

Problems of the Newborn

Vomiting, Diarrhoea, and Infection

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Vomiting

The first stage of life, in the words of Jaques from *As You Like It*, is "first the infant mewling and puking in the nurse's arms . . ." Many normal babies vomit, but if the baby is essentially normal the vomiting is either infrequent or is of small amounts at the end of a feed. In fact, these latter small vomits are called regurgitation or possetting—terms not precisely defined but which carry on implication that the vomiting is not serious. Vomiting may carry serious implications when the vomit is bile-stained, blood-stained, excessively large and forceful, or is associated with other findings: vomiting with diarrhoea, vomiting in a baby who is obviously unwell, vomiting in a baby with abdominal distension, vomiting associated with weight loss or weight that is static.

A few points from the history may be helpful. If there has been hydramnios, high intestinal obstruction becomes more likely, as it does if vomiting occurs just after feeds are given. In lower intestinal obstruction vomiting is more likely to be delayed beyond the first 24 hours. A family history of cystic fibrosis, congenital hypertrophic pyloric stenosis, or Hirschsprung's disease suggests the possibility that the disease has recurred in this generation.

BILE-STAINED VOMITING

Bile-stained vomiting in a newborn baby must be assumed to be due to intestinal obstruction until proved otherwise. It should be remembered that bile-staining is green. Normal colostrum is often a fairly deep yellow, and yellow-stained vomit does not carry the important implication that there is an obstruction beyond the ampulla of Vater with regurgitation of bile into the stomach. The baby should be examined, looking particularly for abdominal distension (see below) or masses, and checking the hernial orifices. Even if no supportive signs are found, the bile-stained vomit is sufficient reason to send him to a hospital where neonatal surgery can be undertaken if it is necessary. Before putting the baby in the ambulance, a tube should be passed into the stomach and the stomach emptied. He should be accompanied by a nurse or doctor, who must aspirate the stomach frequently on the journey. The most important investigation will be a plain x-ray film of the abdomen in the erect position. Swallowed gas provides a contrast medium and may enable a diagnosis to be reached. Sometimes, at the discretion of the surgeon, other contrast radiology may be necessary before deciding whether to operate.

BLOOD-STAINED VOMITING

Blood-stained vomiting in the first 24 hours of life is most commonly due to swallowed maternal blood, but the possibility that it is the baby's blood must always be remembered. A simple test on the vomited blood (Apt's test for alkali resistance of the blood) will usually distinguish between maternal and fetal blood. After the age of 3 days a large amount of blood in the vomit is probably the baby's and is probably due to haemorrhagic disease of the newborn. A small streaking of fresh or altered blood suggests hiatus hernia as the cause of the vomiting, but may, of course, be associated with a crack in the mother's nipple if the baby is breast-fed. In any case where the baby vomits a large amount of blood and appears collapsed or has air hunger he should be treated as if serious haemorrhage has occurred and transfused at once.

Vomiting with diarrhoea clearly suggests infection with an enteropathic organism (see below). Vomiting in a child who is obviously unwell may be a sign of parenteral infection, or may be associated with the adrenogenital syndrome or of metabolic disease. It is difficult to sort out the possibilities clinically and the baby should be investigated in hospital.

Distension of the Abdomen

Though abdominal distension is most commonly caused by gastrointestinal disorders, it may also be caused by abdominal masses, ascites, haemorrhage from a damaged viscus, or parenteral infection. It is, of course, important to ascertain if there has been vomiting, and if the baby has passed urine and meconium.

Inspection of the belly will show whether the distension is mainly of the upper abdomen, suggesting a high obstruction, or whether the distension is generalized.

Obvious ladder patterning in a term baby, or visible peristalsis suggests obstruction. Blue discoloration around the umbilicus suggests haemorrhage, and a taut, red, shiny appearance is sometimes seen in peritonitis. On palpation one is mainly searching for masses or enlarged viscera, but even in the newborn it is often possible to get an impression of tenderness. Gentle percussion will identify whether the distension is tympanitic or dull. Transillumination, using a bright pencil torch in a completely blacked-out room, may be useful in proving ascites or in identifying whether a mass is fluid filled—that is, cystic. Rectal examination with the fifth finger should be performed gently, and is sometimes rewarded by a gush of flatus and meconium. If this occurs, some of these babies will eventually prove to have Hirschsprung's disease or cystic fibrosis, especially if the gush is led by a greyish white mucus plug.

Most babies pass their first meconium within 24 hours of birth, though this may be delayed (especially in preterm babies). When prolonged delay is associated with abdominal distension and vomiting it clearly suggests intestinal obstruction. Nevertheless, it must be remembered that even in com-

plete atresia some meconium may be passed. The passage of blood or melaena must of course alert one to the possibility of haemorrhage disease of the newborn but may also be caused by malrotation with volvulus or by necrotizing enterocolitis. A plain x-ray film of the abdomen is essential.

Diarrhoea

Diarrhoea in a newborn baby is always a matter of importance, though the urgency is greatest if the baby is also vomiting. He may become quickly and seriously dehydrated and he may collapse. If he is in a nursery with other babies there are serious dangers of cross-infection. While the diarrhoea caused by enteropathic organisms is often green and watery, this appearance is neither diagnostic nor invariable. Cultures of the stool should be taken, measures to prevent cross-infection instituted, and if a specific organism is found an attempt to identify the source is essential.

If diarrhoea is mild and unaccompanied by vomiting, the baby should be fed with one-fifth normal saline and dextrose instead of milk feeds for 24 hours. One can usually then reintroduce dilute feeds. If the child is seriously dehydrated or there has been a sudden large loss of weight he should be sent to hospital for intravenous feeding and correction of the biochemical disturbance. In mild cases or in cases where the only problem is diarrhoea, antibiotics should not be given. When the baby is systemically ill, especially if he is a preterm, there is a place for systemic antibiotics for there is a danger of septicaemic spread in newborn preterm infants.

Apart from enteropathic organisms there are many causes of diarrhoea in the newborn. Some are relatively unimportant such as overfeeding or maternal laxatives in the breast-fed baby. Others, even if rare, are important and may be dangerous such as necrotizing enterocolitis, carbohydrate intolerance, cystic fibrosis, or congenital adrenal hyperplasia. If the child is obviously unwell, or if diarrhoea persists beyond a few days, further investigation in hospital will be necessary.

Infection

Infection is a perennial problem in diseases of the newborn. Not only is it relatively frequent but it takes many guises, and even if not the primary problem it must be considered in the differential diagnosis or as a possible complication of almost every condition. For an excellent, comprehensive, and recent review of bacterial infection in the fetus and newborn, the reader should see that by Dr. Pamela Davies.¹

SUSCEPTIBILITY OF NEWBORN

For several reasons—some of which are identified but some of which are not understood—the newborn baby is more susceptible to infection than the older child or adult.

The phagocytosis of his polymorphonuclear leucocytes is less efficient. The "gift" of immunoglobulins from his mother with which he starts life does not include the important IgA and IgM fractions. Complement levels are low in cord blood. The inflammatory response of the newborn is less rapid and extensive than in later life. The baby is usually bacteriologically sterile at birth so that there is little competition from a previously existing bacterial flora when he is exposed to pathogens. There are probably other undefined factors which might help explain the well-known fact that boys are more susceptible to infection than girls.

INTRAUTERINE INFECTIONS

So long as the amniotic cavity is intact, intrauterine infections are caused by viruses with a few notable exceptions, such as

syphilis, toxoplasmosis, and listeriosis. The infection in the mother is often unnoticed or even trivial. With intrauterine infections the time in gestation when the infection reached the fetus, which is not necessarily the same time as the mother's infection, is very important.

Infection in the embryonic stage of development leads to teratological abnormalities (such as microcephaly, hydrocephaly, congenital heart disease, abnormalities of the lung and kidney) and the baby is usually small for gestational age. When infection occurs later and the baby is born with a viraemia still in an active phase, he may show a neonatal illness with jaundice, hepatosplenomegaly, anaemia, and thrombocytopenia. This presentation is not characteristic of any one specific virus. The only treatment likely to be helpful is supportive, such as an exchange transfusion with fresh blood to correct anaemia and hyperbilirubinaemia and to provide, one hopes, some useful antibody. At the same time virus infections during the embryonic phase do not usually produce a clinical picture from which one can guess the particular virus concerned. An exception is the rubella virus which causes an embryopathy which may be recognizable—congenital heart disease with cataract or deafness.

When the membranes have ruptured the baby may become infected by organisms ascending from the lower genital tract of the mother. Thus prolonged rupture of the membrane and excessive obstetric manipulation are associated with a higher incidence of infection of the newborn. When passing through the birth canal the baby becomes exposed to the flora of the genital tract and may become infected. In some cases the infection is always thus acquired—for example, gonorrhoea. In others, infection may be thus acquired or acquired in utero—for example, listeriosis or herpes virus infection.

POSTNATAL INFECTIONS

Early Infections

Most babies are born from a sterile environment. They are quickly colonized with bacteria and, in general, minor infections occur in the first two or three days while major septicaemic infections occur after the third day of life. There are important exceptions to this rule. When the mother has gonorrhoea the baby is exposed when passing through the birth canal and develops gonococcal ophthalmia within the first 48 hours of life (see below). Infection with β -haemolytic streptococci or bowel pathogens similarly acquired may cause an infection and even death before 48 hours of age. A baby infected by contaminated resuscitation equipment may suffer a similar fate.

Gonococcal ophthalmia, which is again becoming more frequently seen, constitutes a real emergency since delayed treatment even for a matter of hours may lead to permanent impairment of vision.

Prophylactic treatment of the eyes with silver nitrate drops of the newborn was largely abandoned in Britain over a decade ago but possibly some form of prophylaxis should be introduced in the coming years. Meanwhile it is essential to recognize and treat sporadic cases as they arise. A profuse purulent discharge from the eyes occurring in the first 48 hours after birth must be assumed to be gonococcal until proved otherwise. A swab should be taken for Gram staining and immediate culture—the organism is usually not grown if culture from the swab is delayed for more than a few minutes—and treatment started. Penicillin eye drops (10,000 units per ml) should be instilled at a drop a minute for one hour and then repeated at 3-hour intervals. At the same time parenteral penicillin by intramuscular injection should be given (100,000 units twice a day) for five days.

Should the culture prove that the ophthalmia is caused by a coliform organism, chloramphenicol eye drops or sulphacetamide eye drops should be substituted.

Early infections are more likely to occur if there has been prolonged rupture of the membranes, if there has been birth asphyxia and aspiration of amniotic fluid, if there has been excessive obstetric manipulation, or if the mother has a fever and genital tract infection. If these situations arise prophy-

lactic antibiotics are probably best withheld, unless the baby is unwell, in which case antibiotics are given to treat the presumed infection, after cultures have been taken. The organisms likely to be responsible for early infections are bowel organisms from the perineum or β -haemolytic streptococci but one should not forget rare but important organisms such as *Listeria monocytogenes*.

Infections After the Third Day

Infections are more likely to occur in the circumstances mentioned above, in low-birth-weight babies, in boys, and in babies who have been intubated or had other tubes passed at birth. Superficial infections are usually obvious, the commoner sites being the eyes (purulent discharge), the umbilicus (redness or purulent discharge, or both), the skin (pustules, "pemphigus," or intertrigo), the breasts (mastitis), the nails (paronychia), and the mouth (thrush). More serious and systemic infection usually presents with a number of rather vague symptoms such as lethargic behaviour, poor sucking, failure to gain weight, episodes of cyanosis or apnoea, abdominal distension jaundice, vomiting or diarrhoea, or both. Fever, or alternatively a subnormal temperature, may also occur.

On examination, one may find signs of localized infection, spreading redness, hepatosplenomegaly, and enlarged kidneys. Though one looks for these signs they are not consistently present in an infected baby. Occasionally a symptom or sign points to infection in a particular system—such as respiratory distress, suggesting pneumonia, or a fit suggesting meningitis. Many, if not most, normal babies shows at least one of the vague symptoms listed above at some time in the neonatal period. It is the concurrence of several symptoms in one baby or the fact that the symptom is more than transient that suggests infection as the cause.

Identifying the Organism

Obviously an attempt to identify the infecting organism before starting treatment is vital and is much more than mere intellectual interest. The choice of antimicrobial agent, the means of administering it, and the duration of treatment and the prognosis may all depend on the organism. For all superficial infections, a smear and a culture should precede treatment. For all cases who are systematically ill swabs from nose, throat, umbilicus and any local lesion, blood culture, and examination and culture of urine are important investigations. In many cases examination of the cerebrospinal fluid is also necessary. Though not always important in identifying the organism other tests may be useful in establishing a diagnosis of infection, such as estimating the white cell count, immunoglobulin levels, and antibody titre if virus infection is suspected.

Treatment

Superficial Infection.—In most cases of superficial infection in which there are no symptoms or signs of systemic infection,

the lesion may be treated locally—that is, without giving systemic antibiotics—after cultures have been taken. For instance, a "sticky" eye on the fifth day might merely be treated with sulphacetamide eye drops or thrush treated with gentian violet or nystatin. An exception is gonococcal ophthalmia. It remains important, however, to continue to observe the local lesion and the baby's symptoms and signs to check that there has been an adequate response and that there is no extension.

Systemic Infection.—If a superficial lesion shows signs of local extension, such as widening redness and swelling, or if the baby shows the symptoms and signs of systemic illness described above he should be treated systematically—again after cultures have been taken. Nevertheless, in the ill newborn baby, one should not wait for the result of cultures before starting treatment, because deterioration to the point of collapse may be very rapid. The result of cultures, however, may modify treatment when they become available.

When one knows the infecting organism and its *in vitro* sensitivities, one obviously uses the appropriate antibiotic (but remembering that some antimicrobials, such as sulphonamide, novobiocin, oleandomycin, tetracycline, and naladixic acid are absolutely or relatively contraindicated in the newborn period). When, as is usually the case, the causative organism is not yet known one should use a combination of antibiotics which would be expected to be effective against most Gram-positive cocci and Gram-negative bacilli. Such a combination might be penicillin with kanamycin, or cloxacillin with ampicillin. (Suggested dosage for a term baby of about 3 kg would be penicillin, 50,000 units eight-hourly; kanamycin, 20 mg eight-hourly; cloxacillin, 40 mg eight-hourly; ampicillin, 75 mg eight-hourly.) Both the dose and the frequency should be adjusted to the baby's weight, maturity, and postnatal age.¹ The drugs should be given by injection at least for the first few days. A course of antibiotics should be not less than five days—and much longer in meningitis, osteomyelitis, and urinary infection.

PREVENTION OF INFECTION

The most important single measure in the prevention of spread of infection is effective handwashing by the baby's attendants. Hexachlorophane in a suitable base may be used instead of soap both for handwashing and for bathing the baby. This compound is more effective against staphylococci than against Gram-negative bacilli. Another important site and reservoir of infection is the umbilical stump. At the Hammersmith Hospital it has for some years been our practice to spray the cord at birth with polybactrin spray, and then daily until the cord separates. (The dying umbilicus provides a culture medium for bacteria.) From the time we introduced this regimen the incidence of infection in other parts of the body has been greatly reduced—and so has the incidence of maternal breast abscess. Unless the attendant has a respiratory tract infection, the use of masks is probably unnecessary and even undesirable when handling term newborn babies.

Reference

- 1 Davies, P. A., *Archives of Disease in Childhood*, 1971, **46**, 1.