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Management of FUS and Recurrent Urethral Obstruction

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Summary

Feline Urologic Syndrome (FUS) is a clinical diagnosis characterized by urethral obstruction in some male cats and dysuria with or without hematuria in both sexes. FUS may be chronic and symptomatic therapy may not totally resolve the signs. This paper reviews the medical management of FUS and the preferred prophylactic surgical treatment for recurrent urethral obstruction. Perineal urethrostomy is a prophylactic treatment for male cats with recurrent urethral obstruction. The object of this surgery is to remove the narrow penile urethra which is the site of most urethral obstructions. This decreases the chance of acute postrenal uremia but does not affect the underlying process and formation of the obstructing material. This technique first described by Wilson and Harrison in 1971, utilizes the penile urethra sutured to the skin to reduce urine scald to the skin in the perineal region.1,4

Introduction

Feline urologic syndrome occurs in both sexes but the narrow penile urethra predisposes to urethral obstruction in the male cat.1,3,5 No breed predisposition or inheritance factors have been proven to cause FUS. The syndrome appears to have an age predilection. It is infrequently seen in cats less than one year old. The highest incidence occurs in young adult cats on to three years of age. After three years of age the incidence diminishes in frequency. Heavier cats tend to have a higher risk of FUS.3

Many factors are incriminated as the cause or contributing factor in the feline urologic syndrome.3 The role of specific causes and the interrelation of most factors are unproved in most instances. Several predisposing factors or causes may be responsible for Feline Urologic Syndrome. These factors include bacterial infection, viral infection, struvite crystalluria, dry cat foods, stress, urine retention, decreased water intake, alkaline urine, high ash diets, high magnesium-low calcium diets, bladder trauma and castration.5

Struvite crystalluria is not an abnormal finding, as it is common in the urine of normal cats. However, struvite crystals are the major component of the urethral plug in obstructed male cats. This mineral material composed of magnesium ammonium phosphate is usually in the form of an unorganized matrix of crystals which conforms to the shape of the urethra. Struvite is not in an organized composition like urinary calculi or uroliths.

Diet, urine pH and mucoprotein matrix influence the formation of alkaline urine. Struvite crystals are generally observed in alkaline urine of obstructed cats with a urine pH of 6.8 or higher. Bacterial infection often modifies urine pH as the end products of the metabolism or urea splitting organisms may cause alkaline urine.

High ash diets and high magnesium-low calcium diets are claimed to cause FUS but there is little experimental evidence to prove this theory.3 Decreased urine volume and dry cat foods increase struvite crystallization as greater ion concentration occurs.

Routine aerobic culture for isolation of bacteria is usually negative indicating that the bacteria are present in low numbers probably as contaminants or secondary invaders. The potential for bacterial growth increases with urine retention and urinary mucosal injury. Bacterial urinary tract infection may predispose to reobstruction.

The theory of a viral cause of FUS is unproved. FUS has been experimentally created with picorna virus, herpes virus and...
syncytium virus. The relationship between the FUS and viral types is vague. It has been theorized that the picorna virus triggers the infection and that the other viruses are responsible for the obstruction. Syncytium forming virus hinders the isolation and identity of the other viruses that may be present and have a role in causing FUS. A herpes virus serotype has been isolated from FUS and has experimentally shown a tendency to form intracellular and extracellular mineral crystals.³

Case Report
An 18-month old castrated male cat was admitted to the Iowa State University Small Animal Clinic with a presenting complaint of anorexia, dysuria and hematuria during the last two days. The cat had a previous history of FUS and repeated urethral obstruction during the previous nine months. The most recent urethral obstruction occurred 6 weeks prior to admittance.

On clinical exam the depressed cat had a temperature of 101.8, pulse rate of 185 and respiration rate of 76. On abdominal palpation a hard distended urinary bladder was palpated. The cat had been frequently licking his prepuce and had shown signs of straining and unsuccessful attempts to urinate during the previous 2 days.

The case was treated as an emergency condition. With the help of general anesthesia the urethral obstruction was relieved, and the bladder catheterized. 150 ml lactated Ringers solution was administered intravenously to correct water, electrolyte and acid base changes. A blood sample was submitted to clinical pathology for analysis. A urine sample was submitted for bacterial culture and sensitivity. Antibiotic therapy was started using 10 mg/# polyflex BID. Surgery was scheduled for the following afternoon.

The returned blood analysis confirmed a slightly elevated BUN:

<table>
<thead>
<tr>
<th>Test</th>
<th>Result</th>
<th>Units</th>
<th>Normal Range</th>
<th>Low</th>
<th>Normal</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urea Nitrogen</td>
<td>92</td>
<td>mg/Dl</td>
<td>10–30 mg/Dl</td>
<td>(---)</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Glucose</td>
<td>126</td>
<td>mg/Dl</td>
<td>50–120 mg/Dl</td>
<td>(---)</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Albumin</td>
<td>5.2</td>
<td>gm/Dl</td>
<td>1.9–3.8 gm/Dl</td>
<td>(---)</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>SGPT</td>
<td>25.1</td>
<td>IU/L</td>
<td>1.0–60.0 IU/Dl</td>
<td>(---)</td>
<td>(X)</td>
<td></td>
</tr>
<tr>
<td>Alkaline phosphatase</td>
<td>14.3</td>
<td>IU/L</td>
<td>5.0–40 IU/L</td>
<td>(X)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Bacteriology laboratory results showed the presence of E. coli resistant to ampicillin but sensitive to cephaloridine, chloramphenical, gentamycin, streptomycin, sulfa, tetracyclines and tribrissen.

The perineal urethrostomy surgery was completed the following day without complications. The post-op medical treatment of the cystitis was changed to tribrissen 100mg BID in response to the bacteriology sensitivity report. The cat responded well to the antibiotic and surgical therapy. No post-operative strictures or complications occurred. The sutures were removed 10 days post-op and the cat was released from the clinic.

Discussion: Medical Treatment of FUS
In the cat where the urethra is not obstructed there may be few signs of illness on physical examination. Dysuria usually with hematuria may be the only signs. The body temperature is usually normal. The bladder is often empty as the cat frequently voids its urine.⁶

Cats with dysuria without urethral obstruction should have urinalysis and urine culture/sensitivity tests performed. While waiting for culture and sensitivity results, the cat is discharged with therapy to (1) decrease smooth muscle spasms and discomfort, (2) minimize formation of crystals that may irritate the bladder, and (3) resolve urinary tract bacterial infection.⁶

Parasympatholytic drugs (atropine, scopolamine, hyoscyamine) may be used as antispasmotics at a dose of 0.25 mg BID. The owner is advised of the side effects of these drugs, including mydriasis, constipation and decreased saliva secretion that causes licking.

About 1.0 gm of salt is given each day to increase urine volume. Increased urine volume decreases the likelihood of crystal formation by decreasing the solvent: solute ratio of these salts likely to form crystals.
Most cats with FUS have alkaline urine. In cases where the urine pH is above 6.8 urine acidifiers are indicated. An initial dose of 100 mg bid of D,L-methionine is given with subsequent dose adjustments to obtain the urine pH desired.

Sulfonamides or chloramphenicol are administered orally until urine bacterial cultures and sensitivity are available. Sensitivity results are used to make appropriate choices of antibiotics. In the absence of significant bacteriuria, continued antibiotic therapy cannot be justified.

The client should be informed that FUS may be chronic and that the symptomatic therapy may not resolve the signs. Owners of male cats are warned about the signs and consequences of urethral obstruction. The owner should provide plenty of clean, cold water for the cat and a balanced diet.

Urethral obstruction is an emergency condition. The duration of time between urethral obstruction and signs of severe illness is variable. The variation is related to the bladder capacity and the degree of trauma to the bladder mucosa. Severe bladder trauma occurs from distention and altered vascular perfusion. With damage, components of urine are reabsorbed into the blood increasing the severity of the condition. Obstruction lasting 72 hours is usually fatal unless emergency therapy is given.

The severity of alterations present in the obstructed cat when first examined is variable. Cases presented to the veterinarian can be expected to span the spectrum between normal and severe illness. The body temperature may be normal to subnormal. Ultimately, urethral obstruction causes dehydration (5 to 10 percent), hyperkalemia, metabolic acidosis, hypocalcemia, hyperphosphatemia, mild hyponatremia, azotemia and hypothermia. Mild hyponatremia may be related to vomiting. Acidosis, hyperkalemia, azotemia and hyperphosphatemia are consequences of anuria. The moderate hypocalcemia is probably related to hyperphosphatemia. The obstructed cat may appear normal or depressed. Often the penis is swollen or discolored as the plug may occur near the tip. On abdominal palpation of obstructed male cats the bladder is usually hard and distended with urine. This is diagnostic for obstruction.

The first consideration in treatment is to reverse the life threatening conditions of severe dehydration, metabolic acidosis, hyperkalemia and azotemia. Treatment for the urethral obstruction includes (1) removal of the obstruction, (2) short term maintenance of urethral patency, (3) correction of water, electrolyte and acid-base changes, (4) maintenance of body temperature and nutrition, and (5) long term prophylactic measures.

Relieving the obstruction and fluid therapy will usually reverse the life threatening conditions. When removing the obstruction use clean procedures with sterile equipment. Minimize trauma to the penis, urethra and urinary bladder to prevent cystitis and stricture formation.

Anesthesia may be required to remove the obstruction. The moribund cat may require no restraint; the alert cantankerous cat usually requires general anesthesia. Atropine and an ultra-short IV barbituate may be used. Halothane and nitrous oxide induced and maintained via facemask is preferred. Although ketamine is popular for this purpose, the drug is excreted via the urine and its effect may be prolonged in animals with renal dysfunction. Epidural anesthesia can be induced with 1 to 1.5 ml of 2% lidocaine injected at the lumbosacral junction.

To remove the obstruction the penis is gently extruded and the tip rolled between the thumb and forefinger in an attempt to dislodge the debris at the tip. If this fails, attempts are made to remove the obstruction by back flushing with an open-ended sterile tom cat catheter using sterile saline.

The tom cat catheter is coated with sterile lubricant and inserted into the urethra while the penis is grasped and gently extruded. After the obstruction is encountered, sterile saline is injected. The saline is allowed to flow around the catheter to the outside flushing obstructing particles with the saline. If this doesn't work to remove the debris, the penis is held more tightly to prevent reflux of the saline. On injection the saline solution exerts pressure on the obstruction, probably dilates the urethra and allows passage of both debris and the catheter into the bladder. Sterile saline should be repeatedly flushed into the bladder and recovered until the returning solution is clear. The catheter prevents
repeated obstruction and subsequent trauma to the urethra and penis during attempts to relieve the obstruction. The extruding catheter end is dried and wrapped with ¼ inch adhesive tape and sutured to the prepuce to hold it in place. While the catheter is in place, the bladder is palpated a few times daily to make sure the catheter is not blocked. If the catheter is blocked, it can be readily flushed.

Hydration, serum potassium concentration and acid base status are the most significant imbalances in cases of life threatening FUS. A significant decrease in hyperkalemia occurs by relief of the obstruction and administration of multiple electrolyte solution to correct water and acid-base deficiencies. The degree of dehydration is estimated and intravenous administration of warmed lactated Ringers solution is started. The complete hydration deficit should be administered during one hour. Thereafter daily maintenance requirements are given via subcutaneous injection. Fluid requirements in the azotemic cat after relief of obstruction may be large because an osmotic diuresis is associated with renal excretion of urea and other nitrogenous wastes. Acute renal damage associated with obstruction may also impair the cat's ability to concentrate urine.

Cats with FUS that are extremely ill frequently are hypothermic. Fluids used to treat the cat should be warmed prior to use. The hypothermic cat should be placed on a heating pad and attempts to maintain normal body temperature should last about twenty four hours following relief of the obstruction.

Response to therapy is routinely evaluated by clinical observation and evaluation of Blood Urea Nitrogen concentration. BUN in cats with FUS may be used to determine if hyperkalemia persists. If post-therapy BUN values are markedly decreased, it is likely that serum potassium concentration is normal.

Recommendations to prevent recurrence of urethral obstruction include: (1) use of salt (¼ to 1 tsp. per day in the diet) for the life of the patient to induce water intake and increase urine output; (2) free access to clean cold water; (3) use of D. L. methionine as a urine acidifier in those cats in which acid urine is not produced. The objective of dietary management in cats predisposed to forming urinary obstructions in FUS is to reduce the necessary raw materials by restricting minerals, particularly phosphorus and magnesium in the diet. By keeping the ash content below 5% (dry basis) reobstructions can be kept to a minimum.

Surgery is contraindicated during the severe illness associated with the urethral obstruction. Since some cats have but one episode of obstruction and since the incidence of urethral obstruction decreases with age, medical treatment is probably best during the initial syndrome. If recurrent obstruction or penile urethral stenosis occurs following removal of the catheter, surgery may be considered as a prophylactic treatment for FUS.

The most satisfying surgery technique for recurrent FUS is perineal urethrostomy. The object of this surgery is to remove the narrow penile urethra which is the site of most obstructions. The remaining wide pelvic urethra is sutured to the perineal skin and first intention healing occurs. Therefore, the chance of granulation tissue forming with subsequent strictures is reduced and the wide urethral opening is maintained. The cat urinates in the normal position and due to the size of the pelvic urethra, urinary calculi are easily eliminated. The penile urethra is also utilized as a drain-board so that the incidence of urine scald is reduced.

Surgical Technique of Perineal Urethrostomy

General anesthesia is required for surgical preparation and surgery. 100-150ml lactated Ringers solution is given intravenously during the operation to promote diuresis. The hair on the perineum and external genitalia is clipped and the area is surgically scrubbed. A purse string suture is placed in the anus to eliminate fecal contamination of the surgical field. The cat is placed in ventral recumbency with the perineum elevated about 30 degrees. The surgical site is then draped.

A) An elliptical incision is made around the prepuce and scrotum. The dorsal apex of the incision should lie 3 to 4 mm ventral to the anus on the midline. The elliptical piece of skin is dissected to free the scrotum and prepuce from the penis. Blood vessels supplying the penis, prepuce and scrotum are ligated. If the cat has not been castrated, castration is performed at this stage.

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B) The penis is isolated and blunt dissection of connective tissue is used to expose the ischiocavernosus muscles which are usually covered with fat.

C) A closed mosquito forceps is inserted beneath the ischiocavernosus muscle and carefully opened to free the muscle. The forceps are then clamped in the middle of the muscle.

D) The penis is reflected at a 45-degree angle, the clamps removed and the contralateral ischiocavernosus muscle is transected with scissors parallel to the pelvic floor to avoid cutting the pelvic urethra.

E) The penis, free of its muscular attachments, is reflected dorsally and the ligamentous attachment to the symphysis pubis is carefully incised with scissors. This frees the penis and pelvic urethra from all ventral attachments.

F) Traction is applied to the penis in a ventral anterior direction until the bulbourethral glands are well exposed.

G) A disposable sterile tomcat catheter is passed into the penile urethra and on into the bladder. The retractor penile muscle is carefully dissected from the urethral surface of the penis towards its origin in the area of the bulbourethral glands. The muscle is transected and discarded exposing the penile urethra.

H) The penile urethra is incised on the dorsal midline with a no. 10 Bard Parker blade or a small blunt scissors.

I) After the urethra has been entered, the incision is extended with a small sharp-sharp iris scissors until the incision opens the pelvic urethra cranial to the bulbourethral glands. The incision must extend into the pelvic urethra which is at least 4.0 mm in diameter. If the incision is not carried to the wide pelvic urethra, a portion of the narrow penile urethra will be a potential site of obstruction.

J) The pelvic and penile urethral mucosa are sutured to the perineal skin with monofilament non-absorbable sutures. These sutures pull the pelvic urethra posteriorly and produce the maximal urethral orifice. The 3rd and 4th sutures are placed lateral to sutures 1 and 2 with traction to evenly and totally appose the urethral mucosa to the skin edge. The area in which it is most important to obtain apposition is at the dorsal apex of the incision. If this area is not properly apposed, a suture at the dorsal apex will accomplish this. The two most important points on the suture technique are to pick up only the urethral mucosa and appose it to the skin; and second, not to leave any defects at the union of the skin and mucosa.

K) The remainder of the urethral mucosa is sutured to the perineal skin with simple interrupted sutures for one-half to two-thirds the length of the penis. A mattress suture is placed across the penis and tied proximal to where the penis will be amputated. This will control hemorrhage from the cavernous tissue. The last two sutures are placed 45 degrees to the midline at the ventral end of the flap to widen the urethrostomy fistula.

The bladder which should contain urine from the fluid administration during surgery is expressed to show the patency of the opening and to clear debris that may be present in the bladder and urethra.

Post-operative treatment should include appropriate medication for control of cystitis. A protective ointment such as zinc oxide, furacin, or vaseline is applied to the surgical site for the first week. The sutures are removed 10 to 14 days following surgery. During the first and second post-operative days, manual expression of the bladder two to three times a day may be necessary. Since the cat will lick at the surgery site, an Elizabethan collar should be used.

References