Nursing Care of Patients Undergoing Radio Surgery

Angela Gnanadurai

Introduction
Radio surgery - Surgery without a knife: Though modern brain surgery is as safe as travelling in an aircraft, there is a natural tendency to avoid the knife if possible. Stereotactic radio surgery is a technique for obliterating intracranial targets which are inaccessible or unsuitable for open surgical techniques by means of collimated beams of ionizing radiation.

In the technique of radio surgery a very high dose of radiation is delivered to a precisely located abnormal area in brain as a single one time treatment.

Generally ionizing radiation, and Gama rays are used for radiotherapy. They are obtained from Linear accelerators. One of the latest advantages is to use the “X” and Gama radiation for Neurosurgical procedures called Stereotactic Radiosurgery.

Stereot - Three Dimensional
Tactic - To touch
Radiosurgery - an alternative to surgical removal of the volume of tissue.

When there is tumour or vascular malformation in the brain its growth has to be arrested. Ideally the abnormal tissue is to be removed. This involves a craniotomy using anesthesia and the theoretical possibilities of excessive bleeding during surgery, post operative infection and worsening or neuro surgical status. An alternative treatment option is to destroy the abnormal area alone with radiation. The effective radiation dose required to achieve “a tumour kill” is several times more than the maximum dose, which the adjacent normal brain can tolerate.

Common Indications
1. Alterative or venous malformation
2. Acoustic neuromas

3. Meningiomas
4. Metastasis

Others: 1) Patients who refuse surgery
2) Recurrent brain tumours
3) Tumours incompletely removed by surgery
4) Brain tumours less than 4 cm not suitable for standard surgical measures by virtue of their location or due to other risk factor

Advantages
1. It is efficacious for treating lesions in inaccessible regions of the brain.
2. Morbidity and mortality are low (eg) there is almost no risk infection or haemorrhage.
3. Treatment is quick and precise.
4. Existing LINAC used for general radiotherapy can be used for radiosurgery with suitable modifications.

Disadvantages of Radio Surgery
1. Suitable only for well defined specific cases.
2. Success and complication can only be assessed after many months.
3. Not freely available.
4. Considerable expertise and infrastructure required.

Difference between Radio Surgery and Radiotherapy
Radio surgery differs from Radiotherapy in principal and technique.
In radiotherapy the abnormal cells have to be susceptible to effects or radiation.
In radiosurgery the extremely accurate localisation and the very high dose delivered makes cell susceptibility less important.

Radiotherapy large tissue volumes are irradiated while in radiosurgery tissue volumes irradiated are very small.
Radiotherapy involves fractionation for radio biological consideration.

Stereotactic radiation with multiple fractionation is called as Stereotactic Radiotherapy (SRT).
A single fracture stereotactic radiotherapy is called Stereotactic Radiosurgery (SRS).

Technique
Stereotactic radiotherapy uses radiation to obliterate tissue that is either in-accessible or unsuitable for open surgical approaches by inducing gliosis or fibrosis within it. (eg) it uses a beam of ionizing radiation as a surgical tool to remove a lesion, not "treat" the tissue containing the lesion.

In stereotactic radiosurgery, a high dose of radiation is delivered to a precisely defined small volume of tissue the lesion, while the entrance and exit doses are distributed so that tissue outside the lesion is minimally irradiated.

There is no attempt to preserve "good" cell within the lesion by taking advantage of a differential biological sensitivity to radiation, which is a basic principle of conventional radiation therapy.

Radiosurgery calls for a multi-disciplinary approach requiring the combined skills of neurosurgery, radiation oncology, radiation physics and expertised nursing care.

The effects of the treatment will be seen on the scans or angiograms, only after several months or even a few years. Follow up scans are required at 6 monthly or 1 year intervals to confirm sclerative destruction of the tumour or malformation.

System for Stereotactic Surgery
A complete system for Stereotactic radiosurgery must have reliable hardware and a plan of operation (including software) to accomplish the following:

a) Determine the size and location of the lesion.

b) Plan the treatment.

c) Deliver the radiation precisely according to plan.

Linac Radio Surgery System using X-knife I. Hardware
a) Linear Accelerator

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b) Brown / Cosman Robert Wells stereotactic system c) Linac collimators
d) Cough mount

2) Linac Treatment parameters
a) Isocenter location b) Arc Rotation Interval c) Cough Angle d) Collimator Field Size e) Dose per Arc and Isocenter

3) Software Capabilities
a) Image Display with contouring cap-
bilities b) Interactive Dose Compu-
tation display c) 3D Surface Rendering d) Fast Easy Isocenter and Arc Configurations with Beams Eye View e) Automatic optimisation function

PREOPERATIVE PREPARATION
Patient gets admitted on the day or previous day of the surgery, is kept nil orally from midnight or hours prior to the surgery. The tumour is localised.

Tumour Localisation
1. It is well known that a point can be precisely located, if its relationship to three different planes - x, y and z axis-
all at right angles to each other are known
2. A stereotactic frame is fixed to the patient’s head, using local anaesthesia. The patient is fully awake.
3. With the frame in position he/she is then scanned using CT/MRI/Digital subtrac-
tion Angiography to visualize and precisely demarcate the target lesion. Tumour localisation for children (16 years) is done under general anaes-
thetia.
4. Once the target localisation is com-
pleted, treatment planning is done.

Treatment planning
1. A very sophisticated dedicated computer system reviews the area to be treated 2. A host of parameters like size shape, volume, relationship to adj-
cacent areas of the brain - (eg) presence of optic nerve 2mm away and so on are taken into account. 3. a) The maximum tolerable dose of radiation
b) The time over this should be delivered
c) The precise distribution within differ-
ent areas of the tumour itself are cal-
culated for the given patient. (Time taken for planning varies from 60 - 90 minutes) 4. To ensure absolute provi-
sion and to avoid damage to adjacent normal areas. Collimators of appropriate size (varying from [15 - 40mm] can be
chosen).

Radiosurgery Procedures
The head ring remains on the pa-
ient for the entire procedure.
The set up in the treatment room be-
gins with attaching the collimator hou-
sing to the gantry followed by installing the appropriate collimator size.
Quality assurance checks are then
conducted on the gamma rays the pa-
tient will receive. The whole pro-
cess takes about 30 minutes.
Quality Assurance provides the cer-
tainty that the day of treatment ev-
ery part of the system is operating cor-
rectly in all its phases.

The patient (with the head ring in posi-
tion) enters the room and lies on the LINAC couch.
Head ring is fixed firmly to the
LINAC Cough Mount Adaptor. Using a stereoradiographic technique plastic
localiser the target is brought to the isocentre of the LINAC.
This indicates that the target vol-
ume is at the LINAC’s “isocenter” the
point where all collimated beams from
the gantry will converge to deliver the
appropriate dose to the target.
The treatment begins with a series of
couch and gantry movements and the planned beams are executed.
There are several checks and coun-
ter checks at every stage and safety of the highest order is ensured.
During treatment the patient is con-
tinuously monitored by means of a
video and two way audio system.

Post procedural care
After the treatment the Head Ring
is removed. The patient is kept for a
few hours or a day for observation and
then discharged.
1. Normal activities can be resumed
immediately.
2. There is no mortality or worsening of neurological status due to the procedure.
3. Follow up CT/MRI/DSA is done af-
after 6 months and at yearly intervals af-
after that.

Nursing care
Today more than ever the Neuro sur-
gical Nurse must have a base of knowl-
edge that facilitates the ability to look
at a wide range of issues as well as
highly defined and placed of information. She must also be as self actualised as
possible, physically, emotionally and
spiritually in order to meet the chal-
lenge of technology advanced procedures like Radio surgery.
Increasingly ill patients, increas-
ingly complex technology, ethical de-

densions and changed in service delivery systems including nursing care are
some of the current issues facing Neuro surgical Nurses.
The essence of nursing care of pa-
tients undergoing radiotherapy lies not
not only in special environments and
special equipment, but also in a decision making process based on a sound un-
derstanding of physiological and psych-
ological entities and skilful nursing care

delivered.
Nursing care has become techni-
cally oriented, yet the physical, educa-
tional, emotional and spiritual needs are

to be met.

Following are the common problems
need to be anticipated in the patients
under going Radiosurgery.

Anxiety and fear
Vomiting
Knowledge Deficit
Increasing Neurological deficit
Headache
Complications
Increased ICP
Seizures

Nursing Diagnosis and interventions
1. Anxiety and fear related to
inadequate preparation for
surgical procedure, fear of the unknown and false hope for a speedy recovery.
- Be sensitive and supportive
- Provide reassurance
- Provide ongoing opportunities for the family and the patient to ask questions/express fears
- Promote rest and sleep
- Assess patients’ family knowledge
- Provide information about procedures according to patients’ family’s readiness, emotional state and previous understanding (eg) fixing the frame, CT scan
- Angiogram
- Radio surgery
- Be realistic in giving information about the prognosis as the changes take place slowly.

2. Knowledge deficit related to the disease condition and pre and post operative care
- Reinforce physician and explanation, planning procedures, actual treatment fixing of frame, and skin markings.
- Encourage verbalization of concerns.

3. Comfort alteration in pain: Headache related to the surgery
- Assess headache pattern; report to physician; provide analgesic and comfort measures.
- Elevate head of bed 30 deg.
- Monitor respiratory status, Blood pressure, pulse at ordered frequency
- Administer medication as ordered

4. Altered tissue perfusion, increased ICP related to cerebral edema:
- Elevate head of bed 30 deg. at all times
- Assess Neurological status using Glasgow Coma Scale
- Evaluate
- Level of consciousness
- Pupil size
- Papillary reaction
- Seizures
- Blood Pressure
- Monitor vital signs

5. Potential for seizures related to Radiosurgery
- Anticipate these are more likely to occur
- Anticonvulsants resumed
- Keep accurate record of seizure
- When loading dose of anti-convulsants begin, note effect of depressing level of consciousness.

6. Fluid electrolyte imbalance related to vomiting
- Observe for vomiting
- If there is more vomiting, keep the patient nil orally and meet the nutritional need through intravenously
- Watch for dehydrations
- Check for electrolytes value frequently
- Correct electrolyte imbalance promptly to avoid further complications.
- Maintain accurate intake and output chart
- Administer medication
- Management of diet, pace activities
- Reassure that the side effect will disappear.

7. Increasing Neurological deficit related to the disease condition
- Base line neurological assessment
- Neuro checks frequently until the stable record is obtained
- Notify the doctor of any new worsening deficit
- Prevention and management of increased intracranial pressure.

8. Potential for late complications
- Tissue necrosis and recurrence of tumour related to the surgery
- Watch for deterioration of neurological status
- Tissue necrosis occur after 6 months or an year
- Give realistic information about the characteristic of tumour
- Instruct the patient and the relative to come for follow up without fail

9. Patients who undergo general anaesthesia need special attention and specific care related to general anaesthesia.

CONCLUSION
Radiosurgery is becoming more popular and effective method of treating deep seated tumours and A.V.M. in brain. The Neuroscience Nurse plays a major role in pre-operative care and the anticipation of complications during and post operative phase.

BIBLIOGRAPHY

ATTENTION
AUTHORS / CONTRIBUTORS
The Research Report sent by the authors / contributors should contain the date of the study in its content and the references both.

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