

## Intravesical oxybutinin chloride in children with intermittent catheterization: sonographic findings

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**Abstract.** The sonographic findings in the bladder are presented in four children with myelomeningocele and neurogenic dysfunction of the bladder, who were treated with intermittent self-catheterization and intravesical oxybutinin chloride. All were referred for routine sonography of the urinary tract. Each had infused a crushed tablet of oxybutinin chloride intravesically 30–120 min before the examination. In two children, brightly echogenic, non-shadowing particles were suspended in the bladder urine. In one of these, the particles swirled giving the impression of a “snowstorm”; in the other, most of the particles gradually settled forming an irregular clump on the bladder base. In the remaining two children, the urine appeared diffusely hazy with innumerable tiny particles giving the impression of a fine mist filling the bladder. The sonographic appearance of the urine in the bladder after intravesical instillation of crushed tablets can be dramatic and can simulate pus, blood, fungus, or other debris in the bladder lumen. In the absence of clinical symptoms or hematuria, a history of recent infusion of medication into the bladder should be sought.

The sonographic findings in the bladder are presented in four children with myelomeningocele and neurogenic dysfunction of the bladder who were being treated with intermittent self-catheterization (ISC) and intravesical oxybutinin chloride (Ditropan, Marion Laboratories, Kansas City, Mo).

### Case reports

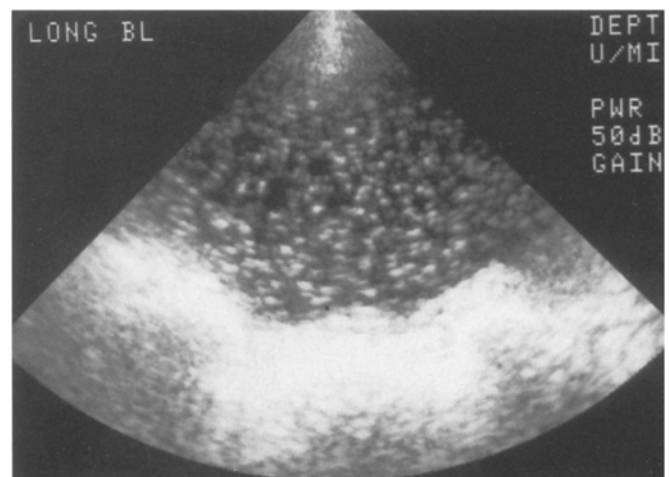
#### Case 1

A boy with a lumbosacral lipomyelomeningocele and neurogenic dysfunction of the bladder had been treated with ISC and daily gentamicin irrigation of his bladder. At 5 years of age, intravesical oxybutinin chloride (2.5 mg b.i.d.) was prescribed. During routine so-

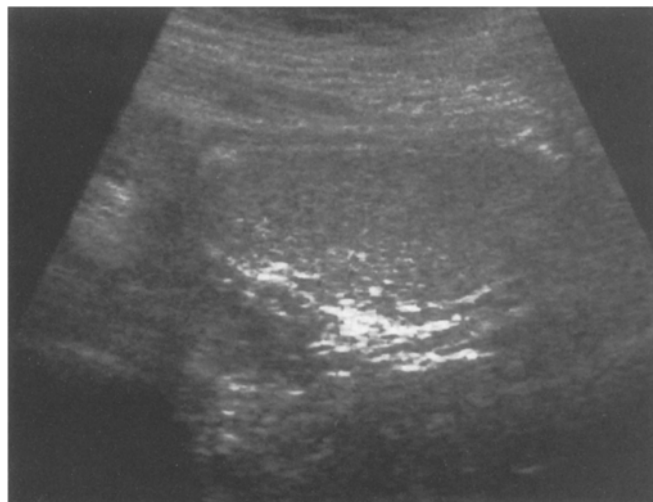
nography (at age 6 years), innumerable brightly echogenic non-shadowing 1 to 2-mm particles were visible suspended within the bladder urine. (Fig. 1) The particles swirled, giving the impression of a “snowstorm”. Approximately 1 h earlier his mother had crushed a 5-mg tablet of oxybutinin chloride against her kitchen counter with a spoon. She scooped the crushed tablet into a syringe containing gentamicin solution and infused it into his bladder through the catheter. The boy was asymptomatic and urinalysis showed only occasional red and white blood cells and a few bacteria.

#### Case 2

A girl with a lumbar myelomeningocele and neurogenic dysfunction of the bladder had been treated with ISC. At 5 years of age she was put on a regimen of intravesical oxybutinin chloride (5 mg t.i.d.). On two successive ultrasound examinations the bladder was filled with non-shadowing, echogenic particulate material. On one sonogram (at age 6.5 years) innumerable tiny particles were seen



**Fig. 1.** US of bladder, longitudinal view, in a 6-year-old boy with neurogenic dysfunction due to myelomeningocele (case 1). Approximately 1 h earlier his mother had infused a crushed 5 mg tablet of oxybutinin chloride into his bladder. Innumerable brightly echogenic, non-shadowing 1–2 mm particles are suspended in the bladder urine. The particles swirled giving the impression of a “snowstorm”



**Fig. 2.** US of the bladder, longitudinal view, in a 6.5-year-old girl with neurogenic dysfunction due to myelomeningocele (case 2). Just before the examination her mother had infused oxybutinin chloride into her bladder. Innumerable tiny particles are suspended in the urine in the bladder resulting in a misty appearance with the largest particles settling along the bladder base

suspended in the urine in the bladder, resulting in a misty appearance with the largest particles settling along the bladder base. (Fig. 2) On the other sonogram (at age 7 years), numerous larger echogenic fragments (1–2 mm in diameter) were seen. The girl was asymptomatic at the time of both studies. The two sonographic appearances corresponded to two different methods that the patient's mother had used for crushing the oxybutinin tablets. She usually prepared an 8-day supply in advance by filling eight 30-ml containers with gentamicin solution and adding a crushed 5-mg tablet to each vial, refrigerating them until use. Just before infusing the medication into her child's bladder, she shook the vial several times producing a suspension of very fine particles. Alternatively, when she ran out of her pre-made supply, she crushed a 5-mg tablet of oxybutinin chloride between two spoons and added the fragments to a syringe containing the gentamicin solution that she then infused into the child's bladder.

### Case 3

A girl had a low lumbar myelomeningocele and hydromyelia with a lumbar intraspinal dermoid that had been repaired in infancy. At 4 years of age she was put on a regimen of intravesical oxybutinin chloride (5 mg b. i. d.). During routine sonography at 6 years of age innumerable tiny non-shadowing echogenic particles were visible suspended within the urine in her bladder, producing a hazy appearance. With the patient supine, the particles appeared to slowly settle into a clump on the bladder base. She was asymptomatic and urinalysis was negative. Two hours earlier she had received an intravesical dose of oxybutinin chloride. Her mother had used a commercial pill crusher to grind a 5-mg tablet of oxybutinin chloride to a powdery consistency and then mixed the powdered medication in a gentamicin solution and waited approximately 2 min before infusing the suspension into the child's bladder.

### Case 4

A boy was born with a lumbosacral myelomeningocele that was repaired when he was 2 days old. At 4 years of age, intravesical oxybutinin chloride (5 mg t. i. d.) was prescribed. During routine follow-up sonography at 6 years of age, the urine in his bladder appeared diffusely cloudy like a fine mist filling the bladder. Several hours before the examination his mother had given him an intravesical dose of oxybutinin chloride. She prepared the medication by crushing a 5-mg tablet between two spoons and then added the crushed tablet to a syringe containing a gentamicin solution. The child was asymptomatic, and urinalysis was normal apart from showing occasional white blood cells.

## Discussion

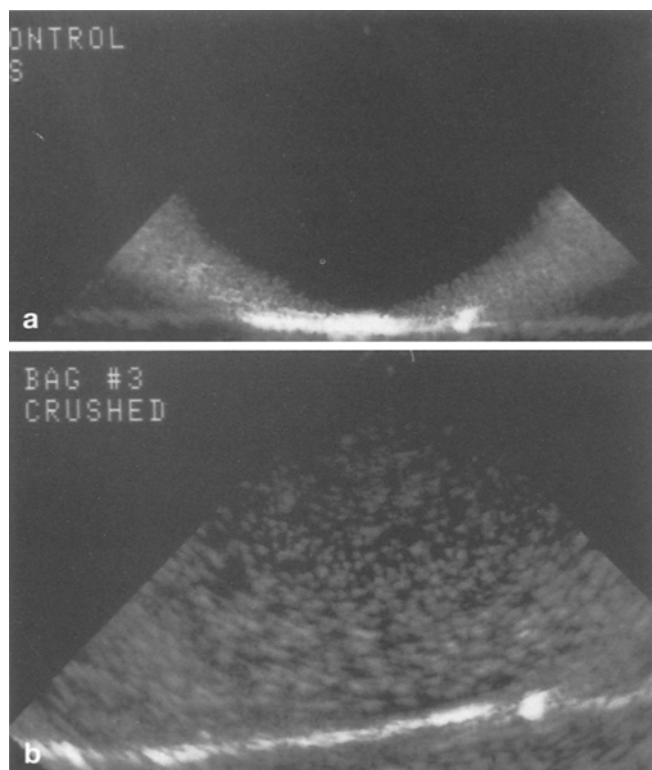
Oxybutinin chloride is frequently used for treating children with myelomeningocele and neurogenic dysfunction of the bladder [1–5]. The mechanism of action of oxybutinin is through a direct antispasmodic effect on the detrusor muscle, and inhibition of the muscarinic action of acetylcholine on smooth muscle. The result is a lowering of the intravesical filling pressure.

When administered orally, oxybutinin is usually very effective, although variation in the rate of its absorption may reduce its effectiveness [4]. Anticholinergic side ef-

**Table 1.** Visual appearances of suspensions of tablets of oxybutinin chloride in sterile water using different methods of fragmenting the tablet

| Time   | Whole tablet   | Tablet split in half   | Tablet crushed between spoons   | Tablet pounded on wax paper  |
|--------|--|--|---|--|
| 0 min  | Whole tablet unchanged   | Two halves of tablet unchanged   | Multiple particles of non-uniform size settled on bottom                                | Multiple very fine particles suspended with larger particles settled on bottom   |
| 5 min  | Some fine particles suspended with tablet still identified   | Some fine particles suspended with dusting on bottom; larger particles settled on bottom                             | Some fine particles suspended with dusting on bottom; some suspended particles clumping | Some fine particles suspended with dusting on bottom; some suspended particles clumping                                |
| 15 min | Some fine particles suspended with dusting on bottom; small particles floating on surface and clinging to sides of container | Uniform fine particles with dusting on bottom; fine particles floating on surface and clinging to sides of container | No further change   | Non-uniform fine particles suspended with dusting on bottom; small particles floating on surface and clinging to sides |
| 30 min | No further change  | No further change  | No further change   | No further change  |

One 5 mg tablet of oxybutinin chloride was suspended in 10 ml of tap water at room temperature in a 30-ml vial in each experiment. Each suspension was agitated for 3 s at 0, 5, 15, and 30 min



**Fig. 3a, b.** Sonographic appearance of sterile water before and after suspension of a crushed tablet of oxybutinin chloride. **a** Sterile water; **b** sterile water 5 min after introduction of crushed tablet

fects are also very common (in 40–80 % of cases), and frequently prompt either decreased dosing or discontinuation of the medication altogether [5]. Oxybutinin may be administered intravesically in children on ISC for whom the drug has not proved to be acceptable when given orally [1, 2, 4]. Intravesical oxybutinin is clinically effective and is associated with fewer side effects. A specific formulation of oxybutinin designed for intravesical use does not exist. Liquid preparations of oxybutinin are not used intravesically because they contain glucose and may promote bacterial growth [2]. Therefore, most parents are instructed to suspend crushed oxybutinin tablets in saline for instillation into their child's bladder.

Alterations in the sonographic appearance of the urine in the bladder have been observed after intravesical instillation of crushed tablets. Differences in the appearance probably depend upon the size and number of the particles, and may correspond to the method used by

the patient (or the patient's parent) for crushing the tablets (Table 1). When the tablets are broken into larger pieces, brightly echogenic, non-shadowing particles of varying sizes are seen suspended in the bladder urine (Fig. 1). The particles can swirl, giving the impression of a "snowstorm", or can gradually settle to form an irregular clump on the bladder base. When the tablets are pulverized, the urine appears diffusely hazy with innumerable tiny particles, giving the impression of a fine mist filling the bladder (Fig. 2). Although some of the medication may become dissolved in urine, much is actually suspended rather than dissolved. When tablets of oxybutinin chloride are suspended in water, a large amount of particulate material can be demonstrated sonographically (Table 1, Fig. 3).

To our knowledge there have been no previous reports of the sonographic appearance of the urine in the bladders of children who have been treated with intravesical medications. The appearance of suspended oxybutinin particles can be dramatic and can simulate pus [6–7], blood, fungus [8], or other debris in the bladder lumen. When echogenic debris is visible in the bladder of a child who is on ISC, and there are no clinical symptoms of acute urinary infection or hematuria, a history of recent infusion of medication into the bladder should be sought.

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