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Collective Review

The Kidney of Pregnancy

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IN REVIEWING recent literature on the so-called kidney of pregnancy, with its associated conditions of edema and hypertension, one is struck by the variety of classifications of kidney disease encountered, and the rather confusing nomenclature employed. For our purpose it is not essential to minutely examine the foundations on which these various overlapping and often conflicting divisions of pathology and symptomatology are based. It will suffice here to bring out the more salient points of those facts which seem fairly well established.

In studying renal involvement during gestation one must necessarily differentiate a true nephritis from those nephropathies under discussion, for upon this differentiation depends our future attitude on what may be called the kidney of pregnancy. Any case in which renal changes appear prior to conception cannot strictly be classed with the type of disease under discussion, even if the symptoms are aggravated by the subsequent impregnation. Nor should a case in which permanent renal damage is found following delivery be placed in this category, for v. Leyden long ago pointed out that one of the characteristics of the true nephropathies of pregnancy is the rapid disappearance of all symptoms following the emptying of the uterus by natural or artificial means. Heyneman¹⁰ and others have recently again emphasized a point in differential diagnosis, by calling attention to the fact that the kidney of pregnancy is manifestly based primarily on degenerative processes, while a true nephritis is primarily of inflammatory origin. It is true that borderline types will be encountered now and then, where it will be difficult to determine which condition dominates the clinical picture, but in the main the kidney of pregnancy does not show the changes found in nephritis.

The newer views on this subject are taking a much broader interpretation of the symptom-complex exhibited, and have followed the line of reasoning so ably stated by Atchley¹ in the concluding paragraph of his article, in which he says, "One must express the feeling that the investigation of this disease (nephritis) has been hindered by an interest too closely restricted to the kidneys. A broader study of the chemical balances of the body as a whole may demonstrate that the kidney is of secondary importance, both from an etiologic and pathologic standpoint."

Working along these lines many new and interesting avenues of investigation have been opened by workers the world over. Eckelt⁵ found that in those cases exhibiting moderate degrees of intoxication, with albumin, edema and hypertension, there was no nitrogen retention. Losee and Van Slyke¹³ showed that in the kidney of eclampsia there was neither marked nitrogen retention, nor severe acidosis, and concluded from this that the toxemia is not a uremia. Zangemeister¹⁶ in his rather exhaustive work on this subject demonstrated that although a definite retention of sodium-chloride occurred in the body during the edemas of pregnancy, the total percentage of all salts excreted in the urine was still relatively high, which proved that no marked insufficiency for salt elimination by the kidney existed. He further showed that in the early stages of the disease there was no functional disturbance in the water output of the renal parenchyma, oliguria occurring only as a later development.

The pathologic picture of a degeneration, the lack of nitrogen retention, the relatively unimpaired salt elimination, the clinical observation that the nephropathies of pregnancy tend toward a spontaneous cure after delivery without causing permanent renal changes, force one to the conclusion that the renal pathology is not responsible for the symptom-complex, that the kidney is not primarily involved, that its function is not seriously impaired until late in the disease, that the changes which occur are of a secondary nature, and that we must look elsewhere for a causative factor rather than cling to the older ideas which are no longer tenable.

The development of the Micro-capillary Tonometer by Danzer and Hooker⁴ has given a new impetus to the study of extrarenal factors in all pathologic kidney conditions, especially those connected with pregnancy. It is now possible directly to observe over long periods of time the individual capillary and its tiny blood stream, and to accurately check any deviation from the normal which may exist. Using modifications of this technic, various observers have brought to light some interesting and instructive observations. Working with the capillaries under the finger nail, they showed distinctive changes in both the vessel wall and its fluid contents, in the various degrees of intoxication, found associated with the kidney of pregnancy.

Hinselmann,⁹ investigating those cases showing evidence of hypertension, was able to demonstrate a distinct spasm in segments of the capillary wall with a resulting dilatation in other portions of the tube. He was able to observe the contents of the capillaries stagnate with each contraction, the color of the blood gradually changing from red to blue, and in the worst cases all flow ceasing. When relaxation occurred and the flow became reestablished or strengthened the blood again changed color, this time the blue giving way to a normal red, and the overdistention becoming less marked. He found these spasms to be intermittent in character, and their duration and frequency bore a direct relation to the severity of the symptoms. In one very marked case there was complete stagnation for 65 per cent of the time the patient was under observation. An interesting point to be noted is that following delivery the spasms became fewer and of shorter duration, that the overdistended portion of the capillary gradually returned to its normal caliber and that coincident with these changes, the blood pressure began slowly to fall. The same result was obtained, but to a

lesser degree, following appropriate treatment, which will be discussed later. Hinselmann concluded from these findings that the capillary spasm found in the skin was only a part of a generalized vessel contraction throughout the body, and thus gives some support to those investigators who have long held that the kidney changes found in pregnancy are due to a spasm of the blood vessels in the glomeruli.

Nevermann¹⁴ comparing the capillary action in the pregnant and nonpregnant state found that no difference existed, normal gestation evidently causing no change in this portion of the vascular system. As soon, however, as any symptom of an intoxication entered the clinical picture, the findings became abnormal with a resulting stagnation of the capillary blood and a dilatation of the vessel wall. He further showed that venesection with the removal of 300 to 500 c.c. of blood improved the capillary circulation, decreased the number and duration of the spasms, produced a better interchange of blood, and symptomatically seemed to be of benefit to the patient. All of this occurred, however, with a fall in blood pressure of only 20 or 30 mm. of mercury. This observation fits in nicely with the work done by Krogh,¹² who found that capillary tension did not depend on blood pressure, but on the tonus of the capillary wall, and that if stasis existed in the capillary the tonus suffered.

At this time it seems fairly well established that a rise in blood pressure is due to a diminution in the caliber of certain portions of the vascular system, the result of a contraction or spasm of the vessel walls. The causative factor of this spasm is still clothed in utter darkness, which up to the present has defied all attempts at clarification. Some consider it as a part of a general toxic condition associated with pregnancy, but Bumm has shown that one may inject as much as 1000 c.c. of blood from a toxic patient into a nontoxic one and cause not the slightest disturbance. Gessner emphatically denies the existence of a toxic substance circulating in the blood, and points out that any poison which acts over a period of weeks or months must cause changes in the interstitial tissue as well as in the blood vessels. Such changes are not found in the nephropathies of pregnancy, the pathology here being essentially that of a nutritive disturbance of the secreting cells.

The question of edema in pregnancy has from time immemorial been much associated with changes in the kidney substance and only in recent years have we got away from the old dictum, and advanced into a newer and broader understanding of this complicated condition. Zangemeister¹⁵ considers the primary cause of edema to be due to some extrarenal factor which produces a change in the lining of the capillary wall with a resulting transudation of fluid into the tissue. This conception is held by many other investigators, and perhaps typifies the most prevalent attitude of present-day observers. Fink,⁶ however, in his rather interesting observations on the causation of edema, sharply attacks this theory, and suggests some very plausible arguments based on the newer conception of the nature of colloids and the laws of osmosis. High blood pressure artificially produced, he maintains, has never caused an edema to manifest itself, even if the vessels were greatly overdistended with fluid, and points out that the interchange of liquid from vessel to tissue is not to be looked upon as merely a filtration process. Edema is not essentially the result of a

kidney involvement, but in this conception depends rather on the quantitative relationship of the organic and inorganic substances in the body to the physiologic processes of the tissue cell. If this relationship is disturbed, molecules and electrones of various substances, ingested or produced by metabolic changes, are set free in the body in excess of cell requirement, and become temporarily stored in various organs, especially the subcutaneous tissue. If the individual cell groups are unable to dispose of these products by speedy elimination they become fixed in the tissue and thus the body colloids are placed in a state where water absorption becomes imperative. We have, therefore, in pregnancy, edemas becoming manifest as soon as a disturbed relationship exists between the molecules presented to the organism by the metabolic processes of both mother and fetus, and the ability of the maternal cells to properly rid themselves by elimination of these excess substances. Fink⁶ is in agreement with those authorities who state that edema is responsible for the kidney changes in pregnancy, but differs with them in his conception of the *modus operandi* by which the pathology is produced. He contends that the process is mechanical rather than toxic, that the colloids of the renal parenchyma absorb fluid because of the excess of unused molecules stored in the cell, that the resulting swelling causes pressure to be exerted on the capillary blood supply with interference in the circulation and consequent cell damage, producing albuminuria and cast formation. He considers edema not as a water retention following kidney changes, but water retention with kidney changes, the causative factor of which lies outside the urinary apparatus.

From the brief summary of the literature here presented it will be apparent that the kidney is no longer looked upon as the chief factor in the production of those symptoms which we have come to recognize as part of the picture of the kidney of pregnancy. Most investigators are agreed that the actual changes in the renal parenchyma are secondary, depending upon some extrarenal factor, the nature of which has not as yet been definitely established. The first essential, therefore, in outlining a rational therapy for this class of cases, is an accurate diagnosis, which takes into consideration the possibility of a primary kidney involvement aggravated by pregnancy. Where this unfortunate complication can be ruled out, the treatment as outlined in the following paragraphs would seem indicated.

All authorities are agreed that rest in bed is the treatment *par excellence* for the nephropathies of pregnancy, for by this simple measure the extra work, incident to the erect posture, is taken from the capillaries; the heat regulation becomes simpler, a more even body temperature resulting; less muscular and nervous energy is expended, and the quantity of food and liquid necessary to maintain proper nutrition can be much reduced.

The diet should be bland, avoiding those substances which tend to produce a rise in blood pressure, as spices, coffee and alcohol. Protein and fat can be reduced to a total intake of 60 or 70 grams per day, as the experiences of the Central European countries during the war, when these substances were not easy to procure, demonstrated the advantage of these low figures, in the decrease in the number of severe intoxications recorded. Salt must be restricted to a minimum in any diet prescribed for patients suffering from this condition, as we know

that sodium chloride is retained in the tissues and predisposes to the formation of edema. Liquid intake must be cut down to such a quantity that the body is not overburdened by an excess of fluid which cannot be properly eliminated by the kidneys. A good working rule which may be of service in properly adjusting the amount of liquid ingested is to give only as much fluid per mouth in 24 hours, as the amount of urine excreted in the same time.

From what has just been said it will be apparent that a milk diet, as formerly prescribed, is not suitable for these cases, as milk contains too much water, increasing the fluid intake above the desired amount, and too much salt and protein to come within the required limits. We must rely on carbohydrates to supply the deficiencies in the reduced values of other foodstuffs, and keep up the body weight by a generous supply of such substances as rice, flour, potatoes and sugar, etc.

In those cases which show no improvement under the treatment outlined or where preeclamptic symptoms begin to manifest themselves, special measures must be adopted, the most important of which is venesection. We have seen that the mere taking away of a relatively small quantity of blood is of immense benefit in reestablishing the capillary flow and reducing the angiospasm which are so prominent a factor in this disease. It is, therefore, advisable to take from the circulation 300 or 500 c.c. of blood whenever the indication arises, and to repeat this procedure at short intervals until the desired result is obtained.

The question of the termination of pregnancy is one which hardly comes within the scope of this review, inasmuch as we have limited ourselves to the consideration of the kidney of pregnancy *per se* without taking up either eclampsia or true nephritis. It is selfevident that where no improvement can be brought about after a prolonged trial of the above mentioned measures, and where with the most careful attention the patient rapidly becomes worse, the uterus must be emptied.

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