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Australia and New Zealand Horizon Scanning Network

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Horizon scanning prioritising summary

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Cyberknife®: Minimally invasive precision radiosurgery for conditions where radiation treatment is indicated.

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PRIORITISING SUMMARY

REGISTER ID: **0000066**

NAME OF TECHNOLOGY: **CYBERKNIFE®**

PURPOSE AND TARGET GROUP: **MINIMALLY INVASIVE PRECISION RADIOSURGERY FOR CONDITIONS WHERE RADIATION TREATMENT IS INDICATED**

STAGE OF DEVELOPMENT (IN AUSTRALIA):

☒	Experimental	☐	Established
☐	Investigational	☐	Established *but* changed indication or modification of technique
☐	Nearly established	☐	Should be taken out of use

AUSTRALIAN THERAPEUTIC GOODS ADMINISTRATION APPROVAL

☒	Yes	ARTG number	119027
☐	No	☐	Not applicable

The Cyberknife® system is currently distributed y Taylor Bryant Pty Ltd.

INTERNATIONAL UTILISATION:

COUNTRY	LEVEL OF USE		
	Trials Underway or Completed	Limited Use	Widely Diffused
Korea	✓		
United States	✓		

IMPACT SUMMARY:

Accuray Incorporated developed the CyberKnife® (Accuray 2004) with the aim of providing minimally invasive stereotactic radiosurgery for conditions where radiation treatment is indicated. Stereotactic refers to "*a technique or apparatus used in neurological research or surgery for directing the tip of a delicate instrument (as a needle or an electrode) in three planes in attempting to reach a specific locus…*" (2004). Traditional radiation therapy using an external beam has the drawback of causing damage to tissue that surrounds the target site. Stereotactic radiotherapy attempts to avoid this problem by sending multiple beams at lower doses of radiation to the target site from different angles. However, the radiation dosage at the target site is theoretically cumulative providing a toxic dose of radiation to the tumour. In order to accomplish this with current stereotactic radiosurgical techniques, the patient is required to be immobile throughout the procedure and is placed within a frame. This leads not only to patient discomfort but limits the use of the procedure to specific head and neck cancers and all but eliminates its use in cancers at other body sites where movement is inevitable. With computer assisted stereotactic radiosurgery such as CyberKnife®, regular assessment of the target position by several x-ray cameras, and correction of the aim of the device with a robotic arm, makes immobilisation of the patient less critical.

Reported use of this technology can extend to the treatment of cancers of the head and neck, spine, lung, pancreas, liver, kidney, prostate and bone (CyberKnife Society 2004). In Australia this amounts to approximately 25,000 new cancer patients per year that could be eligible for this treatment (AIHW 2003).

Limited research is available on the effectiveness and safety of using the CyberKnife® system for cancers amenable to radiotherapy. No studies have compared the effectiveness of the CyberKnife® with the traditional frame-based sterotactic radiotherapy in the head and neck region. Comparisons in other body regions cannot be done due to the restriction of frame-based radiotherapy to the head and neck region.

In a case series (level IV evidence) of 31 patients with advanced pancreatic tumours (Kim 2003), palliative treatment with CyberKnife® resulted in a reduced use of opioids for pain. Patients were monitored by computerised tomography for response to treatment at a median follow-up of four months. Four of the ten patients exhibited a partial response and in the other six patients the disease had stablised. In seven patients, whose disease was monitored by biochemical marker (CA19-9), all experienced a 50% reduction in the marker level. Three of the 31 patients experienced acute pain during treatment that subsided soon after the procedure was complete. There was one dropout due to this acute pain experience and three patients experienced nausea and vomiting.

In another case series, 23 patients diagnosed with lung cancer were followed-up for a mean of seven months. Two of the patients had complete response to treatment with the CyberKnife®, 15 showed partial response, four patient's tumours stabilised, and only two patients exhibited progressive growth of the tumour (Whyte et al 2003). No complications due to treatment were noted in this study.

One report claimed that this technology significantly increased the operative volume in their community neurosurgery practice (Naff et al 2003).

While the initial trials of CyberKnife® technology appear to be positive, studies are few and those that exist are of a level of evidence that cannot unequivocally determine effectiveness.

There is currently no costing information available on CyberKnife®.

CONCLUSION:

Despite the paucity of available evidence and the low quality of existing studies for the use of CyberKnife® in the performance of stereotactic radiosurgery, this technology may have a great impact on the Australian public health system.

HEALTHPACT ACTION:

It is therefore recommended that a Horizon Scanning report be conducted.

SOURCES OF FURTHER INFORMATION:

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SEARCH CRITERIA TO BE USED:

Neoplasms/secondary/*surgery
*Radiosurgery/adverse effects/methods

Text words
Stereotactic
Cyberknife