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THE PREVENTION AND CONTROL OF PUERPERAL SEPSIS, INCLUDING ITS MEDICO-LEGAL ASPECTS*

BY

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There is no question that conditions in regard to puerperal infection have considerably improved during the present generation, but we are far from having reached any irreducible minimum in its incidence. What we have achieved is a fairly complete understanding of its causes. We know something about the conditions upon which the patient's resistance depends, and that toxæmia, hæmorrhage, exhaustion, and malnutrition depress it. We know that trauma and hæmorrhage diminish the local resistance of the tissues. We know the common sources of the most dangerous organisms, and we have learned a good deal regarding the methods of preventing their access.

Types of Infecting Organism

To make my subsequent arguments clear let me say at the outset that, broadly speaking, there are two types of infecting organism to be guarded against. There are, first, the organisms commonly found in the skin of and around the vulva, on the hands and clothes, and on unsterilized dressings and instruments—for the most part anaerobic and non-hæmolytic streptococci, staphylococci, and coliform organisms. These organisms most commonly give rise to infection after labours in which there has been considerable injury of the tissues. They cause a true wound infection, and against them our preventive methods are essentially the same as those adopted in surgery. Secondly, there is the hæmolytic streptococcus associated with scarlet fever and erysipelas, but most commonly with tonsillitis, nasal infections, and morbid conditions of the upper air passages generally. The view that this organism is the cause of many puerperal infections and of the vast majority of the fatal cases seems to have been proved by the work of Smith (1927, 1931, 1933), Paine (1931, 1933), Leonard Colebrook (1933, 1938), Dora Colebrook (1935), King (1930), and others. Not only is this type of infection more deadly to the individual patient, but as often as not it attacks the woman who has had a normal spontaneous delivery, and among recently delivered women it appears to have a degree of contagiousness comparable only to that of small-pox. A great advance in recent years has been the clear demonstration that this organism is practically never present in the birth canal before labour, but is conveyed from without, and usually by droplet or spray infection from the nose or throat of one or more of those in attendance at the delivery or

during the puerperium, not excluding the patient herself. The danger is greatest when any of those concerned is actually suffering, or has recently suffered, from some infection of the nose or throat. After recovery a small proportion, estimated at about 7 per cent. in general, but probably nearer 30 per cent. during seasons when colds and sore throats are rife, continue to be carriers of hæmolytic streptococci; but there seems to be evidence that in such circumstances the organisms are not so virulent and the risk of their infecting a patient, although by no means absent, appears to be definitely less serious (Murray, 1930). In medicine, as in warfare, each newly discovered method of attack is quickly countered by a new method of defence, and in this case the defence is twofold: first, the use of masks to cover the mouth and nose of all in attendance, and, secondly, the tracing of the cause of the infection by bacteriological examination of the throat and nose of each person who has been in close contact with the patient, and, if possible, the exclusion from obstetric work until after recovery of any person found to be a probable source of the puerperal infection.

One final preliminary statement is that in the last two years there have been two cases in England in which a patient who went into a small maternity hospital or home for her delivery and there contracted puerperal infection has successfully claimed damages from the hospital authorities or doctor concerned because of alleged lack of reasonable care against infection.

It is these recent advances in our knowledge of the nature of the attack and of the means of defence, together with the disturbing situation created by the legal actions mentioned, which make this subject so suitable for discussion at a time when the State is placing on local authorities an increasing responsibility in regard to midwifery.

Value of Ante-natal Supervision

In trying to lay before you a brief consideration of the points which obstetricians in general regard as important in the prevention and control of this disease, I would stress in the first place the value of ante-natal supervision. It must be interpreted in its widest sense, and its aim in this connexion must be to build up the patient's resistance. The general health of the patient should be assessed as early as possible during pregnancy, and treatment directed to any faults. I have had the opportunity of studying some hundreds of "maternal death schedules" through the courtesy of Dr. Charlotte Douglas of the Department

* Read in opening a discussion at a joint meeting of the Sections of Obstetrics and Gynaecology, and Public Health and Hygiene at the Annual Meeting of the British Medical Association, Plymouth, 1938.

of Health for Scotland, and this has impressed upon me the lamentable number of cases of death from puerperal infection in which pregnancy should never have been allowed to occur, because coexistent conditions of disease and debility made these women unfit to resist the infection which ultimately destroyed them. Here we impinge upon vast and complex economic and social problems, questions of self-control and birth-control, possibly even the vexed question of the law in regard to abortion, which I have no time to discuss.

Apart from attention to general health and any special indications of disease, the ante-natal prevention of puerperal infection involves the treatment of septic foci in the body—for example, teeth, tonsils, sores, and the cervix uteri. The very real danger of marital intercourse in the later months of pregnancy should be explained to the patient and, if need be, to her husband.

Diet

After this comes the important question of diet. In general it is quality rather than quantity that is at fault, and the ultimate cure is education in the elements of dietetics. Vitamins are greatly in vogue at the present time, and there is probably no profession more susceptible to the dictates of fashion than our own. That vitamins, particularly A, B, C, D, and E, are essential may be accepted as an axiom, but in patients who are on a reasonably good mixed diet it is probably unnecessary to administer supplementary vitamin preparations. If every pregnant woman would include fresh fruit in her daily diet, and add to the fruit fresh green vegetables, dairy produce, and fresh herrings, the needs of the situation would be fully met and incidentally some of our economic difficulties ameliorated. In addition to vitamins the mineral elements of the diet are of great importance, as the growth of the foetus makes real demands in respect of these substances, which must be supplied from the mother's diet if her own tissues are not to be depleted to an extent which may undermine her powers of resistance. But here again a reasonable mixed diet should suffice, and it is only in cases where a deficiency of, for example, iron is clinically detected that direct medication is desirable.*

The more strictly obstetrical side of ante-natal care is preventive in an important degree. By foreseeing causes of danger and difficulty, steps can be taken to ensure a method of delivery calculated to minimize trauma and haemorrhage, to control toxæmia, and to eliminate the risks inevitably associated with delivery in unsuitable surroundings.

The Place of Delivery

This brings me to the question of the *locus* of the delivery where circumstances offer a choice. I see no objection to delivery in the patient's own home provided it is suitable, and provided that the patient is in good general health and that no obstetrical operation of any gravity is likely to be required; but only medical considerations, and not sentiment, should determine the choice. Unless the patient's own home is clean and airy, and she can have a bed and preferably a room to herself, it is not a suitable place for a confinement. Far too many women are still delivered in wholly unsuitable houses, and if there is no hospital accommodation for them then we must press for its provision. Other essentials are that

sterile outfits of dressings, etc., must be provided either by the patient or by the local authority. Furthermore, the danger of contact with members of the household newly returned from infectious diseases hospitals, or with running ears or infected throats or sores, must be kept clearly in mind, and the presence of any such risk should determine removal to hospital. Any comparison of the relative safety of delivery at home and in hospital or a maternity home involves the assumption that in the latter the conditions and the technique are good. This point was made by the judge in one of the legal cases mentioned. In the past most hospital reports have shown a lower general mortality rate in the outdoor cases than in the indoor cases; and the obvious explanation is that difficult and complicated cases naturally gravitate to the hospitals and so weight their figures adversely. The comparison is therefore fallacious, as the two groups of cases are not strictly comparable. What more concerns us to-day is that evidence is accumulating that, so far as infection is concerned, the statistics of hospitals in which careful bacteriological control is exercised are beginning to show a lower incidence of infection in hospital than in district practice (L. Colebrook, 1938; Rose, 1937). I am therefore in favour of institutional midwifery except where the domiciliary conditions, regarded from the obstetrical standpoint, are really good; and, in my view fortunately, the social trend in favour of institutional midwifery will probably continue despite any opinions to the contrary.

It therefore behoves us to see to it that all maternity hospitals and homes conform to the high standard in accommodation, personnel, and technique which their existence is now legally taken to imply. Overcrowding is too common even in some of our famous hospitals. Accommodation should be available for the complete separation from the very outset of clean and of "suspect" cases—that is, cases which have been examined or handled outside—and for the immediate segregation of all puerperae who present symptoms suggestive of infection. Recognized cases of infection should be transferred at once to an entirely separate unit or a special hospital. In the design of new hospitals these points should be insisted upon as primary essentials.

Maternity Institutions

Maternity homes should be inspected more frequently and more searchingly than has often been the case hitherto by a responsible official of the local authority who has a real practical knowledge of midwifery. Much of the so-called inspection at present is merely a formal compliance with the letter of the law.

In every maternity hospital and home one individual should be charged with the ultimate responsibility for distribution of patients to the various wards and the notification to doctors in charge of patients as well as to the local authority of all cases of puerperal pyrexia or infection. In the larger hospitals this should be the resident obstetrical officer; in the smaller hospitals and nursing homes the matron.

Another question arises in regard to the admission of cases of puerperal infection to maternity institutions. Unless a whole separate block is reserved for such cases this seems to me quite wrong. Again, if such cases are housed in a separate block, or in a hospital for infectious diseases, it seems desirable that they should be under the supervision of an obstetrician. This recommendation is not intended as a reflection on the competence of the staff of such hospitals, but as a plea for increasing the experience of the obstetrician in a particularly important type

* In connexion with diet in relation to the prevention of puerperal sepsis the interim reports of the unfinished investigations of the Joint Council of Midwifery are most suggestive. See *Public Health*, April and November, 1937, and March, 1938.

of case to which he is often called as a consultant. What of abortions, which are almost always "suspect"? Should they be sent to a maternity hospital, to a gynaecological ward, or to a special ward connected with a maternity hospital? The last seems to me the best plan; for again, and even more emphatically, these cases should always be under the care of an obstetrician.

Intra-natal Technique

Intra-natal technique is the most important point of all, for it is during labour that the danger is at its maximum. The simple main requirements are a clean vulva, clean hands, clean dressings, clean instruments, and the prevention of the contamination of any of these clean things during the labour. The attainment of these desiderata means safety; anything short of it spells danger. A completely aseptic technique is even more unattainable in midwifery than in surgery, and there are those who, recognizing this, rely wholly upon the lavish use of antiseptics and produce fine results in support of their policy. But I think the better and more rational plan is to combine both methods—to render aseptic, by boiling, everything that can be boiled, and to apply adequate antiseptic methods to those that cannot. Thus gloves, gowns, sheets, dressings, and instruments can and should be sterilized; the skin of the hands and of the vulva can be rendered reasonably safe by thorough antiseptic treatment.

I cannot here enter upon the relative merits of the many antiseptics in use. For information upon that point, and indeed upon this whole subject, I would refer you to the invaluable work of Dr. Leonard Colebrook (1938). I would only emphasize that the strict routine observance of a careful technique is much more important than the particular antiseptic used. The one essential is that the antiseptic should be used in a strength sufficient to be really and rapidly germicidal. Let me rather give you an outline of the technique which we follow in the Royal Maternity Hospital, Edinburgh, and which I put forward not dogmatically but just as an example.

1. At the outset of labour the patient's whole body should be thoroughly washed if time and her general condition permit. In hospital this is done by a spray bath, with the woman sitting on a stool or lying on a slab, to prevent the possible entry of soiled water into the gaping vulva of a multipara. In the absence of such facilities a bed bath, or in an emergency a thorough washing of the lower abdomen, vulva, and thighs, must suffice.

2. The vulva and pubes are shaved, again well washed with soap and water, and dried. Thereafter a soap-and-water enema is given unless the patient is bleeding or is advanced in labour, and, after the rectum has been evacuated, the whole area is treated with 5 per cent. dettol as a lotion or in the form of 30 per cent. dettol cream.

3. Before any examination, and in any case always at the end of the second stage, dettol lotion or cream is again applied. We more often use dettol blue—that is, dettol with an inert pigment—for the skin, as it clearly shows the limits of the area treated.

4. Before examining or delivering, the obstetrician washes his hands thoroughly with warm running water and soap, rinses them in methylated spirit, dons a sterile cap, mask, and long-sleeved gown and sterile gloves. Dettol cream is used as a lubricant for the fingers and for such instruments as the forceps. If running water is not available care must be taken that the basins used have been sterilized, and the water itself should be boiled wherever there is any doubt about it.

5. The vagina is not treated antiseptically except in the presence of a leucorrhoeal discharge, in which case it is douched out with 5 per cent. dettol solution immediately before delivery.

6. After delivery the vulva, buttocks, and thighs are swabbed clean with 5 per cent. dettol and a sterile gamgee pad applied.

Obviously such a technique is not applicable in detail in many of the houses of the poor, but, given the provision of a sterile outfit by the local authority, something closely approximating to it is usually possible. I would draw attention to L. Colebrook's (1938) evidence that dry hands or dry unsterilized gloves can be rendered sterile and even actively antiseptic by rubbing pure dettol or 30 per cent. dettol cream into them until they are dry. In an emergency this is an invaluable hint.

I anticipate that the question of masks will arise in this discussion, but if the importance of spray or droplet infection from the mouth or nose of an infected attendant or even a healthy "carrier" upon hands, dressings, and instruments, or upon the vulva itself, is admitted, then it seems to me that the wearing of a mask is the obvious and inescapable common-sense preventive measure. The only alternative to a mask is to conduct the labour in absolute silence, but an unexpected and irresistible cough or sneeze may betray even the most devout Trappist. Moreover, the mask to be adequate must consist of *at least* four folds of fine-meshed gauze and must itself have been sterilized. Many of the masks in use are more figuratively than literally of the nature of lip-service to the doctrine enunciated.

With this technique the further endeavour to prevent infection during labour lies in the observance of the principles of good midwifery in the conduct of the case, in particular in the avoidance of trauma, haemorrhage, and exhaustion. Unnecessary interference is certainly to be deprecated, but unnecessary delay is also undesirable, and the obstetrician who has conscientiously observed the precautions mentioned need not fear to undertake any minor intervention, such as a low forceps operation. Major forms of intervention, especially those involving the introduction of the hand into the uterus, must always remain more dangerous, and will always carry some toll of subsequent infection. Whenever possible they should be carried out in a hospital, where the surroundings, the facilities, and the number of assistants are more suitable.

The Puerperium

In the early days of the puerperium similar precautions must be maintained, for there is abundant evidence that some women become infected a day or two after delivery. The main principle is again the prevention of infection from the hands, nose, and throat of the nurse or others attending the patient; and to this must now be added the prevention of contagion, air-borne or otherwise, from one patient to another. Before giving any attention to the genital area, the nurse must scrub her hands and forearms and should don a mask and sterile gloves. In hospitals and nursing homes each patient should, as far as possible, have her own individual outfit and equipment, and where this is impossible all articles should be sterilized before use. In particular does this apply to bed-pans. The importance of fresh air and sunshine, and the promotion of drainage of the uterus by propping the patient into a sitting position at frequent intervals after the first twenty-four hours, need only be mentioned.

The sphere of drugs in the prophylaxis of infection in the puerperium has received attention from time to time. Quinine, for example, has long had a vague but rather unsubstantiated reputation in this respect, and in combination with ergot is widely used. The recent introduction of sulphanilamide preparations and their striking

success in the therapeutic treatment of streptococcal infections naturally raised the question whether their administration would be correspondingly successful in prophylaxis. To test this my colleagues and I in the Royal Maternity Hospital, Edinburgh (Johnstone, 1938), made a rough-and-ready clinical experiment on a large scale by giving a prophylactic course of these drugs to every patient delivered in the hospital during the year 1937. A comparison of the results of the year's working with those of the previous year showed a reduction in the number of puerperia which were morbid according to the B.M.A. standard from 3.06 per cent. in 1936 to 1.9 per cent. in 1937. In order to test the real significance of this apparent improvement we are this year using all sulphanilamide drugs only as therapeutic agents in cases of pyrexia in which infection is suspected; and the further comparison of our 1938 figures with the two previous years may prove interesting. In the meantime I hesitate to make what may prove to be exaggerated claims for the prophylactic use of these drugs, although in our experience their administration was apparently beneficial and was seldom, if ever, associated with any detriment.

Control of Infection

I pass now to the question of the control of infection. In the first place a chart of the morning and evening temperature and pulse should be kept during every puerperium, and the nurse should make a daily note of the state of the lochia and of any abnormal symptoms. Any rise of temperature to 100° F. after the first twenty-four hours should be regarded with suspicion, and if it recurs within the next twenty-four hours without some obvious extragenital reason the patient, if in a hospital or nursing home, should be removed forthwith to the segregation room or department. This is no counsel of perfection, but a most reasonable precaution. A high vaginal swab may be taken with advantage and sent to a competent bacteriologist, preferably one who has the means of grouping streptococci. Here I would interpolate that in our experience the ante-partum taking of vaginal swabs has not proved helpful, and the general conclusion is that such streptococci as may be found occasionally in the vagina before labour rarely cause serious infection after it. I do not deprecate the procedure, but I do not regard it as part of the essential technique, which I am trying to keep down to its simple elements.

After segregation of the patient, the next step—and one of particular importance in hospitals and maternity homes, where infection is, for obvious reasons, most apt to become epidemic—is the bacteriological investigation of the nose and throat in all contacts with the patient who has developed infection. The logical sequel to this is, when at all possible, the temporary exclusion from obstetrical work of any persons found to be “carrying” haemolytic streptococci and the segregation of any other patients in the same ward who are harbouring these organisms. Here again I would make an interpolation. Where there are no symptoms referable to these organisms, the preliminary swabbing of the throat and nose of those about to engage in maternity work, as well as the routine swabbing of those already engaged in it, seems to me unnecessary provided a technique such as I have described is conscientiously observed. Admittedly the omission of this step falls short of the full and rigid application of our present bacteriological knowledge, but I submit that the full application of that knowledge might well lead us into positions so impracticable as almost to paralyse the work of our hospitals as well as of the single-

handed country practitioner. Lyons (1936) of Boston has estimated that in winter, when infections of the air-passages are common, the exclusion of all carriers of haemolytic streptococci—that is, of healthy carriers as well as those with recognizable infections—would reduce the staff of a hospital by 30 per cent. I believe that even the bacteriologists recognize the impracticability of this situation. Moreover, if routine test swabbing is to be done, how often is it to be done? If fortnightly, why not weekly? If weekly, why not daily?

It should, however, be a rule in every maternity hospital or home that any nurse or ward servant suffering from a sore throat, or even from a cold, should report that fact to the matron, who should arrange for the prompt taking of swabs for bacteriological examination and for relieving such a person from duty in the labour room or puerperal wards until she has recovered and has had two swabs negative to haemolytic streptococci. The same principles should be observed by all doctors engaged in midwifery. Where these precautions cannot be carried out without grave dislocation of the work to be done—as, for example, in hospitals with limited staffs or in single-handed practice in country districts—precautions against droplet infection should be intensified and rigidly observed.

Air-borne Infection

One last risk deserves consideration—namely, air-borne infection. A few years ago most of us would have belittled the serious suggestion of such a possibility, but recently the work of Cruickshank (1935), W. F. and M. W. Wells (1936), and Daryl Hart (1937) has shown us that the air in rooms occupied by infected patients contains multitudes of virulent organisms. This is possibly the explanation of some epidemic outbreaks of sepsis in small hospitals and maternity homes which have no adequate means of segregating infected cases, as well as of some sporadic cases in domiciliary practice. Incidentally it may also possibly have been the explanation of the infection in the two recent cases in which the patients sued for and were awarded damages. In both of these instances a “clean” case was put into a ward in which there was another patient who had a high temperature and other symptoms which were strongly suggestive of puerperal infection, and who ought therefore to have been segregated. Personally I do not think we can escape the conclusion that such a procedure does constitute a lack of reasonable precautions in an important respect.

These two cases are profoundly important because they introduce an element of the fear of the law into ordinary midwifery practice, but we must not allow ourselves to exaggerate the position. No sane judge would allow damages against a doctor or an institution simply because the plaintiff had contracted puerperal infection. He would require to be satisfied that in some essential point or points there had been a breach in the observance of reasonable precautions. At the same time one successful claim is apt to encourage others, and we must protect ourselves against vexatious actions. The doctor who signs a certificate of insanity or who treats a fracture without having recourse to radiographs does so nowadays at some risk to his peace of mind and his pocket. We must not allow any similar paralysing apprehension to enter the field of obstetric practice for lack of a clear statement as to what, in the present state of our knowledge, are the simple and reasonable essentials of the proper conduct of a midwifery case. And if such a state-

ment cannot be derived from a discussion such as this, then we may possibly have to look to the Ministry of Health or to some equally authoritative source to frame one.

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PREVENTION OF PUERPERAL SEPSIS*

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No excuse is needed for the detailed consideration of a subject like puerperal sepsis, where slight carelessness, or even too great enthusiasm on the part of the nursing or medical personnel for remaining on duty, may result in tragedy.

The Modern View of Puerperal Infection

It is of great interest to notice the complete change of attitude since the war regarding the causes of the condition. This shows more clearly than any other fact the progress that has been made, and gives us increasing hope for the future. When the Public Health Act, 1936, officially eliminated the term "puerperal fever" the end of an epoch was indicated. The very points I have been asked to discuss to-day emphasize the general acceptance of the modern view of puerperal infection. We are no longer content to consider the possibility of infection in relation to the delivery alone. It is recognized that during the ante-natal period certain definite precautions should be taken.

A good deal of stress is laid by some authorities on the importance of dental care. It is obvious that a clean mouth is a first step in personal hygiene, and the provision of dental treatment in connexion with ante-natal clinics is now recognized to be not only advisable but necessary. During 1937, 8,974 women received treatment at the child welfare dental clinics in Birmingham. The majority, or about 60 per cent., were sent from the ante-natal clinics and represent roughly 50 per cent. of those attending the clinics. This does not give a complete picture of the need, for there is still a good deal of prejudice against dental care. The provision of cheap dentures does much to encourage the removal of decayed teeth, however, and actually 968 women were supplied with dentures in 1937. At the City Maternity Homes the women are so anxious to obtain admission that they submit to having dental care whenever the medical officer considers it necessary, this being a condition of admission.

* Read in opening a discussion at a joint meeting of the Sections of Public Health and Hygiene, and Obstetrics and Gynaecology at the Annual Meeting of the British Medical Association, Plymouth, 1938.

The careful examination of every woman suffering from a vaginal discharge, with an inspection of the cervix, is an essential step in the preventive side of ante-natal care, and the treatment required must be insisted on. The possibility of throat and sinus infections must be remembered also.

On the educational side, while the preparation of the delivery room is asked for by every district midwife, instruction should also be given to report the occurrence of any infective condition in the family, not forgetting the child with impetigo or otorrhoea. Such conditions should, of course, receive immediate attention. Health talks at ante-natal clinics should include information on such points.

Ante-natal Care

There is also the very important question of building up resistance. It is obvious that an anaemic and badly nourished woman will have a poor chance of recovery if she should be infected, and she is more liable to infection. A complete system of ante-natal care should include the provision of a satisfactory diet. Milk alone is obviously not enough, although it is so valuable a food. The supply of meals in necessitous cases meets the need to some extent, but in the worst cases only. In the diet of a large proportion of working-class women iron, calcium, and vitamins are primarily deficient, and these can be supplied as useful supplements.

Ante-natal care plays its full part in the prevention of sepsis only when every effort is made to obviate malpresentations and disproportions, causing difficulties at labour. The importance of early induction of labour or of Caesarean section in suitable cases should not be overlooked in this connexion. The association of toxæmia and ante-partum haemorrhage with sepsis is universally recognized. It is not possible to deal successfully with toxæmia outside an institution, and ante-partum haemorrhage, however slight, also requires full investigation. Sepsis often follows where repeated small haemorrhages have been allowed to occur.

An obvious step is the provision of sterile dressings for district midwifery. The maternity packet is now very generally available, but it is not yet very generally used. I should like to see such sterile dressings supplied in every case and the cost included in the midwife's fee. Meanwhile the careful instruction of the expectant mother in the proper preparations for the delivery is essential. The supply of drums of sterile dressings to every midwife rather than the use of sterile packets involves a prohibitive cost for transport as well as a high original expenditure, but some such provision for emergencies is advisable.

The development of ante-natal care has proceeded very rapidly during the last ten years and the general standard is constantly rising, but even yet there is too little appreciation of the amount of actual ill-health requiring investigation and treatment in an institution properly equipped for such work; such investigations, moreover, require to be guided by the physician rather than by the surgeon, for pregnancy furnishes more medical than surgical problems.

The ante-natal clinics must be used to assist the district midwives, but there need be no failure in co-operation with general practitioners or hospitals if there is sufficient understanding and good will on both sides.

The Spread of Infection

The spread of infection by the midwife or doctor in puerperal sepsis is now more often due to direct infection,