CLINICAL CASE

Stone formation in an Indiana pouch presenting as obstructive uropathy

G.J. Sedano-Valenciaa,*, F.J. González-Gonzálezb, H. Becerra-Herrejonaa and R. Carvajal-Garcíab

aa Urology Speciality Residency, Hospital Regional Dr. Valentín Gómez Farias, Instituto de Seguridad y Servicios Sociales de Trabajadores del Estado, Guadalajara, Jalisco, Mexico
bb Urology Service, Hospital Regional Dr. Valentín Gómez Farias, Instituto de Seguridad y Servicios Sociales de Trabajadores del Estado, Guadalajara, Jalisco, Mexico

Received 16 October 2014; accepted 1 April 2015
Available online 23 May 2015

KEYWORDS
Neobladder lithiasis;
Urinary diversion;
Metabolic changes

Abstract Cystolithiasis is a complication of urinary reservoirs, seen mainly in patients presenting with muscle-invading bladder cancer. Depending on the type of reservoir and bowel segment utilized, different metabolic complications arise that can cause lithiasis. The most important etiopathogenic factor in the formation of stones is urinary stasis, which is promoted by intestinal mucus and urinary infections with chronic colonization by urease-producing bacteria, hypocitraturia, hyperoxaluria, and alkaline pH. Frequency varies from 10-50%.

A 65-year-old man had a past history of radical cystoprostatectomy plus a continent Indiana pouch urinary diversion due to muscle-invading bladder cancer 18 years prior. His present symptoms began with nausea, vomiting, dyspnea, and anuria and he presented with acute renal insufficiency secondary to obstructive uropathy. During his hospital stay giant bladder stones were detected. Given the stone burden, they were removed through open surgery. The patient had adequate progression and was released with good renal function, as well as a functioning urinary diversion. The majority of these patients can be treated with minimally invasive techniques. Open extraction is considered when other modalities cannot be safely performed.

© 2014 Sociedad Mexicana de Urología. Published by Masson Doyma México S.A. This is an open access article under the CC BY-nc-nd license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

PALABRAS CLAVES
Neocistolitiasis;
Derivación urinaria;
Cambios metabólicos

Neocistolitiasis en derivación tipo Indiana. Uropatía obstructiva como forma de presentación

Resumen La neocistolitiasis es una complicación presente en reservorios urinarios, principalmente en pacientes con cáncer de vejiga con invasión muscular. Dependiendo del tipo
Introduction

The intestine is used for substituting the bladder as a conduit that drains urine to the abdominal wall or it is remodeled to form a substitute bladder. The ileum and colon are the most widely used segments. Metabolic complications of the urinary diversions include intestinal malabsorption syndrome, bladder stones, chronic diarrhea, and stones in the urinary diversion. The most important etiopathogenic factor for the formation of stones is urinary stasis that is promoted by intestinal mucus and urinary infections with chronic colonization by urease-producing bacteria, hypocitraturia, hyperoxaluria, and alkaline pH. Frequency varies from 10-50%. The majority of these patients can be treated through minimally invasive techniques and open extraction is considered when other modalities cannot be safely performed.

Stone formation in the urinary diversions utilizing intestine constitutes a long-term complication of this type of surgical technique when used in oncologic surgeries.

Case presentation

A 65-year-old man was from San Vicente Nayarit and a resident of Zapopan, Jalisco.

He had a past history of intense alcoholism related to beer drinking for 30 years and stated he was a non-smoker. Eighteen years prior he underwent transurethral resection of the bladder with a histopathologic result of T2a muscle-invading urothelial cell carcinoma. Radical cystoprostatectomy with an Indiana pouch was performed at that time.

Illness onset was 3 weeks prior to hospital admission. He had rapid progressive deterioration, asthenia, adynamia, nausea, vomiting, and diarrheic evacuations with no mucus or blood. He presented with progressive dyspnea for 8 days and fever measured 39° on one occasion. He was brought to the emergency department presenting with difficulty breathing and polypnea and so was put on mechanical ventilation. Physical examination of the patient on mechanical ventilation revealed a soft and depresseable abdomen with a surgical scar at the midline, with no signs of peritoneal irritation. A Foley catheter was placed in a stoma with no stenosis and drained 6,000 cc of turbid urine.

Laboratory work-up reported: Hb 15.3 g/dl, Hct 42.8%, leukocytes 27.2, PT 17, PTT 31, glucose 138, urea 437, creatinine 9.9 mg/dl, Na 130 mEq/l, and K 3.17 mEq/l. The patient was managed in the intensive care unit and the nephrology service decided to initiate renal substitution therapy with hemodialysis. Once the patient was stabilized, a noncontrast-enhanced CAT scan was done that revealed stone formation in the neobladder consisting of approximately 18 stones, measuring 5 x 6 cm in diameter (figs. 1 and 2).

When the patient was in good condition the decision was made to perform open stone extraction, given that the stone burden hindered the performance of a minimally invasive procedure (fig. 3).

The approach was carried out at a distance from the stoma to prevent damaging the continence mechanism and all the stones were extracted (figs. 4 and 5).

The patient progressed favorably and was released on the third postoperative day. There were no surgical complications.

Discussion

Urinary diversion techniques are divided into 2 types: the non-continent diversions, which include the Bricker-Wallace II technique, and the continent diversions, which can be orthotopic with anastomosis to the urethra (Hautmann technique) and heterotopic with urine exit through the anus (Mainz II technique) or self-catheterizable (Mainz I technique). The most popular diversion to date is the Bricker diversion. It is made from 15-25 cm of ileum and its popularity is due to its being a relatively easy procedure and to the fewer metabolic changes because it is a shorter segment that does not contain urine. Nevertheless, 10% of the patients with ileal conduits will have metabolic alterations that will require therapy.
Various reservoirs made from ileum segments are used for continent diversions or orthotopic neobladders that include the Hautmann, Studer, and Kock variants. In contrast to the ileal conduits, 40 to 80 cm are used. The ileal segment creates a deposit of low filling pressures capable of containing quantities of urine similar to those of a native bladder. Consequently, urine is in contact with the bowel segment for more time, enabling extensive metabolic exchange. The Mainz and Indiana diversions are examples of ileocolonic diversions.

The ileum and colon are the most commonly utilized bowel segments for bladder substitutions, and the continuous secretory and absorptive function contributes to the origin of these complications.

The duration of contact between urine and intestine, and the segment of the intestine and its length used are factors that determine the nature and grade of the effect on metabolism. The diversion will have immediate changes on metabolism. Complications can occur shortly after the diversion, but in contrast, many complications will only manifest themselves months or years after the surgical procedure.

The prevalence of urolithiasis in patients with urinary diversions varies from 3-43%, depending on the case series. The lithiasis rate is reported at 12.9% in patients with the Indiana pouch vs. 43% in patients with the Kock pouch.

The most important etiopathogenic factor in the formation of stones is urinary stasis, which is promoted by intestinal mucus, urinary infections with chronic colonization by urease-producing bacteria, hypocitraturia, hyperoxaluria, alkaline pH, and exposure to non-absorbable surgical material.

In the majority of patients with urinary diversion, a multitude of bacteria colonize, regardless of type, and the colonization rate ranges from 14-96%. The majority of these patients remain asymptomatic. In one study on the prevalence of asymptomatic bacteriuria in patients with continent diversions, 57% of the patients were positive for Escherichia coli, Enterococcus faecalis, Enterococcus faecium, and Proteus mirabilis. According to their composition, stones can be classified as metabolic or infectious. The majority of the patients have a mixture of both; most are composed of struvite, but studies have reported calcium oxalate, apatite, and calcium phosphate, as well.

Another stone-forming factor in patients with urinary diversions made from bowel segments is metabolic acidosis due to the loss of bicarbonate and reabsorption of urinary solutes such as ammonium, chloride, and hydrogen ions. Acidosis can cause hypercalciuria, inhibiting calcium absorption in the nephron. It also induces hypocitraturia. Metabolic acidosis produces bone demineralization.
through a tamponade mechanism that releases calcium, increasing its excretion. In some parts of the intestine that are exposed to urine, the elements of ammoniac, ammonium, hydrogen, and chloride are also reabsorbed. As a consequence, the presence of an ileocolonic urinary diversion always implies a chronic acid load.

Patients with diminished renal function are at increased risk for metabolic acidosis. Colon segments appear to be more prone to metabolic changes compared with ileal segments. Some authors advocate the use of ileal segments in patients with altered renal function. This hyperchloremic metabolic acidosis is subclinical in almost all cases. However, after a median 1-year follow-up, 10% of the patients with an ileal conduit have been reported to present with clinically important metabolic acidosis. In severe cases, this can result in muscle weakness and bone demineralization.

The clinical manifestations include abdominal pain in the flank, urinary infections, gross hematuria, difficulties in self-catheterization, and alterations of the continence mechanism.

The continent reservoirs usually require open surgery or a percutaneous approach, given that prolonged or repeated instrumentation could damage the continence mechanism and the possible residual fragments could contribute to recurrence.

The therapeutic options include open and endoscopic interventions, depending on the size of the stone. The open technique for lithiasis has a 90-100% success rate and is reserved for large stones that could injure the bowel segment if they were fragmented inside it.

The amount of time it takes complications to appear varies from 6 months to 11 years after the diversion. The mean presentation time for complications is 50 months with a range of 7-100 months.

Recurrence risk is 63% and is attributed to persistent bacteriuria and therefore long-term bacterial prophylaxis is considered.

Catheterization alone cannot evacuate small stone crystals and mucus inside the urinary diversion; both can act as a nest for the formation of stones. Patients with an irrigation protocol were observed to have an overall stone incidence of 7% vs. 43% in those that did not receive irrigations. It is important to completely empty the reservoir of residual urine and scheduled emptying and catheterization is recommended.

Given that many patients remain asymptomatic, periodic studies, plain abdominal film, and ultrasound are advised, as well as abundant liquid intake and periodic reservoir irrigation to eliminate mucus and crystals.

Metabolic studies should be ordered due to the treatment-susceptible metabolic anomalies that can present. Correction of the metabolic alterations is also critical in patient management. In addition to hypovolemia, hypocitraturia must also be attended to with oral supplementation to promote reduced disease recurrence risk. Antibiotic therapy may be indicated in patients with infectious stones, particularly patients with recurring stones.
Conclusions

Neobladder stone formation in patients with urinary diversion is a complication secondary to different factors. The most important one is urinary stasis with the production of mucus and recurrent urinary infections. Metabolic changes caused by the type of diversion and bowel segment utilized must be taken into account.

Rigorous follow-up should be conducted and metabolic studies done in the case of stone recurrence, evaluating the use of prophylactic antibiotic therapy and urinary evacuation with a strict schedule in patients with urinary diversion. The present article described the case of a patient with a continent urinary diversion secondary to radical prostatectomy, who years later, presented with obstructive uropathy.

Ethical responsibilities

Protection of persons and animals. The authors declare that no experiments were performed on humans or animals for this study.

Data confidentiality. The authors declare that no patient data appear in this article.

Right to privacy and informed consent. The authors declare that no patient data appear in this article.

Financial disclosure

No financial support was received in relation to this article.

Conflict of interest

The authors declare that there is no conflict of interest.

References