Tissue Distribution of Methamphetamine and Amphetamine in Premature Infants

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Abstract

An amphetamine-abusing mother who had taken methamphetamine 5 hours before beginning labor gave birth to twins who died 1 to 2 hours after birth; an autopsy and toxicological examination were performed. The results are consistent with previous findings of premature delivery and retarded intrauterine development. Tissue distribution shows a similar pattern to an earlier reported case, though drug concentrations are about 10 times higher.

Introduction

Methamphetamine is one of the popularly abused drugs in our society today. Forensic pathologists and toxicologists are quite familiar with the involvement of methamphetamine and related substances in the various deaths they investigate. Women of childbearing age and pregnant women are among those who abuse methamphetamine. Considerable research has been devoted to determining the adverse effects upon the infant when the mother uses methamphetamine during her pregnancy. Little et al. (1) described the findings in neonates born to mothers who abused methamphetamine during pregnancy. In their series of 52 such cases, fetal growth was significantly delayed, but congenital anomalies were not significantly increased. Bailey (2), reviewing amphetamine detection in a university medical center patient population, reported that 12% of the cases positive for amphetamines were in neonates; presumably, transplacental transfer of the drug(s) from the mother had occurred. In a series of 104 mother–infant pairs with positive urine toxicological analysis results, Oro and Dixon (3) reported higher rates of prematurity and intrauterine growth retardation than in the control drug-free group. Eriksson and co-workers published a series of studies (4–6) dealing with the influence of amphetamines and other drugs during pregnancy; they noted (5) that “Poor prenatal care is a common finding in alcohol and drug abuse leading to a high incidence of complications during pregnancy and delivery including premature labor and small-for-gestational-age babies. An increased perinatal mortality has been reported following all types of abuse including tobacco use, probably as a consequence of poor prenatal care as well as of a toxic effect on the fetus.” Garriott and Spruill (7) reported the premature delivery and death of an infant from a mother who admitted using methamphetamine during her pregnancy for suppressing weight gain. The toxicologic findings in the infant are also reported.

Clinical History

A 27-year-old gravida 7, para 6 mother last seen in prenatal care 16 days earlier entered the hospital at 5:30 a.m. with contractions and vaginal bleeding. She had used methamphetamine intravenously 5 h earlier. Examination revealed contractions every 2–3 min, complete effacement, and complete dilatation, at 2 + station with intact membranes. She was taken to the delivery room where a male infant was delivered, APGAR 1 at 1 min, 1 at 5 min. Amniotic fluid was bloody. The placenta was delivered spontaneously and was intact.

Enroute to the recovery room, another intact amniotic sac was crowning, and a second male infant was delivered 56 min after the first. The placenta was removed manually. Postpartum recovery was uneventful. A serum specimen drawn from the mother before delivery tested positive for methamphetamine.

The mother has six living children at home. She had begun intravenous methamphetamine use between her third and fourth pregnancy, which resulted in a premature infant delivered at 30 weeks gestation. The child is living and well. The fifth pregnancy resulted in normal fraternal twins which were born at 36 weeks gestation and are living and well. Maternal medical history included hepatitis five years earlier. She was HIV and HbsAg and RPR negative on the last prenatal visit. Following delivery and death of the immature twins, she has ceased intravenous drug use and modified her lifestyle.

Pathology

Twin A lived 2 h and 35 min with supportive care in the neonatal intensive care nursery. Twin B lived 64 min. Complete autopsies were performed and tissues were submitted for toxicological analyses. The twins were fraternal with different blood groups, A and O. Only one placenta was received for examination and analysis, although delivery notes confirm that a separate
Table I. Body and Organ Weights

<table>
<thead>
<tr>
<th></th>
<th>Body Weight (g)</th>
<th>Body Height (cm, crown-heel)</th>
<th>Organ</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Brain (g)</td>
<td>Liver (g)</td>
<td>Heart (g)</td>
</tr>
<tr>
<td>Twin A</td>
<td>378</td>
<td>26.5</td>
<td>Not recorded</td>
</tr>
<tr>
<td>Twin B</td>
<td>480</td>
<td>29</td>
<td>71</td>
</tr>
<tr>
<td>Expected</td>
<td>500</td>
<td>29.4</td>
<td>70</td>
</tr>
</tbody>
</table>

Table II. Distribution of Methamphetamine and Amphetamine

<table>
<thead>
<tr>
<th>Specimen</th>
<th>Methamphetamine*</th>
<th>Amphetamine*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Twin A</td>
<td>Kidney 6.34</td>
<td>0.97</td>
</tr>
<tr>
<td></td>
<td>Liver 9.20</td>
<td>0.18</td>
</tr>
<tr>
<td></td>
<td>Brain 5.71</td>
<td>0.76</td>
</tr>
<tr>
<td>Twin B</td>
<td>Blood 6.3</td>
<td>0.28</td>
</tr>
<tr>
<td></td>
<td>Kidney 7.38</td>
<td>0.95</td>
</tr>
<tr>
<td></td>
<td>Liver 11.0</td>
<td>1.43</td>
</tr>
<tr>
<td></td>
<td>Brain 4.53</td>
<td>0.61</td>
</tr>
<tr>
<td>Placenta</td>
<td>8.66</td>
<td>1.18</td>
</tr>
</tbody>
</table>

* A serum specimen was obtained from the mother before delivery; it was sent to a reference laboratory. This specimen was reported to be qualitatively positive for methamphetamine, but no quantitation was performed.

Results

The concentrations of methamphetamine and amphetamine in these two infants are presented in Table II. No ethanol or other drugs were found in either infant.

Discussion

The abuse of amphetamine, methamphetamine, and related substances by pregnant women has been recognized as a significant problem. Numerous studies have reported the adverse effects of these drugs used during pregnancy. However, few authors have been able to report the concentrations of these drugs in tissues of the newborn infants resulting from such abuse during pregnancy.

Comparison of the present results with those reported by Garriott and Spruill (7) is interesting. The ratio of methamphetamine to amphetamine is similar in both reports. However, the concentrations in the present report are approximately 10 times higher. One possible explanation is that the case reported by Garriott involved oral ingestion of “diet pills” (15 mg), whereas the mother of the twins in this report was an intravenous abuser of unknown dosage. Furthermore, substances ingested orally pass through the liver and undergo “first pass elimination” before reaching the fetus, whereas substances injected iv would reach the fetus before passing through the liver. Consequently, the twins were likely subjected to much higher drug concentrations than the infant in Garriott’s report.

Summary

Twins delivered of an amphetamine-abusing mother died approximately one to two hours after delivery. An autopsy and toxicological examination were conducted on each twin. The findings of the autopsy and the tissue distribution of methamphetamine and amphetamine are reported. These findings are consistent with previous reports, as regards premature delivery.
and retarded intrauterine growth or development. The tissue
distribution shows a similar pattern to that reported earlier,
although it is suggested that intravenous use may explain why
the concentration in this instance are higher than those of the
previous report.

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