'Bhabhatron'- A step in realizing Bhabha's Vision for Cancer Radiotherapy

S.K. Shrivastava[1], T. Gupta[1], R. Sarin[1], K. A. Dinshaw[1], D. D. Deshpande[2], R. Phurailatpam[2], M. Singh[3], D. C. Kar[3] and K. Jayarajan[3]

1. *Radiation Oncology, Memorial Centre, Mumbai, INDIA*
2. *Medical Physics, Tata Memorial Centre, Mumbai, INDIA*
3. *Division of Remote Handling and Robotics, Bhabha Atomic Research Centre, Trombay, Mumbai 400 085, INDIA*

Background

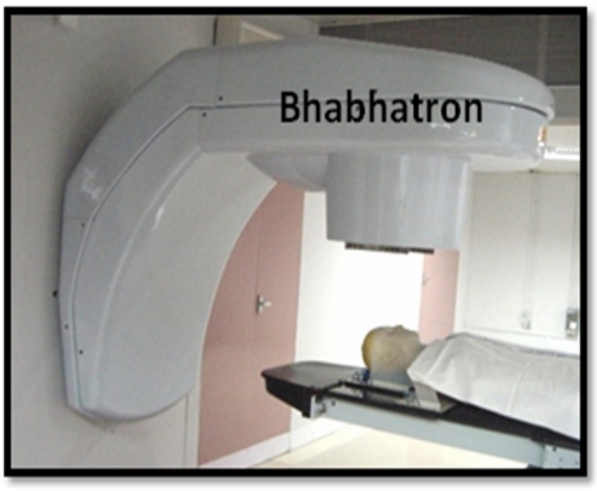
According to recent estimates over one million new cancer cases are diagnosed in India every year, with a large majority presenting with advanced stage disease. Amongst the three established modalities of cancer treatment viz surgery, radiotherapy, and chemotherapy, radiotherapy has been shown to be the most cost-effective. As per conservative estimates >65% of all cancer patients need radiotherapy at some point either in the radical or palliative setting, making it a cornerstone for effective cancer management. Currently there is a huge shortfall in the availability of Radiotherapy equipment in the entire developing world. While in the developed countries there are 2 – 4 teletherapy machines available per million population considering the prevailing socio-economic conditions, the WHO has recommended 1 teletherapy unit per million population for the developing countries to provide essential cancer services. There are several developing countries, which do not have a single teletherapy machine and most others fall way short of the WHO recommendation of 1 machine per million population. The number of new teletherapy machine installation in India has increased rapidly in the last 5 years. However with approximately 400 teletherapy units existing for a population of over a billion, we still need another 800 teletherapy machines to reach a very modest target of 1 machine per million population. Among other reasons the cost of the imported teletherapy equipment is one of the important deterrent towards fulfilling this huge shortfall of 800 teletherapy units in our country.

Objective

To develop an integrated and sustainable programme for accelerating the process of developing, validating and marketing a more cost-effective indigenous telecobalt radiotherapy unit in a limited resource setting.

Methods

Towards realizing this goal, the Department of Atomic Energy (DAE) of the Government of India set up a special task force to develop indigenous radiotherapy equipment including telecobalt and medical linear accelerator. The Division of Remote Handling and Robotics of Bhabha Atomic Research Centre (BARC) was entrusted with the task of designing the indigenous telecobalt unit, which was very aptly christened as 'Bhabhatron', in keeping with the vision of the doyen of Atomic Energy in India, Dr Homi Jehangir Bhabha.



Results

Bhabhatron is an isocentrically mounted telecobalt unit with 80 cm source-surface distance (SSD). It is very user-friendly with complete digital display, electronic operations, and computerized control console. For commercial manufacturing, the technology was transferred to an industry partner – Panacea Medical Technology Private Limited, Bangalore. In consultation with the clinical and medical physics team from the Tata Memorial Centre, which is a grant-in-aid autonomous centre of the DAE, the prototype machine (Bhabhatron-I) was fabricated by Panacea Ltd and installed in 2004 at the Advanced Centre for Treatment Research & Education in Cancer (ACTREC), the basic, translational, and clinical research unit of Tata Memorial Centre. This indigenous unit was rigorously evaluated for electrical, mechanical, radiation safety, dosimetric and clinical utility features by the team of scientists, oncologists and physicists from BARC and Tata Memorial Centre.

Bhabhatron-I fulfilled both national as well as international radiation safety and dosimetric

requirements and was given type approval and commissioning approval by the Atomic Energy Regulatory Board (AERB). To make the unit more compact and contemporary, several design modifications were suggested. Based on technical reports, clinical evaluation, and user feedback, improved features of clinical utility, versatility and advanced technical parameters were incorporated into the commercial unit, Bhabhatron-II, which has since replaced the prototype unit at ACTREC. Bhabhatron II has been installed or under the process of installation at 10 other cancer centres in India. India is also donating one such unit to Vietnam under the IAEA PACT programme. Over 1500 patients with cancer of various sites have received radiotherapy on the Bhabhatron series (I & II) at ACTREC since commissioning.

In keeping with rapidly evolving technology, it has been proposed to fabricate a multi-leaf collimation system on Bhabhatron for delivery of three-dimensional conformal radiotherapy and intensity modulated radiotherapy to bring high-precision treatment within the ambit of a larger section of the underprivileged at nominal cost.

Conclusion

This programme has demonstrated that with coordinated and goal oriented academia - industry partnership it is possible to develop high quality and cost effective indigenous technology in developing countries such as India. 'Bhabhatron' can be considered a small but significant step in the whole programme of 'Atoms for Peace'.

References

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