

RECENT TRENDS IN CESAREAN SECTION*

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AN INCREASED interest has developed during recent years in the use of cesarean section due to the introduction of new agents to combat infection, improved supportive measures, and the standardization of surgical techniques. Recently, we¹ reported a decreased morbidity and a liberalization of the indications for the low flap type of operation. The study was based on a limited experience in which all of the above principles were applied. Since that time we have accumulated more data to substantiate our previous conclusions and to clarify further the indications for the transperitoneal low flap operation in complicated labors.

As a result of recent advances in pre- and postoperative therapy, surgeons² are at present able to perform extensive intestinal procedures with primary anastomoses where contamination is inevitable. The bowel may now be treated preoperatively with appropriate sulfonamides so that the entire intestinal flora becomes markedly reduced. With adequate dosage of the antibiotics and sulfonamides postoperatively, the peritoneum is capable of eliminating a large amount of bacterial contamination. In addition to chemotherapy, intestinal suction, careful control of fluid and electrolyte balance, rapid blood replacement, parenteral amino acids and vitamin therapy have improved healing, diminished infection, and reduced the risk following intra-peritoneal surgery. The change is further reflected in the treatment of peritonitis following appendicitis in which drains are rarely placed in the peritoneal cavity. The peritoneum, with the advantages of modern postoperative therapy, is able to control the infection adequately. It is with these same pre- and postoperative aids that we have performed cesarean sections, particularly during the past three years.

Early experience with the sulfonamides³ indicated clearly that they were of great value if employed prophylactically but might prove disappointing when used after an obvious infection was established. We, accordingly, have employed sulfadiazine since 1942 when infection was anticipated. After penicillin became available, we instituted it also as a prophylactic agent. Our present indications for this combined therapy are as follows: (1) ruptured membranes and twelve hours of labor with delivery not imminent; (2) intact membranes and twenty-four hours of labor with delivery not imminent; (3) questionable dystocia or abnormal presentation with trial of labor; (4) desultory labor, ruptured membranes, and anticipated prolonged labor; (5)

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anticipated cesarean section or difficult delivery; (6) intrapartum infection or intercurrent infection; (7) uterine hemorrhage, intrapartum or postpartum.

The penicillin and sulfadiazine have been used, as reported previously, without serious toxic effects. The usual dosage is 6 Gm. of sulfadiazine and 160,000 units, or more, of penicillin G in divided doses daily. Recently, we have employed penicillin G in saline or in procaine in a dosage of 300,000 units once or twice daily. Streptomycin has been added occasionally as a third antibacterial agent.

Following the advent of the modern surgical era in the latter part of the last century, various techniques were introduced to diminish the possibility of peritonitis subsequent to cesarean section. A number of these methods, such as vaginal section, peritoneal exclusion, and exteriorization of the uterus have been discarded in this country. The low flap operation, first described in 1805, was popularized in this country by Beck, DeLee, and others. The principle employed in this procedure involved an initial contamination of the peritoneal cavity but the prevention of subsequent insults. The extraperitoneal approach was employed with some regularity in Germany beginning about 1908. The operation was done infrequently in the New York Lying-In Hospital as early as 1915. It was Jellinghaus, however, in this institution, who in 1923 initiated a real interest in the procedure in this country for the delivery of patients with intrapartum infection.

Steele,⁴ in 1930, reported fifty-nine Latzko sections with complications such as perforation of the peritoneum ten times, three instances of vesicovaginal fistula, a vesicouterine fistula, and nineteen wound infections. Subsequent reports by Fellows of this Society, Burns,⁵ Sackett,⁶ Norton,⁷ Cosgrove,⁸ Aldridge,⁹ Waters,¹⁰ Marr,¹¹ and Williamson and Goldblatt¹² constitute a large part of the American literature on this subject.

Irwin¹³ wrote in 1941 that although extraperitoneal sections were used in Europe for thirty years and in America for seventeen years, very few clinics were familiar with the procedure and less than twenty reports of its use were in the American literature for the preceding ten years. He further stated that "the failure and neglect to use this technique have been due to fear of complications rather than lack of confidence in it." In 1940 Waters¹⁰ and Ricci¹⁴ independently reported the use of supravescical techniques which they thought simplified the operation and reduced complications. Waters¹⁵ stated in 1945 that he had 68, or 27 per cent, peritoneal injuries and four bladder perforations in 250 cases. Daichman and Pomerance¹⁶ used the Waters technique in 100 cases and reported 42 peritoneal injuries and 15 bladder perforations. They found that most cases had drainage from the wound over a period of two weeks. Recently, in 1946, Norton¹⁷ reported a paravesical approach in 160 cases with 9, or 5 per cent, injuries to the bladder and 27.5 per cent to the peritoneum. No permanent fistulas were found by these authors.

In a report of all cesarean sections for the state of Massachusetts from 1937 to 1941, DeNormandie¹⁸ found that only 1.2 per cent of 11,030 reported sections were of the extraperitoneal type. This would indicate that during this five-year period only a small portion of potential and infected cases were being sectioned in the state of Massachusetts by extraperitoneal operation. Although scattered reports of the extraperitoneal section continue to be published, it appears that only a few clinics regularly employ this procedure.

Dieckmann and associates¹⁹ have recently reviewed the indications for cesarean hysterectomy at the Chicago Lying-in Hospital. Out of a total of 153 cesarean hysterectomies, 21 were performed in infected cases and 12 in the potentially infected group. The only death in the series occurred in 1937 from peritonitis after twenty-one hours of labor with ruptured membranes for forty-five hours. These authors believe that the extraperitoneal section is indicated in the potentially infected case and cesarean hysterectomy in the truly infected patient.

In the three years under study at the New York Lying-In Hospital, 1946 through 1948, no hysterectomy was performed for prolonged labor and infection. The indications for hysterectomy were chiefly fibroids in elderly multiparas, occasionally for uterine hemorrhage, and rarely for rupture of the uterus. For sterilization, tubal ligation was used in our series. In the infected group of cases, the method of choice was transperitoneal low flap section and no uteri were sacrificed.

Since the opening of the Lying-In Hospital at its present location in September, 1932, to July, 1948, 54,937 deliveries and 1,622 cesarean sections were performed. The incidence of cesarean sections for this period was 2.9 per cent with a maternal mortality of 1 per cent (Table I). McCormick²⁰ has compiled data from twenty of the country's leading clinics for the five-year period 1941 to 1945, inclusive. In a total of 245,000 deliveries, the section incidence was 3.3 per cent with a mortality rate of 0.61 per cent. The highest incidence reported in this group was 7.06 per cent from the University of Pennsylvania and the lowest from Emory University was 0.51 per cent. Mortality varied from zero to a little over 2 per cent. During the same five-year period on our service, the section incidence was 3.3 per cent with a maternal mortality rate of 0.38 per cent.

TABLE I. 1932-1948

Total deliveries	54,937
Total cesarean sections	1,622
Incidence	2.9%
Maternal mortality	1.0%

The annual number of sections performed was about the same from 1933 through 1941 with a progressive increase since that time. The incidence from 1933 to 1941 varied between 2 and 3 per cent (Fig. 1). For the last four years, however, our incidence has been 4 per cent. This increase in the incidence of cesarean sections is due largely to a change in our concept of indications. In a review of this subject in our hospital, it is apparent that we are doing more sections at present for desultory prolonged labors, fetal asphyxia, elderly primiparas, and prolapse of the cord. In contrast to the earlier years, elective operation for dystocia without adequate trial labor is now seldom performed. The decreased risk associated with the procedure undoubtedly has increased its applicability.

The data on maternal mortality (Table II) are divided into approximately three equal periods. From 1932 to 1937 there were nine deaths; from 1938 to 1942, four; and from 1943 to 1948, three. In the first period, 1932 to 1937, five of the nine deaths were due to peritonitis, three to hemorrhage, and one to heart disease. In the second period, pulmonary embolus was the main cause of death although there was one death from hemorrhage and a second from infection. In the third period, 1943 to 1948, no deaths resulted from peritonitis or hemorrhage. Two deaths were caused by malignant tumors, one an adenocarcinoma of the liver and the other a neurogenic sarcoma in the pelvis. The third death in the recent group was caused by a fulminating bilateral

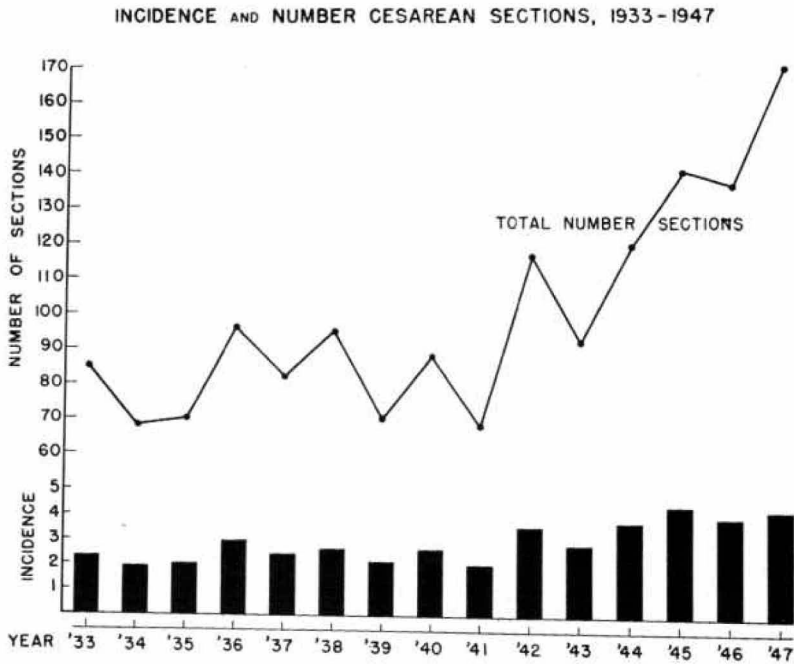


Fig. 1.

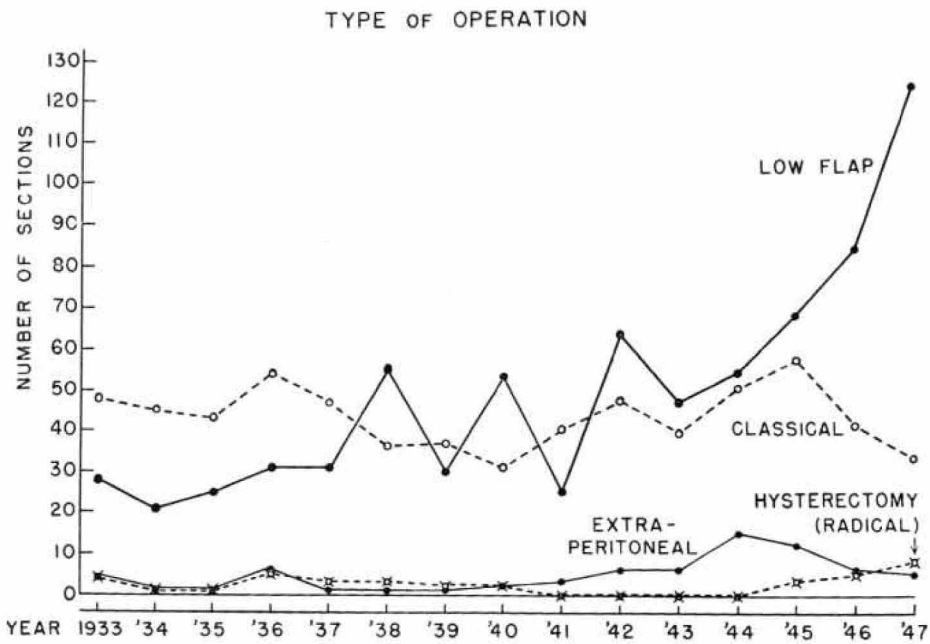


Fig. 2.

renal cortical necrosis. In each of these instances, the disease responsible for the death constituted the indication for the operation. It is of interest to note the absence of a maternal death from peritonitis from 1940 to 1948 despite the great increase in sections performed after twelve and twenty-four hours of labor.

TABLE II. CESAREAN SECTION MORTALITY

	1932-1937	1938-1942	1943-1948
<i>Causes.—</i>	9	4	3
Peritonitis	5	1	0
Hemorrhage	3	1	0
Embolus	0	2	0
Neoplasm	0	0	2
Cardiac	1	0	0
Renal necrosis	0	0	1

Fig. 2 illustrates the general trend in the type of operation during the years 1933 through 1947. From 1933 to 1937, the classical type and the low flap were used with about equal frequency. Since 1947, the low flap has greatly superseded all other techniques. In 1947, about three-fourths of the sections were performed by the low flap method. The extraperitoneal operation was seldom performed before 1940. Thereafter, the number increased to a peak in 1944. Since that year the number has gradually fallen despite the larger number of sections performed after twenty-four hours of labor. In 1947 there were only five extraperitoneal sections and these were done chiefly for teaching purposes. The cesarean hysterectomy continues to be performed on rare occasions. These data clearly indicate the great increase in the use of the low flap transperitoneal section and a reduction in the classical and extraperitoneal varieties.

TABLE III

ANALYSIS OF SECTIONS, OVER 24 HRS. OF LABOR

	1946	1947	1948*		TOTAL
TOTAL SECTIONS	136	169	114		419
24 HRS. LABOR +	16	30	24		70
LOW FLAP	14	28	19		61
EXTRAPERITONEAL	2	2	5		9
POSTOP. HOSP. DAYS	13.5	12	11.4	AVERAGE	12
MORBIDITY	7	8	8		23
UTERINE INFECTION	5	5	7		17
WOUND INFECTION	2	1	1		4
URINARY INFECTION	0	2	0		2

* INCLUDES SECTIONS JAN. to JULY 1948

From January, 1946, to July, 1948, seventy patients, or one-sixth of the total number on whom sections were performed, were in labor over twenty-four hours (Table III). The majority of indications for operation were pro

tracted desultory labor with lack of progress, fetal distress, or, more rarely, cephalopelvic disproportion. Nine of the seventy sections were extraperitoneal, either by the Latzko or Waters technique. All the others were of the low flap type. The postoperative stay in the hospital averaged twelve days which was slightly longer than in the elective cases. Sixty-five patients received prophylactic penicillin and sulfadiazine during labor; one received the drugs therapeutically following operation. Three received penicillin alone prophylactically and a single patient received no chemotherapy at all; the latter was a private patient, in labor for twenty-eight hours with intact membranes. The total morbidity for this prolonged labor group was 32 per cent, which is the same for all sections in 1946 and 1947. Only one patient developed an intrapartum infection with a temperature of 38.4° C. for a single day. In this particular case, the postoperative course was afebrile. There was no evidence of infection among the newborn and one infant died in the neonatal period of congenital anomalies. The total number of morbid patients was twenty-three (32 per cent) and in these cases the membranes were ruptured an average of twenty-four hours. It was thought that in seventeen cases there was intrauterine infection. The febrile reactions were mild and of short duration and in only two instances lasted as long as five days. Four wound infections developed of which two were mild in character. The other two had protracted temperature elevations for eight and ten days. The longest febrile case in the group was a wound infection following an extraperitoneal section which required secondary closure. There were two instances of urinary infections; both were mild and one complicated diabetes mellitus. Nineteen of the morbid group had low flap sections and four, the extraperitoneal type operation.

TABLE IV

TREND IN CESAREAN SECTION

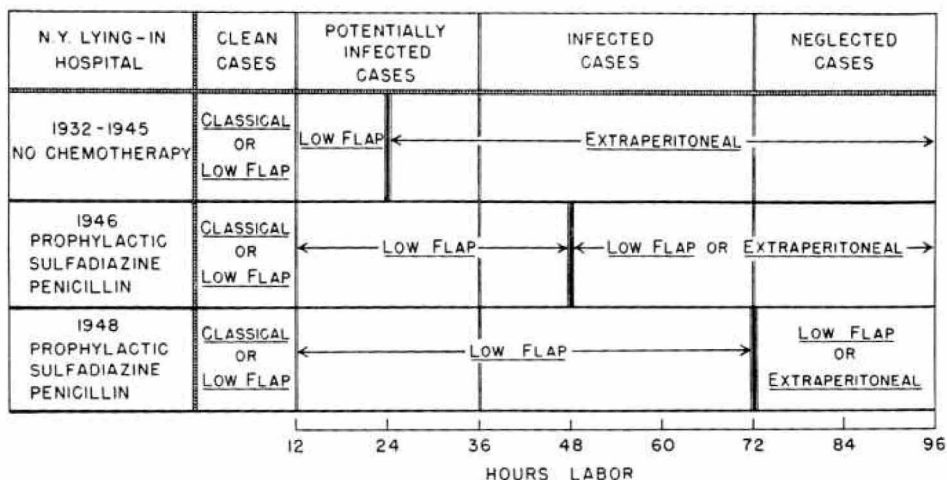


Table IV illustrates the type of section performed during three periods, in patients in labor with ruptured membranes. Prior to the advent of modern preoperative surgical preparation, including prophylactic penicillin and sulfadiazine, the low flap section was performed usually before twelve hours of labor. In 1946, at the onset of the routine use of prophylactic chemotherapy, the indications for the low flap type of operation were extended to include patients with ruptured membranes in labor for two days. Finally,

in 1948, the low flap section was further extended to all patients, irrespective of the duration of labor. The extraperitoneal section has been occasionally employed in patients with protracted labors for teaching purposes. Since 1945 we have not been impressed with the necessity for an extraperitoneal section. The classical procedure was usually performed in clean cases after a labor of less than twelve hours with intact membranes, or in patients in whom the lower uterine segment was poorly developed, or when a rapid delivery was required for placenta previa, premature separation of the placenta, or fetal asphyxia.

Our experience with neglected cases is rather limited but we have encountered instances where delivery through normal birth passages had to be abandoned because of the probability of serious injury to mother or baby. We have unhesitatingly done the low flap operation after attempted forceps, repeated vaginal examinations, and other intrauterine manipulations. On several occasions the umbilical cord was maintained manually in an intrauterine position until the baby was delivered. We have had the opportunity to see patients with protracted labor in other institutions. These cases include attempted forceps delivery and those with many vaginal examinations where no chemotherapy was instituted up to the time of operation. Both drugs, however, were maintained during the early puerperium and the puerperal course was entirely uneventful.

Discussion

Mortality following cesarean section has been due chiefly to hemorrhage, infection, and complications as a result of anesthesia. Our data indicate clearly that infection may be eliminated as a cause of mortality or as a serious complication when the low flap operation is employed, even in the presence of infection. By adequate exposure, this approach affords the operator a much better opportunity of controlling hemorrhage. Unanticipated abnormalities, such as ovarian or uterine tumors, extreme atony of the uterus, or other intra-abdominal disease, may be recognized and appropriate measures adopted. A recent example occurred in a patient with prolonged labor. The unexpected finding at the time of operation was a pedunculated ovarian cyst with a small perforation. Obviously, this potentially serious complication would not have been recognized if we had elected to employ the extraperitoneal approach in this patient.

Our experience and that of others has demonstrated that blood loss is at a minimum when local-block procaine anesthesia is employed. No other anesthetic is as safe or has as few complications. In the extraperitoneal operation, however, it cannot be utilized with any regularity because of exposure difficulties and the need for greater relaxation. The transperitoneal low flap operation may be done under local anesthesia when indicated. There is little or no danger of injury to adjacent structures, such as bladder, ureter, and the main branches of the uterine arteries. In addition, our experience indicates that the postoperative course is less complicated and the primary wound healing is encountered more frequently. In fact, the only instances in recent years with significant wound infection occurred when the extraperitoneal approach was employed.

Our hospital is a large teaching institution, intimately associated with the medical school. A full-scale program for undergraduate and graduate in-

struction and training is in progress. Our primary consideration, at all times, is the welfare of the patient. The resident staff is trained in both obstetrics and gynecology and performs practically all of the surgery on our pavilion (ward) service. They are capable of acquiring the necessary technical skill to perform the extraperitoneal operation. With the limited number of opportunities none could be considered proficient. It appears then that if the resident staff is to be trained in this operation, radical changes in indications would become necessary. We believe that from the present data the change is not justifiable. A searching investigation of our experience with prolonged labor and other complications during the last three years has failed to reveal any case in which the low flap operation could not be undertaken with safety.

Conclusions

1. At the Woman's Clinic, New York Hospital, the incidence of cesarean section has increased from 2 to 4 per cent during the years from 1933 to 1947.
2. The low flap transperitoneal section has gradually replaced the classical and extraperitoneal techniques.
3. A review of maternal mortality at this clinic indicates an absence of deaths from infection during the past eight years.
4. Seventy cesarean sections preceded by over twenty-four hours of labor are reported in a series of 419 consecutive sections since the use of prophylactic combined chemotherapy from January, 1946, to July, 1948.
5. Sixty-one were performed by the low flap technique and nine by the extraperitoneal route. No serious infections were encountered.
6. With the prophylactic use of modern surgical supportive therapy, including chemotherapy, electrolyte and fluid balance, adequate nutrition, and intestinal intubation, the extraperitoneal or radical cesarean sections have not been indicated.
7. The low flap section is simpler to perform, is without adjacent structure injury and is without protracted wound drainage.
8. Peritoneal surfaces may adequately care for large amounts of bacterial contamination if the source of such infection is limited and chemotherapy is instituted early.
9. When gross negligence results in intrapartum infection which cannot be controlled, extraperitoneal section or cesarean hysterectomy may be indicated. We have not observed any patients in this category in recent years.

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Discussion of Papers on Cesarean Section by Dr. D. Anthony D'Esopo and by Drs. R. Gordon Douglas and Robert Landesman

DR. WILLIAM E. STUDDIFORD.—The results that have been obtained in the performance of cesarean section on the Obstetrical Service at Bellevue Hospital confirm those presented here. Beginning in June, 1940, a policy was instituted whereby all patients who were subjected to cesarean section after they had been in labor with ruptured membranes were treated with sulfonamides. In addition, in the last few years they have also been given penicillin. Up to Oct. 1, 1948, there were 14,671 patients delivered, 387 of them by section. That is an incidence of 2.65 per cent which is strikingly lower than the figure cited by Dr. D'Esopo. I do not believe that our incidence has changed a great deal. However, it may have risen slightly in the past few years. Of these cases, 160 were elective operations, and many of the patients were delivered by the classical operation. There was one death in the group, a patient with placenta previa and pre-eclampsia and fibroids. She hemorrhaged severely at the time of operation and died four days postoperatively of an ileus. Autopsy showed no evidence of any infection. There were 227 patients in the series delivered after a trial of labor and these were uniformly done by the low flap type of operation. There were no deaths in this group.

We have not done any extraperitoneal operations since June 2, 1940.

This gives a mortality, on a service which has taken care of a great many emergency cases that we have not been able to study in the antepartum period, of 0.26 per cent.

DR. SAMUEL A. COSGROVE.—I feel that I am impelled to speak because our viewpoints, and I say viewpoints because I am sure the three chiefs of our own services share them and are united in holding them, are so radically different from the viewpoint expressed. We make extensive use of cesarean section. The rate, as in Dr. D'Esopo's experience, is increasing. I do not know where Dr. D'Esopo got the very low rate for our service that he showed; it was probably from some early communication. In the last ten years our rate has been 3.3 per cent, and last year it was 4.4 per cent. There is a definite increase in our incidence of cesarean section on very much the same basis which was discussed.

I am particularly happy to subscribe to Dr. D'Esopo's belief that the increasing incidence of cesarean section, paralleling the elimination of difficult vaginal delivery, is wholly salutary and will, I hope, increase until, as he has said, anything but the simple operative vaginal deliveries will be completely obsolete in our experience.

But the use of extraperitoneal section in our hands is very much greater than in either of the other clinics. The reason for this naturally is due to the success which has attended our use of this technique. I will admit perfectly freely that we are perhaps riding the hobby hard in our clinic, because we have represented there the proponents of what I think are the two best extant techniques of that operation.

Our educational program is wholly postgraduate and inasmuch as we believe very thoroughly that every competent obstetrician should have in his armamentarium facility in the use of the extraperitoneal section, we use it largely as a teaching facility.

Entirely apart from that, while I by no means derogate the contribution that the sulfonamides and the antibiotics have made to our modern resources of safety for patients, I

do not feel that they should displace good surgical judgment in any field and that they should not be relied upon to displace safer operative procedures, which we believe the extraperitoneal operation to be.

Several years ago, when we were just beginning to be interested in the more extensive indications for the extraperitoneal section that we recognize today, Dr. Waters published a study in which he showed that in periods of duration of labor and periods of ruptured membranes, the mortality and morbidity rates, particularly the latter, ascended sharply after certain limits of those phenomena were passed. Dieckmann, Douglas, and others have shown a similar correlation between postoperative mortality and morbidity and the use of the transperitoneal section in relation to the duration of labor and the duration of ruptured membranes. In a recent survey of our own we found that that difference in morbidity has been entirely eliminated. In other words, there is no essential difference in our postoperative morbidity as between those patients who have been in labor a short time and over long periods, and as between those who have had ruptured membranes a short time and those who have had ruptured membranes a very long time.

We cannot gainsay the value of the sulfonamides and of penicillin in that elimination of the difference in morbidity, but we do not believe that they account for it all. We believe that the application of strict criteria limiting the transperitoneal approach in favor of the much safer and not tremendously more difficult extraperitoneal approach, is responsible for this change rather than the availability of the sulfonamides and antibiotics.

DR. RALPH L. BARRETT.—I am glad to note that there is a definite tendency toward higher incidence of cesarean section in the last ten years. Some fifteen or twenty years ago at the Woman's Hospital, we began to increase our incidence of section, largely in the treatment of placenta previa and premature separation and in the borderline pelvis with poor progress in labor frequently noted as cephalopelvic disproportion. We also selected cesarean section rather than delivery by bimanual dilatation of the cervix and delivery by mid- or axis traction forceps in the more protracted labors.

With this increase in incidence of cesarean, our maternal mortality and morbidity showed a definite drop and there was decided decrease in our fetal and neonatal mortality.

Classical cesarean is rarely used in the Woman's Hospital. Our choice is the low flap type. We do use extraperitoneal cesareans for the frankly infected or potentially infected cases. We are firm believers in the merits of the extraperitoneal operation in these cases.

DR. EDWARD G. WATERS.—We have been doing the low transverse cervical operation since our hospital (Hague Maternity) was opened. Since 1929 I have done but two classical sections. The usual operation is the low flap popularized in this country by DeLee, Phaneuf, Beck and the Brooklyn group, and others. It is very encouraging after twenty years to find that these two outstanding clinics have finally accepted the low transverse operation as a good procedure. In the years ahead, as the technique of the not-too-difficult extraperitoneal operation becomes more familiar and as more learn how rather than find excuses for not doing it, the operation will have greater use than it has today. I use it in private practice frequently in clean and elective cases because of the good postoperative recovery with early ambulation which permits return home by the tenth day.

The experience with our own private patients, covering a period of nearly four years, shows a high incidence of section, for there were 109 operations, or 6.5 per cent, in 1,617 deliveries. Thirty-one per cent represented elderly primiparas over 35 years of age, and about the same number and per cent were for repeat sections. Of the 109 operations, 59 were of the low transverse type and 50 were supravescical extraperitoneal sections. Seven of the latter patients had previously had low transverse operations. Almost all of the extraperitoneal cesareans were elected to demonstrate technique. Only one was necessitated by infection. Gross infection today should be a rarity, and the extraperitoneal cesarean section is therefore more often elected in potential infection and because of the smoother postoperative course.

agree completely with Dr. Waters' statement regarding the relative value of antibiotics and sulfonamides. Moreover, I made the point that potentially infected patients adequately protected with these agents can be subjected to transperitoneal double flap procedures with the same or greater margin of safety than may be obtained by the extraperitoneal operation. Our patients are out of bed on the first postoperative day and frequently discharged prior to the tenth postoperative day.

During the past three years almost 500 patients a month have been delivered at the New York Lying-In and Mt. Vernon Hospitals and I have been looking for but have not found a real indication for the extraperitoneal section. Our data presented clearly indicate that there is no superiority of the extraperitoneal over the transperitoneal approach. In fact, primary wound healing is better and other complications are encountered less frequently with the latter procedure.

I do not know whether Dr. Heaton referred to a comment that I made when he objected to the relegation of the extraperitoneal section to history. I did not make that comment, but stated that vaginal cesarean section, exteriorization of the uterus, and peritoneal exclusion operations had been discarded in this country. I did not include the extraperitoneal section.

Like Dr. Waters, Dr. Cosgrove, and Dr. Norton, I am anxious to see the best results obtained. Certainly, if they can be achieved by one group by means of the extraperitoneal section, then it becomes the method of choice for their clinic. If better results by another group can be obtained by the low flap procedure, then it is the method which the second group should employ.