TREATMENT.

The symptoms being due to pressure on a nerve root, they cannot be cured except by removing the pressure, and this can only be done by surgical operation.

In the absence of pain it is doubtful whether a patient should be urged to submit to operation merely on account of paresis of some of the intrinsic muscles of the hand unless his occupation is one which requires the use of these muscles. But the doctor is hardly likely to be consulted unless there is pain; if he finds that pain in the hand or forearm is relieved by raising the limb above the head, and is accompanied by thenar wasting, he should have the patient x-rayed; and even if no cervical rib is found to be present the characteristic syndrome will justify a diagnosis of rib pressure and warrant recourse to operation.

The operation is a dissection of the neck, demanding an accurate knowledge of anatomy; if a cervical rib is present it is isolated, divided posteriorly, and removed. If no cervical rib is present a portion of the first rib is removed. Provided the symptoms have not persisted too long cure is to be expected—usually rapid cure of pain and much less rapid restoration of muscle power.

The case which we have to describe came under the care of one of us (W. W.) on March 16th, 1922.

He was a well developed, muscular young man of 25, living in the country, who had previously been in good health. Five months ago he began to have pain in the back of the right wrist; later it spread to the arm, and a fortnight ago the right side of the root of the neck became painful. The pain was intermittent, and he might be free from it for two or three hours at a time; but when present the pain was severe and burning, and at night prevented sleep. He found some relief from supporting the elbow. On examination, the pad of the forefinger was dry and black, and there was a smaller area at the tip of the thumb, and a quite small black spot on the tip of the middle finger. The right thenar eminence was smaller than the left, and the muscles of the right forearm had less tone in them than those in the left. Sensation was impaired in the thumb and forefinger.

Palpation at the root of the neck revealed on both sides a hard bone-like outgrowth, suggesting an extra rib, which was confirmed by a skiagram. The sensory impairment and trophic changes at the tips of the thumb and first and second fingers pointed to involvement of the sixth or sixth and seventh cervical nerves, and the slight wasting of the thenar eminence showed that the eighth cervical had not wholly escaped.

On inquiry as to a possible cause for the development of the symptoms the man stated that he had been digging rather vigorously in his garden for many days prior to the onset of the pain.

Operation.—On March 28th, 1922, through an L-shaped incision the right cervical rib was exposed and divided posteriorly and removed.

Result.—The operation was followed by immediate relief of pain. The trophic changes cleared up less quickly and the gangrenous tip of the forefinger had ultimately to be amputated.

Writing on October 25th, 1922, the family doctor thus describes the man's condition: "There is slight tenderness at the corner of the scar to the ulnar side—this has always been the tenderest spot. No anaesthesia or pain in forearm or hand. No trophic changes except that the terminal inch of the forefinger is slightly red, glazed, and numb. The muscles of the forearm are like a blacksmith's, very well developed, and there is no difference between those of the right and left hands except as regards the thumb muscles."

ASTHMA AND ADRENAL INADEQUACY.*

BY

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I do not propose to enlarge in any detail on what we one and all picture to ourselves as asthma, and what we readily recognize as such, but there are a few points I should like to refer to.

Dieulafoy, in his description, says: "The attacks of dyspnoea which constitute asthma . . . appear suddenly weeks, months, or even years apart." They consist of two elements—(1) a nervous, which is constant, and (2) a catarrhal, which is variable, may not be present with first attacks, but appears as a complication in later attacks. The attack of asthma generally begins "in the early hours of the night." Then follows a picture of the patient during a paroxysm:

"An attack of asthma is rarely single; we usually see a series of attacks which are repeated for several days or weeks; they often return at the same hour—usually at night. . . . Analysis of the attack shows that the dyspnoea presents peculiar characteristics. . . . The painful and wheezing inspiration

only allows an insufficient quantity of air to enter the chest, and the expiration, which is still more painful and three or four times as long as the inspiration, does not drive out the inspired air. . . . We do not see sucking-in, as in croup, because in asthma the chest is always filled to its maximum with air."

In the true variety the nervous element is alone in play and it is only when catarrh appears that the picture is modified. "The attack of asthma is certainly produced by spasm of the muscles of respiration," though authorities disagree in allocating the spasm to the intrinsic muscles of respiration, the extrinsic, or both. Asthma is a neurosis and presents all the caprices of such, and further, it is almost always a diathetic and hereditary neurosis.

"The spasm of the respiratory muscles and the phenomena of vaso-dilatation and vaso-secretion are themselves due to a special condition of the nerves which govern these functions. This state of irritability is sometimes spontaneous or at least apparently so; at other times it is due to a reflex act which starts in the terminals of the sensory nerves which supply the bronchi or the nasal passages."

Thus Dieulafoy, and if one reviews his treatment the drugs used are all those which have an inhibitory action on the vagus.

Now in coming to a logical conclusion as to what is the root mischief at work, wherein has lain our difficulty? As I regard it, the reason is that we have to deal with a condition which apparently is subject to no fixed laws, whether of heredity or environment, germinal origin, seasonal incidence, racial characteristics, or age period. I say "apparently" advisedly, as there is evidence, if we seek it, of some hereditary influence, of some relation to the age of the individual and to his environment. Thus, faced with the initial difficulty of incidence, can we isolate any one condition common to all cases, any one condition subject to the above influences, any one condition of which we could say: "This is the fundamental principle lacking in the human economy of all asthmatics, and this is the cause of asthma, however it as a cause may be produced"? I think we can do so.

The fundamental fault in the incidence of asthma I believe to be *suprarenal inadequacy*, and I propose to advance as briefly as possible evidence in favour of this opinion.

Some months ago the one question knocking at my brain was: Why do so many cases of asthma obtain such marked and definite relief—even though only of a temporary nature—from an injection of adrenaline or some such derivative of the suprarenal medulla? The answer was: This supplies temporarily a deficiency; this has to do with the cause of the condition, and is a manifestation of the specific action of adrenaline in restoring the normal tonus of the bronchial muscles.

On this basis the problem required much wider, more minute, consideration: the first principle involved was the review of the known action of the extract of the suprarenal glands, and the second was how this action could be affected or modified by external influences acting on the glands or by influences on the glands themselves. The actions are familiar, but they will bear recapitulation.

The glands probably have two secretions—one produced by the medulla and one from the cortex—whose action may be supplementary, but probably is antagonistic, to adrenaline. We owe to Langley the important generalization that the action of adrenaline on any part is the same as stimulation of the sympathetic nerves to that part. It will not act on a structure that at no time in its history has been innervated by the sympathetic. Elliott, in extending these observations, has brought forward some facts which suggest that, after excision of the suprarenals, the muscles innervated by the sympathetic cannot be thrown into activity even by electrical stimulation of the nerves.

Adrenaline appears, then, to be a chemical body whose presence is essential to the activity of the sympathetic. Nor is this the only example of such an association, for sympathetic paraganglia and structures such as the carotid body contain paraganglin—a similar but more stable body which does not lose its effect even if left in contact with the stomach wall for twenty-four hours.

Adrenaline constricts cutaneous vessels, but, on the contrary, has a dilatory influence on intramuscular vessels and on those of the heart itself. It has little or no action on the vessels of the lungs or brain. It liberates sugar in the blood. It causes relaxation of intestinal muscles and of bronchial muscles. It contracts all sphincters. It can bring about rapid recovery of the normal irritability of muscle after this has been lessened by fatigue, and this is an inherent property of adrenaline itself and not produced through its influence on the circulation. The glands are innervated by the sympathetic system, and since the secretion stimulates the same activities that are stimulated nervously by this division it is possible that disturbances in the realm of the sympathetic, although initiated by nervous discharge, are automatically augmented and prolonged through chemical effects of the adrenaline solution.

Every one of the visceral changes noted—the cessation of processes in the alimentary canal (thus freeing the energy supplied to other parts), the shifting of the blood from the abdominal organs and skin to the organs mostly in need of them, the lungs, heart,

* Abstract of a paper entitled "Asthma—a phantasy with some facts," read before the Durban Medical Society.

and central nervous system; the increased vigour of contraction of the heart, the quick abolition of muscular fatigue; the mobilizing of energy-giving sugar into the circulation—every one of these visceral changes is directly serviceable in making the organism more effective in the violent display of energy which fear or rage or pain may involve (Cannon). Thus the emotions affect the glands and the adequate response is made.

My next remarks may seem irrelevant, but I wish to show how the glands may be affected by simple causes, and thus lay the foundation for assuming that some such cause may be at work in the production of asthma.

Why does a red rag irritate a bull? The retina in its pigmentation and because of its pigment must be in close association with the suprarenals. Certain retinal cells and fibres are connected through the autonomic system with the adrenal medulla; certain cells are connected through the same system with the adrenal cortex; and therefore, as the retina in different animals, races, and individuals differs in its structure and sensitiveness, so in the bull the connexion with the adrenals may be such that red as a colour immediately stimulates and rouses it and the associated glands, with the resulting increased production of adrenaline and the stirring up of pugnacity and the emotion of anger.

We know the stimulant effect of red as a colour—a stimulation which goes on to irritation if one is too long exposed to it. Red stimulates the suprarenal glands to overproduction of adrenaline, with consequent demonstrable influence on the emotions. Black and darkness depress and frighten, and asthma in most cases is of nocturnal occurrence. The inference, as related to adrenaline production, is obvious. Assuming, therefore, an origin for asthma arising through the medium of the retina, can we not with equal justice assume that an influence in the nose, acting through the sympathetic, can produce suppression of adrenal secretion, with resultant asthma, or border-line asthma precipitated by the added depressing influence of darkness? The vital tide is at its ebb at 2 o'clock in the morning.

Can we not proceed on the same lines, and assume that indigestion or a heavy meal (and remember the stomach and bowel congestion, the lethargy produced by the necessity of digestion is the antithesis of what obtains when there is a superabundance of adrenaline in the blood) may reflexly affect the suprarenals with temporary suppression of secretion, permitting the onset of an attack of asthma? Once get a suppression of sufficient magnitude and in most cases an attack supervenes.

Assuming that this theory of adrenal suppression, as the cause of asthma, is correct, let us briefly consider the mechanism at work.

The bronchi, or rather bronchioli, affected are directly innervated by the autonomous nervous system, and this innervation is through the medium of two distinct entities, the sympathetic nervous system and the vagus. The sympathetic, as concerned in the mechanism of asthma, keeps the bronchioles patent. It is definitely stimulated to activity by adrenaline. Further, it is closely interrelated with the adrenal glands and conveys to them stimuli which increase their activity, and, what is even more important in the present discussion, impulses which may suppress function. The vagus action is directly opposed to that of the sympathetic and it is the careful balance of these opponents which maintains bronchiole equilibrium. Unopposed by the sympathetic, the vagus produces spasm of the bronchioles and consequent asthma.

Again, during sleep the endocrine glands are at rest. The sympathetic, receiving no external impressions, unstimulated by internal secretions or relatively so, is sleeping as well, while the vagus—concerned in the perpetuation of cardiac action and rhythm, bowel peristalsis, respiration, etc.—is necessarily active. We can, therefore, all the more readily appreciate the propensity for asthmatic attacks to develop during sleep. And so it is in practice—asthma, colic, and labour pains tend to develop while the sympathetic is at rest.

Thus, given bronchiolar muscle of border-line instability, it may be kept apparently stable by an active sympathetic. The activity of the sympathetic depends on a steady flow of adrenaline. This may be just sufficient during the day when the sympathetic is wakeful and continuously requesting the glands to function. But when the sympathetic sleeps, what then? The supply of adrenaline is more or less rapidly exhausted, the gland sleeps with the sympathetic; and calls for more secretion are not made and not received. Asthma supervenes.

In leading up to this I have endeavoured to indicate a selective action of suprarenal products, as of all endocrine products. But why should one person get asthma and another, under apparently identical conditions, not get it? It is all a question of degree. The normal individual manufactures normal amounts of internal secretion, enough to

keep the peace during the day and to tide him through the hours of darkness. But glands vary as do individuals. If the thyroid can be deficient in one individual, then why not the suprarenal in another? Thus we assume congenital deficiency. Again, it is known that glandular function may alter without any definite evidence in the glands themselves. If this can happen with the ovary, thyroid, and pituitary, why not with the suprarenal? Thus we assume deficiency later in life. Moreover, glands are subject to disease processes and toxic influences, and adrenal hypofunction and asthma may often be a sequel of some other exhausting disease.

But there are cases of asthma which we can explain by none of these suppositions. Endocrinologists inform us, and produce indubitable proof, that the endocrine glands form a chain, the strength of which depends on the integrity of each link. Let one link of the chain be malformed, weak, distorted, or broken, and the chain as such gives evidence of the weakness when put to the strain; and, moreover, the weakness is found at the particular link affected. Exophthalmic goitre, cretinism, Addison's disease, dystrophica adiposo genitalis, acromegaly, osteomalacia, are all cases in point. But the chain means more than that: the perfection of action of one gland link depends on the perfection of action of another gland link.

Thus the ovary and thyroid are interdependent, as are the thymus and ovary, and change in one is evidenced as well in the other. Now the ovary has a close relation with the suprarenal, and so has the thyroid. During pregnancy the action of the ovary in certain directions is in abeyance. Menstruation has ceased. That there is in many cases some deleterious effect produced on the suprarenal glands is certain. They are the chromophil glands, and we have only to note phenomena of brown areolar pigmentation, brown discoloration of the skin, apathy, somnolence, all indicating a kind of pseudo-Addison's disease. To what does this lead us? To the supposition that the ovary has a stimulating influence on the suprarenal glands. Before puberty this stimulation is absent; it is absent during pregnancy; it is lost after the menopause.

Is not asthma a condition rather of ante-puberty or post-menopausal ages? Have we not all made brilliant prophecies concerning the disappearance of the child's asthma at puberty? We were taught so by experience, but we did not understand the mechanism at work. May we not attribute the emotional disturbances of the climacterium with its flushings, etc., to a disturbed and constantly changing function of the suprarenal glands?

So much for the ovaries. Similar evidence can be adduced showing that inhibition of function or excess function of other glands may produce a suppression of suprarenal function. The adenoid and lymphoid overgrowth one associates with the youthful asthmatic is the direct result of glandular abnormality. Thus we adduce faults in the glandular chain which may work towards adrenal deficiency and consequent asthma.

Throughout this paper I have argued that asthma is primarily due to suprarenal inadequacy. In the present state of our knowledge of the separate actions and concerted interrelation of the endocrine glands it is difficult to substantiate this theory by facts which have the confirmation of physiological and pathological proof. It may, indeed, be necessary to enlarge the scope of the theory, and to accept a disorganization of the endocrine chain as a whole as the fundamental reason for this distressing condition. Nevertheless, on the supposition that suprarenal inadequacy is the chief factor in the incidence of asthma, the problem of treatment becomes somewhat simplified.

We must have two objects before us in undertaking treatment:

(1) It is necessary to discover the adverse influence at work, be it in the eyes, nose, throat, abdominal tract (and, of poisons there, I include peptone products), thoracic tract, or urinary system, or be it in the associated endocrine glands. We must try to discover it and eliminate it, calling to our aid all the devices that medicine and surgery have bestowed on us.

(2) We must reinforce the action of the suprarenal glands themselves, and re-establish normal function.

I defer consideration of (1). Each case must be dealt with on its merits and the origin located; appropriate treatment must be instituted to deal with it, bearing in mind that failure to do so may prejudice or stultify the results of treatment instituted under (2). For treatment under (2) we have at our disposal

the extract of the suprarenal medulla itself, and we have the extracts of glands known to work in unison with it. It is my practice to order mixed gland because I can see no harm in giving an overdose of a gland substance known to stimulate the suprarenal glands, and no harm in giving gland substance which has no demonstrable action on the suprarenal. But where there is evidence of hyperfunction of any particular gland I withhold that gland substance in treatment.

It will be said: "But we have all had failures with the exhibition of adrenaline in asthma." Perhaps these can be explained by reference to the properties of the extract and to what happens when it is administered. When given subcutaneously it brings about intense constriction of subcutaneous vessels and thus tends to defeat its own absorption. It does the same in the stomach, but this may not be a disadvantage. It is rendered inert though not destroyed in an alkaline medium. The stomach contents are acid and the vaso constriction produced would be useful in producing a slow, continuous absorption, unlike the quick absorption obtained from an intramuscular injection, for adrenaline dilates intramuscular vessels. Therefore, for immediate ease, an intramuscular injection should be given, and oral administration employed for a slow continuous action.

My great difficulty in compiling this paper has been the paucity of available bibliographic references to the endocrine glands and asthma. There are, I feel, many flaws in my argument, but if the paper serves to stimulate discussion I shall feel amply rewarded.

THYROIDFISSURE FOR MALIGNANT DISEASE IN A MAN OF 74.

BY

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THE case here reported is interesting in view of the advanced age of the patient. So far as I have been able to ascertain, the only instance in which thyroidfissure has been performed on a patient older than this is that of a man aged 75, on whom Sir StClair Thomson operated successfully. There is naturally a certain amount of hesitation in advising an operation on a patient of such an age, especially if he is at all debilitated, but this man is more vigorous than usual at this time of life—thin, but with good arteries, and unhesitatingly chose to have the operation.

W. T., aged 74, attended as an out-patient at the Throat Hospital in May, 1922. He complained of hoarseness of several months' duration, and this was the only symptom. A small warty growth could be seen on the margin of the right vocal cord, at the junction of the middle and anterior thirds. There was no lagging of the movement of the cord, the only impairment of the movement being caused by the mechanical obstruction of the growth to proper apposition. A specimen showed the growth to be a squamous-cell carcinoma.

On June 6th thyroidfissure was performed. The isthmus of the thyroid gland was ligatured and divided and tracheotomy performed in the median position. Before opening the trachea a 2 per cent. solution of cocaine was injected into its lumen and into the interior of the larynx. The tracheotomy tube was inserted and the larynx opened without any of the usual disturbance. On exposing the growth by sawing through the ossified thyroid cartilage it was found that, as is so often the case, it was much more extensive than it appeared to be, spreading below the cords across the anterior commissure to implicate the tissue below the opposite cord in the anterior part. In consequence a considerable amount of tissue on both sides of the larynx had to be removed; this was done after placing a swab dipped in 2 per cent. cocaine into the larynx and packing off the trachea and pharynx.

As soon as he recovered consciousness and there was no sign of bleeding the tracheotomy tube was removed, a suture having been placed in each side of the trachea at the time of the tracheotomy. These were left *in situ* for a short time, so that if necessary the wound could be readily opened and the tracheotomy tube reinserted. He was kept in the upright position in bed and encouraged to get up and sit in a chair from the third day onwards; convalescence was uneventful. A small tumour appeared at the anterior commissure and persisted for several months; this was removed and proved to be the remains of granulation tissue with no evidence of malignancy. He now speaks in a loud whisper, which, taking into account the amount of tissue which had to be removed, is as much as can be expected.

The case illustrates clearly the importance which should be attached to persistent hoarseness or alteration of voice occurring in a man over 40. Semon and all laryngologists have pointed out the great importance of a laryngeal examination when it occurs, but unfortunately this symptom is

frequently ignored until some other reason sends the patient for an examination. Then it is too often found that the disease has progressed to such an extent that operation is impossible, and only a very severe operation offers any prospect of success. Alteration of the voice, being the only symptom of intrinsic cancer for some considerable time, should arouse suspicion when occurring in a man of 40 or over, which suspicion should not be set at rest even if no growth is visible at the time of examination, unless some other definite cause can be found for the condition, treated and cured. It is now possible to examine the larynx below the vocal cords by means of a mirror, introduced by Irwin Moore, so early growths in this region can be detected. As in the case mentioned above, the growth is frequently more extensive below the cord than is at first imagined. Impaired mobility or lagging of the cord implies some infiltration of the intrinsic muscles by the growth, and when present in conjunction with a growth is considered pathognomonic of malignant disease. In the case recorded it was not present, in spite of the size of the growth. In the larynx, as in other situations, epitheliomatous growths may be divided into those which tend to grow outwards (exfoliate) and at first show little tendency to invade the deep tissues; those which at first tend to extend over the surface, with little tendency to exfoliate or invade the deeper tissues; and those which tend to invade the deeper tissues at an early period of their growth.

The injection of cocaine into the trachea and larynx is of great value in the operation. Everybody knows the violent coughing, venous congestion, wide movement of the trachea, etc., which occur as soon as it is opened. After introducing a few drops of the 2 per cent. cocaine solution it can be opened with absolutely no disturbance. The disturbance when opening the larynx is even more marked, and the manipulation of the tissue may, by the inhibitory action of the branches of the recurrent laryngeal nerve, cause dangerous and fatal collapse. All this is done away with by the use of cocaine, which has the still further advantage of greatly reducing the haemorrhage and more clearly defining the growth and diminishing the shock.

The early removal of the tracheotomy tube is a matter of considerable importance, as it enables the patient to cough up secretions much more easily than when the tube is retained. It can easily be replaced, by the nurse if necessary, if sutures have been placed in the trachea, the wound being easily opened by traction on them.

The median position of the tracheotomy opening offers several advantages. After division of the thyroid isthmus the trachea is superficial in this region, so the operation is more easy than low tracheotomy; the tube can readily be reinserted if necessary, and during the operation is sufficiently out of the way not to cause inconvenience. In high tracheotomy the tube is in the way during the operation, and the thyroid isthmus, which has to be retracted when the trachea is opened, may get in the way and cause difficulty and delay in replacing the tube should necessity arise after its removal. In low tracheotomy there is often much difficulty in reinserting the tube owing to the depth at which the trachea lies.

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PRIMARY UNION AFTER OPERATION FOR SUPPURATIVE APPENDICITIS.

BY

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IT is now the practice of many surgeons to close the peritoneum without drainage in cases of abdominal sepsis, such as perforated gastric or duodenal ulcer, pyosalpinx, and appendicitis with localized abscess or general peritonitis, when it has been possible to remove the focus of infection. In such conditions, the root of the trouble having been removed, and as much as possible of the septic material having been swabbed out, the peritoneum is left to deal with what remains; provided that the infecting organism does not belong to one of the more virulent strains of streptococci (when the patient would probably die in any case), and provided also that the patient has not been left till *in extremis*, that membrane seldom betrays the trust reposed in it.

The tissues of the abdominal wall have not the same