On July 31, 1 ml. (10 µg.) of vitamin B₁₂^d was given intramuscularly and an excellent response was obtained, the expected reticulocyte count and the expected red cell total both being reached (Fig. 2). This result again showed that 10 µg. of vitamin B₁₂^d had maximum anti-anaemic-factor activity.

Summary

Two cases of pernicious anaemia have been successfully treated with vitamin B₁₂^d in the very small dosage of 10 µg. Both showed the anti-anaemic activity to be of the same order as that of crystalline vitamin B₁₂.

In one case 10 µg. of vitamin B₁₂^d gave the same response as 1 ml. of examen, having full anti-anaemic activity at that dose level.

The crystalline vitamin B₁₂^d used in the treatment of the two cases described above was supplied by Glaxo Laboratories Ltd., to whom I wish to express my thanks.

MUCUS CATHETERS*

BY

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The removal of mucus from the respiratory passages is a basic step in treating asphyxia of the newborn. Without a clear airway no success can be expected from other methods of resuscitation. Relatively little attention is often paid, however, to the means by which the air-passages are to be cleared. Unsatisfactory instruments are widely used. A review of current methods, especially with reference to the risk of infecting the child, therefore seems overdue.

Historical Notes

Special tubes have long been used for blowing into babies' throats. An early example was Pugh's (1754) air pipe, "made of a small common Wire, turned very close (In the Manner Wire-Springs are made) and covered with thin soft Leather." Chaussier (1785) designed a metal tube for passage into the trachea. Quills and the stems of churchwarden pipes served the same purpose.

During the nineteenth century simple tubes of metal or rubber came into use for preliminary suction also. The chief patterns were the "tracheal pipes" of Blundell (1834) and Chaussier. The unpleasantness of sucking mucus into the mouth was soon recognized but long tolerated. Traps were indeed foreshadowed by Dewees (1825), who wrote, "Might not a properly constructed syringe be highly useful in removing the obstructing mucus?", but no such instrument appeared until 1877. Tarnier then adopted the insufflator, operated by rubber bulb, which bears the name of Ribemont-Dessaignes (1900).

Champneys (1886, 1911) advised that the air-passages be cleared without suction, by tilting the child's head back and blowing into the mouth. The mucus, having gravitated towards the posterior nares, was thus expelled through the nose. "In rare cases," he added, "it may be necessary to pass a catheter into the trachea. If passed 3½ in. (9 cm.) from the lips, it will be below the glottis and above the bifurcation of the bronchi."

The chest should be compressed with one hand and the operator should blow down the catheter, which will cause an up-draught in the trachea and empty it of mucus."

A trap was added to the old tracheal pipe about 1898, when Carton, of Dublin, invented his mucus catheter (FitzGibbon, 1923; no original description traced) with closed end and lateral apertures. Cowell's (1912) design was similar but had a terminal opening. These metal types, with the glass-bulbed patterns which appeared after 1920, remain in common use in Britain. In the United States, De Lee's glass mucus trap has been used for about 50 years.

Methods of Removing Mucus

Drainage by gravity, holding the baby up by the feet, is now considered unwise in cases of severe asphyxia, when intracranial haemorrhage may be present. The blowing method is likely to infect the child. Champneys (1886) himself quoted Reich's account of an outbreak of tuberculous meningitis due to mouth-to-mouth insufflation by a phthisical midwife, and non-tuberculous infection is also important. Suction may be applied by mouth, by rubber bulb, or by a Venturi tube operated by water, by a cylinder of compressed gas (Saher and Salt, 1943), or by electric motor (Roberts, 1949).

The electric and gas-cylinder devices are said to be effective, but are costly and not available in the home. The water suction pump is also confined to institutions and is inconvenient, involving long tubing and usually an assistant to stand by the tap. Excessive negative pressures, which may damage the child, must be guarded against with these instruments. The recoil of a strong rubber bulb produces adequate negative pressure, but the tube must be removed from the throat, probably several times, to renew the vacuum. It is less convenient than mouth-suction.

Of all methods, for convenience, simplicity, and accurate control, mouth-operated mucus catheters are still usually preferred. Their continued use, however, can be recommended only if they are of effective design and properly used.

Essential Features

It is suggested that a mucus catheter must fulfil three conditions.

1. *It Must Have an Efficient Trap.*—Many catheters are not fully protective. Some are too small. In others the inlet is at the bottom of the trap; then, when thin fluid partly fills the space, air is drawn through it and froth is sucked up. One common pattern has no trap but consists of two rubber tubes with a glass connexion of equal diameter. Through this device mucus and meconium often reach the operator's mouth, and it is remarkable that so many doctors and nurses tolerate it. Mucus, as well as being unpleasant, may infect the attendant.

2. *The Tip Must be Soft and Flexible.*—The infant's mucous membrane is easily damaged, and the asphyxiated baby, if livid and hypertonic, or flaccid and lying head downwards on a slope, may lurch suddenly. Rubber tubes should therefore replace those of metal or glass.

3. *It Must Not Infect the Child.*—A mucus catheter which becomes blocked is commonly cleared by blowing

*Based on a paper read before the Scottish Paediatric Society on June 16, 1950.

and then used again : a dangerous practice, for the tube has become contaminated by organisms from the attendant's throat. This risk of carrying infection to the child has only recently been emphasized (Munro Kerr and Chassar Moir, 1949 ; Ellis, 1950).

How can the danger be eliminated ? A plug of cotton-wool in the mucus trap is unsatisfactory, as it is easily clogged. Deflection of the air-stream by tubes within the trap is only a partial safeguard. Clearly, whenever the instrument becomes choked it should be laid aside and a fresh sterile one taken. At least three, therefore, should be boiled and placed ready at every confinement. "The practice of blowing through a blocked mucus extractor is inexcusable" (Ellis, 1950).

A further precaution is to use the mucus catheter with discretion. It tends to be employed at every birth, without good reason and with needless repetition. Many babies, after all, need no help in clearing their airways. Premature and feeble infants, so prone to infection, call for particular care.

A mucus catheter should also be simple, easily cleaned, and cheap but not unduly fragile, and the trap should be transparent.

Bacteriological Tests

The object of the tests was to assess the danger of infecting the child and the protection afforded by different patterns of mucus trap.

1. An operator with a healthy throat was selected. Five different types of mucus catheter and six samples of 1 ml. of broth were sterilized. A was the mucus catheter with no trap ; B had a simple trap which did not deflect the air-stream ; the traps of C, D, and E thoroughly deflected the air-stream through them. With each catheter, 1 ml. of broth was sucked up and blown out three times, then incubated for 36 hours in a poured blood-agar plate. A control sample of broth was exposed to the air and similarly incubated. This series of tests was carried out on three separate days, and the following number of colonies of organisms grown is the average of the three occasions.

Pattern	Average No. of Colonies
A. No trap	Uncountable
B. Simple trap	8
C. Experimental	5
D. Aberdeen	3.5
E. Middlesex Hospital (large trap)	11
F. Control	4

In cultures A to E the organisms were mainly *N. catarrhalis*, *Str. viridans*, and *Staph. albus*, with some haemolytic streptococci, *Staph. aureus*, and diphtheroids. In the control cultures they were *Staph. albus* and diphtheroids.

2. With an operator recovering from a heavy cold, similar tests were made. (A throat swab produced on culture a profuse mixed growth of *Str. haemolyticus* and *Str. viridans*.) First, one short breath was blown through each mucus catheter on to a blood-agar plate.

Pattern	No. of Colonies After 24 Hours
No trap	6 <i>Str. viridans</i> ; 2 contaminants
Middlesex Hospital	1 <i>Str. viridans</i> ; 2 contaminants
Control plate	2 of contaminants

1-ml. samples of broth were then sucked up and blown out twice with each instrument and incubated in poured blood-agar plates.

Pattern	No. of Colonies After 24 Hours
No trap	9 haemolytic streptococci; 75 <i>Str. viridans</i>
Middlesex Hospital	1 <i>Str. viridans</i>
Aberdeen	1 <i>Str. viridans</i>
Control	1 contaminant

3. Similar results were obtained in the labour ward. Mucus was repeatedly sucked from an infant's throat with the same mucus catheter and each sample cultured separately. The serial cultures showed that with repeated aspiration and blowing the contamination rapidly became heavy. Twelve babies were thus observed.

Our conclusions are that the mucus catheter which has no trap is dangerous, that any trap reduces contamination from the attendant's throat, and that no pattern of trap prevents it.

A New Design

If the above criteria are accepted, many current types of mucus catheter must be regarded as obsolete. To satisfy these criteria, the pattern illustrated has been developed at Aberdeen Maternity Hospital.

The trap is of hardened glass. The rubber bung carries two glass tubes, one bent upon itself. The inlet tube projects $\frac{1}{2}$ in. (1.25 cm.) into the trap, the outlet being flush with the bung. On each end is a length of rubber tubing, the upper tube being firm enough to make a mouthpiece unnecessary. The lower tube is smaller and softer, but not so thin-walled as to collapse readily. For ordinary use plain tubing is preferred to a narrow catheter with a lateral aperture. Its cut end has not been found harmful, but the rounded tip of a

rectal tube can be substituted if desired. Occasionally, when tracheal suction is needed, a thin tube can be attached by a tapered connexion of metal (as illustrated) or glass. A Magill's silk-web endotracheal tube, No. 4, or a rubber catheter may be used, according to the method of intubation. The combination may be employed for De Lee's method of resuscitation, by intratracheal insufflation with the attendant's breath (De Lee and Greenhill, 1947). The force required is well stated in a detailed account by Mathieu and Holman (1929). It should, "with the lips pursed to whistle, be felt on the wet finger about $3\frac{1}{2}$ to 4 in. (9 to 10 cm.) from the mouth," and the operator should puff about forty times a minute. This can be commended as an emergency measure only, to treat extreme asphyxia in domiciliary practice when the risk of infection must be subordinated to that of immediate death. In hospital practice, mechanical insufflation with known pressure is preferred.

The Aberdeen mucus catheter is supplied by Archibald Young and Son, Ltd., 57-61, Forrest Road, Edinburgh, with the choice of a plain or rounded tip.

The term "catheter" can be correctly used in this connexion, and is preferable to the less pleasing "extractor," "evacuator," or "aspirator."

Summary

- A mucus catheter operated by mouth-suction is the most convenient means of clearing the throat of the newborn baby, but an efficient mucus trap must protect the user.

The danger of carrying infection to the child is demonstrated. After a mucus catheter has been blown through it should never be replaced in the baby's throat.

Mucus catheters of effective design can be cheaply made of glass and rubber, and several should be provided at every delivery.

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CHRONIC RENAL DISEASE WITH SECONDARY HYPERPARATHYROIDISM

BY

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It is now well established that a close relationship exists between renal disease and parathyroid hyperfunction. Thus many cases of primary hyperparathyroidism show evidence of disturbed renal function, and, pathologically, calcium deposits in the kidneys are a feature. These may be intratubular, peritubular, or interstitial, and be accompanied by cellular infiltration and fibrosis. The usual result is interference with tubular function, leading to urine of constant low specific gravity, polydipsia, and polyuria. The large amount of calcium excreted in the urine in this condition often results in renal calculus formation, and this may lead to obstruction or infection.

However, the functional relationship between the kidneys and the parathyroid glands is a reciprocal one. The subject is reviewed by Anderson (1939). Bergstrand (1921) noted the frequency with which parathyroid enlargement accompanied renal damage, and Gilmour and Martin (1937), in an extensive statistical study, found the parathyroid glands to be of a higher mean weight in renal disease than in other disease groups. They also noted that the glands had a higher percentage of parenchyma per unit of weight in renal disease than occurs normally. In rare instances of chronic renal

disease this hyperplasia may be sufficiently well marked to give rise to clinical manifestations of hyperthyroidism. In still fewer instances bone lesions similar in every respect to the osteitis fibrosa of primary hyperparathyroidism have been present. Such cases have been reported by Hubbard and Wentworth (1920-1), Albright *et al.* (1937), and Herbert *et al.* (1941). The renal lesion has varied from case to case. Chronic nephritis, chronic pyelonephritis, and polycystic disease have been described, but in all cases the renal insufficiency has been long-standing and severe.

In children, as in adults, long-standing renal insufficiency may lead to parathyroid hyperplasia and hyperfunction. Langmead and Orr (1933) reported a case of renal rickets in which all four parathyroid glands were grossly enlarged and the histological changes in the bones presented a composite picture of classical osteitis fibrosa and of true rickets. Gilmour (1947) found similar histological changes in the bones of seven out of eight subjects aged 3 to 17 years with chronic renal disease. In five of these the parathyroid glands were definitely hypertrophied.

Metastatic calcification is an interesting phenomenon which has an undoubted association with both renal disease and hyperparathyroidism. In this condition calcium salts are deposited in previously normal tissues. In addition to the kidneys, the common sites of calcium deposition are the arterial walls, the heart, the mucous membrane of the stomach, and the skin and subcutaneous tissues (calcinosis). The condition may be produced experimentally in animals by overdosage with parathyroid extract or with vitamin D. In both instances deposition of calcium salts in the kidneys may lead to severe renal impairment. Essentially the same pathological picture has been produced in man by excessive administration of vitamin D. The association of metastatic calcification with renal disease has excited much interest since the original description of the condition by Virchow (1855). He observed five cases, in all of which there was more or less severe nephritis. Four of these were accompanied by destructive bone disease, but in one there were no demonstrable skeletal changes.

Barr (1932) stated that it was difficult to find cases of metastatic calcification in which a renal element could be excluded. Herbert *et al.* (1941) collected 19 cases of metastatic calcification from the literature, and 16 of these were associated with gross renal disease. In 11 of these 16 there was evidence of parathyroid hyperplasia, and in only one case was parathyroid hyperplasia definitely excluded. In three cases unassociated with gross renal disease the parathyroid glands were normal. Gilmour (1947) described three well-marked cases of metastatic calcification occurring in chronic renal disease. In each of these there was marked parathyroid hyperplasia and the bone changes of osteitis fibrosa.

In the case of chronic nephritis reported below, gross enlargement of the parathyroid glands was found in association with metastatic calcification and bone changes of osteitis fibrosa.

Case Report

The patient, a married woman aged 44, gave a history of scarlet fever in childhood. In 1927, at the age of 22, she developed swelling of the face and legs, and was treated in hospital for three months as a case of nephritis. She then remained well, and married in 1931. One year later a pregnancy was terminated because of persistent vomiting, and sterilization was performed by ligation and division of both Fallopian tubes.