The Role of Artemesunate in Cancer Treatment: A Literature Review

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ABSTRACT
Artesunate is a semi-synthetic derivative of artemisinin which is also water soluble, it is derived from a Chinese medicinal herb. It is typically used for the treatment of Malaria. Scientists have started using it to fight against cancer. Cancer needs iron to spread from cell to cell. Iron and artemisinin enter the cell together which creates special atoms, free radicals. The free radicals can kill the cancer cells without causing any harm to the healthy cells. This method has also shown to cause cancer cells to stop dividing, self-destruct, or even cut them from their blood supply. There has not been an approved cancer treatment protocol with artemisinin or artemesunate, it will theoretically be proven useful. This treatment is sometimes used when the cancer cells are resistant to chemotherapy and the drugs administered during that treatment. This form of treatment is also non-toxic, easy to administer, and much cheaper than most of the cancer treatment available. I looked through different articles and studies to find how effective this treatment option is. It was found that patients with Artesunate treatment have shown at least a 12% reduction in cancer cells.

BACKGROUND
Cancer is disease that causes uncontrollable cell division. These abnormal cells manipulate the cell cycle to metastasize through proliferation pathways. In this research we are going to explore the potential role of Artesunate in treating cancer. Artemesunate is a derivative of a compound called artemisinin which is derived from a Chinese plant called Artemisia annua which has been described in Chinese medicine for over two thousand years. This compound was studied for its antimalarial effects and proved effective. In the last twenty years derivatives of artemisinin, one of them being artemesunate, have been studied for their potential inhibitory effects on the growth and proliferation of cancer cells. It’s effectiveness in targeting tumor cells was started when several group of researchers reported artemisinin therapeutic properties against cancer for e.g a group reported artemisinin having cytotoxic effects on retinoblastoma cell lines with negligible effects on normal retina cell lines, another reported a meta analysis of 108 clinical trials of artemisinin therapy where none described adverse life threatening or serious effects, a group of researchers evaluated the possibility of too toxicity in breast cancer patients that were being treated with artemesunate plus in an ongoing 4 week treatment and noticed vertigo in only 4 out for the 24 patients which they concluded wasn’t grounds for stopping treatment.

ARTESUNATE AND ARTEMISININ
Artesunate is a derivative of artemisinin which in turn is a compound extracted from the Chinese plant Artemisia Annua. Research on artemesunate and artemisinin’s therapeutic role against cancer is new and ongoing which is why its mode of action is not well known however it is known that these compounds have the capability to essentially arrest cell growth and disrupt the steps in proliferation pathways. Centered around the capabilities of these compound there are a few proposed theories as to how artemisinin and its derivatives like artemesunate counter cancer cells. One hypothesis is that the artemisinin end stage is an endoperoxide bridge which reacts with intracellular iron or heme groups to produce free radicals that have alkylating capacity and are cytotoxic to tumor cells. Studies have shown that artemisinin cytotoxicity increases in the presence of intracellular iron. Cancer cells have higher iron requirements and so the cytotoxicity of artemisinin can be increased by a 100 fold if cancer cells are full of iron or iron saturated holotransferrin. Another study performed in vitro found that artemisinin accumulates inside lysosomes and mitochondria leading to cell death. Proliferation pathways inhibited by the drug include Wnt beta signaling pathway catenin, adenosine monophosphate, and second messenger involved in intracellular signaling, along with angiogenesis factors.

METHOD
I looked at multiple studies that were done using the anti-malaria drug as new way to treat cancer. It was approved to be used on May 26, 2020. The approval was based on the Southeast Asian Quinine Artemesunate Malaria Trial (SEAQUAMAT) and the African Quinine Artemesunate Malaria Trial (AQUAMAT). These 2 studies examined a total of 6886 patients and included adults, children, and pregnant women. The first study showed a reduced mortality rate by 34.7%. The second study showed a reduced mortality rate of 22.5%. This averages out to be 28.6% mortality rate reduction. This shows an increased rate of survival by more than 25% which will make a major difference. Another study I looked at was conducted in China. This study showed what would happen if you applied Artesunate in addition to chemotherapy. This study was done on 120 patients with metastatic non small cell Lung Cancer. The rate of disease control in the trial group with the Artesunate was 88.2%. The rate of disease control in the control group without the addition of Artesunate was 72.7%. There was a 15.5% difference.

SUMMARY & FUTURE PERSPECTIVE
The research on Artemesunate for cancer treatment is new. It is usually used as a very effective Malaria treatment. The research conducted for Artesunate thus far has proven to be effective. This could potentially be a viable method for the treatment of cancer. The patients that are given Artesunate as a treatment exemplified a decrease in at least 12% of their cancer cells in comparison to those who didn’t receive it. We may be looking at another possible course of action for the treatment of cancer. Artemesinate-based combination treatment is the act of Artemisinin being partnered with another drug to increase efficiency. The following excerpt reflects this concept, “Drug combinations which can often reduce adverse side effects of a single drug as lower doses, can also be used for drugs in the combo but with increased efficacy. Efficacy is determined by the drug partnering the artemisinin derivative and, for artesunate–mefloquine, artemether–lumefantrine, and dihydroartemisinin–piperazine, this usually exceeds 95%. Artesunate–sulfadoxine–pyrimethamine and artemesinate–amodiaquine are effective in some areas”. This has been proven very effective against Malaria, but there has not been enough research on how it affects the treatment for cancer. Further research should be deemed necessary to explore the effects that Artemisinin has against cancer.

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