

ANSWERING PATIENT DEMAND



Liver cancer is the third major cause of cancer death in Korea. Approximately 45 men out of 100,000 contract the disease every year; for women, the rate is 12 out of 100,000. In comparison, fewer than 7 out of 100,000 men and 6 out of 100,000 women in the US are affected, although that rate is climbing.

Liver cancer is most prevalent in East Asia (China, Japan, Korea, and Taiwan) and sub-Saharan Africa. Linked to high carrier rates of hepatitis B and C, it is often not diagnosed until quite late, when spread of disease, as well as chronic hepatitis and cirrhosis, make curative treatments much more difficult. As a result, the mortality rate is extremely high. In Korea, around 75 percent of patients with liver cancer will die from the disease.

“We desperately wanted something new,” says Dr. Jinsil Seong, professor of radiation oncology at Yonsei University in Seoul. In 2006 the department was looking for an advanced intensity-modulated radiation

therapy (IMRT) solution that could handle the difficult cases they were seeing—gastrointestinal cancers such as liver and pancreatic cancer, as well as head and neck tumors, multiple metastases, and recurrent cancers of different types. They chose to install the TomoTherapy® Hi-Art® treatment system and have since treated over 700 patients on the system.

“We can use *TomoTherapy* to treat patients from head to toe,” notes Dr. Seong, “It’s very, very powerful.”

A recognized expert in the treatment of liver and pancreatic cancer, Dr. Seong has published and presented widely on

Case Study: Treating Hepatocellular Carcinoma

CASE SUMMARY

Institution: Yonsei University Cancer Center, Seoul, Korea

Patient: 39-year-old male

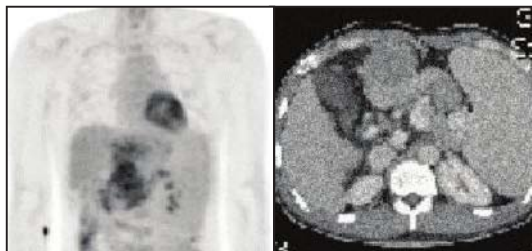
Diagnosis: B-viral hepatocellular carcinoma, 7.5 cm hepatic mass associated with main portal vein invasion

Plan: Concurrent chemoradiotherapy with NTCP for the liver under 5%

Treatment: 50 Gy in 20 fractions with intra-arterial continuous infusion of 500 mg of 5-FU during the 1st and the last week of radiotherapy

PATIENT HISTORY AND PRESENTATION

A 39-year old male patient with no specific symptoms presented with virally-induced hepatocellular carcinoma (liver cancer). His tumor was 7.5 cm in size, involving the main portal vein.



In an initial PET scan (left), intense fluorodeoxyglucose (FDG) uptake could be seen in the left lobe of the liver, indicating fast-growing malignant cells. Pre-treatment CT scans (right) show a large mass replacing the left lateral segment of the liver.

these topics, including recent articles in the *International Journal of Radiation Oncology-Biology-Physics*, as well as the *Journal of the Korean Association for the Study of the Liver*. In 2004 she earned the Young Investigator Award at the International Congress of Liver Disease, and in 2006 she won the Distinguished Scientific Award at the 4th International Conference of the Japanese Society of Hepatology.

Since liver cancer is often not diagnosed until it has reached an advanced stage, one key to improved outcomes is the ability to escalate dose to the tumor site. However, many patients who come to Yonsei for treatment already have poor liver function due to chronic hepatitis and cirrhosis. In these cases, sparing of the healthy liver tissue is critical.

For this reason, Dr. Seong calculates a Normal Tissue Complication Probability (NTCP), which is the probability of the patient experiencing liver-related side

effects from the radiation treatment. Dr. Seong then selects the *Hi-Art* treatment plan offering the highest dose to the tumor while keeping the NTCP below 5 percent.

“*Tomo Therapy* can achieve a very precise plan and very precise delivery,” Dr. Seong points out, adding that they’ve been extremely pleased with their ability to escalate dose safely by effectively using the *Hi-Art* treatment system.

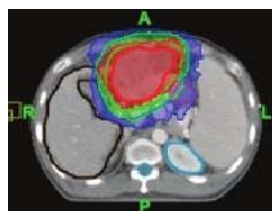
Even though the department has other IMRT equipment available, Dr. Seong notes that “most patients who are candidates for IMRT are moved to the *Hi-Art* treatment system.” On average, the department treats 25 patients per day on the *Hi-Art* system. And despite the fact that many types of IMRT treatments, including *Tomo Therapy*, are not yet covered by insurance in Korea, patients continue to choose *Tomo Therapy*

treatments over other options.

“I show my patients two options: 3D-conformal (which insurance covers) or *Tomo*SM. And they choose *Tomo*, even though it is more expensive for them because it is not covered.”

Dr. Seong attributes this choice in part to patients taking a more active role in their own care. “Korea is a pretty Internet-savvy country, and more and more patients are doing their own research online,” Dr. Seong observes. “With older patients, often they’ll have a son or daughter research the best treatment options.” And for many, that means the *Hi-Art* treatment system. In fact, so many patients are opting for the *Hi-Art* treatment system that there is currently a two-week waiting period for *Tomo Therapy* treatments at Yonsei.

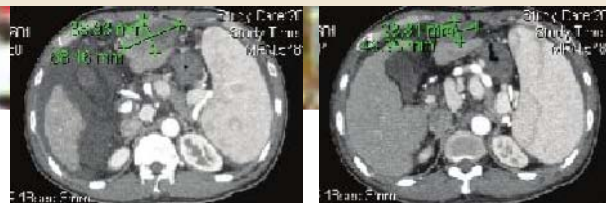
“Patients are more and more demanding,” notes Dr. Seong, “they want the highest quality treatment available.”



TREATMENT PLAN AND DELIVERY

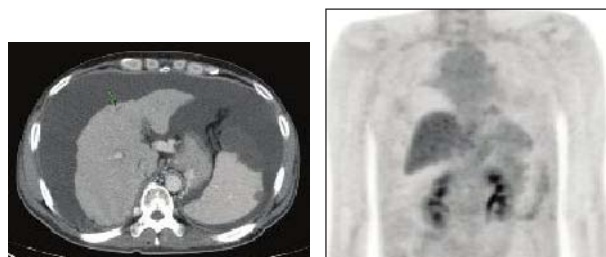
For this case, the treatment of choice was concurrent chemo-radiation, with 5-FU administered intra-arterially during the first and last week of a

4-week, 20 fraction *Tomo Therapy* treatment course to a total dose of 50 Gy. This fractionation schedule was chosen via calculations of normal tissue complication probability (NTCP), such that NTCP for the liver should be under 5%.



OUTCOME

On CT scans acquired immediately post-treatment (left), and one month later (right), the tumor can be seen to have responded to treatment and to be continuing to decrease in size.



CT scans taken six months post-treatment show further decrease in size of the tumor. A corresponding PET image shows no enhanced FDG uptake in the liver, indicating absence of cell activity shown in the initial PET scan.