Radiotherapy (Selective Internal Radiation Therapy with Yttrium-90 Microspheres)

I. Introduction

Selective Internal Radiation Therapy (SIRT) using yttrium-90 (Y90) microspheres is an internal radiation therapy for liver tumors where curative resection is not possible.

Yttrium-90 is a high-energy beta-emitting isotope with no primary gamma emission. The maximum range of penetration in tissue is 11 mm with a mean of 2.5 mm. The half-life is 64 hours. The yttrium-90 microspheres are sized between 20 and 40 microns in diameter. Following delivery via a hepatic artery catheter, Y-90 microspheres become lodged in the micro-vessels of liver tumor where they have a local radiation effect. There may be some limited concurrent damage to healthy tissue caused by radiation that escapes tumor boundaries and from Y-90 microspheres that fail to become embedded in tumors. Following decay of the yttrium-90, the inert microspheres will be retained permanently in tissue.

Treatment with SIRT-Y90 exploits a normal physiological process to selectively target the tumor tissue. The liver has 2 different blood supplies. Malignant liver tumors larger than 2 cm usually derive about 80% of their blood supply from the hepatic artery while the healthy liver tissue receives most of its blood supply from the portal veins. As a result, injection through the hepatic artery permits the selective targeting of yttrium-90 microspheres to tumor cells.

Radiation Safety and Protection Measures

Normally the radiation from yttrium-90 microspheres retained inside the liver tumor will not be able to penetrate beyond the abdominal wall. However, when the total dose is higher than a certain limit, there is still some concern of potential harm to other people from the secondary radiation generated.

According to Radiation Ordinance and the HA Code of Practice on Radiation Safety and Protection, the activity of yttrium-90 in a patient must be below 1.5 GBq before he/she is allowed to be discharged or travel by public transport. Therefore, all patients after receiving SIRT-Y90 must stay strictly in an isolation room to avoid radiation hazard to their family members or members of the public. **Patients are forbidden to leave the isolation room until the radiation dose from their body was checked to fall below a safe limit.** This may take a few hours up to a few days after SIRT-Y90, depending on the actual dose they received. In the event of death, cremation may be denied by health authorities or may be deferred for a period of time depending on residual radioactivity.

II. Procedure

- The procedure usually takes about 1-2 hours.
- The doctor will puncture the femoral artery (at the groin) and inject the yttrium-90 microspheres through the hepatic angiographic catheter placed near the tumor-feeding artery.
- The catheter will be removed after the procedure and pressure will be applied on the puncture site to stop the bleeding.
- If you feel unwell during the treatment period, please inform our staff.

III. Risks and Side Effects

- Some of the common and potentially severe side effects are discussed below. Each patient reacts differently and may experience none, some, or all of the complications to a varying degree of severity.

1. Most patients may experience a mild post-embolization syndrome that include fever, abdominal pain, nausea, vomiting, diarrhea and mild liver function test abnormalities which is usually self-limiting and will resolve in a few days. Painkiller and anti-sickness medication may be required.

2. Potential rare complications arising from the hepatic angiographic procedure include the risk of bleeding, damage to blood vessels with associated organ damage (such as stroke, heart attack).
3. Very rarely radiation induced liver damage (radiation hepatitis) may occur, or some of the yttrium-90 microspheres may enter other organs and cause damage, including the lungs (radiation pneumonitis), stomach and duodenum (gastritis and duodenal ulcers), pancreas (acute pancreatitis), gallbladder (acute cholecystitis). Most of these complications can be prevented and treated but some can be fatal.

- Radiation-induced tumours may occur, but this is rare.
- It is possible that the intended treatment outcome cannot be achieved, and the disease may not be alleviated or may recur/ progress in the future.
- Unpredictable and unpreventable adverse outcomes may occur after treatment. Please kindly ensure that you understand the pros and cons of radiotherapy before deciding on undergoing the latter.

IV. Before the Treatment / Preparations Required

Before SIRT, patient is required to have a diagnostic hepatic angiogram (HAG) to establish the arterial anatomy of the liver and the tumor. At the same time a pretreatment simulation scan will be done with the injection of a radioactive tracer Tc-MAA, to predict the distribution of the microspheres in the body.

When necessary the feeding arteries to the stomach or duodenum will be embolized to prevent the flow of radioactive particles to these organs.

Only patient with suitable arterial supply and favorable result from the Tc-MAA scan can safely proceed to receive SIRT-Y90.

Note:

- **Radioactive substance can cause teratogenicity (i.e. lead to abnormal fetal development). During the course and within 2 months after treatment, both male and female patients (if applicable) should use an effective method of contraception.**
- **Do not breastfeed during the first 2 weeks after treatment.**

V. After the Treatment

1. After the SIRT, all patients are required to stay strictly in an isolation room for a few hours up to a few days until the radiation from their body fall to a safe level.
2. As the patients can still emit low levels of radiation after discharge from the hospital (<1.5 GBq), they are advised to observe the instructions given by the instruction card.
3. Avoid close contacts with pregnant women or young children.

VI. Follow-up

1. The time taken for recovery varies from person to person, some people can go back to work shortly after the completion of treatment.
2. After completing the treatment, a follow-up appointment will be arranged to assess your response to the treatment and to look for complications. Please attend your appointment as scheduled.
3. Please ensure that you follow precisely the instructions given to you regarding medications (if applicable).

VII. Remarks

The list of complications is not exhaustive and other unforeseen complications may occasionally occur. The risk of some complications may actually be higher for certain patient groups. For further information, please contact your doctor.