Lymphoma Simplified

Our body is made of countless cells of many types. Cells have specialized jobs and names, such as skin, nerve, heart, lung, blood, immune cells, and so on. For the human body to function normally, each organ must have a certain number of cells.

By design, the cells in most organs have a short lifespan. Therefore, to continue functioning, the body needs to replace these lost cells by the process of cell division.

Cell division and cell death are controlled by genes that are located in the cell nucleus. Genes function like an instruction manual telling the cell what proteins to make. These proteins in turn control the behavior of the cell.

Some proteins direct the cell to divide; others how long it will live; and others begin cell death - a normal process by which the body rids itself of old, unneeded, or damaged cells.

Under normal conditions there is a balance in which new cells replace old, and each cell carries out tasks specific to its kind: Heart cells pump, stomach cells produce acids, immune cells recognize invaders and kill them, and so on. The balance ensures that the organs and systems function properly and serve the needs of the body.

The Beginning of Cancer

In any cell the genetic code can get damaged so that the instructions in the "manual" are altered in ways that produce abnormal types and amounts of proteins that can lead to abnormal behavior of the cell. Instead of resting, the cell may continue dividing; instead of dying the cell stays alive.

The first cell to lose normal growth control is called the cell of origin. When this cell divides, the new cells inherit the genetic defects of the parent cell. Thus, in cancer, the descendants of the cell of origin are clones of this cell.

A hallmark of cancer cells is that they have growth and survival advantages over normal cells. There cell division is not balanced by cell death. The abnormal cells may eventually form lumps called tumors. The word tumor simply means a mass of cells.

Tumors can be either benign or malignant. Benign tumors are not a threat to long-term health, while malignant tumors are. The word malignant means 'showing great malevolence - being disposed to do evil.'

One way that pathologists identify a tumor as being malignant is if the cells within it are clonal - all identical to the cell of origin. In contrast, benign tumors are made up of related but different cells.

The hallmarks of cancer cells include:

- Limitless potential to divide and grow
- Resisting cell death (resisting apoptosis - normal programmed cell death)
- Evasion or suppression of the immune system
- Development of a sustaining blood supply (angiogenesis)
- Self sufficiency in growth signals
- Insensitive to anti-growth signals
- Tissue invasion and metastasis, spreading beyond the organ of origin

Note: Lymphomas, being derived from blood cells, are generally systemic (widespread) at diagnosis, and also potentially reversible with treatment at any stage.

Lymphoma is a Blood Cell Cancer

Blood is a fluid made up of plasma and many types of blood cells, such as red blood cells (erythrocytes), white blood cells (leukocytes) and platelets. Blood circulates through the heart, arteries and veins. It carries "nourishment, hormones, vitamins, antibodies, heat and oxygen to the body's tissues."

Lymphoma is a cancer that affects a type of white blood cells called lymphocytes – immune cells that normally protect you from illness.

About 85% of lymphomas are of b-cell origin, and 15% of t-cell origin.

- B-cells originate and mature (differentiate) in the bone marrow.
- T-cells also start out in the bone marrow, but they differentiate and mature in the thymus gland.
- Natural Killer cells are a third kind of lymphocyte. They specialize in killing foreign cells and possibly signaling to alert other immune cells of invaders. ...

The different types of lymphoma are determined by the type of lymphocyte that has become cancerous, and the stage of development.

As with other cancers, the root cause of lymphomas is damage to genes that leads to abnormal growth controls in the cell.

Lymphomas are a Family of Related Cancers

The cell of origin determines the subtype of lymphoma, and its likely clinical behavior.

The cell of origin, such as T-cell, B-cell, and NK cell, and the stage of maturation of that cell determine the type of lymphoma. This is often referred to as the cell type or diagnosis, [or histology] such as follicular small cleaved lymphoma.

When a lymphocyte becomes malignant, its biologic behavior is arrested at that stage -- this influencing its location and growth rate and other cellular behaviors. Consider that just as children grow faster than adults, cells at earlier stages of development tend to grow faster than they do at mature stages.

The malignant cells then may accumulate to form tumors that enlarge the lymph nodes or spread to other areas of the lymphatic system, such as the spleen or bone marrow, or outside the lymphatic system to the skin, or mucosal linings of the stomach.

How widespread the lymphoma is, is called stage. Staging is the process of determining where the lymphoma is located by imaging and other methods.

NOTE: It's common for the lymphoma to be at stage IV at diagnosis. But, advanced stage of disease does not mean the treatments will not be effective.

About growth rate: The cell of origin will also determine how fast or slow the lymphoma cells will tend to grow. The growth tendency of the lymphoma is also called the grade.

Aggressive grade lymphomas divide and grow rapidly, and therefore prompt and aggressive treatment is indicated.

Indolent grade lymphomas may not divide faster than the cell of origin. Here the malignant behavior is the resistance to cell death, which results in a slow buildup of excess cancer cells causing tumors to form, but more slowly.

Mutations also Influence the Clinical Behavior

The specific damage to DNA - and the gene expression - is likely to be different for patients who have the same diagnosis.

These differences may explain, in part, why patients with the same diagnosis can have a lymphoma that develop at different rates, and respond differently to the same treatments.

Recall that genes expression determines what proteins the cells express and this determines behavior. Consider also that response to treatment is also cell behavior.

For example, cells detecting damage to DNA induced by treatment will initiate cell death, but only if the genes that can activate the cell-death program are functioning or activated by the treatment.

"Ultimately, it may well be that the optimal treatment will be determined by patient clinical and biological characteristics." ~ Dr. Bruce Cheson - Advances in the Treatment of Non-Hodgkin's Lymphoma (Medscape)

Each Lymphoma can be unique

Factors that may account for clinical differences in lymphomas:

- The cell type: T-cell, B-cell, NK-cell, and subtypes of each;
- The stage of development of the cell of origin
- Slight differences in stage of development
- Specific damage to the genes
- Different patterns of gene expression - silent versus active genes
- Differences in the health, strength and characteristics of the immune systems
- Differences in the microenvironment in the tumors, which are made up of malignant cells and normal cells. Here the interactions among the cells in the tumor may be promoting or stabilizing
- The presence or absence of antigen stimulation inside the body

  For example, a bacteria (the antigen) may trigger the cancerous lymphocyte to activate and divide, thus promoting the growth of the lymphocyte tumors. MALT is a subtype of lymphoma that develops in the mucosal linings. This lymphoma can resolve in many cases by treating a bacterial infection called H-pylori.

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www.Lymphomation.org