Gemcitabine (pronunciation: jem-SITE-a-been) is a nucleoside analog used as chemotherapy. It is marketed as Gemzar by Eli Lilly and Company.

Chemically gemcitabine is a nucleoside analog in which the hydrogen atoms on the 2' carbon of deoxycytidine are replaced by fluorine atoms.

As with fluorouracil and other analogues of pyrimidines, the triphosphate analogue of gemcitabine replaces one of the building blocks of nucleic acids, in this case cytidine, during DNA replication. The process arrests tumor growth, as only one additional nucleoside can be attached to the “faulty” nucleoside, resulting in apoptosis.

Another target of gemcitabine is the enzyme ribonucleotide reductase (RNR). The diphosphate analogue binds to RNR active site and inactivates the enzyme irreversibly. Once RNR is inhibited, the cell cannot produce the deoxyribonucleotides required for DNA replication and repair, and cell apoptosis is induced.

Gemcitabine is administered by the intravenous route, since it is extensively metabolized by the gastrointestinal tract. Dose ranges from 1-1.2 g/m2 of body surface area according to type of cancer treated.

Medulloblastoma

Pemetrexed and gemcitabine preferentially inhibited G3 Medulloblastoma proliferation in vitro compared to control neurospheres and substantially inhibited G3 MB proliferation in vivo. When combined, these two drugs significantly increased survival of mice bearing cortical implants of mouse and human G3 MBs that overexpress MYC compared to each agent alone, while having little effect on mouse MBs of the sonic hedgehog subgroup. The findings strongly suggest that combination therapy with pemetrexed and gemcitabine is a promising treatment for G3 MBs [1)].

1)
Morfouace M, Shelat A, Jacus M, Freeman BB 3rd, Turner D, Robinson S, Zindy F, Wang YD, Finkelstein D, Ayrault O, Bihannic L, Puget S, Li XN, Olson JM, Robinson GW, Guy RK, Stewart CF, Gajjar A, Roussel MF. Pemetrexed and gemcitabine as combination therapy for the treatment of Group3 medulloblastoma. Cancer Cell. 2014 Apr 14;25(4):516-29. doi: 10.1016/j.ccr.2014.02.009. Epub 2014 Mar 27. PubMed PMID: 24684846; PubMed Central PMCID: PMC3994669.