

*Annotation***SURGICAL TREATMENT
OF ASTHMA**

The purpose of this communication is to attempt to analyse as simply as possible the present position of surgical procedures in relation to asthma. The approach to the subject must necessarily be guarded for there is as yet insufficient evidence on which to base firm opinions. Medical feeling has so far been biased against surgery because surgeons are still unable to state what are the criteria for operation and, if surgery is agreed upon, what operation is to be done. How shall we tell which asthmatic will respond favourably and which will not? Gay and Rienhoff's (1938) method of choosing only cases which had failed to respond to any other treatment and who were consequently 'bad risks,' does not appear to be ideal for in such cases thoracotomy becomes a dangerous procedure, secondary changes having already occurred.

It would seem reasonable therefore to review certain physiological and pathological facts, remembering that the term 'asthma' may include more than one disease, that it may be complicated by emphysema, right heart failure and so on, and that a number of other diseases by producing respiratory difficulty may closely simulate asthmatic attacks.

Conditions Simulating Asthma

Any obstruction of the major air passages, any obstruction of a major proportion of the bronchioles as by the oedema of congestive right heart failure, or any lesion where considerable quantities of air are retained in the lung as in gross emphysema or bullous cysts of the lung, may simulate asthma. A careful clinical examination must include X-ray examination of the chest, assessment of the condition of the heart and, above all, bronchoscopy.

The commonest types of obstruction of the major air passages producing expiratory difficulty are those which have a valvular action. In the larynx, for instance, a papilloma hanging from a vocal cord may be nipped in the glottis in expiration (Fig. 1). In the same way tumours of the trachea, more especially adenomata of pedunculated type may not seriously impede inspiration but may cause the greatest difficulty in getting rid of the inspired air (Fig. 2). Such sufferers may show an X-ray picture of the lungs indistinguishable from those of the asthmatic. Again, similar tumours of the major bronchi or even granulation

tissue pouting into the bronchial lumen as a result of ulceration of tuberculous hilar glands and perhaps associated with a bronchial stricture may give rise to difficulty. The diagnosis in these cases is readily established by bronchoscopy.

Severe degrees of emphysema and bullous cysts of the lung present greater difficulty. Emphysema of greater or less extent is indeed a common result of asthma and may develop at an early date, but it may also occur without true asthma and operation will afford no relief. As to giant bullous cysts, they are, in the majority of instances, unilateral and although they may appear to occupy the whole of one side of the chest, they usually arise from only one lobe and the rest of the compressed lung tissue is visible.

**Physiological Considerations (Miscall,
1943)**

In normal respiration, active inspiration and passive expiration suffice. In asthma, the intrinsic widespread obstruction to the conducting

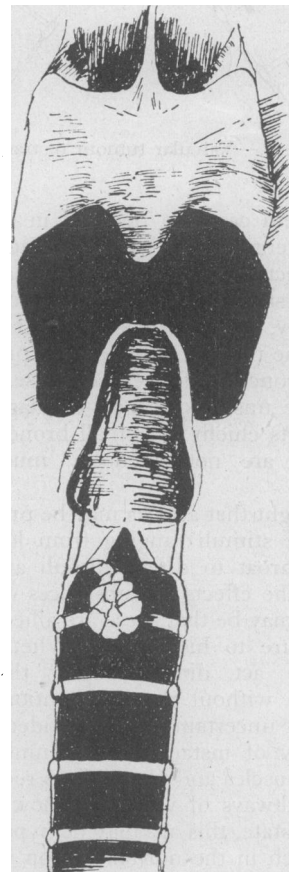


FIG. 1.—Valvular tumour of vocal cord

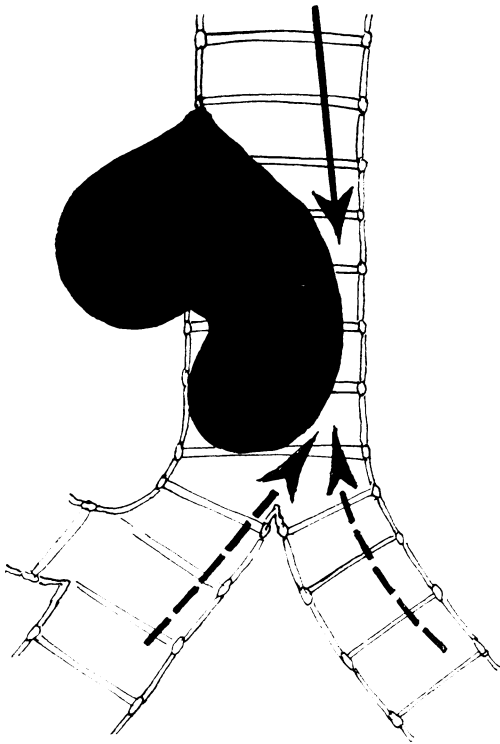


FIG. 2.—Valvular tumour of trachea.

airway system causes a demand in excess of the ability to ventilate. Laboured breathing results. This obstruction is of two kinds, namely spasm due to overstimulation of the bronchial muscles and secondly, the presence of excessive tenacious mucus. The muscle spasm affects principally the terminal bronchioles because these, unlike the bronchi, are unsupported by cartilage whilst the mucus affects chiefly the small bronchi, since the bronchioles are not lined by mucus-secreting glands.

It is thought that attacks may be precipitated by a variety of stimuli ranging from lesions in the nose and throat to direct stimuli arising in the lung from the effects of substances of an allergic nature. It may be that these are allied to or are of similar nature to histamine. Whether in some cases these act directly upon the bronchial musculature without the intervention of a reflex arc is as yet uncertain but the evidence is that in the majority of instances overstimulation of the bronchial muscles and glands does require a reflex arc, the pathways of which are now known. In the allergic state, this arc may be hypersensitive to stimuli which in the normal person would be insufficient to cause an effect or response.

The respiratory centre integrates all respiratory

function but it is extremely complex in that it is affected by both sympathetic and parasympathetic afferent impulses on the one hand and by chemical influences in the shape of carbondioxide, anoxia and various toxic substances on the other. Both the sympathetic and parasympathetic divisions of the autonomic nervous system affect respiration in as much as they each contain afferent and efferent fibres from and to the lung.

From the pulmonary stretch receptors, stimulated by expansion, impulses pass up the vagi chiefly from the homolateral lung and inhibit the inspiratory centre. The ganglia of these fibres are found in the ganglion nodosum. The afferent sympathetic fibres pass via the upper five thoracic ganglia and probably also over the cardiac accelerator nerves. Stimulation of them causes broncho-constriction via the vagal efferents.

The vagal efferents whose fibres originate in the dorsal vagal nuclei are, like the vagal afferents, almost entirely homolateral in their lung distribution and in function are broncho-motor and secretory. Division of them thus results in secretory inhibition and broncho-dilatation. The sympathetic efferents however reach the lung either directly from the upper dorsal ganglia or over the accelerator nerves, being chiefly vaso-motor and broncho-dilator in function.

Surgical Considerations

Where intractable asthma exists, therefore, and where there are no contra-indications to the operation, it would seem rational to interrupt the vagal distribution to the lungs on both sides. So far as can be judged, no unpleasant sequelae follow posterior-pulmonary plexus resection for this purpose other than the risks involved in operations upon subjects whose respiratory and consequent cardiac capacity is impaired. By so doing, the relief of excessive tonus of the broncho-constrictor muscles and the diminution of secretion no longer traps air in the distended alveoli and residual air therefore falls. Blood passing through the lungs is more freely aerated and the pulmonary resistance reduced, thus relieving right heart strain. In all probability, even if a moderate amount of emphysema is present as a result of alveolar septal rupture, considerable relief may be obtained.

The differentiation of clinical types of asthma is important. Where real allergy exists and the bronchial muscles are sensitive, surgery may well be both unnecessary and contra-indicated, but in the larger group where no distinct allergy is demonstrable various infective sources may be responsible for the abnormal bronchial spasm. These may be either pulmonary or extra-pulmonary (e.g. nasal); or again the main cause may be psychological.

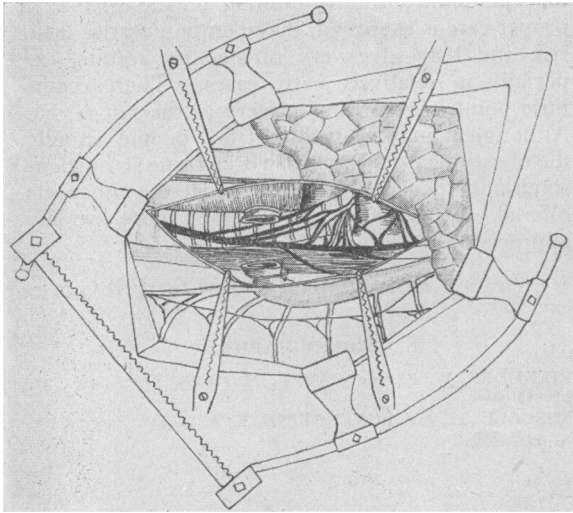


FIG. 3.—Posterior pulmonary plexus, right side.

Provided that sources of infection and of psychological stimulation have been dealt with and that the patient is not in severe heart failure, cases may be considered for bilateral posterior pulmonary plexus resection, an interval of two or more weeks elapsing between operations on each side.

The principals of surgical treatment thus rest firstly on clearing up infective foci, and secondly on interrupting the reflex arc causing broncho-spasm. The afferents of this reflex run with the sympathetic, its efferents through the vagus. Interruption of the afferent sympathetics rarely gives relief since it is impossible to resect with certainty all the pathways, many of which do not pass through the dorsal or inferior cervical ganglia. Results of this procedure are disappointing. Resection of the posterior pulmonary plexus through which all the pulmonary vagal (and incidentally many of the sympathetic) fibres pass, is, on the other hand, often strikingly successful and so far as can be judged does not (contrary perhaps to expectation) appear to disturb reflexes essential to normal respiration.

Operative Technique

The operation of posterior pulmonary plexus resection is in itself simple and is not fraught with the dangers often attributed to it except that, to take the worst type of case, the mere opening of the chest in a patient with status asthmaticus, by collapsing a lung, may cause such increased stress upon an already overburdened heart as to cause total failure. The important point is that there is no need to allow complete collapse of the lung on

the operated side. This can be kept partially inflated and the operation can be stopped as often as desired in order to re-inflate it completely for a few minutes.

The best approach is through an ordinary lateral thoracotomy, using the sixth intercostal space or resection of the sixth rib. The lung is gently held forward, the pleura opened across the back of the pulmonary hilum and the vagus identified. On the right side (Fig. 3) it is necessary to ligate and divide the azygos vein whilst on the left (Fig. 4) very special care is required to preserve the recurrent laryngeal nerve which turns upwards close under the aortic arch. Pulmonary vagal branches leave the main trunk not only opposite the hilum but both above and below this level and it is of course essential to identify and divide them all. This takes a little careful dissection but the whole operation is straightforward. Having divided the fibres either simply or between ligatures (the question of regeneration is still uncertain) the pleura is closed by a continuous suture and after re-expanding the lung fully, the chest is closed.

As has been stated, not only should care be taken not to divide the recurrent laryngeal nerve on the left side but it should not be stretched. Even slight stretching will cause a temporary vocal cord paralysis which is distressing to the patient and may cause psychological upset.

Post-Operative Management

Nothing special is required in this field except to keep the patient well oxygenated especially for the first 24 hours. The minimum of post-operative interference is to be aimed at and it is rarely advisable to attempt to aspirate air from the pleura. This is not only unnecessary if the lung has been fully expanded at operation, but is dangerous as the needle may prick an emphysematous bulla and cause pulmonary collapse.

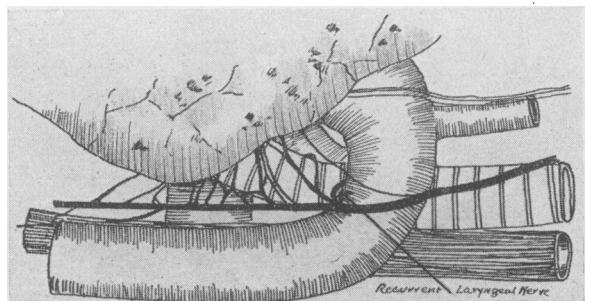


FIG. 4.—Posterior pulmonary plexus, left side.

Occasionally the vagal manipulation may result in some post-operative abdominal distension lasting perhaps 48 hours, but gentleness at operation and avoidance of pulling on the nerve will obviate this.

It is a striking fact that after operation on the first side, the patient will sometimes voluntarily remark that he can breathe freely on this one side. Demonstration of any difference is, however, difficult until both sides have been operated upon because of transmission of sounds from one side to the other.

Conclusion

It is too early to give any definite opinion as to the prospects of cure of asthma by surgical means or even to assess accurately which cases are suitable

for operation. In the opinion of the writer, if proper care is exercised, the operation carries little risk and may give very satisfactory results, especially in relatively early cases. There seems little point in regarding surgery as the last resort. Although it may be true that few people actually die of asthma *per se*, many lives become so burdensome and their health so poor that the prospects offered by surgery should be more widely appreciated.

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