

## NEPHROLITHIASIS AND PREGNANCY

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**D**URING pregnancy, the proper and adequate functioning of the kidneys is of paramount importance. During gestation, lesions affecting the urinary organs assume a particular importance and interest. It is conceded that normal pregnancy plays an important rôle in the etiology of calculi, both large and small; therefore, the disturbances of nutrition incident to lactation, and the superalimentation necessitated by, and accompanying, gestation, are factors which must not be disregarded.

During pregnancy, the kidneys are abnormally taxed by the secretory load consequent to increased metabolic activity and to elimination of fetal and maternal waste products, and are, in addition to the ureters, also subjected by the gradually increasing pressure of the gravid uterus to abnormal physical conditions. During pregnancy, the skin is less active than normally; it excretes less; the pregnant woman's physical condition is one of decreased resistance. Such direct factors as the aforementioned and others acting indirectly as sluggishness of the bowels and consequent constipation, not uncommonly observed during pregnancy, can easily impair normal kidney efficiency and can and may provoke renal disturbances even in the absence of pre-existing or predisposing renal lesions. Therefore, it is conceivable that a kidney, the seat of disease, may be further impaired, functionally and anatomically, during and by the pregnant state.

If only one kidney be affected, the organism may and usually does accommodate itself with the sound kidney; but during pregnancy, the sound kidney alone may fail to adequately eliminate the combined waste products of mother and fetus; signs of toxemia may appear. It must then be decided upon the conditions presented by each individual case, whether a woman with a known kidney lesion, is to be allowed to undergo the risks of pregnancy with the added strain which it throws on the kidneys. If a renal calculus or calculi are present, the medical attendant must determine whether its concomitance with the progress of pregnancy is permissible in the interests of mother and child; and should these interests demand it, what operative measure is called for. On one hand, there is the certainty of increased work for the kidneys, with a possibility of their failure to accomplish it; on the other hand, while the risks arising from

operation may to a large extent be eliminated, and are, in a sense, minimal, yet operation offers no positive guarantee that urinary secretion will be increased. Pregnancy demands efficient kidney functioning. If renal lithiasis be present and operative relief is clearly indicated, we must know how operative intervention will affect the existing pregnancy, and whether it will in any way incapacitate the woman in the event of a subsequent pregnancy or pregnancies.

In this paper, the special kidney lesion I wish to discuss is nephrolithiasis. In its etiology, renal lithiasis is intimately related to food ingestion and food utilization. Excessive, insufficient, or unsuitable foods and metabolic disturbances are factors that at once affect the blood; by hampering the eliminative functions of the kidneys, they predispose to urinary retention and calcareous deposits.

In considering nephrolithiasis as affected by pregnancy we have two main questions to deal with: First, nephrolithiasis complicating an existing pregnancy; secondly, whether a pyelotomy, nephrotomy, nephrectomy, or other surgical operation done for lithiasis jeopardizes the health or life of mother or fetus in the event of a subsequent pregnancy. Our conclusions are based on a somewhat exhaustive analysis of cases reported in the literature, and on our own personal clinical experience.

Renal calculi are not commonly met with in pregnancy principally because they are not common in the female sex. When renal calculi are present with or without infection, antenatal treatment is necessary because, the additional renal activity provoked by pregnancy favors increase in size and number of such calculi as are present. (Marion [8]). The indication is to relieve the kidneys and the organism from any toxemia due either to deficient renal elimination, or to infectious processes present in the kidney itself, or to both of these causes. This can be partially effected by hygienic, dietetic and medicinal measures. If the stone be small, efforts to secure elimination through the natural channels are occasionally successful. If the calculus be in the pelvis and the parenchyma not or but slightly injured, a simple pyelotomy suffices. If there is but one stone in the kidney, a pyelotomy or a simple nephrotomy with a small incision may suffice. But, if the lesion be severe, if the stones be multiple, branched, coral-shaped, etc., a nephrotomy or even a nephrectomy may be indicated. The failure of palliative measures, the severity of the symptoms presented by the patient, the nature and characteristics of the calculi, the extent and nature of the associated lesions, the anatomical state of the affected kidney or kidneys, and the patient's general condition, give the indications for operation and for the type of operation to be performed.



When the patient's other kidney is in good functioning condition, unilateral lithiasis usually does not (in the absence of severe symptoms or advanced degenerative changes in the calculous kidney) seriously complicate pregnancy or labor; but with bilateral lithiasis, the conditions of kidney functioning are usually such as to demand operation. Braasch<sup>1</sup> states that 12 per cent of nephrolithiatic cases are bilateral. In bilateral nephrolithiasis, it is desirable, if possible, that both kidneys be saved; a patient never has too much renal parenchyma. The kidney with the best functioning should be operated on first and the other kidney, some weeks later if conditions be favorable. Some operators of wide repute advocate simultaneous operation on both kidneys. After kidney operations for removal of calculi, when the associated infection is slight, drainage of the renal pelvis, parenchyma or perirenal tissues may be omitted, but, generally, post-operative drainage is indicated; it aims to protect the kidneys from further disastrous effects of the infection and enables the organism to better withstand and overcome toxemia.

Even though urgent symptoms be absent, calculi occurring with bilateral pyelonephritis must always be removed. The same indication obtains in cases of multiple calculi. In the presence of calculous anuria, immediate operation is imperatively indicated. Very large calculi, especially if branched, coral-shaped, etc., cause so much tissue destruction, that ordinarily nephrectomy is called for.

While it should be the general rule not to subject pregnant women to the shock of major operations, one must not overlook the fact that during gestation, the prognosis of kidney operations is largely subordinate to the state of the affected or unaffected kidneys. The tolerance of even advanced pregnancy to major operations is well known, and it will be shown that if the necessity for such an operation exists, pregnancy in itself, within certain limits, is not a contraindication. Operations for nephrolithiasis do not unfavorably influence the evolution of pregnancy or in any way disturb delivery or the puerperium. This is all the greater reason why operative relief should be sought when other means fail to bring about the desired result in regard to kidney-efficiency, removal of toxemia and cure of the latter's source.

Operative relief being indicated, it is necessary to determine as accurately as possible the functional value of the kidneys. For this, both cystoscopy and ureteral catheterization are useful procedures. In obscure cases of suspected lithiasis, a pyelogram is a valuable aid for identification and definite localization of shadows; but pyelography has dangers in the hands of the unskilled. It should be employed only by one having had considerable cystoscopic experience, as well as numerous opportunities and facilities for observing patients

with renal or ureteral lithiasis. It is advisable that pyelography be restricted to cases which can be accurately diagnosed in no other way.

In choosing between pyelotomy, nephrotomy and nephrectomy, one is guided by the conditions found after exposure of the kidney and determination of its actual state by inspection. It should be affirmed at the outset, that pyelotomy is the operation of election, nephrotomy and nephrectomy being operations of necessity. Nephrotomy has dangers, chief among which is secondary hemorrhage. Even a perfectly regular nephrotomy with easy extraction of the calculus or calculi, can be followed by a postoperative hemorrhage severe enough to require a nephrectomy. In a nephrotomy, the incision should be almost invariably along the external convex edge of the kidney.

An associated pyonephrosis or hydronephrosis may necessitate a nephrectomy; the degree of destruction of the renal parenchyma and pelvis will decide. It is questionable whether it is worth while to save an organ having scant functional value and showing marked anatomical changes when a complete recovery can be obtained, by a comparatively safe operation. The existence of a pregnancy, if not advanced beyond the sixth month, does not affect the operative indications, as the gestation can continue its normal evolution uninfluenced, or only slightly so, by pyelotomy, nephrotomy or nephrectomy. All unnecessary trauma and manipulations are to be avoided, so as to impair as little as possible the local tissue resistance, prevent wound contamination and minimize operative shock.

Clinical and laboratory evidence of very low kidney functioning may contraindicate nephrectomy, especially if the symptoms are not very acute. In cases totally unsuited to operation, nonoperative measures, of necessity, must be employed. Cases of pregnancy with renal lithiasis have been carried to term with such treatment.

A search through the literature has brought to light a number of cases of nephrolithiasis complicating pregnancy. Only a few are reported with sufficient data to permit utilization in this paper. These, amounting to twenty-nine cases, are collected in Table A. A study of this table shows that sixteen cases were operated during pregnancy, the operation performed being a nephrectomy in three, a pyelotomy or nephrotomy in ten, one ureterotomy and in two cases the nature of the operation is not stated; ten cases were not operated; three were operated after the pregnancy; and in three cases, no particulars as to the course followed are given. Two of the three nephrectomized patients had normal labors with a living child at term; no complications are reported. The period of gestation in these two cases was 2 and 2½ months, respectively, at time of operation. A nephrectomy done at the fourth month of gestation was followed after a few

TABLE A  
 CASES OF NEPHROLITHIASIS COMPLICATING PREGNANCY \*

CASE NO.	REPORTER AND REFERENCES	AGE; PRIMIPARA OR MULTIPARA	UNILATERAL OR BILATERAL	CO-EXISTING PATHOLOGY	TREATMENT	RESULTS AND REMARKS
1	Tiffany, Medical News, Phila., 1887, vol. 50, p. 428.	27 years	Unilateral Left	History of pain in left kidney region for several years. Pus in urine. 5 months pregnant. Pyelitis, probably calculous, diagnosed.	Kidney exposed; Nephrolithotomy; Calculus found in kidney and extracted.	Pregnancy proceeded physiologically; wound healed well; pus in urine constantly diminishing. Movements of child not noticed more violent than normal at time of operation; no disturbances observed. Subsequent history not given.
2	Landau, Deut. med. Wehnschr., 1893, six, 560.	Not given	Not stated	History of colicky pains for 2 years; 2 mos. pregnant.	Nephrectomy; Kidney found full of calculi.	Operation has given satisfactory results but no further particulars are given.
3	Pou, Memphis Med. Monthly, 1898, xviii, 359.	40 yrs., parity not stated		Pregnant 8½ months; diagnosed renal lithiasis.	Potash salts and later balsam copaiba and nitr. spir. ether.	Third day, blood in urine. Later passed calculus, muceo-pus, blood. Delivered 60 hours later of healthy child. Good recovery.
4	Tucker, Cleveland Jour. Med. 1899, iv, 431.	30 yrs.; 5 para.	Unilateral; right.	History of bloody urine and pain for 9 yrs.; urine abnormal since last labor 6 yrs. ago; 2 mos. pregnant.	Lithotomy; 2 calculi removed from right kidney; larger weighed 86 gr.	Subsequent history not given.
5	Cova, Ann. di ostet. e gines., 1903, xxv, 692-705, case 1.	36 yrs.; 7 para.	Unilateral; left.	Pregnant for 2½ mos.; Kidney calculus.	Nephrectomy.	Colicky pains first noted on left side at age of 27. Pregnancy went normally to term. Living healthy child which was nursed. Pregnant again 5 months later; living healthy child at term. No placental lesions in either case; normal puerperium.



TABLE A—CONT'D.  
 CASES OF NEPHROLITHIASIS COMPLICATING PREGNANCY

CASE NO.	REPORTER AND REFERENCES	AGE; PRIMIPARA OR MULTIPARA	UNILATERAL OR BILATERAL	CO-EXISTING PATHOLOGY	TREATMENT	RESULTS AND REMARKS
6	Lynch Harrigan, Surg., Gynec., & Obst., 1915, xx, 657-660.	35 yrs.		Pregnant 2 months; Kidney calculus.	Nephrotomy for calculus.	Normal labor at term. No further particulars.
7 8 9	Harris, Med. Jour. of Australia, 1916, ii, 291-294.			2 cases of pregnancy complicated by renal calculus; 1 case complicated by ureteral calculus.	Not stated.	No further particulars.
10	Reder, Amer. Jour. of Obst., 1916, lxxiii, 66-77.			In a list of cases operated, mentions 1 case operated for renal calculus during pregnancy. No untoward influence on the pregnancy, which went to term. No further particulars.		
11	Malcolm, Lancet, London, 1917, ii, 459-460.	4-para; age not given.	Not stated.	Pain in side for 7 years. Operated. Large calculus and several weeks after last labor, small ones removed urine bloody and right kidney region hard.		Severe hemorrhage was the only important symptom of the condition.
12	Mussey, Collected papers of Mayo Clinic, 1917, ix, 293.	Not stated.	Not stated.	1 case operated during pregnancy for pyonephrosis with stone.		No other particulars given (in a series of cases).
13 to 16	Bugbee, Jour. Amer. Med. Assn., 1918, lxxi, 1538-1541.			In a series of cases concerning renal complications of pregnancy, ureteral calculi observed in 2. In 1 case, the calculus was passed following cystoscopic manipulations. In the other, the calculus was removed, the patient going to term. Age of pregnancy not stated. In 2 other cases in which renal calculi were noted, the patients were treated by pelvic lavage and pregnancy proceeded undisturbed to term.		

TABLE A—CONT'D.

## CASES OF NEPHROLITHIASIS COMPLICATING PREGNANCY

CASE NO.	REPORTER AND REFERENCES	AGE; PRIMIPARA OR MULTIPARA	UNILATERAL OR BILATERAL	CO-EXISTING PATHOLOGY	TREATMENT	RESULTS AND REMARKS
17	Crowell, Urol. & Cutaneous Rev., 1918, xxii, 572-577. Case 4.	25 yrs. Multipara.	Unilateral; Right.	Pain in right side for past 10 years; severely; x-ray showed shadow in right kidney; 4 mos. pregnant.	Nephrectomy. Large kidney, filled with pus, practically no kidney left. Calculus.	Miscarriage 5 days later. Left hospital in good condition.
18	Mencke, Ann. of Surg., 1918, lxxvii, 376.	21 yrs.	Unilateral; Right.	Right lumbar pain for past 10 months. Had child 2 months ago. Pain and high temperature, etc., for some weeks. X-ray showed numerous calculi in right kidney.	Perinephritic abscess opened; contained calculi; other calculi removed from kidney.	Uneventful recovery.
19	Davis, Jour. Mich. Med. Soc., 1918, xvii, 387-389.	42 yrs. 10-para.	Unilateral; Right.	History of urinary disturbance during previous pregnancies with soreness over right kidney; last pregnancy ended in miscarriage.	Operated for kidney calculus and abscess. Numerous calculi removed.	The history shows 2 miscarriages and 1 premature labor at 8 months.
20 22	Braasch, Collected to papers of Mayo Clinic, 1919, xi, 262-267.		2 unilateral; 1 bilateral.	Nephrolithiasis complicating pregnancy.	During 1917-18, 2 cases diagnosed as renal lithiasis were not operated on account of advanced pregnancy. 1 case of bilateral nephrolithiasis with pregnancy was similarly postponed. The subsequent histories of these cases is not given.	

TABLE A—CONT'D.  
 CASES OF NEPHROLITHIASIS COMPLICATING PREGNANCY

CASE NO.	REPORTER AND REFERENCES	AGE; PRIMIPARA OR MULTIPARA	UNILATERAL OR BILATERAL	CO-EXISTING PATHOLOGY	TREATMENT	RESULTS AND REMARKS
23	Bugbee, Amer. Jour. of Obst., 1918, lxxvii, 781-786.	Not stated.	Unilateral; Right.	Kidney pain during first pregnancy in 1911. Pain intermittent until 1914 when the calculus was removed. 11 calculi since passed spontaneously after catheterizations.		
24	Jeanbrau, Jour. d'Urol., 1921, xii, 361.	Not stated.		7 mos. pregnant. Woman in full puerperal septicemia from calculus pyonephrosis.	Pyelotomy.	Woman died very shortly after operation; general infection and uremia.
25	do.	Not stated.		2½ mos. pregnant. Calculi in kidney pelvis.	Lumbar pyelotomy.	Pregnancy uninfluenced.
26	do.	Not stated.	Bilateral	2 months pregnant; calculus in both kidneys.	Lumbar ureterectomy.	Previous to pregnancy, right kidney operated for calculus. The left ureter was operated during pregnancy. Pregnancy proceeded without incident.
27 28 29	do.			In 3 other cases of pregnancy with symptoms of calculosis, no operation was done and the pregnancies ended normally at term.		



days by miscarriage. Five of the nephrotomized patients proceeded to normal labor at term and delivery of healthy children. In three cases, no particulars as to the labor are given. Of the two cases in which the nature of the operation is not stated, in one case, the patient went to normal labor at term, and in the other, no particulars are given. In the nephrotomies followed by normal labor at term, the age of the gestation at the time of operation varied from 2 to 7 months.

In these 29 cases with nephrolithiasis during pregnancy, the histories show sixteen children born normally at term; in eight cases nothing is stated with regard to the subsequent course of the pregnancy and labor; in four cases which were operated after the pregnancy, the history showed disturbances in pregnancy and labor in only one case. One case was treated by lavage of the renal pelvis and proceeded to term. Bugbee<sup>2</sup> remarks that catheterization of a pregnant woman is not difficult; a moderate amount of pressure may be required to advance the ureteral catheters, if there is torsion or kinking, which is more usual in the case of the right ureter.

In the one case of mishap (miscarriage) after a nephrectomy performed during the fourth month of pregnancy, the kidney condition was at least ten years old; the removed kidney was large and pussy, hardly any of its substance was left. The condition was frankly bad.

Schmidt<sup>3</sup> collected 36 cases of nephrectomy performed on pregnant women for various pathological conditions including renal lithiasis. Of these, 4 were in the second month of gestation; 6 in the third month of gestation; 8 in the fourth month; 7 in the fifth month; 4 in the sixth month; 2 in the eighth month; and in the others the age of the pregnancies is not definitely stated. In seven cases, the effect on pregnancy is not stated.

In 1 case, the operation was done almost at the time of delivery; spontaneous birth with a living child occurred. In 2 cases, the patients died; 21 of the others had a normal labor at term; 3 had spontaneous abortion; 1 had induced abortion; 1 had induced labor; and 1 had a dead fetus extracted. In four cases, it is stated that harmful effects occurred as regards the fetus.

Schmidt is of the opinion that a nephrectomy performed during pregnancy, in cases in which a diseased kidney has influenced its mate, may precipitate eclampsia. He believes that pre-existing chronic disease of the kidney is a very important factor in the etiology of eclampsia. Eclampsia is not mentioned in any of the 29 operated or non-operated cases collected in Table A, of nephrolithiasis during pregnancy. In all cases, in which the puerperium was discussed, it was normal.

Clinical experience fully shows that in a woman otherwise a good operative risk, a pyelotomy, nephrectomy, or a nephrotomy done for nephrolithiasis during the early months of gestation, does not jeop-

ardize the life of either mother or child. It can be affirmed that if such an operation is indicated, its performance is safe and should not be delayed.

The question of the obstetrical future of women having but one kidney has given rise to much discussion, and in the literature relating to it, there is fair agreement in arriving at conclusions. Pregnancy in nephrectomized women occurs far more frequently than is reported in the literature, as the number of nephrectomies done on women within the age limits of sexual activity is considerable.

I have found in the literature 30 cases reported with sufficient data, in which pregnancy followed a nephrectomy or nephrotomy done for nephrolithiasis; these cases are shown in Table B. In three of these cases, the pregnancy occurred within a year of the nephrectomy; in one case, within two years of the nephrectomy, and in one case within three years. At least in two cases, the remaining kidney was affected. One of these women had three children after the operation; she later died from urinary complications. In one case, pregnancy occurred within two years following a nephrotomy. In 21 cases, the time of the occurrence of pregnancy following operation is not stated. In most of the cases, the pregnancies do not appear to have been modified in any way by the operation. When labor was difficult, the difficulty was due to some cause other than the operation. One case is to be excepted, in which the operative scar ruptured owing to the strong labor pains and a forceps delivery was performed in order to avoid a ventral hernia. In the cases therein enumerated, it is reported that 30 women on whom a nephrectomy or nephrotomy had been previously performed, bore 32 healthy children. From the histories, one sees that operation was not followed by any untoward incident of particular importance during the pregnancy, labor or puerperium. The cases therefore, bear the opinion expressed by Schmidt, Cova, Twyman, and other authors. Pregnancy, if not occurring too soon after a pyelotomy, nephrotomy or nephrectomy, is not hazardous, *providing the remaining kidney is not diseased*. If the remaining kidney is diseased, and not functioning properly, childbearing is dangerous to mother and child and is not to be recommended.

The cases recorded show that even when the remaining kidney is involved, the patient does not run any particular risks from the fact of pregnancy. The number of cases reported is small and too limited to justify a dogmatic opinion, but they appear to be the only ones recorded.

Cova<sup>4</sup> collected 73 cases in which pregnancy followed a nephrectomy done for various conditions. In no case was there abortion or premature delivery; all cases went to term and evolved without any grave disturbances. If there was some albuminuria, it was never severe and never called for obstetrical treatment. In



some cases, subsequent pregnancies are recorded with equally good results. It will be seen that these are the results recorded generally in Table B, for nephrolithiasis. Nor does the development of the fetus appear to have suffered in any way.

Hartmann<sup>5</sup> found records of 115 cases in which a nephrectomy or other major kidney operation done on women for various conditions (10 for lithiasis) was followed by pregnancy. In 74 nephrectomies, there were two deaths from eclampsia, 1 death from renal insufficiency, and 1 abortion. In 66 cases collected by Pousson<sup>6</sup> in which nephrectomized women conceived, there were only 7 abortions; 13 of these women had subsequent multiple pregnancies. The infants were living and well at birth. In discussing the condition, Legueu<sup>7</sup> thinks that in the absence of complications, pregnant women should not during pregnancy be operated on for kidney lesions. Marion<sup>8</sup> thinks that women showing kidney calculosis during pregnancy can be classified into two groups. First, those in which the calculus causes complications and which every one is agreed should be operated; secondly, those in which there is an absence of symptoms. In this second category, Marion distinguishes those at the beginning of pregnancy and for whom there is every advantage of preventing infectious complications. These can be operated without risk. In cases in which the pregnancy has passed the sixth month, events should take their course.

Matthews<sup>9</sup> quite recently collected 265 labors occurring in 241 nephrectomized women. Only fifteen were complicated and there were but two deaths. Matthews concludes that after nephrectomy pregnancy follows its normal course and is but little more hazardous to mother or child than pregnancy under normal conditions, providing the remaining kidney is functioning properly. There is usually some albuminuria during the last weeks. If a severe "pregnancy pyelitis" occurs, the pregnancy should be terminated.

Hartmann's<sup>5</sup> study of the literature leads him to conclude that the removal of a diseased kidney, does not exert any unfavorable influence on the development of future pregnancies, and that this operation does not expose the patient to interruption of pregnancy, any more than other major abdominal operations.

Kidney operations, during pregnancy, especially nephrectomy as it throws the entire urinary elimination on one kidney, have received considerable attention. It has been assumed, and verified at autopsies, that after a nephrectomy, the remaining kidney undergoes hypertrophy and is capable of doing additional work. Tridondani<sup>10</sup> has discussed the loss of a kidney in pregnant women. He does not accept the belief that there is a sufficient compensative power in the remaining kidney simply by hypertrophy to deal with the excrementitious materials of the body.

Tridondani contends that during pregnancy venous stasis is induced in the kidney; first, by pressure of the enlarged and enlarging uterus on the renal veins; secondly, by engorgement of the abdominal vessels; and thirdly, by the fact that the uterine arteries during pregnancy draw off a large proportion of the blood from the kidneys. This venous stasis affects the nutrition of the glomeruli both by the increased amount of urea secreted and the irritation caused, and predisposes to albuminuria and other kidney complications of preg-



TABLE B  
 CASES OF PREGNANCY SUBSEQUENT TO A NEPHRECTOMY OR NEPHROTOMY FOR LITHIASIS

CASE No.	REPORTER AND REFERENCES.	AGE AND PARITY OF PATIENT.	PERIOD ELAPSED SINCE OPERATION.	WHICH KIDNEY REMOVED.	REMARKS
1	Shepherd, N. Y. M. J., 1890, li, 723.	Age not stated. Multipara.	Nearly 3 years.	Left.	2 Years after the left kidney had been removed, urine from right kidney contained pus. This was much increased when seen a year later. She had been confined 10 days before and urine was now very scanty. Died. Right kidney found at autopsy to have a large pus cavity with a calculus. 3 children have been born since removal of the left kidney.
2	Harajewicz, Przegl. Chir., 1894, 5, ii, Abstracted Rev. de Chir., 1898, xviii, 275.	Not Stated.	2 years.	Right.	Retrodeviation of uterus, parametritis and endometritis occurred after the nephrectomy. At 7th month of pregnancy, uterus fixed to the right. No albuminuria. Labor normal at term.
3	Twyman, Brit. Med. Jour., 1898, i, 423.	32 years Multipara.	7 months.	Left.	Suffered no more than in previous pregnancies except that morning sickness was more severe. At labor, during unusually strong pains the cicatrix ruptured, and to prevent a ventral hernia the woman was delivered by forceps. Some albuminuria. Puerperium regular. Child healthy. Mother made good recovery.
4	Maberly, Brit. Med. Jour., 1898, i, 604.	Age not stated. Primipara.	2 years.	Left.	The right kidney showed signs of being affected shortly after removal of the left. Craniotomy had to be done in this case on account of general contraction of the pelvic brim; one week later she had slight convulsions, but made a good recovery. This woman again became pregnant and labor was induced at 250th day and she gave birth to a living child weighing 3½ lbs. Mother and child well, but she still shows pus in her urine.

TABLE B—CONT'D.

## CASES OF PREGNANCY SUBSEQUENT TO A NEPHRECTOMY OR NEPHROTOMY FOR LITHIASIS

CASE No.	REPORTER AND REFERENCES.	AGE AND PARITY OF PATIENT.	PERIOD ELAPSED SINCE OPERATION.	WHICH KIDNEY REMOVED.	REMARKS
5	Cova, Ann. di ostet. e ginec., 1903, xxv, 692-705.	Age not stated. 5 para.	5 months.	Right.	Woman had suffered from calculous kidney disturbances for several years; 4 of 5 previous pregnancies ended regularly at term; the last ended spontaneously at fifth month. During the present pregnancy, feeling of malaise on right side aggravated the pain radiating down the ureter. There was some diminution of urine; this was treated and the amount increased. Some albuminuria. Labor at term. First period protracted to 36 hours. Child born spontaneously in good condition. Secundines and puerperium normal.
6	Hartmann, "Travaux de Chir.," Paris, 1913, iv, 159. And Ann. d mal. d. org. gen. urin., 1911, xxix, 98.	26 years.	1 year.	Not stated.	Nephrotomy for calculous pyonephrosis. Normal pregnancy and birth at term. Child nursed by mother; 2 subsequent normal pregnancies at term. Then nephrectomy which after 3 years was followed by a normal pregnancy and labor at term.
7	do.	30 years.	4 years.	Not stated.	Nephrotomy for calculous pyonephrosis. Child born at 7th month and lived only one hour.
8	do.	31 years.	3 years.	Right.	Nephrectomy for calculous pyelitis; pregnancy normal; birth at term; child nursed by mother.
9	do.	Not stated.	1½ years.	Not stated.	Nephrectomy for calculous pyonephrosis. Pregnancy normal; birth at term.
10	Pousson Ann. d. mal. d. to Org. gen. urin., 1911, xxix, 103.			Not stated.	States that of 66 collected cases of nephrectomized women who subsequently became pregnant 10 had been operated for lithiasis. In only 1 case was there a miscarriage. In the 9 others the pregnancy proceeded normally to term, although in some cases the remaining kidney was much altered.
20	Pollak, Centralbl. f. to Grenzgeb. d. Med. u. Chir., 1908, xi, 449.				Saw 11 cases of normal pregnancies after nephrectomy for calculi or pyonephrosis.

nancy. Tridondani thinks that renal venous stasis is compensated by hypertrophy of the left ventricle of the heart and that the danger arising from the kidney is obviated in pregnant women with a sound heart. These views have been assailed by Twyman<sup>11</sup> and others who think that there is no anatomical support for them. Twyman thinks that the safety of the woman pregnant after a nephrectomy does not depend on hypertrophy of the remaining kidney alone, but in an increased action of all the emunctories of the body. *If the remaining kidney is diseased*, pregnancy subsequent to a nephrectomy is dangerous for both mother and child. It should be avoided.

Whatever be the correct facts regarding the elimination of waste products during pregnancy, statistics support the view that a nephrectomy for any cause prior to any pregnancy is not a particular menace to the latter's evolution, and threatens neither the maternal nor fetal life. The loss of a kidney does not appear to unfavorably influence pregnancy, nor does pregnancy appear to put any strain on a nephrectomized woman that it does not put on a non-nephrectomized woman. The clinical facts do not show that a woman with but one kidney, whether it be in a perfectly sound condition or not, runs a much greater risk by becoming pregnant than in the ordinary course she would run from such kidney condition. A woman with one healthy kidney does not, as far as the facts show, run any more risk from pregnancy than does the woman with two kidneys.

Schramm,<sup>12</sup> one of the first to study this question, advised that for fear of eclamptic convulsions it was not safe for a woman with but one kidney to undergo the risk of pregnancy. This opinion is not justified by the facts reported in operations since then carried out. There is always a possibility or perhaps even a probability, of some damage and risk when elimination must be entrusted to one of even two normal kidneys at a time when there is abnormal production of excrementitious matter, and an unusual degree of risk of lesion to the organ. But it is probable that other agencies during this time take up the work of elimination. Roger<sup>13</sup> has recently shown by experimentation that the lungs, in addition to their purely respiratory functions, have a de-toxicating action and can aid other excretory organs in the conversion and elimination of poisonous substances. From a study of the literature, I can say that there should be no hesitation in permitting a nephrectomized woman to marry or run the risk of pregnancy if she has one good functioning kidney, and this is especially true if the nephrectomy has been done for nephrolithiasis. Sufficient time should be allowed to elapse after the operation to permit the woman's kidney functional capacity to be certified as regards sufficiency.



The general conclusions to be drawn from a study of the subject are:

(A) *As regards nephrolithiasis during pregnancy:*

(1) If the condition be latent or if the symptoms be not severe, palliative measures are to be instituted and the pregnancy permitted to proceed; large amounts of water should be given per mouth and urinary antiseptics—urotropin, acid sodium phosphates, etc., prescribed. After pregnancy, the patient should seek operative relief and cure.

(2) If the symptoms are severe, a pyelotomy, nephrotomy or nephrectomy, if not contraindicated for some other reason, may be done with safety to both mother and child up to the sixth month of pregnancy. Careful consideration should be given to number, size, location and characteristics of stones before operating. Good functioning of the remaining kidney should be insured if nephrectomy is to be done. The operative indications for nephrolithiasis during pregnancy are the operative indications for nephrolithiasis in general. With even one kidney functioning approximately normally, the freezing point of blood and urine is about the same but with a diseased solitary kidney, the increasing concentration of the blood, and hence lower freezing point may be the signal for the induction of abortion.

(3) If a major operation for kidney calculus has to be done later than the sixth month of pregnancy, there is the possible danger of premature termination of the pregnancy. An operation done later than the sixth month of gestation, exposes the parturient woman to an interruption of the pregnancy.

(4) Gestation occurring in a nephrectomized woman calls for watchful preparedness. The development and persistence of serious symptoms may call for the induction either of abortion or of premature labor.

(5) In any given case of nephrolithiasis, the question whether to operate or not is to be carefully weighed by the surgeon; judging the operative risk, the favorable effect which a successful operation has upon the pregnancy, the bad effect of continual toxemia and pus formation on the fetus, the dangers incident to the binding of the pregnant uterus by the formation of adhesions, and the fact that such may markedly impede labor. The fact should be kept in mind that a kidney calculus is more troublesome and dangerous during pregnancy than otherwise, owing to the existing greater kidney activity. The age of the pregnancy is not to be disregarded.

(B) *With regard to pregnancy occurring after nephrectomy:*

(1) The nephrectomized woman may be permitted to marry, or if married, to undertake the risk of pregnancy, provided she is in other-

wise fit condition. As a rule, there is no reason to interrupt pregnancy occurring in women with only a single kidney.

(2) An unique kidney does not *per se* compromise the normal progress of pregnancy, labor or puerperium, nor does the development of the fetus in such an organism appear to suffer any loss.

(3) Careful interpretation of the indications and constant observation of the nephrectomized woman during pregnancy is imperative.

#### REFERENCES

- (1) (Quoted by Mayo) Surg., Gynec., and Obst., 1917, xxix, 1. (2) Bull. Lying-in-Hosp., New York, 1920, xii, 11. (3) Surg., Gynec. and Obst., 1915, xxi, 679. (4) Ann. di ostet. e ginec., 1903, xxv, 692. (5) Travaux de Chir, Paris, 1913, iv, 455. (6) Ann. mal. d. org. gen. urin. Paris, 1911, xxix, 103. (7) Jour. d' urol., 1921, xii, 361 (discussion). (8) Jour. Amer. Med. Assn., 1922, lxxxii, 1634. (9) Ann. di ostet. e ginec., 1896, xviii, 522. (10) Brit. Med. Jour., 1898, i, 423. (11) Berl. klin. Wehnschr., 1896, No. 6. (12) Presse Med., Paris, Oct. 5, 1921.

(Others are given in the Tables.)

59 EAST MADISON STREET.