Neonatal Deaths After Hepatitis B Vaccine


Manette T. Niu, MD; Marcel E. Salive, MD, MPH; Susan S. Ellenberg, PhD

Objective: To evaluate reports of neonatal deaths (aged 0-28 days) after hepatitis B (HepB) immunization reported to the national Vaccine Adverse Event Reporting System (VAERS).

Design: Case series; review of autopsy reports.

Setting: Voluntary reports submitted to VAERS, a passive surveillance system, from the US population.

Patients: All US neonates (0-28 days of age) whose deaths after HepB vaccination given alone were reported to VAERS, occurring from January 1, 1991, through October 5, 1998.

Intervention: None (observational database).

Results: Of 1771 neonatal reports, there were 18 deaths in 8 boys and 9 girls (1 patient unclassified). The mean age at vaccination for these 18 cases was 12 days (range, 1-27 days); median time from vaccination to onset of symptoms was 2 days (range, 0-20 days); and median time from symptoms to death was 0 days (range, 0-15 days). The mean birth weight of the neonates (n = 15) was 3034 g (range, 1828-4678 g). The causes of death for the 17 autopsied cases were sudden infant death syndrome for 12, infection for 3, and 1 case each of intracerebral hemorrhage, accidental suffocation, and congenital heart disease.

Conclusion: Few neonatal deaths following HepB vaccination have been reported, despite the use of at least 86 million doses of pediatric vaccine given in the United States since 1991. While the limitations of passive surveillance systems do not permit definitive inference, these data suggest that HepB immunization is not causing a clear increase in neonatal deaths.


Editor’s Note: This report should help allay the fears of the antivaccine groups; it should, but will it?

Catherine D. DeAngelis, MD

N 1991, hepatitis B (HepB) vaccine became the first vaccine recommended to be universally administered to neonates. At the time of licensing of the recombinant HepB vaccines in 1986 (Recombivax; Merck & Co Inc, Whitehouse Station, NJ) and 1989 (Engerix; SmithKline Beecham Pharmaceuticals, Philadelphia, Pa), no serious reaction or death had been reported in infants (aged 0-12 months); however, the safety database was based on limited experience in approximately 2000 infants.

Postmarketing surveillance is an important tool that may identify new or rare adverse events that are only observed after the vaccine is widely used after licensure. The national Vaccine Adverse Event Reporting System (VAERS) is a passive surveillance system monitoring postmarketing vaccine safety. It solicits reports of all events temporally related to immunization, some of which may be coincidental. Despite limitations inherent in passive reporting systems such as biased reporting, incomplete reporting, and underreporting; lack of consistent diagnostic criteria; lack of a comparison group; and lack of data as to the number of vaccine doses administered, VAERS has proved a useful tool in identifying and evaluating vaccine-related events such as thrombocytopenia after measles vaccine and alopecia after immunization, as well as providing further assurance about the safety of HepB and hepatitis A vaccines. Other strengths include the timely availability of data from a surveillance system that derives data from the entire US population.
In a previous study, we reviewed 1991 to 1994 VAERS data that revealed 6 neonatal deaths after HepB vaccination. These deaths did not seem to be causally related to HepB immunization. Recently, in response to an inquiry from the Institute of Medicine, we reviewed neonatal deaths after HepB vaccination reported to VAERS for the years 1991 to 1998. This updated review includes all US death reports after HepB vaccine given alone (rather than simultaneously with other vaccines) in neonates (aged 0-28 days), excluding duplicate and foreign reports.

### CASE REPORTS

From January 1, 1991, through October 5, 1998, a total of 1771 neonatal (aged 0-28 days) events after receipt of HepB vaccine were reported to VAERS. Eighteen were death reports (Table). There were no reports of neonatal deaths in 1991, 1 death in 1992, 7 deaths in 1993, none in 1994 and 1995, 6 deaths in 1996, and 2 each in 1997 and 1998.

Neonatal deaths were reported in 8 boys and 9 girls (sex was not reported in 1 instance). The mean age at vaccination was 12 days (age range, 1-27 days). The median time from vaccination to onset of symptoms was 2 days (range, 0-20 days), and median time from onset of symptoms to death was 0 days (range, 0-15 days). The mean birth weight of the neonates (n = 15) was 3034 g (range, 1828-4678 g). Four cases were reported from New Hampshire, 3 from Pennsylvania, 2 from Texas, and 1 case each from California, Florida, Illinois, Maryland, Minnesota, Missouri, New York, South Carolina, and Virginia. Of 16 reports that included the vaccine manufacturer and lot number, only 2 cases received a dose from the same vaccine brand and lot; these deaths were diagnosed as sudden infant death syndrome (SIDS), and both cases resided in the same state. Cases were reported by physicians (n = 8), nurses (n = 4), state immunization program staff (n = 3), vaccine providers (unspecified) (n = 2), and a relative of the patient (n = 1).

Seventeen autopsy reports were available for review (1 case did not have an autopsy) (Table). The causes of death recorded by the medical examiner at autopsy were SIDS (n = 12); infections (1 case each of bronchopneumonia [no causative organism noted], pneumonitis/...}

### Neonatal Death Reports After Hepatitis B Vaccine Given Alone, US VAERS Reports, January 1, 1991, Through October 5, 1998 (n = 18)*

<table>
<thead>
<tr>
<th>Case No./Age at Vaccine, d/Age at Death, d/Cause of Death</th>
<th>Birth Weight, g</th>
<th>Medical History†</th>
<th>Salient Findings at Autopsy</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/13/15/SIDS</td>
<td>2200</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>2/17/20/SIDS</td>
<td>2608</td>
<td>Found with blood around nose</td>
<td>1-2 d later; respirator turned off; provisional diagnosis: subarachnoid hemorrhage (&quot;CSF bloody&quot; per family physician)</td>
</tr>
<tr>
<td>4/19/20/SIDS</td>
<td>2835</td>
<td>Found with blood around nose</td>
<td>... §</td>
</tr>
<tr>
<td>5/4/6/SIDS</td>
<td>...</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>6/15/17/Intracerebral hemorrhage, sepsis?</td>
<td>2807</td>
<td>Baby fed, then choked, milk seen coming from nose, stopped breathing, went limp, parent “shook” child; CPR done, respirator support, declared “brain dead” 1-2 d later, respirator turned off; provisional diagnosis: subarachnoid hemorrhage (&quot;CSF bloody&quot; per family physician)</td>
<td></td>
</tr>
<tr>
<td>7/14/24/SIDS</td>
<td>2523</td>
<td>Found with blood in mouth and nose; co-slept with mother in bed</td>
<td>...</td>
</tr>
<tr>
<td>8/16/Enterobacter cloacae pneumonia, acute necrotizing myocarditis</td>
<td>4238</td>
<td>2 h after vaccination: leg swollen, fever, vomiting, bloody diarrhea, taken to emergency department, Rx: fluid replacement, acetaminophen, 5 d later, fever (temperature, 40°C), tachypnea, hospitalized, Rx: antibiotics; died 11 d later: lung, nasopharynx, central line cultures: <em>E. cloacae</em>-positive</td>
<td></td>
</tr>
<tr>
<td>9/6/8/Persistent fetal circulation, pneumonitis/bronchopneumonia, aspiration of amniotic sac contents</td>
<td>4252</td>
<td>Congenital fracture of right clavicle; facial nerve palsy; amniotic membrane ruptured 12 h prior to birth; intermittent fever?</td>
<td>Persistent fetal circulation; lungs: pneumonia/bronchopneumonia, aspiration of amniotic sac contents (possibly infected); congenital fracture right clavicle, facial nerve palsy</td>
</tr>
<tr>
<td>10/4/24/SIDS</td>
<td>4678</td>
<td>...</td>
<td>Lungs: occasional intra-alveolar hemorrhage; small bowel: autolytic changes; cerebellum: persistent external granular cell layer</td>
</tr>
</tbody>
</table>

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bronchopneumonia/aspiration of amniotic sac contents in a neonate with persistent fetal circulation, and Entero-
bacter cloacae pneumonia/sepsis); and 1 case each of in-
tracerebral hemorrhage (presumptive diagnosis based on
“bloody cerebrospinal fluid” obtained prior to death in
a “shaken” baby—this was the case where an autopsy was
determined at autopsy. At this time, there is no way to
prove or disprove a causal relation between HepB im-
munization of infants and SIDS; however, in cases of unexplained infant deaths, detailed
review of autopsy materials by pediatric pathologists
should be considered, as causes other than SIDS may be
revealed.

Since the 1991 Advisory Committee on Immunization
Practices recommendation of universal HepB im-
munization of infants, no evidence of either an in-
creased trend in the overall number of neonatal deaths16
or in neonatal deaths after HepB vaccination reported to
VAERS was found. From 1985 (before universal HepB
immunization of infants) to 1996, the number of neonatal
deaths in the United States decreased from 7.0
to 4.8 deaths per 1000 live births.16 During the years 1992
to 1996, the number of SIDS cases (the predominant cause
of infant deaths) reported to VAERS decreased by nearly
50% (US Food and Drug Administration, unpublished
data, 1998). The overall decline in neonatal deaths most
likely is due to improvements in prenatal and obstetric
care and advances in neonatal intensive care for low-

### Table: Neonatal Death Reports After Hepatitis B Vaccine Given Alone, US VAERS Reports,
January 1, 1991, Through October 5, 1998 (n = 18) (cont)*

<table>
<thead>
<tr>
<th>Case No./Age at Birth</th>
<th>Age at Death</th>
<th>Cause of Death</th>
<th>Medical History</th>
<th>Salient Findings at Autopsy</th>
</tr>
</thead>
<tbody>
<tr>
<td>11/23/29/</td>
<td>2637</td>
<td>Died suddenly</td>
<td>Lungs: bronchopneumonia (no organism specified); fallopian tube: serous cyst</td>
<td>Lung: scattered acute intra-alveolar hemorrhage; cerebellum: persistent external granular cell layer</td>
</tr>
<tr>
<td>Bronchopneumonia</td>
<td></td>
<td></td>
<td>Skull: small contusions on surface of skull (no small fracture)</td>
<td></td>
</tr>
<tr>
<td>12/17/18/Accidental</td>
<td>3062</td>
<td>Nasal congestion; heat rash</td>
<td>Heart: massive myocardial infarction; CNS: diffuse ischemic encephalopathy; lungs: interstitial pulmonary edema, atelectasis, small foci of hemorrhage; kidneys: early acute tubular necrosis; thymus: lymphocytic depletion; blood and urine cultures: no growth</td>
<td></td>
</tr>
<tr>
<td>suffocation</td>
<td></td>
<td>co-slept with parents and B71 age 1 y on sofa bed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13/13/22/SIDS</td>
<td>1829</td>
<td>34 wk gestation; apnea of prematurity, feeding problems of prematurity; hospitalized 18 d after birth, discharge weight 2100 g; co-slept with mother on couch, found on back on floor beside couch</td>
<td>Heart: massive myocardial infarction; CNS: diffuse ischemic encephalopathy; lungs: interstitial pulmonary edema, atelectasis, small foci of hemorrhage; kidneys: early acute tubular necrosis; thymus: lymphocytic depletion; blood and urine cultures: no growth</td>
<td></td>
</tr>
<tr>
<td>14/16/20/SIDS</td>
<td>3232</td>
<td>2 1/2 h postvaccine: vomiting for 4 h, fever (temperature, 38°C); Rx: acetaminophen; next morning appeared fine 1 h before found limp, no respirations but with heartbeat, CPR, hospitalized on ventilator, ventilator support withdrawn 2 d later (no clinical signs of brain activity)</td>
<td>Heart: massive myocardial infarction; CNS: diffuse ischemic encephalopathy; lungs: interstitial pulmonary edema, atelectasis, small foci of hemorrhage; kidneys: early acute tubular necrosis; thymus: lymphocytic depletion; blood and urine cultures: no growth</td>
<td></td>
</tr>
<tr>
<td>16/1/19/SIDS</td>
<td>2240</td>
<td>35 wk gestation, perinatal jaundice; mother heavy smoker; co-slept with mother in bed, found on left side</td>
<td>Liver: multifocal areas of extramedullary hematopoiesis, brisk acute and chronic triaditis with focal extension through limiting plate, hepatic infant with hyperemic border; maxilla: right epidural cerebrospinal cyst</td>
<td></td>
</tr>
<tr>
<td>17/20/21/SIDS</td>
<td>3317</td>
<td>2977 Seen in pediatrician’s office for “well-baby” visit, no reported symptoms; child died in car on the way home from office</td>
<td>Liver: extramedullary hematopoiesis; heart: patent ductus arteriosus, patent foramen ovale</td>
<td></td>
</tr>
<tr>
<td>18/18/18/Coarctation</td>
<td>3317</td>
<td>of the aorta, mitral stenosis, chronic biventricular heart failure</td>
<td>Heart: severe coarctation of the aorta, parachute mitral valve (mitral stenosis), persistent left superior vena cava to coronary sinus, patent ductus arteriosus, patent foramen ovale, cardiomegaly, chronic biventricular heart failure</td>
<td></td>
</tr>
</tbody>
</table>

*VAERS indicates Vaccine Adverse Event Reporting System; SIDS, sudden infant death syndrome; ellipses, data not available; CPR, cardiopulmonary resuscitation; CSF, cerebrospinal fluid; Rx, prescription given; and CNS, central nervous system.
†Data abstracted from initial of follow-up VAERS report.
‡Cause of death at autopsy per family physician (patient’s name not provided on VAERS report).
§Cause of death as listed on death certificate (autopsy not performed).
birth-weight infants\textsuperscript{17-19}; the decrease in SIDS cases reported to VAERS may reflect declining SIDS rates after the American Academy of Pediatrics’ \textsuperscript{19} recommendation to put infants to sleep on their backs\textsuperscript{20} and the 1994 “Back to Sleep” campaign.\textsuperscript{21} However, only an estimated 1% of SIDS cases occur in neonates.\textsuperscript{16} These indirect indices, despite their limited interpretability, do provide some reassurance that HepB vaccination is not causing a clear increase in unexplained neonatal or infant deaths.

As events reported to VAERS may be coincidental, detailed epidemiologic studies are needed for more definitive evaluation of potential causal relationships between vaccination and serious events or death.\textsuperscript{15}

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REFERENCES