CRITICAL REVIEW.

MODERN CÆSAREAN SECTION.

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Since Sänger, in 1882, brought forward his improved technique of the operation of Cæsarean section, much has been written concerning the operation, much has been done to still further improve its technique and results, and also to widen its sphere of application. This work has been largely carried out in the great Continental clinics, where pelvic deformities are more common than they are in this country or America. The improved methods have produced so marked a diminution in the mortality attending the operation that it is now performed for indications which would formerly have been considered unjustifiable. Since Sänger's paper the operation has been modified in many respects, but the essential details remain the same, and no doubt its improved results are due, not so much to the details of technique, as to the same causes which have led to the great improvement in the results of all abdominal operations of late years. It may be safely said that no latter-day modifications have had such an effect on the results of the operation as Sänger's original method had. This paper, however, is not concerned so much with the first decade after Sänger's paper as with the next, in which it may be safely assumed that the improved method, having stood the test of time, has been employed to the best advantage, and may be expected to show the best results. In reviewing the literature of the subject, it is necessary to consider three main points—namely, the Indications for the Operation, the Technique of the Operation, and the Results of the Operation.

The Indications group themselves under the heads of—

Pelvic Contraction.
Uterine or other New Growths.
Atresia of the Genital Canal.
Puerperal Eclampsia.
Placenta Prævia.
Unclassified Indications.

Pelvic Contraction.—Here, according to text-books, the indications may be absolute or relative: the former when Cæsarean section is the only means of delivering a full-time child, whether living or dead; the latter when some other operation, such as craniotomy or symphysiotomy, is possible, and may be said to compete with Cæsarean section. Induction of premature labour is purposely left out of the question, because it is never an operation of necessity in contracted pelvis, but is only an alternative to Cæsarean section when the decision has to be made early in pregnancy by the patient herself. In flat pelves and generally contracted pelves the length of the true conjugate diameter is taken as the guide to the indication for operation. Leopold and Haake,[1] in their paper on 50 cases of Cæsarean section since 1893, regard a conjugata vera of 6 cm. or under as an absolute indication, but also agree that a large child with a rather longer conjugata vera also constitutes an absolute indication. In general this estimate is accepted by most observers as an absolute indication for Cæsarean section, provided the child is at full time and alive. If the child is dead, opinions differ as to what are the possibilities of delivering a mutilated fœtus. According to Norris's 'Textbook of Midwifery,'[2] cephalotripsy is a difficult operation when the conjugata vera is 7 cm. ($2\frac{3}{4}$ inches), and is highly dangerous when it is 6·3 cm. ($2\frac{1}{2}$ inches). Tarnier, on the other hand, with his basiotribe, places 4 cm. ($1\frac{5}{8}$ inches) as the lowest limit, and at 6 cm. or more the maternal mortality of basiotripsy is practically nil. The size of the transverse diameter, too, must be considered in this question. According to Fothergill[3] a space of 5 by 7·5 cm. (2 by 3 inches) is necessary for delivery after perforation. The latter estimate probably is nearer the truth in practice. Tarnier's limit in any other hands would probably be attended by a large percentage of failures, even with the basiotribe. Whitridge Williams[4] concludes that the absolute indication for Cæsarean section should be extended to cases with a conjugata vera of 7 cm. ($2\frac{3}{4}$ inches), and bases his conclusion on the fact that he has never seen a full-time child born spontaneously through such a pelvis. Here, then, he believes that the present success of Cæsarean section warrants its employment solely in the interests of the child, for without doubt a full-time child could be delivered through such a pelvis with perforation, followed by cephalotripsy. Reed[5] also would raise the limit of absolute indication to a conjugata vera of $2\frac{1}{2}$ inches in a flat pelvis, and to $2\frac{3}{4}$, or even 3 inches in a generally contracted pelvis. If this higher estimate is to be accepted, we can no longer truly speak of it as an absolute indication, because craniotomy, or even symphysiotomy,

come into competition. Many authors definitely state now that it is unjustifiable to perforate a living child; among these are Freund,[6] Reed,[5] and Everke.[7] All, however, are agreed that if labour is very far advanced, or the patient exhausted or already infected, Cæsarean section becomes a most dangerous operation, and under these conditions would rather perforate a living child than subject the mother to such a risk. Doktor[8] has collected a series of 22 cases of Cæsarean section performed on women already infected, and the mortality was 23·5 per cent. In infected cases where the indications are really absolute Cæsarean section, combined with total hysterectomy, gives good results, and is warmly advocated by Boldt.[9] Erb[10] collected cases, and showed that the operation performed late in labour was attended by a higher mortality than when performed at a chosen time.

In considering what are the relative indications for Cæsarean section, we have in the literature of the subject no such consensus of opinion as we find for absolute indications. In reviewing a large number of cases by different operators, it is seen that they have been guided, not so much by the actual size of the pelvis concerned, as by the history of previous labours, and often by the earnest wish of the patient to have a living child at any risk. Thus, Freund[11] cites 3 cases with relative indications. The first, a primipara of forty-four, with a conjugata vera of 8·5 cm. and rigid soft parts. The second, a 4-para of forty-three, with a diagonal conjugate of 10 cm., and a post-rectal dermoid, which had produced a great œdema of the rectal wall, and could not be diagnosed at the time. The third, a 5-para, with a diagonal conjugate of 8·5 cm., who wished for a living child. In Reynolds'[12] table of 19 conservative Cæsarean sections, all the mothers and 18 children living, there are 12 contracted pelves with conjugata vera varying from 8 to 9 cm., and in all but 4 no living children had been previously born. In Olshausen's[13] series of 29 cases there were 14 rachitic pelves with diagonal conjugates varying from 6·75 to 9·5 cm., and 3 generally contracted pelves with diagonal conjugates of 8 to 9·25 cm. These figures could be multiplied almost indefinitely, but those quoted serve as examples of what is now considered by most operators a justifiable relative indication.

In kyphotic pelves, according to R. Klein,[14] a distance of 5·5 cm. between the ischial tuberosities constitutes an absolute indication, but Von Guérard[15] managed to deliver a perforated full-time child through a kyphotic pelvis of which the distance between the ischial tuberosities was only 4·7 cm.

In osteomalacia it is considered there is now always an absolute

indication, because the disease can only be successfully treated by abdominal section for removal of the ovaries.

Concerning *vaginal atresia* as an indication, there is but little to be found in literature. Hirst[16] quotes 2 cases, both of acquired atresia, in which it was necessary to remove the uterus for fear of infection; and this would seem to be generally the proper treatment, unless it could be absolutely ascertained that there was no infection, and that there existed some sort of canal through which the lochia could drain. Neugebauer[17] published 58 cases of Cæsarean section in narrow and complete or partial atresia of the vagina, but the paper has not been abstracted, and the original is not obtainable.

The literature of Cæsarean section for *labour obstructed by tumours* is so large, and the cases vary so widely, that they cannot be reviewed in connection with other indications. Also, the operation is generally complicated by the removal of the tumour at the same time, and, where uterine tumours are concerned, by removal of the uterus itself, so that the operation no longer can be counted a conservative Cæsarean section.

The *unclassified indications* for Cæsarean section are not numerous in literature, and, although interesting as cases, do not lend themselves for comparison with other indications. It is of interest to note that 9 Cæsarean sections have been performed by various operators for difficult labour following upon vaginal fixation of the uterus, and a like number following ventro-fixation. Rühl[18] discusses these cases, and points out why these difficulties occurred. Here Cæsarean section was a relative indication in most cases, for the chief difficulty lay in the slowness or impossibility of dilatation of the cervix, and might, in some at least of the cases, have been treated by vaginal incisions after Dührssen's method. Among other unclassified indications are—for concealed hæmorrhage, by Pryor[19]; for rectal carcinoma, by Riddett[20]; and for fractured pelvis, by Weiss.[21]

For *puerperal eclampsia* Cæsarean section has now been performed a sufficient number of times to consider seriously whether it should be accorded a place in the rational treatment of the disease. Hillman[22] collected 39 cases up to June, 1899, and to these may now be added 17 others collected from various sources, not included in Hillman's list. Of these 56 cases 33 women died and 23 lived, a mortality of 58·9 per cent. These results are not encouraging, and in considering this question in a recent paper G. E. Herman[23] gives statistics of eclampsia results, treated with or without accelerated delivery. The collective results of Goldberg, Dührssen, Lantos,

Schreiber, Glockner, Olshausen, Schauta, and G. Veit,[24] taken from a paper by the last-named, show a total of 802 cases of eclampsia. Of these cases, 446 were treated by some kind of operative delivery, with 114 deaths, a mortality of 25·5 per cent.; 356 were not delivered by operation, and of them 74 died, or 20·8 per cent. Herman urges that many of the cases treated by operation occurred in pre-antiseptic times, and so the statistics do not compare favourably with latter-day treatment. While agreeing that carefully performed aseptic operations are not likely to prove fatal, aggravate the disease, or injure the patient, Herman gives it as his opinion that—no matter what the operator's skill, what the condition of the patient or her surroundings—in some places operative delivery would have a higher mortality than natural delivery. Further, taking the very best results of operative as compared with non-operative delivery, the difference only amounts to 1 or 2 per cent. (Schreiber,[25] Glockner,[26] Olshausen[27]). These results do not include Cæsarean section, but all other kinds of operative delivery. The reasons given for acceleration of delivery in eclampsia is that the fits are said to cease after delivery. Herman contests the truth of this, and quotes statistics on this point from Schauta, Brummerstadt, Schreiber, Lantos, Goldberg, Bidder, Dührssen, Zweifel, Glockner, Olshausen, Wieger, Auvard, Goedecke, and Herman. Of a series of 2,142 cases from these sources, in 905 the fits ceased after delivery, and in 816 they continued. Roughly, this shows that in 38·09 per cent. of the cases the fits continued with more or less severity after delivery. On these grounds Herman considers that operative delivery is not urgently required in eclampsia, and therefore not Cæsarean section, which is the quickest way of all of emptying the uterus.

For *placenta prævia* Cæsarean section has been performed seven times in America, once in England, and once in Italy. Zinke[28] tabulated the American and English cases, of which six had conservative Cæsarean section and two Porro's operation. Five mothers and six children lived. In Mattoli's[29] case the mother lived, but the child was born dead. In this case the indication was the extreme anæmia of the woman, requiring delivery by the means which would be attended by the smallest loss of blood. After considering a large series of statistics of placenta prævia cases from various authors, Zinke concludes that in central placenta prævia, when the patient is a primipara, the os closed, hæmorrhage profuse, and separation of the placenta around the internal os difficult or impossible, the Cæsarean or Porro operations are legitimate and elective procedures.

THE TECHNIQUE OF THE OPERATION.—Olshausen[30] gives his opinion that the best time to operate is when strong uterine contractions have commenced and when the cervix is soft and beginning to dilate. With this most authorities agree, and many give a hypodermic injection of ergotin just before beginning the operation. With regard to the use of an elastic tube slipped around the lower uterine segment to compress the vessels, many operators now dispense with this; Olshausen,[13] who formerly used it, now has given it up in favour of manual compression, and states that he has less atony of the uterus than formerly. Leopold,[1] however, still uses it, and says that it does not predispose to atony of the uterus. Weber[31] used it in a good proportion of his cases. Manual compression of the vessels is not devoid of danger, on account of possible infection from the manipulation involved. The reasons urged by most observers for giving up the elastic compression of vessels is that, if the uterus is made anæmic for any length of time, it may become atonic, and so hæmorrhage may occur from the placental site.

The chief modifications in the uterine incision are: Fritsch's transverse fundal incision, Caruso's sagittal fundal incision, Olshausen's incision, and Sippel's longitudinal incision after locating the placenta. Fritsch[32] first used his transverse fundal incision in 1897, and claimed for it several definite advantages.

Schröder[33] advocates this incision, and relates 13 cases with 4 deaths, of which 2 were in no way caused by the operation. He agrees with Fritsch's conclusions, and adds that if the operation be performed with the pelvis elevated, the abdominal incision may be made higher than Fritsch thought. Hübl,[34] on the other hand, claims that Fritsch's incision has no special advantages. He considers the bleeding is not less than with the ordinary incision, and makes use of Hyrtl's picture by Heitzmann[35] to prove that the uterine vessels do not run transversely at the fundus. Hahn,[36] however, points out that Hübl's comprehension of this picture is not quite without objection. Hübl, quoting 11 cases from G. Braun's clinic, shows that the placenta was met with at the fundus in 6 out of 11 cases, and so considers the fundal and ordinary incisions of about equal value in this respect. Out of 44 cases collected by him, the placenta was cut in 20, equal to 45 per cent. Atony of the uterus occurred in 4 out of Braun's 11 cases, and in 6 out of 44 collected cases; but Hübl agrees that the position of the incision has nothing to do with the causation of atony. Hübl contends that adhesions are just as likely to form to the abdominal scar as with the ordinary incision, and more likely to occur to intestine. If infection of the uterus occurs,

the wound will become just as easily infected at the fundus as elsewhere. Schröder[37] attacks Hübl's conclusions, and says his objections are partly theoretical and partly controversial, and have often been disputed. His paper proves nothing for the greater security of the ordinary incision. With regard to the branches of the uterine artery, Nagel[38] says they run transversely at the fundus and parallel to each other; this view is confirmed by Waldeyer.[39] With regard to the position of the abdominal wound as a means of preventing post-operative hernia, Schröder quotes Clemenz,[40] Siedentopf,[41] and Walla,[42] all of whom agree that the farther from the pubes the incision is made the less likely hernia is to occur. Gummert[43] agrees that hernia can be avoided by not opening the cavum Retzii, and advises the elevated position of the pelvis so that the uterus can be drawn out through a higher opening. Hübl had not used the elevated position, as he did not believe one could so easily cut and suture a low-lying part of the uterus. If the uterus, drawn right out, is well protected with sterilized towels, there is no danger of infection with skin microbes. In this Hahn agrees with Schröder, and considers drawing the uterus right out before incision is a real advantage. With regard to the position of the placenta, Hahn[36] quotes Gusserow, Schröder, and Bidder, whose collective figures show that the placenta was only at the fundus 8 times out of 382 cases. These figures seem to show that Hübl's statistics are unusual, and that the fundal incision is very unlikely to reach the placenta often. Everke[7] believes that the row of sutures at the fundus is liable to cause a line of anæmia, and so to predispose to bad nutrition and infection. No other author considers this point against the fundal incision. Ludwig,[44] Hahn,[36] Biermer,[45] Walla,[42] Rossa,[46] Freund,[6] Gummert,[43] and Trinks,[47] all agree to the small amount of hæmorrhage and to the general conclusions as to the value of Fritsch's incision. Out of 94 cases, only 14 had bleeding of any importance (Schröder).

Caruso[48] makes his incision sagittally in the fundus after completely withdrawing the uterus from the abdomen. He says there is no bleeding of importance from the wound. Miranda[49] even suggests that with this incision there is less bleeding than with Fritsch's incision.

Olshausen[50] makes his incision first in the centre of the fundus, and then prolongs it backwards or forwards according to the position of the placenta. He reports 30 cases with 2 deaths. Weber[31] follows Olshausen, and remarks that it makes little difference whether the fundal incision is sagittal or transverse. However,

his cases seem to show a greater proportion of obvious hæmorrhage than any of the transverse incision series. Sippel[51] locates the placenta first by Leopold and Palm's method, and then makes his incision so as to avoid it, even longitudinally on the posterior surface.

The comparatively small number of cases with sagittal fundal incision makes it impossible to make any comparison with the transverse. The cases would seem to warrant the opinion that bleeding from any incision must occur if large vessels are cut through; that efficient uterine contraction and carefully placed sutures will always control it.

With regard to sutures, most authors use a double row—one for the muscle layers and one for the peritoneum, as in Sänger's original method. The muscle sutures are tied on the surface, and the superficial sutures lie between them. There is no consensus of opinion as to whether it is essential to use Lembert's sutures; most operators do not. Weber[31] and Everke,[7] however, use three layers of sutures, the deepest taking the decidual lining.

With regard to the removal of ovaries or resection of Fallopian tubes so as to render the patient sterile, there is a growing tendency among operators to leave this procedure alone. Formerly it was the rule to ligature or excise a portion of the Fallopian tube after all Cæsarean section operations. In any case, the mere ligature of the tube is inefficient, as several cases are known where pregnancy has occurred after such a procedure (Horrocks,[52] Bland-Sutton[53]). Formerly, when uterine sutures were not used after Cæsarean section, it was not uncommon for the uterus to rupture if a subsequent pregnancy took place—sometimes during the pregnancy, sometimes during labour (Abel[54]). But now, with accurate suture of the uterine wound, such an accident is of very rare occurrence, although not unknown (Galabin[55]). Repeated Cæsarean section on the same patient has been performed by many operators, among them McCoy,[56] Selhorst, Coakley,[57] Braun-Fernwald,[58] Van der Poll, Lohlein, Olshausen,[59] and Abel.[54] The long list of these cases goes to prove that there is little, if any, added risk in subsequent pregnancy and repeated Cæsarean section on the same patient.

The Results of the Operation.—Statistics on this point are apt to be misleading, because in a large number of cases many must occur in which the conditions are all against a successful result. In such bad cases the operation can hardly be called an elective one. When the operation is really performed as a matter of choice on a patient whose labour is just starting, whose health is otherwise unimpaired, and in whom there is not already any infection, the results

are extremely good. Whitridge Williams,[4] quoting from Chrobak, Schauta, Leopold, Braun, Olshausen, Zweifel, Reynolds, Bar, Charles, Cragin, in a collection of 335 cases of conservative section, found only 23 deaths, or 6·87 per cent. However, even in this series 15 cases were scarcely to be called elective, and 10 deaths were in no way due to the operation, so these should be subtracted. This gives a corrected mortality of 4·06 per cent. Such results as these cannot but lead to the conclusion that the elective Cæsarean section is an extremely favourable operation, and compares to the detriment of such mutilating procedures as craniotomy and embryotomy, with their 100 per cent. fœtal mortality.

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