Neonatal Herpes Simplex Virus Type 1 Infection and Jewish Ritual Circumcision With Oral Suction: A Systematic Review

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Jewish ritual circumcision rarely but occasionally includes a procedure involving direct oral suction of the wound, which can expose an infant to infection with herpes simplex virus type 1 (HSV-1). This practice has provoked international controversy in recent years, but no systematic review of the clinical literature has previously been published. We designed this review to identify and synthesize all published studies examining the association between circumcision with direct oral suction and HSV-1 infection. Our search strategy identified 6 published case series or case reports, documenting 30 cases between 1988 and 2012. Clinical findings were consistent with transmission of infection during circumcision, although the evidence base is limited by the small number of infections and incomplete case data. Published evidence suggests that circumcision with direct oral suction has resulted in severe neonatal illness and death from HSV-1 transmission, but further research is necessary to clarify the risk of infection.

Key words. circumcision; herpes simplex virus; neonatal.

Male circumcision is a fundamental sacred tradition in Judaism that has occurred for thousands of years. Ritual circumcision, known as a “bris,” “brit,” or “bris (brit) milah,” is performed on a boy’s 8th day of life unless medical concerns such as jaundice or severe illness necessitate postponing the procedure. A bris is performed by a “mohel” who is trained in both the religious and medical aspects of the process by other mohels. The bris includes numerous ritual steps and typically occurs outside the hospital setting.

The medical component of a bris involves the surgical removal of the foreskin. Historically, this excision was followed by a step called “metzitzah b’peh,” in which the mohel sips wine, orally extracts a small amount of blood from the wound, and then expels the mixture from his mouth. The wound is then bandaged and additional ritual steps follow. Religious authorities have provided various explanations for the purpose of orogenital suction, ranging from ancient concepts of physiology and medicine [1–3] to esoteric spiritual insights on the bris ritual [3, 4]. Emergence of modern concepts of disease transmission and hygiene, coupled with outbreaks of tuberculosis, syphilis, and other deadly infectious diseases in nineteenth-century Europe, prompted development of alternatives to direct oral suction intended to reduce infection risks for both infant and mohel [1, 3, 4]. These include use of a sterile pipette that separates the mohel’s mouth from direct contact with the wound or the use of gauze as a replacement for direct oral contact. Contemporary religious leaders differ on the permissibility of these alternatives [2, 3, 5]. Direct oral suction is widely practiced within some ultra-Orthodox Jewish sectors, whereas acceptance of alternative methods is the norm for many Orthodox Jews, as well as Conservative, Reform, and other Jewish communities. Unfortunately, no reliable data exist on how frequently the procedure actually occurs.

Circumcision is associated with a low risk of adverse events [6–9], but direct oral suction has been suggested as a source of transmission of herpes simplex virus type 1 (HSV-1) infection via the mohel’s saliva. Herpes simplex virus type 1 is reported to be present in more than half of American adults and frequently manifests as oral lesions
“cold sores”), although many people never or rarely develop symptoms [10]. Herpes simplex virus type 2, which is usually transmitted through sexual contact and characterized by genital lesions, is less common and affects at least 16 percent of the population [10]. Because transmission of HSV infection to infants most frequently results from contact with the birth canal during delivery, even if the mother is asymptomatic and has no history of active infection, HSV-2 infection has traditionally been more common than HSV-1 in neonates [11]. However, recent data have found a growing trend of genital HSV-1 infection in adult women, which has resulted in more infants infected with type 1 HSV [12–14]. Although HSV infection in adults may be painful, it can be catastrophic for infants and lead to encephalitis, central nervous system damage, and death.

Published estimates of the incidence of neonatal HSV (type 1 or type 2) vary widely. Most studies have yielded estimates between 6 and 13 cases per 100,000 live births [15], although some studies have reported rates as high as 31 [16], 60 [17], or 69 [18] cases per 100,000. This variance may be due to different data sources, case definitions, study timeframes, and populations. Infection rates do not differ significantly by gender, although boys may be at slightly higher risk [19].

In 2012, international attention focused on the safety of metzitzah b’peh, after publication of data estimating a statistically significant risk of HSV-1 infection associated with the practice [20]. New York City’s Board of Health then adopted an amendment to the city’s Health Code that requires mohels to obtain written consent before performing a bris that includes direct oral suction, and litigation is ongoing regarding the legality of this policy. Conflict about direct oral suction has also emerged in Israel, Russia, and throughout Europe.

The practice of metzitzah b’peh with direct oral suction has been accompanied by substantial controversy and raises important issues of public health, religious freedom, and government regulation [21]. Several studies have reported cases of HSV-1 infection after a bris, but no systematic review of the clinical literature has previously been published. The goal of this review was to identify and synthesize all published studies examining the association between the practice of circumcision with direct oral suction and HSV-1 infection in infants.

METHODS

We systematically searched OVID Medline, EMBASE, and the Cochrane Library of Databases to identify published studies on HSV infection after circumcision with direct oral suction. The Medline search combined disease-specific Medical Subject Heading terms (Herpes Simplex OR Herpes Genitalis OR Simplexvirus OR Encephalitis, Herpes Simplex) and keywords (herpes OR herpes simplex virus OR adverse event OR complication) with risk factor keywords (circumcision OR bris OR brit). Searches in the other databases used similar strategies. All searches were completed in July 2013, and no limits were placed on year of publication, study design, or language.

Titles and abstracts were screened by 1 reviewer, and 2 independent reviewers performed full-text screening. Reference lists of included studies were also reviewed but did not yield additional studies. Figure 1 summarizes the results of the study retrieval process. Studies were included if they presented original research on HSV infection in the context of Jewish ritual circumcision. Studies were excluded if (1) no data were reported on HSV infections in male infants or adolescents or (2) Jewish ritual circumcision was not identified as a potential risk factor, or the presence or extent of such risk could not be inferred from the study population.

Data were abstracted by 1 reviewer and checked for accuracy by a second independent reviewer. The primary outcome was infection with HSV. Clinical features associated with each case were recorded, including time from circumcision to initial appearance of infection symptoms and HSV serology status of the mohels who performed the circumcisions as well as case mothers. All identified studies were case reports or case series. Evaluation of case series and reports is limited by small sample size, unsystematic case selection, and lack of adequate comparison groups, so risk of bias was assessed qualitatively rather than quantitatively.

RESULTS

The searches yielded 807 unique studies that were potentially relevant, and 29 studies were selected for full-text review. Twenty-three studies were excluded during full-text review: 3 did not present primary research, and 20 described complications of circumcision that did not include any cases of HSV. Our search strategy therefore identified 6 published studies, all of which were descriptive case reports or case series that documented neonatal HSV-1 infection after circumcision with direct oral suction. No cases of neonatal HSV-2 associated with circumcision were identified. Table 1 summarizes the studies, which included 30 cases identified between 1988 and 2012. Thirteen patients were identified in New York, 16 cases in Israel, and 1 in Canada. Two studies described cases identified systematically by either prospective community surveillance [20] or
retrospective review of medical records [22]. Four studies reported cases identified by treating physicians [23–26]. Three of the case reports were published between 2000 and 2004, and 3 more recent studies were published in 2012 or 2013. The studies are reviewed in order of publication to represent the progression of the evidence base.

### Early Case Reports
Between 2000 and 2004, 3 studies were published presenting 11 cases of neonates from New York, Israel, and Canada who were diagnosed with HSV-1 shortly after ritual circumcision [23–25]. The earliest study discussed 2 patients the authors treated 10 years apart, in 1988 and 1998.

### Table 1. Studies Examining Circumcision With Direct Oral Suction and Neonatal HSV-1 Infection

<table>
<thead>
<tr>
<th>Author</th>
<th>Year (Cases)</th>
<th>Location</th>
<th>Year(s) Cases Identified</th>
<th>Time From Circumcision to Symptoms (Days)</th>
<th>Maternal HSV-1 Serology (Cases)</th>
<th>Mohel HSV-1 Serology (Cases)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Case series</td>
<td></td>
<td></td>
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<tr>
<td>Koren 2013 [22]</td>
<td>7 Israel</td>
<td>2001–2007</td>
<td>Range: 6–11</td>
<td>Mean: 7</td>
<td>(-) serology: 4</td>
<td>(+) serology: 5 or 6*</td>
</tr>
<tr>
<td>Case reports</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Yossepowitch 2013 [26]</td>
<td>1 Israel</td>
<td>Not reported</td>
<td>2.5 years</td>
<td>(+) serology</td>
<td>Not tested</td>
<td></td>
</tr>
<tr>
<td>Distel 2003 [24]</td>
<td>1 Israel</td>
<td>Not reported</td>
<td>7</td>
<td>(+) serology: 1</td>
<td>Others not tested</td>
<td></td>
</tr>
</tbody>
</table>

Abbreviations: CDC, Centers for Disease Control and Prevention; HSV-1, herpes simplex virus type 1.

*Specific case data not reported.
†Nine cases were confirmed as HSV-1, 2 HSV cases were not confirmed as type 1 vs type 2; in 6 cases, direct oral suction was confirmed to have occurred, whereas in 5 cases direct oral suction was suspected but not confirmed.

![Flow diagram](Figure 1. PRISMA flow diagram.)
Circumcision of both boys was performed by the same mohel, who reported no history of HSV infection and whose serology status was not known. In 2003, physicians at a hospital in Israel described a patient who developed signs of infection 1 week after circumcision and whose mohel declined serology or saliva testing [24]. A larger set of cases was described in a 2004 study that included 8 patients treated in Canadian and Israeli hospitals [25]. These patients all developed symptoms shortly after a bris that included direct oral suction and had been treated by the authors or their colleagues between 1997 and 2003. Mohels involved in 4 of the 8 cases were found to have positive HSV serology, but the other mohels were not tested.

These studies could not exclude every alternative route of potential HSV-1 transmission, but the 11 cases shared important characteristics that suggested direct oral suction as the likely source of infection: (1) all infections were confirmed as HSV-1; (2) each neonate experienced genital lesions, which are unusual but consistent with transmission at the site of the circumcision wound; (3) symptoms appeared between 3 and 11 days after circumcision, which is consistent with the usual incubation period of 2–12 days for herpes infection; (4) circumcision included direct oral suction in each case; (5) HSV-1 serology of the mohel was positive in all 4 cases where mohels underwent testing; and (6) maternal HSV-1 serology was negative in 9 cases and positive in 2 cases, and none of the mothers exhibited clinical signs or reported history of HSV-1 infection.

**Case Series: HSV-1 Surveillance in New York City**

In 2005, the New York City Department of Health and Mental Hygiene (DOHMH) investigated several cases of neonates in New York City who presented with HSV-1 shortly after a bris. One infant died, and others experienced significant morbidity. The city then adopted a surveillance program requiring healthcare providers and laboratories to report all suspected or confirmed cases of HSV (type 1 or 2) in infants 60 days of age or younger. In 2012, researchers associated with the Centers for Disease Control and Prevention and DOHMH published cumulative data documenting 11 cases in New York City where circumcision with direct oral suction was suspected as the source for neonatal HSV-1 [20]. Six of these cases were reported to or identified by DOHMH between 2000 and 2005, and 5 additional cases occurred after initiation of the surveillance program. All 11 infants exhibited genital lesions, and 9 were confirmed as HSV-1, whereas the other 2 were untyped. Ten of the cases experienced lesions between 5 and 12 days after circumcision, whereas one case emerged 20 days later. Two sets of siblings were represented in these cases, including 1 set of twins. Three of the 11 infants developed disseminated disease, and 2 died.

Information about important elements of some cases was unavailable. For example, maternal history and serology was reported for only 2 mothers (the mother of twins had positive serology for HSV-1, and the other mother was negative). In addition, DOHMH could only confirm that direct oral suction occurred in 6 cases, whereas the other 5 cases were classified as “probable” based on parents’ reporting that circumcision in their communities usually included direct oral suction. Most parents declined to disclose the identity of their mohels, so only 1 mohel underwent serology testing, and he was positive for HSV-1.

The authors also undertook a population-based risk assessment using data collected by the surveillance program after mandatory reporting was initiated. Between April 2006 and December 2011, DOHMH received reports of 84 laboratory-confirmed cases of neonatal HSV throughout New York City. Forty-five cases occurred in male infants, including 22 cases of HSV-1, 15 cases of HSV-2, and 8 cases that were untyped. Five of the 45 cases (4 HSV-1 and 1 untyped) were identified after circumcisions that definitely or probably included direct oral suction. Comparing these 5 cases with the 25 cases of HSV (type 1 or untyped) in male infants that were unlikely to have been exposed to circumcision with direct oral suction, the study authors estimated a risk ratio of 3.4 (95% confidence interval, 1.3–9.0), indicating a statistically significant association between circumcision with direct oral suction and HSV-1 infection.

**Case Series: Medical Record Review in 5 Israeli Hospitals**

In 2013, a retrospective review examined all neonatal HSV cases treated between 2001 and 2007 at 5 Israeli hospitals [22]. Twenty-two cases were identified, yielding an incidence rate of 8.4 per 100,000 live births. Nine cases were female, and 6 of the 13 males developed HSV symptoms during the first 7 days of life (preceding ritual circumcision). However, 7 male infants became symptomatic within 1 to 2 weeks after circumcision, and all were typed as HSV-1. Direct oral suction was confirmed in each case, and all 7 exhibited genital lesions. Five mohels had performed these circumcisions, and 4 underwent serology testing. All 4 exhibited positive serology for HSV-1. Three of the 7 mothers also had positive serology for HSV-1, whereas the other 4 mothers were negative. The clinical data presented in this case series, including the location of lesions, timing of infections, mohel serology, and exposure to direct oral suction, may present the best evidence yet available on HSV-1 transmission during Jewish ritual circumcision with direct oral suction.
2013 Case Report Suggesting Latent Infection

In 2013, Israeli physicians described the unusual case of a 2 and a half year old boy diagnosed with HSV-1 infection after presenting with genital lesions [26]. The child had HSV-1 antibodies, suggesting that the episode was a recurrence rather than a primary infection. Because HSV-1 antibodies typically develop during the first several weeks after infection and persist indefinitely, it is unlikely that antibodies would be present during initial acquisition of the infection. The patient’s mother also had HSV-1 antibodies. The parents confirmed that the boy’s circumcision included direct oral suction, but the mohel did not undergo serology testing. Based on the location of the lesions, the positive serology of the patient, and the occurrence of direct oral suction, the authors concluded that their patient was most likely infected by the mohel during circumcision, but he remained asymptomatic until this episode.

DISCUSSION

Six published studies have documented HSV-1 infection in neonatal males after circumcision with direct oral suction. One study described 11 cases in New York City and estimated a statistically significant risk ratio associated with oral suction based on 5 of those cases. All of the studies presented clinical findings that are consistent with transmission of infection from mohel to infant, including the location of lesions, timing of symptoms, and disease typology. Two infants died, whereas others experienced mild to severe morbidity.

The evidence base is limited by several factors. Relatively few cases—30 over 25 years—have been reported worldwide in published clinical literature. Eighteen of the cases were not systematically identified, and only 5 patients were compared with a control group. Clinical information was not completely documented for all patients, and in more than half the cases it was not known whether the mohels were carriers of HSV-1. In addition, although positive serology indicates that a carrier is a potential source of infection, only genetic testing of HSV isolates can confirm transmission of a specific HSV infection from mohel to infant. However, genetic testing did not occur in any of the cases. Finally, no studies could fully exclude exposure to alternative routes of infection. For example, maternal HSV-1 serology was positive in more than one quarter of cases.

Some limitations of the risk ratio derived from the DOHMH surveillance data should also be noted. The total population exposed to direct oral suction was difficult to estimate. The authors used a survey of enrollment in Jewish religious schools as a proxy for predicting the likelihood of circumcision with direct oral suction. Imprecision in this measure and the data sources used to derive the estimate may weaken the strength of association. For example, if the total population of male infants exposed to direct oral suction is larger than their analysis assumed, which has been suggested by the administrator of the original survey of Jewish schools, then the risk ratio may overestimate infection risk [27]. In addition, confidence in the estimate is limited by the small number of cases and incomplete case data (eg, direct oral suction could not be confirmed for 3 of 5 cases, and 1 case was not confirmed as HSV-1). If any of the cases used to calculate the estimate were excluded, the risk ratio would not be statistically significant. Conversely, it is likely that New York’s surveillance system did not capture all neonatal HSV infections during the study period. Some cases may have been misdiagnosed, were treated outside of New York City, did not present symptomatically within 60 days of birth, or were not reported for other reasons. If any such cases occurred in infants who were circumcised with direct oral suction, then the risk ratio may underestimate the risk of infection.

Standard principles of infectious disease suggest that exposing a neonatal circumcision wound to human saliva, even briefly, creates a risk of HSV transmission. In addition, the American Academy of Pediatrics addressed this issue in a recent technical report [7], which concluded that circumcision is generally safe and provides overall health benefits, but advises against direct oral suction due to risk of infection. However, more research is necessary to clarify the real-world risk of infection associated with metzitah b’peh. An ideal study design might prospectively identify 2 cohorts of Orthodox Jewish families, in which direct oral suction is the religious norm in 1 cohort but not the other, and monitor cases of neonatal male HSV-1 in each group. Alternatively, a case-control study might retrospectively compare HSV-1 cases with uninfected boys within a population of ultra-Orthodox Jewish male infants and identify the frequency of direct oral suction in each group. In any study, validity and reliability of the results should rely on accurate information about clinical factors including disease typology, timing of symptom emergence, occurrence of direct oral suction, mohel serology, maternal serology, and exposure to other HSV risk factors. Ideally, studies would also perform genetic testing of HSV-1 viruses isolated from infected infants and the corresponding mohels.

Neonatal HSV infection can cause severe morbidity and death, so mitigating potential risks for infection is critical. Current evidence suggests that direct orogenital suction during ritual circumcision was the likely source of infection in recent cases that resulted in significant illness and death.
Future research using cohort or case-control designs that fully capture all of the relevant data are needed to more rigorously examine this association.

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B. F. L. is an adherent of Orthodox Judaism, and he is not affiliated with the religious sects that commonly practice direct oral suction during circumcision, nor he is affiliated with any of the organizations represented in the legal case addressing the New York City informed consent rule. B. F. L. and his sons underwent ritual Jewish circumcision, without direct oral suction. C. A. U. is a nonpracticing Roman Catholic whose wife affiliates with secular Judaism. C. A. U. and his son were circumcised by pediatricians in the hospital setting.

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