The same reason might explain the fact that adults are in general less liable to attack than those aged 6 to 10, on whom the highest incidence nearly always falls.

Control.—Infective or epidemic hepatitis is an infectious disease directly transmissible from man to man, and the question therefore arises, What steps can be taken to check it? The first essential is that its infective nature should be generally recognized, and this is not the case at present even within the medical profession. Doctors remember it as having been described in the textbooks under the section of diseases of the liver, and their difficulties are increased by a confusion in nomenclature which is so pronounced that one observer (Lisney, 1937) classifies "infective hepatic jaundice" and "simple catarrhal jaundice" as diseases to be differentially diagnosed from "epidemic catarrhal jaundice." The name "infective hepatitis" is a good one because it signifies the infective nature of the condition, does not stress the single symptom of jaundice, which may be absent, and indicates what is certainly the commonest, if not the invariable, pathological process. Control of an infectious disease usually involves early diagnosis, notification, isolation of the victim, and restriction of the activities of contacts. Early diagnosis is, as already pointed out, an ideal unlikely to be attained at first. Notification would certainly be incomplete owing to the failure to recognize abortive cases; but the information provided would be of great epidemiological interest, and the knowledge that the disease had appeared in a particular area might help towards the early recognition of other cases. Isolation of the sufferer would do little to check the spread of a disease which had probably been already transmitted. And in view of the long incubation period and the generally mild character of the illness, it would scarcely be worth while restricting the activities of a contact for some five weeks unless there was a reasonable certainty that he would become a more serious menace during that time than is actually the case.

Infective hepatitis has repeatedly appeared under war conditions, sometimes on a large scale, and may at any moment become an important cause of incapacity. Once a case has appeared, whether it be in a private house, school, hostel, or Service unit, the medical officer should be on the look out for secondary cases. Contacts should not be restrained from their usual activities, but should be warned that the appearance of gastric symptoms in about a month's time must be reported immediately, so that these can be treated at once, until either the diagnosis has been disproved or the short period of infectivity is passed.

Summary and Conclusions

Infective or epidemic hepatitis, synonymous with "catarrhal jaundice," is a fairly common infectious disease which spreads direct from person to person and tends to appear in series at intervals of about a month. Its period of infectivity is short.

There is a need for a simplification of its nomenclature and a wider recognition of its infective properties.

Jaundice is a common but not an invariable symptom, and the abortive case without it is of pathological interest and of epidemiological importance, in relation both to the direct spreading of the disease and to the use of human serum for therapeutic purposes.

Clinically the disease usually runs true to type, but may simulate not only Weil's disease but acute catastrophes of the lungs, abdomen, or central nervous system. The appearance of bile in the urine is usually the first definite evidence of the nature of the illness. Second attacks are possible.

The evidence suggests that susceptibility is phasic. The droplet theory of its means of spread is not altogether satisfactory.

It is apt to appear under wartime conditions, and the best hope of checking its spread lies in the prompt recognition and removal of secondary cases rather than in an indiscriminate adherence to the usual methods of controlling infectious disease.

My chief thanks must be to the subjects of the inquiry, who never failed to enter enthusiastically into the game of tracking down the disease. I also gladly acknowledge my debt to Dr. W. S. Coltart for telling me of all the patients he had to treat, and to Dr. D. R. Smedley, the then county medical officer, for allowing me every facility for the investigation and

for permission to publish it. Advice and encouragement have come, too, from many others, to all of whom I am much indebted, notably to Drs. J. Alison Glover, M. Greenwood, and C. E. Newman.

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VALUE OF PROCAINE INFILTRATION IN THE DIAGNOSIS AND TREATMENT OF FIBROSITIS

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Fibrositis is the name introduced by Gowers to describe the painful "rheumatic" condition of the muscles and fasciae which has been variously designated "muscular rheumatism," "myalgia," "myositis," and "myofascitis" in general; as "stiff neck," "torticollis," "rheumatic cephalalgia," "brachialgia," "pleurodynia," "lumbago," "sciatica," and a host of other names depending upon the locality of the symptoms. Its indefinite aetiology and pathology, and the lack of biochemical changes, have caused many clinicians, particularly in America, to doubt its existence as a clinical entity, and it must be confessed that, considering the vague descriptions often given, combined with the confused and varied terminology, this is small wonder. Therefore we put forward a strong plea for standardization in the nomenclature and a return to the original name given by Gowers until our knowledge of the aetiology and pathology is placed on a sound basis.

Incidence

Fibrositis is one of the commonest maladies of temperate climates; it has been stated that sooner or later most individuals suffer from one or more attacks in the course of their life. It is rare in tropical and Arctic regions (Hill, 1939). Davidson and Duthie (1939) have estimated that 300,000 new cases of rheumatic disease requiring medical attention occur annually in Scotland alone; of these, 75% are of the fibrositic group. Copeman (1940) has drawn attention to the high incidence of the malady in the B.E.F.

It affects both sexes and all ages, but is commonest in middle and later life, particularly in the male (Bach, 1935). Occupation and increased liability to trauma may account for this. Exposure to damp and chill is also a factor determining its incidence, so that a large number of cases will undoubtedly occur in the coming winter as a result of the "shelter-life" necessitated by air raids.

Aetiology

The aetiology of fibrositis is unknown, and, like most conditions the cause of which is obscure, many agents have been incriminated. Among the more generally accepted

causative factors are damp and exposure to inclement weather, trauma, metabolic errors, infection, and chill; less commonly accepted causes include focal sepsis, fatigue, intestinal intoxication (Albee, 1934), gout (Buckley, 1938), electrolytic imbalance and endocrine dysfunction (Gutstein, 1938), and allergy (Buckley, 1938). Fear and worry may precipitate or maintain an attack. Attention has recently been drawn to the possible role of psychogenic factors in rheumatic illness (Halliday, 1937; Gordon, 1939). Gratz (1937), among others, considers chronic strain to be an important factor. Wesson (1938) believes faulty posture and occupation to be significant: the interesting work of Klinderová (1940) would seem to lend support to this opinion, and the wearing of high heels may be responsible for the condition in many women and girls. An epidemic form of myalgia has been described (Howard, 1938), but as this is probably a true infectious disease it should not be classed as a form of fibrositis. There are also secondary types of fibrositis associated with gonorrhoea, rheumatic fever, various forms of arthritis, tuberculosis, gout, etc. (Comroe, 1940; Slocumb, 1936; Buckley, 1938). In the present series trauma appears to be the commonest factor, but, as Hench *et al.* (1936, 1938) have pointed out, each author tends to find a cause in his own specialty, so we shall refrain from comment.

Pathology

A preliminary consideration of the anatomy and histology of connective tissue before we discuss the vexed question of the pathology of the malady will be helpful, as fibrous tissue is generally believed to be the site of the lesions. Connective tissue is the matrix of fibrous and cellular material in which the more highly organized structures of the body lie. It varies greatly in consistency, from a delicate reticulum of loose texture, the meshes of which contain tissue fluid, to thick firm fibrous sheets. It is these latter which are the commonest sites of fibrositis. There are two elements in connective tissue—the fibres and the cells. There are two kinds of fibres—collagenous or white fibres, common in the great fasciae of the back; and elastic or yellow, best seen in the ligamentum nuchae. The collagenous fibres are arranged in bundles and, except when under tension, run a wavy course. They are highly resistant to tensile strain, and are composed of an albuminoid—collagen. The elastic fibres, less common than collagenous ones, run singly, branch freely, and anastomose together. They too are composed of an albuminoid—elastin. Recent work has shown that the primary functions of these fibres are to resist tension and to retain the shape and contour of the various structures which they contain (Le Gros Clark, 1939; Rouvière, 1939). This might indicate the importance of trauma in fibrositis, as it has been shown that the collagenous fibres are laid down in the direction of and in response to the tensile forces acting on them, and in that case the fibrous nodule might be considered as the first stage in the production of a fibrous strengthening to a fascia which is subjected to repeated trauma or chronic strain. The example of adventitious bursae at once comes to the mind.

The cells of connective tissues are principally of two types—fibroblasts and histiocytes. Fibroblasts are fixed cells and are the producers of the collagenous fibres, Stearns (1940) having determined that the fibres are laid down by the fibroblasts extracellularly. They also play a part in the water-balance of the tissues (Le Gros Clark, 1939), and one is tempted to speculate that the diffuse pains in febrile illness may be due indirectly to some biochemical change which interferes with the water-absorptive power of these cells. The histiocytes, on the other hand, are chiefly

phagocytic in function, and form part of the reticulo-endothelial system; they are therefore of importance in inflammation. Certain other cells are also found in connective tissue—mesenchyme cells, mast cells, plasma cells, fat cells, and pigment cells—the precise function of which is obscure.

Our knowledge of the pathology of fibrositis is vague. Few authors have given any clear-cut pictures of what they believe to be the fundamental lesions (Hench *et al.*, 1938; Comroe, 1940), and, as stated above, American workers have denied its very existence for this reason. Stockman (see Buckley, 1938) has described an inflammatory hyperplasia of the white fibrous tissue in which the fibres become swollen and there is fibroblastic proliferation with exudation of serum. Slocumb (1936) describes three stages of the condition, in the first of which there is "an inflammatory, sero-fibrinous exudate of low grade, with proliferating fibroblasts and newly formed blood vessels." If the inflammatory process is more severe and of longer duration, there supervenes the second stage, in which "indurated, local, tender, thickened tissue or frank, gross subcutaneous nodules" are produced. These may become firm, and in them may be found dense inflammatory hyperplasia of fibrous tissue, thickened blood vessels, and inflamed nerve fibrils. There is no leucocytic reaction. In the third stage, when inflammation has passed spontaneously or as the result of treatment, "some indurations may disappear; others remain as painless thickenings or nodules." The literature on the nodules is confusing. Some authors deny their existence, and there does not appear to be any characteristic feature in the descriptions given; in many accounts the morbid histology is vague, and in no way can the nodules be said to resemble those found in rheumatic fever and known as Poynton-Aschoff nodes. In our experience the nodules were not a constant feature of the malady, clinically; they are absent more often than not.

Gratz, using an air-injection method of radiography (Gratz, 1936, 1937; Carty, 1936), investigated the causes of backache, and has thrown some light on the pathology of fibrositis. In those papers he discusses the physical properties of tendons and fasciae, showing that trauma and shear play a part in the aetiology of backache. He attributes the pain in this condition, first, to fascial adhesions interfering with the normal motion of the muscles, and, secondly, to their involvement of nerves. He maintains that the fascial spaces between muscles and round nerve trunks are comparable to joint spaces. They allow gliding movements of these structures on each other, are lined with flattened mesothelial cells, and are lubricated with lymph. Gratz holds that trauma causes inflammatory changes, characterized by round-celled infiltrations, which lead to the development of adhesions in the fascial spaces. Such inflammatory changes involving nerves would readily account for the symptoms of lumbago, etc. (Watson-Jones, 1937). Gratz has demonstrated these adhesions in the cadaver, and, using the method of air-injection radiography known as fasciography or pneumofasciography, has shown them to be present in the living subject. Gutstein-Good (1940) suggests that there is a disturbance of the local circulation at the site of the lesion, a condition of the blood vessels induced by vasoconstriction (stimulation of sympathetic fibres). This is the "vasomotor disequilibrium" hypothesis of Leriche (Leriche, 1927, 1928; Watson-Jones, 1940; Moynahan, 1939). It offers an explanation of the therapeutic action of procaine in many cases of the malady.

There are no characteristic biochemical or blood changes in fibrositic conditions. The blood picture is usually normal, as is the blood chemistry. The blood sedimentation rate is usually within normal limits: this may help to

differentiate it from various forms of arthritis with which fibrositis may be confused clinically. Albee (1934) has found histamine in "large quantities" in the stools, and in some cases abnormal findings have resulted from the taevulose-tolerance test. The finding of a raised blood uric acid should lead one to suspect gout as the underlying cause of repeated attacks of fibrositis.

Hench *et al.* (1936, 1938), in their critical reviews of the subject, point out that the unsatisfactory position of the pathology of fibrositis is due to the lack of "formal studies with microphotographs showing as well as possible the vague reactions which are considered so basic, and the fact that most authors merely restate oft-repeated comments." This state of affairs is likely to continue until large series of biopsies are properly studied and until our knowledge of the physiology of connective tissue and the minute anatomy of sensation in muscles and fasciae is more complete.

Symptomatology

The symptoms of fibrositis are characteristic, and consist of pain, stiffness, and soreness or tiredness of the affected tissues, sometimes associated with spasm of the affected or related muscles. The character and distribution of the pain vary with the site of the lesions. Pain may be continuous or intermittent, sharp or dull, easily located or diffuse. It is usually made worse by moving the affected part, and eased by relaxation of the muscles acting on that part. When it is remembered that the fibrous tissue anywhere in the body may become the site of a fibrositic lesion it occasions little surprise that the symptoms are so protean. The work of Lewis (1934, 1938) and Kellgren (1938, 1939) on referred pain in muscle and on somatic pain generally has enabled us to explain the somewhat varied symptomatology that fibrositis may present. As a result of their work it is firmly established that pain arising from muscle can be referred to some distance from the site of the lesion. Kellgren (1938b) has shown that the distribution of this referred pain is segmental. He has further shown that pain arising from the more superficial structures is located by the patient with greater accuracy, and that a deeper-seated lesion gives rise to pain which is diffuse and is usually referred away from the site of the lesion. Lewis and Kellgren (1939) are of the opinion that pain arising from a viscus is referred along the same path as that from somatic structures, and that the referred pain of visceral disease is identical with that arising from somatic structures. This is not in agreement with the views of Pollock and Davis (1935) or Morley (1937), but it provides an explanation for certain cases of fibrositis which clinically resemble intra-abdominal or intrathoracic disease.

Gutstein-Good (1940) interprets the syndrome of fibrositis, or "idiopathic myalgia" as he terms it, in the light of this work, as a vasomotor disturbance of muscle.

Points in the Differential Diagnosis

The diagnosis can usually be made on the history and symptoms alone, the presence or absence of nodules being of little diagnostic significance. As the lesions occur almost anywhere the malady may be confused with practically any painful disease. It has been the custom in most textbooks to warn the practitioner of the danger of mistaking a serious disease for fibrositis; but following the work of Lewis and Kellgren, Harman and Young (1940) and Gutstein (1940) have described cases in which the opposite may occur, and fibrositis may be confused with a more serious malady. If the possibility that the patient's symptoms are caused by a fibrositic lesion is not borne in mind he may be subjected to a major surgical intervention for his "chronic appendix pain"—which may well have

been the fate of Case 4, described below—or in a case of pectoral fibrositis be condemned to a long period of invalidism as a sufferer from angina: this is in agreement with Lewis and Kellgren's view that visceral and somatic pain are identical. Procaine injections are of diagnostic value in fibrositis, and if the symptoms are not relieved following the injection, then the condition is not a fibrositis, and another cause should be sought.

Epicranial and cervical fibrositis frequently give rise to headache, and Cyriax (1938) has pointed out that these conditions are usually forgotten in cases of recurrent headache.

Pectoral fibrositis simulates anginal attacks, and intercostal fibrositis ("pleurodynia") simulates pleurisy. Recently Paul Wood (1941) has drawn attention to the role of fibrositis in cases of effort syndrome. The differential diagnosis of lumbar and gluteal fibrositis is that of lumbago and sciatica, and is likely to lead to most errors; in those cases radiographs should be taken to exclude organic changes in the spine, and a careful examination of the central nervous system be made so as to exclude organic disease in that system. Kellgren (1941) has given an excellent account of the differential diagnosis of sciatica, and has shown the value of procaine as a diagnostic and therapeutic aid. Periarticular fibrositis is often confused with some form of arthritis, but the characteristic radiographic changes in the latter should enable the diagnosis to be made.

Treatment by Procaine Infiltration

It has recently been found that injections of procaine hydrochloride into the tender areas of the structures involved in cases of fibrositis give instant and often lasting relief (Kellgren, 1938a; Gutstein-Good, 1940; Button, 1940). The technique is very simple, and its success depends upon an accurate mapping out of the areas tender to pressure. The importance of this cannot be over-emphasized, as failures result if all the tender areas are not identified and infiltrated. For the revealing of these tender spots Dalton (1939) has drawn attention to the value of careful examination with a small electrode through which a faradic or sinusoidal current is flowing, but for practical purposes digital palpation will suffice. These areas should be marked on the skin and, after cleansing, a wheal should be raised by injecting a small quantity of procaine over the site of the lesion. The needle should then be driven down until the tender spot is reached; 2 to 3 c.cm. of the solution should then be infiltrated. The injection gives immediate relief to the pain, and any associated tenderness or muscle spasm disappears at once. A dental syringe and needle are probably best for the infiltration.

The pain returns in a certain number of cases some hours after the injection—not unlike the "after-pain" following "procaïnization" of a sprain. This pain usually wears off in a few hours, and is probably due to the procaine itself. The patient should be encouraged to move the affected part freely and to carry on with his normal occupation. In most cases one injection will suffice, but some will require a repetition. It is also of importance to inject every tender area found, and we invariably persevered until the patient was completely free from pain at the first sitting. "Blind" injections of large quantities of procaine in the hope that the tender spot will be infiltrated by chance are usually useless and should not be done.

Typical Cases

Case 1.—An officer aged 56 complained of pain in the region of the right and left sacrospinalis and at the attachment of the gluteal muscles. The pain radiated down both legs along the distribution of the sciatic nerves. All movements of the lumbar spine were limited. The central nervous system showed no

abnormal signs. He had had a fall six weeks previously, since when pain had persisted. No relief followed the usual treatment by rest, massage, heat, and diathermy. Radiographs of the spine revealed no bony injury, but there was evidence of early osteo-arthritic changes in the lumbar region. Numerous tender spots were found by palpation, and each was infiltrated with 1 to 2 c.cm. of procaine. Severe exacerbation of the pain followed some hours after injection. The injections were repeated for three more days, and resulted in complete relief except for some stiffness, which responded to short-wave diathermy. He had had no relapse when seen two months later.

Case 2.—An airman aged 28 was involved in a motor accident six days previously, and was admitted to an E.M.S. hospital, where radiography revealed no bony injury. He was discharged to his unit perfectly well. While returning he was lifting his kitbag, when he felt a violent pain in the left lumbar region which caused him to collapse in the street. He was unable to get up, and was carried into hospital on a stretcher. Examination showed four tender areas along the attachment of the left gluteus maximus, with pain referred along the course of the left sciatic nerve. Movements of the trunk and left leg were limited by pain. No abnormal signs were observed in the central nervous system. A few cubic centimetres of procaine were injected into the tender areas and the pain was immediately abolished. He was able to walk to his barracks, and when seen the following day had almost recovered. Three months later there had been no recurrence.

Case 3.—An airman aged 23 complained of stiff neck following a night spent in a damp air-raid shelter. All movements of the neck were limited by pain, which radiated into the occipital region and down towards the left shoulder. Two tender spots were found in the trapezius about one inch to the left of the midline just below its occipital attachment. Procaine infiltration gave immediate and lasting relief.

Case 4.—An airman aged 26, who had been suffering from attacks of pain in the right iliac fossa at intervals for two years, for which appendicectomy had been performed six months previously without relief, reported sick with the same symptoms. Examination revealed the presence of three tender areas just to the right of the midline in the region of the eleventh and twelfth dorsal vertebrae. These were infiltrated with procaine. The pain was abolished, and when seen again he was free from symptoms. There has been no recurrence.

Case 5.—An officer aged 42 reported sick, with pain on the dorsum of the right forearm along its radial border. He thought that he had knocked it about six weeks before, during evacuation from Dunkirk. On examination, two tender areas were found, one at the anterior border of the external epicondyle of the humerus, and the other deep in the brachioradialis about the level of the head of the radius. Pressure on this spot exacerbated the pain in the forearm, as did supination and pronation. Procaine was infiltrated into both areas, and the pain was abolished. He was seen again three days later, when it was found that the symptoms were relieved but not cured. Further infiltration of the affected areas led to a permanent cure.

In all over 80 cases of a similar nature have been treated with almost uniformly good results. There were six failures, of which all except one were errors in diagnosis: three proved to be osteo-arthritis of the spine; one was a case of sacralization of the fifth lumbar vertebra; and one proved to be a severe dislocation of the acromio-clavicular joint, with fracture of the acromial end of the clavicle, which was mistaken for deltoid fibrositis. The sixth failure was a case of fibrositis of the shoulder girdle and left arm in which no definite tender spots could be found, and resort to "blind" infiltration failed to relieve the condition. In a seventh case further investigation revealed the presence of prolapsed intervertebral disk, with a history of repeated attacks of severe left sciatica; this patient was eventually cured by excision of the affected disk.

Conclusion

It will be seen from the results obtained that procaine infiltration is of value both in the diagnosis and in the

treatment of fibrositis, although it should be borne in mind that the vast majority of the cases in this series occurred in males between the ages of 18 and 45 and were from a selected group of the population.

The therapeutic action of procaine can be explained if, following Gutstein-Good, we accept Leriche's hypothesis and consider the lesion to be vasomotor disturbance brought about by some cause at present unknown; then the procaine may be said to break the vicious circle and allow the restoration of the vasomotor equilibrium. If, on the other hand, we accept Gratz's view of the pathology and agree that the symptoms are produced by adhesions in the fascial spaces, then the beneficial action of procaine can be accounted for as follows: The procaine produces a local anaesthesia and renders the affected area painless; the patient is then able to move the part freely, the adhesions are broken down, and the fascial surfaces are allowed to glide over each other in the normal way—that is, the patient performs the work of the masseur, exudate is absorbed, and the affected tissues are restored to normal.

Whatever the pathology there is no doubt that the method is well worthy of more extended trial.

Summary

The aetiology and pathology of fibrositis are discussed.

The symptomatology is explained in the light of the work of Lewis and Kellgren.

The technique of procaine infiltration and typical cases are described.

From the results obtained it is considered that procaine is of value in the diagnosis and treatment of fibrositis.

Our thanks are due to the Director-General of Medical Services of the Royal Air Force for permission to publish this paper.

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W. M. Sams and L. Capland (*Amer. J. Derm. Syph.*, 1941, **44**, 226) treated 54 patients suffering from various skin diseases, chiefly impetigo and ecthyma, by local application of sulphathiazole powder or sulphathiazole in an ointment. Good results were obtained in all but one case, in which insufflation of the powder into the external auditory meatus was followed by an acute exacerbation of chronic eczematous dermatitis.