OESOPHAGEAL ATRESIA

EXPERIENCE IN 17 CASES, WITH NOTES ON OPERATIVE TECHNIQUE

BY

CHRISTOPHER PARISH, B.Sc., F.R.C.S.

Consultant Thoracic Surgeon

AND

C. F. A. CUMMINS, F.R.C.S.Ed.

Senior Surgical Registrar

Addenbrooke's Hospital, Cambridge

Though, according to Mackenzie (1884), congenital atresia of the oesophagus was recognized by Dursten as long ago as 1670, no surgical success was recorded until 1939, when Leven (1941) and Ladd (1944), working independently of each other, performed multiple-stage operations for this condition, with survivals. These were followed two years later by the first successful end-to-end anastomosis by Haight (Haight and Towsley, 1943).

The history of the events leading up to these successes has been very adequately described by Leven *et al.* (1952), who discussed the various unsuccessful methods, such as gastrostomy alone, jejunostomy, etc., which were tried prior to 1939, and described their experiences in 103 cases occurring between 1939 and 1952. The operations in their series were performed by nine different surgeons. That large series of cases, and a few other series such as those of Gross (1953), who reports 233 cases, and Haight (1952) with 131, are quite exceptional and will not nearly be approached by the great majority of thoracic surgeons who have the responsibility of treating this condition.

No really large series has been reported from this country, but if one accepts as correct the estimate of Belsey and Donnison (1950) that congenital atresia of the oesophagus occurs once in every 800 births, then some 600 children so afflicted are born every year in the British Isles.

Diagnosis

The diagnosis of this condition has been discussed in detail by many authors (Lanman, 1940; Ladd, 1944; Flett *et al.*, 1949; Leven *et al.*, 1952; d'Abreu, 1953; Grow and Neerken, 1953; Koop *et al.*, 1954; Clatworthy, 1955; Nicks and Caughey, 1955; Roberts *et al.*, 1955), but the most important point is to be aware of it. The symptoms are fairly constant, and, in brief, the condition should be suspected in any newborn child who shows difficulty with respiration, excess mucus secretion, choking or intermittent cyanotic attacks, or who has a maternal history of hydramnios. These symptoms are often precipitated or accentuated when feeding is attempted.

Confirmation can easily be obtained by passing a size-8 well-lubricated urethral catheter down the oesophagus. Clatworthy (1955) makes the point that it should be passed through the nose, whence in normal infants it will enter the stomach easily (proved by the auscultation of injected air or by epigastric palpation), whereas in an infant with oesophageal atresia it will be held up 10 to 15 cm. from the tip of the nose.

Radiological confirmation by the instillation of lipiodol into the upper pouch is not a diagnostic necessity and carries the additional hazard of spill-over into the bronchial tree. If, however, it is undertaken, only a few drops of radio-opaque medium are necessary, and these should be instilled under fluoroscopic control and aspirated immediately the film has been taken.

Diagnosis of the much rarer tracheo-oesophageal fistula without atresia is difficult, and Koop *et al.* (1954) mention

two such cases; one was seen by the bronchoscopist, and the other was found when the No. 10 catheter in the stomach was withdrawn and respiratory sounds were heard as the end passed the fistula. This condition should be suspected if intermittent symptoms persist after a catheter has confirmed the absence of atresia.

The earlier the diagnosis is made, the greater the chance there is that surgery will be successful. Koop *et al.*, in their series of 61 cases, noted a 46% mortality rate in the cases operated on before 72 hours and a 75% rate in three operated upon after this time.

In our series of 17 cases (10 females, 7 males) only one patient was operated on after 72 hours, and he survived; but, paradoxically, we found the average time between birth and operation in the survivors was 47 hours, while in the non-survivors it was 39 hours; these figures, however, include deaths from other associated conditions which in themselves were lethal. The earliest diagnosis in our series was 1½ hours after birth, and was made by a midwife who was endeavouring to administer intragastric oxygen.

TABLE I.—Results

Case No.	Birth Date	Sex	Type of Anomaly	Operation	Remarks
1	2/10/51	F	1	Usual extra-pleural	Died 2nd post-op. day from tension pneumothorax
2	2/11/51	M	1	" "	Good, alive and well
3	11/10/52	M	1	Usual trans-pleural	" "
4	29/10/52	F	1	" "	Needed intermittent dilatation for 2 yrs. Now swallowing well
5	19/11/53	M	1	Unfit	No operation. Died 3rd day
6	14/12/53	F	1	Usual trans-pleural	Congenitally deaf. Stricture excision
7	15/5/54	F	1	" "	Died 5 hours post-op. Had gross cardiac defects
8	4/6/54	F	2a	Gastrostomy. No anastomosis possible	Died 3rd post-op. day. Collapsed lower lobe
9	1/8/54	F	1	Usual trans-pleural	Good; alive and well
10	10/9/54	M	1	" "	Died "4th post-op. day. Pneumothorax
11	9/11/54	F	1	" "	Died 4th post-op. day. Congenital scleroedema
12	19/3/55	M	1	" "	Had needed intermittent dilatation
13	3/7/55	F	1	" "	Died 8th post-op. day. Empyema. Necrosed oesophageal wall
14	19/9/55	F	1	" "	Diagnosed at necropsy. 2nd day after birth. Has gastrostomy and needs occasional dilatation
15	7/3/56	M	1	No operation	Good, alive and well. Imperforate anus subsequently repaired and colostomy closed
16	26/6/56	F	1	Usual trans-pleural	
17	6/9/56	M	1	Usual trans-pleural plus a transverse colostomy for imperforate anus	

Other Congenital Anomalies.—It is a well-recognized fact that oesophageal atresia is often associated with other congenital anomalies (Leven *et al.*, 1952; Koop *et al.*, 1954; Clatworthy, 1955; Nicks and Caughey, 1955), and not infrequently these may be gross, multiple, and incompatible with life. It would seem that a genetic factor can be present in one parent. Mackenzie (1884) cited a case of a father, all of whose children by three wives showed this anomaly; and Sloan and Haight (1956) reported the occurrence of oesophageal atresia in brothers. One of our patients had a sibling with atresia of the oesophagus, and the mother of these children had webbed toes. In our series of 17 cases five children had other congenital abnormalities, of which two were gross—one having a cleft-palate, an atrial septal defect, a ventricular septal defect, and persistent ductus arteriosus, and the other having an imperforate anus, thoracic hemivertebra, and bilateral inguinal herniae. One child had a Meckel's diverticulum, one had congenital duodenal atresia, and one was completely deaf.

Obstetric History

Twelve of these patients were first babies, two were second, and three were third. One of the last was the

smallest of triplets. Four of the babies were born between 37 weeks and term and the remainder at full term. Four of the mothers were reported to have hydramnios, two toxæmia of pregnancy, one an ante-partum hæmorrhage, and one a threatened abortion at 20 weeks. Hydramnios was noted by Clatworthy (1955) in 3 of his 35 cases, and its association with oesophageal atresia is also remarked upon by Nicks and Caughey (1955). Scott and Wilson (1957) found hydramnios in 12 out of 13 cases in their series.

According to Leven (1941) separation of the primitive foregut into trachea and oesophagus is usually present in the 8-mm. embryo; and Gruenwall (1940), who found oesophageal atresia and tracheo-oesophageal fistula in a 9-mm. human embryo, explains the condition as a failure of separation.

Various classifications of the condition have appeared in the literature. That of Vogt (1929), which is often quoted in papers on this subject, does not sufficiently emphasize the frequency of the commonest variety. Gross (1953) described six main groups, and Roberts *et al.* (1955) further subdivided the commonest group into those where the fistula enters the bifurcation low down, with a considerable length of atretic segment, and those where it enters the trachea high up, with overlapping of the fistula by the upper pouch.

It would seem of value to divide the cases into two main groups—those where a primary anastomosis can be performed (Group 1) and those where anastomosis is impossible (Group 2a) or unnecessary (Group 2b), ligation of the fistula being all that is required (see Diagrams).

FIG. 1.—Group 1a: Atresia of the upper segment with lower oesophagus making fistulous connexion with the trachea. Group 1b: Same as 1a, but the fistula is either to the bifurcation of the trachea or to the left main bronchus. Group 1c: The upper oesophageal segment has a fistulous connexion with the trachea or the bifurcation. The lower segment of the oesophagus is a short, blind stump at the diaphragm. Group 1d: There is a narrowing of the oesophagus (or even a complete atresia) at a point near the tracheal bifurcation, but no fistula is present. Various combinations and permutations of these varieties may occur.

In our series 16 (94%) were in group 1, and three of these had the sac and fistula in contiguity. One case in this group had a very high take-off of the lower end, the origin being only just below the vocal cords. Two of the group had a band from the trachea for a few millimetres before it opened out into the lower oesophagus. One case was a Group 2a variety.

FIG. 2.—Group 2a: Atresia of the upper oesophageal segment and an absent lower oesophageal segment. Group 2b: A fistulous connexion between the oesophagus and the trachea. Adults with this variety have occasionally been reported, no operation having been performed.

The Operation

Pre-operative Preparation.—Time spent on improving the general condition is good up to a point, and we are very much in agreement with Clatworthy (1955), who believes that one rarely gains by devoting more than 12 hours to this; in fact, if the infant's condition is so poor that he cannot be prepared in this time there is little hope of salvage. While Nicks and Caughey (1955) have remarked that operation in the early hours of the morning with a skeleton staff probably carries a greater risk than if it is done early the next day, this has not been our experience. In fact, we feel that in a busy general hospital, where lists are often scheduled throughout the day, the night offers uninterrupted operating time which otherwise may not be easily available. In addition, the full and willing co-operation of the anaesthetic and paediatric teams has always been obtained on these occasions.

Aims of the Operation.—The ideal to aim at is closure of the tracheo-oesophageal fistula when present and anastomosis of the two ends of the oesophagus at one operation. The following description applies to those cases where this apposition is feasible. The treatment of the others is discussed later. The operative details of the condition have been discussed fully by many of the authors previously quoted, but the following description contains a number of points which do not seem to have been mentioned hitherto and which we feel are of great importance if a successful result is to be attained. An intravenous cut-down transfusion, using "polythene" tubing into a saphenous vein, is set up in the ward and 1/200 gr. (0.32 mg.) of atropine is given three-quarters of an hour before the operation is due to start. The infant is grouped and 1 pint (570 ml.) of blood is cross-matched; but great caution must be used in its administration, and the amount given in our series varied between 40 and 70 ml.

Anaesthetic

The anaesthetic consists of nitrous oxide at 3 litres a minute, oxygen at 2 litres a minute, and "tubarine," 2 mg. per stone (0.3 mg. per kg.), or suxamethonium chloride, 6 mg. per stone (0.94 mg. per kg.) initially. A further dose of 0.5 mg. of tubarine or the equivalent is given as required.

A Magill size 00 armoured endotracheal tube is passed and connected to an M.I.E. infant absorber, and the anaes-

thetist has available lengths of No. 2 size polythene tubing for frequent suction throughout the operation. It is advisable to mark off the length of the Magill tube on the polythene tubing with a small piece of sticking-plaster before the anaesthetic is started, and to round off the end of the tubing by holding it momentarily in a flame.

Frequent suction of the bronchial tree throughout the procedure is most important, not only to remove secretions but also, as we discovered in one of our cases, to give early warning of bleeding from the ligated fistula. In this instance the anaesthetist had not been sucking out frequently, and noticed difficulty in inflating the lung during the latter stages. On removing the endotracheal tube at the conclusion of the operation he found it was almost completely filled with blood clot.

We used diathermy for cutting the muscles and coagulating all the bleeding-points, and there is no doubt that this is a great time-saver.

Position.—The child is laid on its left side on the damp diathermy pad and a length of 4-in. (10-cm.) wide zinc oxide plaster is applied across the hips and fixed to the under part of the table on each side. A further small piece of narrow plaster is then applied to the flexor and extensor surfaces of the uppermost forearm (right), leaving a loop of plaster some 12 in. (30 cm.) long which can be manipulated by the anaesthetist or a nurse during the early part of the operation, when scapular retraction is required.

Instruments

Special instruments for these cases greatly facilitate the operation. Firstly, the very small space available in which to work demands a thoracotomy retractor which lies out of the way and at the same time gives adequate exposure. One of us has designed such an instrument (Cummins, 1954).

Secondly, the Tudor Edwards infant rib shears are very useful for the rib resection, but a strong pair of heavy scissors are quite effective for this purpose, and can be used if the shears are not available.

Thirdly, the smallest type of skin hook is an essential to atraumatic handling of the very delicate tissues. We use the kind designed by Gillies. These are particularly useful during the anastomosis, as the long handles enable the assistant to keep his hands well away from the wound while at the same time anchoring either end of the oesophagus securely.

Fourthly, a suitable needle-holder must be available; any cross-action variety, such as Mayo's in which the thumb and forefinger pass through the ring handles, is far too clumsy, and tearing of the tissues can occur when the needle is released. We have found that Silcock's ophthalmic needle-holder is an excellent instrument for the purpose, as the self-locking device enables the operator to hold it between finger and thumb, as one would a pen.

Fifthly, a long-handled pair of non-toothed dissecting forceps and a small edition of a right-angled artery forceps, such as those of O'Shaughnessy, also with long handles, are most useful for the dissection.

Finally, the sutures for the anastomosis and the fistula must be atraumatic, and we have found that 5.0 black braided silk arterial sutures (Ethicon code No. 595) answer the purpose very well.

Procedure

An oblique incision is made through the right chest, and after the muscles have been divided in the line of the incision a suitable rib, usually the fourth, is resected subperiosteally and the pleural cavity entered through the rib bed. We prefer this to an intercostal incision because of the greater ease with which the chest can be closed.

An extrapleural approach was used in the first two cases in this series, but subsequently we have used the transpleural. We feel that the theoretical advantage of the

former in localizing a suture-line leak and possibly avoiding an empyema is more than offset by the extra time taken to dissect this very fragile tissue. With the transpleural approach, the parietal pleura over the oesophagus needs to be incised, and with a careful technique a watertight closure of this can usually be obtained on completion of the anastomosis.

The azygos vein is divided between ligatures, and the ends of the oesophagus are sought and mobilized.

The first essential is the closure of the fistula where one is present, as in a few of our cases the anaesthetist was embarrassed by the inflation of the stomach which occurred during the manual compression of the bag before this closure was completed. Early mobilization of the lower segment and slight tension upon a tape passed around it will prevent this happening.

The lower oesophagus must be cut off almost flush with the trachea and a careful closure made by interrupted sutures. This can be subsequently reinforced, if necessary, by available contiguous tissue or a free muscle graft. If a fistula is not present the lower segment is trimmed back by the removal of serial thin slices until the lumen is reached and the cut end bleeds freely.

A size 8 soft rubber urethral catheter passed down into the upper pouch by the anaesthetist is a help in mobilization of the upper pouch, but when working by touch under the sterile towel it often bends and will not enter the pouch easily. However, a size 1 Magill tube, cut off so that it is about 4 in. (10 cm.) long and passed alongside the endotracheal tube at the time of intubation, is a most useful guide for the catheter, which is threaded down it and allows its easy insertion without bending at the critical moment. The dissection of the upper pouch can be greatly aided by the use of two traction sutures on either side near the end, and when this mobilization is completed the tip is incised and the catheter drawn down through it into the wound and threaded into the cut open end of the lower segment. The two ends can then be gently opposed by manipulation of the traction sutures and of skin hooks in the lower end, and any appreciable gap assessed. It may be necessary to mobilize still further before commencing suturing.

A discrepancy in thickness of the two ends is not unusual, and, in fact, we have often been struck by the very poor tissue of which the upper pouch is composed. It often seems to consist of nothing more than mucous membrane with no muscle fibres present for perhaps 0.5 cm. or more, and in these cases we do not see how it is possible to make more than one layer of sutures, as many authors advise when doing the anastomosis. We feel that, even when good tissue is available, a second layer is inviting devascularization of either or both ends, with its attendant risk of fistula.

We use four basic everting mattress sutures which are named north, east, south, and west by the surgeon as he puts them in and hands the ends, which are clamped with a distinctive pattern of forceps, to the assistant. When these are in place the two ends of the oesophagus can usually be approximated if a gentle continuous pull is sustained on them by the assistant while the surgeon "kneads" the ends together, often over a period of minutes.

Usually, one single suture is then placed between each mattress suture, making a total of eight sutures around the periphery, and the parietal pleura is approximated over the anastomosis. Careful closure of this layer is most important.

At this stage the anaesthetist withdraws the rubber catheter over which the anastomosis has been performed and replaces it by a length of fine polythene tubing which is passed across the anastomosis under direct palpation and vision. This tube is for feeding and is passed just through the cardia.

The chest is then closed in the usual way with fine chromic catgut after two intercostal drainage tubes have

been inserted, one up to the site of the anastomosis and the other ending at the apex of the pleural cavity.

Neostigmine is usually given, estimated on the initial dose of tubarine used, 1 ml. of tubarine containing 2.5 mg. The amount of neostigmine required is estimated by the formula:

$$\frac{2.5 \times \text{initial dose of tubarine}}{20}$$

If thoracotomy reveals that for one reason or another direct end-to-end anastomosis is impossible, the fistula, if present, is closed and a gastrostomy and cervical oesophagostomy performed.

Definitive correction of the defect can then be made subsequently by staged operations, and it would seem that in the present state of knowledge the use of a segment of transverse colon is more likely to be successful than oesophago-gastrostomy or oesophago-jejunostomy.

The use of a skin-lined antethoracic oesophagus with its many stages and liability to stricture would seem to have no place in the treatment these days.

Use of Gastrostomy

Apart from those cases where primary anastomosis cannot be performed, the use of gastrostomy must obviously be assessed on its merits in each case. Some surgeons (Leven *et al.*, 1952; Gross, 1953; Clatworthy, 1955; Roberts *et al.*, 1955) advise its routine use either at the time of, or shortly after, every primary anastomosis, but we feel that the polythene tube inserted as described at the conclusion of the anastomosis is quite adequate for nutritional requirements.

If, however, a stricture should occur at the anastomosis, retrograde bouginage with Tucker bougies by means of a string through a gastrostomy is a very useful and effective method, and we have used this in four cases in this series. We find that cineradiography of the oesophagus with the image intensifier is a marked improvement on conventional methods and a valuable aid in assessing changes in the degree of stricture.

We always use two strings, as breakage of the loops of the Tucker bougies is not uncommon, and if this should occur the spare one can be employed to pull through another before any further dilatation is done. The replacing of a single broken string is somewhat tedious and involves the use of a very fine filiform bougie introduced through the stricture from above under direct vision, a suckling bronchoscope being passed down the oesophagus. We use the type of bougie described by Hubbard and Leven (1950). The bougie is passed into the previously washed-out stomach and the end picked up by sinus forceps, the jaws of which are observed by means of a cystoscope introduced alongside the forceps. The string is then tied on to the end of the catheter and pulled back.

Retrograde insertion of a ureteric catheter, via the cystoscope, into the oesophagus is theoretically simpler, but in practice the cardiac opening is most difficult to visualize in an infant.

Post-operative Care

While the subject-matter of this report is primarily concerned with the surgical aspects of the condition, it would be wrong to assume that these are the most important. The contribution of the surgeon, while very necessary, is nevertheless only a fraction of the work involved. It is no understatement to say that, post-operatively, the fate of these children rests almost entirely on the work of the paediatrician and the nursing staff, all of whom spend many worried days and restless nights looking after these very ill patients.

Most of the previously mentioned authors have covered this aspect of post-operative care very fully, and there is little to add to the accepted routines. It is essential that during the first week or two the child has a special nurse right around the clock. She turns him hourly, sucks out his pharynx at the slightest suspicion of mucus, and keeps

an accurate report of changes in the colour, pulse, and respiration. Constant observation of the drainage bottles to ensure that the tubes are patent and not blocked by blood clot is essential. After removal of the tubes a careful watch for evidence of a pneumothorax is of vital importance.

Daily x-ray films are taken for the first two or three days, and antibiotics are used routinely, usually chlortetracycline, 10 mg. per lb. (22 mg. per kg.) body weight per day.

Neonates are notoriously poikilothermic, and care must be taken not to overheat them during the operation and during the first few days.

A direct-vision laryngoscope, a good suction apparatus, and a few sucker ends must be beside the cot throughout every 24 hours of the first two weeks or so.

The apical drainage tube is usually removed at 24 to 48 hours if the lung is expanded, and the other is left *in situ*, still connected to the water seal bottle, until about the fifth or sixth day.

Feeding

Feeding is begun post-operatively with glucose-water hourly, and two-hourly after the first 24 hours. Feeds are given through the polythene tube, and after 48 hours half-strength expressed breast milk is given, being changed to full strength on the fourth day. These feeds are also given via the polythene tube, which is removed about the ninth day in uncomplicated cases. Chlortetracycline is given by the same route, the intravenous drip being taken down as soon as the operation is over. The volume of the feed is gradually increased and the intervals are lengthened. Two of our patients, discharged on the ninth and tenth post-operative days respectively, were by that time having normal breast-feeds. We believe it important to begin normal oral feeding to stimulate swallowing as soon as possible. Even though supplementary feeds may have to be given via a gastrostomy tube, a certain amount of oral feeding is desirable.

TABLE II.—Birth Weights

Survivors		Non-Survivors*	
lb. oz.	g.	lb. oz.	g.
7 12	3,515	5 12	2,608
7 2	3,222	5 15	2,693
7 8	3,402	3 8	1,588
7 4	3,289	4 12	2,155
6 4	2,835	4 14	2,211
5 8	2,495	6 14	3,118
5 13	2,637	6 3	2,807
6 14	3,118	5 1	2,296
Average: 6 12	3,062	5 5	2,495

*One patient was not weighed.

Results in Present Series

Weight and Mortality.—It is generally agreed that, other things being equal, the higher the birth weight, the lower the mortality, and this is certainly borne out in this series. The best case was home on breast-feeding on the ninth post-operative day. The average period in hospital of the others was three to four weeks. Of our 17 cases, 14 had a primary anastomosis, one was diagnosed only at necropsy, one was never fit for operation, and one in Group 2a had a gastrostomy only; both of these latter died. Of the 14 patients with primary anastomoses, nine survived and five died, giving a survival rate of 64%.

Late Results.—Four of the survivors had some degree of stricture post-operatively. These all had a gastrostomy and were treated by dilatation with Tucker bougies as described previously. Of these cases one is now swallowing quite normally and the gastrostomy is closed, two are still receiving retrograde bouginage at increasing intervals, and one after three years has a persistent stricture for which operative repair has been undertaken. The stricture has been excised and the trimmed ends of the oesophagus have been anastomosed satisfactorily. An interesting point in

this case is that the walls of the oesophagus were tissue-paper thin, and at the original operation seemed to consist of mucous membrane only, whereas well-formed and apparently normal oesophagus had developed in the three-year interval before excision of the stricture. The mass of scar tissue at the stricture was incredibly hard, forming a block about 2.5 by 2 by 2 cm., and it was not surprising that it did not respond to frequent dilatation.

Summary and Conclusions

The experience of one team with 17 cases of atresia of the oesophagus is described.

Special points in surgical technique and care of these babies are stressed. Results in relation to the findings are given.

It is felt that the knowledge of the simple diagnostic procedures, the possibilities of operative repair, and the location of the nearest unit willing to undertake these cases should be widely disseminated among general practitioners and midwives.

Experience with these cases is invaluable, from the medical and nursing points of view, in reducing the mortality and morbidity rates. Therefore cases should if possible be sent to an experienced team, and the extra journey with the baby is far outweighed by the advantages of getting the case to such a unit.

Great care in performing the anastomosis pays handsome dividends and speed is of no importance.

Special nursing round the clock is essential for these babies in the first few post-operative days.

We thank Mr. Kent Harrison for allowing us to include two of his Cambridge cases in this series. We are grateful to Dr. Douglas Gairdner and his paediatric team and the anaesthetists at Addenbrooke's Hospital for their encouragement and help, without which these patients would not have survived. We thank Miss Sylvia Treadgold for the drawings.

REFERENCES

- Belsey, R. H. R., and Donnison, C. P. (1950). *Brit. med. J.*, 2, 324.
 Clatworthy, H. W. (1955). *Pediatrics*, 16, 122.
 Cummins, C. F. A. (1954). *J. thorac. Surg.*, 28, 546.
 d'Abreu, A. L. (1953). *A Practice of Thoracic Surgery*. Arnold, London.
 Flett, J., jun., Pratt, E. L., and Darrow, D. C. (1949). *Pediatrics*, 4, 604.
 Gross, R. E. (1953). *The Surgery of Infancy and Childhood*. Saunders, Philadelphia.
 Grow, J. B., and Neerken, A. J. (1953). *J. Amer. med. Ass.*, 152, 1614.
 Gruenewald, P. (1940). *Anat. Rec.*, 78, 293.
 Haight, C. (1952). *Ann. Surg.*, 136, 717.
 — and Towsley, H. A. (1943). *Surg. Gynec. Obstet.*, 76, 672.
 Hubbard, T. B., and Leven, N. L. (1950). *Surgery*, 27, 126.
 Koop, C. E., Kiesewetter, W. B., and Johnson, J. (1954). *Surg. Gynec. Obstet.*, 98, 687.
 Ladd, W. E. (1944). *New Engl. J. Med.*, 230, 625.
 Lanman, T. H. (1940). *Arch. Surg. (Chicago)*, 41, 1060.
 Leven, N. L. (1941). *J. thorac. Surg.*, 10, 648.
 — Varco, R. L., Lannin, B. G., and Tongen, L. A. (1952). *Ann. Surg.*, 136, 701.
 Mackenzie, Morell (1884). *Disease of the Throat and Nose*, 2, 217. Wood, New York.
 Nicks, R., and Caughey, R. H. (1955). *N.Z. med. J.*, 54, 682.
 Roberts, K. D., Carre, I. J., and Inglis, J. McN. (1955). *Thorax*, 10, 45.
 Scott, J. S., and Wilson, J. K. (1957). *Lancet*, 2, 569.
 Sloan, H., and Haight, C. (1956). *J. thorac. Surg.*, 32, 209.
 Vogt, E. C. (1929). *Amer. J. Roentgenol.*, 22, 463.

An "emergency" identification card for the protection of patients on long-term anticoagulant therapy is now available to physicians from the American Heart Association and its affiliates. The card was developed as a result of requests from physicians seeking to protect their patients on anticoagulants in case of accident, dental surgery, or other treatment that may induce bleeding. In case of emergency the card advises that a doctor be called, since the patient may require an antidote. The card contains space for the name, address, and telephone number of the patient's physician, the type of anticoagulant prescribed, and the patient's blood group. Samples of the card are obtainable from the American Heart Association, 44, East 23rd Street, New York City.

PRIMARY ATYPICAL PNEUMONIA AND HIGH SEDIMENTATION RATES

BY

H.-J. B. GALBRAITH, M.D., M.R.C.P.

Senior Medical Registrar, St. Thomas's Hospital, London

AND

K. W. JONES, F.I.M.L.T.

Recently Senior Technologist, Royal South Hants Hospital, Southampton

The diagnosis of atypical pneumonia originated at the time when, following the introduction of antipneumococcal sera and sulphonamides, a group of cases of pneumonia was distinguished from the majority by a failure to respond to these forms of therapy (Finland and Dingle, 1942). Since then further microbiological, serological, and radiological investigations have resulted in the recognition of several subdivisions of this group which are aetiologically, if not clinically, distinguishable. These include the aspiration pneumonias and the pneumonias associated with rickettsial Q fever, ornithosis, the acute specific fevers, and infections by the influenza viruses and the adenoviruses.

The serum of many of the cases of atypical pneumonia which remain unaccounted for contains antibodies which agglutinate homologous red cells in the cold (4° C.). The constitutional upset in these latter cases is often greater, and the radiological changes are often more extensive, than would be expected from the pulmonary symptoms and signs, which are often slight. The white blood count is normal, or only slightly increased, in the early stages of the illness, and the serum may contain agglutinins against the streptococcus M.G. The dramatic response to penicillin therapy usually seen in pneumonia does not occur, but, in some epidemics at least, treatment with one of the tetracycline antibiotics has been found to be effective. The condition has been transmitted by bacteria-free filtrates of respiratory tract secretions to volunteers, and from them to a second series of experimental subjects (Commission on Acute Respiratory Diseases, 1946), but no virus has yet been generally agreed to be responsible. It is for this condition that many now reserve the description of primary atypical pneumonia.

Raised titres of cold agglutinins are sometimes found in other respiratory diseases such as influenza, ornithosis, and pneumococcal pneumonia. These conditions are unlikely to be misdiagnosed as primary atypical pneumonia if titres of cold agglutinins of 1 in 128 or more are required before the diagnosis of the latter is accepted, and even more unlikely if a fourfold increase in titre is observed in serial specimens. Many of these other pulmonary disorders can also be excluded by further serological or bacteriological tests.

Observations

As part of the routine investigation of nine sporadic cases of primary atypical pneumonia, in which the clinical diagnosis, based on the features described above, was confirmed by the demonstration of significant titres of cold agglutinins, estimations of the erythrocyte sedimentation rate (E.S.R.) were made by the method of Westergren (1921). Readings were made of the fall of the red cells in a 200-mm. tube after one hour. Seven of the nine patients had an E.S.R. of over 90 mm. when first estimated, and the E.S.R. of another of these patients was over 80 mm. on admission, rising later to 98 mm. (Cases 1-9, Table I). Four of the nine