accidents, and finally succumbed. The *post-mortem* examination showed a very extensive cerebral thrombosis.

In enteric fever there are two accidents which it is often difficult to differentiate—perforation and haemorrhage. In the former a rise of blood pressure occurs after the primary shock, but in the latter the fall of blood pressure is always very marked and prolonged.

In pneumonia a rise of blood pressure before the crisis is often the first sign of some complication, while a fall may indicate impending heart failure.

Finally, blood pressure observation may be of considerable assistance in cases of albuminuria, a high blood pressure indicating renal disease—either a nephritis or that type of renal damage which results from hyperpiesis or arteriosclerosis. In pregnancy the sphygmomanometer may be especially helpful, for it is often difficult to decide how much importance should be attached to a small amount of albumin in the urine of a pregnant woman. The normal systolic pressure of a woman of about 30 of average physique is about 112 mm. Hg. A pressure of over 130 would suggest the need for careful and frequent examination, and a pressure of over 150 would probably indicate the onset of eclampsia.

I do not think that a blood pressure of over 160 systolic or 90 diastolic is ever normal, although there are cases in which the diastolic pressure remains about 100 for a time without any ascertainable cause, and then returns to normal limits. Excitement may cause such considerable rises of pressure that it is well to bear in mind the rule that a high pressure is of greater significance when accompanied by a slow pulse.

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CHRONIC INTESTINAL STASIS AND EPILEPSY.*

BY

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In the study of epilepsy it seems clear that whatever the actual exciting element the vascular system is the main source of the epileptic phenomena, either alone or as a carrier of toxic agents, and the work that has been done experimentally by the advocates of both views has been very considerable in the last twenty years. Cells cut off from their circulation, even momentarily, show a reaction towards acidity, and this acidity factor must not be lost sight of in the interpretation of the experimental results recorded by the mechanical and vascular theorists. Faradization, and epinephrin will also blanch pial vessels and produce epileptiform convulsions. The proteoses of Cuneo, to be presently described, have the same effect when painted on the cortex. Lastly, lactic acid given intravenously will also produce convulsive seizures. Acidosis, therefore, whether produced locally or remotely, would appear to play a considerable role in the production of the epileptic convulsion, and the work of Cuneo¹ during the last nine years at Genoa goes perhaps further than that of any other investigator to establish its importance.

Cuneo established the presence, in the blood of persons who had just had an epileptic seizure, of a substance which he identified with the proteoses, and this substance introduced intravenously into animals faithfully reproduced the epileptic phenomena. At the same time he showed that the urine of these persons contained an extraordinarily high percentage of organic acids. Other features were a retention of total nitrogen, an increase in the nitrogen content, and continuous acidity of the faeces. Comparative tests in epileptic groups with a protein-rich and with a carbohydrate-pure diet next gave unexpected results, the acidosis in the former group being reduced, with a corresponding

improvement in the severity and number of the fits, whilst there was a percental increase in acidity in the second group, and the fits increased in number and severity. It was next established that the fault in the starch metabolism occurred in the first stage of conversion to the disaccharides, maltose, lactose, cane sugar, etc. Normally this takes place through the action of the amylolytic ferments, the subsequent conversion of maltose being effected by maltase ferment through hydration into glucose. The failure in the first stage resulted, in the absence of sufficient amylolytic ferment, in the production of a more or less intense concentration of organic acids—acetic, butyric, lactic, tartaric, etc.—and these, which should normally have been united with alkaline bases in the small intestine, passed in the epileptic into the blood stream and urine unchanged. The alkaline salts in normal individuals are oxidized—if ammoniacal through ammonium carbonate into urea, if sodium into sodium carbonate, and this is the vitally necessary salt for maintaining the alkalinity of the blood and tissues. Cuneo concludes from his work that this transformation of organic salts into sodium carbonate begins in the mucosa of the small intestine and is completed in the liver, whence the sodium carbonate is returned to the gut with the bile. Lack of bases favours the production of acidosis, while a sufficiency of sodium tartrate favours the activity of the liver ferments and the production of sodium carbonate. If sodium acetate or tartrate is introduced directly into the circulation it causes typical epileptic convulsions, and Cuneo was able to remove from the carotid artery of the animals used a substance which proved to be a proteose.

The source of these proteoses Cuneo found in the reduction of that fundamental constituent of all cellular nuclei, nucleohistone, and in the case of the serum and leucocytes of the blood also this reduction takes place under conditions of acidosis due to the concentration of organic acids. In an acid medium he was able to demonstrate the reduction of nucleohistone from both these sources into an innocuous acid and a toxic base having the chemical and biological properties of nucleic acid and of proteose. Introduced intravenously in dogs the latter not only produced typical epileptic convulsions, but the *post-mortem* appearances in dogs dying in status epilepticus so induced were identical with those found in the viscera and the brain and its coverings in persons dying of proteosaemia (albumosaemia), and as described by Tanzi and Lugaro in their findings in patients who died in typical status epilepticus.

He believes that albumosaemia exists in epilepsy and that this is caused by an insufficiency of the alkali-forming function in the liver and the small intestine, so that the acid organic salts, which are transformable into sodium carbonate, do not undergo this metabolic change, but enter the circulation and cause a division under certain conditions of the nucleohistone element and the nucleo-proteins into nucleic acid and proteoses. These latter remain free and exhibit their convulsive action.

Localized acidosis in derangements of the circulation may also set free albumoses, or it may be other toxins, as in Jacksonian seizures; and in the convulsions associated with cranio-cerebral injury with scar adhesions, brain abscesses, circumscribed areas of encephalitis, brain tumour, cysts, general paralysis, cerebral arterio-sclerosis, the acidosis produced by interference with the vascular supply may, as suggested by Professor Osato,² determine the release of proteoses locally in cells cut off from their circulation, and so excite the convulsions associated with these conditions. In general paralysis and arterio-sclerosis, and probably also in encephalitis, the vascular disturbances and the local cellular destruction processes in the brain elements are ideally combined to produce generalized convulsive seizures.

A little over two years ago it was my privilege to address you on the possibility of proving a close connexion between epilepsy and chronic intestinal stasis. More recently I have published a preliminary report³ on a small group of epileptics treated on lines directed exclusively to the relief of the gastro-intestinal conditions found associated in these patients with the epileptic phenomena. To-day, thanks to Cuneo's researches, I find myself in a stronger position to press the importance of chronic intestinal stasis as a

* An address to the Tunbridge Wells Division of the British Medical Association, February 27th, 1924.

factor in the pathogenesis of epilepsy. I have had opportunity of studying in very great detail 27 cases of epilepsy. In all of these a full personal and family history was obtained, and each patient was examined, system by system, for indications or history of chronic toxic conditions. The blood, menstrual blood, urine, and stools were examined, and the condition of the uterus, urinary bladder, teeth, tonsils, nares, and sinuses investigated. Thirteen cases were x-rayed with bismuth meal and barium enema, and eight of these were operated upon for conditions of advanced stasis affecting the general health. In every epileptic examined the clinical and laboratory evidence was eloquent of considerable chronic intestinal stasis and widespread mucosal catarrh of the intestine, as described first by Lane. As in the early group reported, treatment has been directed in every case primarily to the relief of the intestinal condition.

Of the 27 cases examined, only 20 can be reported upon as still under my personal supervision, and of these 5 have not been sufficiently long under treatment to enable me to include them in any statement of results. I can, however, report on 15 cases sufficiently long under treatment to be included in such a return.

In 5 cases there has been complete arrest of epilepsy over a period of from one to three years; 3 other cases show immunity over a period which just fails to bring them into the same category; 3 cases show a lengthening interval and decrease in severity of the attacks; 3 cases, including one with some injury to the scalp from burns, show no improvement at all; one case died from pulmonary embolus following operation.

When it is remembered that bromides and luminal have been excluded from the treatment, and that the carrying out of my instructions has been in many and various hands, I think that I may fairly claim that the methods of treatment I have adopted have yielded results which go some way towards proving a close association between demonstrable chronic intestinal stasis and epilepsy.

The following points have emerged in the examination of cases:

The faeces were examined in all for intestinal parasites and their ova, with negative results. Fourteen cases showed undigested starch in excess, and practically all cases showed an acid reaction in the faeces. Bacilluria occurred in 15 cases, albumin in 4, sugar in 1, and the average total acidity of the 27 cases was considerably above normal. The blood pressure readings varied: under 100 mm., 4; under 110 mm., 2; under 120 mm., 6; under 130 mm., 5; under 140 mm., 2; 150 mm. or under, 4. So that the average was 121.4 mm. The pulse pressure averaged 43.2 mm. Of 11 females 4 showed definite goitre, and 4 marked amenorrhoea. Tonsils were found enlarged and septic, or had been already removed, in 12 cases. In one case a suppurating antrum had been treated. Sixteen cases gave definite evidence of chronic catarrh of mucous membranes other than the gastro-intestinal tract. Enuresis was reported in 4 cases; sleep-walking in 4; urticaria in 7; stammering in 3; migraine in 3; asthma in 1. A family history of epilepsy was found in 8; stammering in 8; asthma in 3; migraine in 3; urticaria in 2; chorea in 1. In no case was a syphilitic history obtained either in the patient or in the parents. In 2 cases the parents were first cousins. Congenital defects or malformations were found in 5 cases; undescended caecum in 1; maldevelopment of the genital organs 1; persistent deciduous teeth 1; hypoplasia of enamel 2; impacted molars 2; there was a personal history of active tubercle in childhood in one patient, and in one case the family history showed tubercle involving three members of the family, whilst in another case there was a family history of chronic alcoholism in the father.

The results of treatment generally have been, I think, encouraging; and if all the operational cases have apparently not done better than the unoperated group, it must be remembered that these were cases calling definitely for operation on the grounds of intestinal stasis alone, and, further, that with the two exceptions where colectomy was done, the removal of a controlling appendix and acquired bands or adhesions still left the oedematous, turgid, congested, and perhaps denuded mucosal surfaces for after-treatment. Were not colectomy so dangerous an operation I should be inclined to resort to it more frequently in epilepsy, but as a general rule the treatment of cases not operated on, or otherwise operated on, is necessarily prolonged, and results cannot be expected at once in cases of long-standing chronic mucosal catarrh. Yet the immediate cessation of epileptic attacks from the date of operation in several cases has been a very striking experience.

There is much to investigate in every individual case, besides the degree of involvement of the colonic tube. The

extension of the chronically catarrhal and infective processes to the duodenal and upper jejunal area, and to the stomach, is a common feature in all cases of intestinal stasis at all advanced, and it is this extension which links my observations with those of Cuneo. I believe that the leaking septic tank is the first cause of epilepsy, and that the later involvement of the small intestine and liver in chronic intestinal stasis is the next step towards the failure of the alkali reserve which Cuneo has described. And I further believe that the graver the involvement of the mucous membranes of the body generally, but particularly of the colon, in the chronic catarrhal processes, the greater the output of organic acids and the more profound the demineralization of the tissues and cells of the body. Acidosis is the feature of epilepsy, and is associated with persistent acidity or hyperacidity of the faeces and urine. In the presence of such an acidosis the destruction of the nucleo-histone of mucosal cells is constant and widespread, and proteosaemia results on a large scale independently of the actual pressure of organic acids in the blood stream itself. I am confirmed in this view by the constancy with which my patients attribute their attacks to indigestion, to constipation, or to the presence of offensive stools, and by the good results of a return to sound habits of colonic hygiene. It is also my experience that the more chronic and extensive the colonic catarrh the more grave the epilepsy in severity and frequency. Moreover, the more rigorously the system of treatment is carried out the more rapid and complete the improvement. This treatment is directed to the restoration of the function and amenity of the gastro-intestinal tract, and particularly to the reduction of the septic catarrhal process; but no treatment will prove successful which does not also provide for a vitamin-rich diet, for remineralization, for endocrine and general hormone reinforcement, and for the removal of septic processes wherever recognized. Where surgical relief of stasis is obviously necessary it must be carried out.

The part played by heredity is still a matter of dispute, but the figures I give in my own small series are sufficiently striking, not alone for epilepsy, but for the closely allied explosive conditions—migraine, stammering, chorea, asthma, and urticaria. Sargent reviewed over 18,000 cases of cranio-cerebral wounds with skull defect resulting from war injuries. Of these about 800 only, or 4.5 per cent., developed epilepsy. I have, in the last five years, made a complete clinical and laboratory examination of no fewer than 500 cases of typical chronic intestinal stasis; yet of these only 27 have shown any signs of epilepsy—say 5 per cent. In these 500 cases are many showing varying degrees of other nervous conditions—nervous exhaustion, phobias, borderland cases, dementias, sclerosis, etc. But, unless the vulnerability of the cortex to certain specific toxins in certain individuals or families is accepted, we have no other explanation for the very occasional appearance of epilepsy in a condition so common as acidosis. All our present experimental methods of inducing epileptiform convulsions in laboratory animals—as faradization, artificial anaemia or acidemia, painting the cortex with epinephrin or proteoses, etc.—fail to explain the general immunity of the vast majority of people to the epileptiform convulsions so induced in laboratory animals. I, too, like Professor Osnato, am convinced that it is on the lines of Cuneo's work that the great advance is to be looked for. My own work on stasis offers, as explanation of the failure of starch reduction in the small intestine which he has described in epileptics, the fact that extension of the catarrhal processes to the upper small intestine from the colon is due to mechanical obstruction at the ileo-caecal entrance and at the duodeno-jejunal junction secondary to overloading of the static colon. A further factor must surely be the subversion of the hepatic functions by the high acid and toxin content arriving by the portal channel. There is, however, this also to be said: the destruction of mucosal cells in the colon on a wide scale in stasis releases into the vascular system toxic agents, which, coming from such an origin, must have a specific affinity for mucosal cells at a distance. Only thus can we explain the frequency and the chronicity of catarrh of remote mucous membranes—nasal, bronchial, uterine—which is so constant a feature in chronic stasis cases, and

which proves so intractable until the main colonic reservoir of these toxins is overhauled and repaired. Closer study of the leaking septic tank will yet yield a most fruitful contribution to medical science, and a further step to the solution of many problems hitherto accepted as insoluble. These will almost certainly include a large proportion of chronic functional disorders within the province of neurology and psychiatry, and with them the problem of epilepsy will certainly be advanced definitely nearer to complete solution.

I have to acknowledge gratefully the loyal support and co-operation of the many general practitioners who have carried out my suggestions in treatment, and the staff of the various hospitals and homes where operations have been performed. To Dr. A. C. Jordan and to Sir W. Arbuthnot Lane especially my thanks are due for the great skill and interest they have shown in the x-ray and operational sides of the work.

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British Medical Association.

PROCEEDINGS OF SECTIONS AT THE ANNUAL MEETING, BRADFORD, 1924.

SECTION OF LARYNGOLOGY AND OTOTOLOGY.

W. JOBSON HORNE, M.D., President.

IMPORTANCE OF EARLY TREATMENT OF ACUTE OTITIS.

BY

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EVEN in comparatively recent years amongst the general public there was a tradition, which has not yet died out completely, that ear affections are incidents in the lives of individuals, largely controlled by age periods, such as seven or fourteen years, at which times those afflicted were supposed to "grow out of it." It was believed that ears which discharged were safe whilst they continued to do so, on the principle, I suppose, that it was "better out than in," and became dangerous only when the discharge ceased to appear. Pain in the ear was to be soothed by poultices or laudanum drops, until discharge made its benign appearance to relieve the patient's distress, after which the condition was frequently left to *vis medicatrix naturae* and the doubtful consolation of "growing out of it." All this is being gradually changed, and I look to the various child welfare centres and clinics now at work to dispel finally this *laissez-faire* attitude, but they need guidance from some authoritative source on the present otological view of the whole subject. It should be the object, if not the express duty, of meetings of this kind to take a large share in such educational work.

The importance of acute otitis, whether catarrhal, inflammatory, or suppurative, can be put in many ways to convey its true significance to those members of our profession not immediately concerned with the specialty of otology; but I hope you will not consider it is overstating the case to say that fully 90 per cent. of the common and most serious ear affections come within its ambit, if we include all the possible complications and sequelae of otitis media. The term "acute otitis" may be appropriately applied to any acute inflammatory or suppurative process arising in any portion of the organ of hearing, whether external, middle, or internal ear; however, in the usages of everyday practice we limit the term to affections of the external and middle ear only and refer to those of the inner ear as labyrinthitis, though the latter is due to an extension of disease from the

middle ear or its adnexa, with the one exception of cerebro-spinal fever. External and middle ear inflammation expose the function of hearing to the risks of partial or complete destruction; their complications and sequelae not only intensify these risks but are frequently dangerous to life, and sometimes prove fatal. Acute otitis of the outer ear usually takes two forms, the circumscribed and the diffuse, the former being the more common. Neither is dangerous to life, but may be to hearing, since if neglected or not treated with care perichondritis of the pinna and cartilaginous meatus may set in, terminating in necrosis and occlusion of the passage. Circumscribed external-ear inflammation with its associated oedema in many cases assumes a special significance, inasmuch as it may be confused with mastoid extensions of middle-ear infection. This is a pardonable mistake for the inexperienced to make at times, the error being less serious if the grave condition is diagnosed for the simpler than vice versa.

When we come to consider an acute affection of the middle ear the gravity of the outlook is very different, since an acute inflammatory process in such a small air chamber, clothed with a vascular lining, and containing a delicately jointed bony mechanism for the conduction of sound, constitutes a dangerous menace to the function of hearing. If the middle ear were a cavity constructed on the lines of the antrum of Highmore, one would expect an inflammatory infection of its lining to be self-limiting and ending in nothing more serious than an empyema, capable of easy drainage and cure; but the possibilities of extension of disease from the middle ear to the cranial cavity through the labyrinth, or by the mastoid antrum and air cells to the meninges and lateral sinus, are so very real that no effort should be spared in combating the earliest manifestations of the infection to cut short the attack.

Let me briefly recall the formidable array of possible complications and sequelae of acute otitis to emphasize the claims made for the importance of the subject and the need for its early and proper treatment.

1. Acute otitis externa: Perichondritis; necrosis of cartilage; occlusion of meatus; deformity; and deafness.
2. Acute middle-ear catarrh: Eustachian block; impaired ventilation of middle ear; retraction of membrane; impaired movements of ossicular chain; tinnitus; chronic middle-ear catarrh; various grades of deafness; progressive deafness; and internal-ear deafness.
3. Acute purulent otitis media: Acute suppurative mastoiditis; lateral sinus thrombosis; extradural abscess; brain abscess—cerebral or cerebellar; acute labyrinthitis—diffuse or circumscribed; and purulent meningitis.
4. Acute serous labyrinthitis.
5. Acute diffuse suppurative labyrinthitis, which may cause extradural abscess, cerebellar abscess, purulent meningitis, lateral sinus thrombosis.

In addition to these intracranial lesions there are many possible intratympanic ones, such as:

1. Perforation, and partial or complete destruction, of the drum-head, depriving the tympanum of its air-cushion effect in the conduction of sound, and exposing the cavity to a new route of infection.
2. Arthritis and fixation of the ossicular chain with impairment of mobility.
3. Necrosis of ossicles with destruction of their function as a conducting mechanism; probably the commonest intratympanic cause of middle-ear suppuration.
4. Ulceration of tympanic lining with caries of bony wall and formation of polypi.
5. Scarring and adhesions in the tympanum, impeding the conduction of sound and the drainage and ventilation of the cavity, increasing the difficulty of rendering it free from sepsis, and also making it more prone to fresh infection.
6. Necrosis of the posterior tympanic wall, invasion of the Fallopian canal, with neuritis and paralysis of the facial nerve.
7. Various grades of deafness.
8. Deaf-mutism.

Over 60 per cent. of all ear diseases are middle-ear diseases. Apart from the personal affliction, deafness has a large economic side. The partial or complete destruction of such an important educational portal as that of hearing deprives the person of the power to acquire knowledge by sound, with two obvious results: (1) incomplete and inefficient education; (2) inability to fill occupations where communication