iritis the pain appears first in the eyeball—a ciliary pain—and next spreads to the brow and temple along the supraorbital nerve; it may be very severe, throbbing and stabbing, and increasing at night. Sometimes the pain may be referred along the side of the nose, the infraorbital area, even into the cheek.

The pain in acute glaucoma may be very distressing, though its cause is not likely to be overlooked, but in chronic glaucoma neuralgic pains about the face and head are commoner perhaps than is generally believed. For example, in Parsons's textbook, *Diseases of the Eye* (seventh edition, 1934), in his description of chronic glaucoma, no reference is made to pain, and I have heard an ophthalmic surgeon assert that pain is never a symptom of chronic glaucoma. On the other hand, De Schweinitz writes, in his textbook (tenth edition, 1934, p. 417), after describing the pain of acute glaucoma:

"In chronic cases there may be only a general feeling of discomfort, a sense of fullness, occasional shoots of neuralgia, or attacks described by the patient as headache, or pain is entirely absent."

I have seen at least two patients in which violent neuralgic pains in the face, cheek and jaws, and temple appeared to be due mainly, or aggravated by, the presence of chronic glaucoma.

In choroidal tumour, if the tension is raised, a brow pain and neuralgia may be the symptom. The pain of corneal ulcers may be considerable, but is referred mainly to the eye itself, though the general distress and photophobia may lead in some subjects to general headache. Orbital abscess or tumours in this region naturally will be the source of pains referred to the brow and cheek, and if there is marked proptosis, and if the growth invades the eyeball, pain may be referred to the eye itself. Similarly, in exophthalmic goitre, when the proptosis is extreme, ulceration of the cornea may occur, associated with pain and headache. Frontal or ophthalmic herpes may be complicated by certain ocular conditions, such as corneal ulceration, iritis, perforation of the cornea, and panophthalmitis. The violent pains of ophthalmic herpes are, of course, well known, but occasionally—especially in old people—the persistence of the neuralgia is extremely distressing, and this may go on for years, and may apparently be permanent.

Headaches from Cerebral Disease and Neuralgia

The headaches of cerebral tumour, abscess, or meningitis need not detain us here, though papilloedema is a common physical sign in tumour or abscess. In meningitis the disks may remain normal throughout, though slight blurring of the edges is not uncommon. In sinus thrombosis headache may be very severe, and retinal haemorrhages may be most extensive.

The headache of cerebral arteriosclerosis is an important one to be recognized. After middle life it will usually be associated with increased blood pressure, and the pain is more or less continual for days or weeks, though it may clear up at times. These cases will be recognized first by the ophthalmic surgeon by the ophthalmoscopic appearances, by slight haemorrhages around the disk, and the well-known silver wire arteries, with their compression of the veins where the latter are crossed by arterial branches, and in more pronounced cases by the more definite appearances of albuminuric retinitis. The headache is often of a bursting character, and may be worse at night. There may be other symptoms of uraemia, such as vomiting and asthmatic attacks.

Neuralgic headaches that physicians meet with commonly, and which have often been treated extensively by throat and nose surgeons, and by prescribing of spectacles, are the various forms of migrainous neuralgia,

maxillary neurosis, and supraorbital neuralgia, together with the headaches which may be due to frontal and antral sinusitis. These latter are very common after catarrhal infections, or infections from the teeth, and should not be difficult to recognize by transillumination and x-ray, though they have no special connexions with the eye.

A common form of pain in the face, usually referred to the cheek, side of nose, and temple, is almost peculiar to women, and I have termed it "maxillary neurosis," or chronic neuralgia of the jaw. In many cases the pain has started after severe dental extraction, and, being unilateral, is thought to be a true neuralgia due to some piece of decayed stump or diseased bone. These cases usually run the gauntlet of nose and throat surgeons, dentists, and ophthalmic surgeons, before being seen by a neurologist. Patients often complain of a certain amount of swelling and flushing over the cheek, and though all the remaining teeth may be removed, the antrum washed out, turbinal bones removed, and glasses prescribed, the pain continues unabated. The pain is not paroxysmal or tic-like in character, but is more or less persistent, though it varies at different times of the day. No operative treatment is of any value, and alcohol injection should always be refused to these patients.

REFLEX ASTHMA: ITS PATHOLOGY AND TREATMENT

INCLUDING A REVIEW OF 337 CASES*

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Bronchospasm may be produced reflexly in many different ways, but the nose is the most important source of reflex asthma. A distended stomach and a distended rectum may both produce reflex attacks of asthma quite independently of any form of alimentary toxæmia. As Hurst¹ points out, the evacuation of the stomach or of the rectum produces immediate relief long before a change could take place in the blood from diminished absorption of poisons. In certain cases the cause of irritation appears to be central and psychical, but in such cases the action is not a reflex one. The purely nervous or psychical factor will therefore not be considered in this paper.

Mechanism

Some observers hold that reflex stimulation may arise in the lung itself. A focal lesion in the lung, such as an old healed and calcified tuberculous focus, may irritate the afferent fibres of the vagus nerve and so cause reflex asthma. The reflex action from the nose occurs through the naso-pulmonary reflex. This reflex has a reflex arc composed of the trigeminal nerve and the vagus nerve. The afferent, or sensory, branch of this arc consists of the ophthalmic and superior maxillary divisions of the fifth nerve, and of the sensory root and the sensory end nucleus of the trigeminus. The efferent, or motor, branch is formed by the dorsal motor nucleus of the vagus, the nucleus ambiguus, and the efferent fibres of the vagus nerve (see Figure). Certain parts of the nose are more closely connected with the naso-pulmonary reflex than others, and the area of the nose which, if stimulated, is more likely to cause bronchospasm has been called the asthmagenic area, the trigger area, or the ethmoid region. This area begins with the lower margin of the middle turbinal, and includes all of the upper air passages extending from this margin to the cribriform plate, both the lateral and septal surfaces of the nose being included. It is bounded in

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front by the anterior end of the middle turbinal, extends posteriorly to the sphenoid body, and may include the sphenoid cavity. Laterally it extends from the septum to the lateral plate of the ethmoid. Although clinically it is very difficult to produce asthma by stimulation of this area, it is possible in an asthmatic with a hypersensitive nose to produce another reflex action which is often significant—namely, the naso-facial reflex.

If by means of a probe one stimulates the asthmagenic area, and especially the middle turbinal, it is often possible to produce the following manifestations:

1. Intense lachrymation, at first homolateral and then bilateral, with hyperaemia of the conjunctiva.
2. A reflex flush of the ala nasi; the flush sometimes extends to the eyelids, the cheeks, the forehead, the ear, and even to the neck.
3. A swelling of the nasal mucosa giving rise to a profuse rhinorrhoea.
4. A homolateral mydriasis, a spasmodic cough, and in extreme cases nausea, palpitation, collapse, and loss of consciousness.

The presence of a naso-facial reflex is often a useful diagnostic sign, as it indicates that the asthma is probably of reflex origin.

Course of trigeminal, vagus, and glossopharyngeus in the brain-stem. The diagram represents the arc through which the naso-pulmonary reflex is produced. The sensory portion of the vagus and glossopharyngeus and the motor portion of the trigeminal have been omitted. (Modified from Villiger.)

Another reflex action which may be observed in allergic subjects is obtained by intense illumination of the interior of the eyeball; this may cause a sneeze reflex, a cough reflex, or even an attack of asthma. Many hay fever sufferers find that they are worse when exposed to bright sunshine, and this is also the case with many asthmatics. Sunlight may give rise to asthma or hay fever even apart from any reflex action. Patients may be sensitive to sunlight in the same way as they may be sensitive to foreign proteins; physical allergy is now a well-recognized condition.

In addition to reflex stimulation, abnormal conditions of the nose may lead to asthma by many other ways. It is true that the most direct way of causing asthma is by reflex stimulation; spurs and deflected septa causing contact with the middle and superior turbinates may "tickle" the ethmoid region and incite bronchospasm. A septic focus (infected tonsils, infected sinuses) may, however, give rise to asthma by infecting the lungs; the patient may also become sensitized to bacterial toxins, and may react to them as to any other allergen.

A mechanical effect may also be brought about by the presence of growths or enlargements blocking the airway, so that mouth-breathing becomes necessary, and the onus of warming, moistening, and purifying the inspired air is transferred to the bronchi, which are thus constantly irritated.

Earlier Experiments

The importance of the nasal factor in asthma was first recognized by Herck in 1844. It is interesting to note that this clinical discovery followed very closely the experimental demonstration of Williams² in 1840, by means of which he was able to prove the presence of muscle fibres in the bronchi which had been described by Reisseisen some twenty years before. Williams's experiment consisted of connecting the trachea with a water manometer and noting the difference of pressure obtained by applying a galvanic current to the lungs. The experiment was made on dead animals. In 1876 Gerlach began to experiment on living curarized animals, and produced bronchospasm by stimulating the vagus nerve. He was followed by a number of other experimenters—Sandmann (1890), Einthoven (1893), François Franck (1893), Doyon (1897)—who by various methods were also able to demonstrate the presence of constricting fibres in the bronchi. The results of these early experiments were, however, in most cases both unsatisfactory and contradictory, and it was only in 1903 that a real advance was made by the researches of Dixon and Brodie.³

Without doubt the experiments made by these two observers were the most important and the most precise which hitherto had been made; even to-day they constitute the scientific foundation of our knowledge of reflex constriction of the bronchi. The success of the method adopted by Dixon and Brodie lay in the fact that they demonstrated broncho-constriction by registering changes in the volume of air passing through the bronchi, whereas previous observers had only registered changes of pressure.

Dixon and Brodie, by means of their experiments, were able to demonstrate the presence of both broncho-constrictor and broncho-dilator fibres in the vagus nerve. Later, Dixon, working with Ransom,⁴ was also able to show powerful broncho-dilator nerves of sympathetic origin; reflex broncho-constriction was demonstrated experimentally, as well, by the stimulation of the nasal mucous membrane. The best site for stimulation of the nose was the upper and posterior part of the nasal septum, which clinically corresponds to part of the asthmagenic area. Dixon and Ransom in 1913 also demonstrated broncho-constriction of reflex origin by stimulating the central cut ends of various afferent nerves, such as the central end of the vagus and the central end of the thoracic sympathetic. Prevost and Saloz,⁵ working on tortoises, obtained broncho-constriction by stimulating a number of peripheral nerves.

Pathology

From all this experimental evidence one may conclude: (1) that stimulation of the vagus nerve causes broncho-constriction, and (2) that reflex broncho-constriction can be obtained in a number of ways, although stimulation of the nasal mucous membrane proves always to be the most efficacious.

If now one transfers these experimental results to the clinical aspect of asthma, one is faced with a very difficult problem. Irritation of the nose and nasal abnormalities are of very frequent occurrence, yet in only a few cases do they cause asthma.

Thus Becker⁶ in 360 cases of nasal polypi found asthma in only nine cases, or in 2.5 per cent. of cases. Hering in 200 cases found seven cases of asthma, and Schmiegelow in 139 cases thirty-one asthmatics.

These figures show that a source of nasal irritation by itself does not necessarily cause bronchospasm unless the naso-pulmonary reflex is unduly active. What causes this state of irritability of the naso-pulmonary reflex which enables a reflex action to occur and cause asthma?

Many suggestions have been made, but none of them has as yet given a final solution to this fundamental problem of asthma.

Stoland, Sherwood, and Woodbury⁷ have shown that the excitability of the vagus nerve (chronaxie) is increased by the previous injection of foreign sera. An analogous state has been described by Freund and Gottlieb,⁸ who found that peptone or foreign serum causes an enormous increase in the

salivary response to pilocarpine. In this connexion it is interesting to note an experiment made by Dodel. Dodel⁹ found that the action of pilocarpine in guinea-pigs is enhanced by producing a chemical bronchitis by means of a few whiffs of chlorine gas. A dose of pilocarpine, which in the ordinary way would not be a fatal dose, kills the animal in thirty minutes after the bronchitis has been produced. He concluded that the bronchitis produced by the inhalation of chlorine had concentrated the vagotropic action of pilocarpine on to the respiratory system. In a similar way, a chronic respiratory infection in man may cause increased vagal action and thus lead to asthma.

It has been a moot point whether asthma is associated with a state of acidosis or alkalosis, but now there is good evidence to show that an asthmatic attack may be accompanied or may be induced by a state of alkalosis. Epstein¹⁰ states that in asthma there is a tendency to alkalosis similar to that found in other states, such as spasmophilia, certain cases of eczema, in anxiety neurosis, and in melancholia. Certain conditions tending towards acidosis are, on the other hand, often incompatible with asthma, such as acidosis of the last months of pregnancy, of prolonged vomiting, and of diabetes mellitus. He mentions that in 2,500 cases of diabetes mellitus asthma was recorded in only two cases. Tiefensee¹¹ found that the alkaline reserve during free intervals was normal, but that it was raised during an attack of asthma.

There may be a diurnal, seasonal, and sexual variation in vagus activity. McDowall¹² points out that when an individual is at rest vagus activity is at its maximum. Asthmatic attacks are certainly more liable to occur at night, during the week-end, or after a meal. The ionic environment of the bronchi may have a definite influence on bronchial spasm. Pottenger¹³ points out that calcium acts in harmony with sympathetic stimulation, and potassium—and to a less extent sodium—in harmony with vagus stimulation. Increased parasympathetic action presupposes a relative increase in potassium as compared with calcium ions in the cells, either an actual decrease in the calcium or an actual increase in the potassium. Pottenger found that the K/Ca ratio in the blood of normal persons is about 2, but that in asthmatics the ratio was always high (2.04 to 2.93, averaging 2.48). In only one case did it fall below 2.19.

Direct proof of calcium deficiency in asthma is lacking, and a large series of cases at the New York Hospital studied by Lemke¹⁴ shows no significant calcium deviations from the normal.

Review of Clinical Case

During the last four years 337 cases of asthma, which have been seen at the Asthma Clinic of the General Infirmary at Leeds, have had an anterior rhinological examination. In practically every case the rhinological examination has included a transillumination test, and in many cases also an x-ray examination. An examination of the nose and throat has been carried out irrespective of the type of asthma, and of whether or not nasal symptoms were present. In every case the patient has been referred to the ear, nose, and throat department of the hospital for the examination of the nose and throat. The largest proportion of cases was composed of adults, and only 15 per cent. (fifty-two cases) were children under 10 years of age. Of the adult cases 60 per cent. belonged to the first four decades and 25 per cent. were over 40 years of age.

For the purpose of this study it will be convenient to discuss the relation of the nose and throat to asthma under three headings—namely, nasal symptoms, type and frequency of nasal abnormalities, and value of nasal operations.

Nasal Symptoms

About half the patients complained at one time or another of vasomotor symptoms of the nose or throat

(see Table I). The most common symptom was sneezing (25 per cent. of cases). The sneeze was rarely single, but generally occurred in prolonged, violent, and paroxysmal seizures of ten, twenty, or more sternutations in rapid succession. Unlike hay fever or paroxysmal rhinitis, sneezing often occurred alone, and was not accompanied by rhinorrhoea or itching of the eyes. The attacks were more severe at certain hours of the day—for example, at night, or on first rising in the morning—but they also occurred throughout the day. In some cases sneezing

TABLE I.—General Symptomatology
(325 Cases of Asthma)

Symptoms	Number of Cases	Percentage
Sneezing	68	25.0
Rhinorrhoea only	19	6.0
Sneezing and rhinorrhoea	17	5.0
History of "colds"	41	12.0
Dryness or fullness of the nose	2	0.6
Seasonal hay fever	11	3.4
Sore throat	2	0.6
Hoarseness, aphonia	2	0.6
Earache, deafness (seasonal)	2	0.6
Total number of cases with vasomotor affections of the nose and throat	164	50.3

occurred independently of the attacks of asthma, while in other cases it represented the prodromus of an asthmatic attack. Occasionally, on looking back into the history of an asthmatic, one found that persistent sneezing had taken place many years before the asthma had actually started, and had been the first indication that the patient was an allergic subject. Another common vasomotor symptom was rhinorrhoea (11 per cent. of cases). In about half the cases it occurred alone, while in the other half it accompanied sneezing. Itching of the eyes, lachrymation, and photophobia were exceptional symptoms, unless the patient was also a sufferer from seasonal hay fever.

Patients frequently stated that the asthma first started from a "neglected cold," or that the attacks of asthma were heralded in by a cold, which afterwards "settled on the chest and caused the attacks of asthma." This type of history was obtained in 12 per cent. of cases. In the great majority of cases, however, what was described as a cold was not a true coryzal attack, but a vasomotor reaction of the nose representing the first stage of a general allergic reaction, which later manifested itself in an asthmatic attack. This is an important point, as many cases of asthma are erroneously attributed to an infective factor in view of a history of repeated "colds," and are treated by stock or autogenous vaccines, with little benefit, when the real cause is hypersensitiveness to an allergen, and the removal of, or the desensitization to, this allergen often dispels both the "colds" and the asthma.

The distinction between the vasomotor reactions of the nose in asthma and the common cold should not be difficult; in pure vasomotor rhinitis the secretions are always serous, whereas in the case of a true coryza the secretions are in a certain stage muco-purulent. Occasionally the pharynx may also become involved in an attack of asthma. The most common symptom is a dry, irritating, and hacking cough due to itching of the palate and of the upper portion of the trachea. More rarely, the pharynx and the uvula may become greatly inflamed and oedematous, and the patient may complain of marked soreness of the throat. The condition may also extend to the larynx, giving rise to hoarseness and to aphonia. Periodic and

sometimes seasonal deafness may also occur, due to the Eustachian tubes being involved.

All these vasomotor reactions of the nose and throat may precede, accompany, or follow an attack of asthma. The patient may remain free from asthma as long as the vasomotor nasal symptoms persist (especially the rhinorrhoea), but as soon as they cease the patient develops an attack.

Vasomotor affections of the nose were more frequently found in asthmatics during the first five decades of life. After 50 there was a distinct decline in the frequency, and only 7 per cent. of cases complained of nasal symptoms after this age. Vasomotor affections of the nose and throat occurred in all types of sensitivity and in sensitivity both to foods and to inhalants, but were definitely more common in pollen-sensitive cases when one included seasonal hay fever as well. In the other cases they occurred as frequently in subjects exhibiting positive skin reactions to one or more allergens as in those with negative skin tests, and indeed the latter showed a slightly higher frequency (see Table II). This may be explained by the

TABLE II.—*Skin Reaction*
(198 Cases of Asthma)

Skin Reaction	(a) Cases with Vasomotor Affections of the Nose or Throat	(b) Cases with Seasonal Hay Fever	Total with (a) or (b)	
			No.	Per cent.
Positive skin test to pollen (48 cases)	20	10	30	62.0
Total number of sensitive cases (124 cases)	48	10	58	47.0
Cases with negative skin tests (74 cases)	37	1	38	51.0

fact that cutaneous and mucous membrane sensitivity do not always run parallel; thus, in the perennial form of paroxysmal rhinitis unaccompanied by asthma it is a common finding that skin tests are negative, even when there is a definite history of sensitivity to some allergen.

Nasal Abnormalities

In the present series of cases no fewer than 262 cases (77.9 per cent.) showed some abnormality of the nose and/or throat. In many cases, however, these abnormalities were casual findings or minor causal factors (see Table III).

TABLE III.—*Nasopharyngeal Condition*
(337 Cases of Asthma)

Type of Abnormality	No. of Cases	Percentage
Spur	25	105 } 30.9
Deflected septum	80	
Hypertrophy, inferior turbinals	48	82 } 24.0
Hypertrophy, middle turbinals	34	
"Tonsils and adenoids"	78	23.0
Antra dark:		
Explored positive (infected)	21	73 } 21.0
Explored negative	30	
Not explored	22	
Polypi	18	23 } 6.7
Recurrent polypi	5	
Rhinitis sicca	3	0.9
Chronic rhinitis	4	1.0
Nasal hyperaesthesia	3	0.9
Lingual tonsil	1	0.3
Pharyngeal tonsil	1	0.3
Nasopharynx normal	75	22.1

N.B.—Cases showing two or more abnormalities have been included more than once in this table. The number of cases appearing in the table exceeds, therefore, the number of patients examined.

Deflected septa or spurs were found in 105 cases (30.9 per cent.), but in a large number of cases the deformity was slight and of no significance. Inferior and middle turbinal hypertrophy was also a frequent finding, and was noted in eighty-two cases (24 per cent.). A third large group of cases showed tonsillar and adenoidal hypertrophy or infection, and this was observed in seventy-eight cases (23 per cent.). Lastly, opacity of one or more sinuses either to the transillumination test or to x rays was found to occur also with great frequency, and was present in seventy-three cases (21 per cent.). The antra were explored in fifty-one cases, and were found to be definitely infected in only twenty-one instances. In the remaining thirty cases the opacity was probably due to hyperplastic changes of the mucous membrane lining the antra, as exploration proved negative and no pus was found.

A striking example of such a condition was given by a patient who was specifically sensitive to rabbit hair. The antra were first examined while the patient was still exposed to the offending allergen and was continually having severe and frequent attacks of asthma. The antra were found to be completely opaque, both on transillumination and to x rays. One antrum was explored, but with negative result. The patient was then advised to avoid contact with rabbits (the husband was a keen rabbit breeder), whereupon she immediately ceased to have asthma, and the antra, examined a month later, were found to be perfectly normal and translucent again.

Polypi were not a frequent finding, and were observed in only twenty-three cases (6.7 per cent.). In five of these cases they had a tendency to recur, in spite of the numerous operations which the patients had undergone for their removal.

Rhinitis sicca, chronic rhinitis, and lingual or pharyngeal tonsils were only occasional findings. Definite nasal hyperaesthesia was also distinctly uncommon, and was observed in only three cases. An analysis of the incidence of nasal abnormalities among different groups of cases classified according to whether they gave a positive or a negative skin reaction showed that deflected septa and nasal spurs occurred with a remarkably constant frequency in all groups (see Table IV). This was to be expected,

TABLE IV.—*Skin Reaction and Nasopharyngeal Condition*
(213 Cases of Asthma)

Skin Reaction	Naso-pharynx Normal	Spur or Deflected Septum	Tonsils and Adenoids	H.R.*	Polypi	M.T.B.† Enlarged	Sinusitis
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Positive to pollen only (30 cases)	30	30	33	6.6	0	15	0
Protein-sensitive cases (128 cases)	25	30	22	14	7.9	10.9	0
Cases with negative skin tests (85 cases)	26.1	30	17.4	11.7	7.0	9.3	7.0

* Hypertrophic rhinitis. † Middle turbinate bone.

as these nasal abnormalities are not dependent upon any allergic cause, and are quite coincidental as far as allergy is concerned. With regard to conditions which might be the result of hyperplastic changes of the nasal mucous membrane (turbinal hypertrophy and opaque antra), they were found a little more frequently in protein-sensitive cases.

The cases with negative skin reactions gave instead the highest incidence of definite sinus infection. Cases exhibiting a positive skin reaction to pollen had the highest percentage of normals, and of thirty such cases reviewed not a single case presented polyposis or sinus infection. Kern and Donnelly,¹⁵ in discussing the incidence of paranasal sinus disease in hay fever, found that patients with uncomplicated hay fever and patients with hay fever and seasonal asthma showed an incidence

of sinus abnormality that was less than in the average (normal) population. Although pollen-sensitive cases of asthma present nasal symptoms with the greatest frequency, they have the lowest incidence of nasal abnormalities, and it is quite common to find that hay fever subjects and patients with seasonal asthma have perfectly normal noses.

Operative Results

Of the 262 cases showing some type of abnormality of the nose and/or throat, 135 cases have received operative treatment, and of these the results are known in 109 cases. These include thirty-one children.

The period of observation after the operation has varied from a minimal period of six months up to fifteen years, and the average period has been two and a half years. In 19 per cent. of cases the period of observation was under a year, in 25 per cent. of cases one or two years, and in 56 per cent. of cases over two years. All the patients were seen at the asthma clinic, or if they had ceased attending the clinic were circularized and asked to reply to a questionnaire.

Patients were deemed "cured" if they had kept completely free from asthma for a period of at least two years, and "improved" when the attacks of asthma had definitely lessened in severity and/or frequency. The latter do not include patients in whom the operation had improved the breathing but had left the asthma unchanged. In many cases it was impossible to say definitely whether the improvement was due solely to the nasal treatment, as the patients had received other forms of therapy as well, and in such cases one could only infer that the improvement had taken place with nasal treatment rather than by it.

The operative results show that forty-one cases (or 37.5 per cent.) improved after nasal treatment, and three cases (or 2.7 per cent.) were "cured" (see Table V). Another fourteen cases showed some temporary improvement, thus bringing the number of cases which somewhat benefited from surgical treatment of the nose and throat

TABLE V.—Operative Results
(109 Cases)

Operation	Total No.	Cured	Much Improved	Improved	Temporarily Improved	Unchanged	Worse	Asthma Started After Operation
Tonsillectomy ...	43	1	5	5	4	24	1	3
Tonsillectomy and middle turbinectomy	2	0	2	0	0	0	0	0
Tonsillectomy and inferior turbinectomy	1	0	1	0	0	0	0	0
Tonsillectomy and submucous resection	6	1	1	2	0	2	0	0
Submucous resection ...	11	0	1	2	1	5	0	2
Submucous resection and inferior turbinectomy	5	0	2	2	0	0	1	0
Submucous resection and antrum drained	1	0	1	0	0	0	0	0
Submucous resection and middle turbinectomy	3	0	1	0	1	1	0	0
Submucous resection and polypi removed	1	0	1	0	0	0	0	0
Inferior turbinectomy ...	8	0	2	1	1	4	0	0
Middle turbinectomy ...	3	0	1	0	1	1	0	0
Polypi removed ...	7	1	3	0	2	1	0	0
Polypi removed and antrum drained	1	0	0	0	0	1	0	0
Recurrent polypi; multiple curettage	4	0	0	0	3	1	0	0
Antrum drained ...	6	0	4	1	0	1	0	0
Antrum drained and inferior turbinectomy	2	0	1	0	0	1	0	0
Cauterization ...	4	0	1	0	1	2	0	0
Pharyngeal tonsil removed	1	0	1	0	0	0	0	0
Total ...	109	3	28	13	14	44	2	5

up to 55 (or 50.4 per cent.). Of the cases which were improved only twenty-one have been kept under observation for a period of over two years, and can be regarded to have definitely benefited from the operation, while the remainder are still an uncertainty. Thus one may state that of 109 cases which received surgical treatment only about one out of five has been definitely successful.

Of the three "cures" one followed a tonsillectomy, another tonsillectomy and submucous resection, and a third occurred after the removal of a polyp. In all three cases there was some definite indication for operative treatment, and the "cure" could be attributed directly to the operation.

Among the failures, in two cases the asthma was made worse after the operation, and in five cases the asthma actually made its first appearance after the operation. In all these cases the operation had been either a tonsillectomy or a submucous resection of the septum, two operations which may be dangerous in asthma.

Tonsillectomy may prove harmful to an asthmatic when the tonsils are not definitely infected but are merely hypertrophied, as the tonsillar hyperplasia may be a protective mechanism in resisting infection. It is to be noted that pollen-sensitive cases and cases sensitive to inhalants have a higher percentage of "tonsils and adenoids" than any other group (see Table IV). A submucous resection of the septum may aggravate or even induce asthma by creating an irritable ethmoid area, because the mucous membrane covering this area may, in the course of the operation, have become contused and damaged, and the sensory nerve endings may have become unduly irritable.

Discussion of Treatment

The figures given above are somewhat disturbing, and unfortunately no more encouraging results can be obtained from a survey of the literature of the past twenty years. Although the results given by different observers vary considerably, and the percentage of improved cases ranges between 43 and 85, and that of "cured" cases between 1.6 and 48, on taking an average figures not very different from our own are obtained. Thus of a total series of over 700 operated cases reported in the literature, an average of 56 per cent. of cases have improved, and about 10 per cent. have been "cured" (see Table VI).

TABLE VI.—Results with Other Observers

Author	Year	No. Cases Operated	Improved		Cured	
			No.	Per cent.	No.	Per cent.
Dundas-Grant ¹⁸ ...	1913	53	32	60.3	11	20.8
Heatley and Crowe ¹⁹ ...	1923	62	53	85.4	1	1.6
Tod ²⁰ ...	1925	173	76	43.0	19	10.0
Lierle ²¹ ...	1926	21	17	80.0	2	10.0
Leopold and Fetterolf ²² ...	1927	24	12	50.0	5	48.0
Rackemann and Tobey ²³ ...	1929	258	129	50.0	13	5.0
Lyon and Murray-Lyon ²⁴ ...	1930	115	77	66.9	20	18.3
Averages ...	—	706	—	56.0	—	10.0

Some authors take a very pessimistic view on the value of nasal treatment in asthma, and Piness and Miller¹⁸ state that in a group of 834 allergic patients 704 operative procedures on the nose and throat were done on 413 patients without relief, there having been no removal of the offending allergen. Kahn¹⁷ has also reported a group of ninety-four consecutive cases of asthma in which thirty-three received operative treatment. In fifteen cases relief of the nasal obstruction was obtained, but the asthma was unchanged.

While indiscriminate operations on the nose and accessory sinuses of asthmatics should be condemned, they must, if attempted, be radical. Thus it is useless to remove a polyp without treating the underlying sinusitis, as the polyp will recur. Similarly, it is essential in the case of an enlarged middle turbinal, which is pressing on the posterior septum, to remove that portion of the turbinal which touches and irritates the sensitive part of the septum. Definitely infected sinuses should always be treated either surgically or more conservatively by means of intranasal irrigation, nasal packs (Dowling pack), inhalations, and sprays. The hyperplastic type of sinus disease should, however, never receive operative treatment, and should be left severely alone. The same may be said of swollen and oedematous turbinals which are not causing nose-block and are not impinging on the sensitive area. Polypi should be removed, but the operative results are distinctly poor on the whole, except for an occasional brilliant success. In some cases they have a great tendency to recur, and the patient undergoes numerous operations with very little benefit unless the accompanying sinusitis is treated as well. Tonsillectomy should be done whenever the tonsils are definitely infected, but not otherwise; in a certain number of children the results are gratifying.

As a corollary to nasal treatment it is most important that the patient should be educated to breathe correctly once a free air-way has been established. Many patients, who habitually or from some nasal block are mouth-breathers, have to be re-educated to breathe through the nose. Often these mouth-breathers rapidly develop a typical asthmatic chest, over-expanded in its upper half, narrow at the base, and taking the shape of an inverted flask. This deformity is due to the fact that during an asthmatic paroxysm the respiration in these patients is almost entirely of the upper thoracic type, the lower part of the chest remaining practically immobile owing to a spasm of the diaphragm. Expiratory breathing exercises and exercises devised to develop diaphragmatic breathing are of the very greatest value in such cases.

In concluding, one may say that nasal symptoms often do not disclose the part which the nose is playing as an aetiological factor in asthma, as they themselves may be due to an allergic reaction. The presence of nasal abnormalities in the nose and throat is of no greater help, as they are often coincidental or are also a result of the asthma.

1. In a series of 326 cases of asthma about half the number of patients complained at one time or another of nasal symptoms. These symptoms were mostly due to vasomotor affections of the nose and not true coryzal attacks.

2. Vasomotor affections of the nose and throat occurred in all types of sensitivity, but were definitely more common in pollen-sensitive cases of asthma.

3. Abnormalities of the nose and throat were found in 77.9 per cent. of cases, but were mostly coincidental and minor causal factors.

4. Turbinal hypertrophy and hyperplastic sinus disease were often the result rather than the cause of the asthma, and were found slightly more frequently in protein-sensitive cases.

5. Of 135 cases which received operative treatment, 109 cases were followed up, and of these 50.4 per cent. were improved and 2.7 per cent. (three cases) were "cured."

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THE TREATMENT OF BACTERIAL FOOD POISONING

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Although bacterial food poisoning is by no means uncommon in Great Britain, it is in the more torrid portions of the world that it takes a really prominent place among the acute medical emergencies met with in practice. The low standard of personal and family hygiene among those who handle and cook food in many warm countries, together with the prevalence of flies and conditions of atmospheric temperature and humidity most suitable for the multiplication of the organisms concerned, lead to the high incidence of the *Salmonella* type of bacterial food poisoning.

Symptomatology

Many persons spend years of residence in warm countries without contracting malaria, dysentery, or other characteristically tropical diseases, but few escape one or more attacks of the condition now under consideration.

The following is a typical case from my records:

Of eight persons dining together in Rangoon one night in 1928 only five partook of the savoury, at 9 p.m. All five suffered from bacterial food poisoning—the symptoms showing themselves in Mrs. A. at 3 a.m., Mrs. B. at 8 a.m., Mr. A. at 10 a.m., Mr. B. at 11 a.m., and Mr. C. at 4.30 p.m. The severity of the attacks and the rapidity of onset were definitely correlated—Mrs. A. having severe vomiting and diarrhoea and marked collapse, whilst Mr. C. had moderate abdominal pain and diarrhoea, without vomiting and collapse.

It is not only essential, therefore, that medical men practising in such countries should have a firm grasp of the principles of treatment, but it is important that those acting in an advisory capacity to services and firms with men working far from medical help in jungles and forests should issue "first-aid" instructions for the future benefit and protection of their clients.

In severe infections the incubation period is short (two to six hours), and although all those who eat the infected food may suffer acutely, one patient may be very much worse than the others. In such cases it is not unusual to find that the patient most severely afflicted has been suffering from a mild gastro-intestinal upset for some time.

Captain M., aged 25, staying at a hotel in India in 1920, had been suffering from loss of appetite, furred tongue, and mild diarrhoea for over a month without reporting sick. He