Journal of Aging Science
ISSN: 2329-8847
OPEN ACCESS Freely available online
Commentary

Quantitative Assessment of Immunological Level Using Peripheral Blood Cells

Katsuiku Hirokawa*, Utsuyama M

Department of Pathology, Institute of Health and Life Science, Tokyo Medical and Dental University, Tokyo, Japan

DESCRIPTION

This year, 2020, is unforgettable in terms of COVID 19. When infected, high percentage of elderly people become severe in disease state, because they are usually immunologically low in level and have some underlying diseases. It is of note that the severe condition of COVID-19 is also observed in some of younger people. The fact suggests that immunologically deficient status may be observed in younger people. A quantitative assessment of the immune system developed by us was performed in more than 6000 people of various ages and indicated that a significant decline was observed in about over 10% of younger people without notable diseases. Major possible reasons for immunological depression in these younger people are stress and improper lifestyle.

Quantitative assessment of immunological level

The immune system comprises various functions and consists of many types of cells with different functions, and it is difficult to select immunological parameters that are suitable for the assessment of the level of immune functions as a whole. Among various cells related to immune functions, lymphocytes are most susceptible to the aging process and stress. Among lymphocytes, T cells are easily influenced by aging and environmental stress.

We have reported that the age-related change in the T-cell-dependent immune system is observed in a decrease in the T-cells number, a change in the T-cell subpopulations, and a qualitative change in T-cells such as a decline in proliferative capacity [1]. Therefore, the number of whole T-cells and their subpopulations, and the proliferative activity of T-cells are useful parameters to assess the extent of the age-related decline of immune functions.

We have defined a new parameter, T-cell proliferation index (TCPI) which is calculated by using the number and proliferation activity of T-cells. We can guess the age of individuals by the value of TCPI using an equation between them. The age obtained by this equation is hereafter referred to as the immunological age (IA). $CD8^+$ $CD28^+$ T cells are an important T cell subpopulation in playing a role as killer T cells for virus-infected cells and cancer cells. There is a reverse relationship between the number of $CD8^+$ $CD28^+$ T cells and chronological age. We called the calculated value as T lymphocytes age. Considering these facts, we proposed a trial of quantitative assessment method mainly using T cells and their subpopulations about 15 years ago [1].

In concrete terms, we performed flow cytometric analysis for T-cells and their subpopulations; number of T-cell ($CD3^+$ cells), number of $CD4^+$ cells, number of $CD8^+$ cells, the ratio of $CD4^+$ cells to $CD8^+$ cells (CD4/CD8 ratio), number of $CD8^+$ $CD28^+$ T cells, naïve $CD4^+$ T-cells ($CD4^+$ $CD45RA^+$ cells), number of memory $CD4^+$ T-cells ($CD4^+$ $CD45RO^+$ cells), and the ratio of naïve T-cells to memory T-cells (N/M ratio). The proliferative activity of T-cells was measured by nonspecific stimulation of T-cells by anti-CD3 monoclonal antibody. In addition to T-cells, the numbers of B-cells and NK-cells were included for this assessment, since these cells are important counterparts of immune functions. Here, we have 8 immune parameters to assess the extent of immunological functions, although we know this is far from the final reasonable goal.

Since it is difficult to imagine the immunological level of each individual by merely looking at the values of the 8 parameters, we have tried to express the immunological level of each individual in a plain style. The value of each immunological parameter was scored into 3 grades based on its value. In particular, values in the range of a cumulative frequency less than 10% of values observed in the healthy subjects were scored 1, which indicates low immunity level; those between 10% and 40% were scored 2, indicating moderate immunity level, and those with 40% or higher were scored 3 indicating sufficiently high immunity level. By summation of scores of 8 immunological parameters, we can get a numeral between 8 and 24 and we named it a Score of Immunological Vigor (SIV). SIV is then grouped to 5 grades; high zone (24), safety zone (21-23), observation zone (17-20), warning zone (13-16), and critical zone (8-15). By this process, a very approximate figure or level of immunity can be obtained for an individual as shown in Figure 1. As *in vitro* proliferation of T cells is difficult in many occasions, we perform flow cytometric analysis for 7 parameters and thus SIV ranges between 7 and 2.

Correspondence to: Dr. Katsuiku Hirokawa, Institute of Health and Life Science, Tokyo Medical and Dental University Open Laboratory, 2-3-10, Kanda, Surugadai, Chiyoda-ku,Tokyo, Japan, E-mail: hirokawa@nakanosogo.or.jp

Received : September 10, 2020; **Accepted :** September 24, 2020; **Published :** October 01, 2020

Citation: Hirokawa K, Utsuyama M (2020) Quantitative Assessment of Immunological Level Using Peripheral Blood Cells. J Aging Sci. 8: 240. DOI: 10.35248/2329-8847.20.08.240.

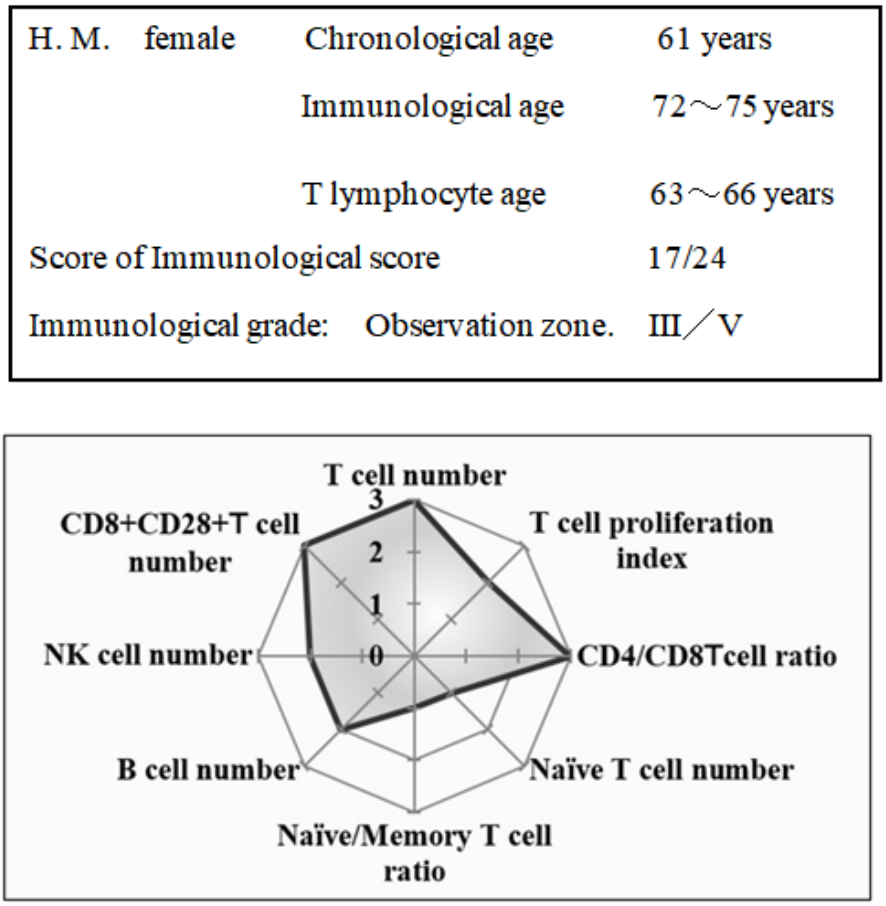

Figure 1: Quantitative assessment of immunological level in a 61 years old female.

So far we measured approximately 20,000 subjects, composed of people without notable diseases, with some diseases and cancers. The aging process and magnitude of stress are dependent on lifestyle. Because of these backgrounds in addition to genetic factors, the level of immune function is variable by individual peoples. Thus, an age-related decline is observed in score and grade of immunological vigor, but individual variation is greater than the age-related change. It is of note that the percentage of immunological grade II is greater in people with diseases and cancers as compared with a healthy population, and the percentage of grade IV is lower in these people (Table 1) [2].

Immunological restoration

Immunological restoration is a very important goal for us. For this purpose, a quantitative assessment of immune function is very helpful. People try to improve their health conditions by improving their lifestyle. For instance, when people have noticed high blood pressure by measuring an apparatus, most of them try to change their lifestyle. The measurement of the immunological level by quantitative assessment works in the same way. When one has noticed the low level of immunological level together with ill-conditioned status, he will try to change the lifestyle for the improvement of the immunological level expecting an improvement of health. We observed a significant rise in the immunological level

Table 1: The percentage of immunological grade.

		Healthy		Diseases		Cancer	
Gender		Male	Female	Male	Female	Male	Female
Number		2541	4082	3139	2520	2690	2867
Age	Mean ± SD	52.5 ± 11.6	49.2 ± 11.8	57.7 ± 14.5	56.0 ± 13.6	63.5 ± 11.0	60.0 ± 13.6
	Range	(18-90)	(18-85)	(12-94)	(17-93)	(18-92)	(17-92)
Immunological grade	I	2.5	0.1	2.5	2.3	3.3	2.1
	II	13.2	10	25.7	27.8	37.2	35.2
	III	57.3	65.1	56.4	54.8	49	52.8
	IV	24.5	24.4	15.3	14.9	10.4	9.7
	V	2.5	0.5	0.1	0.2	0.2	0.2

Numbers indicated as %

in some of those who tried a change of lifestyle and ingested some supplements [3,4].

The quantitative assessment of immunity is useful for the prognosis of cancer patients, since the level of immunity correlated with the progression of cancer stage. Cancer patients in the late stage are generally low in immunity and simple infusion of activated T cells proliferated *in vitro* culture is effective for improvement of the general condition in some cases. Habits indicative of an improper lifestyle are poor sleep, overwork, smoking, excessive drinking, irregular meals, deviated nutrients in food, and insufficient physical exercise. We interviewed more than 50 young people who showed a lower level of SIV and over 50% of them had improper work habits. Among many ways for upgrading immune function, the improvement of lifestyle is the most important aspect. The major components of lifestyle are nutrition, physical exercise, sleep, stressful environment, and tobacco/alcohol habits. For emergent occasions, grafting of cells and tissues, such as infusion of activated T cells is helpful. Here again, to maintain health, people should know their level of immune function.

REFERENCES

1. Hirokawa K, Utsuyama M. Assessment of age-related decline of immunological function and possible methods for immunological restoration in elderly. Handbook of Immunosenescence. 2019. pp: 2767-2793.
2. Hirokawa K. Unpublished data.
3. Oda Y, Uede Y, Utsuyama M, Kamei A, Kakinuma M, Abe K, et al. Improvement in human immune function with changes in intestinal microbiota by salacia reticulata extract ingestion: A Randomized Placebo-Controlled Trial. Plos one. 2015;10(12): e0142909.
4. Annie George. Immunomodulation in middle-aged humans *via* the ingestion of physta® standardized root water extract of eurycoma longifolia jack—a randomized, double-blind, placebo-controlled, parallel study. Phytother Res. 2016;30(4): 627-635.