

## PELVIC DELIVERY FOLLOWING CESAREAN SECTION\*

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IT IS readily understandable that in an era when cesarean section was reserved for cases of marked cephalopelvic disproportion there should arise the oft repeated dictum "Once a Cesarean, always a Cesarean." However, with the rapid progress in the development of aseptic, surgical technique and the introduction of potent chemotherapeutic agents, there has appeared a most gratifying decrease in the maternal mortality and morbidity accompanying the procedure, and an all too prevalent impression that the operation is both simple and safe. Consequently, it is not surprising to note the ever increasing incidence of the operation and the widening of its scope of application to such obstetric complications as placenta previa, premature separation of the normally implanted placenta, uterine inertia, and abnormal fetal presentation, not to dwell on the lengthy roll of questionable indications to be found in the literature. Regardless of what opinion one may possess toward the various indications, there nevertheless has come into being a not inconsiderable group of women, free from pelvic contraction and deformity, who have previously been subjected to cesarean section for some temporary consideration.

It is concerning this category of patient that we wish to dwell in some detail. The woman who has had a pregnancy terminated by hysterotomy and presents herself in a subsequent pregnancy creates a definite clinical problem and challenge. "To what degree is such a patient endangered by the presence of a scar in her uterus?" "What is the prospect for delivery through the natural birth canal in a succeeding pregnancy?" In spite of its significant practical consideration, the literature is meager concerning observations and study of pelvic delivery following cesarean section.

During the interval from Jan. 1, 1928, to Jan. 1, 1947, there have been effected at the Boston Lying-in Hospital one hundred seventy-seven deliveries through the natural birth passage in one hundred eighteen patients who had previously been subjected to cesarean section. Thirty of these women were delivered twice subsequent to hysterotomy, seven three times, two four times, one five times, and one six times, respectively.

It becomes readily evident from the above that during the past eleven years there has been a definite and steady increase in the number of pelvic

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deliveries in women having section scars. From Jan. 1, 1928, to Dec. 31, 1935, there were thirty-nine (22.0 per cent) such deliveries, whereas from Jan. 1, 1936, to Jan. 1, 1947, the total rose to one hundred thirty-eight (78.0 per cent). One might hastily attribute this rising incidence in more recent years to a corresponding increase in the frequency of cesarean section. A survey of the hospital statistics, however, demonstrates a distinct, even though slight, decline in the frequency of hysterotomy in the latter period.

TABLE I

Number of deliveries following cesarean section	1x	2x	3x	4x	5x	6x	Total
Number of patients	77	30	7	2	1	1	118
Total of deliveries	77	60	21	8	5	6	177

These deliveries were distributed over the period under investigation as follows:

TABLE II.

Year	1928	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	19 yrs.
No. of deliveries	4	0	6	2	7	12	6	2	11	17	10	11	11	19	13	14	9	13	10	177

This encouraging trend can be attributed to two major developments in clinic policy during the latter period; first, the adoption and wider employment of x-ray pelvimetry during the course of labor in cases of mild pelvic contraction and uterine inertia, enabling the more intelligent interpretation of progress during labor, and second, the greater consideration directed toward successful pelvic delivery following hysterotomy. During the past eleven years such deliveries alone have been responsible for a reduction of some 12.5 per cent in the total number of cesarean sections that would have resulted, had the presence of a uterine scar been considered an absolute indication for a repetition of the operation.

A large proportion of these patients (70 per cent) were delivered by forceps application after full dilatation of the cervix to avoid the expulsive stage, thereby minimizing the stress upon the uterine cicatrix.

TABLE III. TYPE OF DELIVERY

SPONTANEOUS	LOW FORCEPS	MID-FORCEPS	LOW FORCEPS FOLLOWING SCANZONI MANEUVER	LOW FORCEPS FOLLOWING MANUAL ROTATION	BREECH EXTRACTION
50-27.9%	112-62.6%	1	7	5	4

Sixty-eight (38 per cent) of these deliveries concluded the second pregnancy in patients whose first pregnancy was terminated by hysterotomy, so that for all practical purposes this group was subjected to what should be considered as a primiparous labor excluding the second stage. No disastrous sequelae were observed as a result of this policy, contrary to the opinion<sup>1</sup> that the long and tedious labor allegedly inherent in a primipara is to be avoided in the patient having had a previous cesarean section. The average duration of labor for the entire group was nine hours, twenty-five minutes. The average for deliveries through the primiparous cervix was fourteen hours, twenty minutes, the shortest such labor being four hours and the longest sixty hours. The multiparas averaged six hours, twenty-one minutes, the shortest labor being one-half hour, while

TABLE IV. DURATION OF LABOR

	PRIMIPAROUS CERVIX	MULTIPAROUS CERVIX	ENTIRE GROUP
Average duration of labor	14 hrs. 20 min.	6 hrs. 21 min.	9 hrs. 25 min.
Shortest labor	4 hrs.	30 min.	30 min.
Longest labor	60 hrs.	36 hrs.	60 hrs.

TABLE V. TYPE OF SECTION

	NO. OF DELIVERIES	NO. OF PATIENTS		
Classical	104 = 59%	66 = 56%	a) { Classical	
Kerr	36 = 20%	24 = 20%		b) { Classical
Kroenig	10	9		
Latzko	7	3		d) { Kerr
Water's	2	2		
Vaginal hysterotomy	2	1		
Multiple sections	4	4		
Unknown	12	10		
Total	177	118		

TABLE VI

SECTION PERFORMED AT	NO. OF DELIVERIES	NO. OF PATIENTS
Boston Lying-in Hospital	95 = 53.6%	60 = 50.8%
Other hospitals	82 = 46.4%	58 = 49.2%
Total	177	118

TABLE VII. CONVALESCENCE FOLLOWING SECTION

	NO. OF DELIVERIES	NO. OF PATIENTS
Afebrile	103 = 58.2%	72 = 61.0%
Febrile	42 = 23.7%	23 = 19.5%
Unknown	32 = 18.1%	23 = 19.5%
Total	177	118

the longest was of thirty-six hours' duration. Undoubtedly the reduction from the usually accepted statistics of primiparous and multiparous labors is to be attributed in some measure to the frequent elimination of the second stage of labor.

One hundred four (59 per cent) of the deliveries were in patients who had previously been subjected to the classical type of cesarean section, while thirty-six (20 per cent) occurred in women upon whom the low transverse (Kerr) type of section had been performed. Four patients, each of whom had experienced two previous hysterotomies, were each delivered once subsequently through the natural birth canal.

Approximately one-half of these patients had been operated upon in our own clinic, while an almost similar number were attended by their own physicians or at other clinics. For theoretical and practical considerations one would prefer to limit such deliveries to gravida who had been caesareanized in their own clinic for a temporary indication, and who had enjoyed an uncomplicated, afebrile convalescence. Even superficial inspection of the accompanying data will reveal that these criteria were not rigorously adhered to, fortunately, without development of any complications that could be attributed to such leniency.



As one would anticipate, the great proportion of these patients had been subjected to cesarean section for a temporary indication. The frequency of hemorrhage as an indication corresponds well with the high incidence of the classical type cesarean previously mentioned. This type of operation is the one employed in our clinic for cases of placenta previa and partial premature separation of the normally implanted placenta.

TABLE VIII. INDICATIONS FOR PREVIOUS CESAREAN SECTION

INDICATION	NO. OF DELIVERIES	NO. OF PATIENTS
Placenta previa	51 = 28.8%	34 = 28.8%
Premature separation of placenta	28 = 15.8%	16 = 13.5%
Uterine inertia	27 = 15.2%	19 = 16.1%
Cephalopelvic disproportion	26 = 14.7%	19 = 16.1%
Pre-eclampsia (severe)	12 = 6.8%	9 = 7.6%
Eclampsia	9 = 5.1%	4
Fetal distress	4	3
Prolapsed cord	3	2
Face presentation	2	2
Primiparous breech	1	1
Obstructing pelvic tumor	1	1
R.H.D.-M.S. and M.I. (early decomp.)	2	1
Hydrocephalus	3	1
Chorea	1	1
Varicosities of vulva	1	1
29-year-old primipara	3	1
Unknown	3	3
Total	177	118

Many of the cases of cephalopelvic disproportion were sectioned elsewhere or were delivered of infants considerably smaller than those for which they had been subjected to operation. It is most unfortunate that hydrocephalus, chorea, or elderly primiparity should ever appear in any roll of indications for cesarean section. If at the age of twenty-nine a woman is to be considered old, then certain physicians are soon to become quite unfamiliar with the mechanism, the ease, and the safety of pelvic delivery.

In more recent years it has become our policy to examine the uterine cavity immediately following the third stage of labor in every instance as a safeguard against any symptomless rupture that may have occurred in the uterine scar. The details of this aspect and the method employed in this clinic shall be discussed later.

TABLE IX

	NO. OF DELIVERIES	NO. OF PATIENTS
Exploration of uterine cavity	112 = 63.3%	83 = 70.3%
Not explored	65 = 36.7%	35 = 29.7%
Total	177	118

In spite of the fact that the uterus was explored manually in 112 cases only four patients in the entire group experienced a febrile convalescence, all of them mild in character. One patient whose uterus was not explored had a temperature of 100° to 101° F. during the first seven postpartum days, due to a mild sapremia. A second patient, who entered the hospital two days following

spontaneous rupture of the membranes, ran a temperature of 100° to 101° F. for five days following delivery as a result of sapremia. Cystitis was responsible for a temperature of 101° to 102° F. for a two-day interval in two remaining patients. This morbidity incidence is well within the zone of that for the general clinic population, a fact which is deserving of emphasis. When performed in accordance with well-prescribed aseptic technique, manual exploration of the uterus should have no effect upon the morbidity statistics.

The average hospital stay per patient for the group as a whole compared favorably with the general hospital population.

There was one maternal mortality in the series (0.56 per cent) occurring in 1932.

M. M., No. 6414, was a 25-year-old para iii, whose first pregnancy terminated in a normal spontaneous delivery. Two years later a classical hysterotomy was performed in our clinic because of painless, bright vaginal bleeding due to central placenta previa. Convalescence was uneventful. The present prenatal course was normal except for the development of mild pyelitis which cleared readily with conservative therapy, during the seventh month of gestation. Labor commenced spontaneously at term and progressed rapidly under pentobarbital medication. Four hours following admission to the hospital an easy low forceps delivery was performed under N<sub>2</sub>O-O<sub>2</sub> ether anesthesia with the birth of a normal, active infant. The uterus was not explored. On recovering from the anesthesia the patient vomited a considerable amount of undigested food. She was well until twelve hours following delivery when she became markedly cyanotic, dyspneic, and apprehensive as a result of a "tightness" in her chest. The pulmonary condition became progressively worse with development of patchy areas of consolidation and bronchial breathing, together with rising pulse and respiratory rate. Exitus occurred forty hours following delivery and was attributed to aspiration pneumonitis. Postmortem examination was refused.

It is difficult to ascribe this disaster to any aspect peculiar to pelvic delivery following cesarean section. Such unfortunate circumstances might have resulted following any operative procedure, and more especially subsequent to a reiterative hysterotomy.

All but six of the infants in this series were discharged in good condition. Two were stillborn with extensive congenital deformities incompatible with life. A third was delivered macerated at thirty weeks' gestation. Another stillborn infant resulted from an easy multiparous breech delivery at term. Intra-uterine asphyxia was attributed to the cord being tightly about the neck twice. A fifth stillbirth resulted at thirty-eight weeks' gestation in a multipara with mild pre-eclampsia who, on admission to the hospital in active labor, was bleeding considerably per vaginam. No fetal heart tones could be heard on admission. Labor progressed rapidly and she was delivered by low forceps at full dilatation of a stillborn 5-pound infant. The placenta showed marked premature separation and infarction. The sixth to be included in the infant mortality was a 7 pound, 15 ounce infant delivered normally at term after a short labor of an RH-negative mother. The infant expired at 24 hours of age of erythroblastosis.



It is only proper that the foregoing data be interpreted along with a consideration of whatever hazards may accompany attempts at delivery through the natural birth canal following previous cesarean section. The fundamental question, of course, revolves about the behavior of the uterine scar in subsequent pregnancies, whether it shall prove adequately firm to tolerate the distention of the uterus as pregnancy advances, and to withstand the stress of labor itself. The functional strength of the scar is intimately dependent upon the histology of wound healing in the uterus and the location of the incision. It is for this reason that a number of authors, during the past thirty years, have applied themselves especially to the anatomic study of these scars. There still appears to be considerable enthusiasm existent in the controversy as to the exact nature of the reparative processes taking place in the healing of the uterine incision.

J. Whitridge Williams,<sup>2</sup> from a detailed study of uteri which had been subjected to one or more cesarean sections, noted that the old scar was invisible in most instances or could be identified at most by the presence of shallow vertical depressions over the external and internal surfaces of the anterior uterine wall. This observation has been confirmed frequently by Audebert,<sup>3</sup> Losee,<sup>4</sup> Eardley Holland,<sup>5</sup> and others. In more recent years, there have appeared reports of similar findings in studies directed to the scar in the lower uterine segment. Phaneuf<sup>6</sup> was unable to identify the cicatrix as such in forty-one repeat lower segment cesarean sections, whereas Fuchs<sup>7</sup> found it impossible to visualize the scar in thirty-three of forty-six cases upon which he performed a second cervical hysterotomy. Corroboratory observations have been made by Wetterwald<sup>8</sup> and DeLee, Nadelhoffer, and Greenhill.<sup>9</sup>

In 1895, von Baunfunwald, Shauta, and Brann<sup>10</sup> reported complete muscle regeneration in the scar following a cesarean section. More significant was Williams<sup>12</sup> reiteration that microscopical examination of tissue removed from the site of the incision revealed complete absence of fibrous tissue in the uterine wall, demonstrating that the uterus, just as all other organs containing non-striated muscle, heals by complete regeneration of muscle fibers and not by fibroblastic response. Two schools of thought have grown up around this issue: Williams,<sup>2</sup> Audebert,<sup>3</sup> Losee,<sup>4</sup> and Breistein<sup>11</sup> have been convinced that in those cases where there has been perfect coaptation of the incised tissues, where the various layers have not been separated by blood clot, lochia, or serum, where there has been no infection, the incision heals by complete muscular regeneration in 80 per cent to 90 per cent of the cases. On the contrary, Couvelaire,<sup>12</sup> in 1909, in his report to the Societe d'Obstetrique de France, expressed doubt that the reparative processes could occur without fibrous tissue formation. Fruhinsholz,<sup>13</sup> Lauvray,<sup>14</sup> and Nicoletti,<sup>15</sup> concurred in this opinion. Schwartz and Paddock<sup>16</sup> appeared to have settled the issue in their exhaustive histological study on "The Cesarean Scar," concluding that muscle regeneration plays no important role in the healing of the scar, and that fibroblastic proliferation was practically normal. In a corroboratory study on a series of uteri from pregnant rabbits they<sup>17</sup> demonstrated the proliferation of fibroblasts along the line of incision entering the interstices between the adjacent muscle bundles. As the scar contracts, this becomes less perceptible, and it is difficult to demonstrate the line of the incision with the ordinary stains after a period of two weeks. It is this marked shrinking of the newly developed connective tissue and its branching penetration among the muscle fasciculae that make the cesarean scar so frequently invisible at a subsequent operation.

Mason and Williams,<sup>18</sup> in a series of experiments, carried out on pregnant guinea pigs and cats whose uteri were incised, noted that, after a reasonable convalescent period, with increasing stress exerted upon strips of the uterine muscle containing the scar, that rupture occurred not at the site of the old incision, but rather in the neighboring myometrium in every instance.

In 1886, Krukenberg<sup>19</sup> reported a series of twenty ruptures of the classical incision in a subsequent pregnancy, establishing an incidence of 50 per cent at a period, however, when it was the custom to return the unsutured uterus to the abdominal cavity, with little or no attempt to control hemorrhage. This is in marked contrast to the brilliant results that followed the adoption of the principles of suturing the incised uterus promulgated by Singer<sup>20</sup> in his classic monograph in 1882. In the thirteen years that followed he was able to observe 500 consecutive women in a subsequent pregnancy without a single case of rupture of the cicatrix, an extraordinary accomplishment even today.<sup>21</sup> From 1882 to 1938 there have been reported a total of two hundred eight ruptures of the classical scar in a subsequent pregnancy. One may readily presume that reports of all cases have not found their way into the literature. The incidence of rupture following classical section varies from 2 per cent (Kerr<sup>22</sup>) to 6 per cent (Audebert<sup>3</sup>) with a generally accepted average of 4 per cent. Holland,<sup>5</sup> in his extensive follow-up of more than a thousand hysterotomies, demonstrated an incidence of 3.6 per cent. A recent survey by the McDowells<sup>23</sup> of 3,300 classical cesarean sections performed by the Potters of Buffalo, disclosed that fifty (1.5 per cent) had undergone spontaneous rupture in subsequent pregnancies with but a single mortality! With continued improvement in surgical technique and asepsis, it may be expected to note a progressive diminution in the frequency of ruptured scars.

Statistical surveys of rupture following low-flap cesarean sections may well reflect the results of surgical advances, in addition to the presence of the scar in the noncontractile portion of the uterus. Up to 1938, a total of thirty-eight<sup>21</sup> ruptures subsequent to cervical hysterotomy had been recorded in the literature. Wetterwald,<sup>8</sup> in 1926, reported an incidence of 0.28 per cent ruptures in a review of 3,600 pregnancies following previous low-flap section. Gellé<sup>24</sup> and Fournier<sup>25</sup> arrived at approximately the same figure, 0.25 per cent, or one-sixteenth of that following the classical type of operation.

From Jan. 1, 1928, to Jan. 1, 1947, we have witnessed eight cases of disruption of a cesarean scar in a subsequent pregnancy at the Boston Lying-in Hospital. These are recorded in some detail below.

CASE 1.—E. C., No. 43997, 1929, was a 24-year-old para ii who had been subjected to a classical cesarean section for an unknown indication at another institution four years previously. She was attended by her own physician during this pregnancy. She began to experience bright vaginal bleeding, severe abdominal pain, and vomiting at thirty-seven weeks' gestation. She was then referred to the hospital in severe shock, with a classical picture of a ruptured uterus thirteen hours following the onset of symptoms. No apparent labor. Laparotomy was performed at once. The dead fetus and placenta were free in the general abdominal cavity amidst a large amount of blood and clot. The classical scar was found ruptured in its entire length. Supracervical hysterectomy with drainage was followed by a stormy convalescence, complicated by peritonitis, intestinal obstruction, and bronchopneumonia. The patient was discharged well on the fifty-eighth postoperative day. This case is a glaring illustration of grossly unintelligent management of a major obstetric problem prior to admission to the hospital.



CASE 2.—S. W., No. 3924, 1934, was a 36-year-old gravida vi, para iii, who had had a Kerr hysterotomy in 1928 following a test labor at another hospital. In 1932, a classical section was performed at still another institution. Thereafter, she miscarried three times at ten to sixteen weeks' gestation. When seen in our clinic for the first time she was registered for a third repeat hysterotomy and sterilization one week prior to her estimated date of confinement. Three days prior to the stipulated date of operation she entered the hospital, having been in active labor for four hours. Considerable time was required to locate the patient's spouse, whose signature was necessary for the sterilization procedure. In the one and one-half hours that elapsed the cervix became almost fully dilated and the head low when symptoms of uterine rupture developed acutely. Immediate laparotomy revealed multiple omental adhesions and rupture of the transverse scar with extension into the urinary bladder. The classical scar was found to be intact. Supracervical hysterectomy and reconstruction of the bladder with drainage were performed. The patient was discharged well on the twenty-sixth postoperative day after an afebrile convalescence. The infant succumbed four hours following delivery from atelectasis and intrauterine asphyxia.

CASE 3.—H. B., No. 17503, 1935, was a 30-year-old para iii whose first pregnancy was terminated by forceps delivery, in 1929, with birth of a normal infant weighing 7 lb., 11 ounces. In 1934, she was subjected to a classical hysterotomy for alleged disproportion at another institution. Convalescence was uneventful. While being followed in our clinic, arrangements were made for an elective, repeat section, one week prior to her estimated date of confinement. At thirty-seven and one-half weeks' gestation the patient was suddenly seized with acute abdominal pain and syncope. Laparotomy immediately on arrival at the hospital disclosed numerous adhesions about the old scar and the peritoneal cavity filled with liquid blood and large clots. A one and one-half inch rupture in the uterine scar was extended to permit delivery of a stillborn infant and the placenta which overlay the cicatrix. Scar was excised and uterine incision repaired. Patient was discharged on the seventeenth postoperative day following an afebrile convalescence.

CASE 4.—H. N., No. 13975, 1936, was a 24-year-old para ii whose first pregnancy was terminated by classical hysterotomy for severe pre-eclampsia in our clinic in 1934. She was discharged on the seventeenth day following an afebrile convalescence. Present pregnancy was uneventful until thirty-one weeks' gestation when she developed acute abdominal pain, tenderness over the abdominal scar, with frequency and urgency of urination. Laparotomy revealed complete disruption of the old scar. Nonviable twins and placenta were partially extruded through the rupture. Supracervical hysterectomy with drainage was followed by an afebrile convalescence and discharge on the sixteenth postoperative day.

CASE 5.—M. L., No. 21152, 1937, was a gravida v, para iv, whose second pregnancy was terminated by a Kerr hysterotomy in 1931, and a third pregnancy by classical cesarean section in 1933 because of a suspension and trachelorrhaphy performed one year after her first delivery (pelvic). Both cesareans were performed at another institution. She was registered for a third repeat section and sterilization to be performed one week prior to her estimated date of confinement. On the day prior to the stipulated date of operation, she developed acute abdominal pain. Immediate laparotomy disclosed a dead fetus and placenta free in the general peritoneal cavity, and disruption of the classical scar in its entirety, with extension to involve a portion of the lower transverse



cicatrix. Supravaginal hysterectomy with drainage was followed by an afebrile convalescence and discharge on the seventeenth postoperative day.

CASE 6.—M. B., No. 19663, 1938, was a 25-year-old para ii who in 1936 was subjected to a classical hysterotomy in our clinic because of cephalopelvic disproportion. While being re-examined at thirty-seven and one-half weeks gestation to determine the type of delivery she should have, the patient developed lower abdominal pain and a baseball-sized mass just below the umbilicus. The tumor mass became progressively larger while preparations were being made for operation. Laparotomy revealed rupture of the old scar in its entirety. The membranes were still intact. Following delivery of a living child, supracervical hysterectomy with drainage was performed. The patient was discharged on the nineteenth postoperative day after an uneventful convalescence.

CASE 7.—M. P., No. 19474, 1942, was a gravida iii, paraii, who suffered a fractured pelvis as a result of an automobile accident in 1932. Because of the resultant pelvic deformity an elective classical cesarean section was performed at the Boston Lying-in Hospital in 1936. Convalescence was uneventful and afebrile. The following year she was delivered precipitously of a 6-pound infant at another institution. In this third pregnancy it was elected to permit a test of labor. The patient entered the hospital in mild labor ten days prior to her estimated date of confinement. Following twelve hours of mild labor she suddenly developed severe suprapubic pain. Immediate laparotomy disclosed a dead fetus and placenta free in the general peritoneal cavity, and disruption of the previous classical scar in its entirety. Supracervical hysterectomy was followed by an afebrile convalescence and discharge on the seventeenth postoperative day.

CASE 8.—T. M., No. 38696, 1944, was a gravida ii, para i, whose first pregnancy was terminated by classical cesarean section for placenta previa two years previously at another hospital. X-rays revealed an ample, gynecoid pelvis. It was elected to permit a test of labor. At term the patient suddenly developed severe lower abdominal pain. No labor. On admission to the hospital shortly thereafter immediate laparotomy disclosed a rupture of the previous cesarean scar almost in its entirety. The membranes were still intact, an active infant in good condition was delivered through the rent in the uterus. Supracervical hysterectomy was followed by an afebrile convalescence. Mother and infant were discharged well on the seventeenth postoperative day.

Disruption of cesarean scars forms approximately 20 per cent<sup>26</sup> of all uterine ruptures. Though rupture of the uterus is to be considered among the most serious of all obstetric complications, the accompanying statistics disclose that the accident, when a cesarean scar is implicated, is not accompanied by nearly as formidable a maternal mortality as when it results spontaneously or following a traumatic procedure in the uterus free from a cicatrix. The mortality may be conservatively estimated to be in the vicinity of 10 per cent to 15 per cent under the guidance of good obstetric surveillance. The fetal mortality, however, ranges from 70 per cent to 100 per cent.

A sinister feature of rupture of cesarean scars is that the accident may occur at any period of gestation or labor. This adds to the difficulty, however forewarned by our knowledge of the risk to the patient, to protect her completely. Numerous reports of individual cases of spontaneous disruption of the cicatrix in the relatively early stages of gestation have appeared in the literature;

TABLE X. MATERNAL MORTALITY IN UTERINE RUPTURE

AUTHOR	PREVIOUS CESAREANS		NO PREVIOUS CESAREANS	
	CASES NO. OF	MATERNAL MORTALITY	NO. OF CASES	MATERNAL MORTALITY
Findley <sup>27</sup> 1916	59	18 - 30.5%		
Holland <sup>5</sup> 1921	97	28 - 28.9%		
Davis <sup>28</sup> 1927	24	3 - 12.5%	82	54 - 65.9%
Sacks <sup>29</sup> 1930			24	14 - 58.3%
Bey <sup>30</sup> 1932			110	56 %
Sheldon <sup>31</sup> 1936	7	1 - 14.3%	19	8 - 42.1%
Scley <sup>32</sup> 1937	3	0 - 0 %	9	1 - 11.1%
McNeile <sup>33</sup> 1938		20 %		90 %
Potters <sup>23</sup> 1939	51	1 - 2.0%		
Burkous <sup>34</sup> 1941	18	2 - 11.1%	27	15 - 55.6%
B.L.I. cases listed above	8	0 - 0 %		

Barnes (24 weeks),<sup>39</sup> Wilson (28 weeks),<sup>40</sup> Orrul (28 weeks),<sup>41</sup> Nicholson (28, 32, and 34 weeks),<sup>42</sup> Slevin (30 weeks),<sup>43</sup> and Ford (35 weeks).<sup>44</sup> The accompanying table illustrates that an appreciable number (26.1 per cent) of cesarean scars separate prior to the time when one would ordinarily elect to perform a repeat hysterotomy.

TABLE XI. STAGE OF PREGNANCY AT WHICH RUPTURE OCCURS

AUTHOR	WEEKS														PROPORTION OF CASES OCCURRING AT 38 WEEKS OR EARLIER
	28	29	30	31	32	33	34	35	36	37	38	40			
Findley <sup>27</sup>					6				2		3	42		11 - 20.8%	
Holland <sup>5</sup>			1		11		1		14	2	4	53		33 - 37.2%	
Singer & Marioton <sup>37</sup>					7							14		7 - 33.3%	
Mariana <sup>38</sup>					7				12		5	111		24 - 17.8%	
B.L.I. cases cited				1						1	2	4		4 - 50.0%	
Total												224		79 26.1%	

In our series of eight cases of ruptured cesarean scars detailed previously, but two such accidents occurred in patients who were selected for prospective delivery through the pelvis. Only one of these patients, however, experienced labor, the second suffering spontaneous rupture before the onset of uterine contractions. The remaining six disruptions occurred without labor prior to the appointed date of repeat hysterotomy, customarily performed one week prior to the expected date of confinement in this clinic. This group of cases reflects in a small way the facts frequently reported in the literature.

We shall not dwell upon the factors that encourage imperfection in the cesarean scar, nor attempt to explain the low incidence of rupture (0.25 per cent) among cervical sections as compared with the frequency (3 per cent to 4 per cent) in the classical type. However, when the uterine incision has been sutured carefully in accordance with well-established surgical principles, and when there has been no subsequent infection as characterized by foul lochia or a febrile convalescence, one may well expect the scar to be capable of withstanding the distention of the maturing pregnancy and the stress of labor itself. With attention directed to the perfect coaptation of the margins of the incision and to the avoidance of muscle infarction, bacterial invasion of the wound will be discouraged. Many have emphasized that placental implantation over the scar



predisposes to rupture. It may be this latter factor, together with its site in the noncontractile portion of the uterus, which accounts for the lower incidence of disruptions in cervical scars.

Because of the seriousness of this accident, such pregnancies, labors, and deliveries should be directed by well-trained obstetricians and conducted in maternity hospitals thoroughly equipped to cope with any obstetric complication. The most ideal results are to be expected when the patients are limited to those who have been subjected to a hysterotomy for a temporary indication in one's own clinic, and who are known to have enjoyed an uneventful, afebrile convalescence. As indicated previously, however, we were much more lenient in our selection of cases. The fruitful dividends that eventuate more than compensate the precautions necessary for the successful management of this group of cases.

These patients should be encouraged to seek prenatal care early in their subsequent pregnancies, at which time it is desirable to acquaint them with signs of rupture and to urge them to report promptly any suggestive symptoms. At the initial prenatal visit, or shortly thereafter, the patient's blood type should be determined. Such procedure will conserve valuable time should rupture of the uterine scar occur at any period of gestation, necessitating the prompt administration of blood to combat shock. Hospital blood banks have proved invaluable in just these exigencies.

As suggested by Dippel and Brown,<sup>45</sup> soft tissue roentgenograms of the anterior uterine wall in the last month of pregnancy might prove useful in determining the relative soundness of the myometrium in the region of a previous longitudinal cesarean wound. We have attempted to visualize the anterior wall thickness in a small series of patients previously delivered by cesarean section and found definite, irregular thinning of the anterior uterine wall in one instance. At the time of repeat hysterotomy, the scar proved to be defective as a result of attenuated fibrous tissue. Only positive findings of this nature would be of value, while negative observations would not preclude the absence of a weak cicatrix.

The patient must be impressed with the significance of entering the hospital at the very onset of labor, rupture of the membranes, or appearance of show. Only by uninterrupted, close observation during labor can the earliest signs and symptoms of impending rupture be detected. A compatible family donor should accompany the patient to the hospital with the intention of remaining in the waiting room throughout her labor and until the successful conclusion of delivery. This precaution must be observed, regardless of the associated inconvenience, unless the institution possesses some other reservoir of blood (blood bank). If labor progresses satisfactorily, one may anticipate a favorable termination, while the intervention of severe uterine inertia may be the factor to influence one to perform a repeat cesarean section. The use of pituitary preparations during such labors is mentioned, only to be unequivocally censured.

As mentioned earlier, it is our policy in these cases to eliminate the second stage of labor by effecting delivery by low forceps operation at full dilatation of the cervix. We are of the opinion that such conduct is beneficial in avoiding the rigorous stress of the expulsive stage. Intrauterine manipulations such as internal podalic version or difficult forceps operations invite traumatic rupture of the uterine scar.

Following delivery, the placenta is permitted to separate spontaneously. Oxytocic preparations are avoided until after the cavity of the uterus has been explored. The administration of pituitary extract usually causes such vigorously sustained contraction of the myometrium that the accoucheur may be unable to insert his hand into the uterine cavity to perform a satisfactory examination, or it may even conceal a small rent in the cicatrix. When the placenta has been expressed, the accoucheur should don fresh sterile gown and gloves, while the perineum is prepared anew and redraped. The entire gloved hand is now placed within the uterine cavity to permit a careful, complete examination. It has been our experience that the greater portion of scars in the lower uterine segment are indistinguishable, whereas a furrow or cleft of varying depth can almost invariably be palpated underlying the classical type of scar. Manual exploration of the uterine cavity should be conducted in a systematic fashion so that small oblique ruptures will not escape detection. All portions of the uterus, including the fundus and the lower segment, must be palpated. The examining fingers are pressed firmly against the inner surface of the uterus by counter-pressure of the external hand, and are guided over all surfaces in four directions: from above, downward; from below, upward; from right to left; and from left to right. It is advisable to repeat the foregoing procedure a second time at the suspected site of the old cesarean scar. Only after the accoucheur has convinced himself beyond any doubt of the integrity of the uterus may both the pituitary and ergot preparations be administered. There is, to be sure, a slight increase in the amount of blood loss associated with delivery as a result of the delayed use of the oxytocic principles.

From an analysis of our own cases and a review of the literature, we cannot but conclude that in properly selected cases that have been previously subjected to cesarean section for some temporary indication, attempts at pelvic delivery are to be encouraged, providing the foregoing precautions are observed. By pursuit of such a policy, one may anticipate not only a considerable curtailment in the frequency of cesarean section, but a gratifying reduction in the maternal mortality and morbidity, as well as a conservation of hospital days.

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