

Postrenal Reflex Anuria

by

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Spasms of the normal ureters mediated through a certain neurogenic mechanism rarely result in the prolonged suppression of urine flow, in which azotemia and hyperpotassemia may occur. The term "reflex anuria" could be applied to this phenomenon.

This is a case of anuria of sixty hours' duration on the eleventh postoperative day following right hemihepatectomy, which was dramatically relieved by means of ureteral catheterization. Because of rarity with which postrenal reflex anuria was noted in a child after surgery, it is thought of interest to report such a case.

CASE REPORT

A 10-year-old boy was admitted to our hospital on October 23, 1964 with chief complaint of a painful abdominal mass of 18 months' duration, which had been rapidly increased in size since 6 months before admission. Neither icterus nor urinary disease was noticed since the onset of his illness.

Both past history and family history were noncontributory.

Physical examination: The right upper abdominal region, as indicated in Fig. 1, disclosed a circumscribed swelling about the size of child head with a fluid wave on its center. The liver was palpable 5 finger-breadths below the right costal margin and 7 finger-breadths below the xyphoid process. The spleen and the bilateral kidneys were not felt.

Laboratory findings: As shown in Table 1, the examination of blood, urine and liver function revealed no evidence of marked abnormality. The phenolsulfonphthalein test showed 25% excretion in 15 minutes, 30% total in 30 minutes, 45% total in 60 minutes and 50% total in 120 minutes. The intravenous pyelogram presented the mild dilata-



Fig. 1

Table 1

Hematological examination

RBC	424×10^4	
Sahli	68%	
WBC	7700	
Seg. neutrophils		61%
Nonseg. neutrophils		9%
Eosinophils		2%
Basophils		0%
Lymphocytes		25%
Monocytes		3%
Platelet counts	14.5×10^4	
Hematocrit	36.5%	
Serum electrolyte concentration		
Na	142.8mEq/L	
K	1.24	
Cl	4.8	
Ca	108.1	
Serum nonprotein nitrogen	26.2mg/dl	
Serum total protein	7.2g/dl	
Liver function test		
Icterus index	6	
Co	4	
Cd	10	
TTT	1-2	
BSP	0% (30 minutes)	
Urinalysis		
straw colored, clear, acid		
specific gravity	1010	
volume	800-1000/day	
albumin	(-)	
urobilinogen	(+)	
sugar	(-)	
bile	(-)	
sediment	unremarkable	

tion of the right renal pelvis and the slight delay of right renal excretion. Otherwise no abnormal shadow was noted along the urinary tract. There was no evidence of distant metastasis, either clinically or roentgenologically.

Operative findings: Under hypothermia, the abdomen was entered through a thoraco-abdominal incision. The right lobe of the liver, on which the mass was localized, was resected nearly along so-called Cantlie's line after the ligations of the right branches of portal vein, hepatic artery and hepatic duct (Fig. 2). An intraperitoneal drain was inserted through the right flank region. The blood pressure and pulse rate remained within nearly normal levels during the course of the operation. The microscopic observations revealed the tumor to be primary anaplastic sarcoma of the liver.

Postoperative course: Except for bile drainage 100 to 200 cc in volume per day, it was exceedingly uneventful up to the following described anuric episode. Postoperative medication consisted of penicillin, tetracycline, digitalis and hepatic agents in the usual dosages. Neither sulfonamide nor narcotics was administered. The child remained afebrile and his urinary conditions were grossly normal until the eleventh postoperative day, when his urination abruptly ceased following 90 cc of urine output on the morning. The catheterizations were made several times, but no urine could be found in the bladder. On the evening it was accompanied by bilateral flank pains, which had been gradually increased in severity. Regardless of various

diuretics as well as potassium, protein, salt and water restriction, the anuric state continued for the whole next day. On the morning of the third day of anuria, serum potassium concentration was 6.78 mEq/L, serum sodium concentration 120.8 mEq/L, serum protein 5.7 g/dl, serum nonprotein nitrogen 25.6 mg/dl and blood pressure 180/70 mmHg. Temperature rose to 38.6°C, but neither convulsion nor unconsciousness developed. Furthermore palpation revealed the bilateral kidneys to be enlarged and tender, and then on the evening the cystoscopic examination was attempted with suspicion on postrenal obstructive

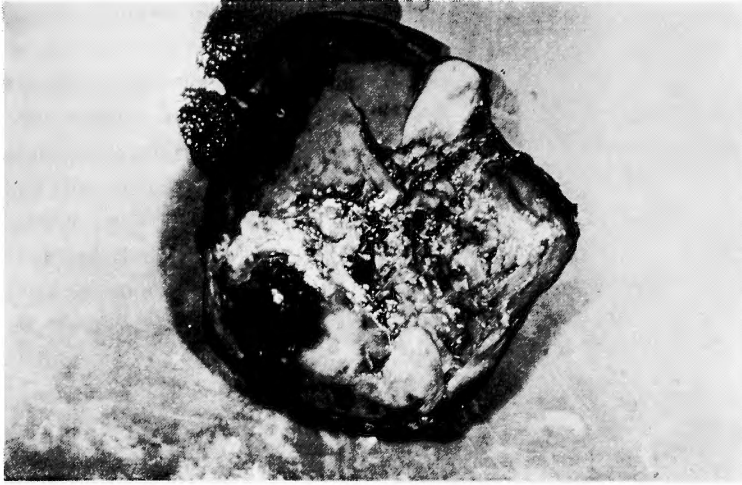


Fig. 2 (resected right hepatic lobe)

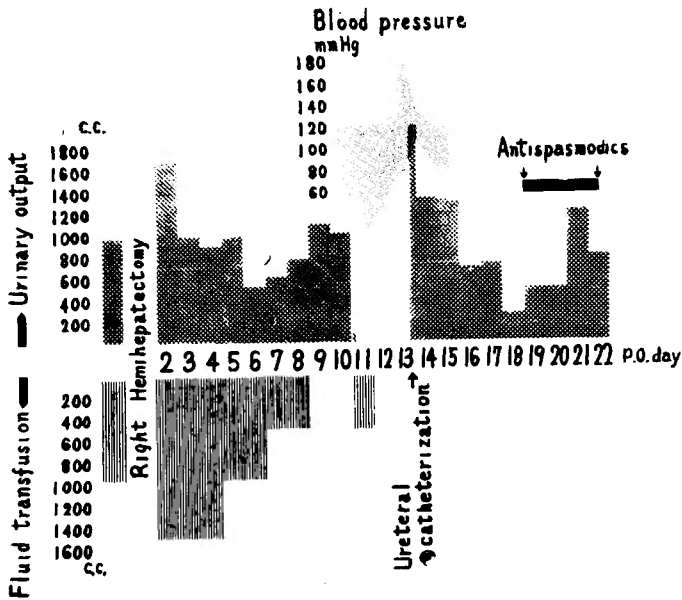


Fig. 4

anuria. The bladder was grossly normal but devoid of urine. The ureteral catheter was first inserted into the left ureter and passed up to a point approximately 10 cm from the ureteral orifice, when a profuse flow of urine of grossly normal appearance gushed out. Another catheter secondarily inserted into the right ureter also resulted in a tremendous flow of urine at the same distance as in the left ureter. The catheters were allowed to remain in situ for next twenty-four hours and the patient was promptly released from lumbar pains. The second day following diuresis, blood pressure showed 122/80 mmHg, serum potassium concentration 3.28 mEq/L and serum sodium concentration 143.5 mEq/L.



Fig. 3

Thereafter normal urine output ranging from 500 cc to 1300 cc was noticed for three days, while on the 18th postoperative day oliguria 280 cc in volume per day again occurred without any complaints. Administration of a large dosage of antispasmodics relieved the oliguria to normal levels, which had been maintained during his hospitalization. An intravenous pyelogram on the seventh day following diuresis showed the right renal pelvis to be moderately dilated with slightly delayed excretion. Otherwise no abnormality was noted along the ureters and bladder, as shown in Fig. 3. Serum electrolytes concentrations as well as serum non-protein nitrogen were all within normal ranges on the eleventh day after diuresis. The patient was discharged on the 53rd postoperative day, when he appeared to be remarkably improved and asymptomatic.

On January 26, 1965 the patient died of heart weakness secondary to recurrence of liver sarcoma.

Autopsy findings: The liver weighing 2500 g presented a large tumor mass along the surgically resected surface, and multiple nodules on the left lobe which seemed to be intrahepatic hematogenous metastasis of sarcoma. The left kidney was 75 g in weight and $9.5 \times 4.5 \times 2.5$ cm in size, and the right kidney 75 g in weight and $10.0 \times 4.0 \times 2.0$ cm in size. Furthermore, the shape, size, site and consistency of the bilateral ureters and the urinary bladder revealed to be grossly normal except for slight jaundice. Further observations could fail to disclose stones, strictures, edematous changes or metastatic involvements along the urinary tract. Accordingly there appeared no organic lesions sufficient to exclude reflex anuria. These aspects supported the view that previously described anuria and oliguria might be functionally caused by the reflex spasms of the bilateral ureters.

DISCUSSION

Reflex anuria in a narrow sense means sudden stoppage of urinary excretion on the healthy kidney initiated by unilateral reno-ureteral involvements as well as painful episodes of other organs. Currently renal vasoconstriction mediated through certain neurogenic stimuli has come to be regarded as a cause of reflex anuria. On the other hand some conflicting results are reported against the fact that the normal kidney results in prolonged anuria by means of reflex mechanism. For instance, according to Block's experimental studies, electric stimulation of the renal nerves under optimal conditions caused sufficient renal vasoconstriction. However renal blood flow returned to preestimation values within

1 to 2 hours, and anuria or oliguria of more than 70 minutes' duration could not be produced.

In 1943, Ichikawa and Takayasu reported a case of anuria followed by the spastic occlusions of the bilateral ureters which were relieved by ureteral catheterization. Thereafter Takayasu described the concept concerning postrenal reflex anuria and divided it into three types; reno-ureteral, uretero-ureteral and other organs-ureteral reflex types. Reflex anuria of postrenal origin may be due to the reflex spasms of the ureters, not of the renal blood vessels, which are characteristically improved by means of ureteral catheterization alone, as presented in this report. Consequently the prognosis appears to be remarkably favorable in comparison with that of renal and prerenal anuria.

The present case revealed no marked organic involvements on the urinary tract such as urolithiasis, tuberculosis, tumors and malformations, except for the slight distention of the right renal pelvis. Furthermore oliguria on the 4th day following dramatic diuresis by means of ureteral catheterization could be relieved with administration of antispasmodics. These observations may clearly demonstrate that the anuric symptoms in this case were secondary to spasms of the bilateral ureters, probably pelvoureteral junctions, mediated through certain reflex pathways. The original site from which this reflex anuria resulted might be speculated to lie either in the operated hepatic portions or in the right kidney or ureter, to which drain, leaked bile or hematoma probably made mechanical stimulus through the operatively opened retroperitoneum.

In 1957, Sirota reported three cases of reflex anuria after nontraumatic catheterizations, which were relieved by ureteral recatheterizations. According to his considerations, clinical features of these patients are followings: 1) Usual predisposing factors for acute tubular necrosis are absent. 2) The rise in blood pressure is more rapid and of greater severity. 3) The urine obtained during and after relief of the ureteral obstruction may not have the fixed low specific gravity. 4) There may be marked fluctuation of daily volume of urine. 5) They have more of signs of a urinary tract infection.

These investigations appear to be exceedingly in agreement with those of ours.

SUMMARY

A case of postrenal reflex anuria of sixty hours' duration in which hyperpotassemia and hydremia developed has been reported. The definite pathogenesis of reflex anuria is still a matter of speculation. However the spasms of the bilateral ureters mediated through the autonomic nervous system are regarded as a cause of postrenal reflex anuria which is characteristically relieved by means of ureteral catheterization as well as antispasmodics.

It is of prime importance to differentiate it from renal or prerenal anuria and to make diuresis as early as possible.

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和文抄録

反射性仮性無尿症の1例

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術後合併症のひとつである無尿症の原因は低血圧の持続、或いはショックのための腎低酸素血症による急性腎不全が殆んどであるが、肝右葉切除後11日目に突然全くの無尿状態に陥り、約60時間後、尿管カテーテル挿入により排尿をみたという反射性仮性無尿症と考えられた一症例を経験したので報告する。

10才、男子。

腎、尿路疾患の既往歴はない。

1年半前より右季肋部に無痛性腫瘤あるに気づく。放置したところ徐々に増大し疼痛を伴うに至った。血液、尿所見及び肝、腎機能に著変を認めない。

低体温下に右開胸、開腹術を施行した。腫瘤は塊状に肝右葉に局限していたので概ね Cantlie 線を境に肝右葉を切除した。組織像は肝原発性の anaplastic sarcoma であった。

術後極めて順調に経過していたが、術後11日目朝90ccの排尿を最後に突然無尿に陥った。各種利尿剤投与の効もなくこの無尿状態は持続し、翌々日には血圧上昇、高カリウム血症、水血症の様相を呈して来たので

術後13日目夕方、無尿60時間目に逆行性に尿管カテーテル挿入を試みたところ、両側尿管とも膀胱尿管口より約10cm上方にて、突然外観正常の大量の尿排出をみた。カテーテルはそのまま留置き翌日抜去した。以後順調に排尿を続けたが術後18日目再び無尿状態を呈するに及んだ。しかし鎮痙剤連続投与により再度正常尿量に復する事ができた。

術前、術後を通じ、尿路結石、尿路結核、腫瘤尿路圧迫、畸形などの器質的異常所見は認められず、結局両側尿管壅塞による所謂反射性仮性無尿症と結論づけた。不幸にも患者は術後55日目肉腫再発による心臓衰弱にて鬼籍に入つたが、剖検所見にても反射性無尿症を否定するにたる尿路系の病変は発見し得なかつた。

反射性無尿症についてはその発症機転に不明確の点も少なくない。少なくとも本診断は、無尿を起こすあらゆる可能性を慎重にひとつひとつ排除した上で、最終的に到達すべき性質のものであろう。本報告例に対してもかかる見地より考察を試みた。