

## A pointed question: is a child at risk following a community-acquired needlestick injury?

### SCENARIO

You are asked to see a previously well 5-year-old boy who presented to the accident and emergency department. While playing in a public park he picked up a discarded 1 mL syringe with an attached 27-gauge needle and punctured the skin of his hand. His mother asks, "Will he catch AIDS? What should we do now?"

### STRUCTURED CLINICAL QUESTION

In a child with a community-acquired needlestick injury (CA-NSI) (patient, intervention), what is the risk of blood-borne virus (BBV) transmission (outcome)?

### Introduction

CA-NSI in children causes significant parental anxiety. The risk of HIV and hepatitis virus transmission following NSI in health-care settings is well established. The risk of BBV transmission to a child from a CA-NSI is substantially less than from occupational exposure. Despite this, many clinical guidelines are based on occupational NSI.

### SEARCH STRATEGY AND OUTCOME

Medline was searched using the Ovid interface (1946 to present/no limits set) using MeSH subject headings: (\*needlestick injuries/ or \*needles/ or \*syringes/) and (\*blood-borne pathogens/ or \*hiv infections/ or \*acquired immunodeficiency syndrome/ or \*hiv seropositivity/) or (\*hepatitis/ or \*hepatitis, viral, human/ or \*hepatitis b/ or \*hepatitis c/) or (community. mp. or \*community-acquired infections/ or \*environmental exposure/)). No age limits were imposed for reported cases of BBV transmission from CA-NSI, on the basis that confirmed transmission at any age would support the theoretical possibility of transmission in children. Only papers addressing non-healthcare-related CA-NSI were included. Cross-sectional studies with no longitudinal follow-up and those reporting exclusively BBV transmission from injecting drug use were excluded. The search date was 11 May 2014.

The Medline search retrieved 1100 publications, of which 16 were relevant. Search of Embase via the Ovid interface (1974–present) using the same search strategy retrieved 918 publications and identified 1 additional relevant paper. The 17 relevant publications were hand-searched for further references and 4 further relevant publications were found. Search of the Cochrane Library database retrieved no relevant reviews. The final 21 included studies are summarised in [tables 1](#) and [2](#). When the original publication provided insufficient information, authors were contacted for further details.

### COMMENTARY

Of the 21 studies, there were 17 observational studies ([table 1](#)) and 4 reports describing a total of 5 cases ([table 2](#)). Repeated attempts to contact the authors of one observational study to clarify the findings were unsuccessful and that paper was excluded from further analysis.<sup>1</sup> The remaining observational studies were heterogeneous in study design (nine retrospective,<sup>2–10</sup> six prospective,<sup>11–16</sup> one mixed<sup>17</sup>) and completeness of reported outcomes, including the age of cases. Some studies included CA-NSI alongside other exposures, and where

possible, the other exposures were excluded from our review. Some did not distinguish between exposures in reporting results (none of these studies documented a BBV transmission). For most studies, there was a high rate of loss to follow-up. Serological results for hepatitis B (HBV), hepatitis C virus (HCV) and HIV were inconsistently reported and available for all three in only a few studies.

Between 1987 and 2011, 1565 cases of CA-NSI were reported in the 16 observational studies. HIV postexposure prophylaxis (PEP) was recommended in 198 cases. Where reported, adherence to prescribed HIV PEP was generally poor. Of the 1565 cases, 1 unvaccinated adult caring for a relative with chronic HBV infection, in a country with a relatively high HBV infection rate and without routine HBV vaccination, developed evidence of HBV infection in the 8 weeks after sustaining a NSI while disposing of an intravenous needle and after declining postexposure HBV immunoglobulin and vaccination. There were no other cases of HBV seroconversion (serology reported for 604 patients), HCV seroconversion (423 patients) or HIV seroconversion (995 patients). There were no cases of virus transmission in children or adolescents.

Five cases of BBV transmission attributed to CA-NSI were reported in the four case reports, including two cases of HBV<sup>18 19</sup> and three of HCV.<sup>20 21</sup> In each case, the possibility of viral transmission by an alternative route could not be ruled out. There were no reports of HIV transmission. Only one of the five cases was a child and occurred following a CA-NSI from a needle discarded by a neighbour with known HBV and HIV infection. The child's immunisation status was not reported, and he was not given post-exposure HBV immunoglobulin or vaccination. The remaining four cases occurred in adults, two of whom were in high-risk occupations. For the single adult case of HBV infection, immunisation status was not reported and he did not receive appropriate postexposure HBV immunoglobulin or vaccination. Each of the five patients developed hepatitis. In the three adults with HCV transmission, HCV antibody was detected from 3 months post NSI. One adult with HBV cleared the virus, and one adult with HCV had successful interferon-based treatment. The 4-year-old boy had unsuccessful treatment and developed chronic hepatitis.

Occupational studies provide estimates of the risk associated with NSI. Meta-analyses report mean risk rates of 0.23% for HIV,<sup>22</sup> 0.75% for HCV<sup>23</sup> and 23–37% (HBeAg-negative source) or 37–62% (HBeAg-positive source) for HBV.<sup>24</sup> However, for HBV, vaccination or adequate PEP (vaccine±immunoglobulin) confers near-total protection. Risk for BBV transmission in the healthcare setting is highest with deep injection of a large inoculum (large volume, high viral load) as is more likely to occur in association with a large-gauge hollow-bore needle.<sup>25 26</sup> Extrapolated to the community setting, deep injury with a large-gauge hollow-bore needle, visibly stained or filled with blood, sustained minutes following use (such as might occur in a household with a known infected drug user or in a deliberate assault), would be expected to carry a similar risk. However, most episodes of CA-NSI in children, such as in our scenario, are not associated with these risk factors. While study findings of viral persistence give cause for concern, the same studies indicate that under usual conditions of needle use in the community (small-gauge, low-void-volume syringes) and subsequent environmental exposure (time, heat, drying, humidity, chemicals), infectivity is markedly and rapidly reduced.<sup>27–35</sup> This risk analysis assumes the source needle user is infected, whereas BBV rates among people who inject drugs actually vary markedly worldwide and are lower in developed countries with universal HBV vaccination and needle exchange.<sup>36–38</sup> Very low risk of infection

**Table 1** Observational studies of blood-borne virus (BBV) transmission following community-acquired needlestick injury (CA-NSI)

Citation	Study group	Study type (level of evidence)	Outcomes—planned BBV serology (timing post CA-NSI)	Key results			Comments
				No with serology reported	BBV seroconversions	No prescribed ART	
Butsashvili <i>et al</i> <sup>2</sup>	Georgia, age range: 2–63 years, 25/46 <18 years (n=46)	Retrospective cohort (level 3)	HBV, HCV, HIV (0, 6 months)	46/46 (100%)	1 HBV	0	See text for discussion of single case of HBV seroconversion.
Celenza <i>et al</i> <sup>3</sup>	Australia, age range 19–62 years, median 31 years (n=39)	Retrospective cohort (level 3)	HBV, HCV, HIV (0, 3, 6 months)	2/39 (5%)	None	6	Of 31 HBV non-immune patients, only 4 received recommended PEP. Of 6 patients prescribed ART, 2 did not have baseline HIV serology checked.
Papenburg <i>et al</i> <sup>17</sup>	Canada, age range: 1–17.7 years, median 7.3 years (n=274)	Mixed retrospective and prospective cohort (level 3)	HBV, HCV, HIV (0, 6 months)	189/274 (69%)	None	82 (84% adherence)	Of 230 patients not known to be HBV immune, 189 (82.2%) received immunoglobulin, 213 (92.6%) received vaccine.
Szenborn <i>et al</i> <sup>7</sup>	Poland, age range 2–19 years, mean 9.5 years (n=51)	Retrospective cohort (level 3)	HBV, HCV, HIV (0, 1, 6 months)	51/51 (100%)	None	31 (94% adherence)	
Thomas <i>et al</i> <sup>16</sup>	UK, age range 5–10 years (n=20)	Prospective cohort (level 3)	HBV, HCV, HIV (0, 3 months)	20/20 (100%)	None	19 (50% adherence)	Single-event mass exposure with diabetic lancets at primary school, one child known HIV positive.
de Waal <i>et al</i> <sup>12</sup>	South Africa, age range 3–14 years, median 9.6 years (n=54)	Prospective cohort (level 3)	HBV, HCV, HIV (0, 3, 6 months)	44/54 (81%)	None	44 (52% adherence)	Single-event mass exposure to used needles and syringes on sports field.
Makwana <i>et al</i> <sup>13</sup>	UK, age range 1.7–16.5 years, median 8.4 years (n=53)	Prospective cohort (level 3)	HBV, HCV, HIV (0, 6 months)	25/53 (47%)	None	0	All 25 patients followed up completed three doses of HBV vaccine.
O'Leary <i>et al</i> <sup>5</sup>	Australia, age range 2–79 years, median 26 years, 25/120 <16 years (range 2–15 years, median 6 years) (n= 66, 120 with non-CA-NSI cases)	Retrospective cohort (level 3)	HBV, HCV, HIV (0, 6 months)	10/120 (8%)	None	10	Uncertain which group of patients attended follow-up (was not only ART patients).
Russell <i>et al</i> <sup>15</sup>	Australia, age range 1.8–14.3 years, median 6.9 years (n=50)	Prospective cohort (level 3)	HBV, HCV, HIV (3, 8 months)	36/50 (72%)	None	0	First HBV vaccination provided in 41/42 non-immune cases. Completion of three-dose course in 22/42.
Babl <i>et al</i> <sup>10</sup>	USA, age range 2–3 years (n=4)	Retrospective cohort (level 3)	HIV (0, 1, 3, 6, 12 months)	3/4 patients (75%)	None	4 (25% adherence)	Reviewed HIV PEP use in 10 children and adolescents, after a variety of exposures.
Slinger <i>et al</i> <sup>6</sup>	Canada, age range 0.8–16.9 years, median 6.6 years (n=116)	Retrospective cohort (level 3)	HBV, HCV, HIV (timing not reported)	49/116 (42%)	None	0	Only 1.7% previously HBV immunised, 78% received HBV immunoglobulin and 76% received vaccine (73% both).
Nourse <i>et al</i> <sup>4</sup>	Ireland, age range 2–14 years, median 7.4 years (n=50, 52 with non-CA-NSI cases)	Retrospective cohort (level 3)	HBV, HCV, HIV (0, 6 months)	10/50 (20%)	None	1 (non-CA-NSI patient)	One high-risk CA-NSI from needle used by HCV-infected brother. 48 received first-dose HBV vaccine. 29 also had HBV immunoglobulin.
Aragón Peña <i>et al</i> <sup>11</sup>	Spain, age range 1–15 years, median 5.8 years (n=249)	Prospective cohort (level 3)	HBV, HIV (0, 6, 12 months)	180/249 (73%)	None	0	189 (75.9%) received HBV immunoglobulin, 144 (71.8%) completed HBV vaccination course.
Wyatt <i>et al</i> <sup>9</sup>	UK, mean age 6 years (n=67)	Retrospective cohort (level 3)	HBV, HIV (timing not reported)	3/67 (4%)	None	0	No HBV PEP for 11. Immunoglobulin and vaccine as per local recommendations for 49/67 (73%).
Montella <i>et al</i> <sup>14</sup>	Italy, age range 2–72 years, median 26 years, 50/408 <12 years (n=408)	Prospective cohort (level 3)	HIV (0, 6, 12, 18, 24 months)	408/408 (100%)	None	0	Cites local HIV prevalence in injecting drug users of >50%.
Walsh <i>et al</i> <sup>9</sup>	UK, 'children' (n=18)	Retrospective cohort, case report (level 3/4)	HBV, HIV (timing not reported)	3/18 (17%)	None	0	Reports CA-NSI in 3 children at a dump, and reviews 15 subsequent patients. Proposes testing syringes, if available.

HBV, hepatitis B virus; HCV, hepatitis C virus; PEP, postexposure prophylaxis.

**Table 2** Case reports of blood-borne virus (BBV) transmission following community-acquired needlestick injury (CA-NSI)

Year	Country	Virus	Age (years)	NSI circumstances	Management	Follow-up
1 2011 <sup>18</sup>	Australia	HBV	26 M	Cleaner, previous injecting drug use, negative serology previously. History of likely HBV vaccination. NSI to hand with 1 mL syringe with no visible blood	Negative baseline serology. Safe-sex counselling. HBV vaccine advised but administration delayed until day 46 post NSI	HBsAg and HBeAg detected at day 63, followed by acute hepatitis. Later clearance of HBeAg and HBsAg with development of anti-HBs and anti-HBe. HIV and HCV antibodies not detected
2 1997 <sup>19</sup>	Spain	HBV	4 M	Acute hepatitis B following NSI from needle discarded by neighbour known to have HBV and HIV. Immunisation history unstated. Parents HBV and HCV negative	No medical attention at time of injury. No immunoprophylaxis	Chronic carrier of HBsAg. Unsuccessful interferon treatment. HIV-1 antibody not detected
3 2007 <sup>20</sup>	Australia	HCV	'Young man'	Caravan park worker. NSI with 1 mL tuberculin needle and syringe while emptying rubbish bins, emptied daily. Unvaccinated for HBV	HBV immunoglobulin and vaccination. Negative baseline serology	HCV antibody positive on day 93 post NSI. Developed hepatitis
4 2007 <sup>20</sup>	Australia	HCV	64 F	NSI to foot with 27-G needle and syringe while walking through city park with high local prevalence of injecting drug use	No medical attention at time of injury. No immunoprophylaxis	HCV antibodies detected at 3 months post NSI. Chronic viral hepatitis. HBV and HIV negative
5 2005 <sup>21</sup>	Spain	HCV	64 F	NSI in a cemetery while cleaning mausoleum	Baseline serology negative. HBV vaccination. HIV PEP 'at the patient's insistent request.'	HCV antibodies and acute hepatitis from 3 months post NSI. Successful interferon treatment. HBV and HIV negative

HBV, hepatitis B virus; HCV, hepatitis C virus; PEP, postexposure prophylaxis.

combined with the relative infrequency of CA-NSI in children means observational studies may never yield sufficiently confidence-inspiring CIs.

Overall, data from our systematic review, the healthcare setting and experimental findings suggest the risk of BBV transmission from a CA-NSI in a child immunised against HBV or given adequate HBV PEP is so low as to possibly be negligible.

### Clinical bottom line

- ▶ We did not find any reports of blood-borne virus (BBV) transmission to a child from an incidental community-acquired needlestick injury (CA-NSI).
- ▶ CA-NSI in children is distinct from NSI in healthcare settings and is associated with much lower risk of BBV transmission.
- ▶ In a susceptible child, the highest risk for transmission is for hepatitis B virus (HBV). This risk is virtually eliminated by postexposure prophylaxis (vaccine±HBV immunoglobulin).

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