**Types of chemotherapy drugs**

Chemotherapy drugs can be divided into several groups based on factors such as how they work, their chemical structure, and their relationship to another drug. Some drugs act in more than one way, and may belong to more than one group.

Knowing how the drug works is important in predicting side effects. This helps doctors decide which drugs are likely to work well together. If more than one drug will be used, this information also helps them plan exactly when each of the drugs should be given (in which order and how often).

**Alkylating agents**

*Alkylating agents* directly damage DNA (the genetic material in each cell) to keep the cell from reproducing. These drugs work in all phases of the cell cycle and are used to treat many different cancers, including leukemia, lymphoma, Hodgkin disease, multiple myeloma, and sarcoma, as well as cancers of the lung, breast, and ovary.

Because these drugs damage DNA, they can cause long-term damage to the bone marrow. In rare cases, this can lead to acute leukemia. The risk of leukemia from alkylating agents is “dose-dependent,” meaning that the risk is small with lower doses, but goes up as the total amount of the drug used gets higher. The risk of leukemia after getting alkylating agents is highest about 5 to 10 years after treatment.

Alkylating agents are divided into different classes, including:

* Nitrogen mustards: such as mechlorethamine (nitrogen mustard), chlorambucil, cyclophosphamide (Cytoxan®), ifosfamide, and melphalan
* Nitrosoureas: such as streptozocin, carmustine (BCNU), and lomustine
* Alkyl sulfonates: busulfan
* Triazines: dacarbazine (DTIC) and temozolomide (Temodar®)
* Ethylenimines: thiotepa and altretamine (hexamethylmelamine)

The*platinum drugs* (such as cisplatin, carboplatin, and oxalaplatin) are sometimes grouped with alkylating agents because they kill cells in a similar way. These drugs are less likely than the alkylating agents to cause leukemia later.

**Antimetabolites**

*Antimetabolites*interfere with DNA and RNA growth by substituting for the normal building blocks of RNA and DNA. These agents damage cells during the S phase, when the cell’s chromosomes are being copied. They are commonly used to treat leukemias, cancers of the breast, ovary, and the intestinal tract, as well as other types of cancer.

Examples of antimetabolites include:

* 5-fluorouracil (5-FU)
* 6-mercaptopurine (6-MP)
* Capecitabine (Xeloda®)
* Cytarabine (Ara-C®)
* Floxuridine
* Fludarabine
* Gemcitabine (Gemzar®)
* Hydroxyurea
* Methotrexate
* Pemetrexed (Alimta®)

**Anti-tumor antibiotics**

These drugs are not like the antibiotics used to treat infections. They work by altering the DNA inside cancer cells to keep them from growing and multiplying.

**Anthracyclines**

*Anthracyclines* are anti-tumor antibiotics that interfere with enzymes involved in DNA replication. These drugs work in all phases of the cell cycle. They are widely used for a variety of cancers.

Examples of anthracyclines include:

* Daunorubicin
* Doxorubicin (Adriamycin®)
* Epirubicin
* Idarubicin

A major concern when giving these drugs is that they can permanently damage the heart if given in high doses. For this reason, lifetime dose limits are often placed on these drugs.

**Other anti-tumor antibiotics**

Anti-tumor antibiotics that are not anthracyclines include:

* Actinomycin-D
* Bleomycin
* Mitomycin-C
* Mitoxantrone (also acts as a *topoisomerase II inhibitor*)

**Topoisomerase inhibitors**

These drugs interfere with enzymes called topoisomerases, which help separate the strands of DNA so they can be copied during the S phase. (Enzymes are proteins that cause chemical reactions in living cells.) Topoisomerase inhibitors are used to treat certain leukemias, as well as lung, ovarian, gastrointestinal, and other cancers.

Topoisomerase inhibitors are grouped according to which type of enzyme they affect:

*Topoisomerase I inhibitors* include:

* Topotecan
* Irinotecan (CPT-11).

*Topoisomerase II inhibitors* include:

* Etoposide (VP-16)
* Teniposide.
* Mitoxantrone (also acts as an *anti-tumor antibiotic*)

Topoisomerase II inhibitors can increase the risk of a second cancer – acute myelogenous leukemia (AML) – as early as 2 to 3 years after the drug is given.

**Mitotic inhibitors**

*Mitotic inhibitors* are often plant alkaloids and other compounds derived from natural products. They work by stopping mitosis in the M phase of the cell cycle but can damage cells in all phases by keeping enzymes from making proteins needed for cell reproduction.

Examples of mitotic inhibitors include:

* Taxanes: paclitaxel (Taxol®) and docetaxel (Taxotere®)
* Epothilones: ixabepilone (Ixempra®)
* Vinca alkaloids: vinblastine (Velban®), vincristine (Oncovin®), and vinorelbine (Navelbine®)
* Estramustine (Emcyt®)

They are used to treat many different types of cancer including breast, lung, myelomas, lymphomas, and leukemias. These drugs may cause [nerve damage](http://www.cancer.org/ssLINK/peripheral-neuropathy-caused-by-chemotherapy-toc), which can limit the amount that can be given.

**Corticosteroids**

Corticosteroids, often simply called steroids, are natural hormones and hormone-like drugs that are useful in the treatment of many types of cancer, as well as other illnesses. When these drugs are used as part of cancer treatment, they are considered chemotherapy drugs.

Examples of corticosteroids include:

* Prednisone
* Methylprednisolone (Solumedrol®)
* Dexamethasone (Decadron®).

Steroids are also commonly used to help prevent nausea and vomiting caused by chemotherapy. They are used before chemotherapy to help prevent severe allergic reactions, too.

**Other chemotherapy drugs**

Some chemotherapy drugs act in slightly different ways and do not fit well into any of the other categories.

Examples include drugs like L-asparaginase, which is an enzyme, and the proteosome inhibitor bortezomib (Velcade®).