PROTON BEAM THERAPY

Position Paper

Proton beam therapy

Beams of hadrons, such as protons and ions, may offer advantages over x-ray radiotherapy for some tumours. Protons are most widely used, with carbon ions being under evaluation at several research centres.

Protons deposit very little energy in tissues surrounding a cancer, unlike standard external beam radiotherapy which means a radiation oncologist can increase the dose to the tumour while reducing the dose to surrounding normal tissues. This allows the dose to be increased beyond that which less-conformal radiation therapy will allow. The overall effects lead to fewer harmful side effects, more direct impact on the tumour, and increased tumour control.

The production of therapeutic hadron beams requires a cyclotron or synchrotron, being a complex machine and of larger size and greater cost than the linear accelerators used for megavoltage x-ray therapy.

Applications

Proton beam therapy is intended to treat tumours in patients where surgical excision is deemed impossible, too dangerous, or unsuccessful and where conventional radiotherapy is also impossible or limited by radio-sensitive structures close by.

Proton beam therapy to date has been utilised in the treatment of various cancers fitting this description, including: ocular/uveal melanoma; skull base and spinal sarcomas; benign meningiomas; paranasal sinus, nasal and nasopharyngeal tumours; and a range of paediatric tumours, particularly those of the central nervous system and brain. In addition, proton beam therapy has been used for carcinoma of the prostate, hepatocellular carcinomas and early-stage lung cancers.

The British National Commissioning Group for Highly Specialised Services Guidance for referral for proton therapy abroad recognises certain conditions for which proton therapy is considered the treatment of choice. These include: base of skull and spinal chordoma; base of skull chondrosarcoma; spinal and paraospineal bone and soft tissue sarcomas for adults and children.

Locations of proton beam therapy facilities

As of June 2011 there are 37 proton beam therapy facilities operating worldwide, with the majority situated in Japan and the United States, but with a growing number in Europe.

There are currently few facilities in the South East Asian region, with one in China and a facility is planned for operating in Taiwan in 2011. There is one proton beam therapy facility in England, although two others are planned, and one each in Canada and South Africa.

Cost

Proton beam therapy has high establishment costs. A NSW Feasibility Study, conducted in 2003, indicated capital costs ranging from $125.14M to $182.53M, and recurrent costs of $6.83M to $11.4M per annum. Recent proposals continue to indicate establishment costs in the order of >$150M, exclusive of land costs.

There is currently no Medicare or Health Program Grant (HPG) item for proton beam therapy.

Workload

The Advisory Board Company 2008 report suggests that a multi-room proton facility required a national referral base of some 10 million people.

The Evidence

In June 2006, the Australia and New Zealand Horizon Scanning Network (ANZHSN) published a horizon scanning prioritising summary on proton beam therapy.

It concluded that there is a large body of poor quality evidence indicating the successful use of proton beam therapy in a diverse patient base. Proton beam therapy may be of great benefit to a group of vulnerable patients who either have untreatable cancers with conventional therapies or conventional therapies would put them at a high-risk of future, secondary disease.

In December 2006, ANZHSN published a Horizon Scanning Report to provide advice to the Health Policy Advisory Committee on Technology (HealthPACT) on the state of play of the introduction and use of proton beam therapy for the treatment of intracranial, head
and neck tumours. It concluded that despite a substantial number of studies of proton beam therapy, the results were largely inconclusive due to poor quality of studies.

A further literature review in 2009 was unable to identify any randomised trials comparing the use of proton beam therapy to conventional radiation for the treatment of cancer. The majority of studies were case series evidence (level IV) and of poor quality. Cost-effectiveness studies also indicated that proton beam therapy was more expensive compared to conventional radiation therapy.

**Current NSW Health position**

In light of the lack of evidence from randomised controlled trials for patient benefit from proton beam therapy to date, the NSW Government’s approach to cancer therapies will continue to concentrate on increasing access to, and utility of, services that have a proven patient benefit.

Given the costs and the potential applications for this technology, a national referral base would seem to be most appropriate given the high capital and operating costs. Establishment of proton beam therapy would need to be considered in this broader context, including a strong research and evaluation program to demonstrate patient benefit.

**Future Developments**

Decisions regarding the procurement of new technologies will continue to be balanced by consideration of the evidence available, and the requirement of the health system to provide contemporary clinical services.

Considerations of the introduction of new and emerging technologies are informed by established assessment bodies, such as the Medical Services Advisory Committee and Health Policy Advisory Committee for Technology (HealthPACT).

It has been proposed that proton beam therapy be considered through these established health technology assessment processes.

**References:**


**Disclaimer**

This Position Paper has been prepared by NSW Ministry of Health to assist NSW Local Health Districts and Statewide and Rural Health Service and Capital Planning Branch with health service planning and policy making decisions.

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