Background of Cancer
• Cancer cells divide uncontrollably, causing an excess of cells called tumors that can spread into nearby tissues.
• Breast cancer begins in breast milk glands, milk ducts, or sometimes breast tissue and spreads dangerously fast if it reaches the lymph nodes or blood stream.
• 80% of breast cancer is diagnosed as invasive ductal carcinoma (IDC), which spreads from the epithelial cells in the milk duct to the surrounding breast tissue (Figure 1).
• In most cases, the patient has an excess amount of the human epidermal growth factor receptor 2 gene (HER2), which signals the cell to grow more than normal.
• There are over 320,000 new cases of breast cancer diagnosed each year and 40,000 cases result in death. These cases contribute to the continually rising $90 billion spent on cancer treatment each year in the United States.

The Future Outlook
• There has already been research conducted to improve its absorption by creating a human serum albumin, the most prevalent protein found in the blood, which is loaded with Tykerb nanoparticles.
• Researchers are also working to make Tykerb available to men, younger women, and pregnant women.

Tykerb
• Tykerb, a specific brand of Lapatinib, is a dual tyrosine kinase inhibitor.
• This target drug blocks HER2 protein receptors, stopping phosphorylation, which is the process that adds a phosphate group and allows cancer cells to divide.
• Tykerb was approved by the FDA in 2010 for postmenopausal women.
• Monoclonal antibodies can either attach to the antigen to kill the cell themselves or the antibodies can carry other cancer treatment drugs. When the breast cancer is resistant to monoclonal antibodies, oncologists use target drugs.
• Tykerb is a protein kinase inhibitor that interrupts signal transduction and prevents the normal function and cell communication of the protein kinase, which controls cell growth. This stops a phosphate from being added, which turns the HER2 protein off and stops the cell from receiving signals to continue growing.
• Tykerb nanoparticles are more effective than monoclonal antibodies because it enters the cells to connect to the HER2 receptors (Figure 2) rather than attaching to the antigens on the outside of the cell.

Sustainability
• GlaxoSmithKline (GSK), the pharmaceutical company that owns and markets Tykerb, has begun to further develop their global pricing strategies.
• Through negotiations, GSK provides Tykerb at a discounted price to those with private or no insurance.
• GSK has partnered with other pharmaceutical companies, expanding its market, and making it a proprietary global oncology drug.

Advantages
• Distinguishes between cancerous and noncancerous cells to minimize damage unlike chemotherapy
• Fewer and less severe side effects
• More accessible because it is taken as a pill rather than intravenously.

Disadvantages
• Low oral absorption
• Requires a large daily dosage
• Only approved for postmenopausal women
• A month’s supply of Tykerb can cost $5,000 to $6,000

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