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TREATMENT OF BREAST ABSCESES WITH PENICILLIN

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The following account deals with various methods of treating breast abscesses with penicillin. The justification of those methods depended on their results as compared with those obtained from the methods at present employed. For this reason a series of controls was treated contemporaneously with

Several cases examined during the puerperium, with flushed and tender breasts, some pyrexia, but ill-defined induration, were excluded as not giving sufficient evidence of infection. These did in fact clear up without chemotherapy, by the usual methods of elevation of the breast and the application of ice-bags. The distinction, however, was not always easy to make, and one case in which induration was not well defined was included in the controls.

Table Comparing Results in Breast Abscesses

	No. of Cases	Duration in Days after First Treatment of					
		Pyrexia		Suppuration		Healing Time	
		Mean $\pm$ S.E.	S.D.	Mean $\pm$ S.E.	S.D.	Mean $\pm$ S.E.	S.D.
Controls	16*	7.5 $\pm$ 1.97	$\pm$ 7.86	13.8 $\pm$ 3.0	$\pm$ 12.0	26.5 $\pm$ 2.45	$\pm$ 10.17
Treated	18	3.9 $\pm$ 0.91	$\pm$ 3.78	6.3 $\pm$ 0.82	$\pm$ 3.5	13.5 $\pm$ 1.50	$\pm$ 6.37
Difference		3.6 $\pm$ 2.17		7.5 $\pm$ 3.11		13.0 $\pm$ 2.87	

Methods of Treatment

S.E. = Standard error of mean. S.D. = Standard deviation.
* Two control cases excluded, because in Case 1 the follow-up was not conclusive, and in Case 2 the duration of pyrexia was 63 days, suppuration > 88 days, and healing > 119 days.

† Mean of 17 cases only; no record of 18th case.
‡ Mean of healing time of abscesses in 17 breasts.

the penicillin series and the two were compared not only as to the average duration of pyrexia, suppuration, and healing time, summarized in the accompanying Table, but also with regard to a number of other points which were considered important. The apparent advantages obtained by the use of penicillin would seem to justify a detailed description of the methods of administration found most satisfactory.

The survey comprised all cases which came under treatment at the Central Middlesex County Hospital between Nov. 19, 1943, and May 18, 1944. They were nursed in the obstetric or surgical wards according to whether their symptoms arose during the puerperium or later. Both series were cared for by the same nursing staff and the same surgeons. The cases numbered 36, and, in order to eliminate any bias on the part of the investigators, they were chosen for the control or penicillin series in strictly alternate chronological order. There were 22 abscesses in the 18 control cases and 24 in the 18 penicillin-treated cases. Factors which might have favoured one series more than the other were also noted. The time of onset in relation to parturition was within the first fortnight in 6 control and 7 penicillin-treated abscesses, and a further 9 and 7 respectively arose within five weeks of the same date. The incidence in primiparae was half the total in each series. The age incidence was somewhat lower and the onset more often rapid in the penicillin cases, and pyrexia from other causes during the puerperium was present in 4 of the latter. Extraneous factors therefore could not be said to have favoured the penicillin group.

No case was accepted for investigation unless a well-defined, tender, and indurated mass was palpable in the breast tissue.

The penicillin cases were treated according to the type of case and, as the investigation progressed, also to the lessons learnt from earlier mistakes. No sulphonamides were given, and stilboestrol was administered to only 3 cases, all in the early stages of the inquiry. The methods are described in detail below.

Items of Comparison

1. *Bacteriological Findings.*—*Staph. aureus* was the only organism found at operation in the abscesses with no external communication. One which had arisen from the residual sinus of an earlier abscess was, however, infected with a haemolytic streptococcus alone. Milk from six infected breasts was examined and found to contain *Staph. aureus* in each instance. The pus from one case in the control series was sterile on culture at operation and revealed no organism but *Bact. coli* in subsequent cultures. It is as well to mention that a phenomenon noticed in other acute infections was also noted here on several occasions—namely, that some swabs taken from pus at the time of the first incision were sterile on culture and yet cultures made later from swabs of the wound walls produced an abundant growth of *Staph. aureus*. Subsequent swabbings were made at weekly intervals in the controls and as soon as pus had disappeared in the penicillin-treated cases—i.e., from the second to the thirteenth day after the first local treatment. In the controls *Staph. aureus* persisted in 18 of 21 abscesses followed up till healing was nearly complete, and disappeared in 18 out of 20 “treated” abscesses before treatment was discontinued. The time of disappearance was anything from the second to the fifteenth day of treatment.

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The disappearance of pus from the exudate coincided closely with the disappearance of *Staph. aureus* from cultures. In fact, it was soon realized that in these staphylococcal infections the taking of a swab for culture was simply a way of confirming the clinical finding that the replacement of pus by a sero-sanguineous exudate signified that the abscess walls were no longer infected.

Secondary infection with *Str. haemolyticus* occurred in 3 control cases, the healing times of two of these being prolonged much beyond the average. No penicillin-treated cases became so infected. The remaining secondary invaders—*Staph. albus*, *Micrococcus tetragenus*, *Bact. coli*, and *Proteus*—appeared in 7 control and 5 penicillin-treated series, the Gram-negatives occurring in the same number—2—of each series. No clinical significance could be attached to the presence of these organisms, as they appeared only when wounds were superficial and healing.

2. *Suppuration* seemed to have been prevented by sulphonamide administration in one control case for several weeks, but after discharge from hospital this patient reported again with a painful lump in her breast. Unfortunately she was lost sight of after this. In some instances it appeared that pus formation was prevented or at least reduced by the use of sulphonamides. No frank pus was found in 3 cases. A fourth had a virulent infection in several loculi of one breast which spread later to the other. She received intensive courses of sulphamezathine and sulphathiazole, and pus was found in quantity only at the first incision, subsequent incisions into large swellings revealing only small amounts of sero-pus. In spite of this, however, once pus had formed in an abscess it continued till healing was well advanced. No case treated with penicillin at the stage already defined avoided the formation of pus. In fact, suppuration seemed to be speeded up and, while it localized readily, the pus became much thicker than in any of the control cases. It disappeared quickly, however, so that its average duration was less than half that of the controls.

3. *Twenty-two operations* were performed on 17 of the 18 controls, 5 cases requiring later incisions owing to extension of the infection. In all, 32 incisions were made. There were 4 operations in the penicillin-treated series and 4 incisions.

4. *Pyrexia* at the beginning of treatment varied very much from case to case, being little more than 99° F. (37.2° C.) where abscesses were already well localized, but reaching 103° F. (39.4° C.) in those whose infection arose in the puerperium. There were 5 cases in each series whose initial temperature rose above 101° F. (38.3° C.), the remainder all having milder degrees of pyrexia. The average duration after penicillin treatment, however, was reduced to half that of the controls. This was not because the penicillin-treated cases necessarily reached normal ranges before the controls, but because, once normal, their temperature did not rise again, as happened in several of the latter.

5. *Complications* in controls consisted of secondary abscesses in the same or the opposite breast or in axillary glands in 6 instances, and septic dermatitis in 3, while the infection in one long-standing case spread to the lids and the patient suffered from a persistent blepharitis. In the "treated" series two secondary abscesses developed, both in cases receiving local treatment only. A milk sinus persisted in a third case, prolonging the healing time to that of the average for the controls.

6. *Healing time* was estimated from the beginning of treatment, chemotherapeutic or surgical, till no further dressing or other local treatment was needed. In the case of open wounds or sinuses the end-point was the day on which the wound became quite dry; in abscesses that were aspirated it was the day after the last aspiration on which any fluid could be withdrawn, no further treatment then being required. Where several abscesses were present in one breast the healing time covered the period from first treatment till the last abscess was healed. But if abscesses were present in both breasts their healing times were assessed separately (see Table).

Two patients had to be excluded from the control series—one because, though the induration and pyrexia appeared to subside under sulphonamide therapy, she later reported to the out-patient department with a painful lump in her breast; but thereafter she could not be traced. The second patient had so severe and prolonged a convalescence that her healing time

would have upset any reasonable comparison of the two series. There were no exclusions in the penicillin-treated series. After their abscesses had healed all these cases were followed up for from one to six weeks, according to the severity of the initial lesion. The healing times were therefore considered genuine, and they showed that not only was their average reduced to one-half that of the controls but that only one of all the penicillin-treated cases exceeded the average time for the controls.

7. *Breast feeding* had to be stopped in the majority of controls who were lactating. In the penicillin-treated cases, once confidence in the method of treatment had been gained, the avoidance of stilboestrol gave the mothers every opportunity to continue feeding their babies on the normal breast throughout treatment and to resume with the other after it had healed. In one case suckling was difficult because of retraction of the nipple following a persistent milk sinus, but in others the lack of scarring and retraction was in marked contrast to that of some of the controls. Induration in penicillin-treated cases, especially around those abscesses which were only aspirated, persisted for up to five weeks after treatment was begun; but it eventually resolved, and after this time it was difficult to detect any indication that an abscess had existed.

8. *Days in Hospital*.—A final assessment was made of the days spent in hospital by the two series and also of the period of time during which they had to attend the out-patient department for treatment. These were as follows:

	Control	Treated
Total number of days spent in hospital	348	191
Total period of out-patient treatment	313	41
Total	661	232

Only 4 penicillin-treated cases had any out-patient treatment, though undoubtedly a good part of the treatment all received as in-patients could have been carried out effectively by daily attendance at the hospital. The need for accurate and frequent observation when a new method of treatment was being used, however, impelled their retention until it was possible to claim with assurance that these methods, when systematically used, were not only devoid of serious consequences but gave reliable results.

Methods of Treatment with Penicillin

These depended on the condition of the breast when the patient was first seen. The choice of dose—for systemic or local effect—depended on whether or not the infection was still in the acute spreading stage with attendant constitutional disturbance. The method of treatment depended on whether an abscess had formed and on the amount of pus present.

Intramuscular Injections of 15,000 Units Three-hourly (13 Cases).—These were used for the acute phase before fluctuation could be detected, also when there was much pyrexia and a generalized flush over the breast, and for all infections arising in the puerperium. (Two cases with puerperal abscesses, not so treated initially, demonstrated the necessity for systemic treatment in acutely spreading lesions.) Injections were continued for a minimum of 12 hours, but no case required them for more than 3½ days. An injection was given pre-operatively immediately before any incision or exploration was carried out. The intramuscular treatment was stopped as soon as the pain had diminished, the flush began to fade, the oedema to lessen, and the pyrexia to subside.

Aspiration and Injection of Penicillin under Local Analgesia once in 24 hours (10 Abscesses).—This method was employed as soon as any fluctuation could be detected, and was even attempted without definite signs in deep and small abscesses which appeared to have localized. No spread of inflammation occurred after these explorations, but the patient always had penicillin circulating in her blood stream from an intramuscular injection given immediately before they were carried out. The aspiration was done with a wide-bore needle—a West Middlesex transfusion type containing a stylet was found satisfactory, as the needle could not become blocked before it had penetrated the abscess cavity. The area of maximum redness and swelling was avoided and the needle inserted obliquely from

where the skin was firm. A syringe having been attached to the needle after withdrawal of the stylet, all possible pus was aspirated. A second syringe containing the penicillin solution then replaced that used for aspiration, and an amount was injected equal to two-thirds the volume of the pus aspirated. If no pus was found a small amount of penicillin was injected into the tissues and along the needle track as the needle was withdrawn.

These aspirations and injections did not overlap the intramuscular treatment in any case by more than 24 hours, the assumption being that once pus was localized there was no need for further intramuscular treatment. When any doubt about complete localization existed, and when it was possible to inject a full 24-hour dose without leakage, 120,000 units, made up at the bedside in the required quantity of saline, were injected into the abscess cavity. Such a dose ensured a circulating concentration of penicillin for at least 12 hours (Florey and Heatley, 1945). By this method of systemic treatment three abscesses in one breast received treatment by injections into one only, until all had localized and could be treated individually. Where the abscess was well localized a concentration of 500 units per ml. was quite sufficient to sterilize the infected tissues. If no sinus formed this process was repeated every 24 hours till the pus, which became thicker and more slimy during the first two or three days of treatment, disappeared and was replaced by slimy blood-stained and then sero-sanguineous fluid. On the appearance of a sero-sanguineous exudate a film and a culture were made from the fluid, and if *Staph. aureus* was not present in either no further treatment was carried out. The breast was palpated carefully each day for at least a week and signs of recrudescence were looked for in temperature, flush, tenderness, or increasing induration. There was no recurrence in any of the cases so treated, but it should be remembered that treatment was never considered completed without confirmation of a sterile culture. Abscesses so treated contained no more than 10 ml. of pus and required daily injections for 4 to 7 days, irrespective of whether or not preliminary intramuscular treatment was necessary.

Instillations of Penicillin after Expression of Pus (5 Abscesses).—These instillations were most frequently made through a sinus which formed where the abscess pointed. This occurred very rapidly under the influence of penicillin therapy, and on the 24-hourly-aspiration-and-injection schedule it was often impossible to prevent sinuses developing. They were, however, of considerable value in treating the case, because the abscess cavity could now be emptied twice a day by gentle pressure and instillation carried out as often. In the interval, the mouth of the sinus was covered with cotton-wool soaked in collodion to prevent the egress of solution. Instillations were made by means of a fine rubber tube, nasal or ureteric catheter size, or by means of a West Middlesex needle, the important point being that the tube should completely occlude the mouth of the sinus to prevent escape of the solution during the injection.

A combination of the two methods of local treatment was used in 5 abscesses, instillations being made once a sinus had developed along the track of the aspirating needle. After

FIG. 1.—Treatment by indwelling cannula. Small breast abscess tending to point at c. a: West Middlesex needle inserted obliquely into abscess cavity so as to avoid the area where pointing would occur. b: Layers of gauze dressings held by strapping to secure the position of the needle. Needle and dressings are covered with another sterile gauze dressing in between treatments.

aspiration a West Middlesex needle was left in the abscess cavity and fixed in place under a sterile dressing so that a second evacuation and instillation could be performed by the nursing staff in the absence of the medical attendant (Fig. 1). A sinus developed along this track in a day or two. At each subsequent treatment discharge was first expressed through the sinus, and the needle could then be inserted without local analgesia and by unskilled hands. The disadvantage of sinus formation over aspiration alone was the fact that it added a week to the healing time, but this was offset by the greater comfort of the treatment and the fact that it could be repeated more often, thus getting rid of purulent exudate quickly and so hastening the subsidence of infection.

Instillations Following Incision and Suture (Fig. 2) were used for 4 abscesses, all with large cavities containing 100 to 150 ml. of

FIG. 2.—Treatment by incision and insertion of drainage-tube. Large abscess tending to point at a. b: Rubber tubing inserted through incision line, which has been sutured after evacuation of abscess. c: Syringe containing penicillin solution—the amount being two-thirds of the pus evacuated or not more than 10 ml. d: Adapter for inserting in rubber drainage-tube so as to enable a Record syringe to be used. e: Spigot for closing mouth of tube after injection.

pus. Complete evacuation of the cavity required a good opening—away from the area where the abscess was pointing—but this was then sutured round a rubber tube with an internal diameter of about a quarter of an inch (5 mm.). Providing penicillin was instilled, once pus was fully evacuated from a well-localized abscess it did not form in quantity again, and the emptying of the discharge through the tube could then be achieved by gentle pressure. This modified method of drainage was a great deal more satisfactory than aspiration if an abscess contained more than 10 ml. The patients preferred instillations to intramuscular injections or aspirations and injections, for they were almost painless. There was the added advantage that they could be carried out by the nursing staff at more regular intervals than are generally possible with the medical attendant. These abscesses required treatment twice daily for from 4 to 8 days when well localized. Though this method alone cleared up a virulent spreading infection in 15 days, subsequent cases treated with preliminary intramuscular injections till localization had occurred improved more quickly. The choice of local (500 units per ml.) or systemic dose (120,000 units in 24 hours) was governed by the same considerations as have been discussed already, but as administration was twice daily the systemic dose was divided in two, 60,000 units being given at each injection.

The methods used can thus be summed up:

For the acutely inflamed stage, intramuscular injections of 15,000 units 3-hourly till localization occurs (120,000 units in 24 hours).

When fluctuation is detected, aspiration every 24 hours of all pus, and injection of penicillin solution up to two-thirds of the volume of the pus aspirated, providing this does not exceed 10 ml.

When localization is not complete and full retention of the injection can be ensured, intramuscular injections may be replaced by the injection of the full 24-hour dose of 120,000 units into the abscess cavity. When localization is complete, systemic treatment may be discontinued and, for reasons of economy, a solution whose concentration is 500 units per ml. can be used for injections.

When the abscesses contain more than 10 ml. of pus, incision, evacuation, suture, and twice-daily instillations of penicillin solutions following complete expression of pus. The choice of dose is

governed by the same considerations as apply to aspiration, but the systemic dose, as it is given twice daily, can be reduced to 60,000 units.

Where sinuses exist or are made, twice-daily expression and instillation by means of a rubber tube or wide-bore blunt-ended needle, the mouth of the sinus being occluded by a collodion dressing in the interval.

Finally, it should be emphasized that complete emptying of the cavity before each instillation is as essential a part of the treatment as it is in the more usual methods of open drainage.

Discussion

Little work on breast abscesses treated with penicillin has been reported up to date. Complaints in which the risk to life is small have naturally not attracted much attention in the last three years unless directly connected with the prosecution of the war. Yet the social consequences of this malady are considerable, and not least in this category must be placed the inability of mothers to continue suckling their babies when a virulent infection has arisen in the puerperium. Consequently a treatment which can obviate the routine use of stilboestrol has considerable advantages. Fraser (1944) described some not very satisfactory results from local treatment only, and O'Hanlon and MacClancy (1944) seem to have come to no definite conclusions as to the value of the local methods they employed. Hodgkinson and Nelson (1945) reported 24 cases of puerperal mastitis in which three-hourly intramuscular injections for five days appeared to have prevented the formation of breast abscesses in 24 cases, but they considered the use of stilboestrol necessary. Unfortunately no controls were observed simultaneously with this series, and the virulence of infection is known to vary from year to year. This seems to be borne out by our second survey (1945-6), in which no breast abscesses developed in either control or penicillin-treated series when treated early enough by chemotherapy, and the average healing time of the control abscesses was half that in the first survey.

The treatments described in the present paper are by no means unprecedented. One or other, or a combination, have been used in a variety of conditions such as acute suppurative mastoiditis (Florey and Florey, 1943; Macbeth, 1945; Johnson *et al.*, 1945), the suturing of wounds in battle casualties (War Office Report, 1943), acute pyogenic meningitis (Cairns *et al.*, 1944), empyema (Tillet *et al.*, 1944; Fatti *et al.*, 1946), pericarditis (Norman and Ainsworth, 1945), sinusitis (Hauser and Work, 1945), various abscess cavities (Florey and Williams, 1944); Barron and Mansfield, 1944; Noth and Hirshfeld, 1944), osteomyelitis of the mandible (Mowlem, 1944), and in chronic sinuses from osteomyelitis (Florey and Florey, 1943; Robertson, 1944). But the special problem attached to infection in the lactating breast is that of the facility with which multiple loculation occurs, so that the surgeon has been faced with the choice of doing the minimum of damage by incisions which may not drain all loculi completely, or of running the risk of spreading infection by breaking down dividing walls when exploring the extent of the suppuration. Unfortunately, as the controls show, sulphonamide therapy did not give complete protection against this spread, so it is satisfactory to find that it did not occur in any of the cases treated by systemic penicillin.

Now that economy in dosage is not a major consideration there is no reason to suppose that long-continued intramuscular penicillin combined with incision might not eliminate sepsis as satisfactorily as did the method used here of switching over to local administration as soon as it was practicable. The use of vehicles delaying absorption may also rob the intramuscular method of much of its discomfort by reducing injections to once or twice a day. The two great advantages of local treatment, however, are the ability to introduce such relatively enormous concentrations at the focus of infection that there is no need to regulate the dose according to the resistance of any particular staphylococcus and, possibly more important still, both local methods ensure drainage and irrigation of infected surfaces with the minimum of damage to tissues and, in consequence, a much increased rate of healing. In this connexion it must be recognized that the improved rate of healing is by no means due simply to the ability of penicillin to eliminate sepsis. It is, in the average case at least, equally due to

the fact that a technique can be adopted that enables healing to take place without the delay caused by the processes of granulation, contraction, and epithelization which the healing of an open wound necessitates.

The technique of finding and of fully aspirating small and sometimes deeply placed abscesses is a matter of skill which requires practice, and is not so easily acquired as that of incision, where anaesthesia enables the surgeon to conduct his exploration with greater ease. The danger in advocating this method of treatment appears to be that less importance is usually attributed to methods of treatment which do not need the panoply of an operating theatre for their execution. If the inexperienced houseman or student is left to carry out aspirations without any preliminary instruction in technique or aseptic precautions (which should be as rigid at the bedside as in the theatre) the method of treatment will undoubtedly cause much suffering and unnecessary damage to surrounding breast tissue. Also, though the continued use of penicillin up to the last time a dressing was required undoubtedly reduced the risks of secondary infection (cf. infection of three controls with haemolytic streptococci), yet the clinical significance of an abscess cavity infected with organisms not susceptible to penicillin is not yet known. For this reason as much care in asepsis should be observed as should have been the rule before this chemotherapeutic agent was available.

Summary

In 1943-4 two simultaneous series of 18 patients suffering from breast abscesses were treated with present accepted methods and with a combination of intramuscular and local penicillin.

The average healing time in penicillin-treated cases was reduced to half that in controls.

Suppuration was hastened rather than retarded, but ceased more rapidly.

The use of stilboestrol was not necessary, and the mothers were able to continue suckling throughout treatment.

The number of operations was reduced from 22 to 4.

The total number of days during which treatment at the hospital was required was reduced from 661 to 232.

The methods of treatment with penicillin are described in the text, and depend on the preliminary use of intramuscular injections followed by local administration.

ADDENDUM

A further controlled survey was carried out by two of us (M. A. M. B. and J. S. M.) in the winter and spring of 1945-6. This time penicillin or sulphathiazole was given systemically as a prophylactic measure to all inflamed breasts in the puerperium. Abscesses, when they developed, were treated with similar methods to those described in this paper, but reliance was placed on incision and instillation in 50% of penicillin cases. These results will be published later, but they indicated that early prophylactic use of chemotherapy should reduce considerably the incidence of breast abscesses in the puerperium, and also that the less virulent the prevailing infection the less obvious the benefit accruing from the use of penicillin as compared with sulphathiazole.

These cases were observed and treated entirely at the Central Middlesex County Hospital at the suggestion of the Director, Dr. H. Jules, and owing to the kindness of Mr. T. G. I. James and Mr. J. D. Fergusson, in whose surgical wards some of the cases were nursed and whose responsibility they were. Mr. A. J. Wilson and Mr. H. Hashemian are thanked for their willing help on the surgical side; Dr. J. H. Humphrey and his staff for all the bacteriological examinations; the nursing staff for their enthusiasm and vigilance; and Miss D. M. Barbour for the drawings.

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