XIII received vaccines for ten months without influence on the symptoms and without diminishing the bacilluria. It is possible that the low position of the kidney was an important element. The first pregnancy was terminated, but the second went to full term. Soon after confinement the urine for the first time showed evidence of pyelonephritis.

Case XV developed cystitis six months after nephrectomy. Vaccines at first produced some amelioration of her symptoms, she stopped treatment, her condition became worse and thereafter they had no effect. She may be classed with the severe cases of cystitis such as Cases VIII and IX, which have not been influenced by vaccines.

Case XI probably had a renal calculus with consequent infection at the first attack, as the appendix was found normal and the right kidney was enlarged, though there was no positive evidence of stone as no x-ray was taken. Just after the second attack a small stone was found in the bladder. Six months after its removal she was well and the urine was bacteria free, although vaccines had been given for ten months previously and cultures had always shown a profuse growth of *B. coli*.

Case XVI cannot be said to have been appreciably influenced by vaccine treatment. While the kidney was being drained, no effect was noted. Eight months after nephrectomy, the urine, which had gradually improved with the patient's physical condition, was bacteria free.

The pyuria and bladder irritation of Case XVII seemed to come from the infected stump of the ureter. There was no improvement during a month and a half of treatment with urotropin and bladder irrigations. After three months' treatment with vaccines and irrigations the symptoms subsided, and six months later the urine was nearly clear, with marked improvement in the general condition.

Case XII had no objective evidence of pyelitis. During the ten days that she had been observed there was pain in the left kidney region and a moderate temperature. The pain disappeared and the temperature came to normal the day after the first inoculation. At the end of thirteen months the urine still contained bacteria. Vaccines should not receive the credit for this fall in temperature, as a sudden drop is not unusual in pyelitis.

It seemed as if the speedy and complete recovery of Cases X and XIV might be due to the vaccine treatment. Case X, with cystitis and probably double pyelitis, recovered completely in two months with a bacteria-free urine. The temperature had fallen before the vaccine treatment began. During the first half of the time, she received bladder irrigations and urotropin, as well as vaccines; during the second, vaccine alone. Case XIV, with cystitis and left pyelitis, was completely well and urine bacteria free in a little less than three months of treatment with vaccines and copper sulphate.

Our experience with bacterial vaccines in the

cases thus reviewed leads us to the following conclusions:

1. They are efficient in relieving symptoms in mild forms of cystitis, but have less marked effect on pyuria.
2. They are without value in severe forms of cystitis.
3. They probably hasten the recovery of pyelitis.
4. They have no influence on bacteriuria.

ECTOPIA OF THE KIDNEY, WITH REPORT OF CASES.

BY JOHN C. MUNRO, M.D., BOSTON,
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THE existence of ectopic kidneys has been recognized for centuries, but only within the last decade has the condition been studied from a clinical point of view with any accuracy. As a hindrance to parturition the presence of pelvic kidneys has been especially noted by obstetricians; rarely has it been recognized surgically.

The works of Graser, Schaad, Hoehenegg, Sträter, Albrecht, Müllerheim and others cover the literature very thoroughly, and free use of their writings has been made in the present paper. Altogether, several hundred cases have been collected. Taken in conjunction with the recent work of urologists, a fairly clear picture of the healthy or the pathological ectopic kidney can be drawn by which its presence should be suspected or definitely determined.

When the renal anlage moves upward from its original position in the pelvis to its final resting place in the loin, its migration may for some reason be interrupted. It then takes lodgment at some place in this line and derives its blood supply from adjacent vessels, such as the common or external iliac. It may thus be differentiated from the wandering kidney (acquired ectopia) whose vessels arise normally from the upper part of the abdominal aorta. Failure to recognize and record the abnormal origin of the blood supply makes certain cases reported as ectopia really cases of misplaced or wandering kidney.

As Müller's duct does not normally develop until the primitive kidney has ascended to its final level it is easy to see that in a large proportion of cases of ectopia there will be some genital malformation. For example, an ovary or a tube may be absent; a tube may end blindly at the uterine end, but have a normal *ostium abdominale*; the uterus and vagina may be malformed or wanting. In the male there may be ectopia of the testis, absence of the seminal vesicles or of the vas on one side, etc. In other words, we may expect variations in the development of any organ arising from Müller's duct.

Anomalous developments of the intestinal tract may take place, as shown by displacement or reduplication of the lower gut, atresia ani, etc. Even skeletal anomalies corresponding to the location of the ectopic kidney may be found. Furthermore, a kidney attaining its full develop-

ment in the small pelvis might easily cause secondary changes in the adjoining rectum.

If both kidneys develop low down in the abdominal cavity and fuse together they will form the horseshoe kidney, or, if flattened over the spine or promontory, the so-called *Kuchenniere*.

The left kidney is much more frequently ectopic than the right; occasionally both are ectopic and rarely there is crossed ectopia, both organs lying on the same side of the median line. Complicating these anomalies one finds in rare instances a supernumerary kidney which may or may not be ectopic. An instance of this was reported by Dr. S. W. Goddard with the writer in the *American Journal of Medical Science* for September, 1907. In this case the supernumerary kidney was ectopic and had degenerated to a pyonephrotic cyst.

Clinically, more cases have been reported in women, probably because of the more frequent identification of tumors in, and operations on, the female pelvis. If the figures of autopsies are included in statistics, ectopia will be found about equally distributed between the two sexes.

The adrenal glands developing independently will be found in their normal situation in the loin.

In brief, a single ectopic kidney may be found in its proper side, either in the abdominal cavity, at the promontory or pelvic brim, or entirely in the true pelvis. If it crosses to the opposite side it may or may not fuse with its fellow. Both ectopic kidneys may be found each on its proper side or they may fuse to form the horseshoe kidney.

An ectopic kidney is more or less changed from its normal shape. It usually is smaller than normal, exhibiting fetal lobulation and it may be oval, spherical or even shaped like a triangular pyramid. The entrance and exit of vessels is anomalous and the number varies considerably, cases with six or more arteries being reported. The pelvis usually lies anteriorly, corresponding to the fetal relation, or it may not be developed at all. The entrance of the ureters into the bladder is normal so far as the reported cases demonstrate. The persistence of fetal lobulation is important, according to some writers, because of the theoretical tendency of kidneys of this type to become tuberculous.

In all cases it is important to realize that an ectopic kidney may be the only one present in the individual.

The tendency to undergo pathological change (hydronephrosis, pyonephrosis, etc.) may not be relatively greater than in the organ normally situated, though some authorities believe that the short ureter, malformed pelvis and compression by neighboring organs by producing stagnation in the urinary current predispose these organs to infection. The fact that in 58 cases collected by Sträter 12 had hydronephrosis and 6 had pyonephrosis would support this view.

The diagnosis is not easily made, and most cases demonstrated clinically have been diagnosed as appendicitis, ovarian tumor, retroperitoneal growth, etc. A supernumerary pelvic kidney has

been excised on the supposition that it was a tuberculous lymph node. Many cases give no symptoms and are recognized only at autopsy, while in others we may find colicky pains, constipation or even obstruction, pelvic neuralgia or menstrual pain. We may also find the symptoms of a hydro- or a pyo-nephrosis, of stone, etc. Rarely has nephritis been demonstrated. Hochenegg, Israel and others have observed definite associated mental and psychic disturbances. Israel believes that this is not an accidental association, since defects in development may be considered as degeneration-stigmata. In a case of Albrecht's there was considerable hydrocephalus, evident defects in intelligence, abnormal anxiety and physical clumsiness. Furthermore, a study of the reported cases would seem to show that in patients with ectopia, illness is relatively frequent.

As aids to diagnosis we must consider the absence of one or both kidneys from their normal location, as shown by palpation or the x-ray; the presence of a tumor palpable through the abdominal wall or the rectum or both. The tumor feels lobular, often with a hilus-like depression, and if it is palpable by rectum it is very tender, especially when there is associated distention of the pelvis. The pulsation of a good-sized artery on the anterior wall of the tumor is strong evidence in favor of a kidney of this type. The deflection of the rectum as established by insufflation may be a valuable diagnostic sign. The presence of associated genital malformation should arouse suspicion, and attacks of pyuria when associated with an abdominal tumor, especially if the patient complains of occasional attacks of acute intestinal obstruction, is strongly suggestive of a misplaced kidney. Neufville has reported a case with edema and thrombosis of the lower extremity.

At cystoscopic examination a difference in the length of the ureters, amounting sometimes to several inches, may be found. In some cases if the ureter is not shortened, but lies coiled up, this fact may be determined by the use of metal stylets and the x-ray. If the pelvis, filled with collargol, is examined by x-ray, its anomalous position or distention may be determined. A marked pulsation of the trigone, due to an underlying renal artery, has proved a valuable sign in several instances. Sometimes a sound in the ureter can be palpated by rectum.

With regard to treatment, it is important to leave an ectopic kidney alone if it is functioning and does not give symptoms, or if there is no second kidney. In case it lies above the pelvic brim it may in some cases be transplanted and anchored, but in a number of instances where this has been done a nephrectomy was necessary later because of persistence of discomfort and other symptoms due to a misplaced kidney, not relieved by shifting its location. A pelvic kidney probably cannot be transplanted because of its short pedicle and its anomalous arteries. Hence, if it causes symptoms because of mechanical interference with the intestinal functions, it is best removed, even though it is healthy.

When there is a hydro- or a pyo-nephrosis, due to pressure, kinks or stricture, an attempt at a plastic restoration of the canal may be considered, although it is of doubtful value because recurrence must be expected since the original cause is not eliminated. When, of course, such a kidney is the sole kidney, every attempt at plastic restoration should be made or a direct implantation of the ureter into the bladder be attempted.

In the several cases of ectopia that I have seen, the organ lying above the pelvic brim, I have been very careful to warn the patient to protect himself against abdominal blows or pressure by which the kidney would be squeezed and thereby fractured against the spine.

Plastic work on a kidney in the lower abdomen can be done most easily and rapidly through an intra-peritoneal approach, and with proper gauze protection the dangers of infection can be reduced to insignificant proportions. Certain kidneys lying laterally may be attacked extra-peritoneally if necessary, but this approach will be limited in its scope for various reasons.

I have seen four cases of renal ectopia, only one of which will be reported in detail. In none were there symptoms referable to the urinary tract. The first case was in a young man with chronic appendicitis. In diagnosing the retroperitoneal tumor, which lay close to the right side of the aorta at the level of the umbilicus, a misplaced kidney was considered. The artery came from the aorta about two vertebrae below the normal level. In the second case, a young man, the misplaced kidney was discovered at operation for acute appendicitis. It lay on the lumbar spine close to the aorta on the right, slightly smaller than normal, and lobulated. Its blood supply could not be safely investigated, but it probably was a case of true ectopia. The third case, a supernumerary kidney, has already been reported.¹

The fourth case, a physician forty-eight years old, was brought to me by Dr. Cousins, of Portland, Me., last September with the following history: For ten years he had had almost constant backache, and five years previous to his visit to me he had worn a plaster jacket for several months with some relief. Ten years ago Dr. Cousins had operated upon him for acute appendicitis. In the spring of 1909 he had a severe attack of abdominal pain requiring morphine for relief. This attack passed off in twenty-four hours and left him feeling perfectly well. A second similar attack followed in June. Both of these followed an unusually heavy dinner of the previous evening.

During July and August he spent the week-ends at a camp, and regularly every Sunday morning he would have an attack of colic. Suspecting that the weekly meal of baked beans, or the spring water used at the camp, might be the exciting cause, he abstained from both without relief. In September an attack came one day earlier, and being seen by Dr. Cousins at this time, he was brought to Boston for consultation. At this time he first noticed a tumor in the region of the bladder, tender to pressure. The urinary history was negative, except that during the height of an attack the bladder emptied itself slowly. Various examinations of the urine proved negative. All his life he had been troubled with marked constipation, though he was

careful to have a stool daily. During the attacks the constipation increased.

He described the pains as colicky, extending over the entire abdomen and radiating into the right testis and the lumbar spine. Upon subsidence of the colics the backache, otherwise constantly present, would disappear for several days. There was no nausea nor distention during attacks. He had not lost weight, his appetite was good, and outside a feeling of apprehension he seemed in pretty good condition.

The family history was interesting and played too important a part in making the diagnosis. His father had died of cerebral hemorrhage, but his paternal grandfather and eight granduncles (brothers of the grandfather) were said to have died of cancer of the gastro-intestinal tract.

Examination revealed an indefinite mass to the pelvic side of the appendix region, tender to pressure. By rectum, a tender tumor could be palpated, but the outline was not clear. Elsewhere the abdomen was negative. The tumor strongly suggested an inflamed cancer of the lower sigmoid with some feces blocked behind it. During a slight attack of colic on the day preceding operation the tumor was much more sensitive and intolerant to careful palpation. There was nothing in the urine to give us a clue to diagnosis nor to suggest a cystoscopic examination. There was no genital malformation.

At operation under ether the left kidney was found normal, but in the right loin there was no kidney. Instead, it lay over the sacral promontory a little to the right of the median line, somewhat lobulated, the lower pole lying deep in the pelvis, the upper pole resting just above the level of the promontory. The hilus lay anteriorly, the pelvis and proximal two thirds of a short ureter being distended to the size of the finger, this distention ending abruptly at a stricture beyond which the normal ureter, two or three inches in length, ended normally at the bladder. The ureter was ligated and cut and the kidney removed. One artery entered the lower pole, apparently taking origin from the sacra media. The main renal vein passed in front of the right edge of the kidney through some fat tissue to the common iliac vein, so far as could be told. The main artery accompanied this and apparently originated from the corresponding artery, though its exact origin was not carefully dissected out.

The pelvis, shaped like a dilated ureter, and the ureter itself; passed upwards to the upper edge of the kidney and then doubled leftwards on itself to pass downwards and to the right, ending as described above. The rectum and lower sigmoid lay a little to the left of the normal, and their blood supply was not disturbed.

The posterior peritoneal wound was closed and the abdomen closed in layers. Convalescence was uneventful and the patient reports himself as well four months later, with less backache and free from colics.

CORRELATION OF RESPIRATION AND HEART BEAT DURING EXERCISE.*

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It is a matter of everyday observation that during vigorous muscular exercise the heart beats faster and more forcibly, while the rate and depth of the breathing movements undergo a corresponding increase. The phenomenon suggests the idea that there must be some mechanism by means of which the breathing movements and heart beat are correlated; that either the two are controlled

¹ Munro and Goddard: *Op. cit.*

* Thesis in Physiology, Boston Normal School of Gymnastics, 1909.