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COBALT vs LINEAR ACCELERATOR

Cancer has been present throughout human history. In fact, the global cancer incidence is predicted to double between now and the year 2020 at which time there will be over 200,00,000 new cases diagnosed each year. Majority of these will be in the developing countries. Of these, 12,000,000 deaths will result. WHO estimates that if these trends continue, cancer will be the leading cause of death everywhere except in sub Saharan Africa and most victims will be in the 50-60 year age group.

Accurate information regarding the disease and different modalities of treatment have been developed only during the last century. Treatment strategies for cancers have evolved mainly during the last 50 years. Radiotherapy is one of the major modalities of cancer treatment and every alternate cancer patient will require radiation during the course of treatment.

Cobalt-60 Teletherapy Unit

The invention of the cobalt-60 teletherapy unit by HE Johns in Canada in the early 1950s provided a tremendous boost in the quest for radiotherapy in the treatment of cancer. In 1951, Cobalt 60 teletherapy was first put to clinical use in London, Ontario. A typical teletherapy 60 CO source is a cylinder of diameter 2 cm., height 5 cm., and is positioned in the Cobalt Unit with the circular end facing the patient.

Cobalt units with low energy of gamma rays are ideal for treatment of head and neck cancers. Majority of others will be cervical cancers and others like cancers of oesophagus, lung, prostate, etc. where the separation or thickness of parts to be treated will be greater than 20 cm. Even though Cobalt units can be used for above clinical situations they do not give the idea] depth dose for deep situated tumors like cervix, pro state etc.

Cobalt-60 units over the last several decades have remained static in design and there has been very little change in ancillaries and accessories. The major problem with these units is the decaying source, reduced output resulting in increased treatment times which in turn will effectively reduce the patient

output. The source needs to be replaced every 5-7 years. Disposal of spent source is another major problem.

Linear Accelerators (linacs)

From the technology of World War II radars came the ability to produce high energy microwaves. This field advanced with the development of high energy microwave tubes known as Klystrons or Magnetrons which are still at the heart of today's modern Linear Accelerators.

The First medical Linear Accelerator was created and used in England in 1953 followed by USA (at Stanford University (Ginzton 1984). Basically the Linear accelerator (Linac) is a device that uses high frequency electromagnetic waves to accelerate charged particles such as electrons to high energies through a Linear tube. The high energy electron itself can be used for treating superficial tumors or it can be made to strike a target to produce x-rays for treating deep seated tumours.

The concurrently developed medical linear accelerators (linacs), however, soon eclipsed the cobalt unit, moved through increasingly sophisticated generations, and became the most widely used radiation source in modern radiotherapy. With its compact and efficient design, the linac offers excellent versatility for use in radiotherapy.

As we know the effectiveness of radiotherapy treatment depends upon maximizing the radiation dose to the tumour while minimizing the dose to all the surrounding normal tissues; newer technologies like multi leaf collimators (MLC) fitted to Linac; intensity modulated Radiotherapy Plans (IMRT) have helped to improve accuracy in executing treatment and also delivering differential dose to tumor and surrounding normal tissue.

Several arguments have been put forward both for and against Cobalt Units as well as Linear accelerators. These arguments relate to physics, clinical advantages and more importantly, the cost consideration.

1. In Cobalt units dose will reduce because of decay, and depends on source

activity, whereas with Linear Accelerator one has the guarantee of constant dose rate

2. Linear accelerator are very useful for deep seated tumours. Skin sparing is better with Linac

3. In Linear accelerator one can have reproducibility of Dosimetry system and the dose delivered is continuously monitored and recorded.

4. In Linear accelerator Dose rate is fixed, while in Cobalt dose rate decreases with decay of source

Conculsion:

Cobalt 60 units provide relatively high energy gamma rays for radiotherapy which are ideally suited for treatment of head and neck cancers and other superficially located tumours like breast cancers and soft tissue sarcomas of extremities. They are not adequate for treatment of deep seated tumours and have the added disadvantage of decreasing output with decay of source and the need for source replacement within 5-7 years. Disposal of decayed source is another major concern. The beam characteristics when compared to 6mv Linacs are inferior and fewer ancillaries are available for cobalt machines as compared to Linacs.

High energy Linacs in addition to giving two or three x-ray energies can also generate variable energy electron beam for treatment

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