patients.

Opportunistic infections as a result of the transient immune suppression are usually not so serious in ordinary measles patients as in AIDS patients. Therefore, some host defense mechanism(s) is expected to be in action in measles patients. We found an enhanced expression of CD16/CD56 molecules, a surface marker of NK cells, in the surviving PBMC of measles patients (Fig. 4). Just after onset of rash, the number of NK cells was markedly increased, and in turn, they were decreased within 7 days. It was therefore suggested that the NK cells were activated and compensating for the immune suppression resulted from the extended deaths of non-infected immune cells. This was supported by the result that INF-γ was also increased in the NK cells (data not shown). However, the mode of NK cell proliferation was similar among all age groups (Fig. 4), although for the older groups, the severe lymphopenia persisted for a long period, even after the recovery of NK cells to the normal level (Fig. 1). Taking together, it is suggested that NK cells played a roll in compensating for the lymphocyte deficient in the age group of 1-3 years old, whereas in the age group of 10 years or older, such compensation by NK cells could not be retained until the lymphopenia was restored. This might explain, at least partly, why the immunosuppression is severer in aged groups.

All measles viruses isolated from the present cases were of genotypes D3

and D5 [22], and there was no particular relationship between the genotype and the data presented (data not shown). The question whether or not the results obtained in this paper can be generalized to all other genotypes of wild-type virus is left to be answered.

A critical question has been asked as to whether it is proper to immunize AIDS children, especially in developing countries, with live attenuated measles vaccines [1]. It is necessary to reexamine its safety and efficacy to promote the Expanded Programme on Immunization (EPI) by WHO. We are also investigating the immune state of vaccinees after inoculation with live measles vaccines, compared with wild measles patients.

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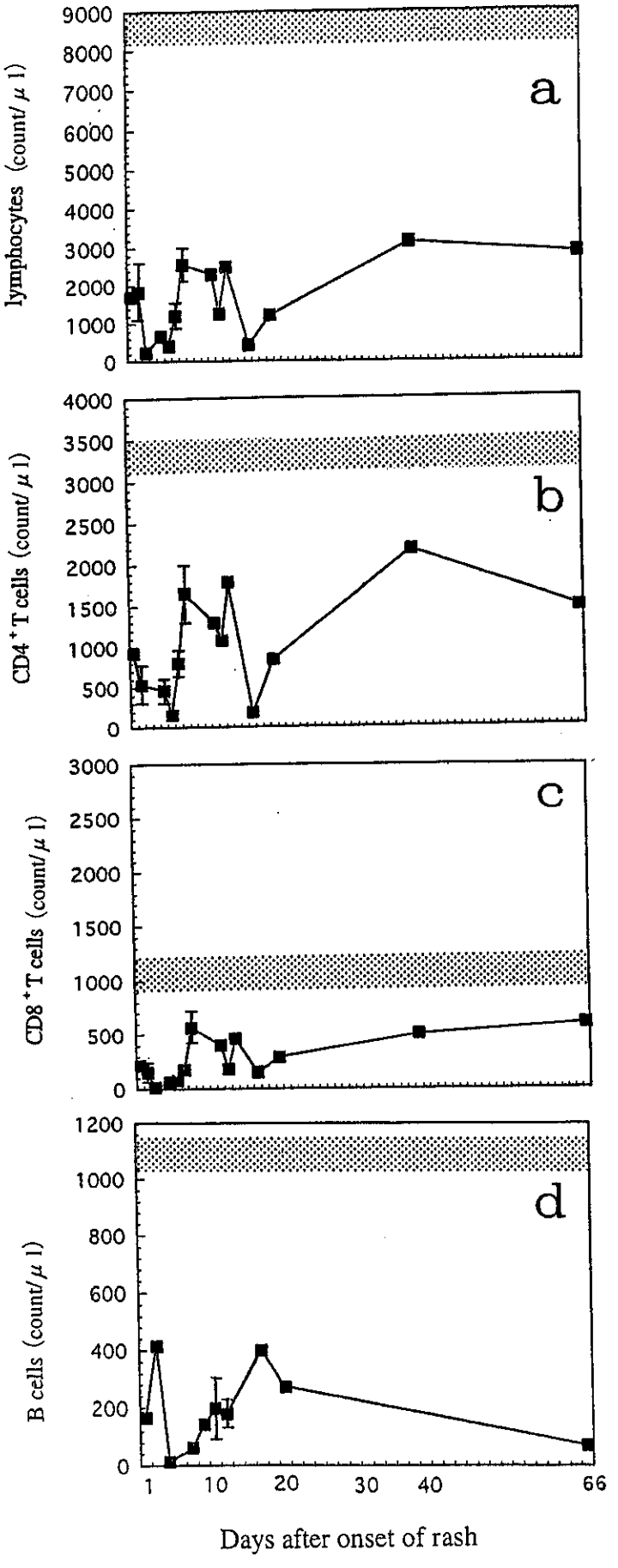
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b
c
d
lymphocytes (count/μl)
CD4+T cells (count/μl)
CD8+T cells (count/μl)
B cells (count/μl)
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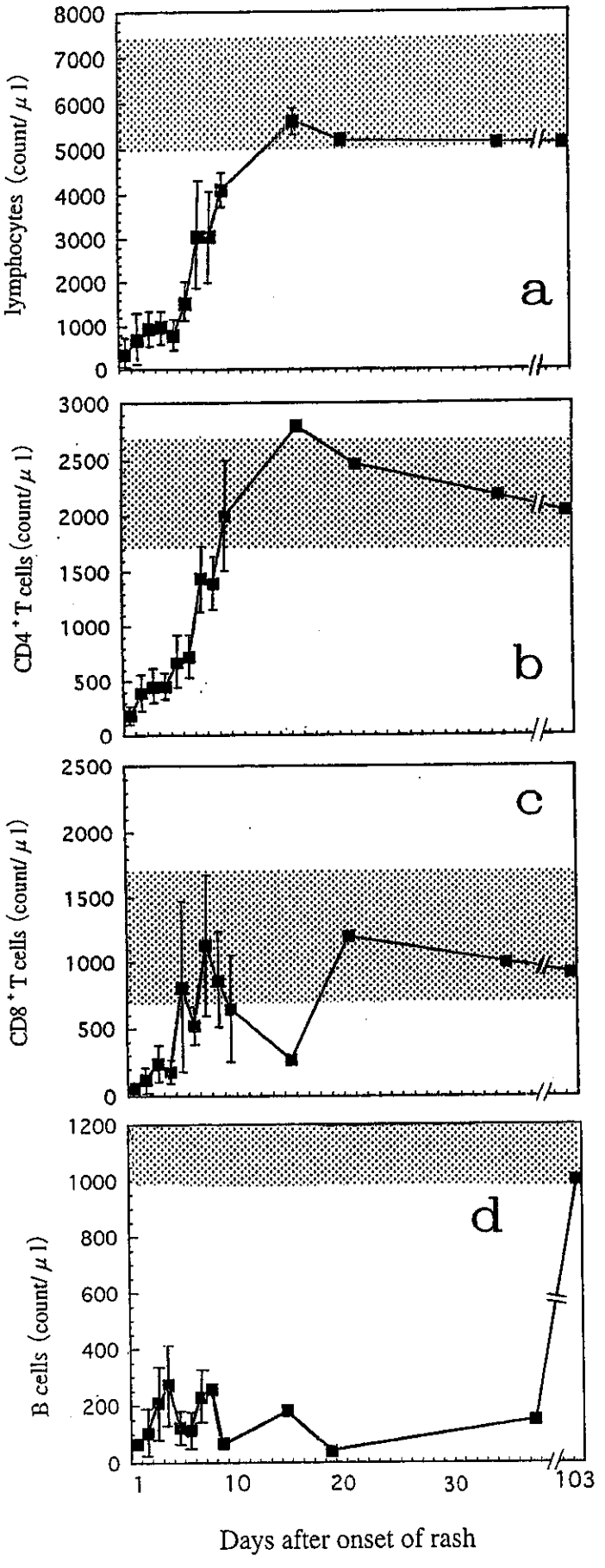
8000
7000
6000
5000
4000
3000
2000
1000
0
4000
3500
3000
2500
2000
1500
1000
500
0
3000
2500
2000
1500
1000
500
0
1200
1000
800
600
400
200
0
1
10
20
30
40
66
Days after onset of rash

Fig1(A)


lymphocytes (count/μl)
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7000
6000
5000
4000
3000
2000
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0
a
CD4+T cells (count/μl)
3000
2500
2000
1500
1000
500
0
b
CD8+T cells (count/μl)
2500
2000
1500
1000
500
0
c
B cells (count/μl)
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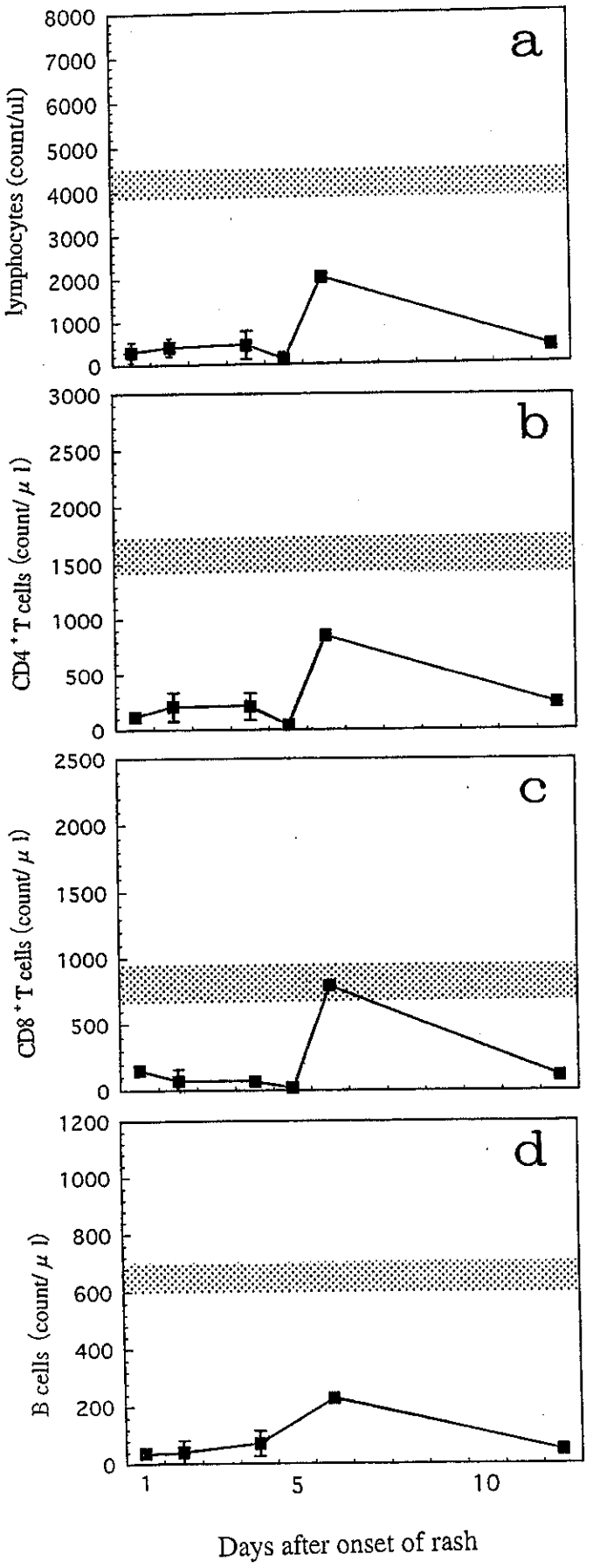
1000
800
600
400
200
0
d
1
10
20
30
103
Days after onset of rash

Fig1(B)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lymphocytes (count/ul)
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7000
6000
5000
4000
3000
2000
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0
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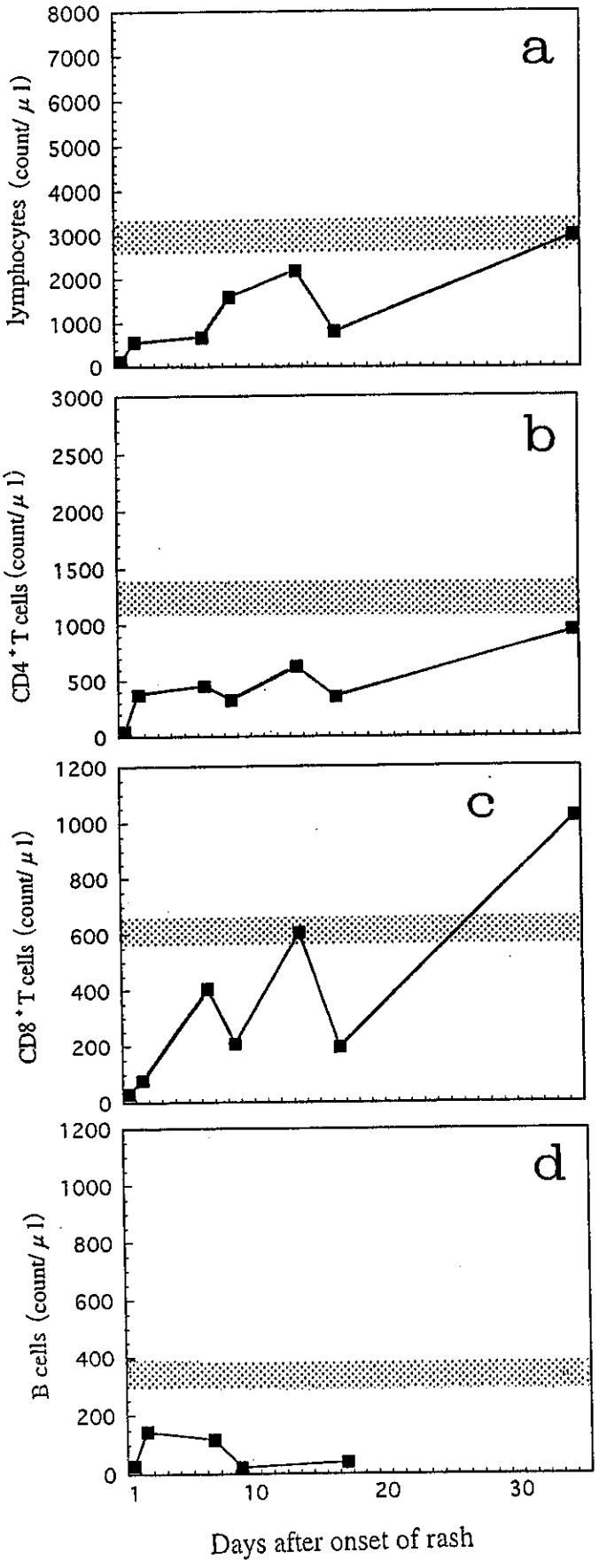
2000
1500
1000
500
0
c
CD8+T cells (count/μl)
2500
2000
1500
1000
500
0
d
B cells (count/μl)
1200
1000
800
600
400
200
0
1
5
10
Days after onset of rash

Fig1(C)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b
c
d
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CD4+T cells (count/μl)
CD8+T cells (count/μl)
B cells (count/μl)
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0
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600
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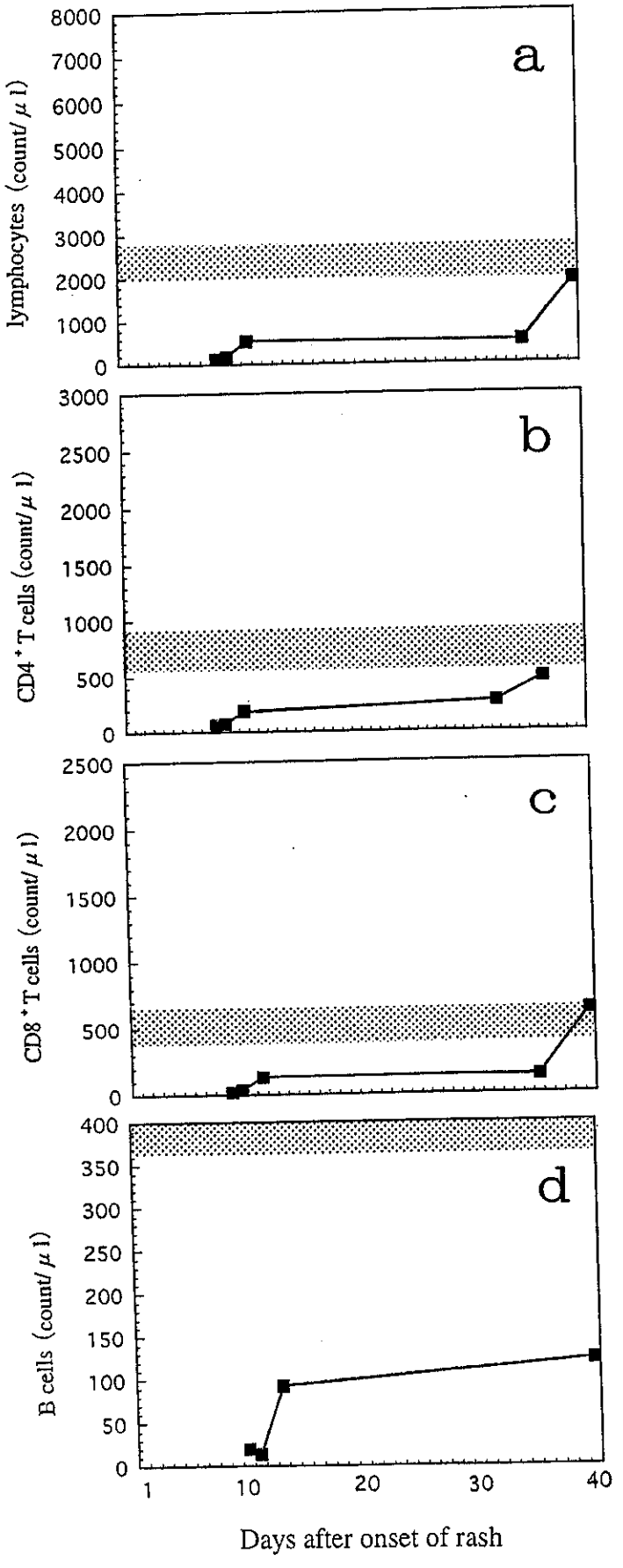
0
1
10
20
30
Days after onset of rash

Fig1(D)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b
c
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lymphocytes (count/μl)
CD4+T cells (count/μl)
CD8+T cells (count/μl)
B cells (count/μl)
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7000
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3000
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2000
1500
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500
0
2500
2000
1500
1000
500
0
400
350
300
250
200
150
100
50
0
1
10
20
30
40
Days after onset of rash

Fig1(E)

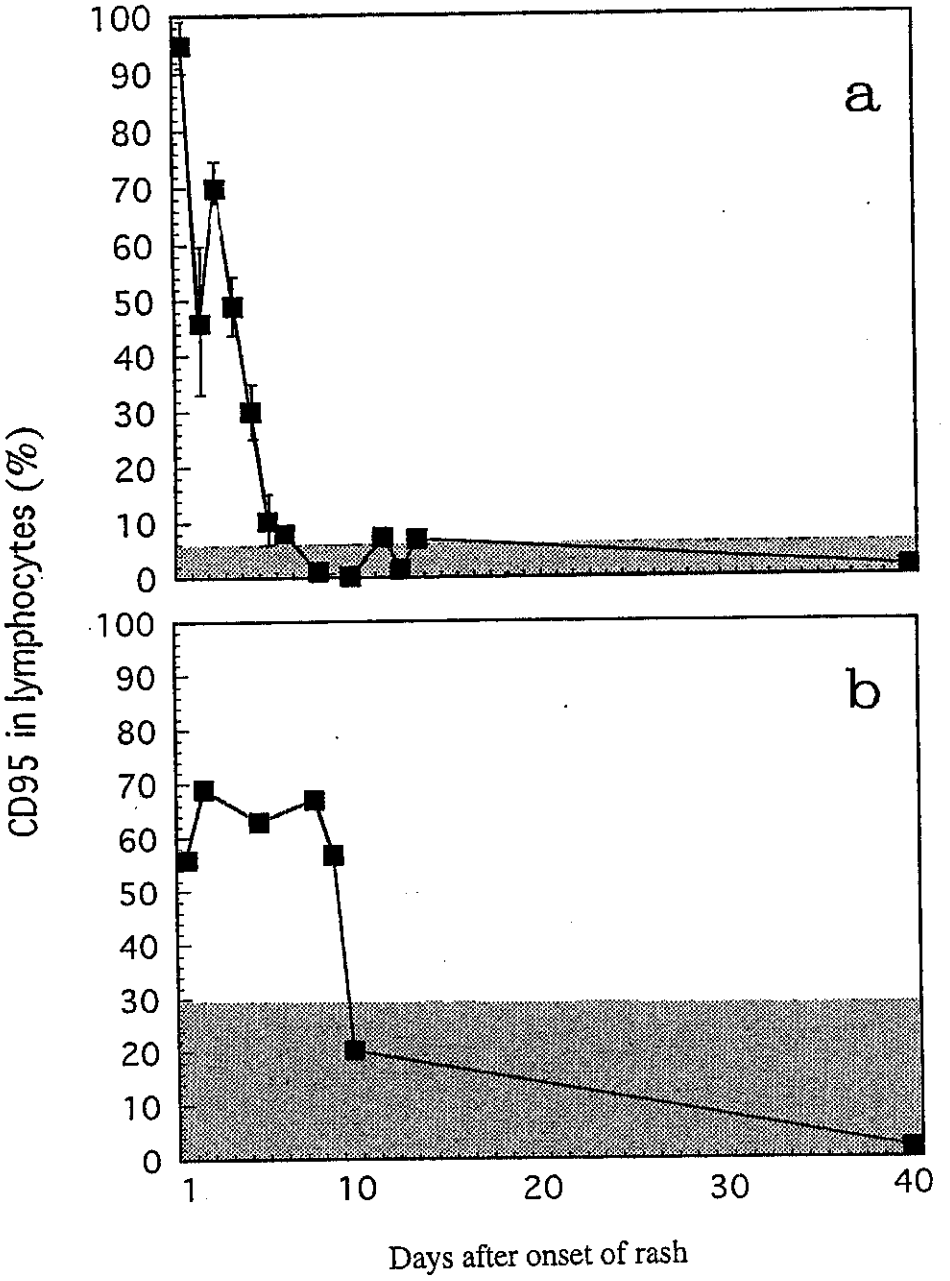
a
b
CD95 in lymphocytes (%)
100
90
80
70
60
50
40
30
20
10
0
1
10
20
30
40
Days after onset of rash

Fig2

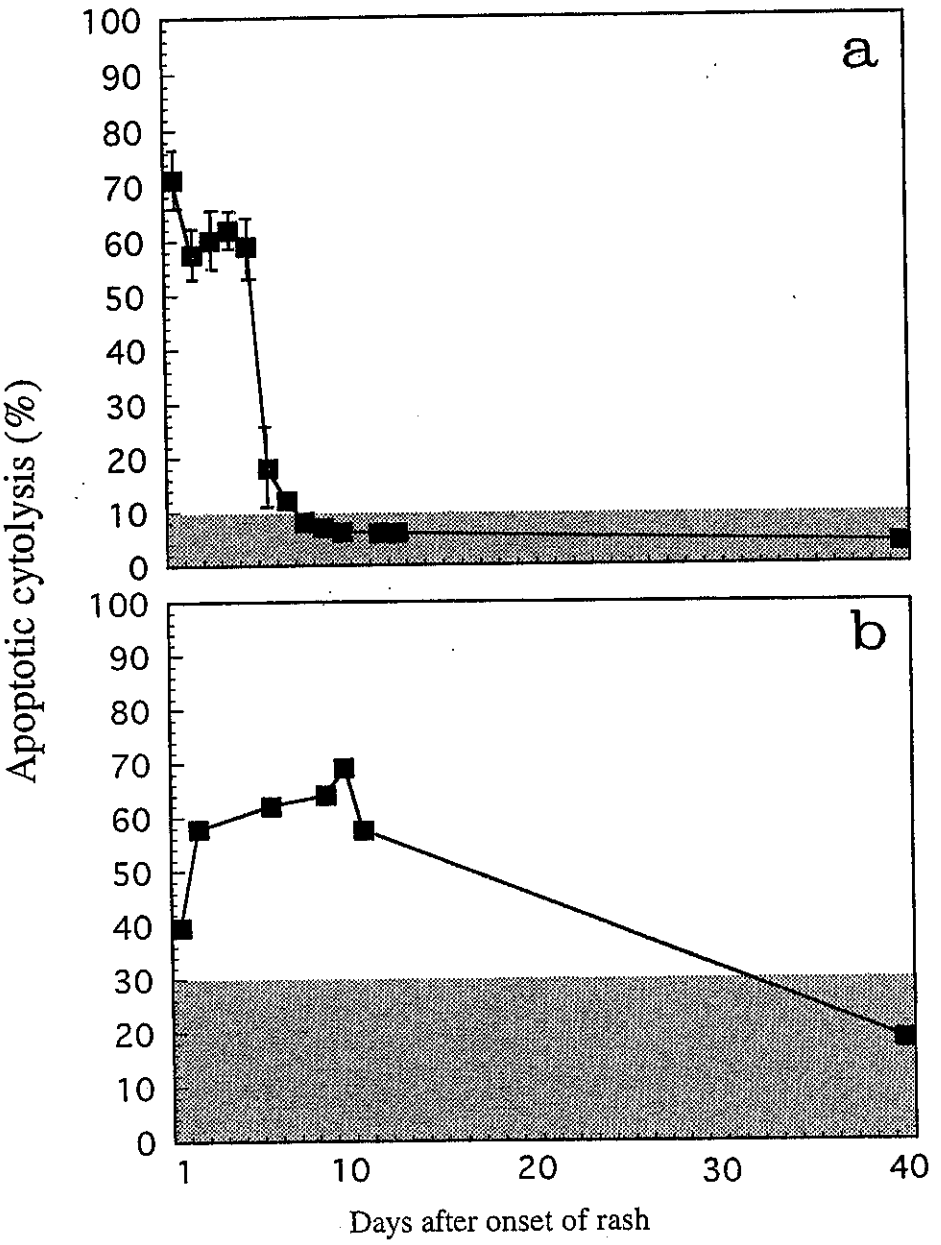
a
b
Apoptotic cytolysis (%)
100
90
80
70
60
50
40
30
20
10
0
1
10
20
30
40
Days after onset of rash

Fig3

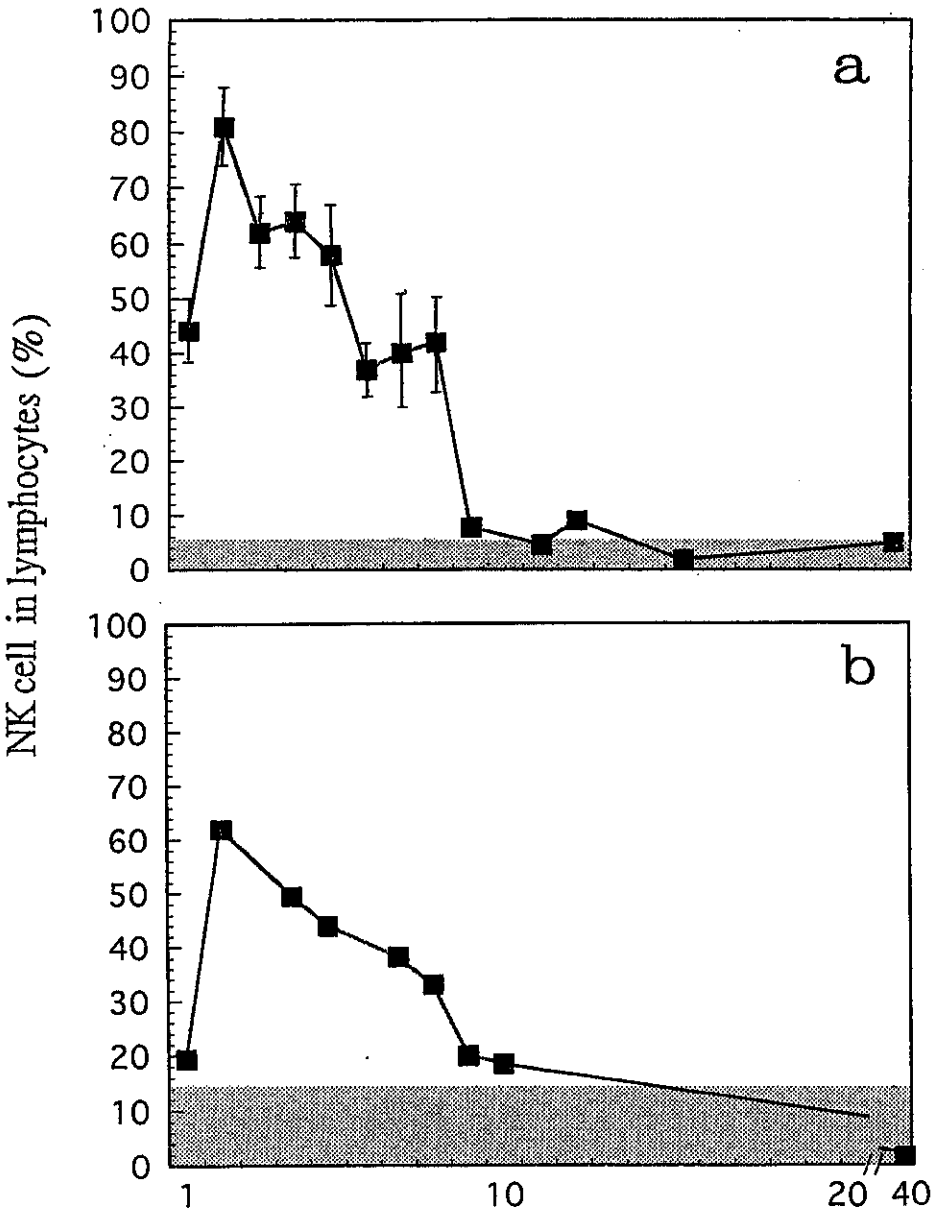
a
b
NK cell in lymphocytes (%)
100
90
80
70
60
50
40
30
20
10
0
1
10
20
40
Days after onset of rash

Fig4

Legends for Figures

Fig. 1. Time-dependent changes in the absolute number of lymphocytes and their subsets in the peripheral blood of measles patients. Blood samples were collected at the indicated days after onset of rash. The number of total lymphocytes (a), $CD4^+$T cells (b), $CD8^+$T cells (c), and B cells (d). Grey zones represent the normal levels of each item in age-matched healthy subjects. Each closed square (■) indicates the average of 3 to 73 samples, and vertical bars indicate standard deviation when the sample number was more than 4. (A) Total 20 patients aged lower than one year old. (B) Total 73 patients aged 1-3 years old. (C) Total 18 patients aged 4-6 years old. (D) Total 16 patients aged 10-15 yeas old. (E) Total 7 patients aged higher than 15 years to adults. Note that the scales of the vertical and horizontal axes are different among the figures.

Fig. 2. Expression of CD95(Fas) on the surface of lymphocytes. Ratios of CD95-expressing cells to total lymphocytes are shown in percentage from 35 measles patients aged 1-3 years old (a), and 4 patients aged 10 years old to adults (b). Grey zones indicate the normal level in age-matched healthy controls.

Fig. 3. Apoptosis inducing activity of PBMC. PBMC obtained from measles patients at the indicated days after onset of rash were incubated in vitro for 24 hr and fragmentation of the chromosomal DNA was quantified by flowcytometry as a marker of apoptosis. Total 35 cases of measles patients aged 1-3 years old (a), and from 4 cases aged 10 years old to adults (b). Figures are expressed in percentage. Grey zones indicate the normal levels in age-matched healthy controls.

Fig. 4. Ratios of NK cells to total surviving PBMC obtained from 73 cases of measles patients aged 1-3 years old (a), and from 23 cases aged 10 years old to adults (b). Grey zones indicate the normal levels in age-matched healthy controls.