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One Thousand Cesarean Sections in the Modern Era of Obstetrics

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FACTORS RESULTING in the amazing reduction in maternal mortality in the era of modern obstetrics are reflected in the increased incidence and safety of cesarean section. In the general population of the United States the maternal mortality in 1953 was less than 6 per 10,000 live births. In other words, there was only 1 maternal death for every 1800 births, whereas only 5 years earlier the ratio was 1 in about 950 births, and 10 years ago 1 in about 450.[6] During this period the use of cesarean section has increased at least two-fold and has replaced the brutalizations of craniotomy, accouchement forcé, and the lethal meanderings of scientific apprehension. There is, of course, a point of diminishing returns in this surgical application in preference to vaginal delivery and it remains for the future to set the cesarean section rate at the proper level. That we have not reached this apogee is evidenced by the marked disparity in section rates throughout the country, varying as they do from 0.5 to 14%.[1]

Lahey and Ruzika have pointed out, with data from a large number of cases in five teaching hospitals on three continents, that the expected mortality during any operation and anesthesia from all causes is 1:1000.[4]

Potentialities of Cesarean Section

Pregnancy is an equal partnership of mother and baby, which is dissolved only by the discharge of both in good health. Neither an abdominal scar, an unwarranted fear of the future, the derogation of fetal life, nor the indecent pride in statistics are considered important enough to alter this philosophy. In the mind of the laity, as well as in that of the physician, there exists a deep misunderstanding of the potentiality of cesarean section. The fact that a pregnant woman is as subject to the uncertainties of this mortal existence as is her barren sister is readily forgotten in the light of the ever-decreasing maternal mortality rate. Nothing in this procedure will mitigate a pathologic lesion which would have been fatal whether or not the woman was pregnant.

For years there has been fostered the concept of cesarean section, in many cases, as nothing more than a deliberate attempt to salvage the life of the child at the direct expense of the mother's. De-Normandie, reporting on 11,117

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sections with a mortality rate of 2.4%, as late as 1942, did nothing to dispel this misinterpretation; in his series fully two-thirds of the infants born of mothers who died of their complications or operations survived, and were carried home to motherless childhoods.[2] The physician deludes himself in thinking that abdominal delivery will repair the ravages of prenatal anoxia or in some fashion mend the torn cerebral vessels caused by traumatic labor carried too long, or that it will add weeks of development or ounces of weight to the immature or premature infant. There are some, forgetting that infection from the lower uterine segment and cervix may be spread by the lymph and blood systems as well as by contiguity, who expect the type of section performed to eliminate entirely the possibility of peritoneal infection.

Two Approaches to Obstetric Problems

In this search for proper balance there is both an academic and a practical approach to the problems of obstetric pathology. Table 1 indicates the results in a series of

TABLE 1. 1887 REPORTED CESAREAN SECTIONS, 1934-1943

	Private (%)	*Ward* (%)	*Difference*
Incidence	6.7	3.2	½ frequency
Morbidity	16.5	24.5	50% higher
Maternal mortality	1.1	1.4	3 maternal deaths/1000 higher
Fetal mortality	5.5	7.8	40% higher

1887 cesarean sections, delineating the difference between the two.[3]

With half the number of cesarean sections on the ward side, in those cases where the operation was eventually performed, the fetal mortality associated with it was 40% higher than in private cases, the maternal morbidity was 50% greater, and maternal mortality increased by 3 maternal deaths per thousand. It is clear that to press too hard in an effort to keep the incidence of abdominal delivery at a low level will place an unwarranted burden on those whose condition eventually will require delivery by cesarean section.

Material and Method

The material presented represents a series of 1000 consecutive cesarean sections performed by the staff of St. Elizabeth's Hospital, dating to January 1946, and encompasses a total of 12,995 live births (a rate of 7.7%).

It is obvious that the validity of an accepted indication for the performance of cesarean section does not always exist to the same degree in different patients. Therefore, the decision for its use in an individual situation would preferably be based on an assay of its potential in realizing the objectives desired, rather than on a study of results obtained from its performance on the basis of diagnosis of underlying obstetric pathology. This is a novel method of analysis. We have therefore divided our sections into three groups — primarily in the maternal interest, primarily in the fetal interest, or equally in the maternal and fetal interest; secondly, by classification —elective, selective, or emergency.

Indications for Cesarean Section

Table 2 shows the indications for the cesarean sections in this

TABLE 2. INDICATIONS BY INTEREST IN 1000 CESAREAN SECTIONS

	%
Maternal	11.2
Fetal	34.0
Common	54.8

series. In over half both the mother and infant were involved equally in the obstetric pathology at the time of the operation. On the other hand, three times more cesarean sections were done in the hope of obtaining a live and unharmed infant than for a predominantly maternal indication. This situation never would have prevailed 50, or even 10 years ago, when this operation was a formidable procedure with a maternal mortality rate of 2.4%[2].

Classification of Cesarean Section

In Table 3 are given the three classifications — elective, selective, and emergency. The first and last designations require no definition; the selective cesarean sections were those performed when an obstetric condition made abdominal delivery seem probably, but not absolutely,

TABLE 3. PERCENTAGE OF PRIMARY AND REPEAT CESAREAN SECTIONS BY CLASSIFICATION

Classification	%
Primary (53.2%)	
Elective	20.1
Selective	18.3
Emergency	14.8
Repeat (46.8%)	
Elective	43.9
Selective	0.4
Emergency	2.5

the best way to attain our stated goal. There were 532 primary and 468 repeat operations, an incidence of 4.3% and 3.7%, respectively. It is worthwhile to note that there were almost six times more primary emergency cesarean sections than

TABLE 4. DATA OF TABLE 3, SUBDIVIDED BY OBJECTIVE

	Maternal (%)	*Fetal* (%)	*Common* (%)
Primary			
Elective	4.7	13.3	2.1
Selective	1.6	13.6	3.1
Emergency	4.5	6.0	4.3
Repeat			
Elective	0.1	0.8	43.0
Selective	0.0	0.0	0.4
Emergency	0.3	0.3	1.9
	11.2	34.0	54.8

repeat emergency procedures. This testifies to the evanescent character of many obstetric catastrophies, and is of course, a stimulus to further investigation of the probable cost of vaginal delivery where there has been a previous cesarean section.

It can be shown from Table 4 that 329, or 61%, of the 532 primary cesarean sections were done in the hope of more safely delivering a normal healthy infant in spite of the existing obstetric pathology or situation. This was about three times greater than when the existing obstetric pathology requiring cesarean section affected primarily the maternal organism. In the repeat section the majority, or 92%, were done in the corresponding interest of both, as we believe this situation to be equally dangerous both to mother and child.

Morbidity

The sire of maternal mortality in cesarean section is morbidity. In

this series, using the International Standard of 100.4°F. on any two successive days after the first postoperative day, the morbidity was 14.6%. Table 5 shows morbidity

TABLE 5. RELATION OF MORBIDITY TO INDICATION

Indication	*Cases*	*% Morbid*
Maternal	112	19
Fetal	340	19
Common	548	11
TOTAL	1000	14.6

in relation to the interest of the indications. In summary, it was no more dangerous to perform the operation in the interest of the mother than when the child was the chief concern.

CLASSIFICATION OF SECTION.

TABLE 6. RELATION OF MORBIDITY TO CLASSIFICATION

Classification	*Cases*	*% Morbid*
Primary		
Elective	201	17+
Selective	183	21
Emergency	148	18+
Repeat		
Elective	439	9+
Selective	4	50
Emergency	25	16

Table 6 shows the morbidity in relation to the classification of the cesarean section. The primary elective section has almost twice the morbidity of the repeat in the same category. Just why this is so is not clear. The selective group, done principally in the interest of the infant, shows the highest maternal morbidity. It is in this group that procrastination most often occurs, and 63% of the cesarean sections were done because of relative cephalopelvic disproportion and uterine inertia.

TYPE OF SECTION.

Table 7 refers to the types of cesarean section.

TABLE 7. RELATION OF MORBIDITY TO TYPE OF CESAREAN SECTION

	Total	*Morbid*	
		%	*Average days*
Lower segment	836	14	3.6
Extra peritoneal	101	13	2.4
Classical	36	14	8.0
Hysterectomy	27	44	2.8

The predilection for the lower segment operation is obvious, this type comprising 83.6% of the total. In the extraperitoneal group we have included only those cases in which the bladder was dissected from the peritoneal fold *without* puncture of the latter, regardless of subsequent repair, either before or after incision into the uterus. The average number of days of morbidity in each type is of interest to those who advocate the extra-peritoneal approach for infected or potentially infected patients. Although the basic morbidity rate for the extraperitoneal cesarean section is the same as the low segment operation, the true superiority of the former is indicated by a 33% decrease in duration of morbidity. 65% of the extraperitoneal operations were in the selective or emergency classification with their higher morbidity rate. Of the classical sections, 26 were by choice of the operator and 10 were by necessity, because of adhesions of large veins covering the lower uterine segment. The outmoded classical procedure produced the same total morbidity rate, by patient, as did the other two types, but three times the morbidity by days of the extraperitoneal, and twice that of the low segment operation. Hysterectomy for infection is a valid procedure, as its morbidity by days indicates. Hysterectomy in our hospital is done only on grave indication, which accounts for the high morbidity rate by case.

NUMBER OF PREVIOUS SECTIONS.

Table 8 indicates that the number of previous sections did not affect the morbidity rate. The uteri in this series were subject to 744

TABLE 8. RELATION OF MORBIDITY TO NUMBER OF PREVIOUS CESAREAN SECTIONS

No. of previous cesarean sections	*Cases*	*% Morbid*
0	532	19
1	278	10
2	133	13
3	37	11
4	13	15
5	5	0
6	2	0
TOTAL	1000 (744 previous sections)	

In patients with no previous sections, 19% morbidity; with one or more, 10% average morbidity.

incisions previous to the start of this series and constitute a group of 1212 repeat sections without a maternal death. We believe that the use of the lower uterine incision makes sterilization of the patient unnecessary. Irving, with an incidence of 54.6% of classical cesarean sections, reported a 24.4% sterilization rate, of which 66.4% were on the basis of previous section, and included 12 ruptured uteri, all of which were removed.[3]

ETIOLOGY. In all cesarean section studies, hemorrhage, shock, sepsis, and pulmonary emboli account for the major portion of the maternal mortality and morbidity. In labors lasting over 12 hours before operation the morbidity rate doubled, and with ruptured membranes of the same duration it almost tripled. Postoperative antibiotics, principally penicillin, were used in all morbid cases and in a total of 431 cases postoperatively as a prophylactic measure.

Table 9 shows that shock occurred in 8.5% of the cases. It was twice as frequent when the operation was done for common maternal and fetus indications, and was three times more frequent in the emergency operation. Eighty-nine patients were transfused without untoward reactions. The presence of shock doubled the maternal

TABLE 9. SHOCK IN 85 CASES OF MATERNAL MORBIDITY (ALL INDICATIONS)

Classification	*No. cases*
Primary	
Elective	14
Selective	9
Emergency	26
Repeat	
Elective	32
Selective	0
Emergency	4
TOTAL	85

Indications: Maternal, 20; fetal, 20; common, 45.

TABLE 10. CAUSES OF MORBIDITY (INTRINSIC SEPSIS)

Complication	*No. of cases*
Paralytic ileus	58
Endometritis	9
Parametritis	1
Wound sepsis	6

morbidity rate. It is obvious that no cesarean section should be started without at least one pint of properly matched blood available.

Of the 146 morbid cases it was possible to determine the cause of morbidity in 132, as indicated in

Table 10. Sixty-eight of these involved uterine or abdominal sepsis. In patients with this complication, the two most common indications and classifications were primary selective and repeat elective operations. The interesting fact that Wagensteen suction was not needed in any case successfully done extraperitoneally, indicates minimal peritoneal irritation with this procedure.

Uterine Rupture

The 3 ruptured uteri in this series all occurred in patients with a previous classical section. Two resulted in the loss of the uterus, and all 3 occurred before 38 weeks after the last menstrual period, which is the time of choice for repeat sections. Two of the three infants were stillborn and one, at 36 weeks of age, survived. It has been adequately shown that the classical scar has twice the potential of rupture than does the lower segment scar, which is one more reason against the use of the classical section.

Hysterectomy

Table 11 shows that of 27 hysterectomies, 14 were primary and

TABLE 11. INDICATIONS FOR HYSTERECTOMY

	No. of cases
Fibroid uterus	4
Ruptured uteri	2
Poor scar	6
Hemorrhage	11
Couvelaire uterus	3
Placenta accreta	1

13 in repeat cesarean sections. Ten were in selective or emergency procedures and 4 were associated with afibrinogenemia. In 7 the indication was maternal; fetal in 4; and in 16 both mother and infant were involved equally. The hysterectomy rate for pathologic uteri was 2.7%. Twenty of these women were over 35 years and 25 were over 30.

Of the 6 done for poor scars, 5 were lower segment and one classical. One patient had 3 previous sections; 1 with delayed hemorrhage from the scar, had 1 previous section; and 4 had 2 previous sections. Of the latter group, 2 were in association with placenta previa. In this group of repeat sections, 735 out of 744 previous uterine incisions were adequate at the time of the latest operation. Four of the 9 inadequate scars were of the classical type and 3 of the 5 remaining low segment types were complicated by further obstetric pathology. Eleven uteri were removed for lack of tone resulting in hemorrhage. This is a much higher incidence of hysterectomy for hemorrhage than in patients delivered vaginally—apparently the surgically exposed uterus is more vulnerable to the fears of the obstetrician. The lower segment operation is more liable to incur this complication because the uterine operating site distorts the normal axis of the uterus, contributing to the atonicity. Seven of these were primary sections. This is another reason why preoperatively typed blood is mandatory for all contemplated cesarean sections. The morbidity in our series for hysterectomy was high, and the reason lies in the indication for the operation. The true value for the procedure is indicated in the low number of

days of morbidity, which almost approximates that of the extraperitoneal cesarean section.

Maternal Mortality

It is obvious that our staff practically always follows the dictate of once a cesarean section, always a cesarean section, and in our opinion the proponents of delivery through the vagina following cesarean section in selective cases have not collected sufficient material to prove otherwise.

In this series of 1000 consecutive cesarean sections, 3 mothers died, a mortality rate of 0.3%. The first was a true obstetric death in a patient 28 weeks pregnant who had had a previous myomectomy. The indication for the section was possible rupture of the uterus. A thorough work-up to rule out possible extraneous cause, from flat abdominal plates for the possibility of a ruptured viscus through amylase tests to rule out pancreatitis, left no other possible diagnosis. The uterus was intact, and after negative investigation of its interior for a possible nontoxic separation, there developed intractable generalized hemorrhage resulting in death. The blood findings in this case led to the theory of possible afibrinogenopenia, especially related to pregnancy, and the ultimate discovery of the validity of such a hypothesis one year later.[5] The second death was in a patient who proved to have a complete volvulus of the small bowel and the cesarean section was done merely to present to the abdominal surgeons a field in which to evaluate the most important preoperative findings of free chyle in the peritoneal cavity. The third section ending fatally was an elective procedure done at term, before labor, to salvage a normal baby in a woman in extremis from rupture of a congenital cerebral aneurysm. This death is reported in detail elsewhere.[7] None of the 3 deaths was in any way associated with the technic of cesarean section, and all were emergency procedures. Two were primary sections; the indications were maternal, fetal, and of equal interest. Only in the case of the vascular accident was an infant salvaged.

Neonatal Mortality

Table 12 shows the indications and classifications of cases in which neonatal death occurred. Corrected, for 8 cases each of erythroblastosis and major congenital anomalies incompatible with life, the rate was 44 per 1000 sections. The emergency procedure accounted for 61% of the infant mortality. Primary and repeat elective sections had about the same fetal loss—a reminder that as primary elective sections are generally performed at term and repeat sections at 38 weeks there is another factor besides fetal weight influencing fetal mortality in delivery by this procedure. It is recognized that, without complicating obstetric pathology, the safest method of delivery is via the natural passage.

In 565 elective operations in this series, which involved, therefore, existing but only potential obstetric defection, the neonatal loss was 7 infants of those weighing 2500 Gm. or more, without congenital

deformity. This constitutes a fetal

TABLE 12. INDICATIONS AND CLASSIFICATIONS FOR CESAREAN SECTIONS RESULTING IN NEONATAL DEATH[a]

	Total cases	No.	%
Maternal indication	112	19	17
Fetal indication	340	9	3
Common indication	548	16	3
TOTALS	1000	44	
Primary			
Elective	201	5	2.4
Selective	183	2	1.9
Emergency	148	22	15
Repeat			
Elective	439	10	2.3
Selective	4	0	0
Emergency	25	5	20
TOTALS	1000	44	

*Corrected for congenital anomaly and erythroblastosis.

risk of about 12 infants for every 1000 elective sections, and should serve as a guide in assaying the potential risk of an obstetric situation versus the hazard to the infant of delivery by the abdominal route. Six of these deaths were due to abnormal pulmonary ventilation and 1 to anoxia. The duration of labor or rupture of membranes prior to operation were not important factors—in contrast to maternal morbidity under the same circumstances—and the primary elective section is probably best performed after about 6 hours of labor or 12 hours after the membranes rupture, in the interest of conditioning the infant to extrauterine existence. Half the neonatal deaths were associated with antenatal maternal hemorrhage. Maternal morbidity doubled when the obstetric situation was severe enough to cause neonatal death.

Table 13 indicates that the number of previous sections did not influence neonatal mortality rate. As noted above, repeat sections did not increase the maternal risk.

TABLE 13. NUMBER OF PREVIOUS SECTIONS IN RELATION TO NEONATAL MORTALITY (UNCORRECTED)

No. of previous sections	Neonatal deaths	Stillborn
0	36	15
1	11	9
2	6	3
3	5	0
4	1	0
5	1	0
TOTALS	60	27

PREMATURITY. The incidence of prematurity by weight was 16.7%, over twice the usual hospital rate, as indicated in Table 14. Sixteen

TABLE 14. INDICATIONS AND CLASSIFICATIONS OF CESAREAN SECTIONS RESULTING IN PREMATURE INFANTS

	Total	No.	%
Maternal indication	112	42	38
Fetal indication	340	48	14+
Common indication	548	77	14+
TOTALS	1000	167	
Primary			
Elective	201	28	17
Selective	183	18	11
Emergency	148	67	40+
Repeat			
Elective	439	37	22
Selective	4	3	2
Emergency	25	14	8+
TOTALS	1000	167	

of the 167 prematures were stillborn; two-thirds were under 38 weeks' gestational age. Two-thirds were in the primary section group and almost one-half were associated with antepartum maternal hemorrhage. Thirty-two of the 151 live born prematures died neonatally, accounting for 63% of the total neonatal mortality. Four of these deaths were from a major congenital anomaly or erythroblastosis.

It is noteworthy that 39% of the prematures were in the elective procedures, further indication that the estimate of fetal size in utero is hazardous at best. As indicated above, in primary elective sections it is best to have some labor. In repeat elective sections, inasmuch as those uteri foreordained to rupture in a given pregnancy generally do so by 38 weeks, there should be no hesitancy in waiting further in the interests of obtaining a more mature infant. The corrected neonatal death rate for prematurity was 19%, and 43% of these deaths were associated with antepartum maternal hemorrhage. About 50% of the prematures were the products of obstetric pathology jeopardizing both the infant and the mother equally before birth.

TABLE 15. INDICATIONS AND CLASSIFICATIONS OF CESAREAN SECTIONS RESULTING IN STILLBIRTHS

	Antepartum	Intrapartum
Maternal indication	23	3
Fetal indication	0	1
Common indication	0	0
TOTALS	23	4
Primary		
Elective	0	0
Selective	0	1
Emergency	14	2
Repeat		
Elective	4	0
Selective	0	0
Emergency	5	1

Fetal Mortality

Table 15 shows the indications and classifications for the cesarean sections resulting in the 27 stillborn infants in this series. Over half the mothers had toxemia; 20 of the infants were under 38 weeks' gestational age. Only 1 stillborn was subjected to a labor of 18 hours or more, and only 1 infant was lost during the cesarean section procedure, which was done primarily for its benefit. The maternal morbidity was two and a half times as great as the average when the infant was stillborn.

Summary

The factors resulting in the amazing reduction in maternal mortality in the era of modern obstetrics is reflected in the increased safety of cesarean section with an increase in the utilization of this method of delivery. Neither the true incidence of necessity nor the point of diminishing returns has been determined.

The apogee of obstetric practice is the delivery of a healthy infant by a healthy mother and until this is accomplished the maternal-fetal relationship is an insoluble equal partnership.

The motivation to perform a cesarean section is not always the diagnosis of obstetric pathology but rather the reflection of this defection on maternal or fetal welfare, or both. One thousand cesarean sections in the modern era have been presented, which were evaluated on the basis of the immediate purpose of the operation rather than obstetric diagnosis.

Primary cesarean sections were done three times more commonly in the fetal than in the maternal interest, but it was no more dangerous to perform the operation in the interest of the mother than in that of the child.

The number of previous cesarean sections did not increase the

morbidity rate of the present section, nor was the neonatal mortality rate increased by the number of previous sections.

The risk to a normal infant weighing 2500 Gm. or more, being born to a mother with existing but only potential obstetric pathology in elective section, is 12 per 1000.

Sterilization after cesarean section is unnecessary. When it is done, it is either due to the sacrifice of medical integrity to the unwarranted assumption of a "social indication," or is a result of the failure to employ modern surgical technics.

Four hundred and eighteen patients had a repeat section after this study had been completed (Table A), with a 3.1% maternal morbidity rate and no maternal mortality. One uterus ruptured at 32 weeks in a patient who had had 1 previous classical cesarean section. The entire group is comprised of a total of 1630 repeat sections without maternal mortality and 1208 intact uteri, at the time of subsequent section, out of 1212 subjected to previous incisions. There was 1 inadequate scar in a third section, which required hysterectomy at ensuing section. The four ruptured uteri in the entire series all followed 1 previous classical section and all occurred before 38 weeks gestation.

Addenda

TABLE A. REPEAT CESAREAN SECTIONS NOT INCLUDED IN STUDY

No. previous cesarean sections	*No. cases*	*No. cases of mat. morbidity*	*Neonatal deaths*
1	236	4	3
2	134	7	0
3	39	1	0
4	6	1	0
5	1	0	0
6	2	0	0
TOTALS	418	13	3

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