

GliaSite

GliaSite

- **What?** is GliaSite
- **Where?** Current Statistics
- **Why?** rationale for Using GliaSite Modality / Studies
- **How?** Program Flow TMH Experience
 - Patient History / Prescription
 - Dosimetry Calculation / Dosimetry Verification
 - Source Receipt / Calibration
 - Procedure Preparations
 - Patient Afterload
 - Patient care during BT
 - Iotrex Retrieval
 - RAM waste storage and disposal

GliaSite

- Procedure costs
- Caveats
- What Do I “inspect” concerning this Radiation Therapy modality?
- Conclusions Pro - Con

This is GliaSite

Balloon Catheter

- Three balloon sizes (2,3,4 cm diameters)
- Double wall balloon configuration
- Infusion port pre-attached to silicone catheter
- Malleable titanium element at end of catheter for easy positioning



Iotrex[®]

- Proprietary ¹²⁵I radiotherapy solution
- Organically bound to hydroxybenzenesulfonate to minimize volatility
- Can be shielded during handling

Optimal delivery of radiation

- **Treats target area surrounding balloon**
- **Drops off Inverse square**
- **An option for patients who have previously received XRT.**
- **Conformal, spherically uniform dose of radiation delivered to margins of resected tumor bed.**



- **Maximizes the total radiation dose delivered to target volume.**
- **Eliminates target volume under-dosing and hot spots.**

rationale For Using GliaSite

- More Homogeneous Dose vs Seed BT
No symptomatic radiation necrosis
(re-operation for symptomatic necrosis up to 50%, Shaw et al, Wakeforest Univ.)
- Control area of dose delivery vs Chemo

Rationale For Using GliaSite

- Survival Data

Recurrent malignant brain tumors approx 12 weeks - no therapy, 20 weeks surgery alone, 32 weeks surgery and chemo, 60 weeks surgery and internal radiation, (Wakeforest Univ. 23 July 1999)

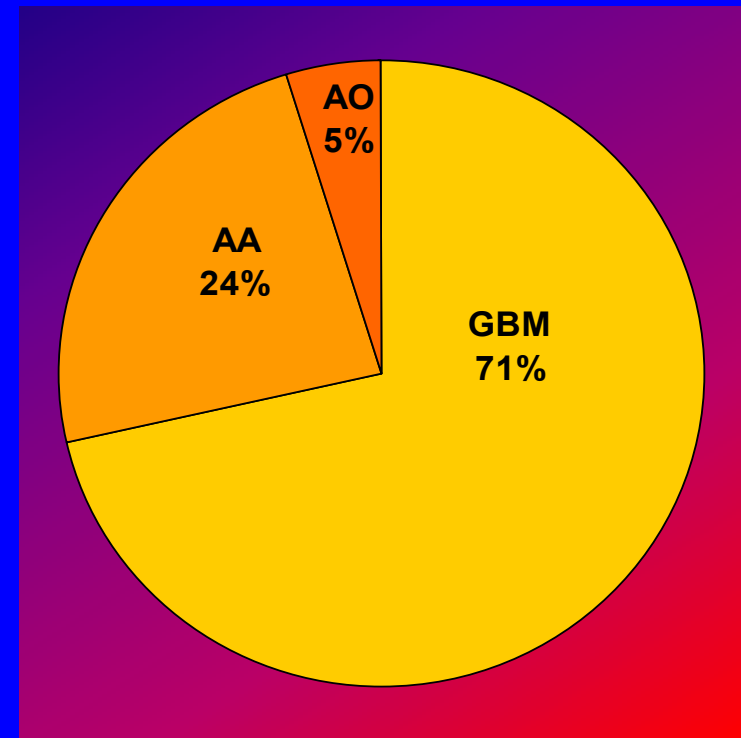
- Small sample n=21 in Phase I study

- Median survival for recurrent GBM patients 30-65, weeks post resection, (Tatter et. al., J of NS, Aug. 2003; n=21(15 GBM, 4 AA, 1 AO))
- 35.4 weeks post resection (Sanan et. al., submitted to AANS; n=60)

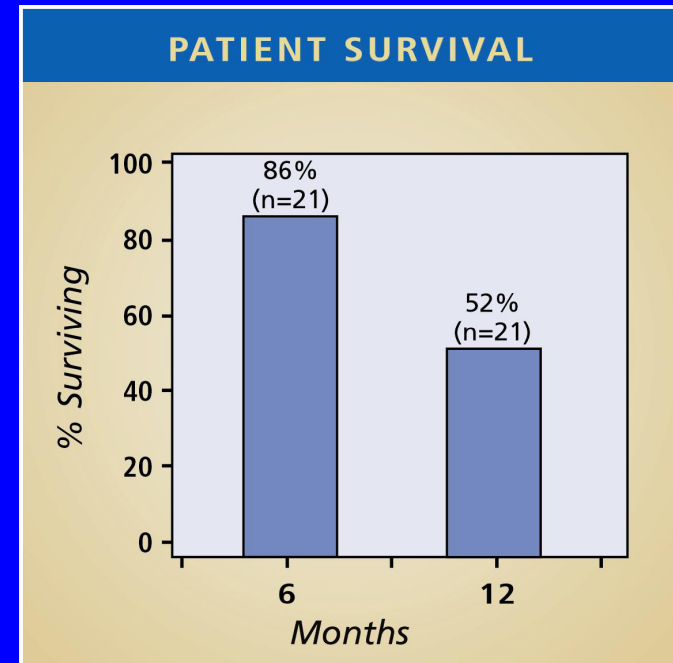
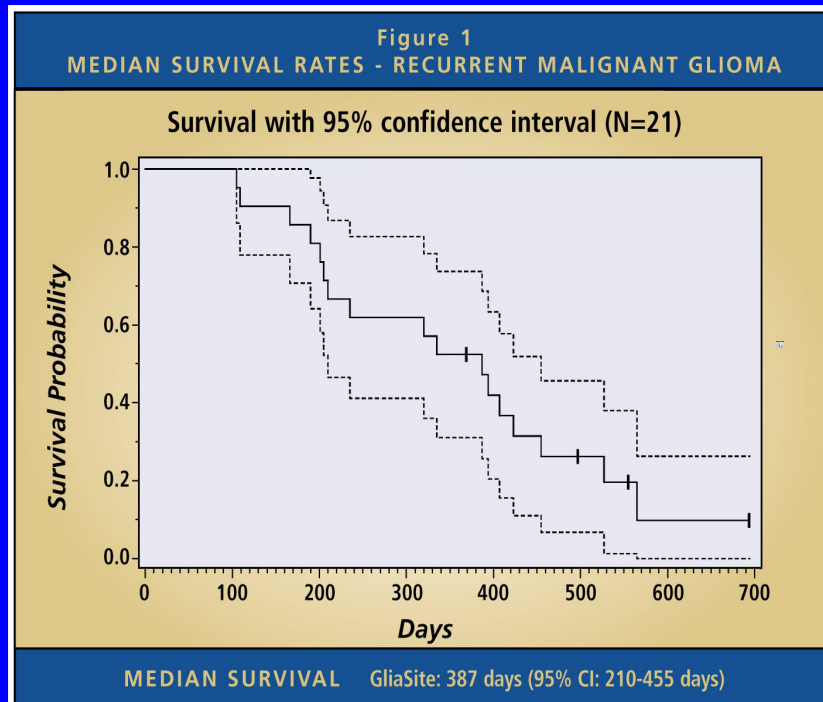
NCI/NABTT Study (Tatter et. al.)

Patient Demographics and Prescription Dose

- 21 patients treated at 6 centers
- Age (Years): 48.4 ± 11.3
- KPS (at enrollment): 80 ± 13.4
- Brachytherapy prescription dose:
 - 51 ± 7.6 Gy (range: 40-60 Gy)
- Prescription depth:
 - 8.0 ± 2.3 mm (range: 5-10 mm)



Survival N=21 Patient Study



- Overall median survival = 387 days
- 52% patient survival at one year from time of treatment

Patient Selection Criteria: Recurrent Malignant Glioma

Table 1

PATIENT SELECTION CRITERIA: RECURRENT MALIGNANT GLIOMA

Parameter	Panel Recommendations
Tumor type	AA, AO, GBM, PNETs
Age	≥ 18 years
KPS	≥ 60
Tumor size	≤ 5 cm preoperatively unless marked mass effect, then ≤ 6 cm
Tumor shape	Any shape (target enhancing area within 1 cm range)
Gross tumor resection	Preferred
Number of lesions	Unifocal
Dose	60 Gy @ 1 cm
Tumor location	Supratentorial

Patient Selection Criteria: Newly Diagnosed Malignant Glioma

Table 2

PATIENT SELECTION CRITERIA: NEWLY DIAGNOSED MALIGNANT GLIOMA

Parameter	Panel Recommendations
Tumor type	GBM
Age	≥ 18 years
KPS	≥ 60
Tumor size	≤ 6 cm
Tumor shape	Any shape (target enhancing area within 1 cm range)
Gross tumor resection	Preferred
Number of lesions	Unifocal
Dose	60 Gy @ 1 cm
Tumor location	Supratentorial

Patient Selection Criteria: Metastatic Brain Tumors

Table 3

PATIENT SELECTION CRITERIA: METASTATIC BRAIN TUMORS

Parameter	Panel Recommendations
Systemic disease state	Absent or controlled
Age	≥ 18 years
KPS	≥ 70
Tumor size	2 cm pre-operative diameter is minimum; no maximum defined
Tumor shape	Any shape (target enhancing area within 1 cm range)
Gross tumor resection	Preferred
Number of lesions	Unifocal (multifocal currently being studied)
Dose	60 Gy @ 0.5 - 1 cm
Tumor location	Supratentorial (infratentorial acceptable if no additional deficit caused)
Life expectancy	≥ 3 months

Gliasite Phase II Study: Metastatic

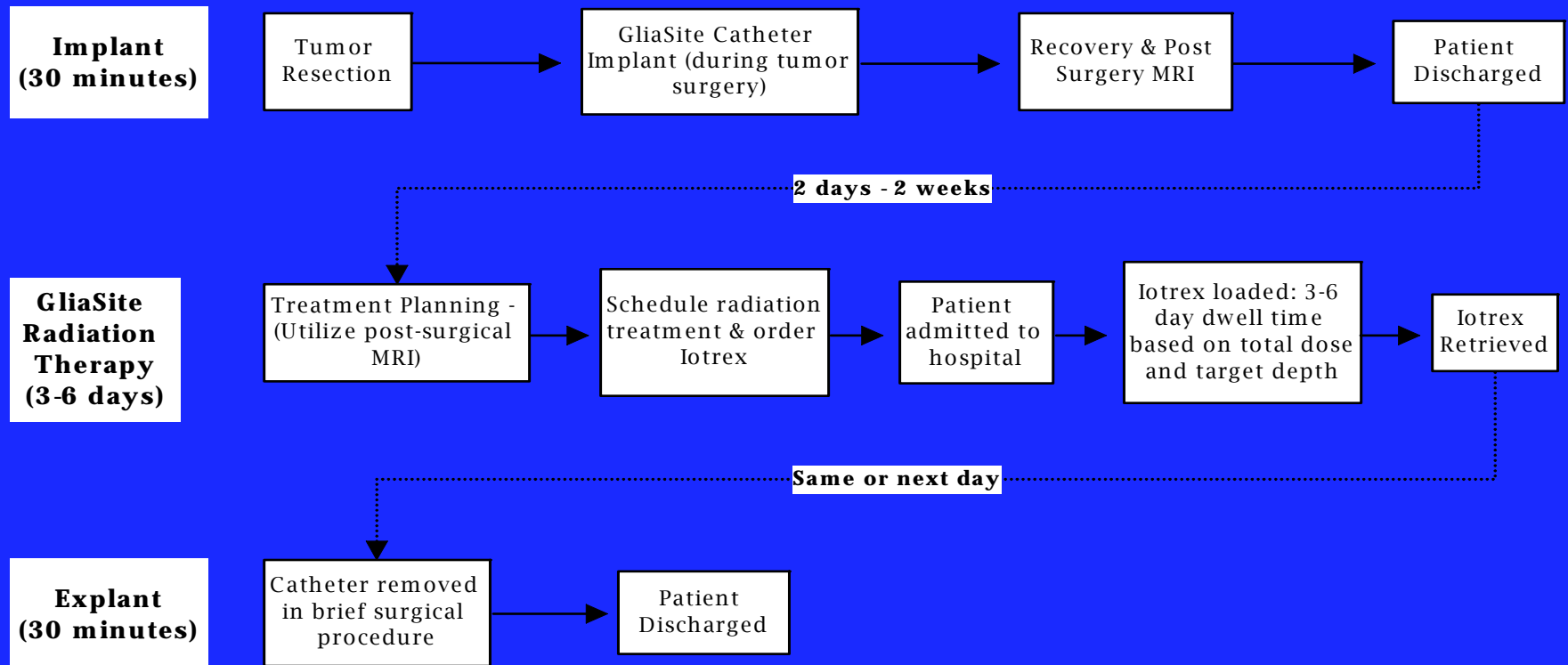
- 13 sites from August '01 to April '03
- Single Resected brain metastasis
- 71 patients enrolled; 54 patients treated
- **Primary endpoint:** Local control at 1 year
- **Secondary endpoints:** Quality of life, survival, distant recurrence, and toxicities
- One Year data matured in April 2004, paper publication is pending

NABTT # 2105 Phase I

**Brachytherapy Dose Escalation Using GliaSite
RTS in Newly Diagnosed Glioblastoma
Multiforme in Conjunction with External Beam
Radiation Therapy**

NABTT # 2106 Phase I
Brachytherapy Dose Escalation Using the
GliaSite RTS in Patients with Recurrent
Malignant Gliomas

TREATMENT FLOW



Treatment Planning tables

Once the balloon fill volume and dose at a specified distance are prescribed, look up the net activity required, the dwell time and corresponding doserate

Treatment Prescription: 60 Gy					
Treatment Depth: 1.0 cm					
GliaSite Balloon Fill Volume (cc)	Maximum Transverse Balloon Diameter (cm)	“Net” Afterloaded Activity (mCi)	Initial Dose Rate (cGy/hr)	Average Dose Rate (cGy/hr)	Dwell time (hr)
4	1.97	200	55.94	54.51	110.1
5	2.12	200	51.70	50.27	119.4
7.5	2.43	250	54.73	53.30	112.6
10	2.67	300	58.02	56.59	106.0
12.5	2.88	300	52.50	51.07	117.5
14	2.99	350	58.10	56.67	105.9
15	3.06	350	56.28	54.85	109.4
20	3.37	400	55.68	54.25	110.6
25	3.63	450	55.67	54.24	110.6
30	3.85	450	50.62	49.19	122.0
33	3.98	450	47.75	46.32	129.5
35	4.06	450	46.35	44.92	133.6

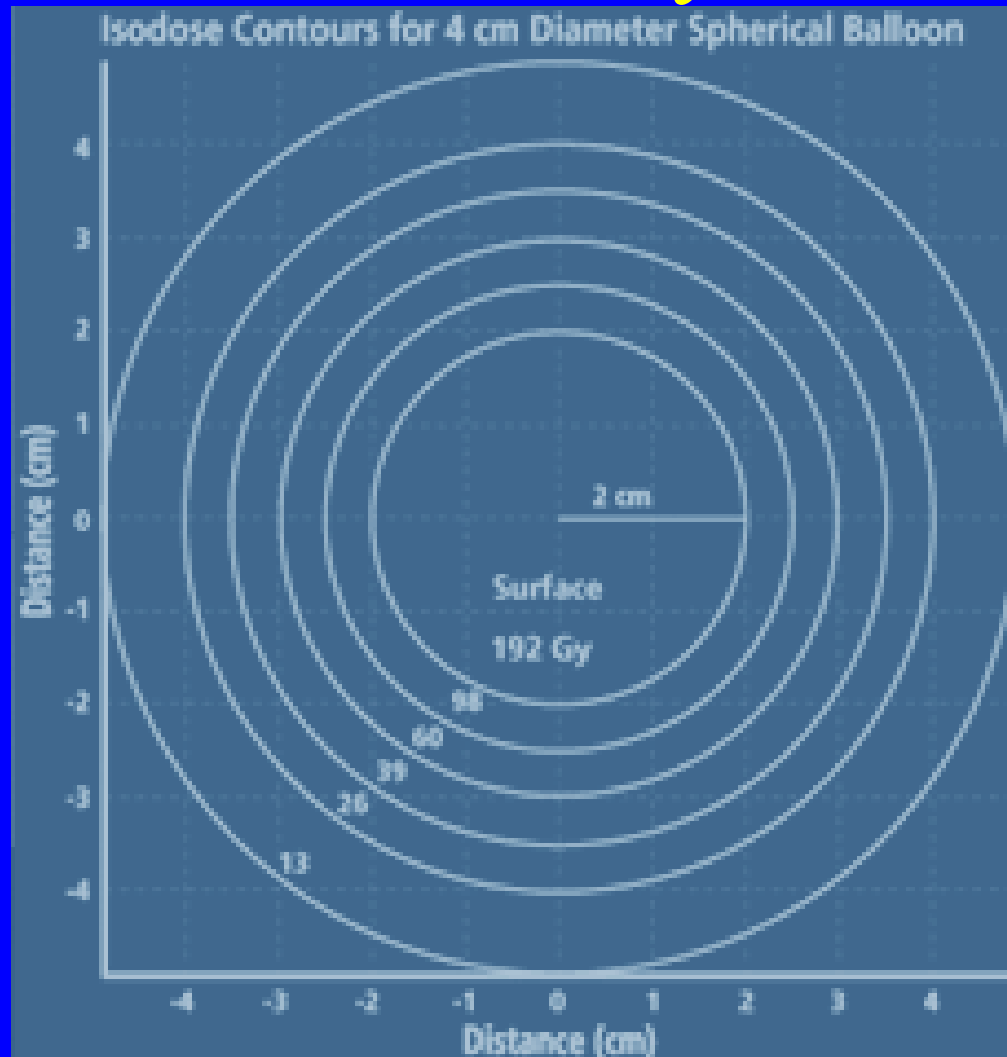
Validation of Dose Calculation

Experimental Validation of Dose Calculation Algorithm for the GriaSite RTS

- Monroe et al Med. Phys 28(1), Jan 2001

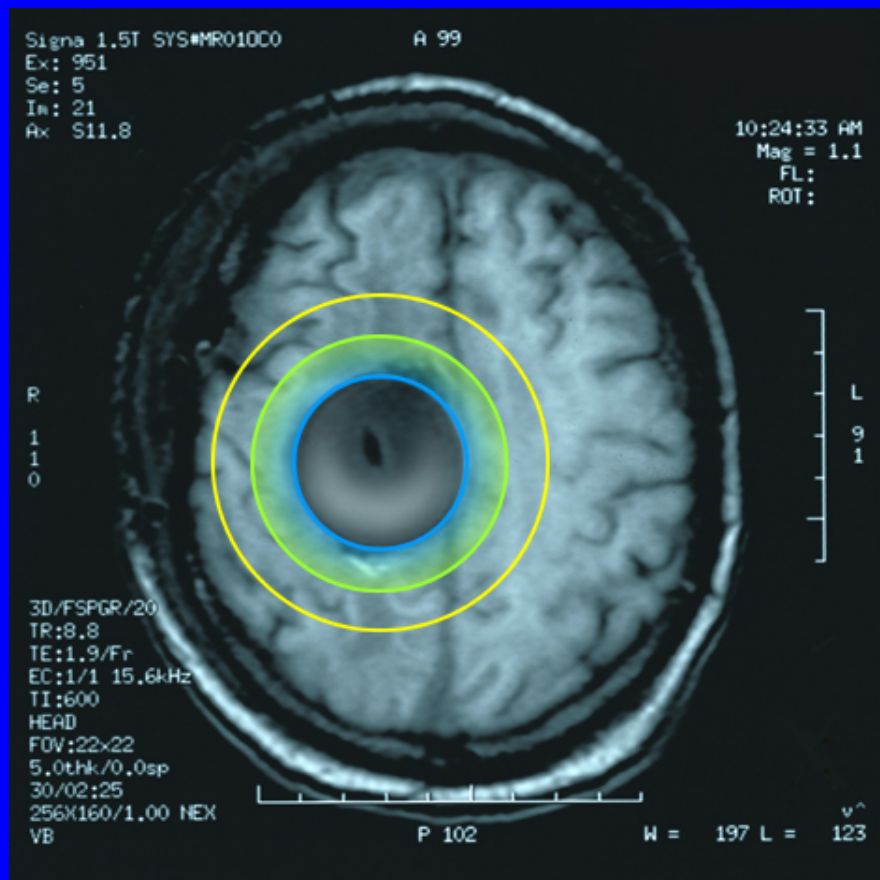
- Solid water phantom
- GafChromic Film
- Error Estimates in quadrature:
 - 4 mm = 7.5% , 10 mm = 5.7%, 30 mm = 6.3%
- Measurement Error:
 - Surface +/- 14.5%
 - 4.0 mm – 25 mm < 6% deviations from Error Estimates

Dosimetry



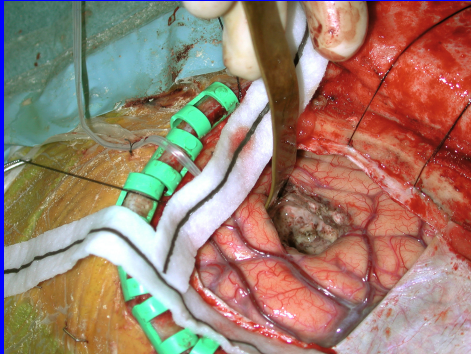
MRI or CT scans are used to determine the enhanced area / target area to prescribe the dose⁹

MRI and Treatment Plan



- MRI shows centering and conformance of the balloon to the cavity.
- Contrast MRI shows suspect tumor area 7 mm from the surface of the balloon.
- Treatment dose was prescribed as 60 Gy at 8 mm.

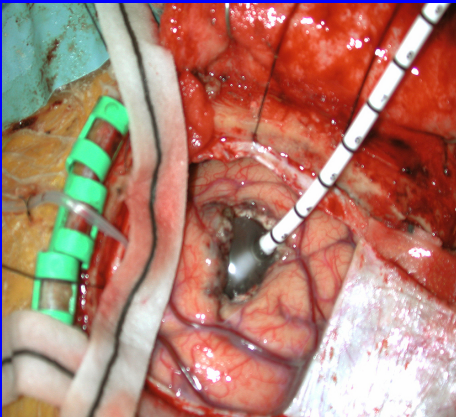
Mets Implant



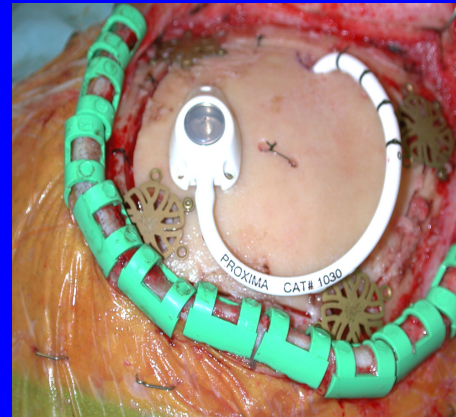
Tumor removed and cavity created



Semi-watertight closure of the dura



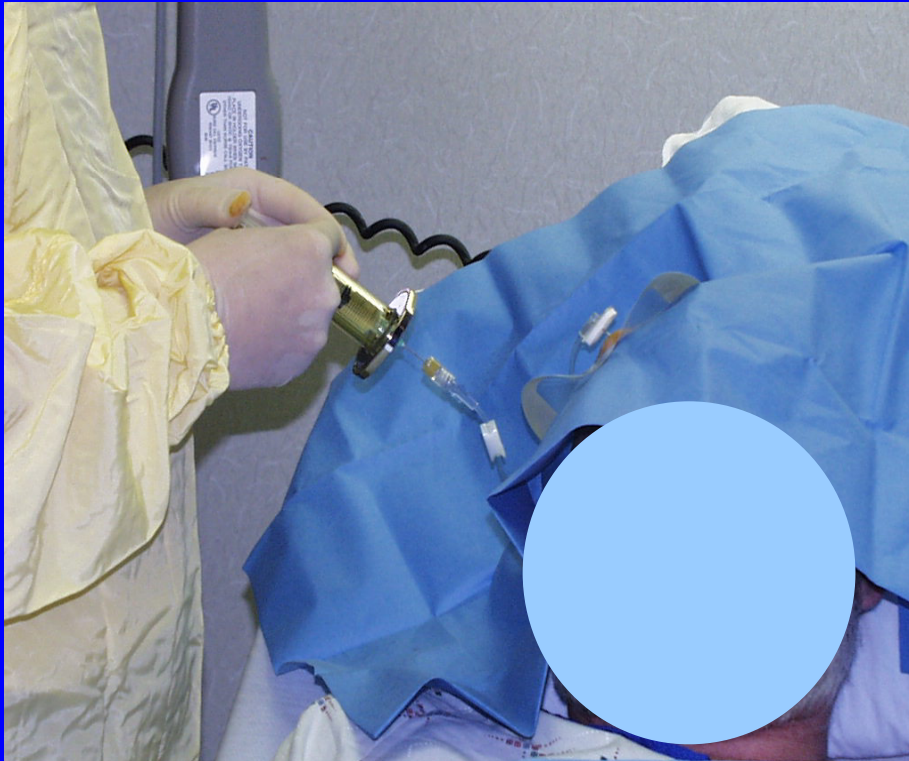
3 cm balloon implanted and inflated



Bone flap replaced and the catheter secured

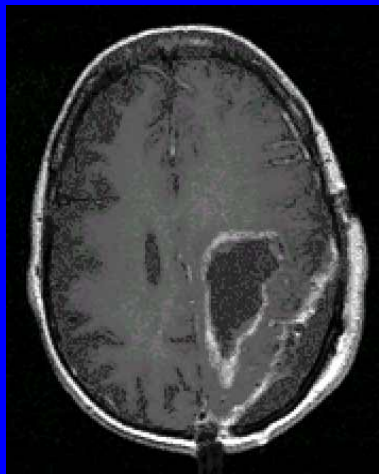
lotrex[®]

Afterloading

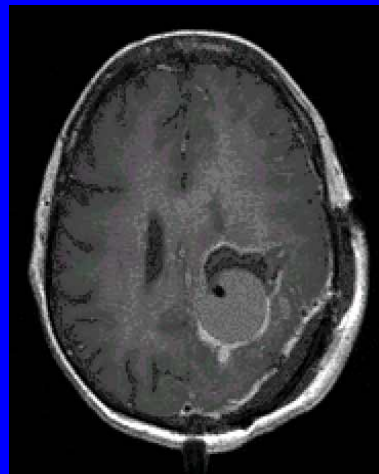


- 375 mCi loaded.
- Procedure completed within 30 minutes.
- Minimum patient discomfort.
- Great precautions to avoid treatment area contamination.

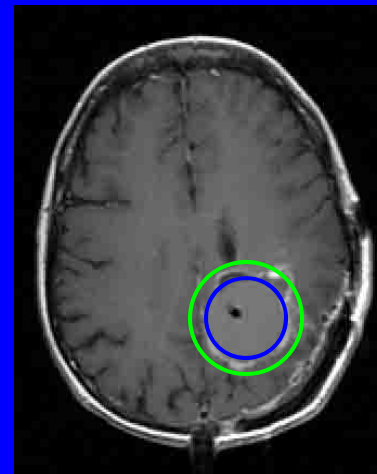
GliaSite RT MRI



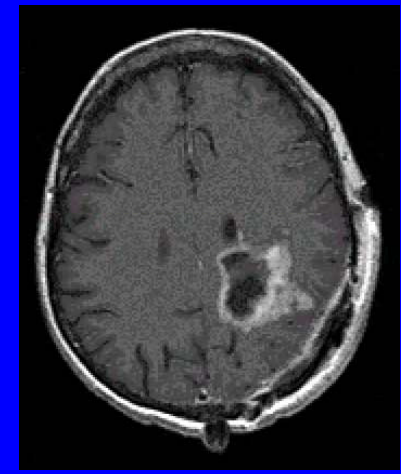
pre-GliaSite
placement



GliaSite in
place



45 min later
prior to
brachytherapy
conformance
has improved



24 hours post-
brachytherapy and
implant removal

Implementation

Are we ready to add GliaSite as a brain tumor treatment option?

- Cross department logistics meeting
- Required Staff training
- Policies / Procedures
- RT Department task assignments
- Practice handling afterloading equipment
- Equipment set-up / Supplies / Vendor accounts
- Radiation Safety Review and license amendment

Implementation

- Who determines dose prescription (Oncologist)
- Who calculates dose required and orders RAM (Physicist)
- Who receives the RAM (RT Dept)
- Who will administer Iotrex (Oncologist)
- Where will the patient stay during brachytherapy (RSO)
- Where will the patient be afterloaded?
(Patient's hospital room or Oncology Dept)

Implementation

Dose Calibrator CRC-15R

TMH Dial Setting = 500 per NIST Calibrated Standard



Calibrated Capintec Model	Equivalent Models	Dial Setting
CRC-12	CRC-127R CRC-7 CRC-712M CRC-712R	497
CRC-35R	CRC-15R	469

Experimental Investigation of Dose Calibrator response for I-125 brachytherapy solutions contained in 5 ml plastic syringes and 2 ml conical glass v-vials as a function of filling mass
Zimmerman et al Med. Phys 29(7), July 2002

SYRINGE and Syringe SHIELD



FEATURES

- ★ Unique sharp pins hold the syringe in shield
- ★ 2.2 mm thick tungsten wall is thickest on market
- ★ Bright yellow florescent interior for easy viewing
- ★ One hand operation to remove syringe

1/4 inch of 5.2 g/cm³ lead glass

Patient Experience

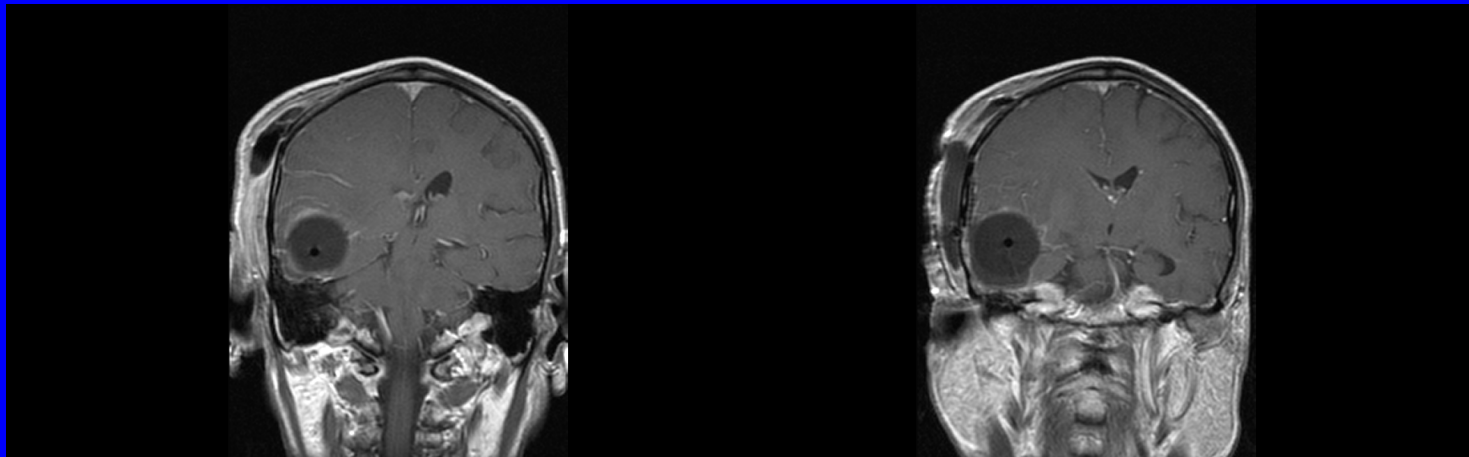
- Patient 59 year old male Glioblastoma multiforme grade IV, Rt Temporal tumor
- 6 months prior to GliaSite RT was treated with surgical resection and 3-D conformal therapy 60 Gy to primary disease volume, 48 Gy to secondary target 10 MV photons Peacock System

Patient Experience

- 40 mm balloon , Fill volume 25 ml
- Rx 50 Gy at 10 mm
- I-125 Iotrex activity 450 mCi required, ordered 465 mCi
- Received 478 mCi, Calibrated 472 mCi
- Net activity afterloaded 462 mCi
- Initial doserate 57.15 cGy/hr, Average 55.93cGy/hr
- Dwell time 89.4 hrs

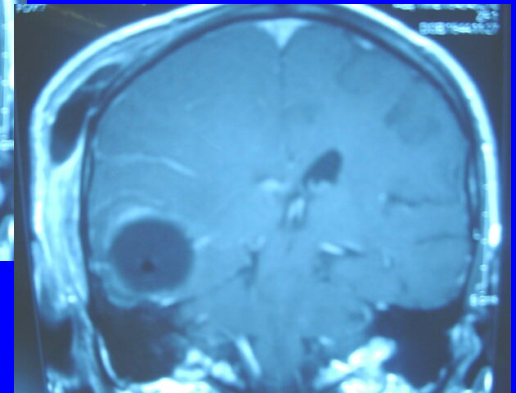
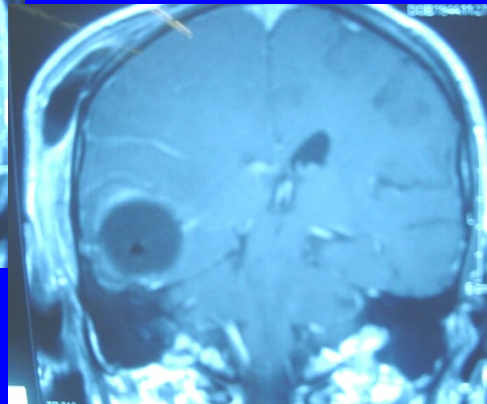
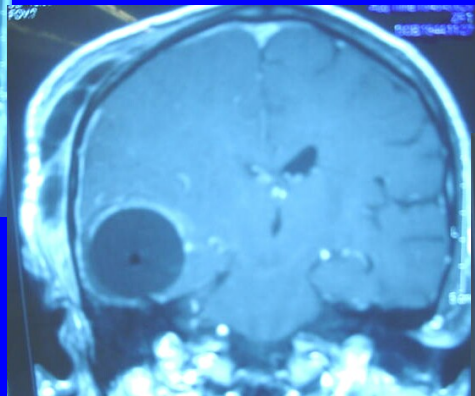
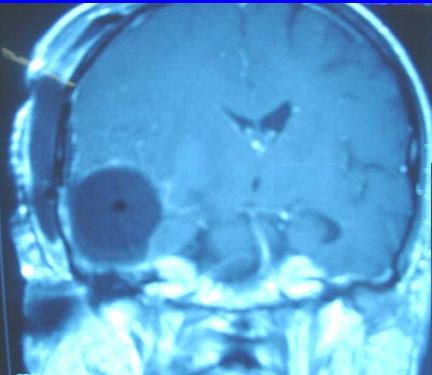
Patient

- Rt Temp Lobe with GliaSite balloon



Patient

- Rt Temp Lobe with GliaSite balloon



Iotrex Exposure Measurements

- Exposure Rates
 - Skull surface: 20 mR/hr to 650 mR/hr
 - Actual 1300 mR/hr
 - 1 meter from bedside: 0.2 mR/hr to 3.4 mR/hr
 - Actual 8 mR/hr (from skull)
 - Doorway: 0.02 mR/hr to 0.6 mR/hr
 - Actual <0.05 mR/hr
- Thyroid Bioassay
 - No uptake measured
 - Actuals Lugols, balloon remained, no test

Patient Experience

- Retrieval time 20+ minutes
- No contamination
- Re-assay Residual in Syringe
- Storage
- Disposal
- Records

Procedure

Out Patient Procedure? Maybe pending

- 1) Patient cooperation (K-Score)
- 2) Shielding
- 3) 2nd License amendment

GliaSite

What do I inspect?

- **License Amendment**
- **Policy and Procedure Program**
- **Quality Management**
- **Emergency procedures, Model Spill Procedures**
- **Written Directive**
- **Patient Instructions (Outpatient?)**
- **Isotope Records (receipt, wipe, calibration, use, disposal)**
- **Training: Oncologist, Medical Physicist, Nurses**

Conclusions Pros / Cons

- Pros: GliaSite offers brain tumor patients another brachytherapy option
- Homogenous distribution
- Cons: 2 invasive operations
- More healthy tissue volume receives Rx dose¹
- During implant balloon can be nicked with suture needle rupture or slowly deflate
- Initial study n=21, Infection rate 10%
- Costs: \$17,000 materials + room + 2nd OR for device removal vs estimated \$2000-3000 for three fraction SR treatment
- Manhours
- Radiation Safety Issues if Outpatient Procedure