EMORY
HEALTHCARE

General Surgery & Surgical Oncology

Hyperthermic Intraperitoneal Chemotherapy (HIPEC)

Peritoneal chemotherapy refers to liquid chemotherapy solution that is poured directly into the abdomen (called the **peritoneal** cavity). Chemotherapy solution is a liquid chemical solution that kills cancer cells. Higher concentrations of the chemotherapy solution can be used when it is given directly into the abdomen, so chemotherapy given this way is more effective at killing cancer cells in the abdomen than chemotherapy that is given IV (through a vein). Chemotherapy given this way also causes fewer side effects than chemotherapy given IV because of something in the body called the "peritoneal-plasma barrier" that prevents the high concentrations of chemotherapy solution from reaching the blood stream.

A newer treatment for cancer that has spread into the abdomen is Hyperthermic Intraoperative Peritoneal Chemotherapy (HIPEC). **Intraoperative** means the chemotherapy solution is circulated into the abdomen (**peritoneal** cavity) while the patient is still in surgery at the time of the cytoreduction (debulking) surgery. The chemotherapy solution is heated to a temperature higher than normal body temperature (**hyperthermic**). When the chemotherapy solution is heated, it is thought to be more effective in killing cancer cells.

This procedure is done because the chemotherapy can reach more places in the abdomen while the abdomen is still open for surgery (it can be swished around and circulated inside the abdomen to reach more areas where cancer cells that are not visible to the naked eye may be hiding). In some cases the chemo is circulated through tubes in the abdomen after the abdomen has been closed (closed technique).

This type of chemotherapy is best at killing cancer cells that are too small to be seen with the naked eye- these include cancer cells that may have been released from larger tumors during the surgery or cells that have been released if the appendix has perforated or ruptured. Peritoneal chemotherapy prevents these cells from being left behind to form new cancerous tumors in the abdomen.

It is felt that this type of chemotherapy is most effective during and immediately following the cytoreduction surgery, before scar tissue and adhesions have a chance to form. Once scar tissue and adhesions have formed, it is felt the chemotherapy will be less likely to reach all surfaces in the abdomen and therefore the therapy will likely be less effective.

Patients at high risk for having cancer cells in the abdomen too small to be seen that remain after the larger tumors are removed (microscopic residual disease) are those with:

- scattered small tumors in the abdomen ("peritoneal seeding")
- cancer that has ruptured the wall of the appendix (perforated cancer)
- cancer cells discovered in fluid from the abdomen when the fluid is viewed under a microscope (positive peritoneal cytology)
- cancer that has spread to the ovaries
- cancer found on organs adjacent to the appendix tumor.

The debulking surgery itself removes only tumors visible to the naked eye. Peritoneal chemotherapy destroys cells and tumors left behind that are too small to be seen. The goal of HIPEC is to prevent these cells from growing into new tumors in the future and causing a recurrence of the cancer.

A slang phrase used for this combination debulking surgery and intraperitoneal chemotherapy treatment is "shake and bake"; "shake" referring to the swishing around of the chemotherapy solution in the abdomen while in surgery and "bake" referring to the higher temperature of the chemotherapy solution. Hyperthermic Intraoperative Peritoneal Chemotherapy (HIPEC) is also done for other cancers that have spread to the peritoneal surfaces of the abdomen after cytoreduction (debulking) surgery is completed, such as ovarian, colon, gastric and pancreatic cancers.

Appendiceal cancer most often kills by spread into the abdomen (peritoneal surface malignancy) and interference with with digestion and the functioning of organs in the abdomen. Because of this, it can be grouped in research with diseases that can kill in the same way but are more common...ovarian, colon, gastric etc. that can also cause "peritoneal surface malignancies".

Some of the specific complications that may occur:

1. Pleural Effusion- a collection of fluid between the membranes lining the lung and chest wall.
2. Nausea and Vomiting
3. Wound infection- infection of surgical wounds by bacteria
4. Pneumonia
5. Atelectasis- collapse or partial collapse of the lung
6. Line-Related Complications- complications related to the use of central venous IV lines
7. Pancreatitis- inflammation of the pancreas
8. Ileus- bowel does not start moving again for a period of time after surgery
9. Arrhythmia- irregular or abnormal heart beat
10. Pulmonary embolus- a blood clot that travels to the lung
11. Diarrhea - liquid bowel movements
12. Intra-abdominal abscess- pocket of fluid and pus inside the abdomen
13. Deep Vein Thrombosis (DVT)- blood clots that develop in the deep veins of the legs
14. Post-operative Bleeding

15. Entero-enteral or enterocutaneous fistula- abnormal passage that forms between the stomach or intestines and other organs or skin
16. Anastomic leakage- leakage of bowel contents from the site where two ends of the bowel have been reconnected
17. Leukopenia- low white blood cell count
18. Renal Insufficiency- decreased ability of the kidneys to rid the body of wastes
19. Myocardial infarction- Heart attack

Things you can do to help prevent complications

While not all complications can be anticipated or prevented, there are things a patient can do to prevent some of the potential complications.

- Blood clots developing in the deep veins of the legs (**DVT-deep vein thrombosis**) are most often a result of blood pooling and clotting when a person is inactive for a long period of time. Normal walking and movement of the muscles in the legs keeps blood circulating through the veins and prevents this pooling of blood and the formation of clots. While in bed, ankle exercises such as pointing your toes to your head and then to the foot of the bed over and over helps keep the blood moving though the veins of your legs. When you are awake you can do these exercises several times every 30 minutes or hour. Compression stockings and or pneumatic sequential compression devices may also be used to prevent this complication. In some cases a doctor may order injections of a medication that helps prevent clotting. Walking as soon as you are able will greatly help prevent this complication.
- Preventing the formation of clots in the deep veins of the legs (DVT-deep vein thrombosis) helps prevent a second very serious and sometimes fatal complication, a **pulmonary embolus**. A pulmonary embolus is a clot (usually a deep vein thrombosis) that dislodges from the veins in the legs and then travels to the lungs.
- **Pneumonia** and **atelectasis**- general anesthesia, prolonged bed rest and decreased movement, along with shallow breathing and underlying lung diseases are all risk factors for atelectasis, or a partial collapse of the lung. These same risk factors also prevent mucous and secretions from being expelled from the lungs and promote the development of pneumonia. Using an incentive spirometer, turning from side-to-side in bed, taking deep breaths and coughing several time an hour, and getting out of bed to walk or sit in a chair will all help keep your lungs expanded and clear. These activities will help prevent respiratory complications. Holding a pillow against your abdominal incision will help you feel more comfortable when you cough.
- **Ileus**: as soon as you are able to get out of bed, start walking. Walk as much as you are able to tolerate. Not only will you expand your lungs and prevent deep vein thrombosis and pulmonary emboli, you will also help your bowels to become more active and to start moving sooner. The sooner your bowels and digestive tract start functioning, the sooner you will be able to be rid of the NG tube! Narcotics also can cause or aggravate an ileus, so as soon as you are able, decrease your use of narcotic pain medication.
- **Nausea and vomiting** are common complications that can be treated with various medications. Nausea and vomiting are very uncomfortable in any circumstance, but they are even more uncomfortable when you have a very large incision in you abdomen. Talk

to the staff until you are able to find a way to control nausea with medication, if you have that side effect. If you do need to vomit, hold a pillow against your abdominal incision for comfort.

*Please note, getting out of bed and **walking** is a great way to prevent numerous complications and to speed up recovery. You can walk slowly and it's okay if you can't stand up straight at first, but do your best to walk as soon as you can and as much as you can.