Original Articles.

CESAREAN SECTION. AN HISTORICAL REVIEW, WITH AN ANALYSIS OF SIXTY CASES.*

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CESAREAN SECTION, originally intended to save the child after the death of the mother, and later branded as the last resort and the most forlorn hope of obstetrics, came down through the centuries almost to our own day a much discredited operation. To modern surgery, with its asepsis and constantly improving technic, belongs a full measure of credit; and yet to those physicians of the past, who preferred the Cesarean to craniotomy and stoutly clung to their belief in its future, all mankind, mindful of the mothers of the race and their unborn babes, owes a still fuller measure of affection. Upon the indications for the operation, the last word has by no means been said. When to operate and why to operate are questions that need repeated emphasis and discussion, and it is only by the contribution of each operator's experience that a final result may be reached. In reviewing the past and presenting my own series of cases, I trust that I may at least add to the "gaiety of nations," if not to the knowledge of my brethren.

Dr. Robert P. Harris, of Philadelphia, some fifty years ago, began a statistical and critical study of this subject from the various cases that he was able to collect. His was a tedious task, undertaken for no selfish motive but solely to place the Cesarean operation where he believed it belonged, among the operations of conservative surgery, and thereby to rescue it from the low level to which it had been relegated by those, who, reckless of the child's right to life, preached the doctrine of the perforator and the crotchet. Cesarean section had never been a popular operation inasmuch as its record of fatalities had branded it as something preferable only to the certain death of both mother and child.

In England, where the gruesome record of dead women was large, it was bitterly opposed. Harris, who never doubted its superiority to craniotomy and the other destructive procedures, was big enough to see that no operation is to be measured by the mortality that follows it if the gravity of each case operated is determined by conditions that are avoidable. He felt that there was in the medical profession a disposition to undervalue to a great degree the life of the child as compared with the life of the mother, and to

sacrifice it for her benefit with very little hesitation.¹ Often the child was sacrificed to no purpose, for the mother was lost by exhaustion due to the consequent delay. The operation was unsuccessful, because, not to mention the lack of modern surgical technic, it was done only after both mother and child were endangered by prolonged attempts at every other method of delivery. With a timely consideration of the child's life almost unknown, a late operation to save the mother was the inevitable result.

The British practitioners for several reasons had been unfortunate in their Cesarean mortality, and their resultant distrust of the operation spread to this country. Churchill, in his "Operative Midwifery," published in Dublin in 1841,² gave some statistics showing the relative merits of the several destructive operations and the Cesarean. In a series of 251 destructive cases 52 mothers died, or about one in five. Of course all the children were lost. Out of 40 Cesareans among British practitioners up to this time, only 11 mothers recovered, and but 22 children were saved. Among Continental practitioners, out of 369 cases of section, 217 mothers recovered and 138 children were saved; and in connection with the children it may be stated that the result to the child could be learned in but 187 cases. On these statistics, wrongly analyzed, because no deductions were made in favor of children saved, was based the hostile attitude of the English, until Dr. Harris, with an enthusiasm, and breadth of vision that now shows him to have been far in advance of his time, appeared as the champion of an almost lost cause.

By the year 1878, besides collecting all available cases in this country, he had with the assistance of Dr. Radford, one of the few British supporters of the Cesarean operation, totalled 118 cases in the United Kingdom.³ Of these last, only 20 were operated early, and of those 20 only 4 recovered. Out of the whole 118 there were but 22 recoveries and only 67 children were born alive. Forty years has shown no improvement over the facts stated by Churchill. Summing up the whole record, the United Kingdom in its first 120 years of Cesarean history saved only 10 women out of 68, and in its last 20 years, only 12 out of 50. This was due to the teaching of the so-called obstetrical leaders of the time. In passing it may be of interest to remark that the first recorded case in the United Kingdom dates back to January 19, 1738, when Mary Donnelly, an Irish midwife, operated, near Charlemont, Ireland, on Alice O'Neil, aged 33 years, who had been 12 days in labor. The child was dead, but the patient's life was saved.⁴

An idea of the disastrous results on the Continent may be gathered from several letters written to Harris by Continental operators. Dr. Winekel, of Germany, who up to 1880 had almost as large a series as any other German operator, saved only 6 women and 9 children out of 14 cases, and this was more than all the op-

* Since this paper was written the author has added three cases to this series without any change in the mortality either to mother or child.

erators of Paris and Vienna saved in a century up to 1876, when the Porro operation was introduced at Pavia.⁵ Neither Paris nor Vienna up to this time could boast of one single mother saved.⁶ Dr. Girolamo Previtali of Bergamo, Italy, wrote that he lost 17 out of 19; Dr. Morisani, that they saved but 2 out of 27 in Naples; and Dr. Belluzzi, that his was the twelfth operation in Bologna and the first to succeed.⁷

It is not surprising that on the Continent the condition of the Cesarean operation was so discouraging when we look back over the record of ordinary obstetrical cases. In the Paris Maternity Hospital, between April 1 and May 10, 1856, there were 64 fatalities in 347 confinements. The hospital had to be closed, and the survivors took refuge at the Lariboisiere Hospital, where nearly all died, pursued it was thought by the epidemic. Tarnier, then a student residing at the Maternité during that disastrous time, related afterward how the ignorance of the causes of puerperal fever was such that he was sometimes called away by one of his chiefs from a post-mortem examination to assist in the maternity wards. Men seemed to be ignorant of the fact that infection might thus be carried from the autopsy room to the bed of the patient. One day in a discussion of puerperal fever at the Academy of Medicine, one of the most distinguished members of the academy was eloquently enlarging upon the causes of epidemics in lying-in hospitals, when Pasteur, that scientific genius unsurpassed in the history of all time, interrupted him from his place. "None of these things," said he, "caused the epidemic; it is the nursing and medical staff who carry the microörganism from an infected woman to a healthy one." Then when the speaker replied that he feared that it would never be found, Pasteur went to the blackboard and drew a diagram of the chain-like organism, saying, "There, that is what it is like!"⁸

From conditions so deplorable abroad, we may turn with a feeling of pride to our own country. In January, 1881,⁹ the results of Harris' researches in the United States showed 120 cases with 50 recoveries and 70 deaths; but the record is best judged by its 28 timely operations productive of 21 recoveries. A summary of his work, besides being of interest, shows also the thoroughness and the zeal with which he worked upon this problem. There were 52 children born alive and 68 dead; of all these, 64 were blacks and 56 whites. Forty of the blacks died and 24 lived, while 30 of the whites died and 26 lived. There were 24 dwarfs from 3 feet to 4 feet 8 inches in height, 17 of whom were white and 7 black. Seven of these 24 dwarf mothers recovered, of whom 2 were black and 5 white. The shortest white who recovered was 3 feet 11½ inches, and the shortest black 3 feet 9 inches. Louisiana and Ohio had the most successful records, the former saving 15 out of 20 women, and 9 children; and the latter saving 7 out of 10

women, and 6 children. Nineteen of Louisiana's cases were black and one white, and the five who died were black. Ohio's cases were all white.

These two states besides leading in the number of successful cases, were also the pioneers in the Cesarean field in this country. Harris gives the honor to Louisiana, crediting to Dr. François Prevost of Donaldsville, Ascension Parish, Louisiana,¹⁰ 4 cases, the first of which he dates prior to 1825, in which year he places the third. The date of the fourth he fixes in 1831. Prevost was born at Pont-de-ce, France, about 1764, graduated in medicine at Paris, and settled in San Domingo, but was driven out during the insurrection. He escaped to Louisiana and spent the rest of his life in Donaldsville, where he died in 1842 at the age of 78. "As he was a bold operator," says Harris, "and was 67 years of age when he operated upon his fourth case, it is quite probable that he may have had others prior to the first on our record, for he was engaged in active practice for more than thirty years in a district in which rickets was not uncommon as a cause of dystocia."

Garrison,¹¹ however, in his recent history of medicine, states that the first Cesarean section in this country was done by Dr. John Lambert Richmond, of Newton, Hamilton County, Ohio, in April, 1827. The date of Richmond's case is beyond dispute, for we have from his own pen the story of that historic event. In the first volume of the *Western Medical and Physical Journal*, published in Cincinnati in 1827-28,¹² there appeared a short statement that John L. Richmond, M.D., of Hamilton County, Ohio, performed the Cesarean operation on a primipara. It goes on to say that during the fifth week after operation she walked two miles in one afternoon, and in the seventh week she walked in perfect health fourteen miles in one day. Several years later the same journal¹³ published Richmond's story of the operation, which deserves more than passing mention.

On the 22d of April, 1827, Dr. Richmond was called seven miles from home to see this patient, already in labor some thirty hours. He found her very much exhausted and having convulsions which continued from three to five minutes. Examination showed an unengaged head and a malformation of the vagina, in which it was impossible to make out the os. After four hours of fruitless endeavor, during which he could get no help, as the night was stormy and the Little Miami River was rapidly rising, he determined to operate. The solemnity of the occasion he well expresses: "After doing all in my power for her preservation, and feeling myself entirely in the dark as to her situation, and finding that whatever was done must be done soon, and feeling a deep and solemn sense of my responsibility, with only a case of common pocket instruments, about one o'clock at night, I commenced a Cesarean section." And when we think that this man on the outskirts of civilization per-

formed this operation on a wild night, in a house of logs with unchinked crevices, without chimney or chamber floor, assisted only by two women whose sole duty was to hold blankets to keep the wind from blowing out the candles, we wish that we could know something of his personal side. The placenta was on the anterior wall of the uterus, and before it could be removed after being incised and detached, a sufficient length of time had elapsed to cause the death of the child. It must be remembered that these were the days before general anesthesia, when pain and the consequent muscular spasm made abdominal surgery heroic work. In fact, before Richmond could deliver the child, which presented its back and was firmly held in its position, he was obliged to make a transverse incision across the muscles of the lower dorsal region, which enabled him to double up the spine and remove the dead fetus. During the entire operation, there was very little hemorrhage, and although during convalescence the patient developed a mild peritonitis, she made a rapid recovery and began to do light work twenty-four days after the operation.

Up to the early 80's, with very few exceptions, the contractions of the uterus were depended upon to approximate the edges of the incision, with the result that many cases were lost by infection due to the escape of lochia into the peritoneal cavity. The first record that we have of uterine suture goes back to August, 1769,¹⁴ when Lebas, a surgeon in Moulleiron, France, sutured the uterus in a successful case, only to be severely criticized for his rashness. Referring to this case the "Comprehensive Dictionnaire de Medicine," Paris, 1834, stated that the uterine wound did not need any special treatment, although an unskilled surgeon once introduced sutures which it was found necessary to remove.¹⁵ The first record of uterine suture in this country, and perhaps the first since Lebas' case in 1769, is the unsuccessful case of a Virginian charlatan in 1828,¹⁶ in which three sutures were used in the uterine incision. No record again appears until 1867 when Dr. T. Beers Townsend of New Haven and Dr. T. Warren Bricknell of New Orleans each employed uterine sutures in their respective cities. Both patients lived. Townsend used three sutures of fine hemp, and Bricknell, six of silver wire.¹⁷ This last operator had advocated this technic in his obstetrical lectures, but had been ridiculed for his wild opinions.

These two cases, sutured in 1867, were two of the three recoveries out of the only four cases operated that year in the United States. The third recovery was the case of William Warren Greene, M.D., of Pittsfield, Mass., who had the honor of doing the first Cesarean section in this state.¹⁸ In his case, the edges of the uterine wound were drawn together perfectly by the contractions of the uterus, and the abdominal wound was sutured with silk soaked in boiling

wax. This last he used with much reluctance as he had no silver wire—a fact which worried him very much. The next four operations in the United States were done without sewing up the uterus, and only one of the women recovered. One of the deaths was due to a loop of bowel being choked in the closing uterine wound.¹⁹

In 1878 Dr. Curtin of Philadelphia reported a case in which he used carbolized catgut.²⁰ It was but the fourth in Philadelphia, and the fifteenth in this country in which uterine sutures were used, and it has also the distinction of being the first operation here in which sutures of animal material were employed. Altogether in the United States up to 1882, the uterus was sewed in but 22 cases, of which 10 recovered.²¹ It seems incredible to us now that for three centuries the surgeons of the world should have left to nature the entire care of the uterine wound, with its unlimited possibilities of infection.

Defects in technic, however, could not be blamed for all the failures. Harris, who continually pleaded for the timely operation, pointed out by his exhaustive analysis of the old cases many lessons that are still valuable today. "Every surgeon in our land," said he, "should make himself fully acquainted with the steps of, and improvements in, the Cesarean operation, and especially with the value of operating as early in the labor as practicable, after he is called in; and every obstetrician should learn the comparative dangers between craniotomy in contracted pelves, and a timely delivery by gastro-hysterotomy, as applied to American women."²² It is this need of operating timely that must be impressed upon us as much as ever today, for if it is to be successful in the highest degree, the Cesarean must be an operation of election and not one to fall back upon after the patient is exhausted and started on the road to infection.

In the old records this fatal delay is much in evidence, just as it is today. Writing in 1879,²³ Harris sadly commented on the fact that instead of progressing towards success, as all other varieties of abdominal surgery were, Cesarean section was retrograding under the teaching of those who condemned it as an operation of election or who passed it by entirely for the destructive operations. Looking over the record of this country prior to 1880 we are struck by the remarkable fact that the ten years from 1868 to 1878 showed an increasing mortality. From 1838 to 1848 we had eight sections with four live women and five children. Three of these operations were timely. From 1848 to 1858 we had twenty-seven operations with a saving of 13 women and 15 children. Here 8 were timely. From 1858 to 1868 we record 23 operations with 13 women and 8 children saved. Of these 5 were timely. From 1868 to 1878 our Cesarean operations numbered 27 and we can boast of but

4 women and 13 children saved. In this last group only five of the operations were timely. Of the cases that died we find two, three, four, seven, and fifteen days recorded as the time of labor, and there were three of these cases in the fifteen-day class. The manner of death as recorded is indicative of the effect of long delay, *i.e.* peritonitis 8, exhaustion 8, hemorrhage and exhaustion 2, septicemia 2, etc. The conclusion is evident. The profession was not ready to accept the fact that in early operation lies the hope of both mother and child, and that the chances of either rapidly diminish as labor advances.

Criticism of the general practitioner for his lack of faith in the Cesarean would be unjust because he was only following the opinion of the leaders. Playfair, in his book of Midwifery, published in 1878, stated emphatically that great as are the dangers attending craniotomy in extreme difficulty, there can be no doubt that we must perform it whenever practicable, and only resort to Cesarean section when no other means of delivery are possible. He even went so far as to characterize as bold the man who preferred it to craniotomy. Fortunately for us, men of the type of Richmond and Prevost were bold. It may be that boldness was the only salvation of the pioneers of the operation in this country. Many of them probably lacked the necessary destructive instruments. It was fortunate for Richmond that he was seven miles from home and unable to procure a destructive kit, even if he owned one, that eventful night near the banks of the little Miami when his little pocket case wrote a chapter worthy of the best in the history of American medicine.

Furthermore, when in 1835 Dr. Meigs,²⁴ of Philadelphia, told Mrs. Reybold after the second craniotomy that he would not destroy her child if again she became pregnant, he too added glory to the history of American medicine. Mrs. Reybold, who was born in Ireland in 1809, came to America in early childhood and married at the age of twenty-one. A year later, when at full term pregnancy, it was discovered by her attending physician that her pelvis was much deformed by previous rachitic disease. A number of consultants were called and the Cesarean operation was proposed, but it was decidedly objected to by the majority of "distinguished surgeons" present, under a conviction that it would be almost necessarily fatal to the mother. After a labor of sixty-four hours Dr. Meigs perforated the head of the already dead fetus, but was unable to deliver it by any of the appliances then in use. He was forced to delay until putrefaction had softened the child before he could remove it, which was not until thirty-three hours later. Mrs. Reybold was much exhausted and narrowly escaped death. Two years later, in 1833, she was again at full term and Dr. Meigs performed a second craniotomy, but told her emphatically that he would not de-

stroy another child in the event of her again becoming pregnant and that she would have to submit to the Cesarean section. Falling pregnant again in due time she placed herself under the care of Dr. Joseph G. Nanercede, who determined that when the proper time came she would be delivered by the abdominal route under Dr. Gibson, who was consulted about the case. When in labor on March 25, 1835, it required two hours of waiting and urging before she would consent to the operation, and then it was only the emphatic stand taken by her father confessor that made her consent to it at all. After a labor of twelve hours she was successfully delivered by an operation that lasted but ten minutes. Two years later, on Nov. 5, 1837, Dr. Gibson was again the operator on a similar occasion. In both cases she made an almost uneventful recovery and was blessed by a boy and a girl, for both of whom she could thank the good judgment and skill of the attending physicians.

In 1879 Mrs. Reybold and her two children were still living, and, moreover, she was the grandmother of six. As Harris truly remarked,²⁵ "What better trophy could Dr. Meigs, if now living, present than Mrs. Reybold with her two children and six grandchildren, as the fruits of his declining in 1835 to destroy any more children for her. She died in 1885, at the age of seventy-six, thus outliving the nine physicians who were present at her first operation, and the four who, with the two Gibsons, made up the group at the second. Harris, ever on the alert to add to his fund of Cesarean knowledge, performed an autopsy on her body with the assistance of Dr. Hornor, also of Philadelphia. They found evidence of old rachitic disease and a badly deformed pelvis, the true conjugate of which was but one and three-quarters inches.

Such is the story of the Cesarean operation up to 1880, when it passed into a new and more successful period of its existence. Antisepsis and asepsis and various other advances in surgical technic came to the rescue. The median abdominal and the median uterine incision became the rule and the uterus was now always sewed in layers. To Säger of Leipsic,²⁶ who operated in August, 1880, in a case of retro-uterine fibroid, we are indebted for the two-row multiple system of suturing. In 1881 he reported his method. In this case he inserted six deep and four superficial uterine sutures, the latter taking up some muscle fibres, and brought the peritoneum carefully edge to edge. Later he recommended more sutures, and it was for these reasons that the so-called new operation became known as the Säger operation, although many departures were made from his original technic. Dr. H. J. Garrigues of New York was very strong in his objection to the name Säger Cesarean, claiming that he and many others had performed every single step of the so-called Säger before anything had been heard in this country

about that operator's method. Said Garrigues, "There is little ground for attaching a single man's name to the operation in its present shape, which is a beautiful outgrowth of general surgical and special gynecological development, an evolution due to the combined efforts of many men working independently of each other, in different countries, especially Lister in Scotland, Spencer Wells in England, Guenoit in France, P. Muller in Switzerland, Leopold in Germany, and last, but not least, Lungren in the United States."²⁷

It is true that Porro of Pavia had introduced in 1876 the operation that bears his name, and it is also true that on the Continent, especially in Italy, it had become a popular procedure. In this country its adherents were few, because our operators, unless some pathological condition demanded it, did not take kindly to an expedient that sterilized the mother. Of course Porro's only purpose in the operation was to reduce the high rate of mortality that was Italy's misfortune under the old Cesarean method. Theoretically the plan of excluding from the abdominal cavity the much dreaded uterine wound and treating its amputated substitute as an external stump, was an excellent one; but practically it was in the beginning a failure, as twenty-nine out of the first fifty women operated on died. Up to the beginning of 1892,²⁸ its record in 21 different countries under 224 operators showed 441 cases with 274 recoveries and 176 deaths among the mothers, and a saving of 345 children. In the number of operations, Italy led all the other countries with 154 cases that scored 85 recoveries, while we had in this country only 21 Porro Cesareans with 10 recoveries and 11 deaths. Our small number was simply due to the preference of our operators for the improved Cesarean, of which there were three to one Porro.

With the Porro meeting with such fair successes abroad, the years immediately following the adoption of the so-called improved Cesarean were especially trying for our operators who were having none too happy results. The obstetric surgeon was given an opportunity only when the risk of operating had been much increased by long labor and repeated attempts at instrumental delivery. For example, beginning with Dr. Garrigues' case in 1882, the first ten new Cesareans cost the lives of six women and three children, and in the case of our Porro operations, eight of the women were delivered of children already dead, some in a commencing state of decomposition, when the operator was called to the rescue. Nevertheless, thanks to men like Lusk, Goodell, and Kelly, our operators did not lose heart, for this triumvirate of surgeons, deserving of no mean place in the annals of our medical history, showed between 1887 and 1891 the remarkable record of ten cases with every child saved and but one woman lost.²⁹ Thus did we come from darkness into light, from discouragement to success, and in

looking back over the whole record of Cesarean achievement we have every reason to feel proud of the great part played by American physicians.

From this time up to the present, the number of sections has rapidly increased. That in the various groups of cases reported the mortality is not as low as it ought to be is not altogether the fault of the operators. In 1909,³⁰ the Boston Lying-in Hospital published its first one hundred cases, the first being the one done by the late Dr. George Haven in 1894 and the hundredth being done about the middle of 1907. The largest number done by one operator was 22, while the rest were distributed among 9 other members of the staff. In this series, the deaths of 8 mothers and 8 children are recorded, —a rather high mortality, as Dr. Newell says, but easily accounted for by analyzing the length of labor before operation. Of 43 primary operations only 1 mother died; of 26 secondary operations there was the same result; but in the 31 operations that are characterized as late, we find the evident cause for the death of 6 mothers. Of these 6 who died, 3 had been in labor 24 hours or more, on one high forceps had been tried and failed, and one patient was suffering from acute nephritis. The cause of death in all these late cases except one was general peritonitis, and that one exception died of intestinal obstruction.

The record of these late cases is the old, old story of Cesarean indications unrecognized outside until too late, when the hospital is called to take the responsibility and spread upon its records a mortality that belongs to someone else. The indications for operation in this series were mainly relative or absolute pelvic insufficiency. In fact, there were only four cases in the hundred in which a pelvic deformity or repeated loss of children was not the main indication. Of these four, one was a contraction of the lower segment of the uterus following a previous myomectomy, the second was a contraction of tissues following an amputation of the cervix, the third was a faulty position of the uterus due to a previous fixation, and the fourth was a vaginal atresia resulting from an extensive operation. Since the publication of these, the Boston Lying-in Hospital has had 131 additional sections, making a total of 231, with an entire loss of 17 mothers. That its percentage of maternal mortality shows such a slight decrease is undoubtedly due to the fact that the fatal cases are the ones sent in exhausted after a tedious labor. At this hospital, the policy is never to remove or impair the function of healthy organs, and it must be a matter of great satisfaction to the operators to point to five successive and successful sections on the same woman, the fifth section being productive of twins.³¹

No institution can have a better proof of the high quality of service rendered by its physicians to the community.

In 1907,³² Dr. Reynolds of Boston, in arguing for the elective Cesarean made an analysis of 289 cases by 20 different operators. Out of 82 operated before labor began there was but one death; out of 158 operated in the early hours of labor, there were 6 deaths; and out of 49 done after labor was well advanced there were also 6 deaths, a mortality of 12%. The majority of the deaths in the secondary and the late cases was due to general peritonitis. Dr. Reynolds himself at this time had 30 cases, all operated early and without a single death,—a truly remarkable record.

In 1908,³³ McPherson reviewed the record of sections at the New York Lying-in Hospital for the previous 19 years. The analysis showed out of 186 cases, 30 dead mothers and 13 dead children. Of the total number of cases, pelvic deformity was the indication for operation in 162. The other reasons for operating were malignant growth, atresia of the vagina, impacted face presentation, eclampsia, complete placenta previa, and large head with impacted shoulder. Of placenta previas there were two, both of which recovered. By the early part of 1912³⁴ the number of sections in the New York Lying-in had grown to 352, with a total mortality of 38 mothers and 53 children. Of the latter, 23 were stillborn. Twelve of the women who died had been manipulated and infected outside before they were admitted to the hospital and the causes of their deaths come under the head of general sepsis, combined on one case with spinal meningitis. One mother was brought in from the ambulance in a state of shock with a ruptured uterus, and a stillborn child in her abdominal cavity. Another mother was so far gone that she died on the table before the abdomen was opened. In another case where lobar pneumonia was the reason for undertaking the operation, both mother and child died, the mother on the first day, and the child on the fifth day after operation. Eclampsia and neoplasms claimed five deaths apiece. Pott's disease was the cause of one where the mother was moribund and the operation done merely to save the child, who fortunately lived. Four died of pneumonia and one of pulmonary embolus. These are not all the causes of the deaths, but they give us some idea of the desperate cases that find their way to the lying-in hospitals of our large cities. With the elimination of the moribund cases, where the chance of the mother's recovery was hopeless, and including general sepsis from outside previous attempts at delivery, pneumonia, eclampsia, and neoplasms, McPherson modestly reduces his mortality to 33 women, or 9.6%, which is much higher than the hospital deserves. Dr. A. B. Davis,³⁵ of this same hospital, has a record of 134 cases up to 1912, most of which are included in McPherson's statistics. Of these, Davis lost 17 mothers, a high mortality, but necessarily so, since he was obliged to operate a number of cases that

were moribund and others that were badly infected. Good, of Boston, reported 20 cases a year ago, with no deaths of mothers or children.³⁶

My own series consists of sixty cases, out of which one mother died. There was no fetal mortality. Of the mothers, 4 were under twenty years of age; 12 from twenty to twenty-five, inclusive; 13 from twenty-six to thirty, inclusive; 14 from thirty-one to thirty-five, inclusive; and 16 from thirty-six to forty, inclusive. There were 34 first pregnancies, 16 second, 1 third, 5 fourth, and 4 fifth pregnancies. Of the sections, 51 were first, 8 were second, and 1 was the third section. The following list sums up briefly the various indications:—

Eclampsia with varying degrees of justo minor pelvis	7
Eclampsia with large baby (9 pounds) in primipara	1
Malposition of uterus after Alexander operation	1
Old tubercular ankylosed hip with deformed pelvis	2
Placenta previa complete in primipara with justo minor pelvis	1
Chronic heart with general edema plus pelvic deformity	1
Primiparous twin pregnancy with breech presenting in flat pelvis	1
Flat pelvis	17
Varying degrees of justo minor pelvis	20

Seven of these cases were absolute indications with internal conjugates of from two to two and three-quarters inches. In the other cases the indications were relative, which is always true in the majority of Cesarean sections. Only 16 of my cases could, by any stretch of the imagination, be called early sections. Of these 16, only 4 were operated before labor began. The remaining cases were in labor from periods of from twelve hours to four days before coming to the hospital, and one of the babies had a facial paralysis, due to attempted high forceps outside. Of the multiparous women on whom the first section was done, 16 were second pregnancies in which the first child was lost after difficult forceps operations. There was one third pregnancy with a history of two previous dead children. Four were fourth pregnancies, of which three had a history of three previous dead children each; and one had two children dead and one living. This living child had a permanent facial paralysis. In three of the four fifth pregnancies, two of whom were thirty-four and two forty years of age respectively, all previous children had been lost in difficult forceps deliveries; and the fourth case, the only fatality in my series, had a history of extremely difficult labors, the last of which resulted in a permanent brachial paralysis to the child. On this occasion she had been in labor forty-eight hours before operation with no advancement, and for twenty-four hours she had refused to submit to a section. Although she left the table in very good condition, she died ten days later of a pulmonary embolus.

It is the fortunate result of my 44 late op-

erations that makes this series interesting, but I doubt if in another similar series I would have such a happy outcome. Although all these late cases had been repeatedly examined by outside physicians, and in some forceps had been applied, it is certainly a tribute to the aseptic obstetrical technic of these men that the women came to the hospital without infection. When the operation was explained to each mother, she gladly consented, since it offered to her a living child. Moreover, it is very doubtful if any of these children could have been delivered alive by any other operation; and I am positive that the maternal mortality would not have been as low, because with babies ranging from six and three-quarters to twelve pounds, there would have been extensive laceration of the mothers, which, combined with the shock and long anesthesia, would have boded ill to these women, already exhausted by tedious labors.

Nevertheless, notwithstanding the satisfactory outcome, I want to emphasize the fact that it rather argues in favor of the early operation. I cannot agree with Hirst that we ought to test our doubtful cases by a long labor and by a cautious application of the traction rods for at least twenty minutes. Up to 1908 he had 77 cases with 5 deaths. In the last 38 of these cases there had been only one death and this was a woman operated before the onset of labor. With this one exception, all his cases were operated after periods of labor of from twelve to twenty-four hours.³⁷ In 1912,³⁸ his cases totalled 125 with 6 deaths,—almost a 5% mortality. This is a practice that should not be encouraged, for it carries with it a mortality that Cesarean section should not be burdened with, and besides it tends to lead the obstetrician into operations of high forceps and version, which are afterwards very much regretted.

The statement of Dr. James A. Harrar,³⁹ of the Lying-in Hospital of New York City, is not only convincing but instructive. "Extending the indication for Cesarean section," he says, "has placed the high forceps operation decidedly on the defensive. The limitations are constantly narrowing. Many of our best obstetricians indeed go so far as to reject it as a recognized method in the treatment of dystocia; and when we consider the many deplorable consequences in the hands of the inexpert, the torn vaginae, the ruptured vaults, the vesical fistulae, and the fetal lives sacrificed, there appear good grounds for their attitude. When the forceps is used, as it so often is, to do what amounts practically to a cranioclasty, it is utterly to be condemned. The axis traction instrument will never bring a head through such a brim to the operator's credit, the proper instrument being the basiotribe." In presenting special statistics in a long series of cases by many different operators, Harrar refutes the common opinion that a version is safer than high forceps when the largest diameters of the head are still above

the pelvic brim. In 60,000 labors, the fetal mortality in high forceps, including deaths in the first ten days, was 26.16%, compared with a fetal mortality in all cases of version of 41.32%. These figures, it may be said in fairness, include indications for version other than those of disproportionment. Yet, comparing the results of the two operations as employed in the treatment of 269 cases of pelvic deformity occurring in 30,000 labors, we find the infant mortality of high forceps to be 25% and that of version and deformed pelves to be 46.16%. Operations carrying such a mortality can by no means be classed as operations of election.

It may be generally stated that an indication for Cesarean section exists when an obstetrician, after a careful study of his case, is convinced that the child can only be born after a difficult instrumental or other form of delivery that may seriously cripple it for life, if it does not cause its death, and which subjects the mother to the possibility of extensive laceration, with shock and probably impairment of her future health. Formerly there was but one indication for Cesarean section, and that was the so-called absolute indication; but today it may be truly said, without employing confusing terms, that all indications are absolute. Unfortunately, there is no set of rules to guide us in determining these indications, and each operator must rely upon the results of his own experience. He must consider the size and the shape of the pelvis; the relative size of the child, its position, and the extent of ossification of the head; he must also estimate the ability of the mother to force that child through the maternal canal within a reasonable period of time.

In estimating the size and shape of the pelvis many factors must be considered. As one writer aptly remarks:⁴⁰ "It is unfortunate that all these important factors have not been reduced to precise calculations such as are known to the mechanical engineer in his problems of resistance. Deprive him of his carefully prepared tables and let him attempt his problems with only his senses of sight and touch and personal experiences, and his errors would soon disqualify him. The mechanical problems of obstructed labor must be more definitely systematized before our conclusions in individual cases can be scientifically accurate. Until that has been done we can only rely on individual judgment with its inherent errors." The physician who would do modern obstetrics must endeavor to satisfy himself about many facts concerning the pelvis. The external measurements upon which so much was thought to depend are of little value as a matter of fact in determining size. The information they give is indicative rather of changes in shape, and consequently they lead to a more careful study of pelvic deformity. It is in determining intra-pelvic conditions that the judgment and skill of the operator are taxed. The thickness of the symphysis, the measure-

ment of the true conjugate, the inclination of the pelvic bone, the prominence of the sacral promontory, the straightness or exaggerated curve of the sacrum, the projection and curves of the lateral pelvic walls, the depth of the pelvis, the character of the cervix and pelvic floor,—these give some idea of all the factors to be considered when we are trying to estimate the general shape and size of the pelvis. Out of the data obtained only one factor is mathematically exact and that is the measurement of the true conjugate, which when two and three quarters inches or less is always a so-called absolute indication. When more than two and three-quarters inches, it cannot, as Norris wisely says,⁴⁰ when considered apart from associated changes in the shape, inclination, and general character of the pelvis, determine the potential obstruction in any given case. He further states that his experience has led him to pay especial attention to the height of the sacral promontory, the height of the symphysis, the angle of inclination of the pelvic inlet, the angle of inclination of the symphysis, and the degree of curvature of the sacrum. In this connection we must also remember the funnel-shaped pelvis, mentioned by Williams, as existing in women who present no external deformity of the pelvis and in whom the usual measurements are normal.

In trying to reach an estimate of the size of the child, the operator is again obliged to depend only on his experience. There are no rules or instruments to serve as infallible guides, but by constant practice the obstetrician in the course of time, after making the various allowances necessary for abdominal fat and the liquor in the uterus, may become quite proficient in arriving at a fairly accurate conclusion. When the pelvic measurements are small, it behooves the conscientious obstetrician to know before the onset of labor whether he is dealing with a six or a twelve-pound baby, and the only way that he can acquire this information is by a timely and careful examination, under ether if need be.

A consideration of the physical power of the mother with reference to her ability to endure labor, especially in the presence of a large child, with a moderate degree of pelvic obstruction, is a problem that cannot be disregarded. There is a class of women, characterized by Reynolds as "the obstetrically worst equipped, who," he says, "endure even natural labor badly and show a high percentage of morbidity after the various intra-pelvic operations." I believe, with Reynolds, that this class of patients should be subjected to the Cesarean section.

The various pathological conditions affecting the uterus and the vagina must be dealt with as they occur. Abnormal positions of the fetus in primiparae show a high mortality and in the presence of border-line pelvis Cesarean alone is indicated. In breech presentations in multiparae the selection of operation must depend

upon the estimated proportion between the size of the fetal head and the pelvic outlet. In any case after a few hours of good labor pains, when the presenting part refuses to enter the brim, the Cesarean operation ought to be considered. In elderly primiparae, especially in those cases where another pregnancy is improbable, Cesarean section should be advised because it offers much better results for both mother and child.

In this series I have had but one placenta previa, done primarily for the pelvic condition. From this one case I am aware that no deductions can be drawn, but it seems to me that the attitude of De Lee on this question ought to carry some weight. He states that there is a reduction of the infant mortality from 50% to 5% and a reduction of the maternal mortality to at least 4%, if not below. His position is that an indication for Cesarean section will arise in cases of central and of partial placenta previa, when the pregnancy is at or near term with a living child, the mother in good condition, and the cervix closed or promising difficulty in dilatation,—conditions most common in primiparae.

In this series eight of the cases were eclampsias, all primiparae, seven of whom had contracted pelvis and one a large baby. It is safe to say that no other method of delivery would have been so successful. Admitting that an abdominal operation on a toxemic patient is serious, yet I believe that the accompanying shock is less than in those cases with a rigid os where a manual dilatation consumes a long period of time and too often ends with a dead baby and with a mother badly lacerated and very much exhausted.

In conclusion, I would emphasize the fact that the Cesarean operation should be an operation of election. This means, of course, that the obstetrician puts himself in the position of a prophet, foretelling the outcome of labor. It is true that he may be criticized, but his results will be far more satisfactory to mother and child than if he puts his trust in the god of chance. Opening the abdomen of a woman exhausted by a long labor and exposed to the risk of infection, is a task from which any operator may well shrink; but since the policy of St. Elizabeth's Hospital, for religious reasons, recognizes that the child in utero has a God-given right to life, there was left open to me no other method of delivery, and its results, I am proud to say, have justified the wisdom of our choice.

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THE FASTING METABOLISM OF INFANTS.

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THE investigation of the processes which take place in the animal or human body when the supply of energy from outside ceases and the total life functions are asserted by means of metabolism of the substances already present in the body, is from different points of view of the greatest interest.

The fasting metabolism forms the fundamental basis for the explanation of the existing conditions of the normal metabolism in different kinds of nutrition, for the investigation of the absolute amount of the metabolism, and for determining the food requirements of the organism under different physiological and abnormal conditions.

The fasting metabolism has been repeatedly investigated experimentally since the work of Lavoisier, the founder of our knowledge of metabolism. Although many and thorough investigations of this subject exist with animals and men, but little is known of the relation of the growing organism during fasting. Since the pediatrician uses the fasting as a therapeutic measure in the treatment of disturbance of digestion in early childhood, the whole question is of a great practical importance. In a small monograph Czerny weighed "pro et contra" of the fasting therapy from the clinical standpoint. He came to the conclusion that nurslings stand complete fasting as well as partial for a long time without evident harm, but he points to the dangers which might arise from the increase of acidosis on top of an acidosis which might already be present in a disturbance of digestion. Langstein and Benfey also expressed the opinion that the healing effect of fasting had been demonstrated in nurslings that have been ill because

of overfeeding, but that fasting can also result in disease.

We know very little about the metabolism of the healthy nursling during fasting.

The few investigations which until now are at hand, as those by Ludwig F. Meyer, as well as those by Ludwig F. Meyer and by Leo Langstein, treat this question from only one angle. The former studied the nitrogen elimination in the urine of three children of different ages during two fasting days. We do not find any report of the food previous to the fasting.

The investigations of Ludwig F. Meyer and Leo Langstein show only the elimination of acetone during a three days' fast.

Rietschel demonstrated in his experiments on six babies which had been taken away abruptly from the mothers' breast and put on a three days' diet of weak tea the one fact, that the urine of five of the children reduced Fehling's solution when they received nourishment again. His results lead him to the conclusion that fasting of several days leads to a disturbance of the normal utilization of the nourishment and diminishes the power of assimilation for sugar. All other investigations were done on sick children and are, therefore, not to be considered physiological. But for us the question is how infants in absolute or nearly healthy conditions react when subjected to fasting.

We do not enter into those experiments where there is no question of real fasting, as in the experiment of Rubner and Heubner, who determined the metabolism of an infant during twenty-four hours' abstinence from food, because in this instance the metabolism and the production of energy is in a great measure influenced by the food, which was previously given. By fasting metabolism we understand the combustion of the real body material. A strict line of division cannot be drawn here, but one can reckon that the beginning of the fasting period, from the physiological viewpoint, comes only after eighteen to twenty-four hours have elapsed after food has been given.

When Schlossmann and myself began the experiments of the respiratory exchange several years ago, the hope of answering the question of the fundamental and fasting metabolism of the nursling seemed to us very small. If, then, the gaseous metabolism which corresponds to the fundamental metabolism should be determined, the organism of the subject must be kept in a perfect state of rest. Therefore every factor which produces energy and which can be avoided must be excluded,—on one hand, the muscular activity, in so far as it is not absolutely necessary for vital functions; on the other hand, the work of digestion. The children, to express myself practically, must be kept in a state of starvation and must keep absolutely quiet during the respiratory experiment. It seemed to us most improbable that healthy and normal nurslings should submit to these de-