"WOUND PHAGEDAENA"**REPORT OF TWO CASES**

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The term "phagedaena" suggests to the modern student of surgery a sloughing condition of the male external genitalia arising in connexion with a venereal infection and caused by anaerobic organisms. For many past generations of surgeons, however, it had a much wider application, and was one of the varieties of "hospital gangrene"—that dreaded miscellany of septic infections now happily almost unknown. For the reasons stated later we consider that the following two cases may be fitly described under this title.

Case Reports

Case 1.—A man aged 46 had appendicectomy performed (A. C.) for acute appendicitis on December 8, 1939. His illness was of seven days' duration and the appendix was perforated, so that it was considered advisable to drain both the abdomen and the wound. The wound discharged, but the temperature remained normal until the eleventh day, when a rapidly spreading inflammation of the edges became apparent. The temperature became irregular (about 101°) and later intermittent with a maximum of 100°, and there was pain in the wound region. By the eighteenth day three-quarters of the area of the abdomen was involved, the skin and subcutaneous tissue having disappeared entirely, leaving the muscle exposed. A further area around was swollen and purple, and discharged pus at many separate points; this area was very tender. Pus taken from the wound on the eighteenth day was examined (Dr. A. Beck) and showed streptococci, Gram-positive diplococci, and *B. proteus*. The streptococci were non-haemolytic, and grew both aerobically and anaerobically. In view of this report and of Meleney's work, dressing with a zinc peroxide cream was tried, but the condition spread very rapidly and the patient died on the twenty-first day after operation.

Case 2.—A man aged 54 had had an empyema operation in 1933, and discharge from the scar had recurred annually ever since. Two weeks before admission he had had incision and drainage at another hospital; the wound was still discharging. On examination on September 7, 1939, two soundly healed scars were seen over the left posterior axillary line. A little further back there was a granulating area about two inches in diameter and apparently healthy; still further back was a small ulcerated area with sloughing edges. X-ray examination (Dr. J. Grieve) showed neither residual empyema nor sequestra in the resected rib. There was no evidence of gas in the tissues. A tentative diagnosis of post-operative cutaneous gangrene was made. Under a general anaesthetic the edges of the ulcer were excised (A. D.). No trace could be found of any sinus leading into the chest.

After the operation a slow painful inflammatory process with much sloughing continued to spread through the skin and subcutaneous tissues of the back. Treatment with uleron, and later with sulphanilamide, had no effect; local application of orthoform appeared to lessen the pain, which was severe. In a few weeks the condition had reached the stage shown in the accompanying illustration. The whole of the area originally involved had healed, but the inflammation had spread at the same time in a radiating manner across the back. The appearance was that of an immense carbuncle—patches of purple skin riddled with discharging spots and in places undermined. There was no special tenderness at the edges, but severe pain was felt in the affected area. A moderate secondary anaemia, a leucocyte count of 7,200, and a negative Wassermann reaction were observed.

The pus was examined (Dr. G. A. Cary Lynch) on September 28. Aerobic culture yielded *B. proteus* and other organisms,

but no haemolytic streptococci. Anaerobic culture gave a free growth of non-haemolytic streptococci. On repetition a week later, *B. proteus*, diphtheroid bacilli, and non-haemolytic streptococci were found on aerobic culture, with a feeble growth of streptococci only on anaerobic culture.

Under treatment with zinc peroxide considerable healing resulted, but the inflammatory process was never abolished at all places at once. A serpiginous ulceration continued for months, the patient's condition gradually deteriorating. There were only occasional slight rises of temperature. Copious sputum developed; this was found to contain streptococci and numerous other organisms but no tubercle bacilli. The streptococci were not strictly anaerobic, but grew better aerobically.

By April, 1940, the patient's condition was very low. On account, no doubt, of the long-continued pain and toxæmia, symptoms of confusional insanity appeared, and it was obvious

Photograph of Case 2, showing healed area, area of active ulceration, and surrounding purple area of skin.

that any measure which held out a hope of cure was justified. A very wide excision of the two remaining active areas was carried out (A. D.). Each area was the size of the palm of the hand; all tissue down to muscle was removed, and the excision was carried well beyond the surrounding reddened area of skin. Improvement was very rapid, the mental symptoms disappeared, and the patient was discharged three months later practically healed. He was seen on June 29, 1941, and was then completely healed and back at work. The scar covered the whole left half of the back, was pliable and healthy, and gave him no trouble.

Discussion

Somewhat similar cases have been described by Meleney (1933) under the title of "post-operative progressive bacterial synergistic infective gangrene of skin," by Langston (1938) as "progressive streptococcal ulceration," and by Mitchiner and Cowell (1939) as "spreading subcutaneous or cutaneous gangrene." The last-named authors identify the condition with "hospital gangrene."

Clinical Features.—The articles referred to all give such clear accounts of the clinical features that these need only

be summarized briefly here. The time of onset is from a few days to two weeks after an operation for an infective condition, or the process may arise at any time in connexion with a discharging sinus. The edges of the wound and surrounding area quickly assume the appearance of a large carbuncle. Although suppuration is profuse there is little general reaction. Great tenderness of the inflamed area is usual, unremitting pain is characteristic, and there is severe secondary anaemia.

Course.—The condition may be acute or chronic. Case 1 was so rapidly progressive as to be almost inevitably fatal. Chronic cases are characterized by the slow progress of the lesion and the tendency to heal at one area while spreading at another. Meleney (1935) reports one case of spontaneous healing after twenty-six months. Usually, however, the patient is worn out mentally and physically by pain and toxæmia. Fraser (1919) remarks that in gas gangrene the mind remains acute to the end, in striking contrast to the mental confusion in Case 2.

Prognosis.—There are not enough data to enable us to make an accurate estimate of the mortality, but published accounts leave an impression that it is about 50% whatever treatment is adopted.

Bacteriology.—In our cases non-haemolytic anaerobic streptococci with *B. proteus* were the significant organisms. The streptococci became aerobic later—a tendency noted by Douglas, Fleming, and Colebrook (1920). These workers found that practically all streptococci in infected wounds were anaerobic at first, and emphasize the necessity for anaerobic culture in all such cases. Milian (1930) and Nativelle (1930) found a bacillus of the *proteus* group with streptococci in cases of cutaneous gangrene. They consider that streptococci facilitate the action of the *B. proteus*. Diphtheroid bacilli were reported by Meleney and in our Case 2, while virulent diphtheria bacilli were present in Langston's. Douglas, Fleming, and Colebrook (1920) reported true diphtheria bacilli in 4 of 61 infected wounds, while Fleming (1919) found that they had a powerful stimulating action on streptococci. While, therefore, various organisms and combinations of organisms may be responsible, both our cases were due to an association of non-haemolytic streptococci with *B. proteus*. The diphtheroid bacilli were not an essential part of the infection, being absent in Case 1 and present only in the later stages in Case 2.

Aetiology.—The reasons for the establishment of this particular variety of infective process are obscure. The organisms were probably present in the original infection, and M.R.C. War Memorandum, 1940, No. 2 (p. 2), draws attention to the importance of the presence of necrotic material or foreign bodies in the establishment of anaerobic infections. Cross-infection may be excluded, since the cases were treated by us separately in different hospitals and without any other similar cases occurring in either.

Investigation.—This concerns the surgeon in so far as he provides the bacteriologist with his original material. The recent memorandum recommends the swab, and this was used in the present cases. Since the process spreads centrifugally and not deeply, the advice given to take material from the deepest part scarcely applies. The spreading edge is the most suitable site for obtaining a specimen. The memorandum makes no mention of examination of excised tissue such as was performed by Meleney. It appears to us that such examination might enable the bacteriologist to distinguish between contaminants and organisms actively invading the tissues.

Diagnosis

We consider that these two cases are examples of a well-defined clinical entity whose essential features are: (1) it

arises in connexion with an infected wound; (2) anaerobic streptococci, later becoming aerobic, and *B. proteus* are present; (3) the lesion spreads through skin and subcutaneous tissues, but not deeper. These considerations enable it to be distinguished from most of the other conditions mentioned by Stewart-Wallace (1935)—namely, common wound infection, erysipelas, ecthyma gangraenousum, specific infections, amoebiasis cutis, and fusospirochaetal infections.

Gas Gangrene.—Although two Medical Research Council reports (1919, No. 39; 1920, No. 57) on anaerobic wound infections were published after the last war, one detailing 65 cases, the condition was not clearly differentiated from gas gangrene. Fraser describes "localized anaerobic infection in wounds" and "slowly spreading anaerobic infections," but regards these as mild varieties of gas gangrene; he does not give a separate description such as would identify them with the present cases.

Progressive Post-operative Gangrene of Skin.—This seems to be the condition most closely allied to our cases. The clinical features of Stewart-Wallace's case—a spreading carbuncular process—were in so many respects like those in our second case as to leave little doubt that these were examples of the same condition. Unfortunately the cultural characteristics of the streptococci in his case were not mentioned. Cox (1936), in a case described under the same title, found a streptococcus that was both aerobic and anaerobic, but states that the lesion was strictly confined to the skin. Langston states emphatically that his case was not one of gangrene, but the organism appears to have produced a lesion in the abdominal walls of guinea-pigs very similar to that in our first case. It appears to us that "post-operative progressive bacterial synergistic gangrene of skin" (Meleney), "spreading subcutaneous or cutaneous gangrene" (Mitchiner and Cowell), and probably "progressive streptococcal ulceration" (Langston) are all conditions essentially similar to those of our patients, and closely allied to one of the varieties of "hospital gangrene." We suggest "wound phagedaena" as a more suitable and concise term than any of the above, including all these conditions and yet excluding the others mentioned in the previous section.

Treatment

Though Meleney and Langston have had success with local application of zinc peroxide, this was unavailing in our cases, as were both uleron and sulphanilamide internally. Incomplete excision is useless, but it is to be noted that the first, evidently incomplete, excision in Case 2 did not accelerate the infective process as it might have been expected to do.

We entirely agree with Stewart-Wallace that there is no doubt at all that the correct treatment is wide excision. Probably with diathermy excision there would be less risk of leaving behind an area of tissue still containing active organisms. In view of the recent activity in research into the chemotherapy of wound infections this opinion may have to be revised soon, but any alternative treatment would have to be well founded in view of the excellent results of a well-planned excision.

Summary

Two cases are reported of a spreading infection of skin and subcutaneous tissues arising from an infected wound or sinus.

The condition appears to be one manifestation of a clinical entity, including "post-operative cutaneous gangrene" and some other similar conditions, closely related to the "phagedaena" of former times.

The infecting agent in each case was an anaerobic streptococcus associated with *B. proteus*.

One case was hopeless from the start ; in the other a cure was effected by a wide excision of the lesion.

"Wound phagedaena" is suggested as a suitable name for the condition.

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ENURESIS IN ADOLESCENTS

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The Subjects and their Surroundings

The subjects of these observations were boys whose ages ranged from 14 to 20 years. They were members of a farm training colony, some 300 strong, to which they had been sent by the Public Assistance Committees of England and Wales. Most of them had been brought up in institutions, and many of them had been "problem cases." In general the boys were of poor type and intelligence, inclined to lack discipline and to show anti-social traits. Many of them had started life with the adverse bias of illegitimacy, separated parents, or an unkind step-parent. The boys at the colony received training to fit them for farm, gardening, or domestic work or boot-repairing. Positions were found for them in one of these spheres at the completion of their course. They played organized games daily, with swimming in the summer, and went to the pictures once a week, on Saturdays. A few of them had started model aeroplane and fretwork clubs. The colony was run rather along Public School lines, being divided up into several houses, with the usual system of internal government. Everything was done to kindle a feeling of responsibility and public spirit, and much of the government of the colony was in the hands of the boys themselves.

Twenty-one per cent. of them were bed-wetters: this high figure is explained by the fact that the colony is one of the few in England admitting such boys, who thus tend to gravitate there. Most were intractable cases who still wet their beds when admitted to hospital in different and possibly happier surroundings. Occasionally some went home, but the trouble nearly always persisted. It was the custom to segregate the enuretic boys in a separate dormitory with beds equipped with rubber sheets. In an effort to avoid a wet bed later in the night, they were waked two hours after going to bed and made to pass water. Thus it was probable that the conditions tended to encourage

enuresis rather than otherwise, in view of the segregation at night and the constant reminder, in being called, that the worst might happen. Alongside this camp there happened to be a colony of forty Jewish refugee boys of similar ages. They were mostly the sons of Austrian artisans and small shopkeepers. These boys were of good intelligence and physique, and when competing in the sports against the boys in the colony had won all the cups and prizes. Enuresis among them was unknown.

Description of Cases more fully Investigated

Twelve boys from the colony together with one from an external source were admitted to hospital for a more detailed investigation. In addition to careful histories and physical examinations, perianal swabs were taken for threadworms, the lumbar spines were radiographed for spina bifida, and an investigation was made to determine whether the boys passed an abnormal volume of urine by day or night. Intravenous pyelography was performed, and each boy was sent for interview by a psychologist. The method employed to determine whether they passed an abnormal volume of urine consisted, at first, in weighing the bed-clothes before and after sleep. This was found to be not very satisfactory, and eventually a comfortable bag for collecting urine was fitted on before they settled for the night. Ten of the boys had enuresis in hospital.

The average age of the subjects was 17, the youngest being 14 and the oldest 20. Ten of them had unsatisfactory family histories, such as the early death of the parents, a broken home, or a father who suffered from "shell shock." There was a family history of enuresis in only one case. All but one were dull, and even this boy was emotionally immature. This dullness was quite obvious on simple conversational contact, and required no special test for its demonstration. All the boys, except one whose development was retarded, were physically normal. Threadworms were found in three of them. There was no significant chemical or cytological abnormality in their urine, of which they passed a normal volume both by day and by night. Intravenous pyelograms showed normal urinary tracts in every case. Radiographs of the lumbar and sacral spines demonstrated some abnormality in nine out of the thirteen boys. This was frank spina bifida occulta in seven, but a congenital abnormality of the first piece of the sacrum was reported in one, and flattened vertebral bodies in another. The incidence of congenital abnormalities is greater than even the most generous estimates for healthy people.

Common factors in the histories and examinations that were noted, among others, were: (1) an unsatisfactory family history, often with some disruption of the home ; (2) poor intelligence ; (3) normal physique ; and (4) a congenital spinal abnormality.

Spontaneous Course of the Disorder

A record of the number of wet beds caused by each of three boys was kept for a period of rather more than two years, during which they were untreated. This is shown in Fig. 1. It will be seen that the disease follows an irregular course, being slightly less troublesome in midsummer. In the case of boys C. and M. there was an exacerbation in the early part of 1940 corresponding to the intense cold at that time. Boy W., however, seemed to be unaffected by this. The course of the illness is not unlike that of epilepsy, a similarity which fits in with the low level of intelligence of most of the boys. The frequency of spina bifida occulta further suggests some abnormality in the central nervous system. The demonstration of spontaneous remissions naturally raises the question of any treatment used. If a

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