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Acute pyogenic mastitis associated with pregnancy and lactation

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ACUTE PYOGENIC MASTITIS ASSOCIATED WITH
PREGNANCY AND LACTATION

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INTRODUCTION

In this paper an attempt has been made to present a comprehensive review of the literature on the subject of acute mastitis as associated with the periods of pregnancy and lactation. Though a complete examination of the literature has not been possible, it has been the author's aim that a suitable cross-section of the available material be covered in such a manner that all phases of the subject have at least been touched upon. No endeavor has been made to draw a series of definite conclusions because in many instances this has not been possible.

The subject itself is of interest because it concerns a condition which has been constantly present, though it is not as common today as it has been in the years past. Perhaps with a clearer understanding of the problem, together with further medical advances, the time will come when acute mastitis is almost non-existent. However, as we view the matter at the present time, it appears that as long as women bear children a small percentage of them will be subjected to the development of an acute breast inflammation. While this is but one of many possible complications connected with pregnancy and lactation, it is only by a proper knowledge of the parts that the whole may be appreciated.

ACUTE PYOGENIC MASTITIS ASSOCIATED WITH
PREGNANCY AND LACTATION

Definition

Acute pyogenic mastitis is an inflammatory condition which occasionally arises in the breast, usually during lactation. It is caused by infection of either or both the parenchymal or interstitial tissues of the gland with the pyogenic micro-organisms. The usual organism is staphylococcus aureus. Clinically, the condition is usually uni-lateral, and is characterized by sudden onset with chills, fever, pain in the breast, and varying degrees of prostration. Pathologically there is an acute inflammatory reaction which may be localized or involve the entire breast and which either resolves in a few days or goes on to suppuration and breast abscess.

History

As one would naturally have expected, this condition, so closely associated with lactation, must have been known for thousands of years. Furthermore, it is a condition which has not been limited to man but has been and is found in cattle, goats, and other lactating animals. When the Ebers papyrus was found, a remedy for disease of the breast¹ was included in its writings.

The condition was recognized by Hippocrates² who spoke of the metastasis of lochia to the breasts and breast

abscess. This is of interest in as much as many writers even up to the present have connected breast inflammation and abscess with the amount of lochia; and many early writers in the nineteenth century connected breast inflammation with obstruction to the flow of lochia.

Paracelsus ³ in the early part of the sixteenth century described the condition. According to him it occurred in a woman with child or after child-birth. The woman would complain of a pain, swelling, redness, and hardness in her breast, which afterwards turns to an ulcer and putrefaction.

Smellie ⁴ connected breast inflammation with the lochia and also gave a more detailed discussion of its causes, associating it with too frequent or too prolonged nursing periods, or as occurring more often in women who never nursed or did not take measures to empty their breasts.

Until the latter part of the nineteenth century, the opinions were very much the same concerning the causes of breast inflammation. It was attributed mainly to congestion of milk ^{5,6} and to increased circulation after parturition which went beyond healthy limits.⁷ Valpeau ⁶ agreed with Smellie that it was more apt to occur in women who weaned their children early.

Meigs ⁸ also suggested that the type of clothing may predispose to this affection and mentioned that the ideal breast supports were similiar to the Greek strophium or

Roman fasciola. Along this line it is of interest to note that Engelman⁹ reported few Indian women had any mammary trouble after their confinement, notwithstanding the fact that they were exposed to the same causes that were such a prolific source of those complications among whites.

Other predisposing causes mentioned were sore nipples,¹⁰ impaired general health,¹¹ primiparity,¹² the puerperal month,¹³ mental agitation,¹¹ engorgement,^{5,6,12,13,14} trauma,¹² nursing,¹⁵ and a constitutional predisposition.¹⁵

Since the true pathology was unknown, the treatment was mainly individualistic. Various plasters were fairly common apparently having been in use from before 1500 B.C. up to the present. Leeches were used by several before the suppurative stage.^{5,6,8,11,16} Of course the medical prescriptions were too numerous to mention. Once an abscess had formed, it was generally recognized that it must be opened and drained.^{4,16} Burns¹¹ described vividly the fatal termination of some cases: "If neglected, new abscesses and sinuses are formed and often both breasts are involved. There are daily shiverings, sick fits, and vomiting of bile, or absolute loathing at food, diarrhea, and either perspiration or a dry scaly or leprous state of the skin; and sometimes the internal glands seem

to participate in the disease, as those of the mesentery; or the uterus is affected, and the matter is discharged from the vagina. After suffering some months the patient sinks."

During the latter part of the nineteenth century, the theory of infection by micro-organisms arose. Then the entire view was revised and the inflammation came to be regarded as a reaction of the organism, provoked by the presence of microbes in the tissues, which must be neutralized or destroyed.¹⁷ Bumm,¹⁸ in 1884, in discussing the etiology of mastitis pointed out the presence of bacteria in the milk of women suffering from mastitis. Two years later¹⁹ he also demonstrated microbes in the milk of apparently normal healthy women, thus confirming the work of Pallecke.²⁰ This reopened the field to pre-disposing causes of mastitis and today it is recognized that some factors other than the presence of micro-organisms, even pathogenic microbes, is necessary to the development of a mastitis.

It might be well to mention here that some of the early work on micro-organisms as the cause of mastitis was directly due to the dairy interests. Macfadyen²¹ and others, in working on mastitis in cows, came to the conclusion that there probably were numerous mastitis bacilli, each capable of causing a definite entity.

Etiology

Incidence:

The incidence of mastitis in lactating women can not be definitely stated. The reported incidence varies from three-tenths (.3) of one (1) per cent to six (6) per cent. Winckel ²⁹ stated that it occurred in six (6) per cent of all nursing women. Jewett ³⁰ reported an occurrence of five (5) per cent to six (6) per cent. Norris ³¹ in 1918 from various sources found a range of five-tenths (.5) to four (4) per cent. Dorman and Mossman ³² in 1921 from two thousand (2000) cases reported an incidence of two and eight-tenths (2.8) per cent. Wolpert ³³ in a study of nine thousand eighty six (9086) cases, delivered from 1918 to 1923, found an incidence of thirty-four hundredths (.34) per cent. Bland ³⁴ in 1927 from various sources gathered reports ranging from five-tenths (.5) to five (5) per cent. Smith ³⁵ found abscesses developing in from thirteen-hundredths (.13) to one and seven-tenths (1.7) per cent of the cases delivered. Dippel and Johnston ³⁶ reported suppuration in one (1) out of two hundred twenty two (222) cases occurring from 1896 to 1924, and since 1924 suppuration occurred in one (1) out of every one hundred thirty one (131) deliveries. Davis ³⁷ states that formerly the incidence of mastitis was around six (6) per cent but that at the present time it is less than one (1) per cent. Klahn ³⁸

in 1937 in a study of sixteen hundred fifty six (1656) cases delivered since 1934 reports mastitis developing in three and seven-tenths (3.7) per cent of the cases. The explanation for the wide variation in these figures is difficult but it probably lies in the type of records kept as well as in the differences in diagnosing the presence of mastitis. Hospital records are inaccurate because many cases develop after the patient is dismissed from the hospital. Personal records are often inexact because many cases which develop are not treated by the doctor who delivered them and so are not in his own records. For these reasons Heaton ³⁹ states that the incidence of breast infections reported as a cause of puerperal morbidity always tends to be relatively too low.

Pre-disposing Factors:

Acute pyogenic mastitis is a condition which may occur at times other than during lactation. It is a condition which may, rarely, affect males. In the female, instances before puberty and after the menopause are rather uncommon ³² and are apt to be infections or abscesses of the adjacent tissues which secondarily involve the breast. Mastitis may occasionally develop during pregnancy but it is most often associated with lactation. Nunn ²³ reported seventy two (72) cases of which fifty eight (58) occurred during lactation and seven (7) during pregnancy.

Bryant ²⁴ reported one hundred two (102) cases of which seventy nine (79) developed during the puerperium and two (2) during pregnancy. Billroth ²⁵ in fifty six (56) cases had forty four (44) cases in lactating and four (4) in pregnant women. Battle and Bailey ²⁶ reported seventy one (71) cases of which only fifteen and five-tenths (15.5) per cent were neither pregnant nor lactating. Shields ²⁷ reported two hundred (200) cases of which one hundred sixty nine (169) were associated with lactation. DeLee ²⁸ states that mastitis occurs almost exclusively in nursing women. It appears obvious, therefore, that mastitis is usually associated with some functional change in the gland, or it occurs during some epoch of development when the tissues are undergoing changes. Furthermore, it seems unquestionable that lactation is probably the most important single factor pre-disposing to mastitis.

Moon and Gilbert ⁴⁰ compared the frequency of acute mastitis in hospital and home deliveries and found it mainly a disease of institutions. In this they agreed with DeLee ²⁸ who believed that patients at home were subjected to organisms to which they have acquired an immunity through constant association. DeLee also believed that the poorer classes in general were less subject to the puerperal infections than the well-to-do for the same reason. Smith ³⁵ agreed with this latter contention of DeLee's but offered

reports showing an increased incidence of abscess in private practice as contrasted to hospital care. Dippel and Johnston ³⁶ disagreed with Smith that the development of abscess was more prevalent in private practice and their figures showed an incidence of one (1) in one hundred seventy five (175) in ward deliveries and but one (1) in four hundred twenty (420) for private practice. Thus the condition would seem to be less common in private practice and home deliveries.

Since the condition is one usually associated with pregnancy and lactation it may be concluded that acute mastitis is commonly an affection of the younger women in the child-bearing age. In this respect in a study of over one hundred (100) cases, Dippel and Johnston ³⁶ report an average age of slightly over twenty two (22) years for both the white and colored races. They also found very little difference in the incidence between white and colored races.

The question of a seasonal change in the incidence of mastitis was first suggested by Fordyce Barker in 1883 who pointed out the frequency of mastitis in the fall and winter and also in certain years.⁴¹ Baer and Reis ⁴² noticed an increase in breast infections following the influenza epidemics of 1919 to 1920. They attributed this to the decreased general resistance of the populace following

the epidemics. Leigh ⁴³ mentioned low resistance as a pre-disposing factor but did not mention seasonal incidence. Smith ³⁵ gave the greatest incidence between November and April when the general health of the people is poorest and infections of all kinds are common. Dippel and Johnston ³⁶ reported a seasonal incidence with an increased frequency during the winter and spring months with the peak in January and February. They believed there must be some connection with the high frequency of colds during this same time of year. Moon and Gilbert ⁴⁰ also reported a periodic variation with the crests occurring for the most part the last two and first two months of the year. It does seem that there is a seasonal variation, as these writers agree, with the maximum frequency of mastitis occurring between November and March. This seasonal variation is probably associated with the decreased general resistance prevalent at that period.

It has been found by many investigators that acute mastitis is much more frequent in the primipara. Tassi, ⁴⁵ Pototschnig, ⁴⁴ and Dippel and Johnston ³⁶ agree that the affection is more common in women after delivery of their first baby than at any other time. Wolpert ³³ reported sixty (60) per cent of the cases were in primiparae; Smith ³⁵ reported seventy (70) per cent in primiparae;

Moon and Gilbert ⁴⁰ reported seventy three (73) per cent; Klahn ³⁸ reported sixty (60) per cent in primiparae. Sherrick ⁴⁶ found the condition more common in primiparae. DeLee ²⁸ makes the same statement. From this, the conclusion may be drawn that whatever the cause, inexperience in nursing or greatest tendency to other pre-disposing factors, acute mastitis occurs with much greater frequency in the primipara.

Moon and Gilbert ⁴⁰ in studying lactation and interference in labor came to the conclusion that interference in labor is a pre-disposing factor. They found an increased incidence of induction, Caesarean section, forcep deliveries, and perineal lacerations or episiotomies in those suffering with mastitis. Correcting for the large number of primiparae (increased incidence of obstetrical interference in primiparae⁴⁸) the figures for instrumental delivery are still double the average. Smith ³⁵ claims operative delivery is not a factor. Klahn ³⁸ also found the distribution of obstetrical techniques to be about the same as in a similar normal group.

Rucker⁴⁷ states that the times of special danger of mastitis developing are: (1) when the mother leaves the hospital or discharges her nurse; (2) when she begins wearing street clothes; and (3) when her milk begins to fail. In the first case one would expect an inexperienced primipara

or otherwise careless woman to not care for her breasts properly or to nurse improperly. In the second instance, it has already been mentioned that long ago too tight clothing was thought to pre-dispose to the condition. In the last instance, with a strong baby and failing milk supply, trauma is very apt to occur especially with a baby developing teeth. In the line of special times of occurrence, the concensus of opinion is that the majority of cases develop in the first puerperal month. Sherrick⁴⁶ says that is because the breast is unused to its new function and that faulty habits of nursing and care are used with unnecessary trauma and neglect. Tassi⁴⁵ says that while the affection developed sometimes in the later phases of the puerperium it was observed more frequently in the first week after delivery. Smith's³⁵ cases occurred at on an average of the fifth and one-half post-partum week. Dippel and Johnston³⁶ report the majority of cases occurred during the third and fourth puerperal weeks. Dorman and Mossman³² found the seventh to the twelfth post-partum days were the chief offenders. From this it may seen that mastitis after delivery is most apt to occur within the first puerperal month.

The possibility of the milk being a factor must be considered. Klahn³⁸ reported that the average milk production of the sixty two (62) women who developed mastitis at the hospital was above the average of the grand total

in the hospital; and forty six (46) of those women were individually above the general average and only nine (9) were below. Certainly, as he says, these women have no functional inferiority. Lowenfeld and Widdows⁴⁹ classified milk into a primiparous type and a multiparous type and also drew attention to the disturbance observed in sugar values of the milk in morbid states of the breast. Whether this is a cause or result is not known yet. As Moon and Gilbert⁴⁰ suggested, however, it may help to explain the higher incidence of mastitis in primiparae.

According to the old ideas, the acute inflammations of the breast in the puerperium were attributed to engorgement of the glandular structures with stagnant milk. Since then we have learned that this condition is not so simple a matter. However, the question of congestion is still considered one of the prime pre-disposing factors of mastitis by many writers on the subject. Pototschnig⁴⁴ mentions that in minor breast affections it would be a mistake to suspend feeding because the gorging due to the suspension of feeding is instrumental in developing a mastitis. Meyerhoff⁵⁰ states that regular and complete emptying of the breasts is the best protection against mastitis. Dippel and Johnston³⁶ found what they termed simple mastitis (engorged breasts) present as a pre-disposing factor in twenty (20) per cent of their cases.

Battle and Bailey³⁶ believe engorgement to be very important. Klahn³⁸ in his series of cases found that none of the women, who for some reason, were unable to nurse at the breast, but pumped off the milk, developed mastitis; and so he concluded that this technique eliminated the chief causes of mastitis, namely congestion and trauma.

In contrast to these opinions we have Williams¹⁷ who discussed experiments on suckling animals where the outflow of milk was artificially prevented, and no inflammation followed unless the milk contained an abundance of microbes. DeLee³⁸ also states that simple milk stasis or local or general engorgement seldom leads to abscess, if it ever does, alone. Holzapfel⁵¹ also states that if congestion of the milk plays an essential role in the origin of mastitis, then mastitis should be more common than it is. While this seems a very logical opinion, it must be remembered that other factors must be considered. In any case it certainly seems conceivable that a markedly distended glandular structure would have a decreased resistance. Bradley,⁵² in fact, considers that leaving the breast partly distended with milk hastens epithelial atrophy through pressure.

The stasis of milk which accompanies an engorgement also seems to be a factor of importance. Valerio⁵³ believes that stasis is undoubtedly one of the most important

factors. Sherrick⁴⁶ states that with poor drainage, the breast secretions stagnate and act as a chemical stimulant and irritant within the organ. Keynes⁵⁴ is of the same opinion, describing a condition which he called "stagnation mastitis" seen in women who for some reason have been compelled to cease nursing a child soon after birth. This condition is believed due to the irritation of the reabsorbed secretions. In addition to this phase of the stasis, it is also unquestionable that the warm stagnant milk would serve as an excellent culture media to the majority of the organisms likely to give rise to a mastitis.

In discussing congestion and stasis, one should consider the functional states in which they are present. The condition called caked-breast is a local engorgement affecting one or more lobules or lobes. It is occasionally due to occlusion of the ducts but may be the result of injury. In this condition you have a small lump of hard convoluted glandular tissue which is tender but without the signs of real inflammation or of a general reaction. According to DeLee²⁸ this condition seldom leads to a mastitis unless traumatized though it is understandable that the bacteria normally present in the lactiferous ducts could thus more easily attain invasive qualities.

One might expect congestion and stasis during involution. In artificial involution due to sudden weaning or

death of the child, etc. there is an attendant breast engorgement which is important as a pre-disposing factor in a mastitis. Battle and Bailey²⁶ say it is a factor in ten (10) percent of the cases. Here you have, as already shown, a milky engorgement which has affected the resistance of the glandular tissue and a stasis of milk which may serve as an excellent culture media for bacteria.

The period of natural involution is also a time during which mastitis may occur. In addition to the possibility of congestion and stasis during this period you have the increased likelihood of trauma, since, as already mentioned, at this time you probably have a large strong baby who has already developed teeth.

Among the pre-disposing causes, one constantly sees sore nipples. Sore nipples may be due to fissures or rhagades, cracks, abrasions, ulcerations, blisters, and erosions. Sore nipples are one of the frequent complications seen early in lactation. DeLee³⁸ says that over half of nursing mothers suffer from sore nipples. This condition is more common in the primipara; in blondes⁴⁶ and especially red-heads²⁸; and in those with retracted or deformed nipples.^{46,28} Smith³⁵ states that darker skins are more resistant to staphylococci and finds that blondes are more prone to develop a mastitis and also says

that 'red-heads' are a special group which seldom go through a lactation without breast complications. Billroth²⁵ years ago, decided that stasis and engorgement were a result of inflammation rather than a cause since many who suddenly ceased nursing never developed mastitis. He also came to the conclusion that disease of the nipples must be the cause of a mastitis developing. Rodman⁵⁵ believed that infection occurred through the nipples by means of some abrasion, etc. Dorman and Mossman³² believe that nipple contamination is the commonest source of infection and that the cracks and fissure, etc. favors the entrance of the organisms. Pototschnig⁴⁴ also believes that the infection in most cases is due to fissures and abrasions. Bland³⁴ states that the portal of entry is a weak protective epithelium and that the entrance of bacteria into the parenchyma of the gland is favored by fissures, maceration of the epithelium, blisters, etc. Riff⁵⁶ states that staphylococci and streptococci cannot penetrate the mammary gland of nursing women except by a fissure of the nipple. Puppel⁵⁷ believes the occurrence of early puerperal mastitis is due to the forgetfulness of rhagades. Kahr⁵⁸ says essentially the same as Kilgore,⁵⁹ namely that lack of cleanliness and fissures of the nipple are the main predisposing causes of mastitis.

Moon and Gilbert⁴⁰ found that many patients develop sore nipples and no mastitis and so they thought the importance of cracked nipples was exaggerated. According to them, the role of cracked nipples depends on the fact that they are good media for bacterial growth, but that is not the only factor to be considered. They did, however, find some nipple trouble in all but fourteen (14) of forty (40) cases. Dippel and Johnston³⁶ found cracked nipples present in only eight (8) of thirty nine (39) cases and considered it one of several pre-disposing factors. Meyerhoff⁵⁰ and others³⁶ have also advanced the hypothesis that rhagades, sore nipples, etc. may act by causing a congestion mastitis since nursing from a sore nipple is painful and the breast is apt to be incompletely emptied or not emptied at all due to nursing being suspended from the affected breast. This certainly is a thought worthy of consideration. It is quite likely that sore nipples act in several ways: to cause congestion and stasis; and to serve as a site of entrance, and as a culture media for the bacteria.

While the traumatic factor has been mentioned by many writers, it has not as yet received the proper attention. Many writers have noted that mastitis was of more frequent occurrence on the right side.^{25,27,36,40} Dippel and Johnston³⁶ also carefully charted the sites of the lesions

and found the inferolateral quadrants most often involved. When one considers the fact that more people are right handed and also that in moving the arm one would expect more trauma to the inferolateral portions of the breast, then the above findings seem to give added importance to minor trauma as a pre-disposing factor. In this connection, however, the incidence of left-handedness in those cases of left breast mastitis should be studied. There is, possibly, some conclusion other than of trauma to be drawn as a pre-disposing factor from the much greater incidence of mastitis in the inferolateral quadrants of the breast, but no other suggestion seems to be so adequate.

In addition to the possibility of trauma as suggested above, in any series of cases one will find several with a history of some accidental injury to the breast and many of these accidents seem to be the definite exciting agent to the development of an acute mastitis. Smith³⁵ suggests injudicious massage as a traumatizing factor and many other writers have also mentioned it. Dorman and Mossman³² state that probably manipulation of distended breasts may diminish the natural resistance of the tissues. DeLee³⁸ states that trauma is often the exciting factor: by some direct injury which may have been remote, by squeezing the breast, by massage, by too much pumping,

etc. Unquestionably trauma is a factor of great importance pre-disposing to a mastitis.

In addition to the factors already discussed, some mention should be made of foci of infection. Dippel and Johnston³⁶ found active foci of infection present in fifteen (15) of thirty nine (39) cases studied. Smith³⁵ stated that almost half of his cases had some foci of infection and listed them in the order of their frequency as disease of the kidneys, pelvis, tonsils, teeth, and sinuses. The fact that organisms cultured from a mastitis are often identical with those cultured from the focal infection might suggest that foci of infection are an important pre-disposing factor in themselves. However, their importance may lie only in the effects they have on the general health of an individual and in lowering his general resistance.

While these foregoing pre-disposing factors have been discussed mainly from a puerperal standpoint, it is important to emphasize that some of them apply equally well to a mastitis developing ante-partum. In particular one should stress the importance of trauma to the breast pre-disposing to a mastitis during pregnancy. Witcher⁶⁰ and Olch²² believed that trauma is of more importance in a mastitis during pregnancy. There is one other factor not previously mentioned which Dippel and Johnston³⁶

offer as pre-disposing to a mastitis in pregnancy, and that is the glandular changes in the breast. This was suggested to them by the work of Allen⁶¹ who has shown that early in pregnancy the breast and particularly the duct system hypertrophies and with this its vascularity increases; while during the latter half of pregnancy, there is an hypertrophy of the alveoli and a secretion of the epithelium lining these glandular structures. Since mastitis occurs with so much greater frequency during pregnancy and lactation, it is reasonable to assume that the structural and functional changes in the breasts are of primary importance in pre-disposing to a mastitis.

Organisms:

It has been recognized for a long time that pyogenic organisms are often found in the ducts and the milk of normal healthy women who never develop a mastitis. Pallese²⁰ in 1892 demonstrated the presence of micro-organisms in the milk of healthy women. Cohn and Newman⁶² demonstrated the same condition even before Pallese. DeLee²⁸ says that in 1893 he also showed the presence of bacteria in the ducts and milk of normal breasts. Kostlin⁶³ examined the milk of one hundred (100) lactating women and found only fourteen (14) were sterile, the rest were infected with staphylococci albus (only two (2) per cent with

staphylococcus aureus). Moon and Gilbert⁴⁰ only recently made thorough studies of the milk in one hundred (100) perfectly normal lactating women and found over half infected with staphylococci; of which the majority were infected with staphylococcus albus alone, a much smaller number with a combination of staphylococcus albus and aureus and only one with staphylococcus aureus alone. Judging from this, it seems streptococci are only rarely found in the normal milk ducts.

Most writers agree that the most common organisms causing acute mastitis are the staphylococcus aureus, the streptococci, and more rarely the staphylococcus albus and the bacillus coli. Occasionally mixed infections occur. Seeleman⁶⁴ reported seventy six (76) per cent were caused by streptococci. Rubeska⁶⁵ found staphylococcus aureus most common as did Holzapfel,⁵¹ Battle and Bailey,²⁶ Heaton,³⁹ and many others. Moon and Gilbert⁴⁰ in cultures from twenty eight (28) cases of acute mastitis found staphylococcus aureus in all of them. Tassi⁴⁵ in eighteen (18) cases found the staphylococcus aureus in thirteen (13), streptococci in four (4), and the staphylococcus albus in only one.

Dippel and Johnston³⁶ took cultures in sixty one (61) cases and the report showed staphylococcus aureus in forty (40), staphylococcus albus in seven (7), mixed staphylococci in one, undifferentiated staphylococci in two (2),

streptococcus hemolyticus in eight (8), undifferentiated streptococci in two (2), and one (1) culture was sterile. From these reports it seems without doubt that the staphylococcus aureus is the most common offender with the streptococci following. Apparently the staphylococcus group accounts for approximately eighty (80) per cent of all cases of acute mastitis. Numerous other organisms have been reported occasionally as causing mastitis such as the pneumococcus,⁶⁶ Leoffler's bacillus,⁶⁷ gonococcus,⁶⁸ bacillus pyocyaneus, bacillus Welchii, oidium albicans, and blastomyces.⁶⁹ Clemente⁷⁰ reported a case of primary Malta Fever during the puerperium ushered in by a incipient mastitis and says other authors have also reported it. Despite the numerous organisms which may cause acute mastitis, it is only very rarely that any other than the pyogenic group is ever involved during the antepartum or puerperal periods.

Source of Infection:

These organisms get to the breast in any of many ways. The patient may infect herself, and probably does so frequently, often from the lochia. The frequency of mastitis during the period when upper respiratory infections are common suggest the possibility of droplet infection or again the hands may transmit the infecting agents. The attendants may carry the infection to the

patients' breast. Clothing and linens are a possible source of infection as has already been suggested. The nursing child may often be the source of infection, especially a child having thrush, pharyngitis, ophthalmia, coryza, pemphigous, impetigo, or any pustular condition.²⁸ Dorman and Mossman³² mention a case where a mildly inflamed forceps injury on the cheek seemed to be the source of infection. Schalck⁷¹ immediately after birth found staphylococci in the mouth of eighty (80) per cent of all newborn babies, streptococci in fifty two (52) per cent, pneumococci in sixteen (16) per cent, bacilli coli in thirty two (32) per cent, etc. Heaton³⁹ mentioned the baby's mouth as a source of infection as did Hamm,⁷² Battle and Bailey,²⁶ Davis,³⁷ and many others. Moon and Gilbert⁴⁰ suggest the possibility that the persistence of infection in hospitals may depend on the same virulent organisms since Hektoen and Kirschsteiner⁷³ have shown that streptococci and staphylococci will live, dried in the air and exposed to diffuse daylight up to ten (10) days, and over a month in dark places. As you can judge from all these facts, the sources of infection seem limitless and strictest precautions are advisable. They also found an incidence of over twenty two (22) per cent of infantile complications (conjunctivitis, coryza, and pustular eruptions) recorded in histories of these mastitis

cases as against ten (10) per cent as a general nursery record.

Portal of Entry

Just how the organisms get into the tissues is open to considerable discussion. There are three routes possible, and each of them have strong arguments in its favor. Obviously these portals of entry are by way of the ducts, by the lymphatics, or via the blood stream.

Ever since it has been known that organisms are often normally present in the ducts and about the nipples of healthy lactating women, many have believed the ducts are the main portal of entry. Cheatle and Cutler⁷⁴ state that the patency of the duct openings (in the state of lactation) and of the ducts themselves may be of etiological importance in the infective as well as the neoplastic processes that originate in the breast. Dawson⁷⁵ also said that the openings of the milk ducts on the nipple, normally closed in the resting breast by a plug of keratin debris, are patent during lactation and facilitate infection from the skin surface. This probably explains the presence of the organisms in the nipples and ducts. Unquestionably in many cases, the organisms already present in the nipple may develop invasive powers. Such a condition is probably aided by the development of engorgement and stasis

as has already been mentioned. Meyerhoff⁵⁰ believes that the organisms gain entry to the interior of the breast by way of the lactiferous ducts; and Moon and Gilbert⁵⁰ had several cases which seemed to directly substantiate that conclusion. Bumm¹⁹ in 1886, found that the glandular structures teemed with staphylococci, which made their way thence into the surrounding tissue. Dawson⁷⁵ agrees with this. The facts all point to the conclusion that in many cases the portal of entry is often through the ducts of the gland.

The high incidence of cracks and fissures about the nipples preceding a mastitis has led many writers to the conclusion that these conditions serve as the portal of entry for the organisms which then follow the lymphatics and cause a mastitis. Holzapfel⁵¹ believes that this is the true portal of entry and remarks that if the ducts were the portal of entry, then pus would be found more frequently in the lactiferous ducts. Olch³² believes the flow of milk would prevent the organisms traveling down the ducts and also stated that the increased patency of the lymphatics during lactation (also mentioned by Dawson⁷⁵) makes infection from the cracks and fissures much easier.

Benians⁷⁶ stated that there were two different conditions: (1) that in which entrance is effected by strep-

cocci via cracks in the nipples; and (2) that in which staphylococci find access to the breast by means of the ducts. Hamilton Bailey⁷⁷ confirmed this statement and also says that the latter is by far the more common portal of entry. Tassi⁴⁵ in his studies stated that the search for the bacteria in the tissues failed to show the route traversed by the different germs.

The third possible route of infection is from the blood stream. Escherich⁷⁸ years ago suggested that since microbes which have entered the blood are often eliminated by the secretions, then possibly microbes associated with puerperal septic conditions, which enter the blood through lesions connected with the genital tracts, often find their way into the milk. Olch³³ in discussing hematogenous infection says that where there is a history of trauma (especially in a non-lactating woman) the assumption is that the traumatized tissue acted as an area of decreased tissue resistance; and the bacteria lodging there from the blood stream, found local conditions more favorable for their growth. Another factor, which some consider increases the importance of the blood stream as a source of infection, is the high number of mastitis patients with foci of infection; and also, the seasonal variation which shows its greatest incidence during the period of upper respiratory infections.

We may conclude, therefore, in a lactating breast, the two main portals of entry are: via the ducts, especially with staphylococci; and via the lymphatics, especially with streptococci. Hematogenous infection is more rare in puerperal mastitis though it can and does occur and is especially associated with puerperal sepsis. In contrast, hematogeneous infection is probably the most common source of infection in mastitis developing during pregnancy. Of course, during pregnancy and lactation, as at other times, a mastitis may develop from an extension of another infection such as a boil, furuncles, osteomyelitis of the ribs, etc.

Briefly stated, the causes of mastitis are contamination with a pathogenic organism and the presence of a diminished local resistance.

Pathology and Classification

It has often been remarked and is certainly true that the pathology of acute mastitis, especially in its early stages, is not definitely known. Schultz⁷⁹ said that anatomic studies of the first stages of a mastitis which would clarify the pathology of the infection are lacking, and though several have attempted to clarify the situation the results are open to various interpretations.

Bumm¹⁹ studied sections at different stages of the disease and decided that the microbes proliferated in the

glandular structure thus causing the milk to ferment, its sugar being transformed into lactic and butyric acids, while its casein coagulated. The glandular structures then became filled with coagula, teemed with bacteria and soon inflammatory changes manifested themselves in the peri-glandular tissues. Certainly it is not difficult to believe that the infecting organisms multiply in the milk and serum about the fissures, etc., and then pass into the breast along the milk ducts with absorption by the lymphatics. The difficulty lies in proving that the glandular portion was primarily involved, and not secondarily from a primary lymphangitis.

It is just as simple an hypothesis that the organisms entered through the lymphatics and the first pathology was a lymphangitis. This can not be decided at present. However, it actually makes little difference since the channels of dissemination for inflammation (lymph and vascular) all follow the ramifications of the gland.³⁵ In other words the inflammatory reaction, though it follows the ducts, etc., may equally well be derived from the small lymphatics which lie so close to the ducts and acini. The acini become surrounded and partially covered by an inflammatory cellular infiltration. The infection never involves the entire gland at once but inflammatory foci are formed which are separate but usually tend to

coalesce, and suppurate together.

The most important point about infection in mammary tissue is that the process leading to abscess formation destroys the glandular structures in the involved areas and ends in its replacement with fibrous tissue. Early there is the typical inflammatory reaction with hyperaemia and tissue edema. Polymorphonuclear leucocytes migrate into the area. Tassi⁴⁵ stated that the lumen and fundus of the glandular portions were infiltrated with cells of hematic origin and the surrounding connective tissue was infiltrated with both hematogenous and connective tissue elements. The inflamed tissues are at first congested, swollen, hard, and painful. With proper treatment the inflammation often stops at this point and resolution takes place; but occasionally it progresses to suppuration.

The breast parenchyma is very cellular during the late stages of pregnancy and especially during lactation since it is then composed mainly of glandular epithelium. This tissue is not resistant to infection, and so, once the organisms enter the parenchyma, this tissue easily undergoes disintegration and liquifaction and gives rise to one or more abscesses.

The abscesses of the breast may be classified according to their location, as sub-cutaneous (usually

sub-areolar), retro-mammary and intra-mammary. The latter may be further sub-divided into parenchymatous and interstitial or phlegmonous types.

Sub-cutaneous infection seldom affects the out-lying portions of the breast. It is usually a sub-areolar condition. It may be localized forming small abscesses or boils usually in connection with the sebaceous follicles. The inflammation may be diffuse and suppuration gives a superficial abscess. It is not uncommon to find a fistulous communication with the milk ducts. In such a case the abscess will drain milk mixed with the pus.

The retro-mammary or sub-mammary abscess is not a common condition. Most writers agree that it probably starts in the deeper portions of the gland and breaks through the layer of dense connective tissue at the base of the gland into the looser areolar tissue beneath. The pus accumulates in this looser tissue and the entire breast is elevated and lifted away from the chest wall so that usually it may be moved as if it were on a cushion.

The inflammations of the intra-mammary type may involve either the parenchymal or interstitial tissues, but more often is a combination of both. In fact it is difficult to conceive of one type not involving the other so close are the tissue relationships. In any case the pus may easily perforate from the connective tissue into

the glandular portions and vice-versa. Tassi⁴⁵ in attempting to show the route traversed by the different germs, found that in general the staphylococci occupied the glandular acini, while the streptococci were localized in the periacinous connective tissue. This may indicate either a difference in the route of infection, or an affinity between the different organisms and the different tissues, or a difference in the tissue resistance of each to the different organisms. In any case it does suggest that there must be two types of intramammary inflammation since it is the organisms which give rise to the inflammation. It is also a well known fact that streptococci infections tend to be more diffuse and much more virulent; in fact in some diffuse cellulitic cases the entire breast is involved forming what has been called a pan-mastitis. In the latter condition the entire breast becomes one huge abscess and all functioning elements are destroyed.

Prognosis

The prognosis of acute mastitis is good. The usual opinion expressed is that suppuration and abscess formation will occur unless the condition resolves itself in forty-eight hours. The various figures presented show that suppuration occurs in from over eight (8)⁸¹ per cent to seventy six (76)⁴⁰ per cent of the cases of mastitis.

Heaton³⁹ stated that abscess formation occurs in over sixty (60) per cent of the cases of mastitis. Dorman and Mosseman³² reported fourteen (14) per cent of their cases developed an abscess. Many others have reported their results and in general these show little uniformity. Apparently many factors enter in the development of an abscess but the most important factor is probably the virulence of the organisms involved.

However, the occurrence of an abscess does not prevent lactation and nursing in a later pregnancy. In fact, usually there is little difference noted in a later pregnancy. Bloodgood⁸² noted that even multiple abscess formation, if rightly treated, is no hindrance to subsequent lactation. Dawson⁷⁵ reported that mammary tissue cut in large sections from patients who gave a definite history of earlier abscess formation with incision and drainage, rarely shows scar tissue. Coen⁸³ found in experimental aseptic wounds of the breast, that the injured area later showed ingrowth of new glandular structures. Dawson⁷⁵ believed that the same condition occurred in septic lesions and assumed that the activity of a subsequent pregnancy causes a glandular proliferation in the affected tissue as well as in the rest of the mammary area. Since most authorities agree that breast abscess does not greatly affect subsequent lactation then

we may well believe that some such phenomena does take place.

In general the causes of failures in feeding later babies are retracted nipples, deficient secretion and painful scars. It has been noted that one abscess does not pre-dispose to the development of another in a future pregnancy.³⁶ While most breast abscesses heal leaving little change in the breast structure and no palpable deep scar, Kilgore⁵⁹ calls attention to Bloodgood's notation of a small group in which a palpable mass in the breast has persisted, presenting microscopically a curious and remarkable hyalinization of periductal tissue. Kilgore⁵⁹ stated that this type of abscess scar must be regarded as pre-cancerous and so advised that all patients developing breast abscess return after a years time for examination. Buchanan,⁸⁴ Gould⁸⁵ and others, however, state that there is no evidence that carcinoma occurs with any greater frequency in breasts that have been the site of a former infection. It may be concluded, therefore, that while in the vast majority of cases acute mastitis does not pre-dispose to a later carcinoma, a few cases, following an abscess, may have a residual deep scar which is pre-cancerous.

The mortality of mastitis and breast abscess is less than one per cent; however, cases are reported where a

virulent infection coupled with low resistance occasionally produced a fulminating phlegmonous inflammation and occasionally even gangrene which terminated fatally.

Complications

The possible complications of an acute mastitis are often disregarded. Complications to the mother are often neglected entirely. It must be remembered that the nursing may transfer the infection from the affected breast to the normal breast. Probably most of the cases of bilateral acute mastitis develop in this manner. Another factor to be kept in mind is that of a blood stream invasion. Nurnberger⁸⁶ stated that it must be remembered that the initial chill means the entrance of bacteria into the blood stream just as in other localized infection; and that the difference between the passage in the blood at the initial period and in the periodic or constant passage of bacteria in the blood in genuine sepsis is one of degree and not of character. He presented a case of a clinically mild acute mastitis which was followed by a purulent metastasis to the right arm and infiltration of the right thigh without abscess formation. There was no external cause for this spread. Apparently blood stream infection in acute mastitis is not as rare as most authorities state.

If an acute mastitis is neglected or improperly

treated, a chronic mastitis will often result. It is often of aid to know whether syphilis or tuberculosis is present.⁸⁷ The complication of chronic mastitis should be avoided if at all possible since it is a condition which may drag on for years and later may present considerable difficulty in differential diagnosis.⁸⁸

Another important complication is the danger of infecting the nursling. Puppel⁵⁷ reported a case where the mother continued nursing even though she had some breast trouble on both sides and when she was later seen in clinic the infant had a septic pleuropneumonia which soon proved fatal. Runge⁸⁹ reported five cases of infection of the nurslings from the mother's milk in which only one infant recovered. Other such cases have been reported.⁹⁰ The obvious conclusion is that acute mastitis may be of greater danger to the infant than to the parent.

Diagnosis

Symptoms:

Some of the symptoms of acute mastitis often manifest themselves a day or two before the acute onset. These prodromal symptoms may be headache, pain in one portion of the breast more marked while nursing, and, occasionally, a slight fever of around ninety nine (99) degrees. The acute onset is usually ushered in by a severe chill and fever. The temperature suddenly rises to about one hundred

and three (103) degrees though it may be even higher and is sometimes less. Pain in the affected breast is the rule and may or may not be severe. Frequently the patient complains of a sense of fulness or distention in the breast. Headache is a common complaint. The patient feels ill and varying degrees of lassitude and prostration are present. In the phlegmonous type of mastitis the constitutional symptoms are quite marked.

Findings:

The affected lobe of the breast, usually the infero-lateral, is quite tender and painful. The whole breast may be enlarged and tense throughout. The surface of the breast especially over the affected portions is reddened, flushed, edematous, and hot. There is induration which makes the breast seem firmer than the unaffected one and often the nipple is at a relatively higher level. Many times there is enlargement and tenderness of the regional axillary lymph nodes. The pulse is rapid and there should be a leucocytosis with an increase in polymorphonuclear cells. In short there are all the findings of an acute localized infection which is located in the breast. Often small quantities of pus may be expressed from the duct or ducts leading to the involved portion.

It is usually stated that properly treated, if the condition does not resolve and the temperature and pain

do not subside in approximately forty-eight hours (unless the other breast is also affected) then suppuration rarely fails to appear. In such a case, chills occur, the fever tends to become remittant, and a localized hard palpable mass is usually found. Unless quite deep, this mass palpably softens and one may then find definite fluctuation.

In the phlegmonous type of mastitis, one may find a fissure and, spreading from this crack, a reddened, fan-shaped area may be seen around the nipple. There may develop a brawny swelling of the skin. The symptoms are the same as already given though greater toxicity may be evidenced. Suppuration is quite common in this type of infection.

If a retro-mammary abscess occurs, then the entire breast is lifted from the thoracic wall, as if floating on a cushion, and edema may or may not be found at the periphery. The large collection of pus gives rise to very marked general symptoms and unless promptly treated, a bacteremia may ensue.

Differential Diagnosis:

The diagnosis of an acute mastitis occurring in the period of lactation is based on several obvious factors. The patient is usually a woman in the first month of

of lactation, and often there is a history of a painful nipple. Occasionally there has been some previous trauma. Usually the symptoms and findings are typical, most often occurring in a primipara in the third or fourth week of lactation. Knowing the other times of special occurrence of mastitis previously discussed is frequently a helpful point. All of these factors point to the correct diagnosis. If pus may be expressed from the duct of the affected lobe, the diagnosis is practically certain.

Of course atypical cases are not uncommon. Such cases are often in the suppurative or abscess stage when first seen. Occasionally the patient has no fever and only a mild leucocytosis and does not have any of the other usual general and local manifestations of an acute infection. Some cases develop a leucocytic infiltration and subsequent connective tissue formation which develops far ahead of the liquefaction of the breast tissue, so that one finds an excessive induration which dispels all suspicion of pus.⁹¹ These unusual conditions are more apt to be present in mastitis not associated with lactation. In doubtful cases, Schrager,⁹¹ Olch,²² and others have emphasized the importance of the use of the aspirating needle to clinch the diagnosis and so enable proper treatment to be started. Frequently an abscess in a non-lactating breast may simulate a solid tumor, Aspira-

tion is an economical and certain procedure in those cases and has very little danger attached to it.

Transillumination of the breast as a diagnostic procedure is of no value during lactation because the lactating breast is found to be completely opaque.^{92, 93} In those cases of mastitis developing in non-lactating women, there is a diffuse hazy shadow due to the greater vascularity engendered by the infection. This opacity, according to Cutler,⁹² gradually diminishes as the inflammatory process subsides, but complete translucency is not reestablished until three months after the acute process has begun to subside.

In any breast lesion, it is of vital importance that the condition be considered in relation to a malignancy. Kilgore⁹⁴ found that six and three-tenths (6.3) per cent of all his mammary lesions were first noted in connection with pregnancy or lactation and over half of those conditions arising during pregnancy or lactation were cancerous. It must be remembered that certain cancer cases have the appearance of acute inflammation.^{84, 95} As already stated, in the non-lactating breast, an abscess may simulate a solid tumor. While it is rare that a difficulty in differentiation between an acute inflammatory condition and a tumor exists, the importance of the correct diagnosis is obvious. Most swelling of the breast arising early in

lactation are either caked-breast or inflammatory mastitis; however, Kilgore⁹⁴ found twenty five (25) per cent of all lactation cancers in his series were first discovered in the early months of lactation - many during the first four weeks. The commonest mistake under such circumstances is to assume it is an inflammatory condition, and to delay exploration of the lump. In a further summary of his work Kilgore⁹⁴ concluded that the age of the patient at the time of onset of a lactation tumor is of little help in diagnosis. The diagnosis of a tumor in the period of lactation must be done by the exploration of the lump.

The differentiation of tumors and an inflammatory condition during pregnancy, especially in the early months may be aided by x-ray studies. Benign tumors show a circinate opaque area, often multiple with a dense periphery and no evidence of involvement of the adjacent tissues.⁹⁶ Malignancy shows the same picture but with involvement of the adjacent tissues. However, the x-ray will not definitely diagnose many breast lesions and in doubtful cases, exploration must be done.

Engorgement should not be difficult to differentiate. It usually occurs on the third or fourth day following delivery and denotes the establishment of lactation. There may be a slight elevation of temperature and the breasts

are often distended and painful. However, the fact that constitutional symptoms are not marked together with the time of appearance should make the diagnosis.

Caked-breast is a local engorgement and is also non-inflammatory. If an x-ray is made at this time the involved portion throws a shadow which is multiple and linear in type, following the general directions of the lactiferous ducts and their accompanying fibrous tissue.⁹⁷

Trauma to a breast may give rise to sufficient injury to cause a hematoma. This condition in a non-lactating breast may be diagnosed by the very dense opacity and irregular outlines as found in transillumination.⁹³ The history of trauma is important together with the sudden appearance of the lump and no signs of inflammation. Such a condition may easily become infected, however.

Trauma may also give rise to a condition of lipogranulomatosis or traumatic fat necrosis. There is a definite history of trauma in this condition together with an absence of fever, inflammation, and regional adenopathy. Usually the area involved is small and localized and there is no duct secretion from it. There may or may not be associated hemorrhage.

Another rare condition found in lactation though it also occurs at other times is the cystic enlargement of one or several milk ducts and known as galactoceles. They

are never attended by any constitutional disturbance, they come on suddenly, are smooth to the touch, not adherent to the skin, are seldom painful, and may be fluctuant or semi-solid.⁹⁸

Treatment

Prophylactic:

The first consideration in the treatment of any condition should be a study of the means of preventing it. While the incidence of mastitis has decreased considerable in the last fifty years, many men even today do not give enough attention to the prophylactic measures.

As soon as pregnancy is diagnosed, the breasts should be examined carefully along with the other routine measures now adopted. Existing deformities of the nipples should be treated if possible. If the nipple is small, undeveloped, or partially inverted by pressure of an improper support, then it may help to gently draw it out manually in the last weeks of pregnancy. Every woman should be instructed in wearing a proper breast support and in the care of the breasts and nipples. The latter is essentially a matter of cleanliness and keeping the skin soft and pliable. Tender nipples may be aided by some mildly astringent lotion or daily exposure to the air. As a prophylactic measure against the development of cracks, fissures, etc., the use of ultra-violet rays has been recommended by Maclellan,⁹⁷

Chatin,⁹⁸ and others. Every degree of trauma to the breasts is to be avoided and the patient should be advised to take particular pains not to injure the breasts in caring for them.

The care of the breasts post-partum is of vital importance. Cleansing the nipples before and after each feeding and use of a sterile pad over them between feedings is recommended.³² Warm water applied with soft pledglets seem to be as satisfactory as anything,⁴⁰ though boric acid or perborate solution may be used. Use of stronger antiseptics is not advisable because of the danger of overly hardening and injuring the skin.^{34, 44, 56} Oily or greasy ointments are also to be avoided because they are difficult to remove. After delivery of the baby, the infant should not be put to the breast for eight to twelve hours or longer; and for the first few days until lactation is established, he should nurse only three to five minutes at six to eight hour intervals. It is to be remembered that too frequent and too prolonged nursing may lead to a maceration of the nipples. The same factor should be remembered when the milk begins to fail, and adequate complimentary feedings given.

Engorgement, itself, seldom leads to a mastitis, but care must be taken not to traumatize the breast during this condition. It may be treated by restriction of

fluids, a tight binder, ice-bags, decreased nursing periods, and some advise massage. Pumping the breasts is seldom advised or necessary. Some patients prefer heat to the ice-bags. It is the injudicious pumping and massage that are most apt to traumatize the breast under these circumstances.

A caked-breast, being a local engorgement, should be treated similarly. However, if it appears after the first week of lactation, massage should not be used. The breast should be left alone, protected from injury, and nursing suspended from the affected side. The question of pumping in these later-developing caked-breasts is undecided. It does seem reasonable, however, that pumping may reduce a local stasis of secreted milk.

In weaning the child in the last part of lactation, the gradual accomplishment of this procedure is preferred. If this is not possible, or if nursing is suddenly suspended due to the death of the child, etc., then the breasts should be dried up. This is probably best done by a breast pump with a gradual increase in the time between each pumping. Various drugs, limitations of fluids, and binding the breasts may be used but seems a less sound practice physiologically.

The treatment of fissured nipples or rhagades is important from a prophylactic standpoint as well as the

patients comfort. Many writers advocate the use of an artificial nipple or breast shield as soon as any type of sore-nipple develops.^{26,36,39,44,46,50,57} Many authorities use some type of medication which has an astringent and hardening influence.^{27,36,44,51,58} Von Brucke⁹⁹ urges the use of a dry dressing of a powder containing tannic acid and formaldehyde. He had but one case of mastitis develop in twelve hundred (1200) women treated in this manner.

It is important to remember that where a sore nipple is present, the breast may be incompletely emptied by the nursing and a congestion develop. The cessation of nursing from the affected side and pumping the breast is a valuable procedure used by many and has the advantages that the child may still have the maternal milk and also that the dangers of virulent organisms being brought to the breast are decreased. Some state that continued sore nipples is a sufficient indication for weaning.³⁹ The use of a two to five per cent silver nitrate solution applied to the fissure or ulcer often is of aid.^{44,46} Painting the injury with iodine has been done.⁴⁴

The important principles in treating a sore nipple may be summarized as: (1) protect the nipple from the nursing and prevent congestion by use of a shield or the breast pump; (2) keep the area clean and as aseptic as possible; (3) do not resume direct nursing until the

lesion is absolutely healed. If the condition is painful some superficial anaesthetic agent may be used.⁵⁰ The use of the ultra-violet in curing fissures has its advocates.^{97,98} However, Hamm⁷² says the quartz lamp irradiation regularly caused a lymphangitis associated with rigors and fever.

One other prophylactic measure which has received slight attention is the substitution of the breast pump for nursing in cases of infections in the nursing. While many speak of the baby as a source of infection, few mention this prophylactic measure which would undoubtedly, if carried out, decrease the incidence of mastitis.

It also seems well here to call attention to the use of vaccines, etc. Many have tried various anti-bacterial measures as prophylactic agents. Hamm⁷² tried subcutaneous injection of vaccines but observed only exceptionally any appreciable increase in immune bodies and no particular protection against the infection in question. He also tried local vaccination by direct application of vaccine on the skin of the nipple in the form of an ointment. In the latter instance he believed some good results were obtained since he never observed a lymphangitis or galactophoritis in the women thus treated four (4) to six (6) weeks before the term of pregnancy although many seemed

to be pre-disposed, showing tender nipples, fissures, etc. This is a phase of prophylaxis which is certainly worthy of further study.

Active Treatment of a Mastitis:

The treatment of acute mastitis is a difficult subject to approach. The great diversity of treatments was well presented by Baer and Reis.⁴² There is no standard treatment as yet and it has been suggested that there probably will not be until some one can bring forward favorable statistics in a sufficiently large number of cases to carry conviction. That the baby should be taken from the affected breast, nearly all agree. This prevents transmitting the virulent organisms to the uninvolved breast and also eliminates the possibility of a severe infection in the nursling. Another procedure which is generally accepted is the use of a tight breast binder for support and pressure. The administration of a saline purgative is a common practice along with the restriction of fluids. The use of ice-bags locally is also urged by most authorities though many advocate warm dry heat. In any case, as soon as it becomes evident that the mastitis is going to suppurate it seems advisable to place hot moist packs of boric acid solution or ten (10) per cent magnesium sulfate over the affected breast and in this way attempt to quicken localization. Relief of pain and

rest may be brought about by sedatives and other drugs. General supportive measures should be used as in any acute febrile condition.

The factor which brings forth the great difference in opinion is whether or not the breast should be pumped during the development and acute phases of a mastitis. Opinions are almost evenly divided in that regard and the results of each group are about equally good. It seems logical, however, to assume that if the breast is not pumped, a congestion of varying degrees will develop. The unaffected breast receives mechanical stimuli and other factors are unchanged so that some secretion must be going on in the involved breast. According to Bradley,⁵³ Keynes,⁵⁴ and Sherrick,⁴⁶ (as already discussed) such a condition is detrimental to the breast tissue. This would indicate that pumping the breast may be of some value. The possibility of further traumatizing the tissues by this procedure must be kept in mind and due care in pumping technique be exercised.

Within the last few years, many writers have brought forth series of cases showing the value of the roentgen ray as a therapeutic measure. Granzow¹⁰² stated that early roentgen irradiation of puerperal mastitis is a very valuable procedure which is not injurious and practically always effective. There is general agreement

among those treating acute mastitis in this manner that in most cases soon after the first irradiation (four (4) to twenty four (24) hours) the pain disappeared, the temperature dropped and the general condition improved. Steinkamm¹⁰³ favored this method of treatment for the additional factors of superior results in preventing abscesses, shortening of the period of illness, and accelerating fluctuation where abscess formation was inevitable. Kahr⁵⁸ found that early irradiation cured about ninety (90) per cent of the cases. Theiss¹⁰⁴ compared his results of eighty nine (89) per cent of one hundred thirty five (135) cases cured with other foreign clinics and emphasized the importance of early irradiation, the earlier an acute mastitis is irradiated the better the results. In one hundred twenty (120) cases which were diagnosed and so treated early, ninety eight (98) per cent were cured. He also stated that where abscesses developed after irradiation the patient's period of distress was shorter and less painful. He found no decrease in the production of milk following irradiation in the majority of the cases. Margraf¹⁰⁵ found approximately the same results in one hundred eighteen (118) cases as Theiss¹⁰⁴ reported. Goedal¹⁰⁶ also emphasized the good results with early irradiation and warned against putting the nursing back to the

breast too soon just because the symptoms were alleviated. Hanne¹⁰⁷ had very good results with irradiation but reported some reduction in the production of milk in the irradiated breasts.⁵ Klahn,³⁸ however, not only found a lasting reduction in the milk secretion in the irradiated breasts but also concluded the roentgen irradiation has no therapeutic advantages. From the preceding facts, one may reasonably conclude that early roentgen irradiation of an acute mastitis will probably cause the condition to resolve in almost every case but may give some decrease in the secretion of milk from the irradiated breast.

The use of vaccines in the treatment of a mastitis has been advocated by some writers. Benians⁷⁶ used staphylococcus aureus vaccines and found them useful as supplements to evacuation of the affected breast. Morgue-Molines¹⁰⁸ employed injections of vaccines together with poultices of bouillon vaccine. Hamm,⁷² following the work of Besredka¹⁰⁹ used a vaccine "antivirus" applied in wet compresses and since using that treatment has never seen an abscess develop, and he further reports the mastitis cases abort more rapidly than ever before. If the milk were examined bacteriologically, Hamm⁷² used the antivirus of the predominant organism, otherwise he used a mixed antivirus locally combined with rubs of an antivirus ointment, morning and evening, in various places

over the entire body. He felt that every nursing woman so treated could be assured that she would not develop an abscess of the breast.

Other treatments of acute mastitis have been urged by various authorities. Meyer and Schneider¹¹⁰ stated that prompt use of Bier's hyperemic method would prevent suppuration. Silzer and Meyer¹¹¹ also recommended the same treatment.

Rubeska¹¹² advocated autohemotherapy and injected forty (40) to sixty (60) cubic centimeters of the patient's own blood into the thigh. These injections were made early and repeated the next day if the temperature was not normal. Sinn¹¹³ also advocated autohemotherapy in sixty (60) cases reported ninety seven (97) per cent of the patients had normal temperatures in three days and in only three (3) per cent did suppuration occur.

Valerio⁵³ suggested the intra-muscular injection of some of the patient's own cerebrospinal fluid for puerperal mastitis. He injected twenty (20) cubic centimeters every twenty four (24) hours for three or four days and found the treatment effective in all of twenty six (26) cases. In cases of sore nipples or stasis, as a prophylactic measure, he injected ten (10) cubic centimeters into the buttocks, followed by another injection in twenty four (24) hours.

Fainsilber and Portret¹¹⁴ strongly advocated the use of diathermy in the acute mastitis. They claim it not only prevents suppuration but causes it to rapidly resolve in most cases. They also suggest it as a possible diagnostic procedure since it has no effects on a tumor but causes an immediate response in inflammatory conditions.

All of the treatments previously discussed have been aimed at the prevention of suppuration and abscess formation. While successful in most cases, no matter what the treatment, a few patients with acute mastitis always develop mammary abscesses which must be treated surgically.

Management of Breast Abscess:

It is generally agreed, and has been common practice for centuries, that when pus is present in the breast, it should be drained. Drainage of the pus should be done as soon as the suppuration is diagnosed. The diagnosis of a breast abscess is usually based on localization as shown by a point of tenderness, and fluctuation. Often there is some delay in treatment because the deep abscess may not show the signs of suppuration. If any doubt exists, it is advisable to aspirate for pus. Use of the aspirating needle will occasionally prevent too early incision and will often prevent a delay in the evacuation of the pus. Prompt drainage of an

abscess is necessary to prevent further involvement of the gland and greater destruction of the tissues. Where this was not done, as in years past, the entire gland was often permanently destroyed and greatly disfigured by cicatrices.³⁵

Open drainage by radial incisions from the nipple was the earliest surgical approach^{4,11} and is the method still used by many men.^{36,51} Billroth²⁵ also used a drainage tube in his incision and washed out the cavity with some mild solution. This treatment, of incision with after packing and irrigation, was trying for the patient and often left a disfiguring scar and decreased function. However, for superficial abscesses, a small radiating incision will give good drainage and leave very little scar. In deep abscesses where this treatment is used, it has been pointed out that gauze packings are poorly tolerated and that rubber tubes should be used for drains.⁴⁴ Battle and Bailey²⁶ advocate dry dressings rather than hot baths and syringing, which they think seems to maintain the inflammatory process.

Some men have found that a counter incision with through and through drainage gives more adequate dependent drainage.^{26,33} Shields,²⁷ stated that the counter incision must be made through the infra-mammary sulcus because that gives more protection to the normal tissue

and also leaves a better cosmetic effect. Counter-incision is often unnecessary and where it seems advisable a single infra-mammary incisions, as advocated by Bohler¹¹⁵ and others,^{40,43,116} would be more practical.

Bohler¹¹⁵ advocates an arched incision through the sub-mammary fold such as has been used for removal of benign tumors. In an abscess of average size, an incision from five to seven centimeters is sufficient. In abscesses of the superior portions of the gland or where multiple abscesses are present a longer incision is necessary. After incision of the skin the layer of connective tissue which separates the glandular tissue from the superficial aponeurosis of the pectoral muscle is reached. Then by blunt dissection with the finger the breast is separated from the muscle and the abscess exposed. The abscess should be incised with the two ideas of perfect drainage and not injuring normal tissue, except as is necessary, kept in mind. A longitudinal incision is made and any protruding necrotic tissue should be removed. If multiple abscesses are present, they may frequently all be drained through the largest abscess by breaking down the walls between the abscesses. Bohler¹¹⁵ also advocates drainage by sterile gauze compresses rather than rubber tubes, and use of a tight dressing.

Leigh,⁴³ with a similar incision, uses rubber dam and

cigarette drains. Vick¹¹⁶ used an infra-mammary incision with Carrel-Dakin treatment and electric heat locally. The advantages of the sub-mammary incision are dependent drainage, easy access, and an invisible scar.

In the early part of this century, the treatment of an early but small incision followed by suction with Bier's hyperaemic bell was introduced.¹¹⁷ Pototschnig⁴⁴ believes that this method has not found the wide application it deserves since pain is avoided if the procedure is properly carried out and the results are uniformly good.^{44,47,110} Under local anaesthesia a small stab incision is made and suction applied for five minutes followed by a period of a few minutes rest. This is repeated five or six times in the course of an hour and is carried out every day. Some writers dislike this treatment, offering that it is painful and that other methods give better results; and they present records to prove the latter contention.^{28,72,77}

In developing a closed method of treatment, Gardiner¹¹⁸ started using aspiration and pressure with very satisfactory results. Cocainizing a tract to the abscess, the pus was aspirated through a needle and a pressure bandage applied. This was repeated every four to six hours until no more pus accumulated. Later he recommended using a basket ball bladder over the dressing¹¹⁹ for getting an

even controlled pressure. This treatment is especially valuable in small abscesses and greatly shortens the time of healing besides leaving no visible scar. However, it is not so satisfactory in larger abscesses since it may not give adequate drainage. Rucker⁴⁷ used this method and also added washing the cavity through the needle with a two per cent mercurochrome solution.

Battle and Bailey²⁶ used aspiration and irrigation with bouillon vaccine, leaving some in the abscess after each irrigation. Their control cases in which they used a non-specific bouillon vaccine showed better results. However, they had as good results with Dakins solution as the irrigant as with the others so saw no advantage in importing the bouillon vaccines. They found aspiration a very satisfactory treatment especially in localized abscesses and urged it be used in all possible cases since incision may always be resorted to later.

Soupart¹²⁰ recently reported a series of cases in which a small puncture was made into the abscess, the organism identified, and the pus aspirated with a needle. A tight binder was used. The same day injection of staphylococcus anatoxin was made into the subspinous fossa. Three or more injections of increasing amounts were made at intervals of five to seven days. He stated that the purpose was not to suppress suppuration but to

preclude diffusion with all its consequences. After the first or second injection the focus seems to be kept within its limits and, after healing is started, the time is shorter. This treatment needs more cases and work done on it before any conclusions as to its value can be drawn. However, along this same trend of thought, Rossenbeck¹²¹ mentions that bacteriophage injected directly into the abscess cavity after aspiration of pus, has been recommended.

In 1932, Hobbs¹²² introduced a new treatment of especial value in deep abscesses whereby through two drainage tubes, one smaller and fitting inside the other, the abscess may be irrigated and drained at the same time. Hamilton Bailey⁷⁷ using Hobbs method as the basis worked out a similar technique. The advantages to these methods are that a small incision (three-fourths inch) leaves little scar, and yet adequate drainage is assured. It combines the advantages of both aspiration and open incision, but care to protect the surrounding skin must be used. Bailey⁷⁷ believes his method shortens the convalescence and is particularly useful in an out-patient department.

Starlinger¹²³ also used thermocautery successfully in treating suppurative mastitis. It has received little attention, however, DeLee²⁸ states that he has found the

use of the infra-red lamp hastens recovery of cases of breast abscess. He also advocated the use of vaccine treatment in persistent cases.

In conclusion, it may be pointed out that abscess of the breast may be best treated as follows: by aspiration if the abscess is small; by the closed method of Hobbs¹²² or Bailey⁷⁷ if the abscess is larger; and by Bohlers¹¹⁵ sub-mammary incision if the abscesses are multiple or retro-mammary. All operative procedures should be done under anaesthesia of some kind. Radial incision and open drainage leaves much to be desired. The use of vaccines, etc., may be of value in shortening convalescence or improving stubborn cases.

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