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Original Articles.

URETERAL CALCULUS.

ITS DIAGNOSIS BY MEANS OF THE WAX-TIPPED BOUGIE.
ESCAPE OF THE CALCULUS PER VIAS NATURALES
AFTER FORCIBLE DILATATION OF THE
URETERAL ORIFICE.
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* On January 31, of this year, I was called by Dr. L. Hamburger to see a woman in extreme pain from renal colic. I found a well-nourished patient about 38 years old, suffering from a pain beginning in the left kidney and extending down the left ureter to its vesical orifice, where the distress seemed to be centered.

and was unable to bear more than the slightest pressure.

The history of the case pointed to a renal calculus which had in all probability descended into the pelvis and was lodged just behind the vesical orifice of the left ureter.

The next steps to be taken manifestly were to determine, with the certainty afforded by the new means at my command, first, that there was really a calculus present, and second, that it was lodged in the pelvic ureter, and then to proceed at once to use appropriate means for its removal. In order to attain these ends as far as possible at one sitting, I took with me, to the patient's house, the following instruments: several open vesical specula, a battery with an electric headlight, cocaine—1 per cent. solution—and a cocain syringe with a long point, a renal catheter 2 mm. in diameter, a wax

Set of ureteral dilators.

The attack had begun a week before, after some unusual exertion in caring for an aged relative, and was marked by frequent urination and some hematuria at intervals. At no time did she pass any debris or crystalline elements suggestive of calculus.

The abdominal examination revealed no point of tenderness or enlargement other than the very fat walls. By the vaginal touch I found a normal right ureter, but on the left side the ureter was exquisitely tender and there was a distinct, firm enlargement about half way between the internal urethral orifice and the cervix uteri. At this point she located her greatest suffering,

and olive-oil mixture, 2 to 1, to coat the end of the catheter in searching for the stone, a ureteral sound, a set of ureteral dilators, and ureteral alligator forceps.

The patient, having emptied her bladder, was placed in the dorsal posture and the ureter was cocainized by injecting about 6 c.c. of the 1 per cent. cocain solution directly into the ureter and into the surrounding tissues, by means of the long hypodermic needle thrust through the vaginal wall into the tender spot felt per vaginam. It was also my intention to inject eucain into the lumen of the ureter, by means of a long silver

tube introduced through the ureteral orifice and attached to a syringe, but I could not find the tube in time.

She was then put in the knee-chest posture on a lounge, and air let into the vagina in order to drop the base of the bladder to the level of the plane of vision; a No. 10 speculum—10 mm. in diameter—was then introduced and the obturator withdrawn, when the bladder filled with air. On examining the bladder through the cystoscope, with the electric headlight, the vesical walls were found perfectly healthy; the right ureteral orifice was normal; the only abnormal appearance about the bladder was at the left ureteral orifice, which appeared broad

on all sides. This angry appearance of the ureteral opening plainly indicated the affected side, but the orifice was not found to be distended as at first surmised from its appearance; but, on the contrary, contracted and strictured. The eversion of the ureteral mucosa was therefore analogous to the everted cervical mucosa in cases of endocervicitis in the unmarried.

A ureteral sound was now introduced into the ureter and gently pushed to and fro in the effort to detect the click of a stone, but without success. I then introduced a metal catheter, 2 mm. in diameter, about 5 cm. within the ureter; as soon as the catheter was well past

Delicate ureteral alligator forceps for grasping stone in the ureter; adapted from a throat instrument.

FIG. 1.—New instrument for introducing wax-tipped catheter into the ureter, preventing it touching sides of speculum.

FIG. 2.—Examining wax tip.

and pouting, surrounded by a deeply reddened everted mucosa extending from 4 to 6 mm. out from the orifice

the vesical extremity of the ureter, urine began to flow until 8 c.c. of clear, yellow, normal-smelling urine escaped. This showed conclusively that the vesical end of the ureter was strictured and that the urine was pent up above the stricture, forming a hydro-ureter.

I then introduced a ureteral dilator (see Fig. 1) 3 mm. in diameter, well up into the ureter, stretching the orifice and thoroughly opening up the stricture. Having so far secured no certain sign of the stone, a wax-tipped catheter was introduced. This catheter is one of my ordinary renal catheters, the point of which is dipped into melted dental wax and olive-oil—2 to 1. A little drop clings to the end of the catheter and cools with a glistening unbroken surface which, examined by a lens, is found perfectly smooth throughout. The catheter, armed in this way, was guided up the lumen of the speculum and into the ureteral orifice, barely touching the smooth side of the speculum, and entirely avoiding the sharp end, and, most important of all, without any to-and-fro movement liable to scrape the wax. I was therefore certain that there were no scratch marks on the wax when the catheter entered the ureter. After moving the end of the catheter to and fro in the lower part of the ureter, I then conducted it on up into the renal pelvis, where 16 c.c. more of pent-up urine at once escaped, showing the presence of a hydronephrosis

of a low grade, and explaining the cause of the renal colic.

After emptying the kidney, the patient—in the knee-chest posture—was asked to raise the body erect while the catheter was partially withdrawn, in order to cause any renal stone to drop toward the uretero-renal orifice and so bring it into contact with the catheter. The catheter was then removed entirely, taking care to hold the labia well apart in order that the wax might not come into contact with the vulvar hairs.

An examination of the wax with a lens was made at

FIG. 3.—Scratch marks on wax-tipped catheter.

once, and showed a *perfectly definite series of scratch marks* (see Fig. 2) *from top to bottom, which marking could have been caused in no other way than by contact with a stone in the urinary tract.* (See Fig. 3).

FIG. 4.—Dilator introduced through stricture; calculus first above and hydro-ureter above that again.

These scratches are shown magnified eight times in the figure.

Further, on examining the urine drawn off by the catheter, it was found that it had broken off a little buff-colored piece of stone 1 mm. in diameter (see Fig. 5), in addition to bringing away a number of other minute pieces. The mammillated surface of the little stone could be seen under the lens and its hardness easily tested with the point of a pin. Dr. Hamburger took the minute pieces and, by the successful application of the murexid test, showed that they were bits of uric acid. The urine, examined by Dr. Mason Knox,

who assisted me throughout the entire investigation, was tested for urea and found to yield 1 c.c. of gas to the cubic centimeter, showing a greatly reduced excretive activity on the part of the kidney (two-fifths normal).

Having dilated the ureteral orifice and demonstrated the presence of the stone, it was not deemed wise to interfere any further, so the patient was left in bed and given a small dose of morphia.

I did not use the ureteral alligator forceps to crush the stone, on account of the capacious lumen of the ureter above the stricture allowing the stone to slip away from its first position, where it could more easily have been felt and grasped. (See Fig. 4.)

Nineteen hours after the dilatation of the stricture an oblong stone 10 by 3 mm., with tapering ends, was expelled, with immediate relief of all symptoms. (See Fig. 5.)

The following interesting points were brought out in this case:

The presence, the exact location and the size of a small stone lodged in the ureter behind the vesical orifice were determined by vaginal palpation, in accord with the experience of several other observers who have also detected ureteral calculi in this way. The honey-combed structure of the stone suggests the possibility of crushing it by making a moderate pressure through the vaginal walls.

FIG. 5.—The ureteral stone; near by the small piece removed by the catheter. Both magnified two times.

The use of cocain injected directly through the vaginal walls into the ureter and the surrounding tissues opens up an interesting field for the use of this drug in the surgery of the lower ureteral tract. It would easily be possible, using cocain in this way, to cut into the ureter through the vagina and remove a stone and sew up the wound without resorting to a general anesthetic.

The interior of the ureter may readily be anesthetized by injecting eucaïn into it by means of a long slender nozzle attached to a small syringe.

The wax-tipped bougie demonstrated the presence of a calculus in the ureter for the first time.

By coating the catheter with wax at intervals from the tip down, it would be possible to determine more precisely the exact location of the calculus, and so avoid introducing a catheter several times to locate the stone.

The renal catheter brought away a bit of the stone, adding one more positive sign of the presence of a calculus.

The catheter showed the positive sign of the presence of a stricture at the lower end of the ureter and a dilated area above the stricture.

The catheter also showed the presence of a hydronephrosis of low grade.

By means of the ureteral dilator the orifice was enlarged to the exact size of the stone, which was thus enabled to escape within twenty-four hours.

I am not aware that a ureteral calculus has ever been assisted to escape in this way before.

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