Some of these tumors, especially the flat button-like lesions, are frequently malignant from their earliest development.

4. Because of this danger all epithelial tumors, no matter how small, within reach of the proctoscope should be destroyed by electrocoagulation or fulguration, since this is a simple procedure devoid of danger. Small tumors with a definite pedicle, which lie so high in the bowel that they cannot be reached through a proctoscope and would require a laparotomy for removal should be observed periodically and removed at once if there is any sign of activity.

5. In some cases, as indicated in this paper, one is justified in simple local destruction of small tumors, though definitely malignant. Caution should be used in advising this procedure, especially in the case of flat button-like lesions. If one is to apply this method at all in malignant cases, one must be careful not to extend its use too far because of its simplicity or the insistence of the patient. In a questionable case the physician must insist on more radical procedures.

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EXPERIENCE WITH ERGOTAMINE TARTRATE IN 120 PATIENTS WITH MIGRAINE

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The use of ergotamine tartrate for the treatment of migraine headaches was first reported in 1926 by Maier.[1] Since then, a number of articles have appeared recording the results of treatment in single or in small groups of patients. The only large group is that of Tzanck,[2] who treated 101 patients with favorable results in a large but unstated percentage. A year ago, one of us (W. G. L.[3]) reviewed the literature and reported the results of parenteral injection in forty-five patients. Additional reports of treatment have appeared as follows: seven patients helped by oral administration (Podolsky[4]), headaches aborted by subcutaneous injection in fourteen of eighteen patients (Brock, O'Sullivan and Young[5]), and in each of nine patients (Logan and Allen[6]). Though the cases reported (including this series) number only 300, the dozen authors who have written on the subject are unanimous that the administration of ergotamine tartrate is effective in the great majority of patients in stopping migraine headaches.

Our experience with ergotamine tartrate now covers nearly three years and a group of 120 migraine patients have been treated by us or on our advice.[7] These have been given a total of several hundred injections for as many headaches and have ingested thousands of tablets.[8] In enumerating the results, we shall first detail the effects of the first administration of ergotamine and then the results of continued treatment of a smaller group.

The patients in this series all suffered from severe periodic headaches. In addition, they had one or more of the following satellite symptoms: hemicrania, nausea or vomiting, visual disturbances, vasomotor disturbance and malaise. They failed to obtain relief from other drugs or treatment, and each gave a history of migraine in other members of the family. Twenty-three of the patients were males and ninety-seven females.

RESULTS

Of the 109 patients who received the drug by intravenous, intramuscular or subcutaneous injection the result of the first administration was abrupt and complete relief in 90 per cent, slight or temporary relief in 4 per cent, no benefit in 4 per cent and headache made worse in 2 per cent. Of the eleven patients who received medication only by mouth, the first trial was followed by relief in 82 per cent, while 18 per cent were made worse.

Of the whole group of 120 patients, 89 per cent experienced abrupt and complete cessation of the headache with the initial use of ergotamine. The cases in which the treatment was given were chronic, and other forms of therapy had not helped. No other drug or treatment which had been reported in the literature has been effective in such a high proportion of patients with migraine. The results, therefore, are dramatic and conclusive. In ergotamine tartrate, the physician possesses a nonsedative drug which almost invariably aborts even the worst of migraine headaches.

Furthermore, the beneficial action of ergotamine seems to be specific, or nearly so, for headaches of the migraine type. Of forty-five patients with headaches from other causes, only seven noted definite improvement after the intravenous injection of the drug. Indeed, intravenous injection in eighty-three nonmigrainous subjects produced headache in six.

Results of repeated treatment are of more importance than those of the initial administration. In general, patients responded to subsequent injection as they did to the initial trial. There were, however, five patients who later failed to obtain the relief experienced at first. Nineteen patients have been followed for more than a year, a few of these having what might be called a "migraine status" with almost continuous headaches. In the others, the attacks before treatment were frequent and severe so that the entire group of nineteen represents a much more than average degree of intractibility. All but one of these patients has obtained relief with each injection of ergotamine. In most of the patients the interval between attacks has not been significantly altered; in a few, especially those most severely affected, the headaches have recurred at more frequent intervals; in a number, the attacks have been more widely spaced. In the entire group of 120 patients, ten have had unusually long periods of freedom since treatment was begun. On the whole, we find that headaches aborted by ergotamine tend to recur at shorter intervals, especially in the first few weeks or months of treatment.

From the Department of Neurology of the Harvard University Medical School and the Neurological Unit, Boston City Hospital, aided by a grant from the Josiah Macy Jr. Foundation.

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5. Brock, Samuel; O'Sullivan, M., and Young, D.: The Effect of Nonsedative Drugs and Other Measures in Migraine, Am. J. M. Sc. **188**: 253 (Aug.) 1934.

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7. Ten patients were treated by our colleague Dr. Stephen Maddock.

8. The ergotamine tartrate (Gynergen) used in this investigation was supplied by the Sandoz Chemical Works, Inc.

The joy of the patient over his miraculous relief from headache is often tempered by certain unpleasant symptoms which he may experience. Nausea occurred in 77 per cent and vomiting in 60 per cent of eighty-nine cases in which such a record was made. In a group of thirty-four patients not subject to headaches who received intravenous injections of 0.5 mg., nausea occurred in 50 per cent and vomiting in 24 per cent. After obtaining relief from headaches by the use of ergotamine, most patients experience a sense of fatigue and lassitude, this being an accentuation of the sensation experienced after spontaneous recovery. A few patients complained of muscular pains which wore away with exercise, or of paresthesias or a sense of substernal or precordial oppression. These various symptoms were not experienced by nonmigrainous patients who were given intravenous injections of the drug. Rarely, gastro-intestinal or other symptoms are sufficiently distressing so that the patient prefers the headache to the treatment.

With serious or permanent ill effects, we have had no experience. Because ergotamine raises the blood pressure, caution should be exercised in administering it to patients with arterial disease. Pregnancy is not an absolute contraindication according to the evidence collected by Barger [9] for ergotamine, even in toxic doses, may not produce abortion. In one patient Schimmel [10] injected 25 mg. in a period of thirteen days without causing an abortion. Excessive and long-continued use carries the danger of ergotism. However, the daily injection of 0.5 mg. for a period of months, and the daily ingestion of from 10 to 15 mg. for more than a week has not produced suspicious symptoms.

THERAPEUTICS

When ergotamine tartrate is injected, the usual dose is 0.5 mg. (the contents of a 1 cc. ampule). In some patients a half or even a third of this dose may be effective and should, therefore, be used. One patient required for relief the injection of 1 mg. Only rarely is a second injection required. We principally made use of the intravenous route because experimental observations were being carried on concurrently. This route has the advantage of giving more prompt relief (in from fifteen to thirty minutes instead of in from forty-five to ninety minutes after subcutaneous injection) and more certain relief and there is no pain due to the injection. Intravenous injection, on the other hand, is more likely to be attended by unpleasant symptoms, such as nausea, vomiting or muscle pain. Intramuscular injection is a satisfactory compromise. Our more intelligent patients have been supplied with hypodermic needles and syringes and have managed their own injections.

In the cat, only 30 per cent of ingested ergotamine is absorbed.[11] In patients the presence of nausea and vomiting is an added obstacle to absorption from the intestinal tract. This probably explains the relatively slight benefit resulting from the use of tablets taken by mouth. However, in milder cases (as represented by our group of patients who received only oral treatment) beneficial results may be obtained from the 1 mg. tablets. From two to five tablets may be given when the headache begins, followed by one or two at hourly intervals until 9 or 10 mg. has been taken or relief has been obtained. Two hours or more may elapse between the ingestion and relief. If nausea and vomiting are violent, atropine sulphate in 0.5 mg. doses may be given in addition to the ergotamine. The enteral and parenteral routes may be used simultaneously. A 0.5 mg. ampule of ergotamine costs at the present time 30 or 40 cents. On the basis of the ergotamine content, the tablets for oral use cost approximately only one-tenth as much. On the basis of therapeutic results, however, we believe that a 0.5 mg. ampule, given intramuscularly, is worth much more than the equally priced five 1 mg. tablets taken orally.

The prevention of headaches by either injection or ingestion of ergotamine may be attempted if the time of the onset of the headaches is predictable. Headaches may thus be postponed or ameliorated but not, except perhaps in mild cases, prevented. It should be emphasized that while ergotamine tartrate is valuable in aborting individual attacks, its use should not take the place of efforts to find and remove the cause or causes of the condition.

THE MECHANISM OF ACTION

The mechanism by which ergotamine tartrate affords relief from migraine headache has not been satisfactorily explained. The occurrence of vomiting appears to bear no direct relationship to the obtaining of relief. Following an intravenous injection, both patients and controls have an increase in systolic and diastolic blood pressure and a decrease in pulse pressure and pulse rate. Investigations thus far carried on in our laboratories indicate that the cerebrospinal fluid pressure is increased, though the rise is less in migrainous than in nonmigrainous patients.[12] The circulatory changes are at their height within a few minutes after the intravenous injection, whereas relief from headache does not begin for from fifteen to thirty minutes. Ergotamine increases the blood flow through the brain [13] and arm of man and causes concentration of the blood.[14] In the cat, it has no consistent effect on the arteries of the pia but constricts those of the dura and the skin.[15]

These results do not in themselves seem adequate to explain the relief obtained from migraine pain. Most authors have suggested that ergotamine paralyzes the motor endings of the autonomic nerves, thus relieving presumed arterial spasm and pain. It might, however, act directly on the sensory fibers of the nerves, especially those supplying the arteries of the brain or dura. The relief obtained from pruritus following the administration of ergotamine is a strong point in favor of the effect on the sensory nerves. However, if this were the case, ergotamine should relieve other types of headache associated with dilatation or contraction of the cerebral arteries, such as headache following an injection of histamine, but this it does not do.

CONCLUSIONS

Ergotamine tartrate was used in 120 patients with migraine headache. The initial trial resulted in abrupt and complete relief from the headache in 107 of these patients. Nineteen patients have used ergotamine for more than a year, and all but one have obtained relief

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on each of the repeated occasions in which ergotamine has been used. In some patients a tendency for the headaches to recur at more frequent intervals or the appearance of unpleasant accompanying symptoms limits the use of the drug. The administration is by intravenous or subcutaneous injection. Ingestion is relatively ineffective. The mechanism by which relief is obtained is as yet unknown.

THE TREATMENT OF PULMONARY TUBERCULOSIS BY ULTRAVIOLET RADIATION

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This study was undertaken to determine the value of sunlight and artificial radiation in the treatment of pulmonary tuberculosis. The members of the staff of the City of Chicago Municipal Tuberculosis Sanitarium believe that if ultraviolet radiation is of value in the treatment of pulmonary tuberculosis it should not fail in all the active forms and should not be limited in its usefulness only to the least active. In their opinion, if ultraviolet radiation should be used only in selected forms of chronic pulmonary tuberculosis it would be impossible to determine whether ordinary treatment in a sanatorium produces an improvement or whether the ultraviolet radiation is a factor in this improvement. It was decided therefore that, if ultraviolet radiation is of value in the treatment of pulmonary tuberculosis, it should show some definite results in three months' treatment in active cases. These patients should have no fever and no hemoptysis and should be able to walk or ride in a wheel chair to the room where ultraviolet treatment is given.

Karsner [1] recently stated that, in the evaluation of methods used in physical therapy, the value of the treatment is not to be measured by the opinion of the physician but rather by the facts he can demonstrate. In this study we have endeavored to follow the statistical method as given by Karsner to decrease whatever errors might arise by the summation of the opinions of interested observers.

In order to obtain facts and not opinions, all the members of the staff of this institution cooperated. The patients were referred to the physical therapy department for ultraviolet irradiation by the physicians in charge of the wards; the blood examinations and roentgenograms were made before and after the three months' course of treatments. The ultraviolet irradiation was given under our direction according to the Rollier technic; the quality and intensity of the radiation were determined by one of us (H. A. C.) and the results were judged by the clinical staff.

Dr. Sweeney, in charge of the laboratory of the Municipal Tuberculosis Sanitarium, examined the reports of the blood examinations and the roentgenograms made before and after ultraviolet irradiation and commented on them without being informed as to the details of each case or the treatment given. The clinical results were recorded on the patient's clinical charts by the ward physicians. It is believed that this method avoided the giving of favorably or unfavorably prejudiced opinions.

In order to check our data further, a series of patients who did not receive ultraviolet treatment were used as controls.

SOURCES OF ULTRAVIOLET RADIATION

Not only is the sun regarded as the source of all energy, but it is also the best of all sources of radiation for ultraviolet therapy. However, owing to climatic conditions, sunlight is not always available for therapeutic use. For example, Tonney, Hoeft and Somers [2] have shown that in the downtown loop district in Chicago during the months of October, November, December, January and February, the ultraviolet content of sunshine is seldom strong enough to provide a minimum erythema dosage. They have also shown that sunshine in that district contains much less ultraviolet radiation than at points outside the congested district, such as the south side of Chicago near Lake Michigan or the Indiana dunes district. Hence, if therapeutic ultraviolet radiation is desired in the wintertime, Chicago physicians are obliged to use some form of artificial radiation instead of natural sunlight. Solariums made of special glass would probably not suffice. In this work we employed artificial radiation during all the months of the year except three—June, July and August. Our source was a large carbon arc lamp, 60 ampere capacity, with C carbons, the cores of which were impregnated with iron, nickel, aluminum and silicon. Polymetallic carbons make the ultraviolet component of the radiation richer than it would be with carbon alone. The spectral intensity curve for carbons impregnated with metals is given by Coblentz.[3]

MEASUREMENT OF ULTRAVIOLET RADIATION

Ultraviolet Meters.—Fairly accurate instruments have been developed recently for measuring the ultraviolet component of artificial radiation emanating from quartz mercury arc (high vapor pressure) lamps and from the carbon arc. One convenient instrument consists essentially of a light-sensitive cell mounted behind a glass filter which permits radiant energy of wavelengths between 2,500 and 4,000 angstroms to pass. This light cell is connected to a sensitive micro-ammeter, and when the cell is in the presence of radiant energy a current is generated, which is measured by the ammeter. This meter is available in two forms—an indicating and a recording type. It appears to be quite satisfactory for measuring radiation from mercury vapor arc (high vapor pressure) lamps and from the carbon arc. This meter is not recommended by the manufacturer for measuring the ultraviolet radiation in sunlight.

Another instrument we employed consisted of a light-sensitive photocell with a direct current rectifier for energizing it, a relay tube and an indicator. The principle of operation is that the photocell, sensitive to certain bands of waves in the light spectrum, allows a minute electric current to pass when it is exposed to radiation. This current is proportional to the ultraviolet radiation energy in the particular band of the spectrum that is used. The small current charges a small condenser, which is connected in parallel to a relay tube.

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