SHORT REPORT

Risk factors leading to *Cryptosporidium* infection in men who have sex with men

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Objectives: Cryptosporidiosis is a devastating illness in people with HIV/AIDS yet there have been no analytical epidemiological studies measuring risk factors leading to cryptosporidiosis in men who have sex with men (MSM). The objective of this study was to measure the risk factors for exposure to *Cryptosporidium* among MSM.
Methods: The study was a case-control design. It recruited MSM who had laboratory confirmed *Cryptosporidium* infection between 1997 and 2000. Participants answered a questionnaire about potential risk factors leading to exposure to *Cryptosporidium*.
Results: 10 cases and 24 controls were recruited. Men having more than one sexual partner in the past month were more likely to have had *Cryptosporidium* diarrhoea p = 0.034 (OR 6.67, CI (1.15 to 38.60). Insertive anal sex (p = 0.059) and attending a sex venue one or more times (p = 0.059) also increased the odds of having cryptosporidiosis.
Conclusion: The study results suggest that sexual behaviour is a significant risk factor for cryptosporidial diarrhoea in MSM. The results will be used to inform risk groups about behaviours that may put them at increased risk of cryptosporidial diarrhoea.

Cryptosporidium was first identified in 1907 but cases of disease in humans were not described until 1976.[1] During the late 1970s and early 1980s further cases were recognised in immunocompromised patients, in particular in AIDS patients. By the early 1990s *Cryptosporidium* was recognised as an important cause of community gastroenteritis caused by outbreaks associated with drinking water[2] swimming pools,[3] and animal exposure.[4] In the general community cryptosporidial diarrhoea is usually a self limiting gastroenteritis lasting 1–2 weeks.

Cryptosporidiosis can be a devastating illness in people with HIV/AIDS because it can cause severe diarrhoea that lasts for weeks and has a significant impact on patients' morbidity and mortality. In the absence of effective therapy or response to highly active antiretroviral therapy (HAART),[5] preventing exposure to *Cryptosporidium* organisms offers an alternative approach. In Australia the primary risk factor for HIV infection is male to male sexual contact[6] and it is this subgroup who are most at risk of contracting cryptosporidiosis.[7 8] Sexual contact has been implicated as a possible risk factor but there have been no analytical epidemiological studies measuring risk factors leading to cryptosporidiosis in men who have sex with men (MSM).

We report the results of a case-control study that aimed to identify the risk factors for exposure to *Cryptosporidium* among MSM. If the risk factors can be identified this helps in advising people about how they can reduce their risk of contracting cryptosporidiosis, particularly MSM with HIV/AIDS.

METHODS

The study was a case-control design. It recruited MSM in both Melbourne and Sydney who had laboratory confirmed *Cryptosporidium* infection between 1997 and 2000. Cases were identified through hospitals or general practices that had a large case load of HIV infected men. Cases were also identified through a larger community study of *Cryptosporidium*. When a case occurred at a practice known to have a high case load of MSM the general practitioner was contacted. If the patient met the study criteria (being an MSM and having a confirmed case of *Cryptosporidium* infection) they were invited to participate in the study. Up to three controls for each case were recruited from the same hospital or general practice that the case attended. They were the next known MSM seen at the practice after the case was identified who had the same HIV status.

Participants self completed a questionnaire that recorded HIV status, drinking water consumption, sexual behaviour, use of sex on premises venues, use of swimming pools, travel, if they were a carer for an HIV positive person, and exposure to children and animals in the month before the participant developing cryptosporidiosis. The cases were compared with MSM who did not have cryptosporidiosis.

Cryptosporidium is a notifiable disease in New South Wales, the state in which the city of Sydney is located. *Cryptosporidium* was not officially a notifiable disease in Victoria, the state in which the city of Melbourne is located, but for all practical purposes was being treated as such by the Department of Human Services. It is now officially a notifiable disease in Victoria. Testing for *Cryptosporidium* varied between the laboratories but generally a modified acid stain or an immunofluorescence assay was used.[9] All analysis is based on an unmatched case-control study and was conducted using STATA version 7. Owing to the small number of cases no adjusted analysis was performed. Local institutional research and ethics committees approved the study. Study participants gave their written and informed consent.

RESULTS

Ten cases and 24 controls were recruited between October 1998 and August 2000. Seven cases (70%) and 16 (66.66%) controls were HIV positive. The mean CD4 count was 320 $\times 10^6$/l for cases and 336 for controls.

Men having more than one sexual partner in the past month were nearly seven times more likely to have had *Cryptosporidium* diarrhoea p = 0.034 (OR 6.67 CI (1.15 to 38.60). The odds of cryptosporidiosis were increased among those who had insertive anal sex in the past month and among those who had been to a sex venue one or more times (p = 0.059 for each variable) (table 1). There was no

Table 1 Crude odds ratio of associations between *Cryptosporidium* infection and risk behaviours in the previous month

Variable		Cases (%) (n = 10)	Controls (%) (n = 24)	Odds ratio	95% CI*	p Value
Swimming	No	80	88	1.00		
	Yes	20	12	1.75	0.25 to 12.50	0.577
Sex with a man	No	20	29	1.00		
	Yes	80	71	1.65	0.28 to 9.79	0.58
Number of male	⩽1	20	63	1.00		
partners	>1	80	37	6.67	1.15 to 38.60	0.034
Anal sex	No	30	54	1.00		
	Yes	70	46	2.76	0.57 to 13.29	0.206
Anal insertive sex	No	30	67	1.00		
	Yes	70	33	4.67	0.95 to 23.04	0.059
Fingering partner	No	40	67	1.00		
	Yes	60	33	3.00	0.65 to 13.76	0.158
Anal receptive sex	No	60	58	1.00		
	Yes	40	42	0.93	0.21 to 4.20	0.928
Partner fingering	No	70	67	1.00		
	Yes	30	33	0.86	0.17 to 4.23	0.850
Rimming	No	50	65	1.00		
	Yes	50	35	2.00	0.45 to 8.98	0.366
Number times at sex	0	30	67	1.00		
venue	⩾1	70	33	4.67	0.95 to 23.04	0.059

*CI = confidence interval.

significant association between drinking tap water (p = 0. 71) or contact with pets (p = 0.46).

DISCUSSION

Our study results suggest that sexual behaviour is a significant risk factor for cryptosporidial diarrhoea in MSM. This is the first case-control study to report this direct association. Previous studies of people infected with HIV have suggested a relation between cryptosporidiosis and sexual activity in MSM compared with injecting drug uses or other HIV subgroups but none looked at specific risk factors in MSM.[7 8 10] Our study found that having more than one sexual partner in the past month increased the risk of cryptosporidial diarrhoea. The odds were also increased among those who had anal insertive sex and attended a sex venue in the past month but the limited power of the study made it difficult for variables to reach statistical significance. The number of case of initial AIDS defining cryptosporidiosis in Australia declined over a 3 year period following the introduction of HAART from 100 in 1993–5 to 40 in 1996–2000, consequently limiting recruitment. It is likely that with an increased number of cases these two risk factors would have been statistically significant.

Our findings are consistent with a study that examined serological markers of *Cryptosporidium* in HIV positive MSM in Melbourne, the city from which the majority of cases and controls were recruited. That study reported that sexual contact in the previous 2 years, having a larger number of sex partners and having anal sex was associated with increased serological response for the 27 kDa marker for *Cryptosporidium parvum*. Attending a spa or sauna was related to a serological response to both markers the 27 kDa marker and the 17 kDa marker ($p<0.05$).[11]

Our results are important because HIV positive MSM may not perceive themselves to be at risk of *Cryptosporidium* from sexual behaviour. A study of HIV positive patients attending an AIDS clinic (86% described themselves as MSM) showed 70% believed they were at risk of infectious diarrhoea but most perceived drinking water to be a major risk factor for cryptosporidiosis; 51% reported they rarely or never drank tap water and 43% reported they exclusively used boiled or bottled water. In contrast, there was lack of concern about the risk of sexual exposure to *Cryptosporidium*; 29% had unprotected anal intercourse in the past 24 months and 39% reported oral-anal contact.[12]

Cryptosporidial diarrhoea remains an intractable problem in HIV infected patients with low CD4 counts who do not respond to HAART.[5] There is also the concern that as patients develop resistance to antiretroviral therapy there may an increase in opportunistic infections such as *Cryptosporidium*. For this reason it is important that we understand the major risk factors leading to *Cryptosporidium* infection and educate patients about how to avoid contracting this infection.

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CONTRIBUTORS

MH, development of the grant proposal and study methodology and protocol and recruitment of participants, managed the project and contributed to the writing of the manuscript; JH performed the statistical analysis and contributed to the writing of the manuscript; JW assisted in writing the study protocol and ethics submissions, recruited and interviewed study participants, performed data entry and contributed to the writing of the manuscript; GD, development of the study methodology, recruitment of the study participants and contributed to the writing of the manuscript; CF, development of the grant proposal and study methodology, recruitment of participants, and contributed to the writing of the manuscript.

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