. The minor forms of infection are "sticky" eyes, superficial skin spots, and small "septic fingers"; more severe lesions are blind boils, cellulitis, or sialadenitis; very occasionally a child may develop an osteomyelitis or a septic arthritis. Most to be feared is the development of pneumonia, for it is both the most serious and the most insidious infection. It must always be considered if a premature infant loses his appetite or has cyanotic attacks; cough rarely occurs, but when present is very significant. The temperature is rarely raised; indeed, it is more likely to be subnormal. Physical signs are hardly ever found; unless a few crepitations are heard. If pneumonia is suspected, consultation or admission to hospital is required urgently.

"Sticky" eyes and small superficial septic spots, unless associated with other signs, are best treated by local cleansing, the eyes being irrigated thoroughly and a thin film of golden eye ointment (yellow mercuric oxide ointment) applied to prevent the lids sticking. "Spots" should be kept as dry as possible if the child is not yet being bathed; if bathing has been started, potassium permanganate crystals may be added to the water, the skin patted dry, and afterwards carefully dusted with a starch and zinc powder.

Thrush may also require treatment. The grey patches of fungus on the cheeks or tongue are easily recognized, and it is tempting to try to remove them by local swabbing. But if this is done a small sore ulcer remains and the child may stop feeding. The most satisfactory treatment is three drops of 1% aqueous solution of gentian violet dropped into the mouth from a pipette or spoon twice a day for four days.

Nursing Care

Finally, there are certain points of general nursing care worth mentioning. The essence of successful care is gentleness in handling and the elimination of all nursing procedures not essential for the child. Thus, bathing or oiling are unnecessary; all that is required until the child is well established is that the buttocks should be cleaned with a soft soapy swab and a smooth cream of zinc oxide and castor oil applied liberally. The flexures and the rest of the skin should be carefully watched but touched as little as possible. Similarly, weighing is only necessary every three or four days, the progress of the child being determined by his behaviour and appearance as much as by his gain in weight. As feeding may be started late, the meconium does not completely change to faecal stools until later than in a full-term infant. Jaundice in premature infants tends to be

deeper and to last longer than in full-term infants. When jaundiced they are sleepy, slow, and often very difficult to feed. If the jaundice becomes very deep, as it does sometimes about the end of the first week, there is always the danger that the child may suffer brain damage—the non-haemolytic kernicterus of premature children. Deep jaundice is therefore a real cause of anxiety.

Conclusion

I have given, in outline, the principles underlying the care of premature infants at home, making the point that such care is always a matter of collaboration between doctor and nurse or midwife and parents. Undoubtedly the smallest and most immature children will require admission to hospital, but 80% of all premature children are more than 3½ lb. (1.6 kg.) when born, and most of these can be looked after successfully at home. In Newcastle-upon-Tyne only 10% of premature children born at home are admitted to hospital in the first 14 days.

Unfortunately prematurity is not simply a medical problem. In about half the cases there is a medical condition which might reasonably be held responsible for the early onset of labour; in the other half—those most likely to be born at home—there is no such cause, and in this group the incidence rises steeply down the social scale. Thus, the premature infant has in addition to the handicaps of his prematurity a greater risk of entering a poor home where standards of care and feeding or protection from infection are likely to be low. Such families stand in need of special care, and here the family doctor with his authority and prestige can do much by keeping a watchful eye upon premature babies. He can also call in the health visitor to help him to maintain the standard of care and nutrition in the first few all-important years.

It is in the prevention of prematurity and the further saving of lives of premature infants that the greatest hope lies of a further significant reduction in the neonatal mortality. No doubt further special units are required for the smallest premature infants, but the greatest gain over the whole country is to be sought by a general raising of the standard of care both at home and in hospitals, and here the family doctor is in the key situation.

Equipment

The equipment needed for home care, in addition to ordinary midwifery equipment, comprises:

- Cot with washable lining and draught-proof sides.
- Mattress with covers—1 plastic and 1 cotton.
- 1 Mackintosh sheet.
- 2 Cot sheets.
- 4 Blankets.
- 1 Coverlet.
- 3 Hot-water bottles (with covers).
- 1 Sterilizer (fish kettle).
- 1 Mucus catheter with rubber catheter attached.
- 1 Wall thermometer.
- 1 Cot thermometer, and low-reading (85° F.—29.4° C.) clinical thermometer.
- 2 Outfits consisting of 2 vests and 2 hooded flannel gowns (if required).
- 1 Cot screen.
- 1 Belcroy feeder.
- 1 Roll of cotton-wool.

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