

Increased Knowledge of Safe and Appropriate Penicillin Injection After Viewing Brief Instructional Video Titled "How to Inject Bicillin LA"

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Brief instructional videos have an increasingly important role in clinician education.^{1,2} Because of declines in primary and secondary syphilis incidence in the years from 1990 to 2000, many currently practicing clinicians may not be familiar with the use of penicillin G benzathine injectable suspension.³ Syphilis incidence, however, has increased substantially since 2000, and more clinicians with limited experience in syphilis management are treating patients newly diagnosed with syphilis.^{4,5} The 2006 Centers for Disease Control Sexually Transmitted Disease Treatment Guidelines advise that the early stages of syphilis, including primary, secondary, and early latent, are effectively treated with a 1-time injection of appropriately administered intramuscular penicillin G benzathine 2.4 million units (MU) [Bicillin LA (long-acting) (King Pharmaceuticals, Bristol, TN)].^{6,7}

Given the Centers for Disease Control recommendations regarding the treatment of early syphilis, it is imperative that providers be trained in the indications for, and appropriate use of, intramuscular penicillin G benzathine. Also, reports of inadvertent misuse of Bicillin CR to treat syphilis, suggest a need for improved education regarding the appropriate treatment of early syphilis.⁸ To address this need for clinician education, a 5-minute instructional digital video, "How to Inject Bicillin LA," was produced in partnership between the San Francisco Department of Public Health and King Pharmaceuticals, Inc. The video was designed to be viewed by clinicians with diverse

backgrounds, as the experience of prescribing physicians, may differ significantly from the experience of nurses who administer the injections.

The video addressed a number of topics regarding the safe and appropriate injection of penicillin G benzathine to treat early syphilis. A single dose of Bicillin LA 2.4 million units via deep intramuscular injection is the recommended treatment for adults.⁶ Bicillin LA is available in single use syringes in 1-, 2-, and 4-ml sizes, containing the equivalent of 600,000, 1,200,000, and 2,400,000 units, respectively, of penicillin G benzathine.⁹ The video recommends that the total dose be given in 2 injections, 1 in each buttock. The potential for confusion between Bicillin LA and Bicillin CR is also emphasized, as Bicillin CR is not indicated for the treatment of syphilis.⁸ Bicillin LA is contraindicated in any person with a history of penicillin allergy, as it has been estimated that there is a prevalence of 0.002% fatal and 0.7% to 10% nonfatal anaphylactic reactions to penicillin.¹⁰ Given the risk of allergic reactions, it is recommended that patients be observed for 20 to 30 minutes after injection. There are reports of serious adverse reactions to inadvertent intravascular injection. Therefore, the video demonstrates appropriate intramuscular injection technique.¹¹ The video also describes the potential for fever, headache, and fatigue in the first 24 hours after injection, associated with the Jarisch Herxheimer reaction.⁷

To evaluate whether viewing the video was associated with an increase in syphilis treatment and penicillin G benzathine administration knowledge, we surveyed clinicians attending a STD educational symposium in San Francisco in October 2007. The symposium participants consisted of a diverse group of 164 clinicians, including physicians, nurses, and medical assistants. Before viewing the video, participants self-administered an optional, anonymous, 5 questions multiple-choice pretest evaluation. After viewing the video, the participants were asked to answer the same 5 questions again, as a posttest evaluation. A total of 151 (92%) of the seminar participants completed both the pre- and posttest evaluations. The 5 questions regarding the administration of Bicillin LA for the treatment of syphilis were:

1. The correct treatment for primary, secondary or early syphilis is:

Penicillin VK 250-mg tablets q.i.d. × 14 days
 Penicillin G procaine daily injection × 7 days
 Penicillin G benzathine 1.2 MU/procaine 1.2 MU (Bicillin CR)
 intramuscularly once
 Penicillin G benzathine 2.4 MU (Bicillin LA) intramuscularly once
 Not sure

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Copies of the digital video "How to inject Bicillin LA" may be obtained from the corresponding author.

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2. Penicillin G benzathine should be given:

- Subcutaneously
- Intravenously
- Intramuscularly
- All of the above
- Not sure

3. In adults the preferred location of Penicillin G benzathine administration is:

- The upper deltoid
- The buttock
- The thigh
- Intravenous
- Not sure

4. After penicillin G benzathine administration, patients should be observed:

- 20 to 30 minutes
- Overnight
- 5 minutes
- Up to 6 hours
- Not sure

5. The Jarisch-Herxheimer reaction:

- Includes fever, headache, nausea, fatigue
- Is an allergic reaction to penicillin
- A contraindication to future penicillin
- Lasts 3 to 7 days after treatment
- Not sure

Pretest and posttest results from the 151 participants who completed both parts of the evaluation were compared with McNemar’s χ^2 test for paired subjects.

The proportion of respondents who answered all 5 questions correctly increased from 32% on the pretest to 81% on the posttest evaluation ($P < 0.001$). In addition, there was a statistically significant ($P < 0.001$) increase in the proportion of participants choosing the correct answer in each of the 5 domains after viewing the video (Fig. 1).

There are several limitations to our evaluation. First, because the pre and posttests were administered in an open auditorium setting, there was the potential for discussion between participants. It is possible that shared knowledge and viewing of the video, may have contributed to the improved scores on the posttest. Second, we acknowledge that improved scores on a brief, immediate posttest survey do not necessarily translate into improved clinical skills. Although not all seminar participants completed the pre and posttest evaluations, only 8% declined. We believe this percentage is too small to have significantly biased our results. Finally, we acknowledge that only 81% of participants achieved a perfect score on the posttest evaluation, with the lowest score on the question regarding the Jarisch-Herxheimer reaction. We hope that in the development of future educational materials we would be able to improve these results. Specifically, the way the video presents the Jarisch-Herxheimer reaction, may not be sufficient to describe the reaction to clinicians from diverse backgrounds. In the future we would also hope to evaluate a change in clinical skills after such an educational intervention. However, despite those limitations we feel that our results suggest that this

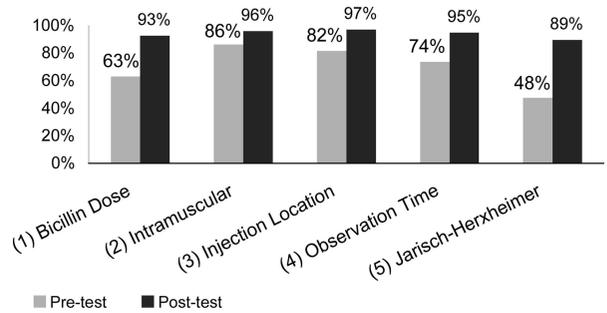


Figure 1. Participants choosing the correct answer by question on the pretest and postevaluation.

instructional video may be an effective format with which to increase knowledge of the proper administration of Bicillin LA. We also believe that the video may have a greater impact or a more general audience. Our audience consisted of a group with significant interest and experience with treating sexually transmitted diseases, and in fact, 32% of the audience got all the questions correct before viewing the video. In a more diverse group, with less general experience in treating syphilis, the effect of the video may have been greater.

In conclusion, viewing of the “How to Inject Bicillin LA” instructional digital video was associated with an immediate and substantial improvement in knowledge regarding treatment of early syphilis and administration of penicillin G benzathine. This digital video may provide an effective means of educating clinicians on the appropriate use and administration of penicillin G benzathine for the treatment of early syphilis.

REFERENCES

1. McMahon GT, Ingelfinger JR, Campion EW. Videos in clinical medicine: a new journal feature. *N Engl J Med* 2006; 354:1635.
2. Lee JC, Boyd R, Stuart P. Randomized controlled trial of an instructional DVD for clinical skills teaching. *Emerg Med Australas* 2007; 19:241–245.
3. Centers for Disease Control and Prevention. Sexually transmitted disease surveillance 2005 supplement, syphilis surveillance report. US Department of Health and Human Services, Centers for Disease Control and Prevention, Atlanta, GA: December, 2006.
4. Zetola NM, Engelman J, Jensen TP, et al. Syphilis in the United States: an update for clinicians with an emphasis on HIV coinfection. *Mayo Clin Proc* 2007; 82:1091–1102.
5. Hook EW III, Peeling RW. Syphilis control—a continuing challenge. *N Engl J Med* 2004; 351:122–124.
6. Smith CA, Kamp M, Olansky S, et al. Benzathine penicillin G in the treatment of syphilis. *Bull World Health Organ* 1956; 15: 1087–1096.
7. Centers for Disease Control and Prevention. Sexually transmitted diseases treatment guidelines, 2006. *MMWR Morb Mortal Wkly Rep* 2006; 55 (RR-11).
8. Centers for Disease Control and Prevention. Inadvertent Use of Bicillin C-R to Treat Syphilis Infection—Los Angeles, California, 1999–2004. *MMWR Morb Mortal Wkly Rep* 2005; 54:217–219.
9. BICILLIN® L-A Prescribing Information. King Pharmaceuticals, 2006. http://www.bicillin.com/pdf/Bicillin_L-A_PI_December_2006.pdf. Accessed September 5, 2008.
10. Neugut AI, Ghatak AT, Miller RL. Anaphylaxis in the United States: an investigation into its epidemiology. *Arch Intern Med* 2001; 161:15–21.
11. Mjahed K, Alaoui SY, Salam S, et al. Acute paraplegia and pulmonary edema after benzathine penicillin injection. *Am J Emerg Med*. 2008; 26:250.e1–e5.