80 to 90 c.cm. per minute (Kestner, 1926). The skin of the face is the most important "point of attack," perhaps the only one. My conclusion is that there are at least two climatic factors at the seaside. Meteorologically they are quite different, but they have the same influence upon the human body. Both factors are also present in the climate of altitudes, which is shown by medical experience to have a curative action similar to that of the seaside. At the seaside during winter the rise of metabolism is due to cold winds; during summer to sunshine; during autumn, the period when these investigations were undertaken, to a combination of the two. The optimum results for convalescent children at the seaside have often been obtained in the winter months at German and Danish resorts (Haeblerlin, 1934).

The sunshine values set out graphically are determined on days with clear sunshine, sharply defined shadows, and blue sky. I have made other determinations when the sun was more veiled. The air was warm, but shadows were less clear-cut and the sky bluish white. In sunshine of this type the metabolic rate was not increased. A series of readings on patient Gy. illustrates this point:

	Indoor	Veiled Sun	Clear Sun
Oxygen	202 c.cm.	198 c.cm. 205 " 205 "	234 c.cm. 233 " 220 " 224 "

Intermediate weather conditions give intermediate results.

Bright sunshine with a blue sky is, we know, rich in the wave-lengths of ultra-violet radiation, which have a curative effect upon rickets and which produce sunburn (Kestner and Borchardt, 1927). But there must also be present in bright sunshine of this type another factor—a set of wave-lengths which influence metabolism—since, while they are rich in antirachitic and bronzing power, the rays of carbon-arc and mercury-vapour lamps have no influence upon metabolism (Nothhaas and Schadow, 1930).

It is evident that the factors which raise the metabolic rate and which have curative properties go hand in hand, for they are common to the climates of the seaside and of mountain altitudes, both of which produce these phenomena.

Conclusion

I asked at the beginning of this paper whether it was possible to ascribe the physiological properties of a seaside climate to its well-recognized meteorological features. The question can be answered in the affirmative, as regards at least these two factors which influence metabolism.

I wish to offer my thanks to the Committee for Research on Delicate Children at the Coasts and to the medical superintendent and staff of the Royal Sea Bathing Hospital for their assistance in these investigations.

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A New Meningitis Virus.—From two cases of mild lymphocytic meningitis in children a virus which differs from any other known virus was recovered by the intracerebral injection of the cerebrospinal fluid into mice. It is proposed to call this disease pseudo-lymphocytic choriomeningitis.—Pseudo-lymphocytic Choriomeningitis. F. O. MacCallum, G. M. Findlay, and T. McN. Scott.—*Brit. J. exp. Path.*, June, 1939; 20, 260.

ABACTERIAL PYURIA

BY

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Pyuria is definite evidence of inflammatory changes in some part of the urinary tract. The causative organism can usually be grown from the urine. When such is not the case there is a strong suspicion that a tuberculous infection is present. Thus it has become almost axiomatic in urological practice that sterile pyuria means urinary tuberculosis. More recently it has been realized that this general rule is not always true. In this paper it is intended to discuss these cases of non-tuberculous sterile pyuria and to report a case which illustrates the excellent result of adequate therapy.

There are some non-infective causes of inflammation in the genito-urinary tract. The constant irritation of a stone in the renal pelvis, for example, may lead to pyuria in the absence of infection, which, however, usually supervenes sooner or later. It is not uncommon in other parts of the body for the organisms causing inflammation to be overcome or so changed in character that it is difficult to culture them, and yet for inflammatory changes to persist for some time. The pus obtained from an infected gall-bladder, for instance, is sometimes sterile: sterile pyuria may in some cases be so explained. The group of cases of abacterial pyuria to which I wish to call attention form a definite clinical entity. Inflammatory changes occur in the bladder and sometimes the upper urinary tract, but no organism can be obtained from the urine, not even after guinea-pig inoculation. The disease is probably caused by a filterable virus. It is of great importance, as the diagnosis of urinary tuberculosis may be made and, when only one kidney pelvis is involved, nephrectomy carried out. Cure of these cases is readily brought about by a few small intravenous doses of an arsenobenzol preparation.

Case Report

An unmarried woman aged 50 was first seen in the urological clinic on May 5, 1939. For five years she had suffered from a burning pain across the lower abdomen and from great frequency of micturition. Urination occurred hourly during the day and about four times during the night. Scalding was present during micturition and there was severe terminal urethral pain. Sometimes this was excruciating. On two occasions haematuria had occurred and lasted a few days. She had seen numerous medical men and had had at least one complete urinary investigation. Almost every known form of medicinal treatment for cystitis had been tried without success.

Examination.—The patient was in good general condition. No abnormality could be found in the genito-urinary or other systems on complete clinical examination. Microscopical examination of the urine showed numerous pus cells. Cystoscopy was undertaken. A little difficulty was experienced in introducing the cystoscope as the urethra was very tight at the external meatus. The bladder showed scattered areas of erythema and swelling of the mucosa, which were most marked on the lateral walls and dome. The base was not particularly affected. Both ureteric orifices were normal and were seen to discharge clear urine. The bladder capacity was very much reduced, being only 150 c.cm. Bladder distension was carried out and the capacity increased to 200 c.cm. Numerous submucous haemorrhages were seen in the bladder after this, but no splitting of the mucosa occurred. The patient was seen again on May 19. She stated that she

was very much better and only passed urine twice during the day and twice during the night. The scalding and pain had also improved greatly. The cultural examination of the urine carried out at the first visit was then available. No organisms of any kind had been found.

Radiological Examination.—The possibility of urinary tuberculosis thus being raised, radiological investigations were arranged. A plain radiograph showed normal kidney outlines and no abnormal shadows. An excretion urogram revealed excellent function on both sides. The urine was examined very carefully on numerous occasions for tubercle bacilli, with negative results. Special cultures for this organism were also negative.

While these investigations were being carried out the improvement in symptoms which followed the bladder distension gradually disappeared. This treatment was therefore repeated, but did not give further relief. When the investigations had been completed it was obvious the patient was suffering from abacterial pyuria. Thus on July 7 treatment with intravenous novarsenobenzol was started. A dose of 0.3 gramme was administered weekly for four weeks.

Progress.—The patient's symptoms began to improve immediately after the first dose. When the course had been completed she was entirely free from all symptoms. She was last seen on September 22. All pain on and frequency of micturition had disappeared; urination occurred four times during the day and not at all during the night. The urine was crystal-clear and was microscopically free from cells.

The Literature of Abacterial Pyuria

Faltin (1909) was the first to draw attention to cases of pyuria in which no organisms could be demonstrated in the urine. Thirty similar cases were reported by Runeberg (1921), in ten of which nephrectomy had been carried out. Histological examination of the specimens showed no evidence of tuberculosis, but in some cases staphylococci were seen imprisoned in the cortex. Nephrectomy was carried out in five of the fifteen cases reported by Peters (1922). On microscopical examination the kidneys showed non-tuberculous inflammatory changes, but no organisms were seen. Söderland (1921) expressed the opinion that sterile pyuria was a definite entity. It was not until 1933, however, that this view gained any general acceptance. Wildbolz (1933) read a paper on the condition before the French Congress of Urology in which he stressed the resistance of the disease to ordinary forms of treatment and its almost miraculous cure by the intravenous administration of the arsenobenzol preparations. Since this time the disease has become more widely known. Briggs (1935) wrote an instructive paper that included a report of three cases successfully treated with neoarsphenamine. Cook (1936) drew further attention to the condition and recorded twelve cases. The work of Schaffhauser (1937) based on an experience of nineteen cases and animal experiments is of great interest. In 1937 Wildbolz restated his original claims. Houtappel (1939) reported two further cases.

Aetiology

Many theories have been advanced, but the cause of abacterial pyuria is at present not known. Schaffhauser (1937) isolated from some of his cases a curious streptococcus, which grew very slowly and then only on a special (Rosenow) medium. He reported that the injection of these organisms into dogs led to a subacute pyelitis. This work, which is of the greatest interest and importance, has not so far been confirmed. Runeberg (1921) supposed that in his cases the pyelitis was due to

the exudation of inflammatory products from the staphylococcal kidney lesions which were demonstrable on microscopical examination. It was believed by Cook (1936) that the pyuria was due to the excretion of toxins absorbed from a septic focus in some other part. He reported cases which responded in the usual way to arsenobenzol preparations but relapsed and were not finally cured until, in addition to the ordinary treatment, a septic focus had been removed. No one, apart from Schaffhauser, whose work as yet lacks confirmation, has been able to isolate an organism from the urine. According to Wildbolz the Wassermann reaction and examination of the urine for spirochaetes by dark-ground illumination are always negative. These results lend strong support to the view that an ultramicroscopic virus is the cause of the disease.

Pathology and Symptomatology

The bladder alone, or the ureter and renal pelvis on one or both sides in addition, are the usual sites of the disease. Inflammatory changes occur but are confined to the mucous membrane, and there is very little change deep to the submucosa. The changes are of a subacute nature and gross suppuration does not occur.

Young men are the most commonly affected subjects. There are several local symptoms of cystitis—pain, scalding, extreme frequency of micturition, and sometimes haematuria. The infection of the renal pelvis does not usually give rise to symptoms. In spite of the diffuse inflammatory changes there are no disturbances of the general health, and pyrexia and increase of pulse rate are conspicuous by their absence. The disease is very resistant to treatment and may last for years. On clinical examination no physical signs are evident. The urine contains numerous pus cells, but no organism can be demonstrated even after the most complete examination. All tests for tubercle bacilli are negative. Intravenous urography reveals normal appearances, but in cases in which there are inflammatory changes in the ureter and renal pelvis these may show some slight dilatation. On cystoscopy a much diminished bladder capacity is found together with diffuse non-specific inflammatory changes. Ureteric catheterization discloses whether there are inflammatory changes in the renal pelvis. If only one is diseased the phenolsulphonophthalein test shows slightly diminished function of the affected side.

Diagnosis

Sterile pyuria always suggests urinary tuberculosis, and it is of the greatest importance that this should be excluded. The most important step is the careful examination of the urine for bacilli together with guinea-pig inoculation. In addition the absence of any destructive renal changes on excretion urography and the fact that on cystoscopy the inflammatory changes are not particularly marked round the ureteric orifice as in tuberculosis make the diagnosis relatively easy. In cases of doubt the therapeutic test is a valuable and, when used with discretion, safe diagnostic aid.

Treatment

The disease is resistant to all ordinary forms of treatment. It clears as if by magic when intravenous injections of novarsenobenzol are given. A dose of 0.3 gramme should be administered at weekly intervals for four weeks.

Summary

Abacterial pyuria is a definite entity, probably caused by an ultramicroscopic virus.

The literature, aetiology, symptomatology, diagnosis, and treatment are reviewed.

A case is reported.

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Clinical Memoranda

Trigeminal Pain due to Leprosy

The following case is perhaps worthy of record not because trigeminal pain has not been described as occurring during the course of leprosy but because in the common practice of neurology leprosy is not often considered as an aetiological factor of the pain. There appears to be no reference to leprosy as a cause of trigeminal pain in our larger textbooks of neurology, and in the books on leprosy itself one finds little helpful reference and no case records. Monrad-Krohn (1923) in his treatise on the neurological aspect of leprosy mentions that in the maculo-anaesthetic form of leprosy acute swellings of the corresponding nerve occur accompanied by neuralgic pain, and there is a very good illustration of a patient from Dr. H. P. Lie's clinic in which a swelling of the left supra-orbital nerve is shown. Dr. G. A. Ryrie, medical superintendent of the Sungei Buloh Leper Settlement, in a personal communication mentions that he has seen only a few cases of trigeminal pain in lepers, and so far as he is aware thickening of the supra-orbital nerve with a localized skin lesion has not been recorded as a primary lesion. The present case is also of interest because of the long history of facial pain, finally severe enough to bring the patient to hospital.

CASE REPORT

On May 12, 1939, a young Cantonese amah aged 22 came to the General Hospital complaining of severe pain over the right forehead. About one and a half years previously she had noticed rather curious attacks of twitching, with numbness and pain in the right frontal region. These attacks came on every two or three days and would last about twenty minutes. She noticed that the right frontalis muscle would give a series of short contractions, following in rapid succession; then there was a pause followed by another paroxysm. The contractions were said "to resemble the skin twitch of a horse's flank when a fly alights." She would then feel a numbness appearing just above the upper eyebrow and spreading irregularly upwards. This was followed by a fairly sharp burning pain lasting twenty minutes and then becoming much more dull. During the day of one of these attacks the skin of the right forehead felt numb on light stroking, but there was pain on deep pressure. Aspirin mitigated these attacks to some extent, but they gradually became more frequent until she was getting several in a day. Three months before admission the pain had become much more severe, and would be brought on by accidental knocks sustained while playing with the children. By this time it would radiate upwards over the right half of the scalp till it reached a level roughly coinciding with the ear tip, and it had become severe enough to cause her to lie down when the paroxysm came on. The forehead was now numb all the time.

On examination the patient appeared robust and well nourished. The right supra-orbital nerve could be seen to be much thickened as it left the foramen. This thickening was visible over a considerable area of the nerve, and its bifurcation into two branches, one lateral and one medial, could be clearly observed. Situated above the supra-orbital notch there was a small patch of slightly upraised and slightly reddened skin. On viewing the patch from the side it was observed that the texture of the cutaneous surface was slightly rougher than that of the surrounding skin. Palpation revealed an irregular thickening of the nerve tissue; pressure upon both supra-orbital nerves gave rise to no pain. There was anaesthesia to pin-prick over the small patch illustrated

in the photograph. Analgesia extended outwards on each side, following the inner lines in the illustration. Light touch to cotton-wool was abolished over the area embraced by the outer lines. The appreciation of protopathic hot and cold roughly corresponded with the area of total anaesthesia. Epicritic hot and cold corresponded almost exactly with the outer lines of the illustration. There was no demonstrable anaesthesia of the cornea and no weakness of the facial musculature except perhaps a slight narrowing of the right palpebral fissure.

An investigation for other signs of leprosy elsewhere in the body was negative. The biopsy report on a small portion of the nerve and sheath removed for section was: "Ziehl-Neelsen stain showed the presence of acid-fast bacilli. A few small remnants of nervous tissue can be recognized. There is an overgrowth of fibrous tissue. Areas of round-cell infiltration are present in surrounding tissue."

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