Unit Dose Erythromycin Ophthalmic Ointment for Neonatal Ocular Prophylaxis

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Silver nitrate solution has been used since the 1880s for newborn prophylaxis against *Neisseria gonorrhoeae* ocular infections. Recommendations by the American Academy of Pediatrics and the Centers for Disease Control state that erythromycin and tetracycline ophthalmic products may serve as alternatives to silver nitrate solution. The selection of erythromycin ophthalmic ointment offers the advantage of antimicrobial activity against *Chlamydia trachomatis* and is not associated with the chemical conjunctivitis often seen with silver nitrate solutions. The only commercially available form of erythromycin ophthalmic ointment is a 3.5-gm tube. Repackaging the ointment into tuberculin syringes reduces the cost to the patient and provides the nurse with a more convenient method of administering the ointment to the neonate.

Ophthalmia neonatorum is an acute conjunctivitis in the newborn. This conjunctivitis may be caused by bacterial infection, chlamydial infection, or chemical irritation. While any of the common bacterial conjunctivitis can occur in the neonate, *Neisseria gonorrhoeae* causes the most destructive form of ophthalmia neonatorum which may lead to corneal perforation and blindness. This gonococcal infection, also referred to as gonococcal ophthalmia neonatorum, can be prevented by the instillation of a 1% silver nitrate solution into the eyes of newborns. The bactericidal mechanism action of silver nitrate is thought to be a combination of the silver ion with surface proteins of the microorganism.

Silver Nitrate

For many years, silver nitrate was the only approved prophylactic agent against gonococcal ophthalmia neonatorum. In 1980, the American Academy of Pediatrics and the Centers for Disease Control recommended that 1% silver nitrate solution may be replaced with ophthalmic ointments or solutions containing either 1% tetracycline or 0.5% erythromycin.[1]

While gonococcal ophthalmia neonatorum may lead to ocular damage and possible blindness, a more common cause of ophthalmic neonatorum within the United States is *Chlamydia trachomatis*. The incidence of gonococcal ophthalmia neonatorum is reported as 0.04%.[2] The incidence of chlamydial ophthalmia is estimated to be 0.4%.[3] Neonatal ocular prophylaxis with silver nitrate solution does not appear to prevent chlamydial ocular infections.[4] The adoption of the alternative erythromycin or tetracycline ocular prophylaxis would provide coverage against chlamydia.[5]

In addition to the expanded microbial coverage afforded with the erythromycin or tetracycline ocular prophylaxis, additional reasons exist to consider alternatives to silver nitrate. A major disadvantage of the silver nitrate solution is the high incidence of chemical conjunctivitis that occurs.[6] The chemical conjunctivitis usually is apparent between one to six hours after instillation of the drops. This sterile inflammatory process does not normally last longer than 24 hours and commonly resolves without damage. However, in some instances, this initial inflammatory response may provide an opportunity for further conjunctival problems either from bacteria or the development of a sterile abscess.[7] The importance of this conjunctivitis on early maternal bonding and parenteral eye contact is under investigation by many concerned groups.[8] Although not permanently disfiguring, the silver nitrate solution will also cause temporary bluish-black staining of the skin if the solution comes in contact with the skin. For the above reasons and the awareness of acceptable al-

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Table 1. Comparison of Ophthalmic Anti-infectives for Prophylaxis of Neonatal Conjunctivitis

Anti-infectives	Brand Name (Company)	Dosage Form	Cost*
Silver nitrate	No brand name (several companies)	Solution	$0.32/ml ampule
Tetracycline	Achromycin® (Lederle Lab)	Suspension	$7.32/4-ml bottle
Tetracycline	Achromycin® (Lederle Lab)	Ointment	$4.31/3.5-gm tube
Erythromycin	Ilotycin® (Dista Products)	Ointment	$2.44/3.5-gm tube

* Based upon 1983 Blue Book Average Wholesale Price.

ternatives, many parents have objected to the routine use of silver nitrate for ocular gonococcal prophylaxis.

In an attempt to overcome the incidence of conjunctivitis with silver nitrate solutions, procedures were developed that encouraged the flushing of the conjunctiva with a sterile saline flush immediately after the administration of the silver nitrate solution. When applied and immediately flushed, the efficacy of the silver nitrate is decreased. Therefore, the American Academy of Pediatrics recommends that prophylactic agents should not be rinsed from the eyes.[1]

Other concerns with the silver nitrate solution are specific to the commercial unit dose waxed ampules. The waxed ampules must be opened by pricking the ampule with a metal pin which may introduce contaminants into the solution. Also, the waxed ampule is semirigid and may be difficult to squeeze and direct the drops into the neonate's eye.

Erythromycin Ophthalmic Ointment

In light of the recommendation of the American Academy of Pediatrics and the Centers for Disease Control, the lack of chlamydia coverage by silver nitrate, the incidence of chemical conjunctivitis with silver nitrate, and the difficulties associated with the use of the waxed ampule, many institutions are reexamining the prophylactic agent used. Many newborn nurseries have changed from the use of silver nitrate solution to erythromycin ophthalmic ointment. Erythromycin is the least expensive of the commercially available recommended ophthalmic ointments and suspensions (Table 1). Chemical conjunctivitis has not been associated with the use of erythromycin and erythromycin appears to provide better coverage against chlamydial infections than does tetracycline.[4]

In-service Nursing Education

Lafayette Home Hospital of Lafayette, Indiana, decided to adopt the routine use of erythromycin ophthalmic ointment for all newborns in March 1983. New nursing procedures were developed that described the use of erythromycin ophthalmic ointment in the newborn. An essential feature of the procedure was to use only one ointment tube per neonate. Once the ointment had been administered to both of the infant's eyes, the remainder of the tube was to be discarded. This policy was adopted to minimize chances for contamination of the ointment and possible cross contamination from one neonate to another.

Before the change to the erythromycin ophthalmic ointment, in-service programs were conducted for the nursing staff. The programs stressed the need for ocular prophylaxis, the problems associated with silver nitrate solution, and the proper means of ophthalmic ointment application. Example tubes were used at each meeting to enable the nurses to handle and become more familiar with the ointment and its package.

Currently, the only commercial form of erythromycin ophthalmic ointment is Ilotycin®, available from Dista Products Company. This ophthalmic ointment is available only as a 3.5-gm tube. The use of the 3.5-gm tube as outlined in the procedures is associated with wastage. Two ribbons of ointment approximately 2 cm in length appear adequate to provide the ocular prophylaxis. Therefore, the remainder of the tube is either wasted during the administration procedure or discarded after the procedure. The amount of drug wasted and the higher cost of the erythromycin ointment in comparison to silver nitrate prompted the hospital's pharmacy department to contact the drug company regarding the availability of a unit dose package. The company is extending efforts toward the design and development of such a package. However, it became evident that it would be some time before the product could be marketed. With this in mind, efforts were directed toward repackaging the ophthalmic ointment by the hospital's pharmacy department.

Repackaging

A procedure was developed to repackage erythromycin ophthalmic ointment in a 1-cc tuberculin syringe (Figure 1). The actual repackaging of the ophthalmic ointment is performed within a laminar flow hood. One-cc tuberculin syringes are arranged in the hood and the plunger is removed from the barrel of the syringe. Then the ointment is squeezed from the ointment tube into the lumen of the

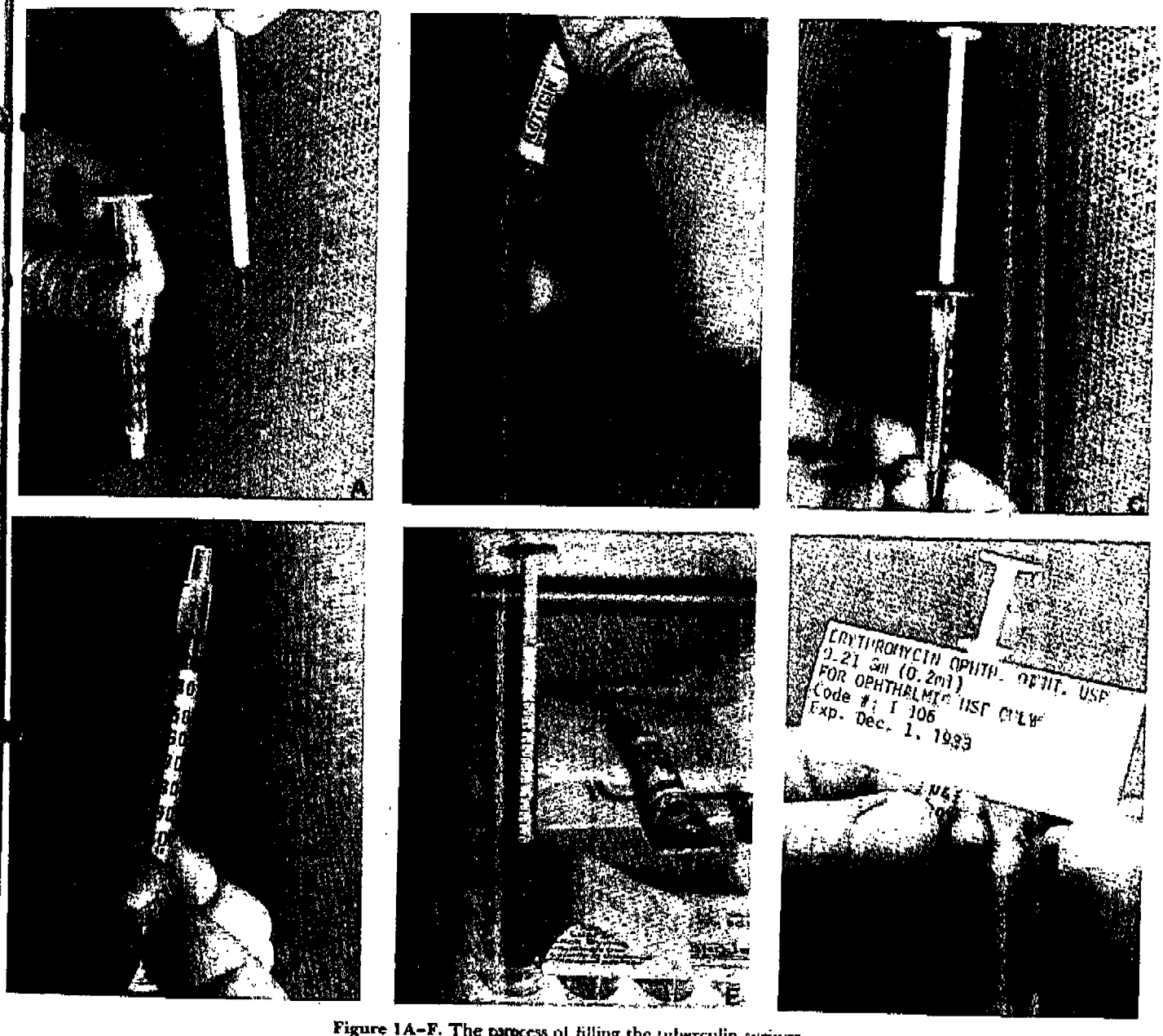

Figure 1A–F. The process of filling the tuberculin syringe

syringe. After instillation of the appropriate amount of ointment, the plunger is replaced within the syringe and the ointment is pushed to the tip end of the syringe. The filled syringe is capped with a sterile tip cap which is firmly placed on the tuberculin syringe. Labels are affixed and the syringes removed from the hood. The repackaged ointment syringes are stored within the pharmacy until requested to be replaced to floor stock by the nursing units.

The volume of ointment within each syringe is approximately 0.2 ml. Our experience indicates that less than 0.1 ml is required for the instillation of the ointment to both eyes of the newborn. In the absence of a standardized dose it was recommended that a ribbon of ointment of at least 15 mm in length be instilled.

Evaluation

Nursing response to the use of the tuberculin syringe-packaged ointment has been positive. New procedures were developed (Table 2; Figure 2) and orientation programs were conducted by the pharmacist using demonstration tuberculin syringes. The nurses have become quite adept at handling the tuberculin syringe and prefer it

Table 2. Instillation of Ointment in a Newborn's Eyes

I. Purpose: Prevention of gonococcal conjunctivitis	
II. Personnel: RN, LPN–Med. Certified.	
III. Equipment: Erythromycin (Ilotycin®) Ointment packaged in tuberculin syringe with sterile leur lock cap.	
IV. Procedure:	Key Points
A. Wash hands immediately prior to administration of the medication.	To prevent contamination.
B. Check medication for RIGHT medication, RIGHT patient, and RIGHT order. Check expiration date on label. If past expiration date, do not use. Return dose to pharmacy.	
C. The ointment may be warmed by placing syringe under the radiant warmer or briefly warming in warm water.	
D. Position baby on back with head flat or slightly tilted back and clean eyes with damp clean softnet.	Be careful not to overextend neck.
E. Use forefinger above eye and thumb below eye and open eye gently by pulling down on skin to expose the conjunctival sac.	Take care not to apply any pressure to the eyeball itself.
F. Depress the plunger to express a thin ribbon of ointment along the conjunctival sac starting at the inner canthus. As you approach the eye's outer canthus, rotate the syringe to help detach the ointment ribbon.	Care should be taken to avoid direct contact to the eye with the syringe.
G. Release the lower lid and gently rotate your finger in a circular motion over the eyelid to disperse the medication.	
H. Use a damp softnet to wipe away any excess medication.	
I. Using the remainder of the ointment in the syringe, repeat the procedure for the untreated eye.	
J. Document the procedure on the newborn record.	
K. Discard the remainder of the medication and syringe.	

over the use of the ophthalmic tube. The administration procedure has become more convenient and associated with less drug wastage.

As the nurses used the repackaged tuberculin syringes, further suggestions were made to make the syringe more convenient. It was found that the ointment would become more semiliquid and flow easier if heated. The ointment-containing syringe could be placed under the radiant heater, held tightly in the hand, or placed in warm water before administration. With any method of heating, care must be exercised to keep the tip on the syringe and maintain sterility. The nurses also discovered that the administration of the ophthalmic ointment was eased by placing a pacifier in the neonate's mouth to distract the infant from the ocular procedure.

The reduction in patient cost has been considerable. Each syringe contains 0.2 ml weighing approximately 0.21 gm. Using this average weight, theoretically, 17 syringes could be packaged from one 3.5-gm tube. Our experience has shown us that practically only 13 syringes can be packaged from one tube. If 13 syringes are filled per tube, the cost of the drug is approximately 19 cents. With the cost of the syringe and the sterile tip cap added, a package is produced that is comparable in price to the silver nitrate previously used.

Questions remain regarding the stability of the erythromycin ointment repackaged into the syringe. There are no biochemical or physical data that would support the reduction of stability of the ointment within the syringe. Since stability studies have not been conducted, an arbitrary six-month in-house expiration date was adopted and a dark storage area is recommended for the packaged syringe. Nurses have been instructed to check the label for the expiration date before using the tuberculin syringes. Any expired syringe is to be returned to pharmacy for credit.

Summary

The change from silver nitrate solution to erythromycin ophthalmic ointment as the routine newborn ocular prophylactic agent has provided many benefits to this institution. Since this decision has been implemented, no reports of newborn gonococcal ophthalmia neonatorum, ocular chlamydial infections, or chemical conjunctivitis have been made. The contributions of the pharmacy department in investigating and implementing a repackaged unit dose form of erythromycin ophthalmic ointment has demonstrated its contribution to

Figure 2. Administration of ointment to the neonate's eyes.

nursing care within the maternal–infant health areas. The nursing personnel received a unit dose package that was convenient, associated with less wastage, and comparable in price to the silver nitrate solution. The newborn and parents benefit from prophylaxis with a superior agent that is associated with fewer side effects.

References

1. Committee on Drugs, Committee on Fetus and Newborn, Committee on Infectious Diseases, American Academy of Pediatrics. Prophylaxis and treatment of neonatal gonococcal infections. Pediatrics 1980; 65:1047.
2. Rothenberg R. Ophthalmia neonatorum due to *Neisseria Gonorrhoeae*. Prevention and Treatment. Sex Transm Dis 1979;6:189–91.
3. Schachter J, Grossman M, Holt J, *et al.* Prospective study of chlamydial infection in neonates. Lancet 1979;2:377–80.
4. Hammerschlag MR, Chandler JW, Alexander ER, *et al.* Erythromycin ointment of ocular prophylaxis of neonatal chlamydial infection. JAMA 1980;244:2291–3.
5. Thompson SE, Dretler RH. Epidemiology and treatment of chlamydial infections in pregnant women and infants. Rev Inf Dis 1982;4:S747–55.
6. Davidson HH, Hill JH, Eastman NS. Penicillin in the prophylaxis of ophthalmia neonatorum. JAMA 1951;145:1052.
7. Nelson WE, Vaughan VC, McKay RJ, Behrman RE. Nelson textbook of pediatrics. Philadelphia: WB Saunders, 1979:479.
8. Butterfield PM, Emdie RN, Suejda MJ. Does the early application of silver nitrate impair maternal attachment? Pediatrics 1981;67:737.

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