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# To Study radioactive isotopes on treatment of chemotherapy

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**Abstract-**

Radiation therapy is an effective cancer treatment option in conjunction with chemotherapy and surgery. Emerging individualized internal and systemic radiation treatment promises significant improvement in efficacy and reduction of normal tissue damage; however, it requires cancer cell targeting platforms for efficient delivery of radiation sources. Abstract Purpose of Review Cardiac masses frequently present significant diagnostic and therapeutic clinical challenges and encompass Broad set of lesions that can be either neoplastic or non-neoplastic. We sought to provide an overview of cardiac tumors using Cardiac chamber prevalence approach and providing epidemiology, imaging, histopathology, diagnostic workup, treatment, and Prognoses of cardiac tumors . Radiotherapy utilization rates for cancer vary widely internationally. It has previously been suggested that approximately 50% of all cancer patients should receive radiation.

The proportion of patients with cancer in whom external beam radiotherapy is indicated according to the best available evidence was calculated to be 52%. Monte Carlo analysis indicated that the 95% confidence limits were from 51.7% to 53.1%. The tightness of the confidence interval suggests that the overall estimate is robust. Comparison with actual radiotherapy utilization data suggests a shortfall in actual radiotherapy delivery.

Radiopharmaceutical basically deals with the application of radioactive nuclides as a therapeutic agent in different Diseases treatment and somewhere also as sterilizing agent. The therapeutic action depends on the radiation Potential of nuclides which is utilized to terminate the cancerous cell by either implanting nuclides close to the Tumour or by selective delivery of nuclides to the malignant cells using immunobiology. Radionuclides are Outlined to be more lethal towards malignant cells in comparison to normal cells, and this stimulated the Researchers to use radionuclides in cancer treatment. ―TELETHERAPY‖ one of the method for treating deep Settled tumors is through the application of a direct powerful narrow beam of gamma rays [ϒ], emitted by an Artificial isotope, into the tumor. Cobalt-60 is most commonly used isotope for teletherapy.

**Keywords –** Asbestos, Herbicides, Spondylitis, Epidemionlogy, Carcinoma, Maligancies,

**Background** –

Yttrium-90 is used for treatment of cancer, particularly non- Hodgkin's lymphoma and liver cancer, and it is being used more widely, including for arthritis treatment. Lu-177 and Y-90 are becoming the main RNT Agents. Iodine -131, samarium -153, and phosphorus -32 are also used for therapy.

**Introduction**

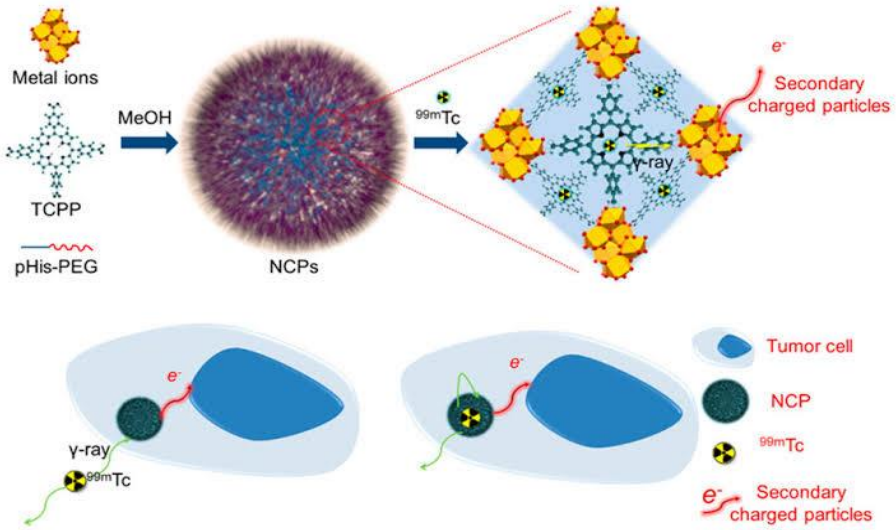
Radiotherapy (RT) Also known as radiation therapy, is a treatment mediation based on the use of high energy rays or radioactive substances, to damage temporal cells and to half their growth and division.

RT, used alone or in association with different treatment has been an effective tool for treating cancer for more than 100 years

Also today, it is an important therapeutic tool for the treatment of different kinds of cancer. It is estimated that about tow third of all cancer patients will receive AT as unique treatment or as a part of the more complex therapeutic protocol.

Nuclear medicine consists of using two major classes of isotopes for therapeutic purpose stable ones, nor undergoing radioactive decay in time and unstable ones. Stable isotopes are mainly used as track errs in pharmacokinetic studies, in order to investigate biochemical pathways in humans. Stable isotopes already play an importance role in current medical research, with great future research aoolication, since the customized synthesis since the customizes synthesis of novel carbon-13, nitrogen-15 and ozygen-18 radiolabelled compounds, as well as noble gas isotopes are actively expanding (1) Unstable is topers have an excess of neutrons that interact with the protons in the nucleus which explains not only their capacity to emit ionizing radiation but also their decay, measured through their half-life The Stability of radioisotope uncles is typically achieved by an a and or an electron of positron emission, accompanies by energy emission materialized as gamma-rays (2)

The present study is a revives of radionuclide therapy in oncology, highlighting the new trends in this field. Approximately 3,800 radiation emitting isotopes can be produced artificially through neutron activation in a nuclear reactor, or by other nuclear reaction in a cyclotron or linear accelerator about 200 radioisotopes have been investigated for potential medical application and less than 50 are used clinically on a regular basis. (3)




**Advantages :**

1. Identify the abnormalities early in the progresstion of the diseases.
2. Give accurate result, if proper metabolic time and technique applied.
3. Wide ranges of stable isotopes are available for cancer therapy.
4. Immune reactions are highly specific and sensitivity when patient is treated over conventional.
5. Easier and cheaper to dispose of lower doses. (4)

**Objective :**

The Objectives of this study were

To estimate the ideal proportion of new cases of notifiable cancer that should receive megavoltage external-beam radiotherapy at some time during the course of their illness using the best available evidence.

To develop a model of radiotherapy utilization that can be sued to estimate the effect of future changes in the relative distribution of tumor sists, changes in stage at presentation, and changes in indications for radiotherapy on the optimal radiotherapy utilization rate.

To compare the estimated optimal rates with actual rates of radiotherapy use.

Side (5)

**Side Effects:**

Along with killing cancer cells, both chemo and radiation can damage healthy cells. Side effects depend on the type and amount of treatment. They also depend on the person, some people have more serious side effects than others.

Some possible side effects that both share include.

Tiredness

Hair loss

|nausea snad vomiting

Diarrhea

Skin changes (Peeling, dryness, Irritation)

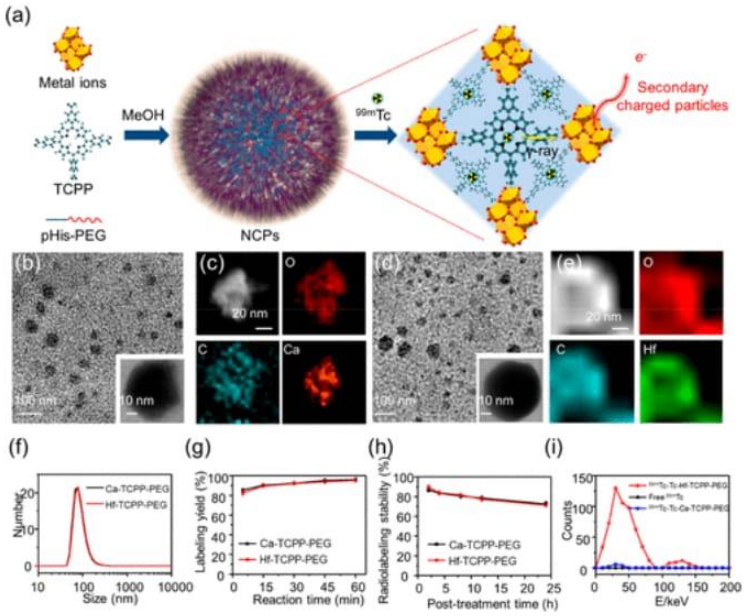
Anemia (low red blood cell count)(6)

Because radiation tends to focus on a particular area, you might notice more side effects in that sop. For example, treatment on your neck might make it hard for you to swallow. Radiation on you chest might cause you to cough or have shortness of breath. Because chemotherapy is systemic, it tends to cause more general symptoms.

Tell your medical teams about nay side effects that you notice. They can adjust your treatments or add medications to help you manage them where possible.

**Differences Between Stable And Radioactive Isotopes**

| Stable Isotopes | Radioactive Isotopes |
|---|---|
| Most abundantly found in nature. | Less abundantly found in nature. |
| No or less emission of radiation. | Spontaneous emission of radiation($\alpha, \beta, \gamma$) |
| Atomic no. And mass are constant. | Constantly changing. |
| Detection by chemical spectroscopic. | Detection by external detectors like gas chambers' scintillation. |
| Not hazards except toxic chemical | Deteriorate effects on biological tissues. |
| No special handling precautions. | Special handling precautions required. |
| No special application needed | Special application in research(mutagenesis), diagnosis(RIA)/ therapy ($R_x$ of cancer) |




**(6)**

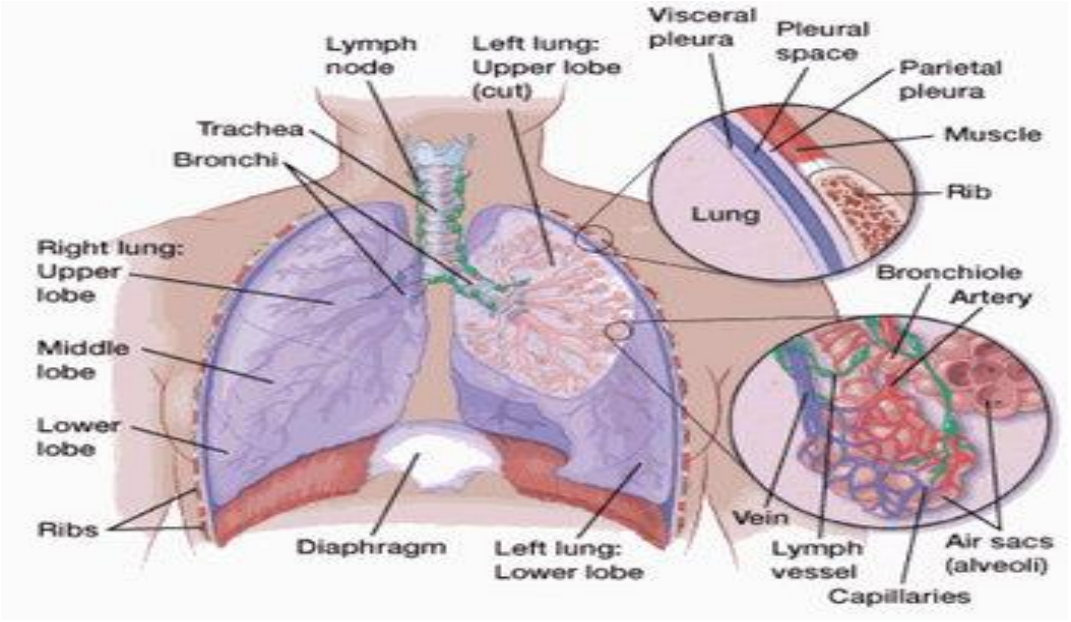
**Methodology –**

Speaking about cancer, one of the most difficult issues is to Find a definite and direct cause. There are few tumors with a Well-known etiology, but renal cell carcinoma (RCC) is not One of them precisely. In these cases, we can only try to identify some clinical And occupational factors, or some substances related to Carcinogenesis. Epidemiology is an important tool to answer many Questions about cancer origin. Differences in age, gender, and Geographic distribution have been reported, and multiple Clinical factors related to the development of RCC have Been established. Some of them have been thoroughly Demonstrated in experimental models and in vitro studies, However not all of them recognized as definite etiologic factors Besides, The incidence of both malignancies is similar in the second Decade of life. In these early ages the papillary differentiation Seems to be more frequent with higher tendency to present A locally advanced and high-degree disease at the moment Of the diagnosis [7], However, when comparing stage by Stage with adult tumors, we find a better response to surgical Treatment and higher survival rates, even with positive nodal Disease.RCC represents 85 to 90% of renal parenchymal malignancies (.8.9 ) Although Cycasin (a Substance derived from a palm fruit that grows in the island Of Guam) induces RCC in animals, a higher incidence of this Neoplasm within the island population could not be shown. Cadmium was demonstrated to have influence on the Development of RCC in smokers [.10.11]

(i) Asbestos. A significantly elevated mortality rate for Kidney cancer has been reported in two cohort Studies, on insulation workers [12] and on asbestos Products workers [13) Autopsy surveys and animal Studies indicate that asbestos fibers can be deposited In kidney tissue.

(ii) Organic solvents. Pesticides, copper sulphate, benzidine, benzene herbicides, and vinyl chloride have Been found as risk factors of RCC in prolonged Exposure. A dose dependent effect has been seen only For organic solvents and copper sulphate [14, 15]. Recent reviews of cohort studies found little or no Evidence of an increased risk for RCC among people Exposed to gasoline and petroleum derived products [16, 17].

Figure –




[18]

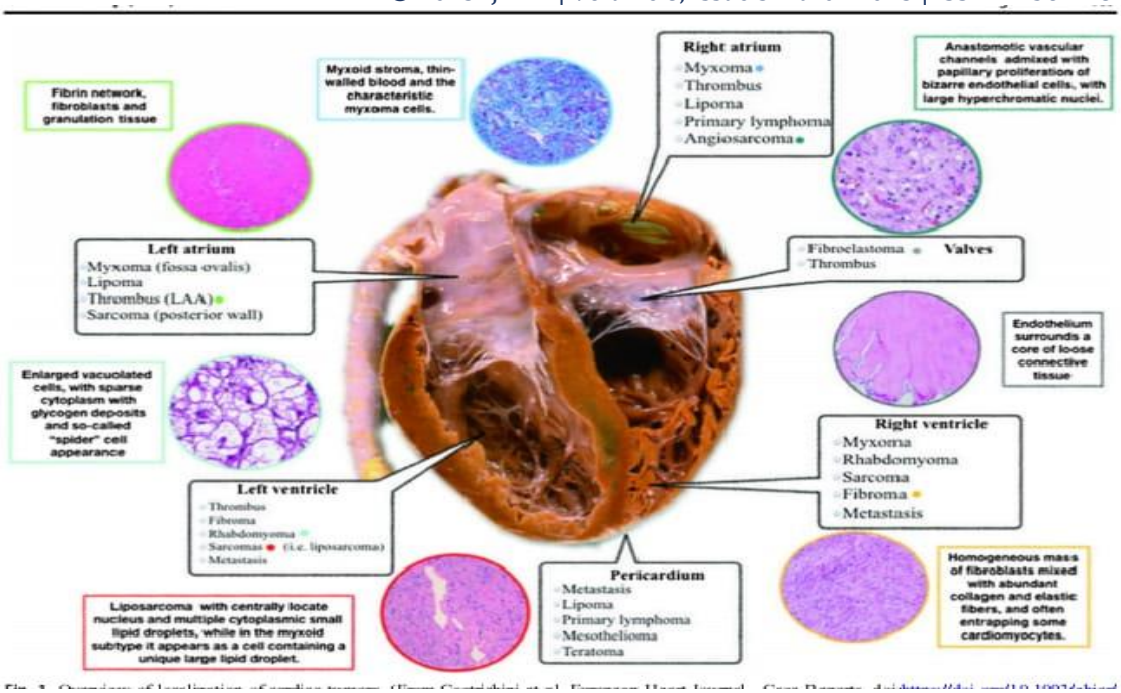
**Heart cancer –**

Clinical presentations of cardiac metastasis are extremely Variable and differ greatly according to the most heavily involved site. Although a cardiac metastasis may be the first or Even the only manifestation of an undiagnosed malignant tumor, they often go unrecognized in vivo and are diagnosed Only after death [19, 20, 21–24, 25].

**Treatment -**

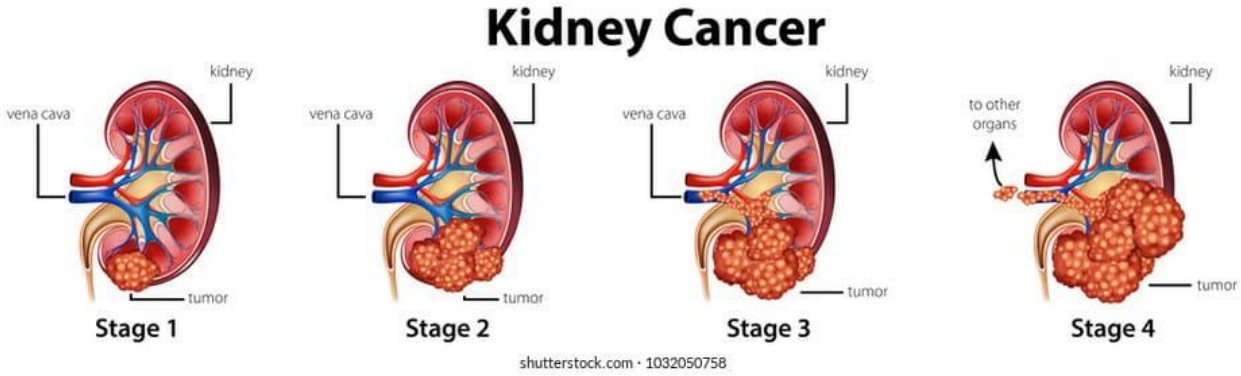
Treatment and Prognosis Surgical removal of benign cardiac tumors or masses, even if Small and incidentally discovered, should always be considered in the setting of left-sided and endocavitary lesions due to The embolic risk. For right-sided and asymptomatic benign Cardiac tumors, in the absence of a patent foramen ovale or Septal defects, strict echocardiographic follow-up can be Employed. All symptomatic benign tumors should be surgically resected (only exceptions are rhabdomyomas, as they Often spontaneously regress or treated with mTOR complex 1 inhibitor [26]; intramural angiomas that can respond to corticosteroids; and fibromas, when the mass is unresectable and Arrhythmias are under control by antiarrhythmic therapy) [27]. A surgical exposure is a "conditio sine qua non" for wide Resection around the base of the tumor to prevent recurrence. In case of endocavitary ventricular neoplasms, surgical approach is through an ipsilateral atriotomy, if the tumor is located in the ventricular inflow, or through aortic or pulmonary Arteriotomy, if it is located in the ventricular outflow [28]. When the neoplasm is intramural in the ventricles, Ventriculotomy with mass enucleation is necessary. Most benign tumors can be resected en bloc, but in case of an Unresectable tumor, a debulking is considered [28]. Orthotopic cardiac transplantation has been accomplished in The absence of metastasis [27]. The gold standard treatment for cardiac myxoma and lipoma is prompt surgical excision by experienced surgeons and Complete removal of the entire base of the tumor. This approach should result in excellent early and long-term outcomes [29]. In 2015, the World Health Organization (WHO) updated the Classification of cardiac neoplasms including benign tumors, Tumor-like lesions, malignant tumors, and pericardial tumors [30]. Cardiac tumors are divided into primary and secondary

Forms. The estimated prevalence for primary cardiac tumors is 1:2000 autopsies and for secondary tumors 1:100 autopsies, With a secondary/primary ratio of 20:1. Approximately 10% of primary cardiac tumors are malignant and 90% benign (mostly myxomas) [2]. Myxomas account for approximately 50% of all benign cardiac tumors in Adults and only for a small percentage in children. Rhabdomyoma is the most common benign tumor in children, Accounting for 40 to 60% of the cases. Other benign cardiac Tumors that have been described include fibromas, lipomas, Hemangiomas, papillary fibroelastomas, cystic tumors of the Atrioventricular node, and paragangliomas [31].




The remaining 10–20% of primary cardiac tumors are malignant and usually Are pathologically described as sarcomas [32]. Primary cardiac sarcomas constitute approximately 1% of All soft tissue sarcomas and are the most common malignant Primary cardiac tumor [4]. Angiosarcomas and unclassified Sarcomas account for approximately 76% of all cardiac sarcomas, of which angiosarcomas are the most common [33]

**Kidney cancer :**




Chemical carcinogens

Some radiological contrasts have been associated with an increased incidence of RCC [34]. Although Cycasin (a substance derived from a palm fruit that grows in the island of Guam) induces RCC in animals, a higher incidence of this neoplasm within the island population could not be shown. Cadmium was demonstrated to have influence on the development of RCC in smokers [35,36 ].

(i) Asbestos. A significantly elevated mortality rate for kidney cancer has been reported in two cohort studies, on insulation workers [37] and on asbestos products workers [38]. Autopsy surveys and animal studies indicate that asbestos fibers can be deposited in kidney tissue.

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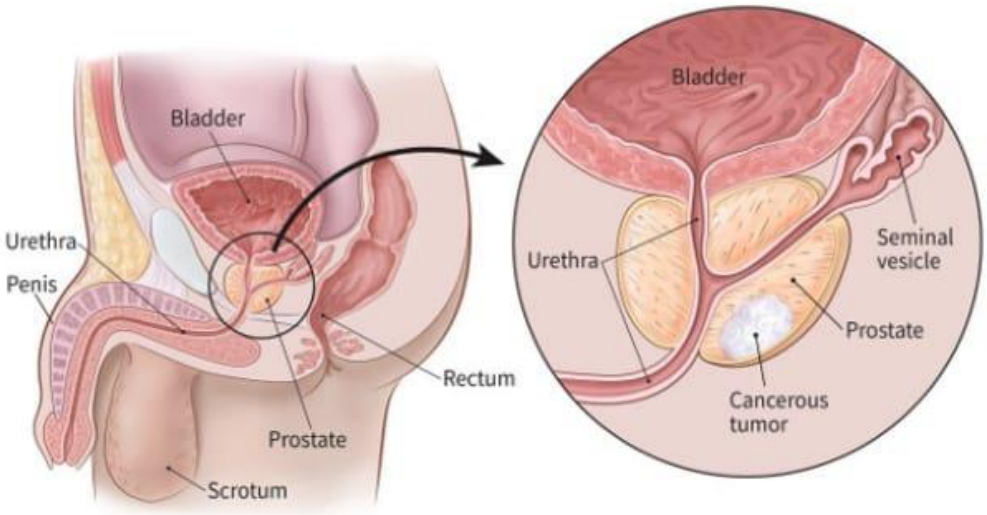
[41,42].

Radiation : Ionizing radiation appears to increase the RCC risk slightly, Especially among patients treated for ankylosing spondylitis And cervical cancer [43]. An increased risk has also been Reported for patients receiving radium 224 for bone tuberculosis and ankylosing spondylitis [44].

**Prostate cancer -**

Cancer starts when cells in the body begin to grow out of control. Cells in nearly any Part of the body can become cancer cells, and can then spread to other areas of the Body. To learn more about cancer and how it starts and spreads, see What Is Cancer? Prostate cancer begins when cells in the prostate gland start to grow out of control. The Prostate is a gland found only in males. It makes some of the fluid that is part of semen. The prostate is below the bladder (the hollow organ where urine is stored) and in front Of the rectum (the last part of the intestines). Just behind the prostate are glands called Seminal vesicles that make most of the fluid for semen. The urethra, which is the tube That carries urine and semen out of the body through the penis, goes through the center Of the prostate [45]

Diagram




[46]

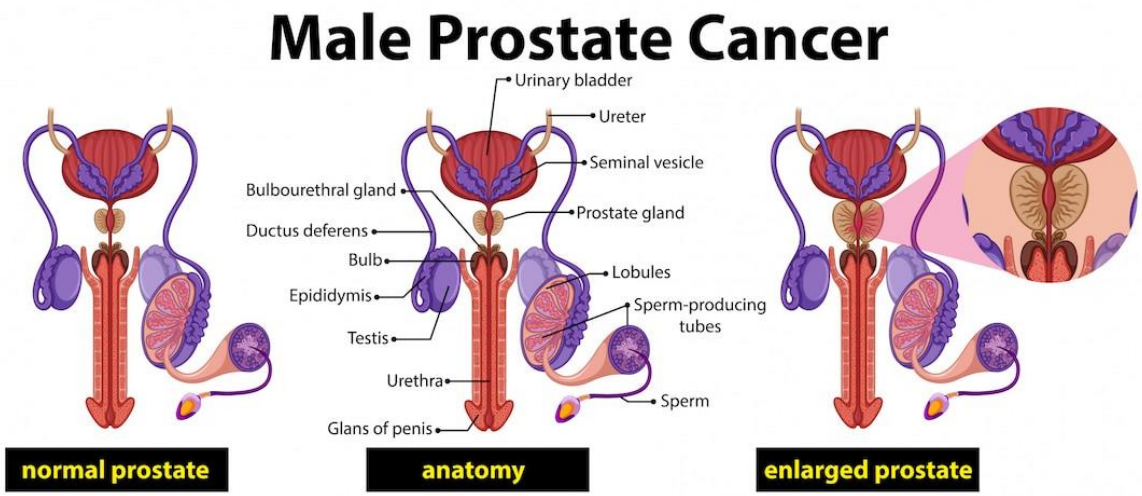
The size of the prostate can change as a man ages. In younger men, it is about the size Of a walnut, but it can be much larger in older men. Types of prostate cancer Almost all prostate cancers are adenocarcinomas. These cancers develop from the Gland cells (the cells that make the prostate fluid that is added to the semen). Other types of cancer that can start in the prostate include: Small cell carcinomas [47]

- Neuroendocrine tumors (other than small cell carcinomas)
- Transitional cell carcinomas
- Sarcomas
- These other types of prostate cancer are rare. If you are told you have prostate cancer, It is almost certain to be an adenocarcinoma Some prostate cancers grow and spread quickly, but most grow slowly. In fact, autopsy Studies show that many older men (and even some younger men) who died of other Causes also had prostate cancer that never affected them during their lives. In many Cases, neither they nor their doctors even knew they had it. Possible pre-cancerous conditions of the prostate Some research suggests that prostate cancer starts out as a pre-cancerous condition, Although this is not yet known for sure. These conditions are sometimes found when a Man has a prostate biopsy2 (removal of small pieces of the prostate to look for cancer). Prostatic intraepithelial neoplasia (PIN) In PIN, there are changes in how the prostate gland cells look when seen with a Microscope, but

the abnormal cells don't look like they are growing into other parts of The prostate (like cancer cells would). Based on how abnormal the patterns of cells look, They are classified as: Low-grade PIN: The patterns of prostate cells appear almost normal. [48]

- High-grade PIN: The patterns of cells look more abnormal.

- Low-grade PIN is not thought to be related to a man's risk of prostate cancer. On the Other hand, high-grade PIN is thought to be a possible precursor to prostate cancer. If You have a prostate biopsy and high-grade PIN is found, there is a greater chance that You might develop prostate cancer over time. PIN begins to appear in the prostates of some men as early as in their 20s. But many Men with PIN will never develop prostate cancer. For more on PIN, see Tests to Diagnose and Stage Prostate Cancer3. Proliferative inflammatory atrophy (PIA) In PIA, the prostate cells look smaller than normal, and there are signs of inflammation In the area. PIA is not cancer, but researchers believe that PIA may sometimes lead to High-grade PIN, or perhaps directly to prostate cancer




**Diagram**

[49]

**DISCUSSION:**

We have used an evidence-based technique to calculate an overall estimate of optimal Radiotherapy utilization of 52.3% for all notifiable cancer in Australia. This final estimate is Remarkably precise (as measured by the tight confidence limits) despite uncertainty existing in Relation to data for some indications for radiotherapy and occasional uncertainty between Treatment options of approximately equal efficacy. The tight confidence interval may be Explained by the fact that good quality data existed for the initial branches of the tree (for Example, data such as tumor type and stage at presentation). Most of the uncertainty existed n the distal or near-terminal branches of the tree and, therefore, affected only very small Proportions of the cancer population and had little effect on the overall estimate. In addition,The effect of these variations was such that some would increase the overall utilization rate Whereas others would reduce it, so that, to a large extent, they cancelled out each other.
The model of radiotherapy utilization developed in this project has many benefits.
It provides a benchmark for planning radiotherapy services on a population basis. The results From this study can be useful in the planning of appropriate radiotherapy services for a given Population using the following calculations.
For every 1000 cancer cases in a population, 523 patients would need radiation as an optimal Part of their management based upon the results of this project (calculated optimal Radiotherapy utilization rate of 52.3%). A further 120 patients, of the above 523 patients, will Require retreatment (based upon an actual retreatment rate of 23%).40

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**Conclusions:**

Radionuclide therapy with strontium-89 and samarium-153 is effective and well tolerated treatment of pain causes by the skeletal metastases. In some cases it is possible to obtain equally good analgesic effect with repeated radioisotopes administration.

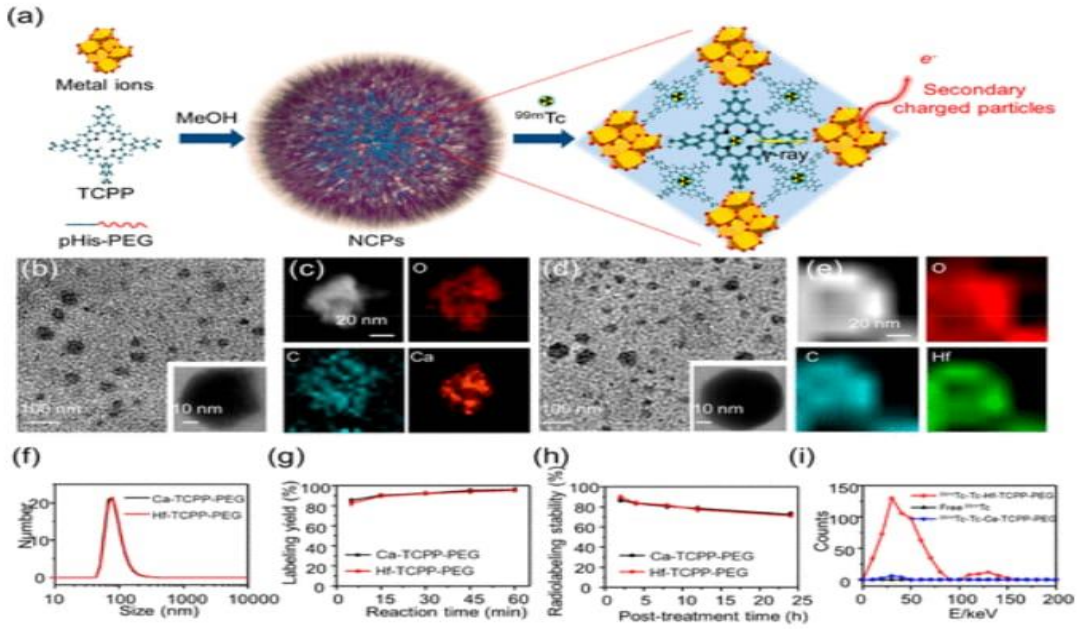
This review of literature highlights the progresses in the field of nuclear medicine for the treatment of unrespectable pancreatic adenocarcinoma. As new tartest for end radiotherapy and new techniques for brachytherapy emerge, a collaboration with research facilities such as the CERN-MEDICIS infracted is needed, which provided a variety of radioisotope [is.

Terbium and Lutetium are two lanthanides of particular interest, with a high theranostic potential.

These new techniques co7uld be combined to current therapies such as chemotherapy an external beam therapy, to improve results. Future large-scale studies are necessary and multidisciplinary collaboration is essential for this purpose.

**Results:**

HF-TCPP-PEG NCP and Ca-TCPP-PEG NCPs were synthesized via a one-pot method following our recently reported method (28) by simply mixing metal ions (Hf4+ or Ca2+), ligans, and pHis-PEG in methanol in room temperature ( Figure 1a). In this process, TCPP molecules with four carboxyl groups could form coordination bonds with Hf4+ or Ca2+ ions. Moreover, pHis-PEG was used so that its pHis domain could bind with metal ions, while its PEG domain could offer the obtained NCPs great water solubility and physiological stability. The as made Hf- TCPP-PEG and Ca-TCPP-PEG NCPs exhibited relatively uniform sizes and similar morphology with transmission electronic microscopy (TEM) (Figure 1b,d) As shown by elemental mapping based on energy-dispersive X- ray (EDX) spectroscopy (Figure 1c,e), Hf4+ and Ca2+ ions were uniformly dispersed within the respective NCPs. The average hydrodynamic sizes of both NCPs were determined by dynamic light scattering (DLS) to be about 70 nm (Figure1f). Moreover, both Hf-TCPP-PEF and Ca-TCPP-PEG NCPs showed similar UV-vis absorbance spectra, in which the characteristic absorbance peaks from TCPP could be clearly observly (FigureS1). Those results collectively evidenced the successful formation of NCPs by our one-pot reaction. Owing to the pH responsive charge conversion ability of poly0 histidine (pka at 6.0), the size of such pHis-PEG modified NCPs showed stable under slightly acidic pH 7.4 but rapidly enlarged sizes under slightly pH (e.g., 5.5), owing to the dissociation of the compact NCP structure after protonation of histidine (Figure

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