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PUERPERAL SEPSIS FROM THE VIEWPOINT OF SURGERY*

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GYNAECOLOGICAL AND OBSTETRICAL SURGEON TO MIDDLESEX HOSPITAL

Sixteen years ago in a paper dealing with maternal mortality I urged that pregnancy should be regarded as a state induced by the growth of a neoplasm, labour as the operation by which the neoplasm was removed, and the puerperium as a period of post-operative convalescence.¹ In the whole sense an operation can be defined as a proceeding involving a dissolution of tissue juxtaposition by purposive force. This definition includes both that severance of tissue continuity which we call a wound and that alteration in the relation of the tissues without a wound which is exemplified in the reduction of a deformity. Labour falls under the former of these categories.

The source of the force may lie with the individual person, or a second person, or be related to both individuals. The removal by oneself of a splinter or a tooth and the spontaneous expulsion from the uterus of a fibroid or the products of gestation may be cited as examples of the first; Caesarean section as an example of the second; and forceps delivery as an example of the third.

Intrinsic and Extrinsic Sepsis

In the paper mentioned, the description of puerperal sepsis as either "extrinsic" or "intrinsic" in origin was first employed, meaning by "extrinsic" that derived from an outside source, and by "intrinsic" that derived from the patient's own body. I pointed out that all post-operative sepsis—not merely that which follows labour—could be similarly classified, and that antiseptic measures at their first introduction were much more directed to preventing infection from without than from within. Partial as was the initial effort, a very great effect was rapidly produced. The sepsis endemic in surgery disappeared almost at once, and operations soon became relatively safe.

During our lifetime the measures against operative sepsis of extrinsic origin have become more and more stringent. Steam sterilization of gowns, drapings, and swabs, the use of rubber gloves, the operation mask, and really sterile catgut have all been introduced within that period. In more recent years surgeons have seriously considered the problem of preventing sepsis of intrinsic origin—a far more difficult matter. Intensive pre-operative measures for sterilizing (or sterilizing as far as possible) the operation area, its isolation from contiguous parts by sheeting and packing, and the elimination of areas of sepsis in other parts of the body, are all steps in this direction. Immunization of the patient before-

hand has been the subject of experiment and trial, but up to now with no marked success.

The effect of Lister's discovery on surgery and obstetrics respectively has often been contrasted, much to the disadvantage of the latter, but the comparison is not so simple as it appears at first sight. Before Lister's time surgical sepsis was endemic, with epidemic exacerbations, but obstetrical sepsis, as the mortality rates of these days show, was not endemic but sporadic, with epidemic increases.

In surgery such sepsis as occurs nowadays is nearly always sporadic, though small epidemics do still occasionally occur in surgical wards. Endemicity has been abolished. In obstetrics at the present time most of the sepsis is sporadic. The often-recurring epidemics have been greatly reduced in frequency, though now and then, as in surgery, restricted outbreaks still occur.

In making the comparison it must be remembered that in pre-Listerian times surgery was in a much worse case than obstetrics, and therefore had a wider scope for dramatic improvement. Allowing for this, the effect up to now of antiseptic measures on surgery and obstetrics respectively may be summed up by saying that in both of them it has caused the incidence of sepsis to become chiefly sporadic.

Sepsis in Surgery

Considering first surgical sepsis as it stands to-day, the rare epidemics in the surgical wards need not detain us. They are certainly due to a breakdown in the measures employed against extrinsic infection, and the place where the breakdown occurs is nearly always the operating theatre. These cases form a very small proportion of the whole. We may similarly dismiss the numerous cases where an operation performed on account of already existing sepsis is followed by sepsis. In the vast majority of these the post-operative state is a continuance of the state existing before the operation. The infection is intrinsic.

There remain those cases where sepsis develops after an operation in an area presenting beforehand no signs of pathological infection. It is necessary to use the term "pathological," because certain parts of the body, the inner surface of the intestines, and the outer surface of the skin, for instance, are normally the residence of micro-organisms. The point at which normality passes into abnormality is indefinable, since some of the organisms natural to these situations are potential for sepsis, given certain conditions, the chief of which is a lowered state of the tissue resistance. This lowering may be general or local, and in the latter case injury is the usual cause.

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Every operation on a part which beforehand contains micro-organisms carries with it, therefore, the possibility of disturbing the balance between bacterial and tissue capability, but the margin of safety allowed the surgeon varies very much. In the case of the skin it is wide, but there are certain situations, as, for instance, the lower reaches of the intestine, where operations are almost always followed by more or less abnormal activity on the part of the organisms resident there, and such operations are therefore attended with a very definite risk of post-operative sepsis.

But beyond the normal bacterial contents of certain parts of the body some individuals habitually carry in one or more of them organisms not merely of relative but of absolute pathogenicity. These carriers fall into two classes: a few can carry, harmlessly to themselves, organisms exceedingly dangerous to other individuals; but in the large majority the boundary between bacterial potentiality and tissue resistance is very fragile. The best example of this state of affairs is given by those unfortunate persons who harbour virulent streptococci in many parts of their bodies, and in whom any lowering of the tissue resistance, whether general or local, is immediately followed by more or less grave consequences.

The liability for sepsis to follow operations on parts which beforehand exhibit no signs of pathological infection varies according to the quantity and quality of the organisms present in the area operated on; therefore, other things being equal, it is least in simple wounds of the skin and greatest in wounds of the lower reaches of the intestine. This differing incidence shows that the larger proportion of sporadic cases of post-operative sepsis must arise from infection of intrinsic origin, for if any considerable part of them arose from infection from an outside source the frequencies would bear no relation to the pre-existent bacterial contents of the areas of operation.

Sepsis after Labour

We now turn to consider sepsis following the operation of labour. In Great Britain for every 1,000 children born alive about two mothers die from puerperal sepsis. The mortality rate of the notifiable cases of the disease is about 20 per cent. When one considers the magnitude of the operation of labour a sepsis morbidity rate of 1 per cent. and a sepsis mortality rate of 0.2 per cent. are very low judged by the standards of surgery. A great many people, however, do not accept this standard; they argue that labour, being a natural act, should be as safe as defaecation or micturition. They overlook, I think, the fact that reproduction is carried out for the maintenance of the race, not the individual, and is attended by a mortality in all species of animals; and, moreover, death itself is a natural act.

But whether the sepsis rate after labour should be considered low or high, one mortifying fact stands out clearly—namely, that in spite of much thought and endeavour we have only succeeded in lowering it very little since pre-Listerian times. The enormous reduction that has been effected in surgical sepsis is often held up as a reproach to the obstetrician who is bidden to "go and do likewise." The fact is, however, that he has already done so in so far as the scope for improvement by measures directed against extrinsic infection permitted. The surgeon by antiseptic measures has abolished endemic surgical sepsis and almost abolished epidemic surgical sepsis, the two irrefutable manifestations of extrinsic infection as it concerns his art. The obstetrician had no endemic puerperal sepsis to abolish, but he has nearly abolished epidemic puerperal sepsis, the irrefutable manifestation of extrinsic infection as it concerns his art.

But neither surgeon nor obstetrician has succeeded in abolishing sporadic cases of sepsis. The question is suggested: have they both arrived at irreducible minima?

Sources of Infection

As regards surgery, we see that the problem of abolishing sporadic cases of post-operative sepsis is largely a question of abolishing intrinsic infection. This has certainly not been completely effected, and perhaps never will, but nevertheless, in the course of a long surgical career I have witnessed a steady reduction in the number of these cases *pari passu* with the various latter-day refinements and safeguards in operative technique. Twenty-five years ago our defences against infection from without—steam sterilization, gloves, and masks—were in use as they are to-day, and yet since that time operations have become progressively safer and convalescence is now markedly more smooth. Disasters still occasionally occur, but less often, and there is a striking diminution in those "excursions and alarms" of convalescence which add so much to the strain on the surgeon. His life has become easier.

The operation of spontaneous labour differs from the cutting operations of surgery in one important particular—namely, that in the former the necessary force is applied under circumstances of absolute sterility, whereas in the latter this can never be achieved, however elaborate the technique. In that regard spontaneous labour is comparable with an orthopaedic manipulative operation, and has a great advantage over surgical cutting operations, but on the other hand it has an important disadvantage. In the majority of surgical cutting operations the wound or wounds are closed, so that there is little chance of infection after the operation has been concluded, whereas the operation of labour leaves a wound open to possible infection for several days after the delivery. Infection of a surgical wound takes place as a rule during the operation; infection of the inevitable wound of labour occurs as a rule after the operation.

As regards the source of the organisms that give rise to puerperal sepsis, all are agreed that in the epidemic form the derivation is extrinsic. Epidemic cases, however, form quite a small proportion of all the cases, the large majority of which occur sporadically up and down the country, unassociated with any particular doctor, midwife, or institution. That this statement, moreover, applies not only to the present time but to the times before Lister, when epidemics were of frequent occurrence, is shown by the fact that the very marked reduction in the number of epidemics brought about by the coming of antiseptic measures effected very little reduction in the yearly total of deaths due to the disease. Then as now the bulk of the cases occurred sporadically, and no agreement as to the derivation of the infection in these sporadic cases has yet been reached.

Cases of sporadic sepsis occurring after labour, where the genital tract presents beforehand no signs of being pathologically infected, are paralleled by the cases of sporadic sepsis occurring after surgical cutting operations (of a magnitude comparable with the operation of labour) in which the area operated on presented beforehand no signs of pathological infection. Yet the sepsis mortality rate of surgery is probably somewhat higher, for to equal that attached to labour a surgeon would on the average have to perform 500 such operations before he had a death directly and solely due to sepsis.

It is admitted that in a certain proportion of sporadic cases of puerperal sepsis the infection is intrinsic in source, but there is disagreement as to the proportion. In the paper I wrote in 1919 I claimed that the proportion was major, and I have not changed my opinion.

For, admitting that the antiseptic measures employed in midwifery have been and still are less stringent than those of surgery, at least they have sufficed to abolish largely that manifestation of the disease in which the source of the infection is unquestionably extrinsic—namely, the epidemic. If then the larger proportion of the sporadic cases also derived their infection from without, the same measures ought to have effected a very considerable reduction, but they have not. As I see it, obstetricians in their efforts to abate sporadic puerperal sepsis are up against the same difficulty that faces surgeons in their efforts to abate sporadic post-operative sepsis. The problem that confronts them both is largely the problem of preventing infection of intrinsic origin.

Those who believe that in sporadic puerperal sepsis the bulk of the cases are infected from an outside source maintain their view chiefly on the results of bacteriological research. The commonest organism isolated from the septic uterus is a haemolytic streptococcus. Since bacteriological examination of the vagina of pregnant women only rarely reveals the presence of that organism it is argued that when found in the uterus it must in the large majority of cases have been conveyed from some outside source. I cannot enter now on the counter-arguments against this conclusion, but I would point out that experimental results that do not accord with clinical and statistical facts should be looked on askance. At the best they can only be a portion of the truth.

During recent years in certain epidemic outbreaks of the disease affecting certain institutions the infection is believed to have been derived from the throat or nose of one of the staff by what is called "spray infection." In order to prevent the occurrence of this, masks are now part of the antiseptic measures employed in all up-to-date lying-in hospitals, and in many instances in private practice as well. While welcoming this step as advancing the obstetrical standard of antiseptics nearer to that of surgery, I do not share the enthusiasm of those who believe that in "spray infection" the whole or at least the major part of the elusive mechanism of puerperal infection has at last been brought to light. If this source of infection was at all common in the past it is difficult to see why the very partial antiseptic measures employed in those days had such a marked effect on epidemics; if it was common in recent times the number of epidemics ought to have been much larger. The importance given by some to "spray infection" does not accord with the statistical fact that the bulk of the cases of puerperal sepsis are sporadic in incidence.

Masks have been introduced into the operating theatre during my surgical life, and unless sporadic post-parturitional sepsis differs widely in its origin from sporadic post-operative sepsis their introduction into obstetrics will operate as it has done in surgery—that is, as only one factor making for the desired improvement. There is no difficulty in shutting the door against extrinsic infection, for the sterilization of instruments, gloves, gowns, drapings, and other appliances and the wearing of sterilized impervious masks, if conscientiously carried out, renders it impossible, except by the very rare agency of air infection, but the case is otherwise with intrinsic infection.

Intrinsic Sepsis

Using the term "infected" to mean "containing organisms" whether potentially or actually pathogenic, and premising that the approaches to an operation area, wherever it be situated, are in this sense always infected, post-operative sepsis of intrinsic origin is seen to be able to occur in the following ways:

1. The operation area may be septic beforehand, and the post-operative sepsis merely a continuance.

2. The operation area may be infected beforehand, and the post-operative sepsis be caused by the excitation of the infection by the operative trauma.

3. The operation area may be infected beforehand, but the post-operative sepsis be caused by organisms from other parts of the body transported to the injured tissues by the blood or other natural currents.

4. The operation area may be infected beforehand, but the post-operative sepsis be caused by organisms transported from the approaches to the operation area by the surgeon during the operation.

5. The operation area may be sterile, and the post-operative sepsis be caused by organisms transported to the injured tissues by the blood or other natural currents.

6. The operation area may be sterile, and the post-operative sepsis be caused by organisms transported from the approaches to the operation area by the surgeon during the operation.

When we proceed to associate these six possibilities with puerperal sepsis in particular it is seen that numbers 1, 2, 3, and 4 denote cases where the uterus is either septic before delivery, as occurs in neglected obstructed labour, or infected before delivery by the introduction into it of organisms, either by that spontaneous ascent of organisms from the vagina which is known to occur, or by the agency of the obstetrician's hands or instruments. Number 5 relates to puerperal sepsis due to the spontaneous ascent into the sterile uterus of vaginal organisms either resident in the vagina before the labour or introduced into it by the obstetrician during the labour. Number 6 is applicable to those cases in which the obstetrician directly introduces into the sterile uterus organisms from the vagina or the external parts. It is sometimes assumed by loose-thinking persons that where puerperal sepsis is of intrinsic origin the obstetrician is necessarily absolved from the onus of it, whereas the considerations just enumerated show that on the contrary he may play a large part in it.

Conclusion

The conclusion to be drawn, I think, from the sum total of the arguments I have adduced is that, if the number of sporadic cases of puerperal sepsis is to be substantially diminished, Obstetrics must fully adopt the method of Surgery in its already largely successful efforts against sporadic post-operative sepsis of intrinsic origin. These methods may be summed up as the sterilization, or if sterilization be not possible the exclusion from the field of action, of the approaches to the operation area, the avoidance of unnecessary trauma and unnecessary haemorrhage in that area, and the removal beforehand of septic foci in other parts of the body. To these it is to be hoped the future will add reliable immunization of the patient before the operation. Hopeful results from the use of anti-streptococcal serum in cases of labour where sepsis after delivery was specially to be feared have recently been reported by H. J. Thomson.²

I have been charged by some who have misunderstood my writings with desiring to make obstetrics more operative. The reverse is the case. Only a fool would lightly interfere with the work of an operator of such experience and reputation as Nature, but I have consistently urged that the obstetrician should approach his cases in the spiritual attitude of a surgeon called upon to oversee an operation and perhaps take part in it himself.

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- ² *Journ. Obstet. and Gynaecol. British Empire*, 1935, xlii, No. 3.