Silver nitrate therapy as an adjunct in the treatment of myelomeningocele

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Fifteen patients in whom immediate closure of a myelomeningocele sac was not possible were treated by continuous application of dilute solutions of silver nitrate. Local infection of the sac was prevented or eradicated in 14 of the 15 patients within 72 hours. There were no infections in subsequent shunting procedures. No adverse neurological effects were noted, although the method was usually restricted to patients with neurological deficits below the level of the myelomeningocele sac. One patient who developed persistent hyponatremia and hypochloremia after prolonged application responded well to cessation of the therapy.

KEY WORDS · myelomeningocele · infection · silver nitrate therapy

In 1965 Moyer introduced the use of dilute solutions of silver nitrate in the treatment of extensive burns. The success of this therapy in controlling bacterial contamination led Matson to suggest that it might be an effective means of preventing local infection and subsequent meningitis in patients with myelomeningocele. Laboratory experiments demonstrated that the application of 0.25% to 1% silver nitrate solutions to normal neural tissues led to serious damage both in peripheral nerves and spinal cord. For this reason the therapy was not advocated for widespread use, although it was employed in a few patients with grossly contaminated myelomeningoceles and complete paraplegia.

In the past 3 years at the University of Minnesota silver nitrate therapy has been applied to 15 patients who had infected myelomeningocele sacs or in whom the myelomeningocele had not been repaired immediately. The therapy was used only in selected cases when our usual course of treatment for myelomeningocele, immediate repair soon after birth, was not feasible. The success of the therapy in preventing and eliminating infection was dramatic.

Treatment
As soon as the patients were seen, a decision was made concerning the feasibility of immediate repair. If immediate repair was not felt to be desirable, continuous application of 0.25% or 0.50% silver nitrate to the entire myelomeningocele sac was begun. Gauze dressings soaked in the material were applied to the myelomeningocele and then kept continuously moist by adding additional silver nitrate at regular intervals. The patients were kept in the prone position, and the entire area isolated by the use of impervious adhesive dressings. Silver nitrate stains both linen and skin, and, therefore, it is desirable to limit its application to the myelomeningocele sac. In most cases cultures were obtained prior to the institution of therapy. Multiple cultures were obtained thereafter in
TABLE 1
Reason for delayed repair of myelomeningocele in 15 patients treated with silver nitrate

<table>
<thead>
<tr>
<th>Time of Repair</th>
<th>No. of Cases</th>
<th>Reason for Delayed Repair</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-12 hrs</td>
<td>2</td>
<td>1 status precarious</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 dehiscence treated</td>
</tr>
<tr>
<td>12-24 hrs</td>
<td>2</td>
<td>1 grossly contaminated sac</td>
</tr>
<tr>
<td>1-7 days</td>
<td>3</td>
<td>2 systemic infections</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 grossly contaminated sac</td>
</tr>
<tr>
<td>after 1 wk</td>
<td>2</td>
<td>1 systemic infection</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 macerated skin</td>
</tr>
<tr>
<td>after 1 mo</td>
<td>5</td>
<td>2 treatments not advised</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2 grossly contaminated sacs</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 status precarious</td>
</tr>
<tr>
<td>no repair</td>
<td>1</td>
<td>1 leaking rachischisis, macerated skin</td>
</tr>
</tbody>
</table>

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each case. When repair was undertaken, the use of silver nitrate was continued in the operating room; there was no preparation of the sac other than application of silver nitrate. The surrounding skin was scrubbed with phisohex for 10 minutes prior to the surgical procedures. When the child was discharged from the hospital prior to repair, the parents continued the treatment at home.

Clinical Material and Results

Clinical Material

This study comprised 15 patients with myelomeningoceles in the thoraco-lumbar-sacral region. The time of definitive repair and the reason for delay are summarized in Table 1.

Delayed Operation

In two patients with huge sacs and complete paraplegia, operation was not felt justified and the parents were so advised; in one silver nitrate therapy was used for 6 months, and in the other for 1 year before definitive repair of the myelomeningocele sacs was undertaken at the parents’ insistence. In three patients serious systemic infection when first seen precluded surgery; one of these children died of aspiration pneumonitis while the other two recovered and underwent definitive repair. Therapy was delayed in two patients because of maceration and bruising of the buttock skin secondary to breech delivery. One of these patients had a true rachischisis which was treated only with silver nitrate; epithelialization was rapid, and healing of the lesion was complete at 5 weeks. The other child had an extremely large lumbar-sacral myelomeningocele which was repaired on the ninth day after institution of therapy.

In four instances the myelomeningocele sac was grossly contaminated at the time the patients were first seen in the University of Minnesota Hospitals. In each case culture of the sac substantiated the clinical impression of serious infection, and in each case sterilization of the sac was prompt with silver nitrate therapy. In three patients the general systemic condition of the child was questionable, and surgery was delayed for this reason.

One additional child underwent repair of a myelomeningocele without the institution of silver nitrate therapy. Following repair there was a significant breakdown of the wound. Silver nitrate was used while secondary granulation occurred. Healing was prompt and sterility was maintained in the granulating wound.

Mortality and Complications

There was one death among the 15 children; this occurred from aspiration pneumonitis present before the child was seen at the University of Minnesota Hospitals.

There was one significant complication of the therapy. One patient developed persistently low serum sodium and chloride levels. This condition was promptly eliminated by discontinuance of silver nitrate therapy, and no significant endocrine disturbances were found in the child. The electrolyte abnormalities were thought to be a direct result of the use of silver nitrate.

Although there were no local infections or septicemia, four patients had wound healing by secondary intention. Three of these were superficial and minor in degree. One was quite severe and involved a large portion of the suture line. Silver nitrate was employed in all four with prompt secondary granulation and epithelialization.

J. Neurosurg. / Volume 36 / June, 1972
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Microbiological Aspects

Six of the children received antibiotics with the silver nitrate therapy. Original cultures of the myelomeningocele sacs were sterile in 10 of the patients and remained so throughout treatment. No culture was obtained in one patient. Two of the remaining three patients had coagulase-negative Staphylococcus infection. One patient had a mixed infection of coagulase-positive Staphylococcus, alpha Streptococcus, and E. coli. Two of the patients treated during secondary healing exhibited infections with Pseudomonas and Klebsiella species. Though daily serial cultures were not obtained in every case, in 14 of the 15 patients cultures of the sac remained sterile or became so within 3 days after the institution of silver nitrate. Most cultures became sterile within 24 hours. In one patient smears 3 days after therapy still demonstrated gram positive cocci, but cultures were sterile at that time.

Discussion

Sharrard et al., have stated that repair of the myelomeningocele sac as quickly as possible after birth is followed by more improvement in neurological function than when repair is delayed even by a few hours. While early repair has always been our general policy, we have not been able to substantiate Sharrard's belief that this preserves neurological function; our experience is in keeping with the experience of Duckworth and Brown,4 Bruce and Lorber,2 and Brocklehurst and his associates.3

We do believe in early repair but the purpose is to reduce infection to a minimum. During the first 12 or even 24 hours after birth the myelomeningocele sac is probably sterile or at least not significantly contaminated, and repair can generally proceed with a minimum risk of meningitis. After 24 hours colonies of bacteria in the myelomeningocele sac are common. Even with immediate repair, Sharrard reported a cumulative 1-year mortality rate of 42%; while the causes of death were not enumerated, meningitis, ventriculitis, systemic infection, and hydrocephalus were listed as the most common complications. In untreated patients the mortality from the same causes was 59%.7 More recently Shulman and Ames8, detailing the treatment of 50 such patients, reported a 12% mortality from ventriculitis and septicemia. The desirability of reducing this infection rate is obvious, and antibiotics have been singularly ineffective in preventing infection.8 In the 15 patients treated to date, maintenance of sterility of the sac or eradication of infection was possible in all but one patient. There were no instances of central nervous system infection or significant local infection following elective repair of the myelomeningocele, and no postoperative infections of shunts occurred when repair was undertaken after a shunting procedure. The one case of rachischisis treated responded very well to silver nitrate therapy, and it appears that this is a useful way to treat this condition without primary repair when complete paraplegia is present.

The use of silver nitrate in prevention of secondary infection and promotion of granulation during the healing by secondary intention also proved to be quite valuable. In none of these cases were any neural elements exposed. The wounds were sterilized quickly, healed quite promptly, and skin grafting was not necessary. We now use this therapy routinely when healing problems are present.

Because of the experiments of Heiskanen, et al., we have avoided silver nitrate therapy in patients with significant function below the level of the lesion. There were two exceptions. Both of these children had good function below the level of the lesion and were seen some days after birth when obvious infection of the myelomeningocele sac was already present. In both cases silver nitrate therapy was used and the sac sterilized promptly. No change in neurological status was observed in the repeated neurological examination of these children. Although no children in the study showed such a change, we feel that the application of silver nitrate to exposed neural elements which may be functional is not warranted routinely.

Silver nitrate therapy is not a substitute for early repair. The child with a myelomeningocele is still considered to have an urgent surgical problem, and operation should be carried out as soon as is feasible. However, when immediate repair is not possible silver nitrate therapy is a safe and effective way to
maintain sterility of the myelomeningocele sac or to eliminate infection already present. We recommend this therapy only when immediate repair of the sac is not feasible, when there are no exposed functional neural elements, or in carefully selected cases with good neurological function when contamination of the sac with infection appears to be the overriding clinical consideration.

Summary

Fifteen patients in whom immediate myelomeningocele repair was not feasible were treated with continuous soaks of 0.25% to 0.50% silver nitrate. No neurological loss was noted during therapy in any patient. Sterilization of the sac was accomplished in all patients within 3 days. The only significant complication of therapy was the development of hyponatremia and hypochloremia in one patient.

References


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