Minimally invasive bladder lithiasis treatment in the patient with spinal cord injury (SCI)

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ABSTRACT

Introduction: Each year there are 10,000 cases of spinal cord injury (SCI) in the United States. Eighty-two percent of these injuries occur in men and mean age is 26 years, having a great impact on the population in regard to their resulting consequences and complications. Urologic management of these patients is fundamental in avoiding further deterioration of quality of life. Urinary lithiasis is reported in 8% of SCI patients and up to 36% develop bladder lithiasis within the first 8 years after SCI.

Objective: To determine bladder lithiasis prevalence in SCI patients at the Instituto Nacional de Rehabilitación (INR) and to report the surgical clinical experience of minimally invasive extracorporeal lithotripsy treatment.

Materials and methods: The present study is a descriptive study of SCI patients treated in the Urology Service for bladder lithiasis diagnosed by means of simple abdominal radiograph and treated with extracorporeal lithotripsy.

Results: Of the total of 439 SCI patients, 332 (75.6%) were men and 107 (24.4%) were women. Mean age was 25.5 years. Bladder lithiasis incidence was 7.2% (n=32) in the 439 patients. In 314 patients, bladder lithiasis was treated with extracorporeal lithotripsy.
emptying was managed as follows: clean intermittent catheterization \((n=249)\) or permanent bladder catheter \((n=65)\). Bladder lithiasis presented in 12 patients (4.8\%) of the clean catheter group and in 20 patients (26.6\%) of the permanent catheter group. There was statistical significance \((P=0.00001)\) for greater risk of presenting with bladder lithiasis in patients with permanent bladder catheter than in those with clean intermittent catheter. More than 75\% of SCI patients developed lithiasis within the first two years after injury.

**Conclusions:** Bladder lithiasis is more frequent in patients with permanent bladder catheter than in patients with clean intermittent catheter and there is greater bladder lithiasis development within the first two years after SCI.

**Key words:** bladder lithiasis, minimal invasion, spinal cord injury.

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**INTRODUCTION**

Spinal cord injury (SCI) is not rare and occurs predominantly in young men between 18 and 32 years of age. Automobile accidents are the principal cause of more than 50\% of cases and 30-40\% are the result of falls and sports-related injuries. Drug and alcohol abuse are also a factor contributing to more than 40\% of traumatic SCI cases. Congenital, infectious, inflammatory and neoplastic causes of SCI are less frequent.\(^1\^2\)

The consequent loss of the bladder storage and voiding relation in SCI patients can have serious and delicate consequences in regard to their quality of life. Renal deterioration can be avoided with proper urological management. In previous decades kidney failure was the cause of close to 40\% of deaths related to SCI patients.\(^3\^4\)

The main objective in treating these patients is to maintain bladder filling pressure lower than 35-40 cm H\(_2\)O, which is indispensable for keeping the upper urinary tract intact. If intravesical pressure exceeds ureteral pressure \((10-20\, \text{cm H}_2\text{O})\), this leads to vesicoureteral reflux and then consequent hydronephrosis, pyelonephritis, lithiasis or kidney failure, among others, and so must be avoided. The majority of SCI patients present with urological complications directly related to high pressure in the bladder storage phase. \(^3\^4\)

The prevention of upper urinary tract complications in SCI patients can be summed up in three basic principles. \(^2\^3\^4\)

1) Keep bladder storage phase at a pressure under 35-40 cm H\(_2\)O

2) Maintain bladder voiding phase pressure low

3) Keep urine as sterile as possible

Some phases of SCI are temporary in which bladder behavior and activity can vary and therefore it is important to identify and manage them correctly. The initial phase is spinal shock, which lasts for days or weeks during which there is minimal reflex activity below the level of the injury. From the recuperation phase, reflex activity below injury level begins but bladder coordination of filling, storage and voiding remains altered. \(^6\^8\)
SCI patient care is urologically successful when kidney function is preserved, bladder continence is maintained with regular and complete voiding as close to pre-SCI behavior as possible, urinary sterility is maintained as much as possible and not least in importance, when sexual function is preserved.¹,²,³,⁸

In 1833 Curling described the risks of bladder catheterization in SCI patients. Among the many methods for carrying out bladder voiding are: conventional cystostomy which was abandoned due to the elevated number of complications; permanent urinary catheter, perhaps the most well-known and utilized method, especially in non-specialized centers; clean intermittent catheter introduced in 1966 by Guttmann and Frankel that completely changed SCI treatment prognosis; clean intermittent self-catheterization introduced in 1972 by Lapidès that was a breakthrough which greatly reduced upper urinary complications and eliminated complications secondary to permanent catheter use.⁴,⁷,⁸,⁹

Unfortunately, urinary lithiasis presents in 8 - 15% of SCI patients and up to 36% develop bladder lithiasis within the first 8 years after injury. The principal cause is lithiasis secondary to infection from urease-producing bacteria. Immobility after the event, associated with hypercalcemia, is another cause of lithiasis as is long-term or permanent urinary catheter use.⁴,⁶,⁹

**OBJECTIVE**

The objective of the present study was to review and study the clinical-surgical experience of minimally invasive bladder lithiasis treatment together with its prevalence in SCI patients at the Instituto Nacional de Rehabilitación (INR).

**MATERIALS AND METHODS**

A descriptive study of SCI patients managed at the Urology Service of the INR was carried out. Bladder lithiasis was diagnosed by means of simple abdominal X-ray as part of control and surveillance protocol and patients underwent minimally invasive intracorporal lithotripsy between January 2004 and June 2008.

Inclusion criteria were SCI patients in Neurological and Motor Rehabilitation at the INR that presented with bladder lithiasis diagnosed by simple abdominal X-ray and that underwent minimally invasive bladder lithiasis treatment.

Exclusion criteria were SCI patients that did not present with bladder lithiasis, SCI patients diagnosed with bladder lithiasis but that were not managed with permanent urethral catheter or clean intermittent catheter, patients that underwent open surgery for bladder lithiasis treatment and patients with incomplete case records.

Data validation was carried out with descriptive statistics using measures of central tendency, dispersion and proportion. Statistical analysis was completed with chi-square test.

Established treatment for bladder lithiasis management was carried out with the same lithotripsy equipment in all cases. Pneumatic-ballistic lithotripter was used and bars of 2 mm in diameter and 40 cm in length were employed for stone fragmentation.

**RESULTS**

A total of 439 SCI patients were included in the study of which 332 (75%) were men and 107 (25%) were women.
Mean age was 25.5 years. Of the 439 patient total, 32 patients (7.2%) presented with bladder lithiasis. In the clean intermittent catheter group, 12 patients (4.8%) presented with bladder lithiasis and in the permanent catheter group 20 patients (26.6%) presented with bladder lithiasis.

Of the 439 SCI patients, 314 (71%) had one of the two types of bladder voiding modalities included in the study; 249 (79%) had clean intermittent catheter and 65 (21%) had permanent catheter (Image 1).

A total of 202 patients (46%) had SCI at the cervical level, 202 (46%) at the thoracic level and 35 (8%) at the lumbosacral level (Image 2).

Chi-square test demonstrated statistical significance with \( P < 0.01 \) for greater risk of presenting with bladder lithiasis in patients with permanent catheter compared with patients with clean intermittent catheter (Table 1). Close to 75% of patients developed lithiasis during the first 2 years following SCI (Image 3). All 32 patients identified with bladder lithiasis were managed with cystolithotripsy. There were no conversions to open surgery or intraoperative complications and surgery duration was a mean 1 hour. Postoperative complications were hematuria in 6% of patients that was resolved with intermittent bladder washing. Hospital stay ranged from 3-6 days with a mean 4.5 days.

**DISCUSSION AND CONCLUSIONS**

It is of the utmost importance for health personnel to be familiar with the SCI patient and when possible be trained in a clean intermittent catheterization program so that upper urinary tract complications and consequent kidney failure can be avoided.

Thus the premises for adequate bladder functioning in SCI patients must be taken into consideration, creating reservoirs of proper capacity (500-600 mL) that are managed at a low pressure and avoiding detrusor contractions as far as possible. Care must also be taken to provide adequate bladder voiding with little residual urine and low pressure. Urinary continence and sexual function should also be managed with equal importance.

In the present study bladder lithiasis presented more frequently in patients with permanent catheter than in those with clean intermittent catheter, concuring with reports in the international literature.

There is a higher risk for developing bladder lithiasis during the first 2 years following SCI. Patients with high SCI are more likely to develop bladder lithiasis as well as other urological complications. Cystolithotripsy is a procedure with very low morbidity and mortality, a wide safety range and short hospital stay. Complete stone extraction is achieved and it is considered to be the treatment of choice in SCI patients presenting with bladder lithiasis at the Instituto Nacional de Rehabilitación.
BIBLIOGRAFÍA