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Introduction

This booklet serves as a guide for potential patients who will be undergoing cytoreductive surgery and hyperthermic intraperitoneal chemotherapy. It will help to explain the condition, possible symptoms, which patients are suitable for the surgery, what the surgery entails and pre and post-surgical care. We hope that this booklet answers your questions. If you have any further queries, please feel free to ask your surgeon or members of our care team.

What are peritoneal surface malignancies?



The peritoneum is a thin membrane that lines the abdominal and pelvic cavities. It covers the external surface of most of the abdominal organs. The peritoneum supports the abdominal organs and serves as a conduit for their blood, lymph vessels and nerves.

Peritoneal surface malignancy refers to a wide variety of cancers that involve the peritoneum and may also involve other abdominal organs such as spleen, large and small intestines, stomach, the liver and the pelvic organs (e.g. uterus, ovaries, rectum, bladder). The tumour may arise from the lining itself or may spread to the lining from other organs.



Tumours that arise from the peritoneum

- Malignant Mesothelioma
- Primary Peritoneal Cancer

Tumours that may spread to the peritoneal lining

- Ovarian cancer
- Appendiceal cancers
 - Low grade appendiceal mucinous neoplasm
 PMP(Pseudomyxoma Peritonei) is a unique condition characterized by diffuse collections of mucinous implants along the abdominal and pelvic peritoneum. It is generally used to refer to a group of peritoneal tumours that are frequently associated with an appendiceal tumour.
 - High grade appendiceal mucinous neoplasm
 - Appendiceal adenocarcinomas
- Gastrointestinal Cancers Stomach, small bowel, large bowel
- Other malignancies Breast, Lung, Melanoma, Hepato-pancreatico-biliary (HPB)

What are the symptoms you might experience if you have peritoneal surface tumours?

You may experience some of the following:

- Abdominal pain
- Abdominal swelling or bloating
- Change in bowel habits, such as recurrent diarrhea or constipation
- Bleeding when passing motion or bleeding from the vagina
- Increasing abdominal distension
- Unexplained weight loss

You may also not experience any symptoms. In certain cases, tumours are usually picked up when your doctor does blood tests or scans for other unrelated conditions.

Causes and Risk Factors

Risk factors for the development of peritoneal disease depends on the type of primary cancer that you have.

Primary Peritoneal Malignancies					
Mesothelioma	Asbestos exposure, Smoking				
Primary Peritoneal Cancer	High estrogen exposure e.g family history				
	of gynaecological malignancies				
Peritoneal Metastases Secondary to other primaries					
Ovarian Cancer	Locally advanced primary disease				
Stomach Cancer	Locally advanced & bulky gastric tumour				
Colorectal Cancer	Locally advanced, bulky, or perforated				
	tumour				
Appendiceal Cancer	Large/Perforated Mucocele/Cancer of the				
	appendix				
Hepato-pancreatico-biliary (HPB)	Locally advanced primary disease				

Preventive measures for peritoneal surface malignancies

Although there are currently no medically proven preventive measures, the following healthy lifestyle habits can effectively promote overall health:

- 1. Do not smoke
- 2. Maintain a balanced diet including fruits and vegetables
- 3. Avoid excessive alcohol consumption
- 4. Exercise regularly and maintain a healthy weight

How are peritoneal surface malignancies diagnosed?

Peritoneal disease often presents insidiously and may be picked up incidentally on computed tomography (CT) (especially if you are undergoing regular surveillance scans for your previous cancers).

Endoscopic procedures may be required to detect a gastro-intestinal primary if one has not been previously found. Computed tomography (CT) & Magnetic Resonance Imaging (MRI) scans are useful to diagnose the presence of peritoneal disease and evaluate the extent of involvement of the peritoneum with disease. Tumour markers (a form of blood test) is also useful to point towards the type of peritoneal cancer you have.

In order to confirm that lesions seen on imaging are indeed cancer, you may have to undergo a procedure where we can send either fluid (ascites, if present) from your abdomen or biopsy tissue to the laboratory for examination. This is a procedure that can be performed under sedation and local anaesthesia.

If a diagnosis cannot be made based on the cells/tissue collected then some patients have to undergo a small surgery (Diagnostic laparoscopy and biopsy) performed under a 'keyhole' technique with a small incision. This allows us to use a camera to take a look at the involvement of the peritoneum by cancer cells and subsequently take samples to confirm the diagnosis.

What is the treatment?

Treatment option varies and depends on the following factors:

- Type of primary tumour
- Histology and stage of primary tumour
- Extent of peritoneal disease
- Previous treatment history

One of the treatment options for patients with peritoneal carcinomatosis is Cytoreductive Surgery(CRS) and Hyperthermic Intraperitoneal Chemotherapy(HIPEC)

Cytoreductive Surgery (CRS) and Hyperthermic Intraperitoneal Chemotherapy (HIPEC)

This surgery involves removal of the peritoneum, any involved organ(s) and the introduction of heated chemotherapy drug directly into the abdominal cavity. This surgical procedure aims to remove all visible tumours completely.

Once the surgical procedure is completed, (HIPEC) is administered at the same setting. The chemotherapy aims to eradicate any microscopic tumour that may be present. The chemotherapy drug is heated and maintained at a temperature of 41-43 degrees celsius via a machine pump, and this is allowed to circulate for 60 minutes. Heat is used to increase the effect of the chemotherapy by increasing the penetration of chemotherapy drug into the tissues and the efficacy of the chemotherapy drug in terms of local toxicity.

Giving the chemotherapy during surgery has other benefits. It allows manual distribution of the drug uniformly to all surfaces of the abdominal cavity. The majority of these patients will have had prior abdominal surgery to remove their primary cancers. During surgery, adhesions caused by previous surgery (scarring between peritoneal surfaces) are taken down and this ensures that the drug is uniformly distributed.

Upon completion of HIPEC, the chemotherapy drug is drained from the abdominal cavity. We will then wash the abdominal cavity thoroughly and drain tubings are left in place to drain excess fluid postoperatively.

Patients will then be transferred to high dependency or surgical intensive care unit for postoperative monitoring and care.

Preparing for Surgery

Upon confirmation of surgery, a date will be scheduled and you may need to go through some of the following procedures.

- Preoperative investigations including blood test, electrocardiogram (ECG), x-rays and CT scans may be performed.
- As part of the prehabilitation programme, you may be reviewed by a stoma nurse, dietician, physiotherapist or rehabilitation medicine doctor. You may be prescribed with supplements to boost nutrition and specific exercises to maintain muscle bulk. This programme, which is done prior to surgery, can help to reduce complications, side effects and improve recovery time.
- Anaesthesia review. The anaesthetist will ensure that you are fit for surgery under general anaesthesia. They will review the investigation results that have been done for you and refer you to medical specialists if required. They will discuss the type of anaesthesia as well as the methods for pain management post operatively.
- You may be given vaccinations to prevent severe infections in the event that removal of your spleen is indicated during surgery.
- The day prior to the surgery, you may be required to take bowel preparation if there is a possibility of the bowel being resected.
- You will also be given an injection of blood thinner which will help to prevent blood clots in the leg.

Post Surgery Care

The surgery may last from 4 to 12 hours or even longer. The surgery duration depends on the extent of adhesions from prior surgeries, the extent of peritoneum being removed and the number of other organs requiring excision. You may be nursed in our surgical intensive care unit (SICU) or a high-dependency unit (HDU), and discharged to the general ward when stable. The average total hospital stay is 10-12 days.

When you first wake up from anaesthesia, you may still have a tube in your throat to assist with your breathing. You will notice intravenous lines in place in your arms and neck. These are necessary for fluid replacement, pain medication and nutrition. A nasogastric (NG) tube may be inserted through your nose into the stomach for draining out the abdominal fluid. You may also have 2 to 4 abdominal catheters for drainage. During the surgery, chest tubes may be inserted and a urinary catheter will also have been placed to assist us in monitoring your urine output.

Pain medications are usually administered via an intravenous line. It may be a continuous infusion or you may have a pump for Patient Controlled Analgesia (PCA). With a PCA, the painkillers will be given as required when you push a button for the medication. In addition to that, we may also place small tubing running continuous analgesia into your abdominal wall which will remain in place for at least 72 hours. These tubings can then be removed at bedside when the analgesia medications have run out.

Stomas

Some patients who undergo this operation will need a temporary stoma. This can be reversed after about 2 months, on discussion with your surgeon and medical oncologist. All patients will be seen by our specialist stoma nurse before and after the operation, who will give you more information about looking after a stoma.

Recovery

When deemed safe and the output is low, the abdominal drains and the chest tubes will be removed. The urinary catheter is removed at the discretion of your surgeon.

The NG tube (if present) will remain until your bowel function returns and you are able to drink. Your oral intake will be progressed from fluids to foods as decided by your surgeon.

To prevent blood clots in the leg that may travel to the lungs and cause a blockage, compression devices will be applied to your legs. This will be applied just before surgery and left on until you start walking. These may be tight and uncomfortable but are necessary to encourage blood circulation. An injection may also be given to you daily to prevent blood clots.

To prevent lung infection, your physiotherapist will work with you on deep breathing exercises. They will also supply you with a device (incentive spirometer) which you can use to continue to do the breathing exercises regularly.

Pain medication will be continued intravenously until you are able to take painkillers orally. The aim is for you to have minimal discomfort.

By the 2nd to 3rd day after surgery, we will encourage you to increase your activity. We will begin by helping you to sit out of your bed or on a chair before we progress to helping you walk with assistance then independently.

Post Surgery Complications

As with all surgical procedures, complications can occur. Some of these risks and complications are inherent in any operative procedures, especially when general anaesthesia is administered. Complications can cause a prolonged hospitalization stay or discharge with significant home care needs. Every effort will be made to minimize the risk of having a complication, and to help you cope if a problem occurs, your surgeon will speak to you more about these risks.

Some of the possible complications following this CRS and HIPEC are listed below. Selected complications are explained in detail below. More information will be given to you by your surgeon.

Early postoperative

- Anastomotic leak
- Postoperative bleeding
- Wound infection
- Intra-abdominal infection/collections
- Deep vein thrombosis (DVT)
- Chest infection
- Urinary tract infection
- Prolonged ileus
- Electrolyte disturbances
- Immunosuppression

Late postoperative complications

- Intra-abdominal infection/collections
- Entero-cutaneous fistula
- Intestinal obstruction
- Bladder and sexual dysfunction (pelvic dissection cases)
- Stoma-related complications

Anastomotic leak

An anastomotic leak can be a very serious complication after the operation that can lead to severe intra-abdominal infection. This may require prolonged hospitalization for intravenous antibiotics or even further surgery. In our experience, the risk of an anastomotic leak is 5%. In rare instances, a leak can present with discharge of intestinal fluid from the operative wound or skin in the form of a fistula (an abnormal passage between two organs in the body or between an organ and the exterior of the body), which will delay recovery and might even require another surgery.

Postoperative bleeding

This can occur in 1-3% of patients and in severe cases might require a repeat surgery to stop the bleeding.

Wound infection

Wound infections occur in about 5% of patients. This complication may prolong the hospital stay and delay the healing of the wound. Occasionally your wound may need to be laid open to facilitate with cleaning. Antibiotics will also be given.

Intra-abdominal infections/collections

Infection within the abdomen can result in abscesses and collections. If these are small, a course of antibiotics is sufficient. However, larger fluid collections will require drainage under radiological guidance or by open surgery.

Chest infection

Chest infection can develop after any major surgery, especially after abdominal operations. This is especially so for patients with pre-existing lung disease, and in smokers. This can prolong the hospital stay as it requires intravenous antibiotics and chest physiotherapy. It is essential that you participate fully in your post-operative chest therapy to minimize the risk of a chest infection.

Bladder and sexual dysfunction

The risks of bladder and sexual dysfunction are increased when the surgery entails working within the pelvis. The problems include difficulty passing urine and impotence. The risk increases when radiation is given as part of treatment.

Stoma-related complications

Such complications are rare, but include prolapse (excessive protrusion), retraction into the wound and parastomal hernias. This may be managed conservatively, with surgery only becoming necessary if the complications cause a lot of discomfort and it becomes difficult to apply the stoma bag onto the skin. Skin irritation around the stoma may arise, especially when the stoma bag is not properly applied. This can be managed with topical creams. Our specialist stoma nurse will assist to manage some of these complications.

Follow up

You will be seen by your surgeon and/or medical oncologist at the outpatient unit in the National Cancer Centre Singapore at approximately 1-2 weeks after the surgery, and at least every 3 months thereafter for 1 year. Subsequently, the frequency of your visits will decrease if you are well.

Systemic chemotherapy will be offered if deemed necessary in discussion with your medical oncologist. CT scans of your body, along with blood tests may be done at each follow-up visit. Appointments with other medical practitioners may also be arranged for you.

Results

Since 2001, our department in Singapore General Hospital/National Cancer Centre Singapore has performed more than 650 CRS and HIPEC procedures for peritoneal disease from colorectal, ovarian, appendiceal, pseudomyxoma peritonei, primary peritoneal and mesothelioma patients. To our knowledge, we have one of the largest experience and volume of cases doing CRS and HIPEC in Asia.

The risk of a major complication in our center is 13%. This risk and the risk of death is comparable to international expert centers around the world.

According to data from various centers around the world, the median 5-year survival for patients undergoing CRS and HIPEC for colorectal cancers, ovarian cancers and pseudomyxoma peritonei is 33-51%, 46-63% and 70-90% respectively. Our department's 5-year survival rates for colorectal, ovarian and pseudomyxoma peritonei are 32.1%, 52.1% and 90%.

Quality of life post CRS & HIPEC

Studies done in our center has shown that physical score returns to baseline about 3-6 months after CRS and HIPEC, whereas emotional and social functioning score returns to baseline at 6-12 months post operatively.

Publications

- Department of Sarcoma, Peritoneal and Rare Tumors (SPRinT): A subspecialty surgical oncological care model for advanced malignancies requiring complex procedures. Asian Journal of Surgery 45 (2022) 546-548
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- Cytoreductive surgery and hyperthermic intraperitoneal chemotherapy in recurrent ovarian cancer with peritoneal metastasis: a prospective registry study on 41 patients. Pleura Peritoneum. 2017 Dec 1;2(4):171-179

Treatment and Support Units at NCCS

Department of Radiation Oncology

National Cancer Centre Singapore Basement 3 & 4 Enquiry line : 6436 8000 Singapore General Hospital Blk 2 basement 1 Enquiry line : 6463 8000

Useful Contact Details

- Appointment Scheduling Unit : 6436 8088
- General Enquiries : 6436 8000
- Dept of Psychosocial Oncology : 6306 1777
- Outpatient Pharmacy Helpdesk : 6436 8091
- Cancer Helpline : 6225 5655

Cancer Resources on the Internet

National Cancer Centre Singapore

www.nccs.com.sg



National Cancer Institue, USA http://www.cancer.gov



American Cancer Society http://www.cancer.org/cancer



University of Maryland Medical Center (UMMC)

http://www.umms.org







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For more information on cancer, please call the Cancer Helpline at Tel: 6225 5655 or email: cancerhelpline@nccs.com.sg

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