

Methods of performing Cæsarean Section.

By EARDLEY HOLLAND, M.D. (Lond.), F.R.C.S. (Eng.),
F.R.C.P. (Lond.),

*Assistant Obstetric Surgeon to the London Hospital; Obstetric
Surgeon to the City of London Maternity Hospital.*

THE objects of improving the technique of an operation are to reduce its mortality and morbidity, and thereby to extend the indications for its legitimate performance. The operation of Cæsarean section has been standardized for the past forty years; in fact, the operation as almost universally performed nowadays is called the "classical" operation.

THE "CLASSICAL" OPERATION.

The technique of the classical operation was perfected nearly forty years ago; it was in 1882 that the tentative efforts of certain obstetric surgeons culminated in the publication of Sänger's important paper on the technique of suturing the uterine incision. Prior to this the uterine incision was not sutured unless to control unusual hæmorrhage, for the surgeons of those days were fearful of leaving suture material in the peritoneal cavity. Sänger's method, with unimportant modifications, is that used by the vast majority of modern obstetric surgeons.

The classical operation has well stood the test of time, and deservedly, for it is extremely simple, and, with the general march forward of surgical technique its mortality has been reduced to such an extent that it has become a very safe operation. In consequence no operation has in modern times had its list of indications so widely, and as some consider so recklessly, extended as Cæsarean section.

Mortality.

I will first deal with the mortality of the classical operation: the safer an operation is, the more often is it performed and the greater is its list of indications. Striking testimony of this is got by comparing old with modern figures. For the old figures I have relied on the second edition of Spiegelberg's text-book, published in the year that suture of the uterus was becoming common practice.

His estimate of the mortality of the operation at the date he wrote (1882) was at least 50 per cent. With this huge mortality, the indications for the operation were correspondingly small. In fact, there was only one indication, namely, that in which delivery by the natural passages was impossible, because of absolute pelvic contraction, obstructing pelvic tumours, or carcinoma of the cervix. As regards the conditional indication for performing the operation in degrees of pelvic contraction other than the absolute (that is, in pelves with a conjugata vera above $2\frac{1}{4}$ in.), Spiegelberg writes: "The question in actual practice amounts to this: are we to sacrifice the mother for the sake of the child?" and again, "The *conditional* indication can alone be legitimate if he (the accoucheur) feels convinced that the mother is willing to sacrifice her life for the sake of her child."

How different are the modern figures and the modern indications. For these we turn to Amand Routh's well-known investigation "On Cæsarean section in the United Kingdom," published in the *Journal of Obstetrics and Gynæcology of the British Empire* for January, 1911, which gave the results of Cæsarean sections performed in the United Kingdom down to 1910. Here we see an amazing reduction in the mortality, accompanied naturally by a corresponding extension in the indications for the operation. The reduced mortality was not due to a radical change in the technique of the operation, for that had remained much the same, but to two factors of vital importance, the relative value of which is hard to estimate—namely, the general improvement in surgical technique and the fact that patients were operated on before or soon after labour had started, or in the early stages of obstetrical complications—not, as in the old days, only as a last resort when already in a dangerous state. The figures given by Amand Routh for cases of contracted pelvis operated on between 1891 and 1910 were as follows:

Condition.	Cases.	Maternal	
		Death.	Percentage.
1. Not in labour	245	9	3.6
2. In labour, membranes intact ...	224	5—14	2.2
3. In labour, membranes ruptured	166	18	10.8
4. Frequent examinations or attempts at delivery	64	22—40	34.3

The standard mortality of the operation *per se* is got by taking clean cases of contracted pelvis—that is, women not in labour, or in the early period of labour when no vaginal examinations have been made.

As for the indications, in great contrast to the one and only

indication of forty years ago, in Amand Routh's paper they make a formidable list of seventeen; and there is still an ever-growing list, containing all sorts of fancy and flimsy indications, such as breech presentation in primigravidæ, delayed first stage of labour, mild cases of toxæmic albuminuria, and so on.

I now come to the figures obtained by the collective investigation initiated by Professor Munro Kerr and myself. We felt that during recent years the problem of Cæsarean section had undergone considerable changes, and that accurate information was badly wanted in several directions; we therefore invited the obstetric surgeons at all the large centres in Great Britain and Ireland to send us, on tables provided for the purpose, their hospital figures for Cæsarean sections performed from the years 1911 to 1920 inclusive. Their response to our proposal has been unanimous, with the result that we are now in possession of the results of about 4,000 Cæsarean sections performed for various indications during the last ten years. Time has not allowed us to make a full analysis of these figures, but we are able to give certain results of great interest. The total number of cases in which the operation was performed for pelvic contraction is 3,374. These have not all been reported in sufficient detail to enable them to be placed in precise categories, but the following groups of cases stand out:—

Condition.	Total Cases.	Maternal Deaths.	Percentage.
A. Not in labour	1,202	19	1.6
B. Early in labour	389	7	1.8
C. Late in labour	220	22	10
D. After induction of labour	35	5	14
E. After attempts at delivery by forceps or craniotomy	107	29	*27

The cases in the above table number 1,953. Classes A, D, and E naturally gave no trouble in their selection. Class B comprises cases very early in labour, and their selection from the returns rested on such attributes as the following: "early in labour," "at onset of labour," "labour commenced," "in labour for two hours" (I have included no case in which labour had lasted for more than six hours), "labour began in hospital," "membranes intact, os two shillings," "operation of election during first stage," "some pains," and so on. Class C comprises cases very late in labour, cases at the other end of the scale to Class B; their selection depended on such notes as "membranes ruptured many hours,"

* After deducting six craniotomies the mortality for forceps alone stands at 26 deaths in 101 cases, or 26 per cent.

“prolonged labour before operation,” “Bandl’s ring present,” “tonic contraction of uterus,” “long (days or many hours) in labour, membranes ruptured,” “labour advanced, and cord prolapsed,” “several hours in labour, several examinations and manipulations,” and so on.

The remaining 1,420 were cases in labour which either did not fulfil the requirements of Classes B and C, or in which the details given were not sufficient to enable them to be classified. The total number of maternal deaths is 139; of these 82 are accounted for in the above table; the remaining 57 occurred amongst the 1,420 unclassified cases.

The cause of maternal death is an important consideration, and was stated in 122 cases to be as follows: general peritonitis 49, septicæmia 17, sepsis 19, pneumonia 17, pulmonary embolism 8, cardiac failure 7, hæmorrhage 4, intestinal obstruction 5, acute paralytic ileus 2. It is clear that sepsis is paramount as the cause of death. In Class C 11.7 per cent., and in Class E 27 per cent., of the fœtuses were delivered dead—what one would expect after the application of forceps; two post-mortem examinations I have made in such fœtuses revealed cerebral hæmorrhage and tearing of the tentorium cerebelli. The important points brought out in this analysis are: (1) The mortality of the operation *per se* (that is, in Classes A and B) has fallen in a gratifying manner; in fact, it is only about half what it was amongst the cases collected by Amand Routh; (2) the mortality from sepsis for cases long in labour or after attempts at delivery remains almost as high as ever; in fact, the 26 per cent. mortality after forceps is a serious warning; (3) in the latter classes of case, when the operation is nearly always undertaken for the sake of the child, it is well to bear in mind that the fœtal mortality is high. The heart of a fœtus with cerebral hæmorrhage will continue to beat so long as it is still in the uterus, and, indeed, for some minutes after delivery; it is the respiration that is paralyzed.

The Defects of the Classical Operation.

Satisfactory as the classical operation is, it has certain disadvantages both in theory and in practice, and these have been coming much to the front lately. In fact, the present is a disconcerting period of unrest about Cæsarean section.

The defects of the classical operation as met with in practice are the following:—

1. The risk of sepsis in infected or suspected cases. The classical operation is not safe in cases in which infection is suspected or present—that is, when labour is advanced and the

membranes are ruptured, and when there have been many vaginal examinations or perhaps attempts to deliver by forceps.

2. The risk of rupture of the scar in subsequent pregnancy or labour. Quite apart from rupture of the scar, which is comparatively rare, the proportion of thin and defective scars which is found at subsequent operations is very high. Rupture of the scar was considered very fully last year; I found that the frequency of rupture in subsequent pregnancy or labour was 4 per cent., and that the proportion of ruptured scars to successful deliveries by the natural passages, in the series of cases I investigated was 1 to 4.¹

3. The risk, a rare one I admit, of intestinal complications during convalescence, an example of which was the case of intestinal obstruction due to the adhesion of intestine to the uterine scar, reported by Clifford White at the recent Congress at Birmingham.

4. Adhesions between the uterine scar and intestine, omentum, or abdominal wall, which sometimes cause much difficulty in repeated operations.

Theoretically, there are certain very definite factors which militate against the healing of the uterine incision in classical Cæsarean section, and favour adhesions to surrounding structures. These were admirably dealt with by Munro Kerr at the discussion at the Royal Society of Medicine last year. They fall under three headings: (1) The structure of the uterine wall, through which the incision is made; (2) the position of the incision in the uterus, lying as it does in the general peritoneal cavity, and covered with intestines or omentum; (3) the liability of infection of the uterine wound. This is not only in possibly infected or "suspect" cases, but in clean cases also there is always a theoretical risk owing to the proximity of the uterine wound to a contaminated area—that is, the vulvo-vaginal tract.

The structure of the uterine wall through which the incision is made is a most serious disadvantage to perfect healing. It is made through a very thick layer of powerfully acting muscle. The contraction of this powerful muscle may interfere both with the accurate coaptation of the edges during suture and with subsequent healing.

Everyone knows how, during the stage of closure of the wound, the incision tends to gape transversely, and the edges are drawn apart when the uterus contracts. If the contractions are very powerful, small gaps, which become occupied by blood clot, inevitably occur between the sutures; or the sutures have to be tied

1. *Proc. Roy. Soc. Med.*, 1920, vol. xiv (Section of Obstetrics and Gynæcology), pp. 22—124.

so tightly that there is a risk of them cutting through the tissues. During the process of healing, the essential condition for the healing of divided muscle is conspicuously absent; the wound is never at rest, for the uterine contractions are always trying to drag apart its edges. Many cases have been described in which it had been necessary to reopen the abdomen for hæmorrhage, or which had come early into the post-mortem room, in which the uterine wound was found widely open owing to the sutures having cut out or, in the case of catgut, to their having become untied.

Should infection of the uterine wound occur, accompanied by the formation of granulation tissue and sloughing of the edges of the incision, healing is delayed, and an imperfect and thin scar is bound to result, owing to the retraction of the muscular edges. These imperfect scars are found of all degrees—from moderately thin scars, consisting chiefly of fibrous tissue, to extremely thin ones composed merely of peritoneum outside and endometrium or decidua inside, with little intervening fibrous tissue. The liability of such thin scars to rupture in subsequent pregnancy or labour is very great.

In the case of even mild infection the position of the incision makes adhesions between the scar and omentum, intestines or abdominal wall almost inevitable. Every obstetric surgeon has met with examples like this. Extreme examples are the cases of death from intestinal obstruction in the present series of collected cases, Clifford White's case, already referred to, and one of the five cases of ruptured scar I reported last year.

Some Points in the Technique.

It is easy enough to perform a classical Cæsarcan section, but the greatest care must be taken to suture properly the uterine wound. This is the step in the operation which is apt to be done imperfectly. There must be no hurry; every suture must be inserted and tied deliberately.

Suture Methods. So long as the thick edges of the uterine incision are brought completely into apposition, and kept there throughout their whole extent during healing, it does not matter much what method is employed. The best method is, in my opinion, the usual one of passing interrupted sutures through the whole thickness of the uterine wall, except the decidua. An essential point is that the sutures should start well outside the edges of the incision, so as to include a good thickness of uterine wall. If the sutures are passed too closely outside the edges, when they are tied the edges tend to buckle and the line of the sutured wound is thinner than the natural thickness of the uterine wall. For this reason a well-curved needle is best, and the path of the needle should take such a direction as to include a wide bite of muscle.

Any method of single interrupted suture which fails to take a wide bite is not good. For example, I do not consider the method of passing the needle just beneath the peritoneal edge is to be recommended. It is true that by this means a much more accurate closure of the peritoneal edge can be obtained, but this advantage is outweighed by the disadvantage of a thin bite.

Closure of the Uterine Peritoneum. This is of great importance in preventing the leakage of possible sepsis from the interior of the uterus to the peritoneal cavity. If the usual method of interrupted through-and-through sutures which start wide of the peritoneal edge is employed, the covering of this layer by a superimposed Lembert peritoneal layer is often difficult to make perfect, especially if the uterus is contracting strongly and is well retracted. To overcome this difficulty I have adopted the following plan. I first incise the peritoneum only, throughout the length of the proposed incision. I then reflect the peritoneum for half an inch all round; this is surprisingly easy. The muscle is then incised in the usual way throughout the length of the bared area. In suturing the wound the muscular wall is sutured first; the reflection of the peritoneum allows of the needle being inserted well outside the edge of the muscle, so as to take a wide bite. After this layer is tied the reflected peritoneal edges can be accurately united, first by a running suture, and over that by a Lembert suture.

Wait for Retraction. Another point I consider of importance is to wait for complete retraction before inserting the sutures; if the wound is sutured before retraction is complete and the muscular walls are thin, the result is bound to be a scar thinner than the rest of the uterine wall, for the sutures fail to include layers of muscle fibres which during complete retraction would have slid inwards and become rearranged, adding to the thickness of the sides of the incision.

The Suture Material. As the result of my inquiry last year, as well as for theoretical reasons, I consider that silkworm gut is the best suture material, silk the next best, and catgut most unsuitable.

Most operators have their own pet method of suturing the incision, as well as other modifications in technique, but in spite of all, the classical operation remains, except for unimportant modifications essentially what it was forty years ago.

THE LOWER SEGMENT OR CERVICAL OPERATION.

In spite of the great merits of the classical operation, many surgeons are not entirely satisfied with it, and have devised other methods of abdominal delivery which will avoid the defects I have already mentioned as inherent to the classical. These new operations can all be grouped together under the designation of "cervical" or "lower-segment" Cæsarean section. As long ago

as the beginning of last century an operation was devised for opening the lower uterine segment extra-peritoneally through an incision above Poupart's ligament; it was revived by the American surgeon Gaillard Thomas in 1870 under the name of gastro-elytrotomy, as an alternative to the ordinary route, in order to avoid the dangers of septic peritonitis. But the operative mortality was as high or higher, and it quickly dropped out when antiseptics and Säger's method of suture came in and brought such good results.

But the lower segment operation with a greatly improved technique has lately been revived, and its chief exponent in this country is Munro Kerr. The many methods of performing the operation can be divided into extra-peritoneal and trans-peritoneal. These I shall not discuss, but shall confine myself to the description of the simple trans-peritoneal operation.

The patient is placed in the Trendelenburg position and the abdomen is opened from the symphysis to near the umbilicus. The utero-vesical peritoneum is picked up and incised, and the bladder is dissected off the uterine wall, exposing the lower uterine segment. This reflexion of the bladder is extremely easy, more especially in cases in which the patient has been for some time in labour, and the bladder has followed the retracting uterus upwards; there should be no hæmorrhage unless the bladder is dissected down too low. The lower uterine segment is then incised. Personally, I prefer a longitudinal incision, but Munro Kerr makes it transversely. The foetus and placenta are extracted and the uterine incision sutured; the muscle may be united either by a continuous or by an interrupted layer; over this another layer is used to close over the thick utero-vesical cellular tissue or fascia. The edges of the divided utero-vesical peritoneum are then united with a carefully placed continuous peritoneal layer.

Its Advantages.

I have employed this operation so far only nine times, and have been extremely pleased with it. Its advantages over the Classical are, I consider the following :—

1. The wound lies in a quiet part of the uterus, and is at rest during healing. There is no tendency for the edges of the wound to be drawn apart, or for gaps to be formed between the sutures. For these reasons healing occurs in more favourable circumstances than in the classical operation.
2. The uterine incision is made through a less vascular area, and bleeding from the edges is extremely slight.
3. The edges of the wound are thin; suture is therefore easier and quicker.
4. The position of the wound is such that adhesions to the intestines, omentum, or abdominal wall cannot occur; there is only

a short line of peritoneal sutures at the bottom of the utero-vesical pouch.

5. The uterine wound is covered with a thick layer of fascia and by the bladder, and perfect closure of the peritoneum can be made. For these reasons there is less likelihood of infection of the peritoneal cavity; for it is generally conceded that the source of peritoneal infection is not so much due to contamination by liquor amnii or other uterine contents during the operation as to the subsequent passage of infection from the uterine cavity between the edges of the incision. Should peritoneal infection occur the lower abdomen is more resistant than the upper.

6. The operation causes less disturbance of the abdominal contents; the intestines are never seen.

7. The scar is in a safer area for subsequent pregnancy and labour, for the lower uterine segment stretches late in labour. The stretching to which the scar is subjected is purely passive, for there is no powerful active drag upon each side of the scar, as there is in the scar of the classical operation.

8. As regards the performance of the operation, it is just as easy to a practised surgeon as the Classical; true, there is more "operating" in it—it is not done, as it were, by two strokes of the knife, as is the Classical. The more advanced the patient is in labour, the easier will the operation be and the lower will the incision lie in the lower segment and cervix; in fact, in cases of excessive retraction of the uterus, the incision will lie partly in the upper end of the vagina.

9. So far only one case of ruptured scar has been reported, and this is not a fair case, as the upper end of the incision had to be extended upwards on to the body of the uterus. At the same time it must be remembered that very few lower segment operations have been done compared to the many thousands by the classical method.

CHOICE OF METHOD OF CÆSAREAN SECTION.

Is it obvious that a great deal more experience and careful recording are necessary before a sound opinion can be come to about the relative merits of the classical and lower segment operations. My own future practice will be to employ the trans-peritoneal lower segment operation for all cases, except when the lower segment is hard to get at, as in cases of shortness of the abdominal cavity accompanying diminutive stature or kyphosis (when the presenting part of the foetus is jammed down against the pelvic brim) and in fibroids. I have had no experience of the operation in cases of placenta prævia. A more moderate view would be to use the operation only in cases in which patients have been long in labour, when the operation is easier, and when infection of the wound is to be feared.