



Inflammation and infection

Intravesical acetic acid in combination with prophylactic methenamine and ascorbic acid to decrease the incidence of recurrent urinary tract infections associated with intermittent urinary self-catherization: A case report

Barbara Henick Bachow



ABSTRACT

A case is presented demonstrating improved efficacy of the use of oral methenamine hippurate and vitamin C urinary tract infection prophylaxis achieved by adding self-administered acetic acid irrigation twice daily during routine intermittent bladder self-catheterization in a post-menopausal female patient with multiple sclerosis.

The patient in this case report is me, a retired radiologist.

Introduction

Recurrent urinary tract infection in susceptible patient populations is difficult to treat over the long term. It is common in patients who perform intermittent urinary self-catheterization, where intracystic inoculation of bacteria is difficult to avoid.

Most commonly isolated urinary pathogens in a cohort of patients studied¹ is *Escherichia coli*, followed by *Klebsiella*, *Staphylococcus aureus*, *Pseudomonas*, *Serratia*, *Enterobacter* and *Streptococcus*. The more resistant bacterial strains were found to be sensitive to intravenous antibiotics only. In that study, two strains of *E.coli* and one of *Klebsiella* were found to be resistant to all antibiotics tested, and treatment of infection in these patients was a therapeutic dilemma.

As recurrent UTIs require suppressive therapy to improve quality of life and minimize complications including pyelonephritis, renal impairment and sepsis, low-dose antibiotic prophylaxis has been a mainstay.

Oral administration of methenamine salts has been found to be useful for prevention of UTIs by sterilizing the urine without the use of antibiotics² to avoid selection of antibiotic-resistant infection. When excreted in an acidic urine formaldehyde is formed. The recommended dose is 1 gm methenamine hippurate po bid. Although oral methenamine alone results in some urinary acidification, ascorbic acid 1 gm po bid is added for augmentation.

Patient information

The patient is a 68 year old, post-menopausal woman with a 20 year history of multiple sclerosis. Fifteen years ago the patient began

practicing intermittent bladder self-catheterization because of urinary retention. Symptomatic bladder infections occurred bimonthly with pyuria and >100,000 colonies of bacteria per HPF in catheter specimens.

Prophylactic low-dose daily nitrofurantoin was initially successful, but after several months became ineffective with pan-sensitive *E. coli* and *Klebsiella* infections.

Prophylaxis with low dose oral trimethoprim/sulfamethoxazole was initiated which failed after several months with resistant *E. coli* species. This was followed by cephalexin suppression, which failed after several months resulting in pyelonephritis, with dysuria, back pain, fever and leukocytosis. Urine culture revealed pan-resistant, ESBL *E.coli*, requiring hospital admission and intravenous ertapenem.

UTI suppression with ciprofloxacin and cephuroxime was then attempted, again with only brief success resulting in pan-resistant bacterial infections.

After five years of unsuccessful antibiotic prophylaxis, bladder irrigation with antibiotics^{3,4} was considered, however not elected. Instead, 1 g of oral methenamine hippurate bid accompanied by 1 g of vitamin C for urine acidification was prescribed resulting in the best outcome to date, with bacterial cystitis every 4–5 months sensitive to oral antibiotics. The patient checked urine pH regularly which was acidic at 6.0–6.5, likely explaining the increased success, although urinary pH no higher than 5.5 is optimal for formaldehyde production. The patient sought a more dependable approach to urinary acidification to further decrease infection.

E-mail address: bhbachow@gmail.com.

<https://doi.org/10.1016/j.eucr.2020.101531>

Received 23 November 2020; Received in revised form 7 December 2020; Accepted 9 December 2020

Available online 11 December 2020

2214-4420/© 2020 The Author.

Published by Elsevier Inc.

This is an open access article under the CC BY-NC-ND license

(<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Daily bladder irrigation with acetic acid was investigated

Bladder irrigation with a 0.25% solution of white vinegar is suggested for children on intermittent catheterization with chronic bacteriuria and/or stones.⁵ Although vinegar irrigation alone appears to decrease bacteriuria, this patient suspected that irrigating with vinegar was likely to lower the intravesicular pH, which could enhance successful formation of formaldehyde from methenamine hippurate. She therefore developed a technique for home use.

Therapeutic intervention

A “clean” technique as used for standard intermittent bladder catheterization was chosen. It was designed to be simple for home use, and performed twice a day, at bedtime and upon rising.

Materials

Coloplast, 14 gauge sterile hydrophilic disposable urinary catheter
Benzalkonium antiseptic wipes for pre-catheterization perineal cleansing

BD 60 cc sterile catheter-tip syringe

Sterile 4 ounce specimen cup

2 × 2 sterile gauze pad

5% white table vinegar in quart bottle: one capful measured 5 cc

Approximately 90–100 cc of warm tap water in cup (slightly over 3 oz)

Procedure

1. Wash hands.
2. Pour one capful (5 cc) of white vinegar (5%) into the specimen cup and dilute with just over 3 ounces (90–100 cc) of warm tap water, resulting in an approximately 0.25% vinegar solution.
3. Fill 60 cc syringe with the solution, and pre-lubricate catheter with tap water.
4. Cleanse perineum with BZK wipes, insert water-lubricated catheter, and drain urine
5. Attach syringe filled with dilute vinegar to catheter and inject into bladder
6. Hold fluid in bladder for 30 seconds, then drain through catheter into bowl
7. Remove catheter

A new disposable catheter is used each time. The syringe and the cup are rinsed with hot water. A sterile gauze is placed in the cup and the syringe returned to packaging. The rinsed cup and syringe are re-used, and replaced twice a week.

Occasional testing of urine prior to irrigation assured maintenance of an acidic pH of 5.5.

Results

The patient was free of urinary-tract infection for 8 months, after which a pan-sensitive *E. coli* infection was treated satisfactorily with oral

antibiotics. She continued vinegar irrigation and maintained urinary acidity. Over the following 6 years she was largely infection-free, having two additional culture-positive infections with pan-sensitive *E. coli*. There were neither infections with resistant organisms nor clinical evidence of upper tract infection.

Conclusion

While taking oral methenamine for UTI prophylaxis in a patient performing intermittent bladder self-catheterization, routine vinegar bladder irrigation appeared to dramatically reduced the incidence of infection. When infections did occur, they were caused by organisms without significant resistance profiles. Given my history of potentially life-threatening infections, I believe this technique merits further evaluation for patients performing intermittent bladder self-catheterization.

Discussion

It has been shown that bladder irrigation with 0.25% vinegar decreases bacteriuria, which alone can reduce infection. Results here suggest a greater effect than would be expected with irrigation alone, felt likely due to the increased production of formaldehyde in the urine with oral methenamine salts.

Studies comparing the two modalities and prospective analysis of formaldehyde concentration in the urine could be helpful, as would evaluation of the apparent change of infecting flora from resistant strains to pansensitive organisms.

Note

This case report represents findings in a single patient. Discussions of bladder irrigation with acetic acid¹⁵ recommend the use of sterile saline rather than the tap water used in this case. Assessment of safety of this technique should be determined for the individual patient in consultation with a physician.

References

1. Kidwai Saera Suhail, Nageen Ayesha, Ghaznavi Samina, Bashir Farhat, Ara Jamal. Antibiotic susceptibility in commonly isolated pathogens from urinary tract infection in a cohort of subjects from low socioeconomic strata. *Pak J Med Sci*. 2017 Mar-Apr; 33(2):254–259. [10.12669/pjms.332.11569](https://doi.org/10.12669/pjms.332.11569).
2. Amy Chwa, Kavanagh Kevin, Linnebur Sunny Anne, Fixen Danielle R. Evaluation of methenamine for urinary tract infection prevention in older adults: a review of the evidence, 2042098619876749. *Ther Adv Drug Saf*. 2019;10. <https://doi.org/10.1177/2042098619876749>. Published online 2019 Sep. 23
3. Elizabeth V Dray, Quentin Clemens J. Recurrent urinary tract infections in patients with incomplete bladder emptying: is there a role for intravesical therapy? *Transl Androl Urol*. 2017 Jul;6(Suppl 2):S163–S170. [10.21037/tau.2017.04.08](https://doi.org/10.21037/tau.2017.04.08).
4. Pietropaolo Amelia, Jones Patrick, Moors Mike, Birch Brian, Bhaskar K. Somani Use and effectiveness of antimicrobial intravesical treatment for prophylaxis and treatment of recurrent urinary tract infections (UTIs): a systematic review. Published online 2018 Aug 9 *Curr Urol Rep*. 2018;19(10):78. <https://doi.org/10.1007/s11934-018-0834-8>. PMID: PMC6097067 PMID: 30094687.
5. *Vinegar irrigation bladder protocol for patients on intermittent catheterization with chronic bacteriuria and/or bladder stones*. Gillette Children's Specialty Healthcare; September 2020. <https://www.gillettechildrens.org/?ACT=57&path=pdf-output%2Fvinegar-bladder-irrigation-protocol&size=letter&orientation=portrait&key=print-pdf&attachment=0&compress=1&filename=878.pdf>.