Detection of HIV infection during window period using polyclonal B-cell activation test

Detection of HIV infection, both in mass screening and in patient diagnosis, relies on detecting HIV-specific antibodies in the serum (serology). Although very specific and sensitive, it does not solve the lack of detec-

Table 1. Seronegative patients considered at high risk for HIV by their physicians.

No. patients	ELISA OD		Presence of HIV (positive/total)	
	Serology	PBAT	ISH	p24
6	Positive	6 (1.900–2.999)	3/3 DNA & RNA	ND
2	Grey zone	2 (0.150–1.270)	2/2 DNA & RNA	ND
24	Negative	12 (0.173–1.270)	+5/9 DNA & RNA +3/9 DNA	0/1
		3 (0.094–1.50)	+1/1 DNA	1/2
		9 (0.000–0.070)	+0/6 DNA	ND

ELISA, Enzyme-linked immunosorbent assay; PBAT, polyclonal B-cell activation test: optical density (OD) reading of culture supernatants on HIV antibody ELISA; ISH, *in situ* hybridization for detecting HIV genomic DNA and RNA; p24, p24 antigen ELISA (the cut-off was very high); ND, not done.

tion during the 'window period' between infection and seroconversion. Recently, the US Food and Drug Administration has also recommended testing blood for p24 antigen and thus shortening the window period by 4–5 days [1]. In the US blood donor populations, this additional test is expected to detect additional 4–6 lood units per year as HIV-infected [2]. The problem of missed HIV detection due to samples collected during the window period is directly proportional to the length of the window and the rate of new infections in a population [2]. We have developed a method for detecting the ability to produce HIV-specific antibodies *in vitro* even prior to their detection in the serum by polyclonal B-cell activation (PBAT) [3], thus enabling an earlier and more complete detection of HIV infection. This method was used to test for HIV infection among a population of very high risk individuals. Thirty-two random samples from patients from Kenyata Hospital (Kenya), whose blood was sent for routine HIV screening due to a suspected risk of HIV, were used both for routine serology and for PBAT and other HIV detection assays.

Six of the samples were seropositive and all were positive using PBAT (Table 1). Two samples had borderne serology and both were positive using PBAT. Of the 24 seronegative samples, 12 (50%) were PBAT-positive and three had grey zone reading by enzyme-linked immunosorbent assay.

In order to validate the current state of infection, cells from some of the samples were tested for the presence of HIV-specific genome (both proviral DNA, and viral RNA), using *in situ* hybridization (ISH). Almost all the samples (eight out of nine) that were seronegative, although PBAT positive, had detectable HIV proviral DNA in the lymphocytes. In the majority of the cases (five out of eight) HIV RNA was also detectable. Three samples of supernatant fluid from PBAT were tested using a p24 antigen assay; one sample was clearly positive, indicating clearly an active infection. The sera of the three samples were negative for p24 using the same kit.

The study shows that among hospital patients in Kenya, in whom the physician strongly suspects an HIV infection, there are many in the window period, who are HIV-infected, but remain seronegative. A similar finding has been reported in emergency department patients [4]. The high proportion of people in the window period stage indicates that the HIV epidemic is spreading among the Kenyan city populations at a high rate. We believe that their high numbers also stem from a longer window period in the Kenyan/African population then the estimated 1 month [1] in the West. Prospective studies are currently being planned to address this issue.

PBAT offers a relatively simple tool for the detection of individuals in the window period. Thus, it could be an important tool in better diagnosis and treatment of hospital patients in areas endemic with HIV.

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