

THE EXPERIENCE OF THE JOHNS HOPKINS HOSPITAL
WITH CESAREAN SECTION*

AN ANALYSIS OF 1,333 OPERATIONS

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IN VIEW of the many statistical studies of cesarean section already published, some explanation would seem necessary in venturing to present yet another. The present group of cases appears worthy of record for a number of reasons. In the first place, it is one of the largest series thus far reported, comprising 1,333 operations, and therefore permits of statistical analysis with a minimum of sampling error. Second, 718 of these cesarean sections were performed because of contracted pelvis. These 718 cases of contracted pelvis necessitating abdominal delivery occurred in a total series of 7,226 cases of pelvic contraction. Quite apart from the size of this group of contracted pelvis, and more important, is the fact that the late Dr. Whitridge Williams, from the earliest days of the clinic, insisted on meticulous pelvic mensuration, including a diagonal conjugate measurement, checked by a senior staff member. Almost half of the total operations here reported, or 43.7 per cent, were done under his surveillance. His conservatism in the use of cesarean section in contracted pelvis and his rigid adherence to contraindications are well known; and his successors have endeavored in general to follow the same policy. We, however, have had the advantage of a technical aid during the past decade which was unknown throughout the greater part of his time, namely x-ray pelvimetry, and, as we shall show, this adjunct has played an important role in the recent management of these cases and in the results achieved. We have here then a large series of contracted pelvis, accurately measured, many by x-ray, and managed, we believe, in accordance with a fairly uniform and conservative policy. This affords unusual opportunity for studying the prognosis of labor in various degrees of pelvic contraction. Third, the series includes 894 classical cesarean sections performed by more than fifty operators over a span of forty-five years and is thus large and variegated enough to permit of certain conclusions about the possibilities and limitations of that operation.

TYPES OF OPERATION

In the early years of the service thirty-three vaginal cesarean sections were done, mostly for eclampsia. There were five maternal deaths, a

*Read, by Dr. Eastman, at the Sixty-Seventh Annual Meeting of the American Gynecological Society, Skytop Lodge, Pa., June 15 to 17, 1942.

mortality rate of 15.1 per cent. We have excluded these from consideration not only because vaginal cesarean section is virtually an abandoned operation today, but also because the issues involved are different from those of abdominal delivery. We have also excluded eleven extraperitoneal cesarean sections (9 Waters and 2 Latzko) because their number is too small to merit attention. There were no maternal deaths in the extraperitoneal group. Nor have we included cases of rupture of the uterus or instances in which the infant weighed less than 1,500 Gm. in the belief, again, that the problems presented by such cases are different from those of cesarean section as the term is ordinarily used. This leaves 1,333 operations, of which 67.1 per cent were classical, 16.3 per cent low cervical, and 16.6 per cent cesarean section-hysterectomy (Table I). During the past decade the incidence of low cervical section has risen slightly to 20.0 per cent, while that of cesarean section-hysterectomy has fallen by about the same degree to 12.6 per cent.

TABLE I. TYPES OF CESAREAN SECTION

TYPE	CASES	PER CENT
Classical	894	67.1
Low cervical section	218	16.3
Cesarean section-hysterectomy	221	16.6
	1,333	100.0

INCIDENCE

The period over which the clinic has operated has been divided into four decades, counting backward from Dec. 31, 1941. The experience of the period 1896 to 1901 has been included with that of the first decade since the material of those six years, two cesarean sections, would obviously have no significance if analyzed separately. The incidence has been calculated on the basis of total hospital deliveries (ward and private) in which the infant weighed 1,500 Gm. or more. The incidence is avowedly high (Fig. 1), particularly in the last decade, but in evaluating these figures it is desirable to recall that our clinic admits no normal multiparas to the ward service, handles a clientele which is 50 per cent negro, and during the past six years has served as the referral center for all pathologic cases encountered in the State Board of Health's nineteen prenatal clinics scattered throughout the counties of Maryland. The marked increase in our incidence of cesarean section in the last decade is due chiefly to the institution of this referral service, but partly to a more liberal use of abdominal delivery in certain cases of placenta previa, fulminating pre-eclampsia, and in certain patients who have had previous cesarean sections.

INDICATIONS

As may be seen in Table II, the indications fall into six groups as follows: contracted pelvis and mechanical dystocia, 58.4 per cent; toxemias, 15.0 per cent; previous cesarean section, 11.2 per cent; hemorrhage, 6.6 per cent; intercurrent disease, 3.0 per cent; and unclassified, 5.8 per cent. In the first group, contracted pelvis naturally accounts for the great majority of the cases, constituting the primary indication in 44.5 per cent of the whole series. Uterine inertia is the second most common cause in this group, prompting 5.4 per cent of the operations. This heading includes, along with uterine inertia, cases of so-called

cervical dystocia, dystocia dystrophy syndrome, and prolonged labor with bad obstetric history. The term "disproportion" is not listed as a single cause since, in our experience, it is always secondary to some specific cause such as contracted pelvis, over-size baby, malpresentation, or some combination of such specific causes. In the series as a whole, fulminating pre-eclampsia accounts for 7.7 per cent of the operations, but in the last decade for 12.7 per cent, a sharp increase which will be discussed subsequently.

While it is customary to report incidence and indications in the manner we have done, a more accurate picture of the policy of a given clinic toward cesarean section may be had by reporting the percentage of cases in any specified complication which are treated by cesarean section. For instance, among our 7,226 cases of contracted pelvis, 718,

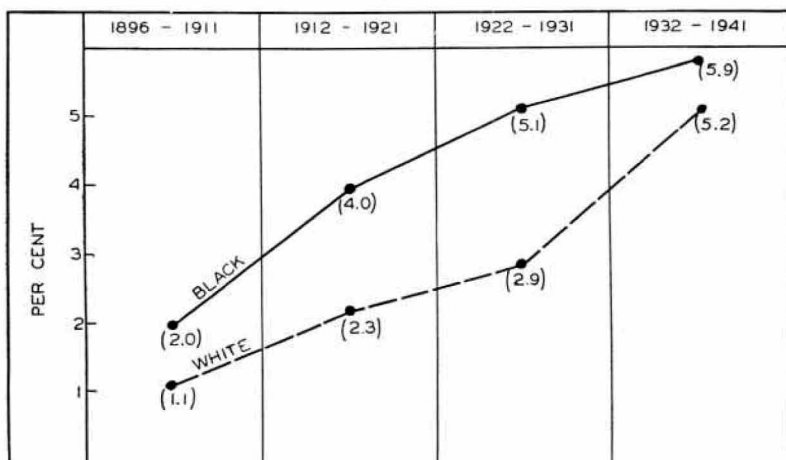


Fig. 1.—Showing the increasing incidence of cesarean section by decades and race.

TABLE II. PRIMARY INDICATIONS

		CASES	%
Contracted Pelvis and Mechanical Dystocia:	Contracted Pelvis	595	44.5
	Uterine inertia	72	5.4
	Malpresentations (45); Oversize baby (14)	59	4.4
	Tumor blocking birth canal	21	1.5
	Elderly primigravidas	35	2.6
58.4%	Total for group	781	58.4
Toxemias:	Pre-eclampsia	104	7.7
	Hypertensive vascular disease	93	6.9
	Eclampsia (before 1920)	6	0.4
	Total for group	203	15.0
Previous Cesarean Section	Previous cesarean section	115	11.2
	Total for group	115	
11.2%			
Hemorrhage:	Placenta previa	40	3.0
	Premature separation of placenta	48	3.6
	Total for group	88	6.6
6.6%			
Intercurrent Disease:	Heart disease, tuberculosis, etc.	40	3.0
3.0%	Total for group	40	
Unclassified:	Sterilization (before 1930), 34; Other 72	106	5.8
	Total for group	106	
5.8%			

or 9.9 per cent, were handled by abdominal delivery. During the first three decades, the incidence rose progressively to 13.8 per cent, but has fallen to 10.4 per cent in the last ten years (Fig. 2). Fig. 3 shows our incidence of cesarean section in cases of contracted pelvis according to decade and diagonal conjugate measurement. For example, among patients with diagonal conjugates between 9.0 and 9.4, only 60 per cent

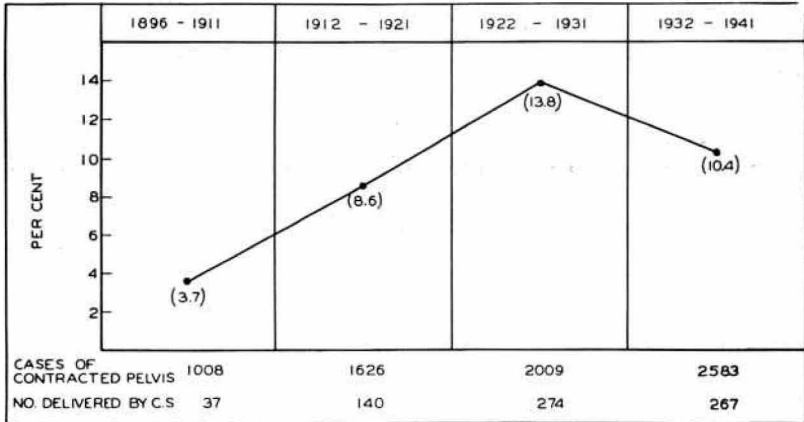


Fig. 2.—Showing incidence of cesarean section in cases of contracted pelvis (c.d. of 11.5 cm. or less) by decades. Total cases of contracted pelvis, 7,226; number delivered by cesarean section, 718; percentage delivered by cesarean section, 9.9.

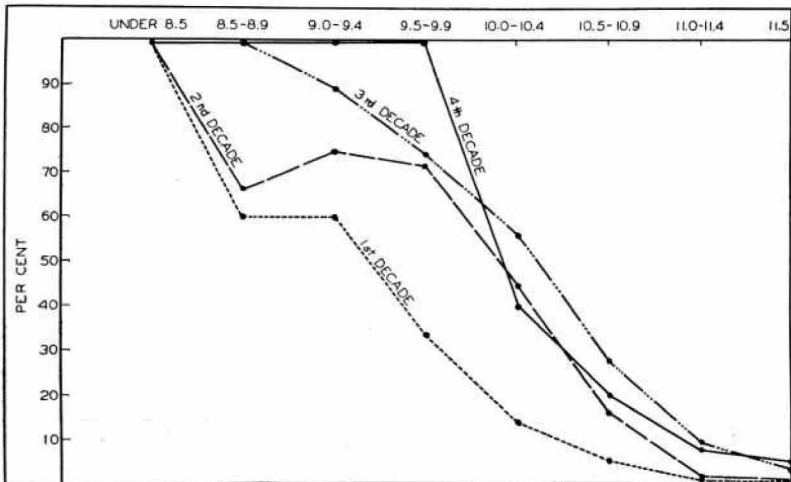


Fig. 3.—Showing incidence of cesarean section in cases of contracted pelvis according to decade and diagonal conjugate measurement.

were delivered abdominally in the first decade, 75 per cent in the second, 87.5 per cent in the third, but in the fourth ten-year period, 100 per cent. Indeed, during the past decade all women with diagonal conjugates under 10.0 have been delivered abdominally. On the other hand, in the group between 10.0 and 10.9, a substantial reduction in the incidence of cesarean section has occurred during the past decade, the percentage of abdominal deliveries being definitely less than in the last decade and in the case of the 10.0 to 10.4 group, being even lower

than in the second decade. It is this diminished incidence of cesarean section in the 10.0 to 10.9 group which has brought about the lowering in the total incidence of cesarean section in contracted pelvis as shown in Fig. 2.

Fig. 4 shows that despite the diminished incidence of cesarean section in contracted pelvis during the past decade, a dramatic reduction has occurred in our stillbirth and neonatal mortality among this group. All mortality figures reported are uncorrected. In the white, the figure has fallen to one-third that of the previous decade and in the black to one-half. We believe that there are three main factors responsible for these results. (1) X-ray pelvimetry has made possible a more precise

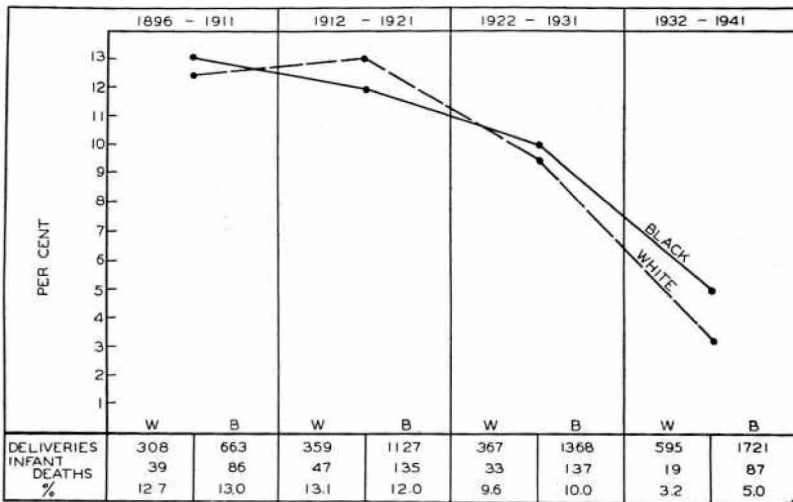


Fig. 4.—Showing the stillbirth and neonatal mortality rate by decade in cases of contracted pelvis delivered vaginally (6,508 deliveries).

estimation of pelvic size and architecture in the troublesome group with diagonal conjugates between 10.0 and 11.0 and has permitted a more correct prognosis in regard to the possibilities of pelvic delivery. Diagonal conjugate measurements above 11.5 almost always rule out contractions of the inlet, but measurements between 10.0 and 11.0 may reflect imperfectly the true or obstetric conjugate diameter. Thus, among women with diagonal conjugates of 10.5 cm., the obstetric conjugate may vary between 8.2 and 10.3, a range of more than two centimeters. X-ray study of the architecture of the midpelvis also affords valuable information as to which cases may be delivered vaginally and which demand cesarean section. In our experience, then, this technical adjunct has played an important role not only in reducing infant mortality in the contracted pelvis group but in eliminating unnecessary cesarean section among these patients. (2) Another factor which may be credited with the results shown in Fig. 3 is the realization that tests of labor in patients with contracted pelvis, when carried beyond thirty hours, yield a fetal mortality rate in excess of 30 per cent, as shown some years ago in our clinic by Peckham and Kuder. With rare exceptions a careful weighing of all the factors concerned, including x-ray findings, after twelve hours of labor, is adequate to yield a proper decision as to whether or not abdominal delivery is necessary. (3) A

third factor which has proved helpful in our hands in establishing the prognosis of labor in contracted pelvis is the behavior of the cervix. Stated briefly, in degrees of contracted pelvis incompatible with delivery from below, the cervix rarely dilates satisfactorily. By way of supporting this statement we have studied forty-nine labors in women with contracted pelvis in which cesarean section was finally performed after thirty or more hours of labor and found that the cervix had reached full dilatation in only eight of these cases, or less than one-sixth; in twenty-nine of the cases, or one-half, the dilatation was less than 5 cm.; in thirteen or one-fourth, it was less than 3 cm. even after thirty hours. To be sure, some of these cases may have been associated with uterine inertia, but the clinical fact remains that tests of labor which ultimately fail are usually stigmatized from the very beginning by a cervix which does not dilate; and conversely, among those which are ultimately successful, the cervix is usually near complete dilatation after twelve hours.

Turning now to pre-eclampsia, the percentage of cases of that complication treated by cesarean section has risen from 2.0 per cent in the first three decades to 7.8 per cent in the last ten-year period. In other words, during the recent period about one pre-eclamptic in every thirteen is delivered by the abdominal route. With occasional exceptions, all of the pre-eclampsics so delivered fulfilled the following criteria: the disease appeared fulminating with convulsions imminent and did not respond to medicinal treatment; the pregnancy was four or more weeks from the expected date of confinement and conditions were unfavorable for rupture of the membranes, that is, the head was high and the cervix long, hard and closed. We believe that cesarean section is indicated under such circumstances. The reason for this attitude is not so much the fear of convulsions as the fact that the long period of time necessary to carry such patients before vaginal delivery can be effected safely, imposes a greater risk in the way of permanent vascular damage, than is represented by the general risk of cesarean section.

Our incidence of cesarean section in other common complications is as follows: previous cesarean section (no other indication), 53.4 per cent for the series as a whole, 63.6 per cent for the past decade; placenta previa, 20.8 per cent for the series as a whole, 38.0 per cent for the past decade; premature separation of the placenta, 27.3 per cent for the series as a whole, 31.0 per cent for the past decade; elderly primigravidas, 18.6 per cent for the series as a whole, 25.0 per cent for the past decade.

TABLE III. MATERNAL MORTALITY ACCORDING TO DECADE AND TYPE

1333 Operations	38 Deaths	Total mortality	2.8%
894 Classical	20 Deaths	Classical mortality	2.2%
218 Low Cervical Section	6 Deaths	Low cervical section mortality	2.7%
221 Cesarean section-hysterectomy	11 Deaths	Cesarean section-hysterectomy mortality	5.0%

TYPE OF OPERATION	1896-1911			1912-1921			1922-1931			1932-1941		
	CASES	DEATHS	%	CASES	DEATHS	%	CASES	DEATHS	%	CASES	DEATHS	%
Classical	24	4	16.6	113	2	1.8	244	6	2.4	513	8	1.5
Low cervical section	0	0	0	0	0	0	66	3	4.5	152	3	2.0
Cesarean section-hysterectomy	17	1	5.8	43	1	2.3	76	8	10.5	85	2	2.2

MATERNAL MORTALITY

As shown in Table III, among the 1,333 operations extending back to 1896, there were 38 deaths, a gross uncorrected mortality rate of 2.8 per cent. Among the 894 classical operations, there were 20 deaths, a rate of 2.2 per cent. The respective mortality rates for low cervical section and cesarean section hysterectomy were 2.7 and 5.0 per cent. During the past decade there were 513 classical cesarean sections with 8 maternal deaths, a mortality rate of 1.5 per cent. The opinion has been expressed that any death rate above 1 per cent in cesarean section is too high; and we are in accord with this view so far as the white race is concerned, but doubt if it can be approached in the black. As shown in Fig. 5, the total maternal mortality for the white race was 2.0 per cent and for the black, 3.5 per cent. During the past decade the corresponding percentages were 0.8 and 2.8, respectively (Fig. 6.). That this difference is not due to a preponderance of neglected cases of labor in the black race is shown by Fig. 7. Here it will be seen that even in elective cases the mortality of the colored race is two and one-half times that of the white.

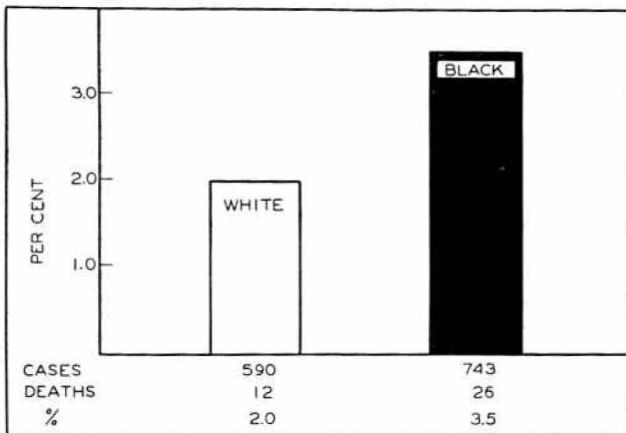


Fig. 5.—Showing the maternal mortality in the total series according to race.

Causes of Maternal Deaths.—The causes of the 38 maternal deaths are shown in Table IV. The most common cause was shock and hemorrhage. A critical analysis of these 9 cases would suggest, on hindsight, that the following errors of commission and omission played important roles in these fatalities: (1) The imposition of a shocking operation (cesarean section, hysterectomy in 5 of the 9) on patients already shocked from premature separation of the placenta, or exhausted by prolonged labor; (2) failure to protect such patients against shock by the liberal use of blood transfusions before, during, and after these operations. Less than one-fourth of the deaths (6 of the 38) were due to generalized peritonitis, but an equal number were the result of paralytic ileus alone, as attested by autopsy. In this latter group the earlier and more persistent use of continuous gastric suction might have saved some of these women. Of the 4 anesthetic deaths, 3 occurred in women who had been in labor over thirty hours, a circumstance attesting the fact that patients exhausted by long labors are poor anesthetic risks as well as poor risks from the viewpoint of shock.

During recent years a number of clinics have reported a reduction in their maternal mortality rates in cesarean section and have attributed this to abandoning the classical operation in favor of the low cervical technique. From the viewpoint of straight thinking it is worth while noting that our maternal mortality with classical cesarean section in

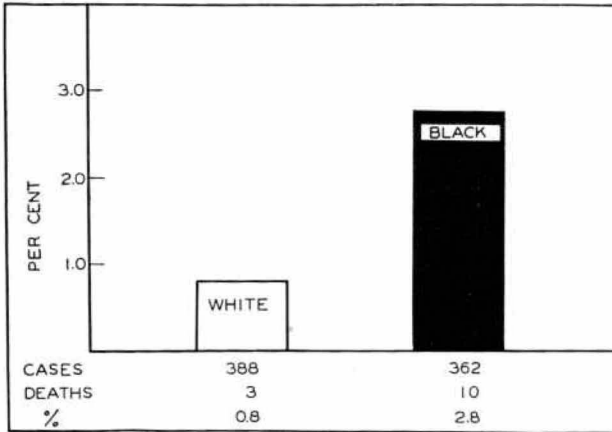


Fig. 6.—Showing the maternal mortality in the last decade according to race.

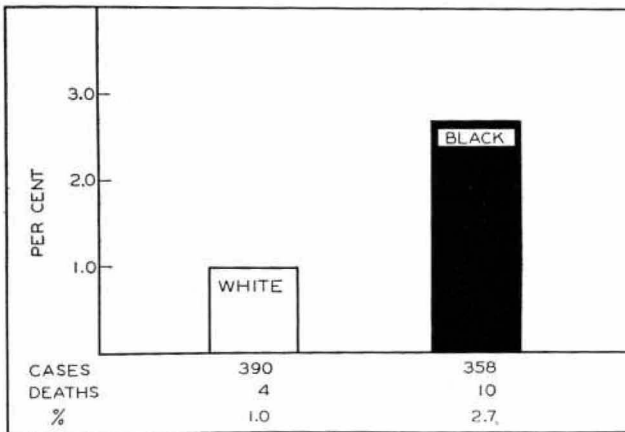


Fig. 7.—Showing the maternal mortality in elective cesarean section according to race.

white women, counting from 1896, was 1.1 per cent in 354 elective cases; in the last decade it was 0.7 per cent in 275 similar cases; no patients died from peritonitis, as attested by autopsy. We believe, accordingly, that prior to the onset of labor, classical cesarean section will give as good immediate results as low cervical provided that contraindications are rigidly observed. Hence, we suspect that the improved mortality rates which have been credited to the low cervical technique are in many instances the result of stricter observance of contraindications, better judgment in the selection of cases and more blood transfusions. So far

TABLE IV. CAUSES OF 38 MATERNAL DEATHS IN 1,333 CESAREAN SECTIONS
(MORTALITY 2.8%)

<i>Deaths Due Directly to Operation</i>			
1. Shock and hemorrhage	9	Classical	4
		Cesarean section-hysterectomy	5
2. Generalized peritonitis	6	Classical	4
		Cesarean section-hysterectomy	1
		Low cesarean section	1
3. Ileus alone. (No general peritonitis; no mechanical obstruction)	6	Classical	3
		Cesarean section-hysterectomy	1
		Low cesarean section	2
4. Ileus due to mechanical obstruction	3	Classical	3
5. Thrombophlebitis with septicemia	4	Classical	2
		Cesarean section-hysterectomy	1
		Low cesarean section	1
6. Anesthesia (including one aspiration pneumonia with death on first post- operative day)	4		
		32	
<i>Deaths Due to Intercurrent Disease</i>			
		Hypertensive vascular disease	2
		Acute thromboendocarditis	1
		Cerebral hemorrhage in pre-eclampsia	1
		Primary meningitis	1
		Miliary tuberculosis	1
		—	6

as the late results are concerned, that is, the integrity of the scar, an inquiry into the literature shows a woeful lack of statistically valid, factual information supporting the supposed superiority of the low segment scar.

The odds in the present series are weighted heavily against low cervical cesarean section inasmuch as this operation, until very recent years, has been reserved for potentially infected cases and any attempt to compare these cases statistically with our classical series would not be equitable. Nevertheless, our experience suggests that even this procedure becomes increasingly hazardous after eighteen hours of labor and in such cases had best be superseded either by cesarean section-hysterectomy or an extraperitoneal operation.

DISCUSSION

DR. FRED L. ADAIR, CHICAGO, ILL.—There are two, possibly three, major differences between the series at the Chicago Lying-In Hospital and the series at the Johns Hopkins Hospital. In the first place, our series is limited to the white race. Second, our series is based predominantly on the low cervical operation, and, third, although it was not mentioned in the paper, I believe that our percentage of cases done under local anesthesia is much higher than in Dr. Eastman's clinic.

We have reported 1,000 cesarean sections covering a period from 1931 to 1938 in 18,009 deliveries, an incidence of 5.5 per cent. From March 1, 1938, to March 1, 1942, there were 11,232 deliveries with 497 cesarean sections, an incidence of 4.4 per cent. I would like to point out that during this latter period we have insisted more vigorously on reaching a decision for or against cesarean section after twelve

hours of ruptured membranes or twenty-four hours of labor. This has not resulted in an increase of cesarean section notwithstanding this rule.

In the first series of 1,000 cases the morbidity was 43.8 per cent. In the second series the morbidity was 32.9 per cent, a decrease of nearly 11 per cent. In the first series there was a mortality of 8 cases, or 0.8 per cent; in the second series a mortality of 2 cases, or 0.4 per cent, a decrease of 50 per cent in our mortality. And I might say that 50 per cent of the mortality in the first series was associated with infection, whereas in the second series there was no mortality from infection. It is very important then to recognize the contraindications against cesarean section, especially from the standpoint of the possibility of an infection which may terminate fatally.

Another point I think is extremely important which Dr. Eastman did not mention is the question of outlet contraction. It is important to recognize it early as it is a bar frequently to natural or instrumental delivery. If it is not diagnosed early the contraindications for cesarean section have arisen before it is recognized and, of course, then the operation is too late to be advantageous.

Another point is that there is a cumulative risk from cesarean section. A woman who has an initial cesarean section is exposed to the risk of a second operation. In the morbidity series we found that 25.6 per cent of approximately 197 cases had had one previous cesarean section, and that 6.7 per cent had had more than one cesarean section.

The lower segment operation was done in 87.2 per cent of the morbidity cases; the classical operation in only 0.6 per cent. Hysterectomy was associated with cesarean section in 10.3 per cent, and the vaginal operation was done in 1.8 per cent, which corresponds rather closely with the figures given by Dr. Eastman. We did a sterilization operation in 42 per cent of the morbidity cases.

The indications for cesarean section were hemorrhage in 11.5 per cent; toxemia in 19.5 per cent; a cardiac condition in 5.5 per cent; previous cesarean section in 6.7 per cent; coexistent pathology in 4.2 per cent; disproportion and dystocia in 52.5 per cent.

Local anesthesia was used exclusively in 53 per cent; combined with general anesthesia in 20.9 per cent; and general anesthesia alone in 26 per cent. These figures apply to the morbidity series and not to the entire series of cases.

DR. HARVEY B. MATTHEWS, BROOKLYN, N. Y.—No discourse on cesarean section should omit a consideration of fetal mortality. At the Methodist Hospital of Brooklyn, from April 1, 1924, to Aug. 1, 1941, there were a total of 31,242 deliveries with a total of 2,089 fetal deaths or a rate of 6.6 per cent. In this series there were 1,116 cesarean sections with a total of 68 fetal deaths, giving a rate of 6 per cent. I appreciate the fact that there were considerable more vaginal deliveries than deliveries by cesarean section; however, the figures do bring out the point that fetal survival is not necessarily simply a matter of performing cesarean section.

Let us take, for the sake of comparison, the fetal mortality rate in cesarean section in 3 other representative hospitals. We find the following: The Chicago Lying-in, 6.7 per cent in 1,000 cesarean sections; The Woman's Hospital, New York, 6.69 per cent in 912 cesarean sections; The Philadelphia Lying-in, 10.8 per cent in 830 cesarean sections. Our rate of 6.0 per cent in 1,116 sections compares favorably with these figures.

In our series, prematurity constituted the largest group of nonsurvivals (25, or 4.0 per cent) and this is in line with other reports. Cesarean section apparently gives no better assurance of survival of the viable premature than well-managed vaginal delivery. Congenital anomalies made up the next largest group in our

series of nonsurvivals (12 or 1.9 per cent), and here I should like to point out that, whenever possible, every cesarean section should be preceded by an x-ray examination of the fetus in utero and thus rule out, at least, certain types of anomalies. Neonatal infection, eclampsia, hemorrhagic disease of newborn, and intracranial hemorrhage were among other causes listed.

In conclusion, I should like to emphasize again that cesarean section carries with it a sizable fetal mortality and that we should constantly reiterate this fact in all our discussions of cesarean section to the end that the lay public, as well as the medical profession, may more fully realize that abdominal section is "no positive assurance of a live baby."

DR. WILLIAM R. NICHOLSON, PHILADELPHIA, PA.—The anesthesia is an important consideration in determining the fetal mortality in cesarean section. For some time I have made a practice of having the woman brought into the operating room, placed on the table, catheterized, and the abdomen prepared before any anesthetic is given. A very slight anesthesia, not much deeper than the first stage, is given and as soon as the woman is unconscious the incision is made. The baby is probably only two minutes under very moderate anesthesia before its delivery. This has made a tremendous difference. Formerly I did not do a cesarean section unless I had a man on the other side of the table perfectly competent to take over the patient, thus enabling me to attend to the resuscitation of the baby. Under this plan of reduced amount of anesthesia for the baby in utero we find that the baby inspires as soon as delivered.

DR. EASTMAN (Closing).—Since the subject of cesarean section runs almost the whole gamut of obstetrics, it was obviously impossible to deal with more than a few aspects of the problem in this survey. With regard to Dr. Adair's comments upon outlet contraction, our experience has been that outlet contraction *alone* is rarely an indication for abdominal delivery. In a primigravida with a breech presentation and outlet contraction, or in a woman with a large baby and outlet contraction, it may occasionally be necessary, but in our series there are only 12 instances in which cesarean section was performed solely on the grounds of a diminished bi-ischial diameter.

In regard to our fetal mortality, this figure was 6.0 per cent for the entire series. The greater number of these stillbirths and neonatal deaths were the result of premature separation of the placenta, placenta previa, and toxemias of pregnancy.