

RUPTURE OF THE SCAR OF A PREVIOUS CESAREAN
SECTION.

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A YOUNG woman was admitted to the Charitè Frauenklinik of Berlin in June, 1915. Two years before she had been Cesareanized at term for a rachitic pelvis. She was in the seventh month of gestation, and was bleeding moderately from a marginal placenta previa. The assistant in charge of the "Kreisszimmer" was of the opinion that a second Cesarean section should be performed, and accordingly the case was submitted to Prof. Franz, who commented upon the wide abdominal scar, but gave no consideration to the possible existence of a defective uterine scar. He counceled against Cesarean section, and gave orders to insert a hydrostatic bag, and after dilatation of the cervix to perforate the head and extract the fetus. These instructions were carried out, and with the second

uterine contraction the patient went into collapse. The fetus was distinctly recognized to be free in the abdominal cavity.

The patient was rushed to the operating room and within thirty minutes the uterus was removed together with the escaped fetus and blood. Death followed within two hours from shock.

A study of the removed specimen revealed a rent directly through a median scar low on the anterior surface of the uterus and largely within the thinned lower uterine segment. It was evident that the uterine scar, as well as the abdominal scar, had become infected following the initial Cesarean section. There was but a thin fibromuscular bridge between the serosa and atrophied mucosa.

In commenting upon the case before the clinic, Prof. Franz said that in the future he would make his incisions high on the uterine body where the muscular development is the greatest, and would advise Cesarean section upon every pregnant woman who bears the scar of a previous section.

A few weeks later I saw Prof. Jardine in the Glasgow Maternity perform a Cesarean section before the onset of labor, because of the existence of a very thin uterine scar. At the same clinic two uteri with ruptured scars were exhibited by Prof. Samuel Cameron.

These observations enlivened my interest in the question of rupture of the Cesarean scar, and has led to a review of the literature for the purpose of determining whether or not one Cesarean section calls for another in event of a subsequent pregnancy. I confess at the onset to have entertained a prejudice in favor of repeated Cesarean section in all cases to forestall a possible rupture, but as the work developed in my library I was led to conclude that such a position is untenable.

In earlier years, when indifferent asepsis and haphazard suturing were practised, we are informed by Krukenberg, in his classical work, that fully half the scars ruptured in subsequent labors. This is in marked contrast to the brilliant results following the adoption of the improved method of suturing proposed by Säger in 1882. From 1882 to 1895 Säger collected reports of 500 cases without a single rupture. From 1895 to 1900 three cases of rupture were recorded and from 1900 to 1911 there were forty cases of rupture and eight of serious dehiscence of the scar recorded. Wyss observes that this increase in the number of ruptures is not chargeable to the growing popularity of Cesarean section, but is perhaps due to departure from the tried and proved method of suture of Säger. While it is true that the exact technic of Säger is not followed in late years, yet the essential principles of the method of suture are generally ob-

served, and it is fair to assume that marked deviations from these principles laid down by Sanger have largely accounted for the increase in the number of ruptures. These principles are tier suturing, sutures which pass through the entire thickness of the uterine musculature and placed close together, infolding of the serosa to prevent the formation of adhesions, exclusion of the decidua in the sutures to prevent the interposition of the decidua between the severed muscle fibers, and finally the tying of all sutures tightly to allow of subsequent relaxations and contractions of the uterus without the formation of gaps in the uterine wound. If the above conditions are maintained and the wound remains aseptic there is every reasonable assurance that there will be firm muscular union with little development of scar tissue. Such a wound healing should favorably insure against rupture in event of a subsequent pregnancy.

The character of the suture material, so long as it is sterile, does not seem to enter into consideration. As expressed by Olshausen and Bumm a proper wound healing depends less upon the suture material than upon the method of suturing. In former years poor quality of catgut would give way and still earlier fine silver wire was known to cut through.

Doubtless the greatest factor in the production of insecure wound healing is septic infection. In this connection we are reminded that too often conservative Cesarean sections are performed in the presence of sepsis when sterilization or Porro operation would have been the wise choice. Furthermore, we have to reckon with latent gonorrheal infections (Wyss) and with retained lochia (Jolly) as sources of infection. *This brings us to the admission that there is no positive assurance of obtaining a perfect wound healing whatever the method of suturing or whoever the surgeon. The uterine scar is an unknown factor in all cases.*

The transverse fundal incision, introduced by Fritsch in 1897, has apparently had more than its share of failures in respect to firm healing of the uterine wound. Vogt reported six ruptures in fundal scars. Couvelaire, in his report of fifty cases of rupture of the scar, finds seventeen of this number were through fundal scars. In 1910 Dahlmann reported twenty-six cases of rupture through fundal scars. In view of these reports, and considering the relative infrequency of the Fritsch operation as compared with the classical operation of Sanger, we are led to agree with Everke that transverse fundal incisions are relatively insecure. Wyss says that introduction of the transverse fundal incision has not lessened the danger of rupture, and Scheffzek remarked that the unusual tissue distortion, especially

in the fundus in puerperal involution, makes firm union of the scar problematical.

As to the integrity of the scar in extraperitoneal and cervical Cesarean sections, experiences and opinions differ widely. Judgment must be withheld until a larger number of repeated pregnancies following these procedures are on record. Frank reported 8, Sellheim 5, Litschkuss 12, Alow 30, and Rohrbach 93 cases of cervical Cesarean section which have stood the test of labor without rupture, and Vogt concludes that rupture of the scar in the cervix is of rare occurrence.

On the other hand, Routh says cervical and extraperitoneal Cesarean sections are not in favor in England. Traugott, Bumm, Gobsdardt, Sellheim, and Wolf report marked thinning of cervical scars with impending rupture, and Wyss assumes a skeptical attitude on the dependability of these scars, and expresses the opinion that a bad cervical scar is more dangerous than a fundal scar because of the marked thinning of the lower uterine segment in labor. Chiaji finds thinning of extraperitoneal scars has occurred in 17 per cent. of cases, and concludes that no security is afforded in subsequent pregnancies. Finally, we have the word of Leopold that classical Cesarean section, with its good results for mother and child, remains the most efficient operation, and which alternative procedures will never supplant or restrict.

Numerous authors have described the manner of healing of the uterine wound. A fibrinous deposit forms on the cut surfaces, and beneath this are newly formed connective-tissue cells. If the wound is kept in perfect coaptation, and free of infection, muscular regeneration will effect a complete muscular union, making the scar invisible to the naked eye and scarcely discernable under the microscope. Perfect coaptation may be prevented by infection, by the giving way of sutures and by the alternating contractions and relaxations of the uterus in the presence of loosely tied sutures. Not infrequently the wound opens up at one or more points in the scar. With the separation of the cut surfaces small hematoma are formed and later are replaced by connective tissue with little or no muscle fiber. Such a scar presents a *locus minoris resistentia*, but it is remarkable to note that they are so often capable of resisting the forces of labor. Couvelaire says 75 per cent. of these defective scars will stand the test of labor without rupture. Uteroabdominal fistulæ have developed in a number of instances as a result of insecure knots and in the same manner dehiscences of the entire uterine wound has occurred. Where silk has been used, fistulæ may make their appearance several

months after Cesarean section and may persist indefinitely. The ovum has been known to attach itself to such fistulæ and form a hernial protrusion of placenta and membranes. In these weakened scars a fibromuscular bridge separates the serosa from mucosa. Occasionally there is an entire absence of muscle fiber. The connective tissue may be scant, leaving little more than the serosa and atrophied mucosa to withstand the forces of labor. When catgut is used the sutures will usually be absorbed in thirty to sixty days. Studdiford found chromic sutures practically unabsorbed six and a half years after their insertion. In a number of instances silk sutures have been known to disappear.

Mason and Williams made a series of experiments on pregnant cats and guinea-pigs to determine the relative strengths of scar and normal uterine wall. Weights were suspended from sections of the uterine wall containing linear scars and it was found that rupture invariably occurred in the muscle and not in the scar, thereby confirming the clinical observations of Schauta, who says that with modern closure of the wound rupture will more likely occur outside the scar. In a number of instances the rupture was observed to start in the scar and to extend through the musculature at the side of the scar.

In 50 multiple Cesarean sections performed in the New York Lying-In Hospital, Harrar finds no visible scar or no thinning in 42, thin scars in 4, partial rupture in 2, and complete rupture in 2.

That placental implantation in the scar predisposes to rupture is the opinion of Dahlmann, Vogt, Couvelaire, Schick, Blind, Wyss, Ekstein, Fischer, and Werth. Vogt found the placental insertion in the scar in 9 of 22 recorded cases, Couvelaire in 8 of 9 cases, Dahlmann in 8 of 15 cases. Werth and Ekstein likened the influence of the placenta upon the underlying scar to the trophoblastic function of the placenta in ruptured tubal pregnancy. Decidua and chorionic structures have been observed to penetrate the fibromuscular bridge to the serosa. Fischer, in referring to the relative frequency of rupture in transverse fundal incisions, expresses the opinion that the probable explanation lay in the frequency of placental implantation at the fundus.

Few authors advocate sterilization following Cesarean section unless by the urgent request of the husband and wife. Numerous authors have reported their second, third, fourth, and even fifth Cesarean section on the same individual, and Charles did his sixth Cesarean on the same woman. This may be taken as an expression of confidence in the integrity of the scar. Notably exceptions to

No.	Date.	Operator or reporter.	Indication for C. S.	Para.	Age.	No. previous C. S.	Time of rupture.	Location of C. S. incision.	Interval between C. S. and rupture.	Placental site.	
										In C. S.	In rupture.
1	1895	Koblank	Rachitis	VI	?	1	Term	Median	4 yrs.	In incision	?
2	1896	Guillaume	Rachitis	II	26	1	7 mos.	Median	3 yrs.	?	?
3	1897	Woyer	Rachitis	II	26	1	?	Median	3 yrs.	In incision	In scar
4	1900	Targett	Transv. position; tetanus uteri	?	?	1	Term	Median	2 yrs.	?	?
5	1900	Schneider	?	?	?	1	?	Median	?	?	?
6	1901	Everke	?	III	?	1	?	Median	4 yrs.	?	In tear
7	1902	Galabin	?	?	?	1	?	?	?	?	?
8	1903	L. Meyer	Lumbokypnosis	II	22	1	Term	Transv. fundal	4 yrs.	?	In tear
9	1904	Jardine	?	?	?	1	Term	Transv. fundal	?	?	?
10	1904	Kerr	?	IV	?	1	Term	Transv. fundal	3 yrs.	?	?
11	1904	Ekstein	Rachitis	IV	33	1	Term?	Transv. fundal	3 yrs.	?	In tear
12	1904	Schutte	Eclampsia	II	21	1	Term?	Median	1 yr.	?	?
13	1904	Ribemont-Desaignes and Rudaux	?	?	29	1	Term	?	2 yrs.	?	?
14	1905	Henckel (Prusmann)	Rachitis	III	40	2	Term	Median	3 yrs.	?	?
15	1905	Werth	Rachitis	III	?	1	8 mos.	Median	12 yrs.	?	In tear
16	1905	Schink	Contr. pelvis	III	28	1	Term	Transv. fundal	3 yrs.	?	In region of scar
17	1905	Wyder (Chalewsky)	Contr. pelvis; trans. position	IV	29	1	Term?	Median	5 yrs.	?	?
18	1906	Wilton (Mabbott)	Contr. pelvis	II	23	1	Term?	Transv. fundal	2 yrs.	?	?
19	1906	A. Martin	Eclampsia	III	?	1	7 mos.	Median	2 yrs.	?	?
20	..	Couvelaire	Contr. pelvis	III	?	1	Term	Median	1 yr. 4 mos.	?	In scar
21	1907	Paddock	Contr. pelvis	VI	36	1	Term	?	?	?	?
22	1907	Schneider	Rachitis	V	25	1	Term?	Median	2 yrs.	?	?
23	1908	Hartmann (Franz)	Rachitis	II	23	1	Term?	Transv. fundal	1 yr. 8 mos.	In incision	In scar

Method of suture in C. S.	Results.		Therapy.	Remarks.	References.
	Mother.	Child.			
Silk and catgut	Recovered	Dead	Suture	Febrile convalescence after C. S.; scar much thinned.	Ztschr. f. Geb. u. Gyn., Bd. xiv.
Tier?	Recovered	Dead	Hysterectomy	Convalescence after C. S. febrile; decidua extended to peritoneum in ruptured scar	Zentralbl. f. Gynäk., 1896.
2 layers silk	Died	Dead twins	Porro	Fever after C. S.	Monats. f. Geb. u. Gyn., 1897, Bd. vi.
?	Recovered	Dead	Porro	Normal convalescence	Trans. London Obst. Soc., 1900, vol. xlii.
Not deep enough?	Recovered	Dead	Porro	.....	Deutsch. med. Wooh. Vereinsbeilage, p. 179.
"Typical Sanger"	Recovered	Lived	Porro	.....	Monats. f. Geb. u. Gyn., 1901, Bd. xiv.
?	Recovered	Dead	Porro	Tubes ligated at time of C. S.; ulcerating ventral hernia at time of rupture	British Med. Jour.
3 layers catgut	Recovered	Lived	Suture with silk	Febrile convalescence after C. S. with pelvic exudate; scar very weak	Kasus. meddeleiser. Bibliotek f. Læger.
?	?	?	?	.....	Zentralbl. f. Gyn.
Catgut	Recovered	Dead	Porro	.....	Trans. London Obst. Soc.
3 layers catgut and silk	Died	Dead	Porro	No fever after C. S.; decidua invaded scar in its entire length; rupture after vomiting	Zentralbl. f. Gyn., 1904.
?	Recovered	Dead	Laparotomy and drainage	Utero-abdominal fistula after C. S.; uterus adherent to abdominal wall	Monats. f. Geb. u. Gyn.
Silk in peritoneum	Recovered	?	Porro	.....	Comp. rend. Soc. d'obst. gyn. et ped., Paris.
2 layers catgut	Recovered	?	Suture	Decidua growing into scar; scar very thin	Ztschr. f. Geb. u. Gyn., 1905, Bd. liv.
2 layers catgut	Recovered	?	Porro	Placenta and fetus in abd. cav.; muscle union of entire scar but serosa not united?	Berl. klin. Wochschr. Nr. 27.
2 layers catgut	Recovered	Dead	Suture	Scar consisted of serosa only; fever after rupture; suppuration; no fever after C. S.	Zentralbl. f. Gyn., 1905.
?	Recovered	Dead	Porro	Fever after C. S.	Korresp.-Blatt. f. Schweiz.-Aerzte und Chalewsky, Inaug. Diss., Zurich, 1907.
Chromic catgut	Recovered	?	Suture with chromic catgut	.....	Am. Jour. Obst., 1907, vol. xx.
?	Recovered	?	Resection scar and suture	Normal convalescence	Med. Klin., Nr. 13.
2 layers catgut	Recovered	?	Porro	Fever after C.S.; rupture just to right of scar	Ann. de Gyn., 1906, 2 serie.
3 layers catgut	Recovered	Lived	Porro	.....	Illinois Med. Jour. München. med. Wooh., 1907, Nr. 41
?	Lived?	Lived?	Suture	Normal convalescence; tubal sterilisation.	Ztschr. f. Geb. u. Gyn., Bd. 8; Zent. f. Gyn., Nr. 3.
5 layers catgut	Recovered	Dead?	Vaginal hysterectomy	Scar consisted practically of serosa and invaded with decidua; rupture in centre; version and forceps delivery	

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										In C. S.	In rupture.
24	1908	L. Meyer	Sarcoma sacri	II	25	1	Term	Transv. fundal	8 yrs.	?	?
25	1908	Lobenetine	?	?	?	2	?	Median over fundus	2 yrs.	?	?
26	1908	Fournier	Rachitis	?	?	2	?	Transv. fundal	?	?	?
27	1908	Brodhead	?	V	35	1	Term?	Median	2 yrs.	?	?
28	1909	Weber (Weil)	Contr. pelvis	?	?	1	Term?	Transv. fundal	1 yr.	In incision	?
29	1909	Nacke	Contr. pelvis	III	29	1	Term?	Transv. fundal	4 yrs.	?	In scar
30	1910	Richter	?	?	?	2	7 mos.	?	?	?	In scar
31	1910	Dahlmann	Cervix myoma	II	33	1	?	Transv. fundal	1 yr. 8 mos.	?	In region of scar
32	1910	Dahlmann	Vaginal varicos	?	?	1	Term?	Transv. fundal	2 yrs.	In incision	?
33	1910	Dahlmann	Rachitis	II	21	1	Term?	Transv. fundal	3 yrs.	?	?
34	1910	Seheffsek	Contr. flat pelvis	II	23	1	Term?	Classical	3 yrs.	?	?
35	1911	Jeannin	?	?	30	1	8½ mos.	Median	1 yr.	?	?
36	1911	Schiok	Edema vulva; eclampsia	III	?	1	Term	Transv. fundal	5 yrs.	?	In tear
37	1911	McPherson	?	III	25	1	In labor	Median	?	In incision	?
38	1911	Hermann	?	?	?	1	?	?	?	?	?
39	1911	Coq and Massey	Flat pelvis	III	?	2	?	1. Trans. fundal. 2. Median	5 yrs. after 2d C. S.	?	In tear
40	1911	Unterberger	Eclampsia	II	22	1	Term?	Transv. fundal	2 yrs.	?	?

Method of suture in C. S.	Results.		Therapy.	Remarks.	References.
	Mother.	Child.			
Tier; 2 layers catgut	Recovered	Lived	Porro	Febrile convalescence after C. S.; ventral hernia	L'Obstétrique, Lannée, February.
3 layers catgut	Died 17 days later, pneumonia	?	Supravaginal hysterectomy	Rupture extended from os internum to fundus mid-line.	Bull. Lying-in Hosp. 1906-1907.
?	Recovered	Dead	Vaginal hysterectomy	Rupture followed induction of labor with bougie	Bull. de la soc. de gyn., April 16.
Chromic catgut	Died	Dead	Vaginal hysterectomy	.....	Am. Jour. Obst., lvii.
3 layers catgut	Recovered	Lived	Total hysterectomy	Tear exactly in scar	Weber, Beitr. f. Geb. u. Gyn., Bd. xv; Weil, Inaug. Diss., Munich.
2 layers catgut?	Recovered	?	Suture of tear	Rupt. found on manual removal of placenta; plac. invasion of scar; death due to pul. embolism	Zentralbl. f. Gyn., 1909.
?	Died	?	Porro	Utero-abdominal fistula developed four months after C. S.	Gyn. Rundschau.
3 layers catgut	Died	?	Postmortem	Fever after C. S. with pelvic exudate; remnants of catgut sutures; decidua extended to serosa	Monatsch. f. Geb. u. Gyn., Bd. xxxii.
2 layers silk; 1st including decidua	Recovered	Dead	Hysterectomy	Mucosa extended to serosa; fistula dev. one mo. after C. S., due to silk suture; healed on its removal.	Monatsch. f. Geb. u. Gyn., Bd. xxxii.
3 layers catgut	Recovered	Lived	Scar resected and suture	Fever after C. S.; no symptoms of rupture before operation; scar in unruptured part very thin	Monatsch. f. Geb. u. Gyn., Bd. xxxii.
?	Died	Dead	Porro	Fever after C. S.; abdom. suture infection; scar adherent to abdom. wall and ruptured in entire length	Ztschr. f. Geb. u. Gyn., Bd. lxxvii, Hft. 3.
"Exact suture" Reindeer tendon	Recovered	Dead	Porro	No fever after C. S.; rupture in spite of weak labor pains; scar thick with evidence of complete muscle healing	L'Obstétrique, 1911. No. 3.
2 layers silk	Died	Lived	?	Version and extraction; rupture then found with placenta in abdominal cavity; autopsy; scar very thin; decidua extended to serosa	Deutsch. med. Woch.
?	Recovered	Lived	Resection scar and suture	Protracted fever after C. S.; unruptured part of scar very thin; resection of tubes	Am. Jour. Obstet., 1911, lxiii, 3.
?	?	?	?	Rupture in region of scar; fetus and membranes in abdominal cavity.	Acad. de méd. de Belgique., v. Cooq., No. 38.
?	Died	Dead	?	Rupture in clinic; rupture in form of "T;" fundal scar only serosal union; synovial elements invaded muscle in median scar	Rev. mens. de gyn., d'obst. et ped.
?	Recovered	Dead	Supravaginal amputation	No fever after C. S.; vaginal hysterectomy; rupture then found in old scar, which was very thin	Monatsch. f. Geb. u. Gyn., Bl. xxxiv, Heft 3.

No.	Date.	Operator or reporter.	Indication for C. S.	Para.	Age.	No. previous C. S.	Time of rupture.	Location of C. S. incision.	Interval between C. S. and rupture.	Placental site.	
										In C. S.	In rupture.
41	1912	Schwartz	Eclampsia; edema vulva	II	30	1	8 mos.	Transv. fundal	3½ yrs.	?	?
42	1912	Ramos	Eclampsia	II?	?	1	8½ mos.	Transv. fundal	1½ yrs.	?	?
43	1912	v. Herff (Wys)	Edema vulva; eclampsia	II	27	1	About term	Median	1 yr. 8 mos.	?	In tear
44	1912	Wys	Rachitis	II	26	1	Term	Classical	3 yrs. 3 mos.	In incision	On posterior wall
45	1912	Jolly	Rachitis	IV	27	1	Term	Median on posterior wall	1 yr. 3 mos.	Anterior wall	?
46	1912	Hofmeier (Fischer)	Contr. pelvis	V	38	2	8½ mos.	1. Transv. fundal; 2. ?	6 yrs.	1. In incision; 2. ?	Partly over tear
47	1912	Davis (Harrar)	Flat pelvis	VIII	35	1	In labor	Median	2 yrs.	?	In tear
48	1912	Davis (Harrar)	Contr. pelvis	V	37	3	11 mos.	All longitudinal	3 years after 3d C. S.	?	?
49	1914	Wolff	Rachitis	II	30	1	Term	Cervical extending into body	1 yr.	?	?
50	1913	Davis	Kypbotic dwarf	II	?	1	In labor	Median through fundus	1 yr.	?	?
51	1913	Weischadel (Everke)	Contr. pelvis	II?	?	1	Term	Transv. fundal	4 yrs.	?	?
52	1914	Walls	Dwarf	?	30	3	7 mos.	?	1 yr.	?	Over scar
53	1914	Walls	Contr. pelvis	?	?	1	Term	?	?	?	?

Method of suture in C. S.	Results.		Therapy.	Remarks.	References.
	Mother.	Child.			
3 layers catgut	Recovered	?	Supravaginal amputation	Slight fever on third day after C. S.; rupture through entire length of scar; fetus and placenta in abdominal cavity	Monatsch. f. Geb. u. Gyn., Bd. xxxv, Heft 5.
Silk	Recovered	Dead	Supravaginal amputation	Four days after C. S. abdominal wound separated with evertation; at rupture fetus and placenta in abdominal cavity	Revue de la clin. obs. et gyn., January and February, 1912 ref., Ztschr. f. Gyn., 1913, Nr. 8.
2 layers silk	Recovered	Dead	Porro	Rupture after vomiting; scar thin in fundal region only of mucos and serosa; synovial invasion of scar	Beitr. f. Geb. u. Gyn. Bd. xvii, Heft 3.
2 layers catgut	Recovered	Lived	Porro	Fever after C. S.; scar thin in places; some muscle fibers in more solid part of scar	Beitr. f. Geb. u. Gyn. Bd. xvii, Heft 3.
2 layers catgut	Recovered	Lived	Supravaginal amputation	Fever after C. S.; decidua extended to serosa; unruptured part of scar showed complete muscle union	Arch. f. Gyn., Bd. 97, Heft 2.
1 deep silk; 3 layers catgut	Died	Dead	Supravaginal amputation	Fever after C. S.; at 2d C. S. scar found to be thin; no fever after 2d; complete rupture of scar which consisted of serosa only with decidua and synovial tissue	Ztschr. f. Geb. u. Gyn., 1912, Bd. lxx, Heft 3.
?	Recovered	Lived	Resection of scar and suture	.....	(Harrar) Am. Jour. Obst., 1912, lxx, 5.
?	Died	Dead	Hysterectomy	Fever after 3d C. S.; complete muscle regeneration; rupture between two of the scars; overtime fetus and placenta in abdominal cavity	(Harrar) Am. Jour. Obst., 1912, lxx, 5.
2 layers catgut	Recovered; cerebral embolism on tenth day	Dead	Total hysterectomy?	Fever after C. S. with utero-abdominal fistula; rupture through scar which was thin with decidua extending almost to serosa	Ztschr. f. Geb. u. Gyn., 1914, Bd. lxxv, Heft 3.
?	Died	Dead	Suture	Normal convalescence after C. S.; rupture of entire scar; fetus and placenta in abdominal cavity	Trans. Am. Assn. Obstet. and Gyn., 1913, xxvi, 43.
?	Recovered	?	Supravaginal amputation	Fever after C. S.; complete rupture of scar; fetus and placenta in abdominal cavity; scar of serosa only	Monatsch. f. Geb. u. Gyn., 1913, Bd. xxxvii, Heft 2.
?	Died	Dead	Supravaginal amputation	.....	Jour. Obstet. and Gyn. Brit. Emp., 1914, xxvi, No. 4.
?	?	Dead	Supravaginal amputation	Scar long, wide and thin, and about to give way; small opening in lower angle of scar; section showed no degenerative changes to account for rupture	Jour. Obstet. and Gyn. Brit. Emp., 1914, xxvi, No. 4.

No.	Date.	Operator or reporter.	Indication for C. S.	Para.	Age.	No. previous C.S.	Time of rupture.	Location of C. S. incision.	Interval between C. S. and rupture.	Placental site.	
										In C. S.	In rupture.
54	1914	Shaw	?	?	?	1	Term?	?	20 mos.	?	In tear
55	1914	Breitein	?	?	?	1	Term?	?	?	?	?
56	1914	Frans	Rachitis	II	24	1	7 mos.; plac. previa	Median (low)	1 yr.	?	Not in tear
57	1903	Futh (Krets)	?	II	25	1	?	?	1 yr.	?	?
58	1914	Applegate	Contr. pelvis	II	30	1	?	Median	18 mos.	?	?
59	1913	Webster (Davis)	Nephritis	III	37	1	Term?	Median	?	?	?
60	1914	Hillis, D. S.	Eclampsia	II?	?	1	Labor	Median	1 yr.	?	?
61	1915	Williams, J. W.	Contr. pelvis	III	?	1	7 mos?	Median	1 yr. 2 mos.	?	?
62	1914	Miller (Jeff.)	Failure of head to engage	I	30	1	In labor full term	Median	15 mos.	Right of incision	Over scar
63	1915	Miller (Jeff.)	Slight contraction	II	18	1	In labor full term	Median (low)	1 yr.	?	Not in tear

this viewpoint are Jardine, Opitz, and Govrich, who advocate sterilization after the second Cesarean section.

John T. Williams, in writing on, "Delivery by the Natural Passages following Cesarean Section," takes issue with Breitein, Couvelaire, Marioton and others who are committed to the rule of "once a Cesarean section, always a Cesarean section." He says: "When a uterus has been sutured with care and there has been no subsequent infection the Cesarean scar will be strong enough to withstand the distention of a full-term pregnancy and even the strain of a full-

Method of suture in C. S.	Results.		Therapy.	Remarks.	References.
	Mother.	Child.			
?	Recovered	Dead	Supravaginal amputation	Entire scar ruptured; section showed increase in fibrous tissue but insufficient to account for accident	Jour. Obet. and Gyn. Brit. Emp., 1914, xxvi, No. 4.
?	?	?	Hysterectomy	After C. S. a 2d labor terminated per viam naturalem; rupture in third pregnancy.	Jour. Am. Med. Assn., 1914, lxi, 689.
?	Died	Dead	Hysterectomy	Induction of labor by bag; rupture in a half hour of entire length of scar, which was thin and only fibromuscular tissue	Not reported; personal observation.
2 layers	Recovered	?	Porro	Fever after C. S.; placenta not found (?); pathological insertion of placenta (?)	Zentralbl. f. Gyn. (?), ref. Wym. Beitr. f. Geb. u. Gyn., Bd. xvii, Heft 3.
?	Died	Dead	Hysterectomy	Fever after C. S.; in hospital two months; scar very thin, showing evidence of poor union.	Not reported; personal communication.
?	Died	Dead	None; rupture found at autopsy	No history obtainable; induction of labor with bag, version, and extraction; dead fetus; died two hours later; autopsy revealed rupture along entire scar and extending toward left tube	Surg., Gyn. and Obstet., July, 1913.
3 layers catgut	Recovered	Dead	Suture	Rupture in scar through entire length; rupture two hours after onset of labor	Not reported.
?	Recovered?	Dead	Supravaginal amputation	Fever after C. S.; rupture probably occurred two days before operation; no suggestion of rupture; intact scar and placenta in abdominal cavity	Not reported; personal communication.
3 layers 20-day catgut	Died	Dead	Suture of rupture	Ruptured on operating table in preparation for C. S.; death from shock in three hours; fever course after C. S.	Not reported.
?	Recovered	Dead	Suture of rupture	Fever course following C. S.; prolonged labor; entered hospital after rupture; pituitrin given by midwife prior to rupture.	Not reported.

term labor." He bases his conclusions upon the records of thirty-two cases reported by Van Leuwen with additional cases of his own.

In none of these cases did the scar rupture during pregnancy or in the delivery through the natural passages.

Among the safeguards against rupture through the scar of a Cesarean section is the relative sterility of these cases. It is estimated that less than half of them again become pregnant. Furthermore, it is noted that a long interval between the section and subsequent pregnancy adds to the security of the scar. Asa B. Davis

tells us that he believes rupture of the scar could have been prevented in all of his cases had a timely Cesarean operation been possible. Second only in importance to timely intervention by repeated Cesarean section when there is reason to believe that the uterine scar is defective or where obstruction exists to the passage of the fetus, is the avoidance, as far as possible, of all intrauterine manipulations such as versions, the application of forceps, the introduction of hydrostatic bags, tampons and pituitrin.

Inasmuch as the great majority of all cases (75 per cent.) that have ruptured ran a fever course following the Cesarean section, I would formulate the rule that all such cases call for serious consideration in event of a subsequent pregnancy.

Repeated Cesarean sections are said by many to give better results than primary Cesarean section, because of the frequent presence of adhesions which wall off the general peritoneal cavity and make it possible to deliver the baby without entering the free abdominal cavity. Such a case I recently witnessed in Polak's clinic at the Long Island Hospital of Brooklyn. Brodhead and Sinclair suggest ventrofixation of the uterus by suturing the uterus outside the margins of the wound to the parietal peritoneum. In thirty cases reported by Sinclair, pregnancy was terminated without untoward symptoms. But, as Wyss observed, ventrofixation has been followed by rupture, and it remains for the future to determine the merits of the procedure. Certainly it is not in line with recognized surgical procedure. We can scarcely hope to have the good fortune of Bar, who has seen no disturbance to mother or fetus from adhesions.

The following data are deduced from the foregoing tables of case reports:

AGE.

In thirty-seven cases, where ages are given, rupture occurred in twenty-one between the ages of twenty to thirty and fourteen between thirty to forty.

NUMBER OF CESAREAN SECTIONS PERFORMED PRIOR TO RUPTURE.

- 55 cases had 1 C. S.
- 6 cases had 2 C. S.
- 2 cases had 3 C. S.

INDICATIONS FOR C. S. PRIOR TO RUPTURE

- In a total of 49 cases there were:
- 32 for contracted pelvis.

- 1 for lumbokyphosis.
- 1 for sarcoma of sacrum.
- 1 for vaginal varices.
- 10 for eclampsia.
- 1 for transverse position with tetany uteri.
- 1 for transverse position with contracted pelvis.
- 1 for nephritis.

PARA.

Ruptures occurred in:

- 2d pregnancy in 23.
- 3d pregnancy in 11.
- 4th pregnancy in 3.
- 5th pregnancy in 4.
- 6th pregnancy in 2.
- 8th pregnancy in 1.

TIME OF RUPTURE.

Time of rupture was mentioned in the reports of 52 cases:

- In 41 cases at full term.
- In 6 cases at seventh month.
- In 2 cases at eight month.
- In 3 cases at eight and one-half months.
- In 1 case at eleventh lunar month.

INTERVAL BETWEEN C. S. AND RUPTURE.

- 9 between 1 and 2 years.
- 22 between 2 and 3 years.
- 6 between 3 and 4 years.
- 4 between 5 and 6 years
- 1 in 8 years
- 1 in 12 years.

LOCATION OF C. S. INCISION.

In 53 cases:

- 33 were median
- 20 were transverse fundal.

METHOD OF SUTURE IN C. S.

In 36 cases there were:

- Tier sutures in 29 (22 of catgut alone, 3 of both catgut and silk, 4 of silk alone).

Typical Sānger suture in 1.
 Peritoneum alone sutured with silk in 1.
 "Exact" suturing with reindeer tendon in 1.
 Silk used but manner of suture not recorded in 1.
 Catgut used but manner of suture not recorded in 1.

PLACENTAL SITE IN C. S.

Mentioned in 10 cases.
 Incision made over placenta in 98.
 Placenta on anterior wall in 2 at side of incision.

PLACENTAL SITE IN RUPTURE.

Mentioned in 20 cases.
 In or near the tear in 18 cases.
 Not in tear in 2 cases.

TREATMENT OF RUPTURE.

Suture of wound in 15.
 Porro in 19.
 Vaginal hysterectomy in 3.
 Total abdominal hysterectomy in 2.
 Supravaginal hysterectomy in 11.
 Laparotomy and drainage in 1.
 Rupture found at autopsy in 2.
 Unmentioned in 4.

RESULTS TO MOTHER.

Mentioned in 59 cases.
 41 recovered.
 16 died.
 2 died on tenth and seventeenth days (cerebral embolism,
 pneumonia).

RESULTS TO CHILD.

47 mentioned.
 34 died.
 13 lived.

GENERAL REMARKS.

Fever followed C. S. in 24 cases.
 Decidua mentioned as invading scar in 10 cases.

Syncytium mentioned as invading scar in 2 cases.

Scar mentioned as very thin in 17 cases.

Scar with complete muscular regeneration in 4 cases.

In only one case did normal labor intervene between C. S. and rupture.

Uteroabdominal fistulæ developed in scar of C. S. in 4 cases.

Tubal sterilization done in 2 cases following suture of rupture.

Rupture mentioned as following induction of labor by bag or bougie and by version and extraction in 5 cases.

In one case pregnancy and rupture followed ligation of tubes at time of C. S.

In one case rupture occurred while patient was being prepared for Cesarean section.

CONCLUSIONS.—1. A perfectly healed Cesarean wound may be relied upon to resist the forces of labor, but in view of the fact that the integrity of the wound is an unknown factor in all cases we are constrained to exercise the utmost caution in the conduct of every case in pregnancy and labor following Cesarean section.

2. Failure to secure perfect healing is accounted for by departure from the principles of suture proposed by Säger and by septic infection of the uterine wound. If we are to obtain the uniformly good results in respect to wound healing that were obtained in the decade following the introduction of the Säger method of suture, we must not deviate from these principles.

3. The possible existence of latent gonorrheal infection may defeat the most painstaking efforts to secure perfect wound healing. Hence it follows that the healing of a Cesarean wound is always an uncertain factor.

4. When Cesarean section has been followed by a fever course the uterine wound should be regarded as insecure in event of a subsequent pregnancy, and should call for a repeated Cesarean section at the onset of labor.

5. Sterilization and hysterectomy should replace conservative Cesarean section when infection is known to exist. The alternative invites faulty wound healing, if not more disastrous results.

6. Transverse fundal, extraperitoneal, and cervical incisions have not lessened the liability of rupture in subsequent labors, but, on the contrary, have probably increased the hazard.

7. The possibility of rupture of the scar following Cesarean section does not justify sterilization, but rather calls for the exercise of masterly control in event of a subsequent pregnancy. All such cases should be hospital cases and labor should be anticipated by

timely repetition of Cesarean section at the onset of labor if the uterine wound is known to be defective or if some cause for obstruction to the delivery of the child through the natural passage exists. Version, high forceps, uterine tampons, hydrostatic bags, and pituitrin should never be employed in the presence of a Cesarean scar.

8. Finally, we may conclude that in view of the evidence that not more than 2 per cent. of ruptures occur in subsequent labors, we are not justified in voicing the slogan "*once a Cesarean section, always a Cesarean section,*" neither are we to rely explicitly upon the integrity of the uterine scar in any case. Furthermore, we would conclude that the liability of rupture is a real danger and should stand as an argument against the increasing tendency to widen the scope of elective Cesarean operations.

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