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### The Use of CyberKnife Stereotactic Body Radiation Therapy in Treating Hepatocellular Carcinoma

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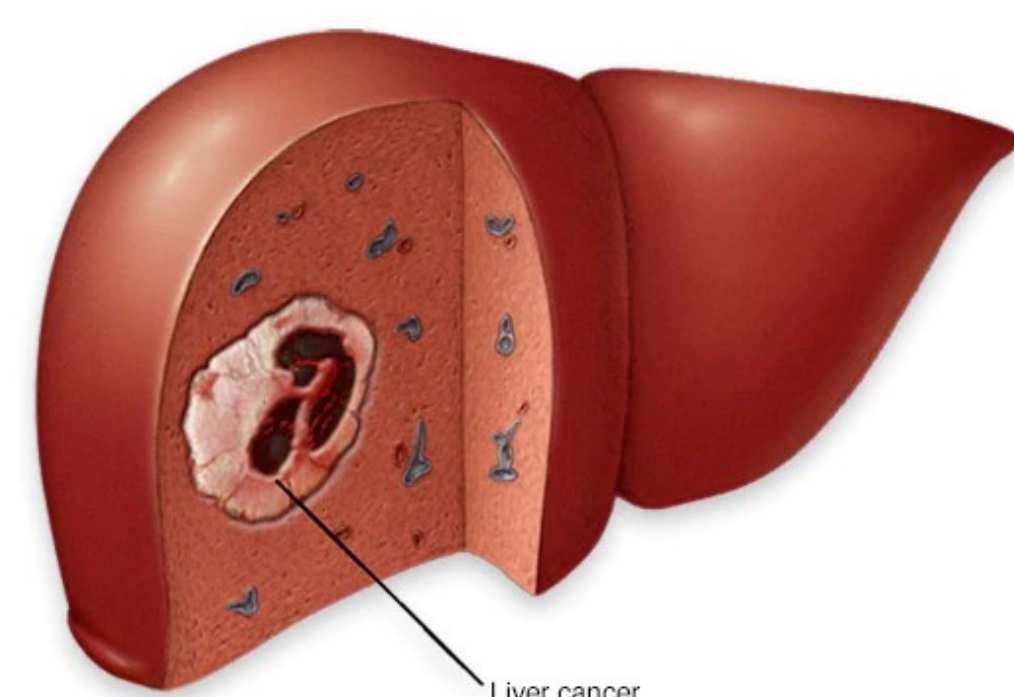
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## What is Hepatocellular Carcinoma (HCC)?

HCC is the most common liver cancer

- It is the third most common cause of cancer-related death in the world and 7<sup>th</sup> in the United States
- Diagnosed late due to lack of symptoms until terminal stages
- Most often occurs in people with chronic liver disease



(Mayo, 2019, para. 1)  
(Ghouri, 2017, para. 1)  
(Daher, 2018, pp. 69-78) (Mayo, 2019, image)

## Etiology and Epidemiology

Majority of people with HCC already have Hepatitis B and C

- Hepatitis-B virus - most common in HCC patients
- Hepatitis-C virus - second most common

Alcohol-related Cirrhosis is also common among HCC patients

- Nonalcoholic Fatty Liver Disease (NAFLD) is the third most common disease that occurs mainly in presence of cirrhosis, found to be a cause of HCC.

HCC - most common among males ages 30-50

- Accounts for 65% of all liver cancers in U.S.

(Ghouri, 2017, para. 3-10)

## Treatment Options

Different treatment options include:

- Surgical resection
- Liver transplantation
  - Limited due to lack of donors and strict indications
- Radiofrequency ablation therapy
  - Safety is dependent on where the tumor is located
- Chemotherapy
- Radiation therapy
  - Due to the liver's sensitivity to radiation, this is limited and has not been thought of as an effective option
  - Stereotactic Body Radiation Therapy, after recent studies, shows good local control rates for primary and metastatic liver cancers without risk of radiation-induced liver disease
- Targeted drug therapy
- Immunotherapy

(Mayo, 2019, para. 4)  
(Zhang, 2018, para. 1)

## Stereotactic Body Radiation Therapy (SBRT)

Pros:

- Enables delivery of high dose radiation
- Surrounding healthy tissue dose limited
- Shorter and less treatments make poor performance patients easier to treat

(Kato, 2015, pp. 13101-13112)

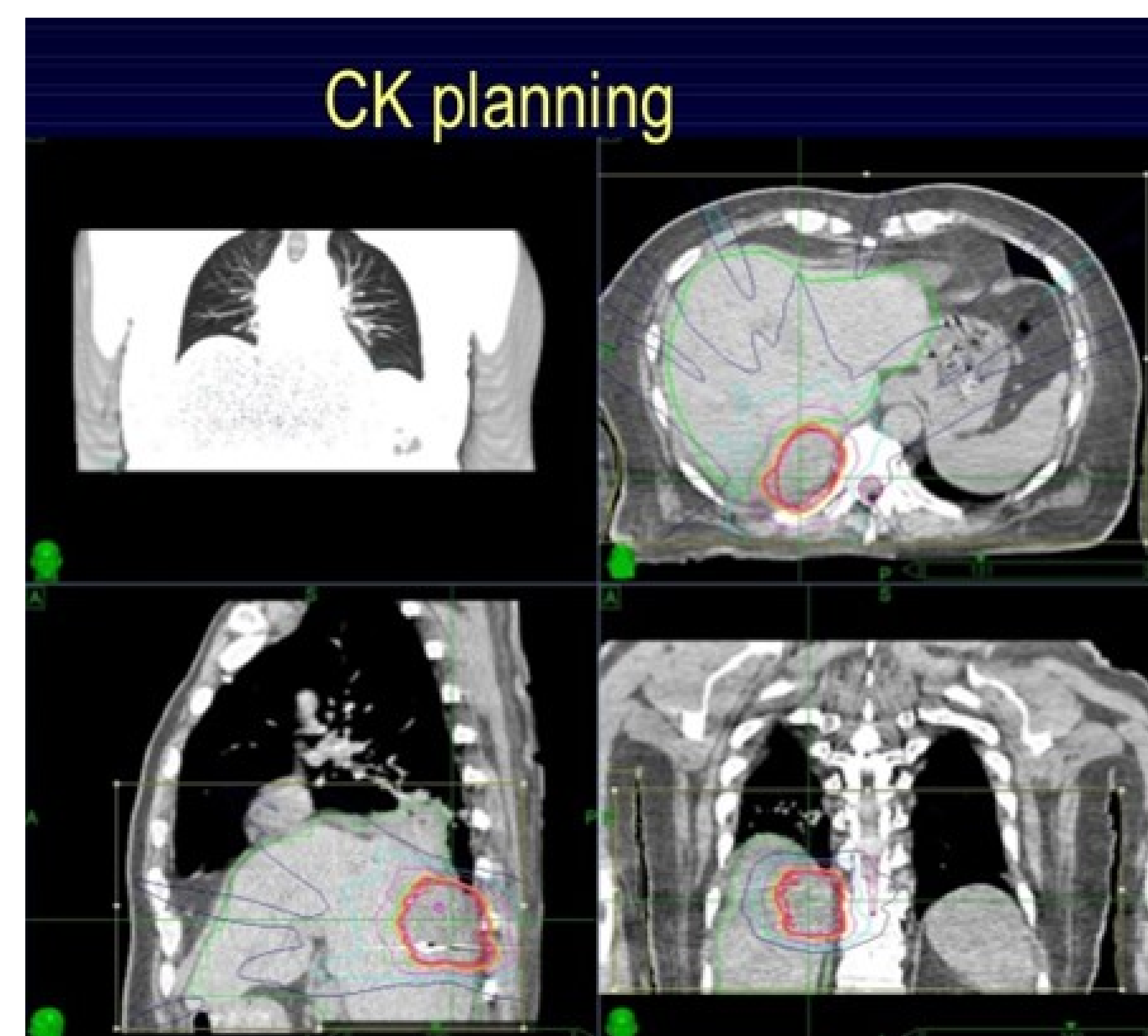
## CyberKnife SBRT



(Radiation Therapy News, 2014, image)

- Ability to deliver precise treatments within one millimeter
- More radiation is delivered to precise target area while preserving surrounding healthy tissue
- System combines intra-operative x-rays with previously acquired CT images of lesion to target each beam of radiation
- Real-time tracking accounts for any movement and adjustments are made to ensure dose is delivered to treatment area

(CyberKnife, 2017, p. 7)  
(Stanford, 2020, para. 5)



(Duttaradio, 2015, sl. 23)

## CyberKnife SBRT for HCC

CyberKnife (CK) is a good treatment option for patients ineligible for other main treatments.

It can be used for:

- pre-surgery therapy to down-stage a tumor
- Preventing tumor growth
- Palliative therapy

It makes radiation therapy treatment delivery extremely precise

- Limits exposure to healthy tissue
- Real-time tumor tracking makes any adjustments for motion

In a study by Que et al., CK SBRT appeared to be a viable treatment option in patients with unresectable HCC

- Low risk of severe toxicity
- 48.7% of patients had complete response
- Overall survival at one and two years was 63.5% and 41.3%, respectively

(Daher, 2018, pp. 69-78)  
(Que, 2016, pp. 1-10)

## Conclusion

- HCC - most common liver cancer and one of the most common cancer-related deaths worldwide
- CK offers near exact precision with treatment delivery using real-time tumor tracking
- Being precise, makes radiation therapy an effective & safe treatment for patients
- Can be used palliatively, pre-surgically, and to prevent any tumor growth

(Que, 2016, pp. 1-10)  
(Daher, 2018, pp. 69-78)