A Lecture ON RENOGRAPHY:

OR,

A STUDY OF THE ABNORMAL MOVEMENTS OF
THE LIVING KIDNEY, AND A HINT OF ITS
BEARING AND INFLUENCE UPON
RENAL SURGERY.

BY

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[With Special Plate.]

GENTLEMEN,—Let us admit that the unduly mobile kidney may be a cause of renal change, bodily suffering, and even mental distress; let us frankly confess that our treatment of it is sometimes unsatisfactory, and our operative interference not always successful. It follows, then, that our knowledge of the defect is insufficient, and the forces we employ to remedy it are often unwisely wielded.

I submit that the hiatus in our knowledge may, to some extent, be filled by employing more scientific methods of studying its various forms, and especially of gauging the direction in which the organ moves during exaggerated respiratory effort—a phase in its life-history which has, I believe, been overlooked by clinicians and operating surgeons.

A few years ago we were quite content to diagnose a kidney as being unduly mobile if we could feel it beneath the costal arch and press it back again into its bed. This method was rough, but amply sufficient, I admit, to detect one form of over-mobile kidney—the “dropped” variety. But this is only one form, and incidentally I may characterize it as being the least dangerous, the least painful, and the one least necessary to operate on. But the bimanual examination is powerless to detect, and therefore to diagnose, the more dangerous and the more painful variety, that in which axial rotation of the organ bends the pelvo-ureteric junction and produces dilatation of the renal pelvis (the hollowed kidney).

I admit we recognized such rotations could occur on clinical grounds, because we spoke in general terms of “torsion of the kidney” and “cinder-sifting kidneys” (Morris), but we could not demonstrate it in a way that would disarm acute criticism. We are able to effect this now.

In my first lecture on the hollowing of the kidney¹ I chanced to mention that I had been using for eighteen months an accurate method of judging the length of the excursion of the over-mobile kidney, the direction of its movement, and of its axial rotation if this existed.

I understand that you would like me to demonstrate the method, and I do so willingly, as I have not seen it used or heard it advised, and, as circumstances have not permitted me to work in the radiographic department here, you are unfamiliar with the matter. My study has been carried on with the expert technical assistance of Mr. Coldwell in his West End laboratory. My work has considerably altered my conceptions of movable kidney, and it will alter yours as well as interest you. It will refurbish for you a very threadbare subject, and give you scientific reasons for rebutting the diagnosis of “hysterical” pain, and for advising or declining operation in cases in which a movable kidney in the female is the subject of discussion. But it may do more. It may

open up for you, as it has for me, a far wider and more fruitful field; it may influence your clinical acumen, your prognosis, and even your operative technique.

The method is simplicity itself. It consists in utilizing respiratory efforts and posture during radiography. To render the matter clearer I must ask your attention to one point.

The Shadow Cast by So-called “Dense” Kidneys.

Occasionally you will see in your radiographs the shadow of the outline of a kidney in the ileo-costal space, and the opinion will be expressed by the radiographer that the kidney is unusually “dense.”

I was much exercised in 1900 about these “dense” kidneys. I had a number of kidneys affected with chronic and acute nephritis removed in our *post-mortem* room and *x* rayed; I could not detect any difference between the depth of the shadow cast by the diseased organs and that cast, under similar circumstances, by normal kidneys. It may well be that my technique was faulty; improvement in the art can easily rectify that failure. But I soon learnt that all kidneys in which the true capsule was thickened cast shadows like “dense kidneys.” I had previously learnt that no truly over-mobile kidney existed which did not have a thickened true capsule. I do not now concern myself with the reason for this, I merely state it as a fact. I commenced, therefore, studying “dense” kidneys in the living by utilizing movable kidneys; I selected females as being the more prone to this complaint and the easier sex to radiograph. At first I forced the movable kidney from

under the ribs and held it down with my fingers while it was being *x* rayed. This failed, because the shadow of the kidney area blended with that cast by the iliac bone and spine. Special steel clips and other contrivances failed for similar reasons. I now utilized forced inspiration, then forced expiration, and, finally, a combination of both with posture, and the results are most striking, not only as bearing on the detection and study of the over-movable kidney, not only in aiding in the detection and elucidation of

DESCRIPTION OF SPECIAL PLATE.

Fig. 1.—Radiograph of the outline of a movable kidney in full expiration (Arrow 1).

Fig. 2.—The same under full inspiration (Arrow 2).

Fig. 3.—Composite tracing of both figures showing descent on full inspiration.

Fig. 4.—Radiograph of the outline of movable kidney with a stone in the pelvis under full expiration (Arrow 1).

Fig. 5.—Same under full inspiration (Arrow 2).

Fig. 6.—Composite tracing of both figures showing descent on full inspiration. Note change in shape of stone.

Fig. 7.—Radiograph of stone in the upper ureter of a movable kidney under full expiration (Arrow 1).

Fig. 8.—Same under full inspiration (Arrow 2).

Fig. 9.—Composite tracing of both figures showing the descent of the ureter with the stone in it.

false shadows, but in indicating the technique of operative procedure.

A Graphic Record of the Downward Movements of the Over-mobile Kidney.

We can now approach the first question, How can we accurately detect and measure the amount of the downward excursion of the over-mobile kidney?

Many of you have seen me pin on to the board in the operating theatre a sketch on paper of the exact size and shape of the stones I was about to remove from a kidney, and, after the operation, you have verified the accuracy of the sketch by placing the stones on the paper. I have always explained that the sketch was made by placing tracing paper on the radiographic plate, by outlining the shadow of the stone exactly, and then, in order to allow for the increased size caused by the spread of the rays, by reducing the contour of the shadow by a millimeter.

I utilize the same method, slightly modified, for movable kidney, because the outline of the organ is well marked in favourable cases by its thickened capsule. Three plates are taken without the body being moved in the slightest degree, or the axis of the lamp altered in any way. For the first, the patient is supine. After breathing oxygen and air for a minute or so, the air is fully expelled from the chest, and the larynx closed. Then—with the diaphragm at its highest point and the liver and kidney at their highest level and fixed—the *x* rays are switched on. Generally the patient can keep rigidly in this expiratory condition for ten seconds, which is quite long enough to take the radiograph. The plate is labelled “Expired supine.”

TO ILLUSTRATE MR. HURRY FENWICK'S LECTURE ON RENOGRAPHY.

Fig. 1.

Fig. 3.

Fig. 2.

Fig. 4.

Fig. 6.

Fig. 5.

Fig. 7.

Fig. 9.

Fig. 8.

TO ILLUSTRATE MR. HURRY FENWICK'S LECTURE ON RENOGRAPHY.

Fig. 10.

Fig. 12.

Fig. 11.

Fig. 13.

Fig. 14.

Fig. 15.

Fig. 16.

Fig. 18.

Fig. 17.

For the second plate the patient takes another dose of oxygen and air, though this is not necessary, and fills the chest as full as is possible, and holds the breath. Then, with the kidney thus thrust down and fixed, the x rays are switched on, and the second plate is taken. This is labelled "*Inspired supine*."

The entire couch is now raised by the head until the body is at an angle of 45 degrees, or even till the patient is almost erect. The kidney is thrust still lower by this position, aided by forced inspiration, and the third radiograph is taken. The plate is labelled "*Inspired erect*." This position is difficult to obtain, and it may often be dispensed with.

These three plates are now carefully developed and dried. Three sharp pencils are taken—black, red, and blue, and a sheet of the thinnest tracing paper.*

The first plate, the "*Expired supine*," is inserted into the negative viewing box, behind which is a strong electric light. The tracing paper is clipped on firmly to the plate, so that it cannot be shifted by the movement of the pencil, and the entire bony outline of the spine and iliac bone visible on the plate is minutely copied with the black pencil. The outline of the kidney is now traced in the same way, and any contained stone is also marked. The tracing paper, which is now an exact reproduction in outline of the "*Expired supine*" plate, is transferred to the second plate, "*Inspired supine*," and is manoeuvred until its black pencil outline of the bony framework shadow is exactly superimposed over the corresponding bony shadows of the second plate beneath. This is adjusted and readjusted until there is but one bony outline visible. If the two bony outlines do not exactly correspond, the patient has moved his body on the plate, or the axis of the light has been changed. The attempt has failed; it is useless.

Provided the outlines correspond exactly, the red pencil traces the kidney shadow, and if there is a stone present it also is marked. If you now glance casually at the result you will be surprised to find how greatly the forced inspiratory effort has thrust the kidney down—the red curve of the cortex of the lower pole may be an inch or more below the black curve. Measure the vertical distance and you will have the measurement of the downward excursion due to the down thrust of inspiration (Plate, Figs. 3, 6, and 9). But this is not all. Clinically, you often want to know what happens when the patient is on his feet; or, it may be, the "*Inspired supine*" renal contour differs but little from that visible in the "*Expired supine*," and you must see if gravity will shift the kidney.

Take the third plate—"*Inspired erect*"—and repeat the manoeuvre of bony shadow superposition, and mark the kidney outline in blue. Your tracing paper now has all the evidences of the downward movements of the unduly mobile kidney increased by gravity, which you can estimate with an ordinary inch or centimetre rule.

You might remark, "But supposing the kidney has not moved at all?" Well, that is another subject to which I will return shortly, for we have not yet exhausted our present subject.

You notice that in most cases the black, red and blue concave lines which mark the cortex of the lower pole do not lie directly one below the other, as they would do if the kidney dropped directly downwards with inspiration and posture, but tend outward, away from the spine (Plate, Figs. 2, 6, and 18). This shows that the lower pole turns outward when the sliding drop of the kidney is finally checked by the restraining pull of the renal pedicle.

Try and visualize what this tilt means to the due drainage of the kidney pelvis—for all problems in kidney pathology and surgery, except that of malignancy, find their

centre and answer in this—the facility or difficulty of renal pelvic drainage.

Will the tilt outwards of the lower pole bend the pelvis at its junction with the ureter, and so impede the outlet? No, it favours the outlet, for it opens the pelvo-ureteric angle, and this position is aimed at by operators in fixing the kidney.

Occasionally, however, you will notice the lower pole turns toward the spine. Surely this will bend the pelvo-ureteric junction, kink the orifice, dilate the pelvis, hollow the kidney, and induce suffering? Not necessarily, for the upper ureter is movable in these cases. The down drag of the kidney has loosened it, and it moves with the kidney in respiration, and it therefore does not kink. If it were fixed, and the kidney movable, a kink must occur at the pelvo-ureteric junction, and all the dangerous and distressing results of kinking and therefore of insufficient drainage ensue.

Some of you will at once say, "But this is in direct opposition to our textbooks! Gigon,² in 1856, asserted that the upper ureter was fixed by the peritoneum and could not follow the kidney in its wanderings, and therefore the ureter kinked and hydronephrosis ensued." And you may add that "since his time it has become an accepted fact by the observations and published records of many surgeons."² Ah! but this is a half-truth. It does apply to the rotating kidneys, but not to the "dropped" variety which we are now considering. Mark the difference clearly in your mind. The dropped kidney with its huge excursion loosens the ureter, and this does

not produce hydronephrosis. The rotating kidney does not loosen the ureter so much, and it is liable to hollowing. If you ask me where is the evidence of this, I answer at once, "The radiograph and a tactile and visual examination of dropped kidneys obtained during operation."

First, the radiographic evidence. Let us take an unequivocal instance.

Plate, Fig. 7, is an oxalate stone in the ureter of a movable kidney in a male. You recognize this as a ureteric shadow at a glance, but with forced inspiration the kidney, and with it the ureter, is forced

downwards, and the stone shadow is seen to be an inch lower down (Figs. 8 and 9). The upper ureter is therefore movable, for if the ureter were fixed the kidney might drop as much as it liked, but the stone shadow in the ureter would not change its position (confirmed by operation).

But we can now do better than this—we can inject the ureter with collargol, and the x -ray shadow demonstrates its curves. Operatively you will find very few of these greatly dropped kidneys have any hollowing of the pelvis or any other signs of kinking of the ureter; the ureter is thrown into curves, of course, but unless there has been periureteritis there is no kink. No, the mobility of the upper ureter does not cause hydronephrosis; it prevents it.

Let me press home this aphorism: The secretory health of the movable kidney, its symptomatology, and the necessity for operative relief depend on the mobility or fixity of its upper ureter.

A Graphic Record of the Exact Line along which the Kidney Moves.

If you desire to see the exact line along which the kidney moves either in drop or rotation, you must utilize another of the expedients I employ. This consists in photographing a stone in the renal pelvis, or a pelvis injected with a shadow-producing fluid (collargol, colloid silver) while it is moving. I call it the "snail track," for instead of a sharply defined outline of the stone you obtain a long, broad, blurred trail of shadow which marks the track of the stone as it slowly moves from its lowest to its highest posture during the exposure of the x rays. Let your patient take the deepest inspiration and hold it for five seconds;

DESCRIPTION OF SPECIAL PLATE.

Fig. 10.—Radiograph of a stone in a kidney pelvis under full expiration (Arrow 1).

Fig. 11.—Same under full inspiration, showing ascent of stone shadow (Arrow 2), this change being due to rotation of kidney.

Fig. 12.—Composite tracing of both figures.

Fig. 13.—Radiograph of stone in kidney under full expiration (Arrow 1).

Fig. 14.—Radiograph of same under full inspiration (Arrow 2).

Fig. 15.—"Snail track" of stone under prolonged expiration, the elongated shadow (Arrow 3) showing the axis of the movement in the kidney.

Fig. 16.—Radiograph of a calcified gland in meso-appendix attached to lower pole of the kidney under full expiration (Arrow 1).

Fig. 17.—Same under full inspiration, showing descent of gland shadow with kidney (Arrow 2).

Fig. 18.—Composite tracing of 16 and 17, demonstrating the certainty of the shadow being a body attached to the lower pole and outside the kidney (elimination of "false" shadows).

* French (vegetable fibre) tracing paper, obtainable at Reeves's, High Holborn, is the best.

time it with your watch. Now let the patient allow a little of the inspired air to escape every three seconds until the fullest expiratory effort is reached; then continue the expiratory effort five seconds. Now look at the radiographic result (Plate, Figs. 13, 14, and 15). You will find a broad stripe of shadow which accurately delineates for you the line along which the stone, and therefore the kidney, has moved. With nervous patients, let them slowly but deeply breathe in and out, and the shadow of the track of the moving stone will appear.

I have now described to you the radiography of the simplest form of dropped kidney—which you can detect bimanually—which drags on and deranges the digestive organs (chylopoietic viscera), but, because its ureter has become freed and because its pelvis does not distend, does not evoke the amount of local suffering, nor the same depreciation of renal function as the succeeding, the rotatory, form.

Let us now take the more important group—those kidneys which do not drop greatly but which rotate on an antero-posterior axis, and in doing so kink the fixed ureter and induce back pressure, create a hollowed pelvis

Fig. 19.—Kidney rotating inwards on antero-posterior axis +, and evoke all the symptoms and renal changes consequent upon that condition.

Axial Rotation of an Unduly Mobile Kidney without Marked Downward Displacement.

When the kidney is placed high up in the thorax its contour can still be followed in favourable cases under forced expiration, although the shadow cast by the kidney tends to blend with that of the liver or spleen.

Suppose you notice the black, red, and blue concave markings of the lower pole do not descend much, but tend rather to rise towards the spine. What may be surmised? Well this: That the upper pole is more or less attached while the lower pole is movable, and the down thrust of inspiration drives the lower pole towards the spine by rotation on an antero-posterior axis.

Two problems arise: What action has this rotation on the renal pelvis? The upper third of the ureter, mark you, is more or less fixed, for it has not been loosened by the long down-drag of the kidney, as occurs in the preceding form. The pelvo-ureteric junction is therefore intermittently bent. Gradually the pelvis is softened, for it is intermittently prevented from easy evacuation, and it distends. Hence comes that hollowing of the kidney which is found operatively in these cases. Hence also the characteristic renal pain at the ileo-costal angle, and widespread nerve distress, and the altered renal function.

The other problem, which to me is of exceeding interest,

is why the kidney is fixed at the upper end so that its upper pole moves but slightly? I believe in some instances that corticitis has fixed it; in other words, that adhesions there are most marked.

In some cases history of hepatic, gastric, and duodenal troubles may be elicited, each of which may cause adhesions around the upper pole to fix it. In some cases there is an aberrant renal artery which, I believe, often tethers the upper pole and allows the free lower pole to rotate and kink the pelvo-ureteric junction.

Can we demonstrate this form of axial rotation more exactly?

It is easily done if an oxalate of lime stone chanced to be in the pelvis, for its shadow rises and passes inwards on forced inspiration (Plate, Figs. 10, 11, and 12). Look at this clay model of a right kidney (Fig. 19). You will realize that it is only by turning on an antero-posterior axis that the shadow of a stone in the pelvis can rise upwards and inwards.

But supposing there is no oxalate of lime stone—and it rarely happens that one is present in the early stages of pelvic hollowing—to help us follow the movement of the kidney by the excursion of its shadow. Inject a little collargol into the renal pelvis, and you obtain a shadow. On the movement and the contour of that shadow in inspiratory effort, whether it opens out or becomes restricted in outline, whether it moves in and up or out and up, will be demonstrated the movements of the kidney. Pyelography will open up a hitherto closed book of problems in the causation of the pathology of surgical affections of the kidney, and its pages will surprise and charm the worker and render renal surgery more accurate, and therefore more beneficent, than has hitherto obtained.

Clinical and Surgical Inferences.

By this method I can generally avoid the mistake of false shadows. True shadows in the kidney move with the kidney. Look at Plate, Figs. 16 and 17. This is not a stone in a kidney but a calcareous gland outside the kidney. By this method I can urge operation for painful kidneys I cannot feel, and dissuade from operation those whose kidneys are not rotating but merely dropping outward. But more than this. At the beginning of the lecture you might have asked, "But suppose the kidney does not move?" Then it is a fixed kidney, and a knowledge of it is of real value in operative surgery.

I cannot deal with this subject at present. I can only hint as to its value to the careful surgeon.

If I come across a fixed dense kidney, with profuse haematuria, I know I have to deal with a carcinoma of the kidney that has passed through its capsule, and has fixed it so that there is no use operating; that I shall not be able to get the kidney away without damaging the inferior vena cava or abdominal aorta, or without getting a rapid recurrence by opening up planes along which the malignant growth has interpenetrated.

A fixed dense kidney shadow, I repeat, high up under the costal arch, with profuse, intermittent haematuria, means a "too-late" cancer, for it denotes a malignant kidney that has become glued, and is therefore inoperative.

A fixed shadow of a dense kidney, with stinking pyuria and shadow of pelvic stones, means nephrectomy, and, if the surgeon is wise, subcapsular nephrectomy by the lumbar incision, without touching or separating more of the pericapsular attachments than is just necessary to enucleate the organ and control its pedicle. The surgeon who acts thus will not lose these severe cases.

A fixed dense kidney shadow without stone, but with coli-pyuria or staphylococcic pyuria, generally needs the simplest pelvic drainage through the loin without disturbance of the pericapsular area.

A dense fixed kidney shadow without pyuria needs serum treatment for the treatment of the corticitis. But the subject is too big for me to enter upon here more fully. I am painfully aware that time and space permit me but to touch upon the fringe of it. I have said enough to convey to you something of the importance, not only radiographically, but clinically and operatively, of the use of forced expiration and forced inspiration with or without vertical posture of the patient, and I leave you and your radiographic department to utilize or condemn the hints I have conveyed.

REFERENCES.

- ¹ Renal Pain, BRITISH MEDICAL JOURNAL, January 7th, 1911.
- ² Quoted by Sir Henry Morris, *Surgical Diseases of the Kidney*, vol. 1, p. 99.