

MATERNAL MORTALITY IN 582 ABDOMINAL CESAREAN SECTIONS*

(From the New York Nursery and Child's Hospital)

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THE maternal mortality of cesarean section has been much discussed in the last few years. It is high and the reasons are being sought. The problem is not alone that the rate is high but rather that there are too many deaths due to cesarean section. Analyses of complete groups of cases are, therefore, in order, and this report is a review of the deaths following the abdominal cesarean sections done at The New York Nursery and Child's Hospital during the years from 1910 to 1928, inclusive. This period covers the work of the hospital as it is now organized. The private cases are included and acknowledgment of this privilege is hereby made.

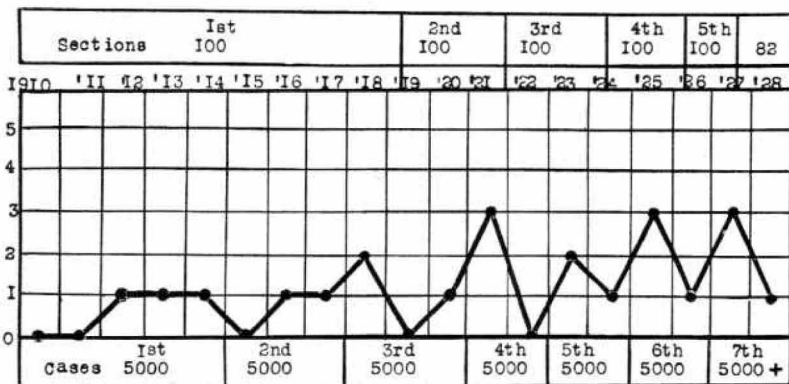


Fig. 1.—Number of deaths yearly.

This series is of particular interest because the operations have been done by so many men. Nearly all the obstetric groups in New York City are represented. There were 83 operators and 37 of them have been, or are, members of this Society.

The following topics will be considered:

First: The number of deaths, the rate, and the part of the total mortality formed by these deaths.

Second: The incidence and its bearing on the mortality.

Third: The causes of death.

Fourth: Variety and choice of type of operation.

There were 22 deaths, distributed according to years as shown in Fig. 1. An increase is noted. There were 7 deaths in the first half of the time and 15 in the second. This picture is probably typical of what

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is happening in many hospitals throughout the country. The number of cesarean sections has been greater and there have been more cases as the years have passed, but the deaths have increased in number slightly faster than have the cases.

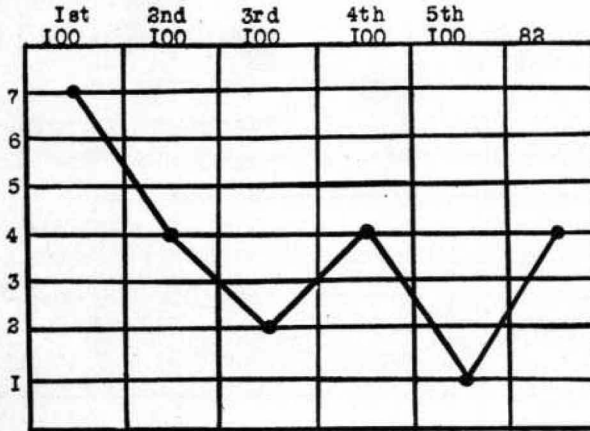


Fig. 2.—Death rate of cesarean section per groups of 100 cases.

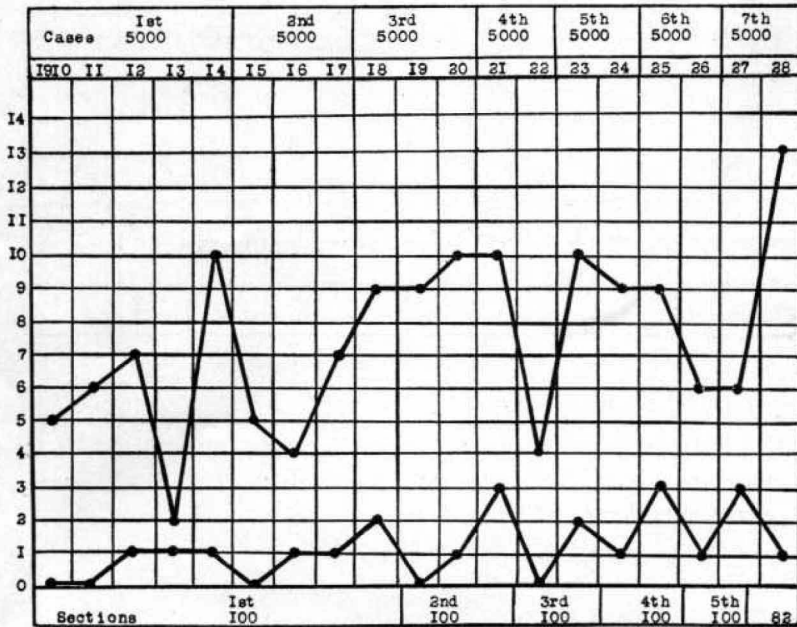


Fig. 3.—Total mortality and that from cesarean section by years.

The total death rate was 3.6 per cent, as shown in Fig. 2 in groups of 100 cesarean sections.

Figs. 3, 4, and 5 show the part of the total mortality formed by deaths following section. Fig. 3 shows both mortalities according to years. There was a total maternal mortality, uncorrected, of 141 in

35,677 cases. This is a percentage of 0.4 or 40 per 10,000. Section was a factor in 6+ deaths. Fig. 4 shows more clearly the trends of these mortalities as the cases are arranged in large groups of 5000. Deaths

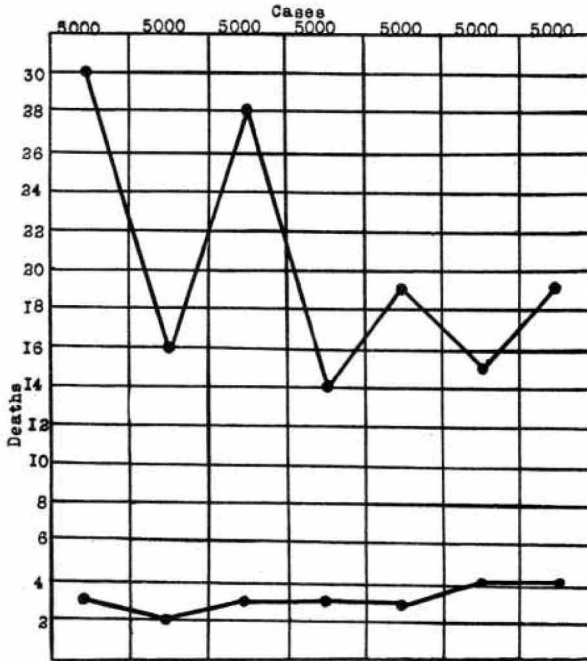


Fig. 4.—Total mortality following cesarean section.

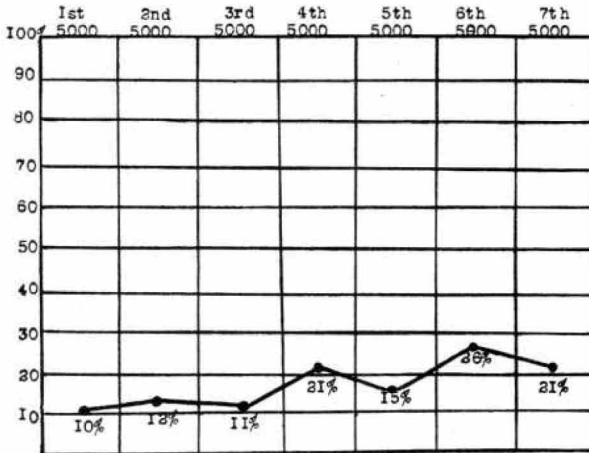


Fig. 5.—Shows the percentage that the deaths from cesarean section formed of the total mortality.

from section are seen to form a larger part of the total mortality as the years pass. Fig. 5 shows, in percentages, the part of the total mortality, in groups of 5000 cases, formed by deaths after cesarean section. The percentage rose from 10 per cent to 26 per cent and in the last

group dropped to 21 per cent. The average was 16 per cent. It may be said that this percentage is high because the total mortality is low. If a patient died in the years 1910 to 1914 there was one chance in ten of her having died after cesarean section. In 1927 or 1928 there was one chance in five of cesarean section having been a factor in her death.

INCIDENCE

Table I gives a complete statement of the incidence of cesarean section for the nineteen years. The number of cases, the cesarean sections with the percentage and rate of incidence, the deaths from cesarean section, and also the number of primary and repeated cesarean sections

TABLE I. SHOWING NUMBER OF CESAREAN SECTIONS IN EACH YEAR, AND DEATHS FOLLOWING CESAREAN SECTION FOR EACH YEAR

YEAR	CASES	TOTAL		RATE	DEATHS	REPEATED	PRIMARY
		CESAREAN SECTIONS	PER CENT			CESAREAN SECTIONS	CESAREAN SECTIONS
1910	913	3	0.3	1 in 300	0	0	3
1911	557	1	0.2	1 in 500	0	1	0
1912	1080	6	0.6	1 in 160	1	0	6
1913	1169	3	0.3	1 in 300	1	0	3
1914	1238	9	0.7	1 in 140	1	1	8
1915	1529	8	0.5	1 in 200	0	1	7
1916	1541	10	0.6	1 in 160	1	0	10
1917	1849	19	1.0	1 in 100	2	2	17
1918	2256	23	1.0	1 in 100	2	1	22
1919	2003	37	1.8	1 in 55	0	5	32
1920	2386	36	1.5	1 in 66	1	7	29
1921	2300	47	2.0	1 in 50	3	10	37
1922	2395	39	1.6	1 in 62	0	4	35
1923	3005	35	1.2	1 in 80	2	5	30
1924	2277	61	2.7	1 in 37	1	12	49
1925	2227	51	2.3	1 in 43	3	12	39
1926	2198	71	3.2	1 in 31	1	19	52
1927	2399	64	2.7	1 in 37	3	16	48
1928	2355	59	2.5	1 in 40	1	18	41
19 years	35677	582	1.6%	1 in 62	22 (3.6%)	114	468

for each year are given. The rate of incidence for the whole number of cases as 1 in 62, or 16 per thousand, or 1.6 per cent. The rate for the primary cesarean section was 1 in 80, or 13 per thousand, or 1.3 per cent.

The incidence is seen better graphically in Fig. 6. It is arranged so that the rate per thousand each year is given. There is a rapid rise from 3 and 2 per thousand in the beginning to 32 per thousand in 1926 and a fall in 1927 and 1928 to 25 per thousand.

Fig. 7 shows a smoother curve of the incidence as it is based on groups of 5000 cases. The broken line is the curve of the primary cesarean sections. The upper line is the curve of the total incidence. The space between the two lines represents the repeated cesarean sections. This space is seen to be steadily increasing. The rise in the curves is due, no doubt, to the surgical solution of the difficult cases.

The indications have been widened as the ease and safety of surgery have been realized. This picture, also, is probably common to most hospitals. The decrease in the incidence seems to be due to better trial labor and to improved means of vaginal delivery. The obstetrician has felt a sense of security in the newer types of cesarean section. He has consequently allowed the cases to go to full dilatation and to have much better trial labors. He has been able to meet the situation of possible infection without fear if cesarean section has been necessary. Rectal analgesia has been very helpful in getting full dilatation without loss of the patient's morale. Confidence has been had, also, in the use of mercurochrome during labor. The Barton and the Kiel-

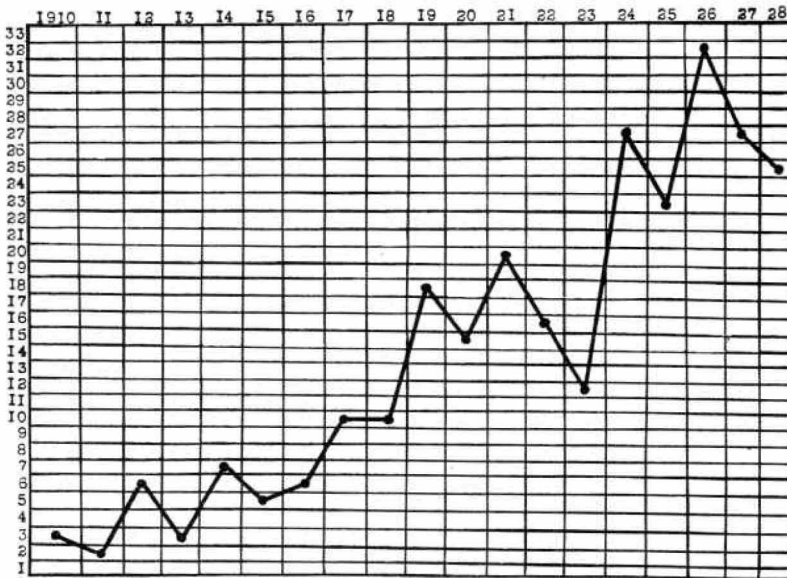


Fig. 6.—Incidence of cesarean section. Rate per year per 1000 cases.

land forceps, as well as better technic in version and extraction, due to Potter's teaching, have improved means of vaginal delivery. They have helped in the deliveries of women who might have been sectioned.

A further analysis of the incidence is seen in Fig. 8. The private and public cases for the past eight years are separated and the incidence per thousand cases in each year is shown for both groups. There were 285 cesarean sections in 7515 private patients. This is an incidence of 3.8 per cent. There were 141 cesarean sections in 11,640 ward patients. This is an incidence of 1.2 per cent. There were ten deaths in the private and four in the ward patients.

The lower curve is probably close to that of the essential incidence for mother and baby. In cases of contracted pelvis or of disproportion, the mothers as a rule had sufficient labor to prove almost positively the

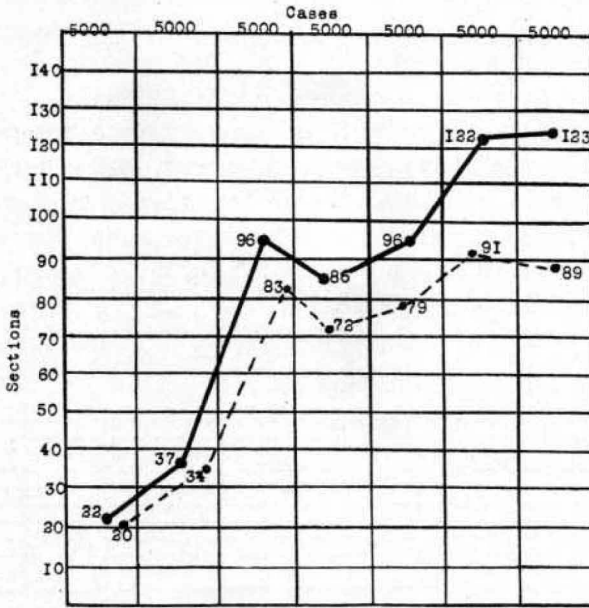


Fig. 7.—Incidence of cesarean section per groups of 5000 cases.

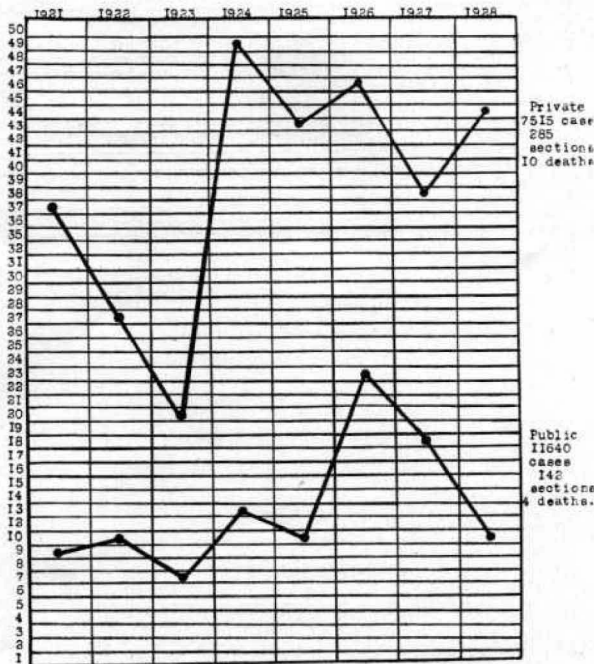


Fig. 8.—Incidence of cesarean section in private and public cases. The rate per 1000 cases per year is shown.

necessity of cesarean section. Other indications had the scrutiny and discussion of the ward service. There were no craniotomies on normal living babies.

The chief reason for the higher course of the upper curve has been the arbitrary choice of cesarean section in the private case. It is doubtful whether there has been a higher percentage of abnormal cases in the private service. Some capable obstetricians have deliberately chosen section in preference to the vaginal delivery in their debatable cases. The anxiety about the private case has played a part in this choice. Other men who have had more experience in abdominal surgery than in obstetrics have also followed the line of least resistance

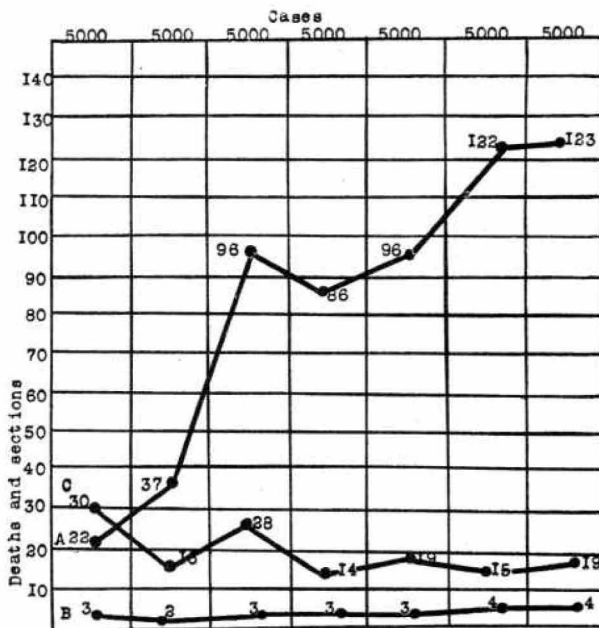


Fig. 9.—Relationship between incidence (A) and the mortality following cesarean section (B), and the total mortality (C).

and have done cesarean sections on many of their patients. Consultations do not always safeguard as they are often merely politely agreeable. This curve, then, may indicate an arbitrary incidence as opposed to an essential one.

This arbitrary or high incidence may be the result of the judgment of good obstetricians or of the demand of the parents for the safety of their babies, but it is one of the causes of the rising maternal mortality about which we are concerned. When cesarean section is chosen the consequences should be remembered. The first result is more deaths from one cause or another. We have seen in this last chart that there were 10 deaths from cesarean section in 7515 private patients and 4 in 11,640 ward patients. Then there is the aftermath of danger of rupture of the uterus in the succeeding pregnancy, danger from the in-

creased rate of mortality of the repeated section, and also the dangers associated with ventral hernia, adhesions, and with therapeutic abortion. Finally there is the end-result of disturbed marital relation and limited productivity.

The relationship between incidence and mortality in this series of cases is seen in Fig. 9. The mortality following cesarean section has not, as a matter of fact, been affected very much by the rapid rise in the incidence. It has been increased by only one in each of the last two groups of 5000 patients or two in 10,000. The complications and sequelae have not been estimated. It seems even fair to ascribe some of the lowering of the total mortality to the increase in the incidence of cesarean section. Other factors, of course, have been prenatal care, improvement in prevention, and in the treatment of infection, and transfusion. In the first 5000 cases there were 22 cesarean sections and 30 deaths from all causes, while in the last 5000 cases there were 123 sections and 19 deaths from all causes. Among the indications for the 123 cesarean sections there were 66 in the interest of the mothers, including 34 repeated cesarean sections. The best results were in the fourth group of 5000 in which there were 86 cesarean sections with a total of 14 deaths from all causes including the 3 deaths from the cesarean sections.

CAUSES OF DEATHS

The causes of the deaths, arranged chronologically, following cesarean section are shown in Table II. It seems safe to say that a lowering of the mortality following section may be expected in the future. Deaths from cesarean section in eclampsia are becoming rare. The last in this series was seven years ago. This indication is being eliminated by better prenatal care and by a change in the method of treatment. The deaths from shock, and from hemorrhage and shock, may occur again but with better general or local anesthesia and with the modern use of transfusion, they will be few. Pneumonia, too, should be less frequent. Improved anesthesia and present day precautions will cut down its incidence. We were fortunate in not having more deaths in bad cardiac cases. These cases are being studied more carefully now in a special cardiac clinic.

Paralytic ileus has been common to a greater or less degree in the classical cesarean sections but this type of operation is being limited more and more to the clean cases, and we may expect less ileus. It is seen less often anyway on account of better pre- and postoperative care. The case of antepartum intestinal obstruction was a rarity and was well advanced on admission. The patient was at term and cesarean section was done. Surgical treatment of the obstruction failed.

The two cases of tuberculous meningitis, associated with spinal anesthesia, were startling. The death from postoperative hemorrhage shows

the danger of additional work in cases of cesarean section. Autopsy showed that the bleeding came from an injury to a large vein in the broad ligament following salpingo-oophorectomy. The death after transfusion was very puzzling. The cesarean section was done for placenta previa. On the fifth day a transfusion was given. The patient was doing well but the red cell count was low. There was no unfavorable reaction. On the seventh day another transfusion was given as an additional boost. The patient had a chill, became cyanotic, and died in coma three hours later. There were no untoward symptoms during the transfusion. The blood was retyped before the transfusion and postmortem. There were 4 deaths in the group of repeated cesarean sections. In the last 6 deaths cesarean section may be exonerated from directly causing the fatalities. There was only one death from septicemia. Possibly there may be more such deaths in a second group of cases as large as this one. There were 7 deaths from peritonitis in the contaminated cases. It should be noted that the last such death oc-

TABLE II

		INDICATION	CAUSES OF DEATH
1	1912	?	Shock
2	1912	Eclampsia	Died after 7 hours. Eclampsia
3	1914	Cervical dystocia. Bagged twice. Labor three days	Peritonitis, 3 days
4	1916	Eclampsia	Shock, 7 hours
5	1917	Contracted pelvis	Peritonitis, 4 days
6	1918	Contracted pelvis, bagged	Septicemia, 10 days
7	1918	Dystocia due to amputation of cervix. Labor 60 hours	Peritonitis, 3 days
8	1920	Preeclamptic toxemia	Pneumonia
9	1921	Cardiac, decompensated	Died after 22 hours
10	1921	Eclampsia	Eclampsia, 20 hours
11	1921	Rigid cervix	Peritonitis, 3 days
12	1923	Preeclamptic toxemia	Paralytic ileus, 4 days
13	1923	Contracted pelvis, previous sec- tion	Hemorrhage, shock, 3 hours
14	1924	Rigid cervix, labor 30 hours	Peritonitis, 4 days
15	1925	Premature rupture of membranes, contracted pelvis, labor 24 hrs.	Peritonitis, 4 days
16	1925	Induction of labor, bagged twice, membranes ruptured arti- ficially, weak pains 48 hours. Temp. 103.4°	Peritonitis, 4 days
17	1925	Intestinal obstruction, ante- partum	Intestinal obstruction
18	1926	Previous cesarean section	Pneumonia
19	1927	Contracted pelvis, cervical dysto- cia	Tuberculous meningitis, spinal anesthesia
20	1927	Contracted pelvis, previous sec- tion	Tuberculous meningitis, spinal anesthesia
21	1927	Previous section, salpingo- oophorectomy	Postoperative hemorrhage
22	1928	Placenta previa	Died on 7th day, in coma 2 hours after second transfusion. Cerebral embolism or anaphy- lactic death

curred in 1925, or three years ago. The newer types of cesarean section will cut these deaths down in the future as has already been the case.

These contaminated cases with disproportion or cervical dystocia have formed a dangerous and difficult group. They have been the predisposing cause for almost one-third of the deaths. The choice has had to be made between almost hopeless deliveries or craniotomies with their consequences and cesarean sections with the danger of peritonitis. This decision has not been an easy one to make.

These cases have sounded the death knell of the classical cesarean section in the contaminated patient. It is true that the classical operation has been successful in many of them but the death rate has been high. An experienced and skillful operator may have good results. Each man knows his own work and knows how he can best handle a given problem. He should, however, be alive to improvement. In the classical operation an operator may succeed in protecting the peritoneal cavity from the initial spill but there is still danger from the secondary leakage or extension of infection from the uterus and, as a rule, no provision for its control. Some men have drained the peritoneal cavity to advantage in these cases.

VARIETY OF SECTIONS

Operations have been devised to avoid the dangers of initial spill and secondary leakage. Some have been abandoned as others more practical have appeared. Table III shows the variety of sections that have been used in this series of cases. It also gives the years in which the different kinds have been in use. From 1910 to 1922 there were only the classical and the Porro. The low flap operation was introduced in 1922.

TABLE III. VARIETY OF SECTIONS

	<i>Classical.</i> The Intrapertoneal Method. Sanger's Operation. High, mid, and low types.
	<i>Porro.</i> Hysterectomy.
1922	<i>Low Flap</i> or <i>Two Flap.</i> A cervical cesarean section Kronig's Operation. Modified by Beck. Laparotrachelotomy of DeLee.
1923	<i>Extrapertoneal Method.</i> Latzko's Operation.
1924	<i>Transpertoneal Method.</i> Fromme-Veit Operation. Hirst Operation. Modified by Brodhead, Langrock, and Cassasa and known as <i>the peritoneal exclusion.</i>

Table IV shows the number of cesarean sections done according to each type of operation and the number of deaths after each kind. It is seen that most of the cesarean sections have been classical and that all but one death have occurred in this variety. It will also be seen that 79 cases, mostly contaminated, have been done according to the newer types of operation and that no death has occurred.

TABLE IV. CESAREAN SECTIONS AND DEATHS ACCORDING TO TYPE OF OPERATION

	NO.	DEATHS
Classical	492	21
Porro	11	1
Low Flap	30	0
Latzko	30	0
Peritoneal exclusion	19	0

CHOICE OF TYPE OF OPERATION

We have been fortunate at the New York Nursery and Child's Hospital in having been able to observe the methods of many operators. We have not adopted any one operation exclusively, believing that each has its place. We feel that at present the obstetric surgeon is able to choose a type of operation to fit his case. There are 5 forms of cesarean section from which he may pick. As in any surgical problem variations in conditions determine selection of type of operative procedure when several methods are available. So it would seem to be with cesarean section, for there is not much doubt that the operation suitable for a clean case is not the choice for a contaminated one. During the past few years other forms of cesarean section than the classical have been used in most of the contaminated cases. Some of the men have done the low flap exclusively, others the peritoneal exclusion, a few the Latzko, and others have done all forms as they have seen fit. This last viewpoint I wish to emphasize.

There has not been a death from peritonitis in the last 212 cesarean sections. All chances have been accepted as no craniotomies on normal living babies have been done. This is strong evidence of the value of the newer types of cesarean section in the contaminated cases. Some deaths from septicemia are bound to happen. The cesarean sections aim only at preventing peritonitis by controlling the initial spill and the later leakage from the uterine wound. They cannot prevent thrombophlebitis or infections from the uterus except inasmuch as they terminate labor. There may be anatomic hazards and technical difficulties involved but they are not to be compared with the risk of peritonitis.

There is no doubt that a combination of essential incidence, good choice of type of cesarean section, good operative technic and proper anesthesia will give the minimum mortality. If a man be inexperienced in the newer types of cesarean section it would be better for him to

operate early in labor. That means higher incidence with its consequences. Some men emphasize the importance of early operation but this should be second choice. There will always be contaminated cases and the obstetrician should fit himself to handle them properly.

In the selection of the type of cesarean section the classical operation is reserved for the elective case, i.e., the woman not in labor. It is useful when speed is essential, as in a case of accidental hemorrhage with little dilatation and mother and baby in danger. It may be easiest in a cardiac case or the choice in a clean case of placenta previa.

The other types are used in the potentially infected cases, although some of the operators have done the low flap operation in the clean and elective cases also. The choice is made usually according to the sup-

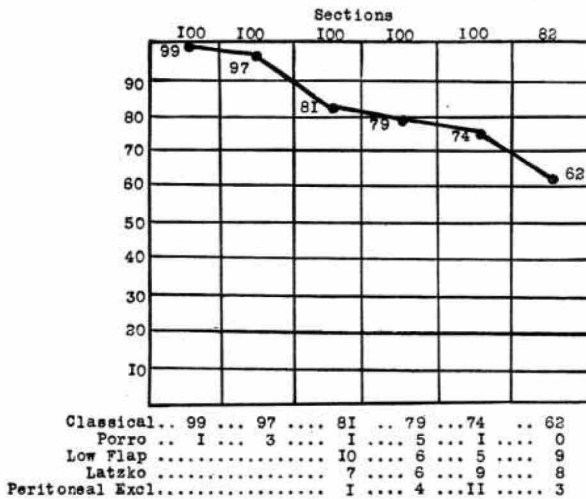


Fig. 10.—Declining curve of the classical operation.

posed degree of contamination in the order of first, low flap; second, peritoneal exclusion; third, Latzko; fourth, Porro.

Thus the low flap operation is done in a case in early or later labor with little or no contamination. Fourteen of the cases which had the low flap operation had had no labor. The average duration of labor in the remaining 16 was fifteen and one-half hours. The labor varied from three to forty hours. Four lasted twenty-four hours or longer. With local anesthesia and with the technic of Beck or DeLee this may prove to be the universal cesarean section.

The method of peritoneal exclusion is chosen in contaminated cases with suspected infection of the amniotic fluid. The initial spill or later leakage from the uterus is considered dangerous. The operation is particularly adapted to a case in which there is likely to be very little retraction of the lower uterine segment. This operation has the advantage of affording drainage if thought necessary. Four of the 19 pa-

tients on whom this operation was done had no labor. One of the 4 had ruptured membranes for three days. In the remaining 15, labor averaged twenty-six hours. The variation was from twelve to fifty-five hours. Eight were twenty-four hours or longer. Its simplicity recommends this operation. The technic described by Brodhead, Langrock, and Cassasa is the more preferred. So far it has given very good results in these rather badly contaminated cases.

The Latzko operation is the selection for the contaminated case long in labor and with the lower uterine segment well drawn up. There may have been much manipulation or possibly ineffectual attempts at delivery from below. This operation also has the advantage of drainage. The patients upon whom this operation was done had all been in labor. The variation was from eight to seventy-two hours. The average was twenty-nine hours. Nineteen had been in labor for twenty-four hours or longer. In the 30 operations of this type the bladder was injured four times. No fistulas resulted. The peritoneal cavity was opened 11 times. It was closed, however, before the uterus was incised.

There is no competition, in our opinion, between the low flap, peritoneal exclusion and Latzko operations, unless the low flap is used in the badly contaminated cases. In this group the peritoneal exclusion or Latzko is considered safer because of better protection of the peritoneal cavity and drainage. If the lower uterine segment is thought to be well retracted the Latzko operation is chosen, otherwise the peritoneal exclusion.

The Porro operation is the old choice for the badly contaminated case with a noncontractile, grossly infected uterus. It is also used in cases of uncontrollable hemorrhage, apoplectic uterus, nonremovable tumors, placenta accreta, and usually in cases of ruptured uterus. It was done only twice for infection in this series of cases.

SUMMARY

In 582 abdominal cesarean sections done in a single hospital by a large number of obstetricians during the past nineteen years, there were 22 deaths (3.6 per cent).

These deaths formed 16 per cent of the total obstetric mortality.

The average incidence was 1.6 per cent. In sixteen years it rose from 0.2 per cent to 3.2 per cent. In the last two years it has dropped to 2.5 per cent.

The mortality following cesarean section increased two in ten thousand deliveries. Section has been a factor in the reduction of the total mortality.

Peritonitis was the chief cause of death. It has been eliminated in the last three years by the use of the newer types of cesarean section.

Our faults have been high incidence and a lack of the proper selection of type of cesarean section in the contaminated cases. In the last

few years a better choice of operation has kept our mortality down in spite of the rise in the incidence of cesarean section.

These faults, high incidence and poor selection of type of cesarean section, are probably more or less common and doubtless largely account for the widespread high mortality following cesarean section.

The remedy, of course, is education of both the public and ourselves. It should be shown that cesarean section is not the simple, safe solution of the difficult labor that it is thought to be. We should equip ourselves well with obstetric surgery, both of the abdominal and vaginal varieties.

11 EAST FORTY-EIGHTH STREET.