A CASE
OF
OCCLUSION OF THE LEFT BRONCHUS BY
A METAL PENCIL CAP,
AND ITS REMOVAL BY TRACHEOTOMY.

BY
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History of the case previous to the operation, by
DR. CHEADLE.

THE patient was a little girl nine years old, the daughter of Mr. F. Mivart, and at school at Blackheath. On January 30th, 1887, she was sucking the end of her pencil while playing over her writing, when the loose cap used for covering and protecting the point became detached, and, by a sudden inspiration, was carried into the throat. Urgent choking and dyspnoea followed, the child's face grew livid, and she was on the point of suffocation. Dr. Creed, of Greenwich (to whom and to Mr. Mivart and Mr. Tegart, I am indebted for notes of the first phase of the case), was immediately sent for, but by the time he arrived the dyspnoea had considerably lessened; nothing could be seen in the throat, or felt there on exploration with the finger. The child still

complained of something sticking in her throat, and pointed to the middle of her neck as the place where it lodged.

A probang was passed down the œsophagus, and this appeared to give relief; but there was still great pain in the chest, and frequent cough of some violence. On physical examination, however, no change of importance was discovered. The pencil cap was believed to have entered the stomach, and its appearance looked for in the fæces. The pain in the chest gradually subsided, but the cough remained, and was observed to be always aggravated by any movement.

On February 3rd, four days after the accident, Mr. Mivart examined the child with Dr. Creed and Mr. Tegart. Although she seemed fairly well, the continuance of cough, although this was not severe, excited some suspicion and the chest was again examined. Partial dulness was now found over the left side behind, and imperfect entry of air there, especially over the middle portion. There was dulness at the left front also, although this was less marked than at the back, and the entry of air into the apex of the lung was noted as deficient. When seen again four days later still the general condition was much the same, but the dulness and want of respiratory sound on the left side had increased. Mr. Mivart also observed that the tympanitic percussion-note of stomach resonance extended upwards nearly to the level of the left nipple.

At this juncture the child was brought to London, and I was asked by Mr. Mivart to see her in consultation with Mr. Tegart and himself.

On stripping the chest two things were at once obvious viz. first, that the left side was almost motionless in respiration; and secondly, that it was smaller than the right. The heart's apex was under the fifth rib at the lower edge of the nipple, in a line with it, *i. e.* a little above and outside the normal position.

On percussing the chest the *left* side was found almost uniformly dull, and vocal vibration was impaired as com-

pared with the right side. The want of resonance was very marked but not absolute. Exceptions to this general impairment of resonance were a small area about the size of a crown piece over the second left space in front, which gave almost normal lung resonance, and the lower portion in front, below the nipple line. In the latter region this was due to the tympanitic note of the stomach, which extended upwards to the level of the nipple. On listening with the stethoscope, hardly any respiratory sound could be detected on the left side, either in front or behind. The silence was almost complete even on forced inspiration. Distant breathing only could be heard, faint and bronchial. The bronchial character of the respiration was most notable over the spine of the left scapula. No wheezing or whistling sound was audible, indicating partial passage of air, and there were no râles. Over the small, more resonant area at the second left space, some natural respiratory murmur could be heard. On the *right* side the percussion-note was fully resonant, the breathing somewhat loud and exaggerated in volume, in remarkable contrast to the feeble, barely audible, bronchial respiration on the left.

The *respirations* numbered 30 in the minute; they were quiet, easy, unforced.

The *pulse* was 92, of natural beat and character. The *temperature* was 97° in the axilla, in the mouth 97.8° . This had been taken regularly, and had never at any time been found as high as 98° in the mouth.

Now and again the child was harassed by a short hacking cough, and this was observed to be always brought on by exertion, and especially by going upstairs. When she was quietly at rest the cough subsided. There was no dyspnoea or distress of any kind connected with breathing, except the cough.

It was quite clear from the physical signs that the left lung was almost completely collapsed. The retraction of the side, the absence of movement, the rising of the stomach to the level of the nipple, the displacement of

the heart's apex upwards and to the left, showing extreme contraction of the lung, together with the impaired resonance and vibration, and almost entire absence of respiratory sound, were conclusive on this point. The history of the case left little question that this general collapse was due to the occlusion of the bronchus by the foreign body. The pencil cap, of which we obtained an exact counterpart, was a tube nearly an inch long, closed

FIG. 1.—Sketch of the pencil-cap impacted (actual size).

at one end, open at another, and appeared to be of just sufficient calibre to enter into the bronchus easily, and yet fit it pretty closely; while in length it would correspond very nearly with the lower portion of the bronchus, where the main branches are given off.

The physical signs thus threw light upon the exact position of this foreign body. The fact that a certain amount of air passed in and out of a portion of the upper lobe, evidenced by respiratory sound and resonance in a limited area of the apex in front, seemed to prove that the cap had passed on to the extreme end of the left bronchus and had thus left the first branch, viz. that which leads to the upper lobe, partially patent, allowing the air to enter this position of the lung to a limited extent, the passage to the rest being absolutely occluded. The position of the foreign body is shown in the diagram, adapted from one kindly furnished me by Mr. Rickman Godlee, and also in the specimen of lung and bronchi with the foreign body *in situ*, kindly prepared by Dr. Penrose, which serves admirably to illustrate the case. I had no doubt as to the impaction of the foreign body in the left bronchus therefore, and that its removal by tracheotomy should be attempted as soon as possible, before serious inflammatory changes were set up in the surrounding tissues.

It was agreed that Mr. Thomas Smith and Dr. Broadbent should first be asked to see the case independently, with a view to the verification of the exact diagnosis, and that we should then hold a consultation to determine finally the question of tracheotomy.

This was done with the result of confirming the diagnosis as to the occlusion of the bronchus by the pencil cap, and its position at the extremity of the main tube. Dr. Broadbent pointed out the probability that the rounded closed end of the cap would pass first into the bronchus. It was obvious that this end would lie towards the throat

FIG. 2.—Diagram of the bronchi, showing the position of the foreign body at the extremity of the left bronchus, beyond the origin of the branch to the upper lobe, which was thus left free. [Adapted from a diagram modified by Mr. Rickman Godlee from one by Dr. Aebly, of Berne.]

as the pencil was being sucked, and it would be less liable to trip or catch in transit. There was therefore a reasonable expectation that the open end would be found uppermost, an important consideration in regard to the prospect of the success of the operation. For the open extremity of the tube would be much more easily laid hold of

than the closed rounded end, which would clearly present great difficulties in the way of firm grip by the forceps.

The operation was successfully performed by Mr. T. Smith, assisted by Mr. Howard Marsh and Mr. Holmes, on the 17th of February.

Account of the operation by Mr. T. SMITH, with remarks.

The specimen furnished us of the foreign body was cylindrical, closed, and rounded at one end, open at the other, with a ring-like depression about the middle of the tube inside. It was $\frac{15}{16}$ ths of an inch long and $\frac{1}{16}$ ths in diameter. As there was no certainty that the open end lay uppermost in the bronchus, provision was made for seizing whichever end might present.

In case the open end lay uppermost Mr. Mayer provided me with forceps having an external grip, such as are used for intubation of the larynx; these placed within the pencil cap held it firmly when their blades were expanded, and they were suitably curved for reaching the bronchus. The closed rounded end of the foreign body could not have been grasped by any forceps from above. I therefore provided myself with means for meeting this difficulty should it occur.

In the operation, after stopping all bleeding and dividing the isthmus of the thyroid body between two ligatures, the trachea was freely opened and the edges of the tracheal wound were temporarily attached to the margins of the skin-wound by one or two silk sutures. A long curved slender probe was passed into the bronchus, and at once detected the foreign body in the position assigned to it by physical examination, and from the sensation communicated to the probe it was judged that the open end of the pencil cap lay uppermost.

The intubation forceps were introduced and pressed firmly against the foreign body, so as to get a good hold of its interior, and the blades being expanded it was at once extracted. The tracheal sutures being removed the

wound was dressed with carbolic oiled lint and left to granulate.

I would venture to recommend the plan of attaching the edges of the tracheal wound to the skin while searching for foreign bodies in the air-passages below ; it keeps the trachea widely open throughout the operation, which is a great help to the surgeon and a source of safety to the patient.

Subsequent history of the case, with observations by
DR. CHEADLE.

When the child was examined the same evening, four hours after the operation, air was found to be entering the left lung very fully, with harsh expiratory sound, except the upper part behind ; here there was still comparative silence. There were no râles audible anywhere. Resonance had improved in marked degree. The temperature was still only 98° and the respirations 30, but the pulse had risen to 120. The child was quiet and seemed comfortable. On the following morning, however, February 18th, there was a sudden access of fever. The temperature had risen from its previous subnormal level to 104° , the pulse to 156, the respirations to 44, and the child had vomited twice. Minute examination of the chest disclosed no cause for the febrile disturbance. Air was found to be entering freely except at the upper part of the left lung behind. Respiratory sound was harsh, but there was no approach to bronchial breathing, and there were no râles or added sounds anywhere. Resonance was still deficient. By 5 p.m. the same day these ominous symptoms began to abate, the pulse had fallen to 130, the temperature to 101° , the respirations to 40.

Next morning, February 19th, the temperature had fallen still further, viz. to 100° , the pulse 116, the respirations 30. There had been no more sickness. Auscultation showed good respiratory murmur all over the left

lung, the upper part now filling with air like the rest ; in fulness of breath-sound and expansion this side was still deficient as compared with the right. The only abnormal sounds were some harshness of respiratory murmur and a few medium-sized moist râles at the second and third left cartilages, *i. e.* about the position of the termination of the left bronchus and the commencement of its first branches. The further expansion of the lower lobe proceeded slowly now ; the respiratory sound was less full there, and the stomach-note still reached to the sixth rib. The pulse, respirations, and temperature continued to fall, so that by February 24th, *i. e.* seven days after the operation, these were 92, 24, and 98.6° respectively. Some bronchial respiration was now for the first time made out at the posterior axillary line, at the level of the angle of the scapula on the left side, with fine moist crepitations as of freshly expanding lung. The resonance over this point was still slightly deficient.

During the following week these abnormal signs gradually declined and disappeared by March 1st. The temperature again fell to subnormal, and remained between 97° and 98° , but never reaching 98° up to the time of the latest observation on March 8th, nineteen days after the operation, thirty-six after the accident.

A final examination of the chest at this date showed normal respiration everywhere restored on the left side, except that it was slightly rough and generally rather deficient as compared with the right. Resonance and expansion were also below the standard of the right side, but the stomach-note of resonance had dropped to the seventh space, and the apex-beat of the heart to the normal position in the fifth. Measurement of the two sides of the chest still gave a difference of half an inch in favour of the right, which was twelve and three quarters inches as compared with twelve and a half on the left.

There seems to be a general acceptance of the statement that foreign bodies entering the trachea almost invariably pass into the right bronchus, and an anatomical

reason has been found for this in the larger size of the right tube, and the fact, first pointed out by Dr. Goodall, of Dublin, that the septum between the two bronchi is placed to the *left* of the middle line, thus making the lumen of the *right* more in the direct line of the axis of the trachea than the left.

In 1855 Dr. Hughes published in the 'Dublin Quarterly Journal' a case of impaction of fish-bone, which he claimed to be singular, as the first recorded in which the foreign body had passed into the *left* bronchus.

The statistics collected by Bourdillat ('Gazette de Paris,' 1868) show twenty-six cases of impaction in the right bronchus to fifteen in the left. Professor Gross, of Philadelphia ('Practical Treatise on Foreign Bodies in the Air Passages,' 1854), out of sixty-three cases found thirteen certainly and eleven probably in the right to four certainly and four probably in the left, or twenty-four to eight. And yet out of the thirty-four cases which I find recorded in the English journals, in the thirty in which the position of the foreign body is stated, in sixteen it was in the *left* bronchus as compared with fourteen in the *right*. In three cases which came under my own observation it was in the left in every one, making in all nineteen left to fourteen right. This at least shows that, as Reigel¹ affirms, the entry of a foreign body into the left bronchus is by no means so infrequent as might appear from the reports of many authors.

The physical signs observed in this case do not correspond exactly with those accepted by authority as typical in such conditions. It will be remembered that the left side of the chest was noted to be markedly deficient in resonance on percussion. This is exactly what might be expected, what I have found in a similar case, and what I believe always occurs in extensive collapse of the lung. Yet I find it stated by Reigel that on the affected side there is "full and clear sound on percussion which all observers admit differs in nothing from the normal

¹ 'Ziemssen's Cyclopædia.'

sound." And, again, in the recent work of the late Dr. Fagge the percussion sound is said to be normal. This is, I am sure, erroneous. In another case of the kind which came under my observation, in which a pea entered the left bronchus, causing complete obstruction, the percussion-note was distinctly dulled on the affected side. The mistake has arisen probably in this way :

1. In cases where obstruction of the main bronchus is complete, before the air is pumped out of the lung or absorbed, and collapse established, resonance is unchanged, and this is the stage which has been noted and regarded as typical. But later, as the air disappears, and the lung becomes collapsed and carnified, resonance becomes more impaired. That collapse had already commenced in the present instance in four days after the accident was evidenced by the already distinct want of resonance and breathing on the left side of the thorax, and four days later by the further increase of this and the rising of the stomach to the fifth space noted by Mr. Mivart.

2. In cases where obstruction to the entry of air *is not complete*, as when the foreign body is of a form which does not entirely close the tube to the passage of air, there may be little or no collapse ; or when the foreign body is not long enough to stop all branches when driven to the end of the bronchus, collapse may be partial and slight, and the difference of percussion-note hardly appreciable.

Again, this case is interesting since it affords further proof of the correctness of Dr. Gairdner's theory of the production of collapse of portions of lung by obstruction to the entry of air by the supplying bronchus ; and shows how complete obstruction of the main bronchus causes absolute collapse of the whole of the lung.

Another point of interest arises in connection with this question of collapse. This case proves that mere collapse is not, in itself alone, a cause of catarrhal pneumonia, or even the chief and most potent factor, as suggested by Niemeyer. The lung in this instance was very completely

collapsed for ten or twelve days before the operation, yet no inflammatory change ensued. There was not only no rise of temperature at any time, but it was persistently subnormal. There was never any crepitation audible until after re-expansion commenced.

The condition of the temperature, of respiration, and of the circulation, deserves a moment's notice. The temperature was always subnormal, viz. 97° to 97.6° . The respirations were increased in frequency, standing at 30 with remarkable constancy, but not doubled, although one lung had to do the whole work of aeration. The pulse-rate ranged between 90 and 100, so that the number of respirations showed an increase of about one third over the normal, the pulse-rate only a quarter over the normal. Yet this was insufficient to compensate fully for the loss of oxygenating power caused by the loss of function in the closed lung, and keep the temperature up to the normal standard.

The sudden sharp burst of pyrexia after the operation is not easy of explanation. I find that a rise of 102° and 103° is recorded in two other cases on the second and third day after a similar operation for the removal of a foreign body.¹ In the present instance the pyrexial period was of extremely short duration, reaching its acme, 104° , in nineteen hours, subsiding in the next six hours to 101° , and it was practically at an end by the third day. Was the fever of traumatic origin? There is little to support this hypothesis. The wound did well from the first. Was it due to abortive pneumonia, of which the moist râles heard on the seventh day after the operation were the only and posthumous evidence? I think not, for such râles are constantly heard over the small bronchi when lung is re-expanding after collapse, as, for example, after tapping in pleuritic effusion, and there was never any other sign in any way suggestive of pulmonary inflammation. The pyrexia may have been due to shock and the excitement of the operation,—purely neurotic. Another possible explanation is that the fever wave was due to the dis-

¹ Marcus Beck, 'Lancet,' ii, 1874, p. 798. Lucas, 'Lancet,' ii, 1881, p. 874.

turbance produced by the sudden abrupt forcing into action of the function of the lung previously in abeyance. The re-entry of air would doubtless produce irritation of the bronchial mucous membrane, and might give rise to neurotic disturbance of temperature, while the oxygenation of the blood would be instantly increased, and metabolism and heat production possibly thus raised, temporarily, to excess.

(For report of the discussion on this paper, see 'Proceedings of the Royal Medical and Chirurgical Society,' New Series, vol. ii, p. 321.)