OAK BROOK, Ill. — A novel technique that delivers high doses of radiation to tumors while sparing the surrounding normal tissue shows promise as a curative treatment option for patients with early-stage liver cancer, according to a study published online in the journal *Radiology*.

Curative treatment options for early-stage hepatocellular carcinoma (HCC), the most common type of liver cancer, include surgery, liver transplantation and radiofrequency ablation. However, many patients are not candidates for these therapies due to the presence of other conditions. In addition, these treatments carry significant costs and potential complications.

*Riad Salem, M.D.*

Radiation segmentectomy (RS) is a minimally invasive option that uses the radioisotope yttrium-90 (Y90) to destroy tumors. The isotope is embedded into tiny beads that are

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**At A Glance**

- Researchers studied long-term outcomes in early-stage liver cancer patients who had undergone treatment using radiation segmentectomy (RS).
- RS controlled the target tumor, slowed the time to disease progression and improved survival outcomes.
- The treatment is performed on an outpatient basis and is minimally invasive.
delivered through a catheter into a blood vessel in the liver. They then travel to the site of
the tumor, where they come to rest and deliver their radioactive effect while sparing much of
the surrounding healthy tissue.

The procedure's name derives from the fact that surgeons divide the liver into a number of
segments. Using an imaging approach called cone beam CT, interventional radiologists gain
a detailed view of the complex liver vasculature and can focus delivery of the Y90 to the
relevant segment.

"Cone beam CT has revolutionized our ability to perform segmental injections isolated to
very small tumors, sparing the majority of normal tissue," said study senior author Riad
Salem, M.D., chief of vascular interventional radiology in the Department of Radiology at
the Northwestern University Feinberg School of Medicine in Chicago. "Before cone beam
CT, we had the ability to focus radiation, but not with this level of accuracy."

Dr. Salem and colleagues studied long-term outcomes in 70 early-stage HCC patients who
had undergone RS between 2003 and 2016. They analyzed the patients' responses to
treatment based on two commonly used sets of criteria.

Based on one criteria, 90 percent of patients showed positive response to the therapy, of
which 59 percent showed complete response. Based on a second criteria, 71 percent
achieved positive response, of which 16 percent achieved complete response.

RS controlled the target tumor, slowed the time to disease progression and improved
survival outcomes at rates comparable to radiofrequency ablation, surgery and
transplantation for early-stage HCC patients.

Almost three-quarters of patients had no progression of cancer in the target tumor five years
after treatment. Median overall survival was 6.7 years, and one-, three-, and five-year
survival probabilities were 98 percent, 66 percent and 57 percent, respectively. One-, three-,
and five-year overall survival probability was 100 percent, 82 percent and 75 percent in
patients with a baseline tumor size of 3 centimeters or less.

"The results show that we are able to impart curative outcomes to these patients," Dr. Salem
said. "Our numbers with radiation segmentectomy match or outperform those of other
curative treatments in terms of tumor control, survival rate and recurrence."

RS is performed on an outpatient basis, is minimally invasive and has a low toxicity profile,
Dr. Salem said. Given the potency of the radiation, RS outperforms transarterial
chemoembolization, another minimally invasive procedure in which cancer-killing drugs are
injected into the liver's main artery under imaging guidance and travel to the tumor
microvasculature. Transarterial chemoembolization has the additional disadvantage of
requiring hospitalization.

The researchers continue to follow the patients from the study group as they work on ways
to optimize the treatment.

"We want to see these outcomes validated in patients over the longer term," Dr. Salem said.
"We also want to minimize the time from clinic visit to treatment, and fine-tune dosimetry
so that we can find the optimal dose that will kill the tumor. In the right patient setting, RS
can be considered curative."
"Radiation Segmentectomy: Potential Curative Therapy for Early Hepatocellular Carcinoma." Collaborating with Dr. Salem were Robert J. Lewandowski, M.D., Ahmed Gabr, M.D., Nadine Abouchaleh, B.S., Rehan Ali, M.D., Ali Al Asadi, B.S., Ronald A. Mora, M.D., Laura Kulik, M.D., Daniel Ganger, M.D., Kush Desai, M.D., Bartley Thornburg, M.D., Samdeep Mouli, M.D., Ryan Hickey, M.D., Juan Carlos Caicedo, M.D., Michael M. Abecassis, M.D., and Ahsun Riaz, M.D.

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