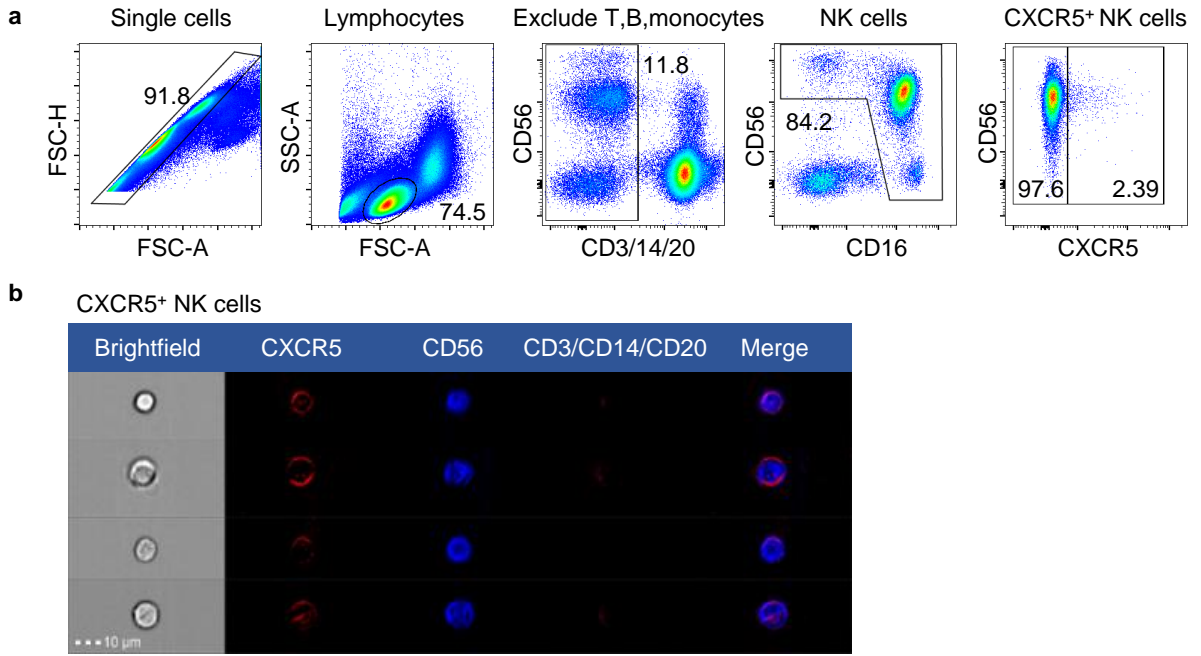


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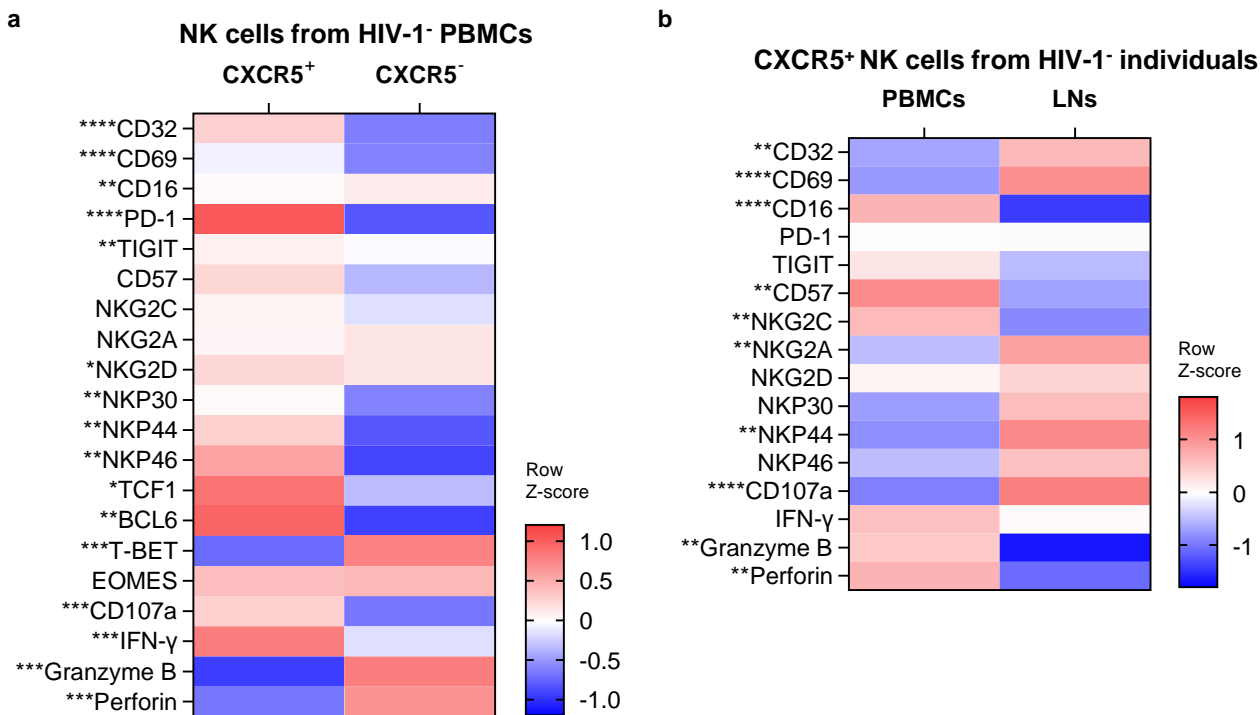
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Supplementary Figure 1 .



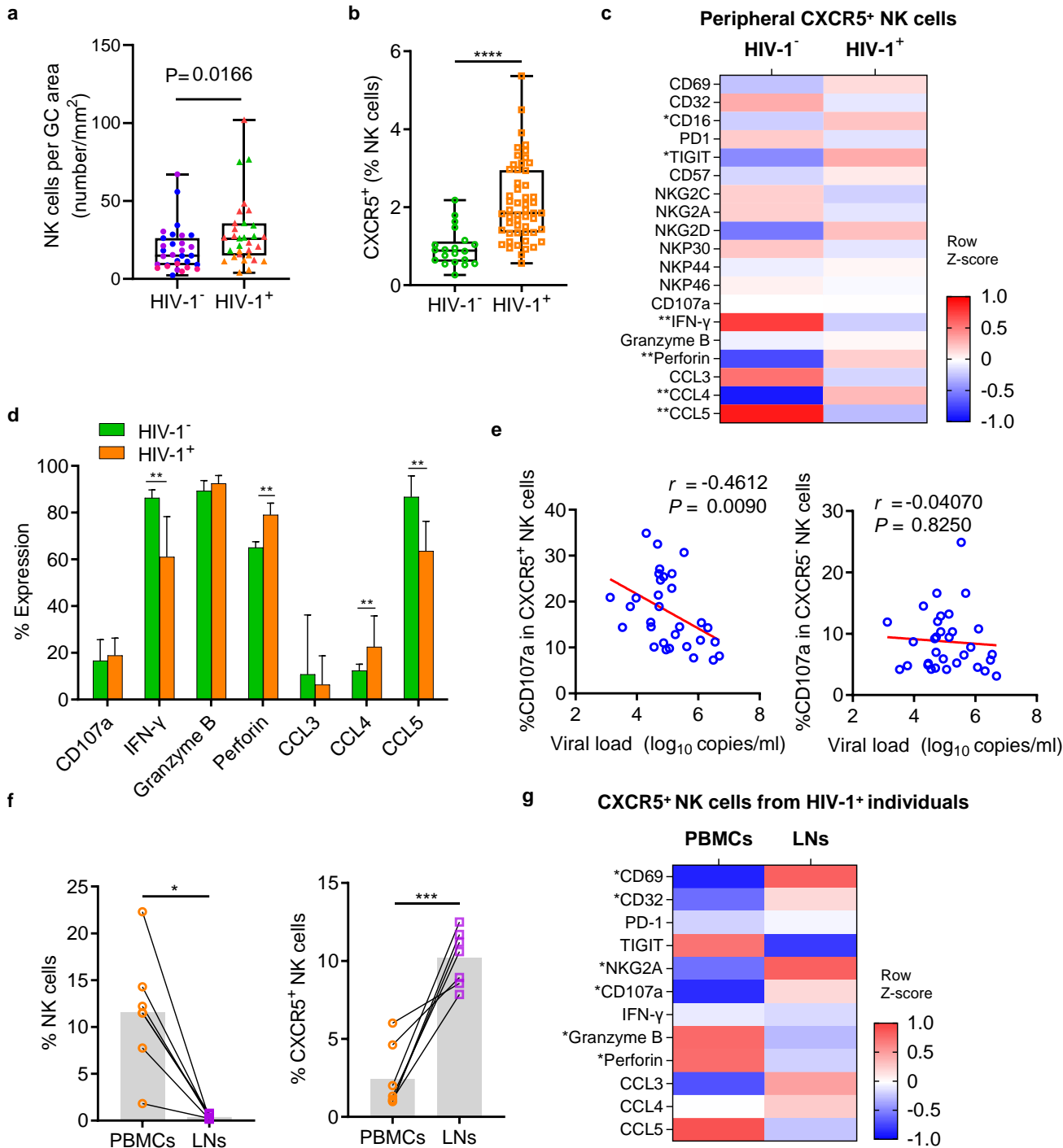
Supplementary Figure 1. Representative flow cytometry plot of peripheral CXCR5⁺ NK cells. (a) Gating strategy of peripheral CXCR5⁺ NK cells by flow cytometry. Numbers indicate the percentage of gated cells. **(b)** The expression of CXCR5 (red), CD56 (blue), and CD3/CD14/CD20 (purple) of peripheral CXCR5⁺ NK cells were visualized by image flow cytometry.

Supplementary Figure 2 .



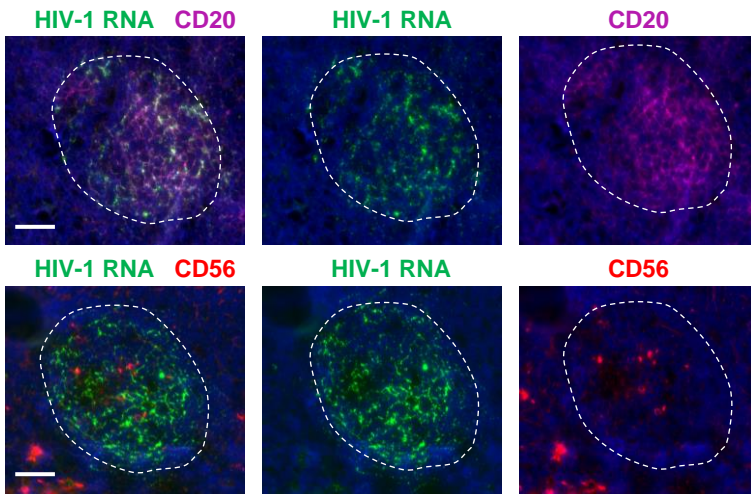
Supplementary Figure 2. Phenotypic and functional profiles of CXCR5⁺ and CXCR5⁻ NK cells in PBMCs and LNs from HIV-1 negative individuals. (a) The protein expression phenotypes of peripheral CXCR5⁺ and CXCR5⁻ NK cells from HIV-1⁻ PBMCs were obtained by flow cytometry. (b) The protein expression phenotypes of CXCR5⁺ NK cells from HIV-1⁻ LNs and PBMCs were obtained by flow cytometry. Significant differences in a were calculated using Wilcoxon signed-rank test, and b were calculated using Mann-Whitney U test. * $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$, **** $P < 0.0001$.

Supplementary Figure 3 .



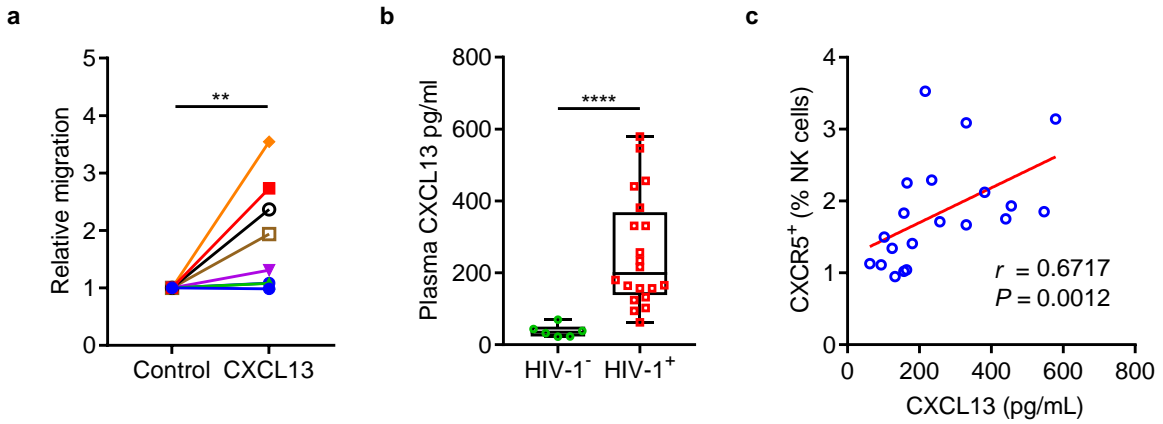
Supplementary Figure 3. Effect of HIV-1 infection on frequency, phenotypic and functional features of peripheral CXCR5⁺ NK cells. (a) The number of CD56⁺ cells per area of GC between HIV-1⁻ and HIV-1⁺ individuals, follicles from the same individual are displayed in the same color. (b) The frequency of peripheral CXCR5⁺ NK cells from HIV-1⁻ (n = 20) and HIV-1⁺ (n = 53) individuals. (c) The protein expression phenotypes of peripheral CXCR5⁺ NK cells from HIV-1⁻ and HIV-1⁺ individuals were obtained by flow cytometry. (d) The expression of functional molecules from peripheral CXCR5⁺ NK cells in HIV-1⁻ and HIV-1⁺ individuals, data represented as median with interquartile range. (e) The correlation between plasma HIV-1 viral load and CD107a expression on peripheral CXCR5⁺ NK cells (n = 31). (f) Paired comparison of NK (upper) and CXCR5⁺ NK (lower) frequencies in PBMCs and LNs from HIV-1⁺ individuals (n = 7). (g) The protein expression phenotypes of CXCR5⁺ NK cells from HIV-1⁺ LNs and paired PBMCs were obtained by flow cytometry. Significant differences in a, b, and c were calculated using Mann-Whitney U test, and e, f were calculated using Wilcoxon signed-rank test. Correlation in d were calculated using Spearman correlation coefficient. * $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$, **** $P < 0.0001$.

Supplementary Figure 4 .



Supplementary Figure 4. HIV-1 mainly located in B cell follicles. Immunofluorescence staining of HIV-1 RNA (green), CD20 (pink) and CD56 (red) of serial sections from one HIV-1⁺ LN (patient No. 6), the circled area represents a B cell follicle. Scale bar = 100 μ m.

Supplementary Figure 5 .



Supplementary Figure 5. The relationship between plasma CXCL13 level and peripheral CXCR5⁺ NK cells. (a) The relative migration rates of CXCR5⁺ NK cells towards CXCL13 were measured by transwell assay (n = 8). (b) CXCL13 plasma concentrations (pg/mL) were measured by ELISA and plotted for HIV-1⁻ and HIV-1⁺ individuals. (c) Correlation between peripheral CXCR5⁺ NK cell frequency and plasma CXCL13 levels (n = 20). Significant differences in a were calculated using Wilcoxon signed-rank, and test b were calculated using Mann-Whitney U test. Correlation in c were calculated using Spearman correlation coefficient. ** $P < 0.01$, **** $P < 0.0001$.

Supplementary Table 1. Characteristics of the participants for PBMC samples

Characteristics	HIV-1 negative group (n=20)	HIV-1 infected group (n=53)
Gender (male/female)	14/6	50/3
Age (years)	28 (26.25-34.5)	31 (24.5-40)
CD4⁺ T (cells/μl)	855.5 (605.8-932)	266 (174-394)
CD8⁺ T (cells/μl)	641.5 (521-779.8)	1038 (663-1289)
CD4/CD8 ratio	1.20 (0.97-1.52)	0.24 (0.16-0.41)
Plasma viral load (\log_{10} copies/ml)	NA	4.99 (4.65-5.53)

All indicators except gender were shown as median (Interquartile range); NA: not available

Supplementary Table 2. Antibodies used in this study

Reagent or resource	Source	Clone	Catalogue number	RRID
Anti-human CD3 APC/Fire750	Biologend	SK7	344840	AB_2572114
Anti-human CD14 APC/Fire750	Biologend	63D3	367120	AB_2572099
Anti-human CD14 PE	BD	M5E2	555398	AB_395799
Anti-human CD19 FITC	BD	HIB19	555412	AB_395812
Anti-human CD20 APC/Fire750	Biologend	2H7	302358	AB_2572126
Anti-human CD16 PerCP	Biologend	3G8	302030	AB_940380
Anti-human CXCR5 BV421	BD	RF8B2	562747	AB_2737766
Anti-human CXCR5 APC	Biologend	J252D4	356908	AB_2561817
Anti-human CXCR5 PE-CY7	Biologend	J252D4	356923	AB_2562354
Anti-human CD56 APC	Tongsheng Shidai	NA	Z6410017	NA
Anti-human CD56 PerCP	Biologend	HCD56	318322	AB_893389
Anti-human CD56 BV510	BD	NCAM16.2	563041	AB_2732786
Anti-human CD32 PE	Biologend	FUN-2	303206	AB_314338
Anti-human CD32 FITC	BD	3D3	552883	AB_394512
Anti-human CD69 PE-CY7	Biologend	FN50	310912	AB_314847
Anti-human NKG2A FITC	Miltenyi Biotec	REA110	130-113-565	AB_2733623
Anti-human NKG2D PE-CY7	BD	1D11	562365	AB_11153309
Anti-human NKp30 AF647	BD	p30-15	558408	AB_647154
Anti-human NKp44 PE	BD	p44-8	558563	AB_647239
Anti-human NKp46 BV510	Biologend	9E2	331924	AB_2563854
Anti-human PD-1 BV510	Biologend	EH12.2H7	329932	AB_2562256
Anti-human TIGIT PE	Biologend	A15153G	372704	AB_2632730
Anti-human CD107a FITC	Biologend	H4A3	328606	AB_1186036
Anti-human Granzyme B PE	Biologend	QA16A02	372208	AB_2687032
Anti-human Perforin PE-CY7	Biologend	B-D48	353316	AB_2571973
Anti-human IFN- γ BV510	BD	B27	563287	AB_2738118
Anti-human CD57 BV605	Biologend	QA17A04	393304	AB_2728426
Anti-human NKG2C PE-vi770	Miltenyi Biotec	REA205	130-103-637	AB_2655398
Anti-human T-bet FITC	Biologend	4B10	644811	AB_2287097
Anti-human Tcf-1 PE	Biologend	7F11A10	655207	AB_2728491
Anti-human Bcl-6 PE-CY7	Biologend	7D1	358511	AB_2566195
Anti-human Eomes eFluor660	eBioscience	WD1928	50-4877-42	AB_2574229
Anti-human KI67 PE	BD	B65	562899	AB_2686897
Anti-human CCL3 FITC	eBioscience	CR3M	11-9706-41	AB_2572533
Anti-human CCL4 APC	eBioscience	FL34Z3L	17-7540-42	AB_2573264
Anti-human CCL5 BV421	BD	2D5	564754	AB_2738932
Anti-human KIR3DL1-PE	Miltenyi Biotec	DX9	130-092-473	AB_871615
Anti-human KIR2D-PE	Miltenyi Biotec	NKVFS1	130-123-710	AB_2819517
Anti-human CXCL13 Antibody	ZSGB-BIO	NA	ZG-0601	NA
Anti-human NCAM1 Antibody	abcam	EP2567Y	ab75813	AB_2632384
Anti-human CXCR5 Antibody	R&D	51505	MAB190	AB_2292654
Anti-human CD20 Antibody	ZSGB-BIO	OT11H4	ZA-0549	NA
Anti-human CD3 Antibody	ZSGB-BIO	EP41	ZA-0503	NA

NA: not available