(*b*) If reinfection of a wound occurs after sterilization by penicillin a sensitivity test should be done on the new invader, as it may be resistant.

Case 7.—A soldier aged 23 was undergoing total reconstruction of the thumb. A pedicle graft had been raised and transferred to the thenar remnant, and at this stage both ends of the pedicle were attached to the hand. As the result of some slight trauma the pedicle ulcerated and became infected with penicillin-sensitive *Staph. aureus*. Penicillin cream was used as a dressing, and sterility was obtained in five days. The wound remained sterile for 16 days without any clinical change and then became reinfected with staphylococci. Penicillin was continued for 27 days without clinical or bacteriological effect. Finally treatment was stopped and the ulcer eventually healed.

(*c*) Although sensitive organisms may disappear from culture, the wound may be so infected with *pyocyaneus, proteus,* or the coliforms as secondary invaders that no clinical improvement is noted or indeed can be expected. This was a common finding, particularly in this group of cases.

(*d*) Penicillin can be a useful adjunct to surgery, but does not replace it. Certain surgical principles may need modification to comply with the requirements of penicillin application.

Summary

These experiments with the local use of penicillin to date indicate that we have an effective weapon in the fight against tissue invasion by certain of the pyogenic cocci. The points that emerge are:

1. Early application is most desirable.

2. Efficient technique must be used to bring penicillin into contact with the infective process.

3. Tissues necrosed as the result of infection are removed by natural processes. Many wounds containing slough or sequestra resist sterilization by penicillin. In some of these cases it is probable that attempts at sterilization impede slough removal and so delay healing.

4. Penicillin as an adjunct to adequate surgical technique is a valuable advance in the treatment of wounds infected with sensitive organisms.

LOCAL TREATMENT OF BREAST ABSCESS WITH PENICILLIN

BY

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Simple aspiration under local anaesthesia has in some hands given good results in the treatment of mammary abscesses, and it seemed logical to add to this penicillin replacement when supplies became available. A series of 15 consecutive cases has been treated, and case histories, with interpretation of results, are here given.

The technique used was simply to infiltrate the skin with a stab of 2% novocain and to aspirate through a needle with a 20-c.cm. syringe. Staphylococcal pus is sometimes thick and breast abscesses are notoriously loculated, but by using saline wash-outs when necessary it was usually possible to evacuate them with fair efficiency. The organism in every case proved to be coagulase-positive *Staphylococcus aureus*. No strains resistant to penicillin were encountered. A solution of calcium penicillin in distilled water of a strength of 2,000 units per c.cm. was then injected through the same needle, dosage varying from 2,000 to 20,000 units according to the size of the abscess. Aspiration and injection of penicillin were usually repeated at two-day intervals: the pus obtained on the second and subsequent occasions was usually sterile or nearly so, and, when placed in an agar cup in a plate inoculated with the standard Oxford H staphylococcus, produced a zone of inhibition indicating that penicillin was still present in effective concentration after 48 hours. I am indebted for the bacteriological investigations to Dr. J. C. Ford.

Except in three of the earlier cases, breast-feeding was discontinued and lactation suppressed by restriction of fluids, mild aperients, and stilboestrol 5 mg. daily for 5 days. The breasts were firmly supported with crêpe elastic bandages.

Case Histories

Case 1.—Primipara aged 23. Painful breast after 5 weeks of lactation. Admitted Jan. 15, 1944, with large breast abscess and infection involving most of breast. Same day: Aspiration 40 c.cm. pus; 12,000 units penicillin. Jan. 16: Aspiration 16 c.cm. pus; 10,000 units penicillin. *Result:*—Next day spontaneous discharge from aspiration site and rapid resolution. Home in 8 days.

Case 2.—Multipara aged 30. No recent pregnancies. Two small breast abscesses in past year treated by surgical drainage. Three weeks ago, gradual development of another, involving one-third of the breast above and behind areola. Dec. 28, 1943: Aspiration 7 c.cm. pus; 10,000 units penicillin. Dec. 30: Aspiration 12 c.cm. pus; 8,000 units penicillin. Jan. 1, 1944: Aspiration 14 c.cm. pus. *Result:*—Remained closed, and on Jan. 14 there was good resolution.

Case 3.—Aged 23. Breast abscess following weaning at 10 months, involving about one-quarter of breast. Duration 8 days. *Treatment:*—July 11, 1943: 10,000 units of penicillin injected immediately after aspiration of 5 c.cm. of pus; pentothal anaesthesia, as patient was very nervous. Twenty-four hours later, second aspiration: no anaesthesia: 5 c.cm. of sterile pus which inhibited growth of staphylococci to a distance of 4.5 mm. 5,000 units again injected. *Result:*—Abscess pointed 2 days after starting treatment. Discharged profusely and healed rapidly. Patient was afebrile in 3 days; home in 6 days.

Case 4.—Aged 25. Breast abscess following lactation. Child 3½ weeks old. Breast had been uncomfortable for 2 weeks and a lump had gradually appeared. Four days before admission the lump looked yellow, and the whole breast was painful. Two days later the abscess burst; the pain got worse, and on admission was radiating to the axilla and the arm. *Treatment:*—Aug. 10, 1943: 6 c.cm. of pus aspirated from the abscess and 10,000 units of penicillin injected. Aug. 12: 8 c.cm. of pus aspirated and 10,000 units of penicillin injected. 9 mm. inhibition. Aug. 13: Under local anaesthesia incision of abscess and drainage of 10 c.cm. of pus. This pus produced an 8-mm. zone of inhibition, and on a blood-agar plate grew only 8 colonies of *Staph. aureus*. Aug. 27: Breast-feeding discontinued. Aug. 31: Under general anaesthesia—incision and drainage of a large retromammary abscess. The pus from this gave a profuse growth of *Staph. aureus* on blood agar, and failed to produce any zone of inhibition. Sept. 12: Wound healing well. Sept. 14: Breast healed; patient discharged. *Result:*—The patient was febrile until the retromammary abscess was drained on Aug. 31, after 23 days in hospital, and was discharged after 37 days in hospital. Local treatment and the effort to maintain breast-feeding were a failure.

Case 5.—Aged 19. Breast abscess after ceasing to feed baby 6 weeks old. Lump in breast noticed for 3 weeks; increased recently. Abscess involving about one-quarter of breast. *Treatment:*—July 11, 1943: Under local anaesthesia 3 c.cm. of pus aspirated and 4,000 units of penicillin injected. Forty-eight hours later, 3 c.cm. of pus aspirated, which was sterile and gave a 1-mm. zone of inhibition. 6,000 units again injected. *Result:*—Three days after onset of treatment abscess pointed and discharged. Patient was afebrile on third day and home on sixth.

Case 6.—Aged 22. Breast abscess following lactation. Child 5 months old. Eight days before admission lump appeared in right breast. Disappeared after three days. Three days before admission lump reappeared and became painful. Treated as an out-patient with kaolin poultices. On admission she had a breast abscess 2½ in. in diameter above the right nipple. *Treatment:*—Nov. 10, 1943: Aspiration of 10 c.cm. pus; 10,000 units penicillin injected. Nov. 12: Aspiration of 10 c.cm. pus (this pus inhibited standard staphylococci to 11 mm.); 8,000 units injected. Nov. 14: Aspiration of 10 c.cm. pus; 7,000 units injected. Nov. 16: Aspiration of 7 c.cm. pus (this pus inhibited standard staphylococci to 6 mm.); 10,000 units injected. Nov. 18: Aspiration of 4 c.cm. pus. Nov. 20: Cured. *Result:*—The patient was 9 days in hospital, and afebrile on the third day after starting treatment.

Case 7.—Blind primipara aged 27. Had staphylococcal paronychia at delivery, Sept. 25, 1943. Early in puerperium marked breast engorgement, which went on rapidly to development of bilateral breast abscesses involving most of both breasts. Oct. 14: Aspiration, and penicillin replacement under pentothal. 60 c.cm. pus right —15 c.cm. pus left; 15,000 units of penicillin to each side. Oct. 16: Right, 15 c.cm. pus; 16,000 units of penicillin. Left, 4 c.cm. pus; 8,000 units. Oct. 18: Right, 50 c.cm. pus; 8,000 units. Left, 30 c.cm. pus; 6,000 units. Both breasts then broke down and freely drained through a small hole at the site of aspiration. The right rapidly resolved, and cleared up entirely. She was allowed home on Nov. 14 with sinus discharging in left breast. This had not cleared up by Dec. 24, so she was readmitted and the sinus opened up under anaesthesia, with removal of sloughs. *Result:*—On Jan. 20, 1944, after three months, the right breast texture was normal, the left still slightly indurated.

Case 8.—Para-5 aged 39. Had had breast abscesses after third and fourth children; also small areolar abscess in this pregnancy. Always same breast affected. On tenth day of puerperium admitted with segmental mastitis. 3 c.cm. of penicillin injected under local anaesthesia into affected area. Increased tension caused consider-

able pain, but breast improved for a few days, only to develop a large abscess, which was incised on Nov. 28, with removal of 80 c.cm. of pus; 8,000 units were left in drainage wound. Abscess loculated, and required counter-drainage on Dec. 2, after which she made good recovery. Home after 23 days in hospital.

The patient should not have been encouraged to feed from a breast deformed by past infection and incisions. Prophylactic penicillin found impracticable, and useless locally. Incision was resorted to in order to secure efficient drainage of a deep-seated abscess.

Case 9.—Aged 23. Breast abscess after lactation. Child 3 weeks old. Breast-feeding stopped, as supply insufficient. Patient admitted with abscess involving two-thirds of breast that had been developing over a period of three weeks. A small superficial abscess had been treated by surgical drainage a fortnight before. Considerable induration of the deeper tissues of the breast was noticed at the time. *Treatment:*—On July 17, 1943, the patient came under our care. On the 18th 5 c.cm. of pus was aspirated under local anaesthesia and 15,000 units of penicillin were injected. Twenty-four hours later there was free spontaneous drainage at site of the old incision—pus inhibiting standard staphylococcus to 3 mm. Twenty-four hours later 6,000 units injected, and three days later 8,000 units into indurated area. *Result:*—The patient was 10 days in hospital—afebrile after 7 days.

Case 10.—Aged 29. Breast abscess complicating scabies, which she had had for some weeks. Induration developed in the breast about a week previously. When seen she had an intramammary abscess involving two-thirds of the breast. *Treatment:*—20 c.cm. of pus aspirated under local anaesthetic and 15,000 units of penicillin replaced. Forty-eight hours later 4 c.cm. of pus aspirated with difficulty; this inhibited a growth of staphylococci 11.5 mm. 15,000 units replaced. Forty-eight hours after second injection abscess further localized and pointing on the surface. Incision and drainage done under pentothal; 4 to 5 oz. of pus evacuated. This pus inhibited standard staphylococcus to 5 mm. There was rapid resolution after efficient drainage. *Result:*—Patient was afebrile 7 days from onset of treatment and returned home in 12 days.

Case 11.—Aged 35. Seen in post-natal clinic at 10 weeks, with slight induration in right areola. One week later (Oct. 18, 1943) there was a small superficial abscess: 1 c.cm. of pus aspirated; 4,000 units of penicillin injected. Oct. 20: 1 c.cm. of pus aspirated; 3,000 units injected. Breast-feeding continued. The breast settled down, and she was allowed home on Oct. 22. She returned on Oct. 26 with mastitis involving whole breast which developed overnight. Breast-feeding abandoned. The abscess was incised and drained on Oct. 28; no penicillin was used. The breast slowly resolved, the patient being very ill for a fortnight, and, as a sinus persisted, penicillin was injected down it. On Nov. 22 and 23, 8,000 units; on Nov. 25, 2,000 units were given, but no improvement was noticed, and on the 26th the sinus was explored under general anaesthesia and a slough 2½ by 1½ in. removed. The wound was drained, and 8,000 units of penicillin injected down the tube. The breast rapidly resolved, and was healed by Dec. 1.

In this case an attempt to maintain breast-feeding in presence of breast abscess was a failure: the inefficiency of local aspiration treatment if there is a slough in the depth of the abscess is also illustrated.

Case 12.—Aged 22. Breast abscess following lactation. Child 7 weeks old. Eight days before admission painless lump in left breast. Three days later lump became painful and red, and was treated with kaolin poultices and hot bathing. On admission she had a fluctuating breast abscess 3 by 2½ in. on the outer aspect of the left breast. Nov. 12, 1943: Under local anaesthesia 9 c.cm. of pus aspirated and 10,000 units of penicillin injected. Nov. 14: Several discharging sinuses on under surface of abscess; induration less; 6,000 units injected at site of original injection. Nov. 20: Sinuses beginning to heal; no discharge or induration. *Result:*—The patient was 7 days in hospital, and afebrile the day after the first injection of penicillin.

Case 13.—Aged 35. Developed a segmental mastitis when her baby was 8 weeks old. Baby kept at breast and condition resolved with local treatment, to recur one week later with development of small peripheral abscess. Nov. 14, 1943: Aspiration 1 c.cm. pus; 4,000 units penicillin injected. Nov. 16: Aspiration 1 c.cm. pus; 4,000 units injected. Nov. 18: Aspiration *nil*; 4,000 units injected. *Result:*—The abscess discharged spontaneously; patient returned home on Nov. 23 with breast healed and lactation still well established.

Case 14.—Aged 30. Breast abscess following weaning at 9 months; case first seen with segmental mastitis on Oct. 27, 1943. Stilboestrol and local heat given. Six days later afebrile, but local abscess: 10 c.cm. of pus aspirated; 20,000 units of penicillin injected. Nov. 7: Admitted for aspiration-replacement treatment; doses were 20,000, 8,000, 8,000, and 8,000 units, given on Nov. 7, 9, 11, and 13 respectively. *Result:*—Condition underwent slow resolution without breaking down. There was still slight induration on Nov. 20.

Case 15.—Para-7 aged 45, first admitted on fourteenth day of puerperium with mastitis, which resolved with local treatment and abandoning of breast-feeding. Patient went home after 7 days, to return with abscess. Jan. 13, 1944: Aspiration 3 c.cm. pus; 4,000 units penicillin. Jan. 15: Aspiration 5 c.cm. pus; 4,000 units. *Result:*—Spontaneous discharge from aspiration site, with satisfactory resolution.

Comment

These cases fall into three groups. In 5 cases surgical drainage was necessary, and conservative treatment may be said to have failed. In 7 cases spontaneous drainage occurred, either at a puncture site or elsewhere, and in only 3 did the abscess remain closed and resolve slowly with no evacuation of its contents except by aspiration. On the other hand, the cases in both the second and third groups required no operation or anaesthetic, and their recovery was on the whole more rapid than is usual with simple drainage.

It is possible that some other method of local treatment may give better results, and, in view of the fact that aspiration sometimes cannot sufficiently evacuate the contents of the abscess, surgical drainage followed by instillation of penicillin solution through an indwelling catheter is being used in a further series. When larger supplies of penicillin become available a trial should be made of systemic treatment at an earlier stage in order to control the inflammatory process before suppuration has occurred, and so permit the continuation of breast-feeding.

PENICILLIN IN TREATMENT OF CERTAIN DISEASES OF THE SKIN

BY

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The unique properties of penicillin as an antiseptic suggested that it might be of value in the treatment of some diseases of the skin. This seemed a suitable field of inquiry for two further reasons: first, the probability, from bacteriological principles, of a good response from some of the pyogenic infections of the skin; and, secondly, the likelihood of comparatively small amounts of penicillin being required.

The present survey comprises 75 cases. These were all in-patients, and it was thus possible closely to supervise the treatment, which was by local application alone. All cases were investigated bacteriologically before treatment was begun, and the penicillin-sensitivity of the organisms present was qualitatively determined. Unless otherwise stated, the bacterial flora described as being present was, to a greater or lesser degree, penicillin-sensitive. The number of units used in each case should be regarded as only approximate, and was often related to the extent of the disease rather than to its severity. The word "cure" is used in this paper to imply complete healing of lesions at some particular time. It does not necessarily mean a permanent eradication of the disease.

Sycosis Barbae (15 Cases)

This was chosen as a suitable disease for preliminary investigation because it so often fails to respond adequately to other methods of therapy. Crusts, if present, were removed before penicillin was applied, and shaving was discouraged, especially in the early stages of treatment. Penicillin was usually applied as an ointment containing 400 units of calcium or sodium penicillin per gramme of base, the latter being a mixture of equal parts of lanette wax S.X., petroleum jelly, and water. In a few cases the strength used was 200 units per g., and in some the base contained 50% of water with 25% of each of the other ingredients. It was felt that if the base contained 50% of water it might be of more suitable consistency, but this did not prove to be so. In other cases solutions of penicillin were used.