Note: Uploaded by patient, Steven Keating, after a brain tumor surgery (astrocytoma). This is the BWH legal medical record, with doctor phone numbers and patient ID codes/details blanked out. If interested, more information on this case-specific health data (imaging, labs, pathology, genetics, surgery video + more) is at www.stevenkeating.info

Thank you to the amazing medical teams for their great care and treatment, at BWH, DCFI, and MGH. Also thank you to family/girlfriend/friends/MIT. Thanks and have a splendid day!

Partners HealthCare System, Inc.
BRIGHAM & WOMEN'S HOSPITAL
A Teaching Affiliate of Harvard Medical School 75 Francis Street, Boston, Massachusetts 02115

Health Information Services Patient Extract

From 1/1/2004 through 12/29/2014

MRN: (BWH)
KEATING,STEVEN
Date of Birth: 04/29/1988
Age: 26 yrs. Sex: M

Table of Contents

Cardiology From 1/1/2004 through 12/29/2014

08/15/2014 09:03 **12 Lead ECG** **Final**

Report Number: 2722171 Report Status: Final
Type: 12 Lead ECG
Date: 08/15/2014 09:03
Ordering Provider: CHIOCCA, ENNIO
Reviewed by: LEWIS, M.D., ELDRIN F.

Ventricular Rate 60 BPM
Atrial Rate 60 BPM
P-R Interval 148 ms
QRS Duration 100 ms
QT 390 ms
QTc 390 ms
P Axis 48 degrees
R Axis 84 degrees
T Axis 49 degrees
Normal sinus rhythm
Normal ECG
No previous ECGs available
Confirmed by LEWIS, M.D., ELDRIN F. (225) on 8/19/2014 12:11:08 PM

Discharge Reports From 1/1/2004 through 12/29/2014

08/19/2014 06:22 **Discharge Summary** **Final** **Ennio A. Chiocca, M.D. Ph.D.**

BRIGHAM AND WOMEN'S HOSPITAL
A Teaching Affiliate of Harvard Medical School
75 Francis Street, Boston, Massachusetts 02115

Admission: 8/19/2014
Discharge: 8/21/2014

Discharge Summary
FINAL

Patient Information:
Home address:

Discharge Disposition: Home

Patient/Family Agreed with discharge plan: Yes - 3

Contact Person:
Name:

Health Care Proxy:
Name:
Telephone:

Discharge Code Status: Full Code (presumed)

HOSPITAL CARE TEAM:

Service: NES	**Team:**	**Unit-Bed:**
Role:	**Name:**	**Phone Number:**
Inpatient Attending:	CHIOCCA,ENNIO A.,M.D.,PH.D.	
Clinician contact at BWH:	Chiocca, Ennio A	
Discharging Clinician:	Meghan E. Dolan,P.A.-C.	
Discharging Nurse:	Nina A Johnson,R.N.	
Care Coordinator:	Carol A Kale	
Occupational Therapist:	Lisa R Cohen	

OUTPATIENT CARE TEAM:

PCP:	FIRN,LEIGH M.,M.D.

Diagnoses:

Admission:	left frontal glioma
Principal Discharge:	Intracranial glioma

Discharge Condition: Stable

Electronically Signed by: Meghan E. Dolan,P.A.-C. on 8/21/2014 8:33:15 AM
Electronically Signed by: Nina A Johnson,R.N. on 8/21/2014 10:56:41 AM

Discharge Reports from 1/1/2004 through 12/29/2014 (cont)

BRIGHAM AND WOMEN'S HOSPITAL
A Teaching Affiliate of Harvard Medical School
75 Francis Street, Boston, Massachusetts 02115

KEATING, STEVEN J

DOB: 04/29/1988 26M
Admission: 8/19/2014
Discharge: 8/21/2014

Discharge Summary
FINAL

TRANSITION PLAN:

Follow up Appointments:

Please call the numbers listed below to confirm that the appointments are scheduled for the locations listed. If you cannot attend the appointments that have been scheduled for you, please call to reschedule them.

Chiocca, Ennio A, Neurosurgery
Address:
Phone:
Date/Time: 8/29/2014 12:00:00 PM
Reason: Follow up admission

Important Communication to Outpatient Care Providers

Results Pending at Discharge

Category	Test(s)	Date/Time	Status
Pathology/Surgical Pathology		08/19/2014	In Process

Electronically Signed by: Meghan E. Dolan,P.A.-C. on 8/21/2014 8:33:15 AM
Electronically Signed by: Nina A Johnson,R.N. on 8/21/2014 10:56:41 AM

Discharge Reports from 1/1/2004 through 12/29/2014 (cont)

BRIGHAM AND WOMEN'S HOSPITAL
A Teaching Affiliate of Harvard Medical School
75 Francis Street, Boston, Massachusetts 02115

Admission: 8/19/2014
Discharge: 8/21/2014

Discharge Summary

FINAL

ADMISSION PRESENTATION

Information obtained from LMR:
This is a 26-year-old right-handed white male who used to live in Canada. In 2007, he participated in a functional MRI research study. At that time, he was called back saying that this was a lesion in his left frontal area. He was told that this lesion could be followed because it was small. Over the years, he has had serial MRI scans, the last one in Canada in October 2010 did not show growth of the lesion. He was then lost to follow up. However, in the last week, he developed the equivalent of a seizure-like activity. This has involved lightheadedness, deja vu type feelings, smells, and left eye twitching. He had no loss of consciousness. These episodes were followed by dull headaches. He was started on Keppra and then on MRI scan was performed. This showed a large left frontal and insular lesion. He comes in today for followup. They obtained my name from a neurosurgeon that knows his PhD advisor. He otherwise has had no speech issues. He had no memory issues.
FAMILY HISTORY: There is no family history of brain disease of brain cancer.
SOCIAL HISTORY: He does not use of tobacco. He is currently a PhD student and works on 3D printing. He occasionally drinks. He is here not only with his PhD advisor, but also with his parents and other relatives.
PHYSICAL EXAMINATION: On examination, he is completely awake and alert. There are no focal neurological symptoms or signs that I can tell.
IMAGING: His MRI scan shows a large left frontal and insular lesion that involves the operculum in the front where it seems to be involving Broca's area. There is a little bit of the tumor in the left anterior temporal lobe as well. The tumor is T2 and FLAIR hyperintense. It does put pressure with some left and right shift of the brain, particularly anteriorly.

Electronically Signed by: Meghan E. Dolan,P.A.-C. on 8/21/2014 8:33:15 AM
Electronically Signed by: Nina A Johnson,R.N. on 8/21/2014 10:56:41 AM

Discharge Reports from 1/1/2004 through 12/29/2014 (cont)

BRIGHAM AND WOMEN'S HOSPITAL
A Teaching Affiliate of Harvard Medical School
75 Francis Street, Boston, Massachusetts 02115

Admission: 8/19/2014
Discharge: 8/21/2014

Discharge Summary
FINAL

HOSPITALIZATION SUMMARY

Surgical (OR) Procedures:
08/19/14 CHIOCCA,ENNIO A.,M.D.,PH.D.
BRAINLAB GUIDED AWAKE LEFT FRONTAL CRANIOTOMY FOR RESECTION OF BRAIN TUMOR, HEAD HOLDER, MICROSCOPE, DRILL, BRAINLAB GUIDANCE, ANES: M.A.C., ---ICU REQ--- (SCT 6:00 + 30)

Brief Summary/Assessment:
Mr. Keating is a 26 year old male with a history of a left frontal low grade glioma and partial seizures s/p brainlab guided awake left frontal craniotomy for resection of tumor with Dr. Chiocca on 8/19/14

Hospital Course:
Hospital Course: Patient was admitted to the Neurosurgical Service on 8/19/14 for a brainlab guided awake left frontal craniotomy for resection of tumor with Dr. Chiocca. Patient was taken to the operating room on the day of admission and underwent an uncomplicated procedure. Please see Dr. Chioccas's separately dictated operative note for details. Post-operatively patient was extubated and transferred to the Neurosurgical ICU for close monitoring. He remained hemodynamically stable, neurologically at baseline, and with his pain well-controlled throughout his hospital stay. On POD#1 he was transferred to the floor in stable condition and was deemed ready for discharge on POD#2.
NEURO: Patient remained neurologically at baseline throughout his hospital stay. A&O x 3, PERRL, EOMI, VFF, FS, TM, SAR 5/5, sensation grossly intact, no drift, steady gait. Post-op MRI of the brain was without complications. He was maintained and discharged on Keppra 500 mg PO BID. He was started and discharged on a dexamethasone taper of 3 days to off.
CV: Hemodynamically stable at all times.
GU: Voiding on his own after foley removed with no signs of retention or UTI.
GI: Tolerating a regular diet with no nausea or vomiting.
HEME: SQH and SCDs for DVT prophylaxis.
ID: Afebrile at all times. Perioperative ABX. Incision remained clean, dry, and intact with no evidence of erythema, warmth, or hematoma.
DISPO: Ambulating on his own and feels ready to go home with no services needed. At the time of discharge his pain remained well controlled on oral medications. Patient will follow up with Dr. Chiocca in 1-2 weeks.

Non-OR Procedures:
None

DISCHARGE EXAM

Discharge Vital Signs:

Date/Time Vital Signs Taken: 8/21/2014 12:00 PM
T: 35.8 degrees
HR: 88 BPM
BP: 120/64 mmHg
RR: 20 per min
O2 Sat: 95 %
Current Weight: 75.5 kg Height/Length: 188 cm BMI: 21.4

Mental Status at Discharge:
Alert, oriented, follows instructions

Key Discharge Physical Exam Findings:
A&O x 3, PERRL, EOMI, VFF, FS, TM, SAR 5/5, sensation grossly intact, no drift, steady gait

Pain Assessment:
Intensity scale: 0

LABS AND STUDIES

Most Recent Reported BWH Lab Values During This Admission

Electronically Signed by: Meghan E. Dolan,P.A.-C. on 8/21/2014 8:33:15 AM
Electronically Signed by: Nina A Johnson,R.N. on 8/21/2014 10:56:41 AM

Discharge Reports from 1/1/2004 through 12/29/2014 (cont)

BRIGHAM AND WOMEN'S HOSPITAL
A Teaching Affiliate of Harvard Medical School
75 Francis Street, Boston, Massachusetts 02115

Admission: 8/19/2014
Discharge: 8/21/2014

Discharge Summary

FINAL

Basic Chemistry:			Complete Blood Count:			Routine Coagulation:		
Na	137	8/21/2014 9:23 AM	WBC	23.76 (H)	8/21/2014 9:23 AM	INR	1.1	8/21/2014 9:23 AM
K	3.8	8/21/2014 9:23 AM				PTT	27.7	8/21/2014 9:23 AM
Cl	98	8/21/2014 9:23 AM	Hct	35.8 (L)	8/21/2014 9:23 AM			
CO2	26	8/21/2014 9:23 AM	Hbg	12.4 (L)	8/21/2014 9:23 AM			
BUN	13	8/21/2014 9:23 AM	PLT	259	8/21/2014 9:23 AM			
Creat	0.73	8/21/2014 9:23 AM						
Glu	131 (H)	8/21/2014 9:23 AM						
Ca	9.3	8/21/2014 9:23 AM						

Reference Ranges:
NA 136-145 mmol/L, K 3.4-5.0 mmol/L, CL 98-107 mmol/L, CO2 22-31 mmol/L, NA-PL 136-145 mmol/L, K-PL 3.4-5.0 mmol/L, BUN 6-23 mg/dL, CA 8.8-10.7 mg/dL, CRE 0.50-1.20 mg/dL, GLU 70-100 mg/dL, WBC 4-10 K/uL, HCT 40-54 %, HGB 13.5-18.0 g/dL, PLT 150-450 K/uL, PT-INR 0.9-1.1 , PTT 23.8-36.6 sec

** No result denotes that the lab test was not done during this patient's Hospitalization.*

All labs performed at Brigham and Women's Hospital 75 Francis Street Boston, MA 02115

Most Recent BWH EKG Result During This Admission

Electrocardiogram Report (Accession # 15-09927K)

REFERRED BY:CHIOCCA,ENNIO. REVIEWED BY: LEWIS, M.D.,ELDRIN F.

Date/Time: 08/15/14 09:03
VENT. RATE 60 BPM
PR INTERVAL 148 ms QRS DURATION 100 ms QT/QTC 390 390 ms P-R-T AXES 48 84 49

Normal ECG
No previous ECGs available
Confirmed by LEWIS, M.D., ELDRIN F. (225) on 8/19/2014 12:11:08 PM
REFERRED BY:CHIOCCA,ENNIO. REVIEWED BY: LEWIS, M.D.,ELDRIN F.

Electronically Signed by: Meghan E. Dolan,P.A.-C. on 8/21/2014 8:33:15 AM
Electronically Signed by: Nina A Johnson,R.N. on 8/21/2014 10:56:41 AM

Discharge Reports from 1/1/2004 through 12/29/2014 (cont)

BRIGHAM AND WOMEN'S HOSPITAL
A Teaching Affiliate of Harvard Medical School
75 Francis Street, Boston, Massachusetts 02115

Admission: 8/19/2014
Discharge: 8/21/2014

Discharge Summary

FINAL

Instructions Given to Your Patient at Discharge:

Activities After Discharge:
Walking as tolerated
Other Activity Restriction - as per PT

Diet After Discharge:
House 8/21/2014 7:49:45 AM

Please resume all your home medications except blood thinners (aspirin, motrin, ibuprofen) unless otherwise instructed by your surgeon. Please take pain medications only as needed for pain. Tylenol in addition to prescribed narcotics may help for severe pain. Please do not drive, operate machinery, or drink alcohol while taking narcotic pain medications.
Please do not lift heavy weights (>20 lbs) for one month. No exercise or strenuous activity until after your follow-up appointment.
Please call Dr. Chiocca's office to schedule your follow up appointment. You should be seen within 1-2 weeks for staple removal.
If you need to reach Dr. Chiocca's office during normal business hours, M-F 8am-5pm, please call the phone number below:
(617) 525-9419
If you are unable to reach someone at the above numbers or it is not during business hours please call:
617-732-5500, and have 17577 paged, the Neurosurgery resident on call.
Please do not get your incision wet until after sutures are removed at follow-up. It is OK to shower but keep incision dry. Incision must be covered when showering, and the dressing or shower cap may be removed after showering.
Please call your MD immediately or go to the Emergency Department if the following symptoms occur: headaches, neck pain, fever, chills, nausea, vomiting, diarrhea, worsening weakness, numbness, visual changes, chest pain, shortness of breath, or any other symptoms of your concern.
Return to the Emergency Department or see your own doctor right away if
any problems develop, including the following:
--Fever >100.5 F or shaking chills.
--Purulent discharge (pus) from wound, or any increased drainage.
--Increased redness or swelling around the wound.
--Worsening Headache or Neck Stiffness.
--Seizures or any loss of consciousness, dizziness, or fainting.
--Blurry vision, double vision, or eye irritation.
--Nausea or vomiting.
--Chest or back pain, or shortness of breath.
PLEASE REMEMBER: It is OK to shower but do NOT get incision wet. Incision must be covered when showering and dressing may be removed after showering. No driving while taking pain medication. Avoid strenuous activity until follow-up appointment, at least. Call office or come to ER if: fever>100.5, increasing pain/headache, increasing nausea/vomiting, signs of wound infection (increasing pain, redness, warmth, swelling, or discharge), new or worsening neurologic deficit, or anything else that is troubling to you. Staples will be removed in clinic.

Danger Signs:

Call your doctor if you have:
- Difficulty breathing or shortness of breath
- Chest pain or upper abdominal pain or pressure
- Fainting
- sudden dizziness
- weakness
- Severe headache
- Wound with redness or evidence of infection (drainage
- pus)

Electronically Signed by: Meghan E. Dolan,P.A.-C. on 8/21/2014 8:33:15 AM
Electronically Signed by: Nina A Johnson,R.N. on 8/21/2014 10:56:41 AM

Discharge Reports from 1/1/2004 through 12/29/2014 (cont)

BRIGHAM AND WOMEN'S HOSPITAL
A Teaching Affiliate of Harvard Medical School
75 Francis Street, Boston, Massachusetts 02115

Admission: 8/19/2014
Discharge: 8/21/2014

Discharge Summary
FINAL

- Any sudden or severe pain
- Severe persistent vomiting or diarrhea (three or more loose stools per day)
- Coughing or vomiting blood
- Suicidal Feelings
- Fever greater than 100.5 degrees Farenheit
- Difficulty speaking or walking
- Changes in vision or blurry vision
- Confusion
- Uncontrolled bleeding (e.g. does not stop bleeding when held for 10 minutes)

Electronically Signed by: Meghan E. Dolan,P.A.-C. on 8/21/2014 8:33:15 AM
Electronically Signed by: Nina A Johnson,R.N. on 8/21/2014 10:56:41 AM

Discharge Reports from 1/1/2004 through 12/29/2014 (cont)

BRIGHAM AND WOMEN'S HOSPITAL
A Teaching Affiliate of Harvard Medical School
75 Francis Street, Boston, Massachusetts 02115

Admission: 8/19/2014
Discharge: 8/21/2014

Discharge Summary
FINAL

MEDICATIONS

Allergies/Sensitivities:
Penicillins

Admission Medications:
1. ACETAMINOPHEN (TYLENOL) 500 MG PO Q8H
2. LEVETIRACETAM (KEPPRA) 500 MG PO BID

Discharge Medications

#	Medication Name/ Dose / Frequency	Medication Status*
1	DOCUSATE SODIUM 100 mg by mouth two times a day	New Medication
2	FAMOTIDINE 20 mg by mouth two times a day	New Medication
3	SENNOSIDES 17.2 mg by mouth two times a day	New Medication
4	ACETAMINOPHEN 650 mg by mouth every 4 hours as needed FOR: Pain,Headache	Changed Frequency and Dose
5	DEXAMETHASONE Taper by mouth 2 mg every 6 hours for 4 DOSES 1 mg every 6 hours for 4 DOSES	New Medication
6	LEVETIRACETAM 500 mg by mouth every 12 hours Call HO for an IV order if patient is unable to take PO.	Changed Frequency
7	OXYCODONE 5-10 mg by mouth every 4 hours as needed FOR: Pain,Headache	New Medication

* Medication status indicates change from medication list before admission to medication list on discharge from hospital.

Immunizations Given During Inpatient Stay:
No H1N1, Seasonal Flu, Pneumovax or Diphtheria/Tetanus/Pertussis Vaccines were administered during this admission.

Electronically Signed by: Meghan E. Dolan,P.A.-C. on 8/21/2014 8:33:15 AM
Electronically Signed by: Nina A Johnson,R.N. on 8/21/2014 10:56:41 AM

Discharge Reports from 1/1/2004 through 12/29/2014 (cont)

BRIGHAM AND WOMEN'S HOSPITAL
A Teaching Affiliate of Harvard Medical School
75 Francis Street, Boston, Massachusetts 02115

Admission: 8/19/2014
Discharge: 8/21/2014

Discharge Summary
FINAL

DISEASE MANAGEMENT:

Were the following conditions active problems during this hospitalization?

Heart Failure: No

Coronary Artery Disease: No

Ischemic Stroke/TIA: No

Electronically Signed by: Meghan E. Dolan,P.A.-C. on 8/21/2014 8:33:15 AM
Electronically Signed by: Nina A Johnson,R.N. on 8/21/2014 10:56:41 AM

Discharge Reports from 1/1/2004 through 12/29/2014 (cont)

BRIGHAM AND WOMEN'S HOSPITAL
A Teaching Affiliate of Harvard Medical School
75 Francis Street, Boston, Massachusetts 02115

Admission: 8/19/2014
Discharge: 8/21/2014

Discharge Summary
FINAL

CC LIST:

PCP	FIRN,LEIGH M.,M.D. MIT MEDICAL 77 MASSACHUSETTS AVENUE,BUILDING E23 CAMBRIDGE,MA 02139
Follow Up Appointment	Chiocca, Ennio A

Electronically signed by:

Name	Role	Date	Time
Ennio A. Chiocca, M.D., Ph.D.	Attending	8/28/2014	1:12 PM
Nina A Johnson,R.N.	Nurse	8/21/2014	10:56 AM
Meghan E. Dolan,P.A.-C.	Physician Assistant	8/21/2014	8:33 AM
Lisa R Cohen	Occupational Therapist	8/21/2014	7:49 AM
Bichngoc Thi Nguyen,P.A.-C.	Physician Assistant	8/20/2014	1:41 PM
Carol A Kale	Nurse	8/20/2014	9:56 AM

Electronically Signed by: Meghan E. Dolan,P.A.-C. on 8/21/2014 8:33:15 AM
Electronically Signed by: Nina A Johnson,R.N. on 8/21/2014 10:56:41 AM

Laboratory From 1/1/2004 through 12/29/2014

CHEMISTRY								
Date/Time	**NA**	**K**	**CL**	**CO2**	**BUN**	**CRE**	**EGFR**	**GLU**
08/21/2014 09:23	**137** (136-145)	**3.8** (3.4-5.0)	**98** (98-107)	**26** (22-31)	**13** (6-23)	**0.73** (0.50-1.20)	**>=60**(1)	**131**(*) (70-100)
(1)(Abnormal if <60 mL/min/1.73m2 If patient is black, multiply by 1.21)								
08/20/2014 16:50	**137** (136-145)							
08/20/2014 00:39	**134**(*) (136-145)	**3.8** (3.4-5.0)	**97**(*) (98-107)	**24** (22-31)	**13** (6-23)	**0.78** (0.50-1.20)	**>=60**(1)	**150**(*) (70-100)
(1)(Abnormal if <60 mL/min/1.73m2 If patient is black, multiply by 1.21)								
08/19/2014 18:10	**137** (136-145)	**3.6**(#)(2) (3.4-5.0)	**99** (98-107)	**24** (22-31)	**15** (6-23)	**0.87** (0.50-1.20)	**>=60**(1)	**126**(*) (70-100)
(1)(Abnormal if <60 mL/min/1.73m2 If patient is black, multiply by 1.21) (2)VERIFIED								
08/19/2014 16:17(1)								**168**(*) (70-100)
(1)FIO2: ART OR								
08/19/2014 16:17(1)	**138** (136-145)	**4.9** (3.4-5.0)	**100** (98-107)	**25** (22-31)	**15** (6-23)	**0.86** (0.50-1.20)	**>=60**(2)	**181**(*) (70-100)
(1)OR (2)(Abnormal if <60 mL/min/1.73m2 If patient is black, multiply by 1.21)								
08/19/2014 12:50(1)								**158**(*) (70-100)
(1)FIO2: ART,OR								
08/19/2014 12:49(1)	**134**(*) (136-145)	**4.2** (3.4-5.0)	**96**(*) (98-107)	**27** (22-31)	**14** (6-23)	**0.93** (0.50-1.20)	**>=60**(2)	**161**(*#) (70-100)
(1)OR (2)(Abnormal if <60 mL/min/1.73m2 If patient is black, multiply by 1.21)								
08/15/2014 11:39(1)	**138** (136-145)	**3.6** (3.4-5.0)	**101** (98-107)	**26** (22-31)	**7** (6-23)	**0.83** (0.50-1.20)	**>=60**(2)	**73** (70-100)
(1)surgery date 08/19/2014 (2)(Abnormal if <60 mL/min/1.73m2 If patient is black, multiply by 1.21)								
08/13/2014 12:52	**138** (136-145)	**4.1** (3.4-5.0)	**100** (98-107)	**29** (22-31)	**11** (6-23)	**0.88** (0.50-1.20)	**>=60**(1)	**96** (70-100)
(1)(Abnormal if <60 mL/min/1.73m2 If patient is black, multiply by 1.21)								
Date/Time	**ANION**							
08/21/2014 09:23	**13** (5-17)							
08/20/2014 00:39	**13** (5-17)							
08/19/2014 18:10	**14** (5-17)							

Flag Key: * (Abnormal Value) # (Significant Change) C (Corrected)

Laboratory from 1/1/2004 through 12/29/2014 (cont)

08/19/2014 16:17(1)	**13** (5-17)							
(1)OR								
08/19/2014 12:49(1)	**11** (5-17)							
(1)OR								
08/15/2014 11:39(1)	**11** (5-17)							
(1)surgery date 08/19/2014								
08/13/2014 12:52	**9** (5-17)							
Date/Time	**GLU-POC**							
08/20/2014 11:11	**164**(*) (70-100)							
08/20/2014 06:01	**150**(*) (70-100)							
Date/Time	**CA**	**IC**	**MG**	**TBILI**	**TP**	**ALB**	**GLOB**	**OSM**
08/21/2014 09:23	**9.3** (8.8-10.7)		**2.1**(#) (1.7-2.6)					
08/20/2014 00:39	**9.2** (8.8-10.7)		**1.6**(*#) (1.7-2.6)					**285** (278-297)
08/19/2014 18:10	**9.6** (8.8-10.7)		**2.1** (1.7-2.6)					
08/19/2014 16:17(1)		**1.14** (1.13-1.32)						
(1)FIO2: ART OR								
08/19/2014 16:17(1)	**9.3** (8.8-10.7)		**2.0** (1.7-2.6)					
(1)OR								
08/19/2014 12:50(1)		**1.15** (1.13-1.32)						
(1)FIO2: ART,OR								
08/19/2014 12:49(1)	**9.3** (8.8-10.7)		**2.0** (1.7-2.6)					
(1)OR								
08/15/2014 11:39(1)	**9.5** (8.8-10.7)			**0.4** (0.0-1.0)	**7.6** (6.4-8.3)	**4.5** (3.5-5.2)	**3.1** (2.2-4.2)	
(1)surgery date 08/19/2014								
08/13/2014 12:52	**9.6** (8.8-10.7)							
Date/Time	**bPO2**	**bPCO2**	**bPH**	**UBASEX**	**O2 Sat**	**NA-PL**	**K-PL**	**CO2-PL**
08/19/2014 18:10(1)	**168**(*#) (65-95)	**44** (36-47)	**7.40** (7.35-7.45)	**2** (-3-3)	**99.1**(*) (93.0-97.5)			**28** (22-30)
(1)FIO2: ART								
08/19/2014 16:17(1)	**362**(*) (65-95)	**50**(*) (36-47)	**7.36** (7.35-7.45)	**1** (-3-3)	**99.4**(*) (93.0-97.5)	**138** (136-145)	**4.9** (3.4-5.0)	**29** (22-30)
(1)FIO2: ART OR								

Flag Key: * (Abnormal Value) # (Significant Change) C (Corrected)

Laboratory from 1/1/2004 through 12/29/2014 (cont)

08/19/2014 12:50(1)	**365**(*) (65-95)	**55**(*) (36-47)	**7.37** (7.35-7.45)	**4**(*) (-3-3)	**99.6**(*) (93.0-97.5) **99.2**(*) (93.0-97.5)	**137** (136-145)	**4.5** (3.4-5.0)	**33**(*) (22-30)
(1)FIO2: ART,OR								
Date/Time	**HGB BG**	**HCT-BG**						
08/19/2014 18:10(1)	**14.1** (13.5-18.0)	**41** (40-54)						
(1)FIO2: ART								
08/19/2014 16:17(1)	**14.1** (13.5-18.0)	**41** (40-54)						
(1)FIO2: ART OR								
08/19/2014 12:50(1)	**14.9** (13.5-18.0)	**44** (40-54)						
(1)FIO2: ART,OR								
Date/Time	**ALT/SGPT**	**AST/SGOT**	**ALKP**	**TBILI**				
08/15/2014 11:39(1)	**13** (10-50)	**12** (10-50)	**54** (35-130)	**0.4** (0.0-1.0)				
(1)surgery date 08/19/2014								
HEMATOLOGY								
Date/Time	**WBC**	**RBC**	**HGB**	**HCT**	**MCV**	**MCH**	**MCHC**	**PLT**
08/21/2014 09:23	**23.76**(*) (4-10)	**4.04**(*) (4.5-6.4)	**12.4**(*) (13.5-18.0)	**35.8**(*) (40-54)	**88.6** (80-95)	**30.7** (27-32)	**34.6** (32-36)	**259** (150-450)
08/20/2014 00:39	**24.26**(*) (4-10)	**4.18**(*) (4.5-6.4)	**13.1**(*) (13.5-18.0)	**35.9**(*) (40-54)	**85.9** (80-95)	**31.3** (27-32)	**36.5**(*) (32-36)	**266** (150-450)
08/19/2014 18:10	**16.29**(*#) (4-10)	**4.34**(*) (4.5-6.4)	**13.2**(*) (13.5-18.0)	**37.3**(*) (40-54)	**85.9**(#) (80-95)	**30.4** (27-32)	**35.4**(#) (32-36)	**282** (150-450)
08/15/2014 11:39(1)	**9.67**(#) (4-10)	**4.95** (4.5-6.4)	**15.0** (13.5-18.0)	**45.1** (40-54)	**91.1** (80-95)	**30.3** (27-32)	**33.3** (32-36)	**302** (150-450)
(1)surgery date 08/19/2014								
08/13/2014 12:52	**6.26** (4-10)	**4.85** (4.5-6.4)	**14.9** (13.5-18.0)	**43.1** (40-54)	**88.9** (80-95)	**30.7** (27-32)	**34.6** (32-36)	**299** (150-450)
Date/Time	**RDW**							
08/21/2014 09:23	**11.8** (11.5-14.5)							
08/20/2014 00:39	**11.7** (11.5-14.5)							
08/19/2014 18:10	**11.6** (11.5-14.5)							
08/15/2014 11:39(1)	**11.8** (11.5-14.5)							
(1)surgery date 08/19/2014								
08/13/2014 12:52	**11.7** (11.5-14.5)							
Date/Time	**%POLY-A**	**%LYMPH-A**	**%MONO-A**	**%EOS-A**	**%BASO-A**			
08/21/2014 09:23	**86.7**(*) (48-76)	**4.8**(*) (18-41)	**8.5**(#) (4.0-11.0)	**0.0** (0-5)	**0.0** (0-1.5)			

Flag Key: * (Abnormal Value) # (Significant Change) C (Corrected)

Laboratory from 1/1/2004 through 12/29/2014 (cont)

08/20/2014 00:39	**90.1**(*) (48-76)	**4.3**(*) (18-41)	**5.6**(#) (4.0-11.0)	**0.0** (0-5)	**0.0** (0-1.5)			
08/19/2014 18:10	**95.1**(*#) (48-76)	**3.2**(*#) (18-41)	**1.7**(*#) (4.0-11.0)	**0.0** (0-5)	**0.0** (0-1.5)			
08/15/2014 11:39(1)	**63.0** (48-76)	**26.1** (18-41)	**9.4** (4.0-11.0)	**1.2** (0-5)	**0.3** (0-1.5)			
(1)surgery date 08/19/2014								
08/13/2014 12:52	**53.2** (48-76)	**37.4** (18-41)	**7.3** (4.0-11.0)	**1.6** (0-5)	**0.5** (0-1.5)			
Date/Time	**ANEUT-A**	**ALYMP-A**	**AMONO-A**	**AEOS-A**	**ABASO-A**			
08/21/2014 09:23	**20.59**(*) (1.9-7.6)	**1.13** (0.8-4.1)	**2.03**(*) (0.2-0.8)	**0.00** (0-0.35)	**0.01** (0.00-0.15)			
08/20/2014 00:39	**21.83**(*) (1.9-7.6)	**1.05** (0.8-4.1)	**1.37**(*) (0.2-0.8)	**0.00** (0-0.35)	**0.01** (0.00-0.15)			
08/19/2014 18:10	**15.49**(*) (1.9-7.6)	**0.52**(*) (0.8-4.1)	**0.28** (0.2-0.8)	**0.00** (0-0.35)	**0.00** (0.00-0.15)			
08/15/2014 11:39(1)	**6.09** (1.9-7.6)	**2.52** (0.8-4.1)	**0.91**(*) (0.2-0.8)	**0.12** (0-0.35)	**0.03** (0.00-0.15)			
(1)surgery date 08/19/2014								
08/13/2014 12:52	**3.33** (1.9-7.6)	**2.34** (0.8-4.1)	**0.46** (0.2-0.8)	**0.10** (0-0.35)	**0.03** (0.00-0.15)			
COAGULATION								
Date/Time	**PT**	**PT-INR**	**PTT**					
08/21/2014 09:23	**14.1** (12.0-14.4)	**1.1** (0.9-1.1)	**27.7** (23.8-36.6)					
08/20/2014 00:39	**14.3** (12.0-14.4)	**1.1** (0.9-1.1)	**26.4** (23.8-36.6)					
08/19/2014 18:10	**14.0** (12.0-14.4)	**1.1** (0.9-1.1)	**23.8** (23.8-36.6)					
08/15/2014 11:39(1)	**13.5** (12.0-14.4)	**1.0** (0.9-1.1)	**27.8** (23.8-36.6)					
(1)surgery date 08/19/2014								
08/13/2014 12:52	**13.3** (12.0-14.4)	**1.0** (0.9-1.1)	**28.3** (23.8-36.6)					
URINALYSIS								
Date/Time	**UA-COLOR**	**UA-GLUC**	**UA-BILI**	**UA-KET**	**UR-SPGR**	**UA-BLD**	**UA-PH**	**UA-PROT**
08/15/2014 11:39(1)	**YELLOW**(2)	**NEG** (0-0)	**NEG** (0-0)	**NEG** (0-0)	**1.006** (1.003-1.035)	**NEG** (0-0)	**6.5** (4.5-8.0)	**NEG** (0-0)
(1)surgery date 08/19/2014 (2)CLEAR								
08/13/2014 12:52	**YELLOW**(1)	**NEG** (0-0)	**NEG** (0-0)	**NEG** (0-0)	**1.015** (1.003-1.035)	**NEG** (0-0)	**7.0** (4.5-8.0)	**NEG** (0-0)
(1)CLEAR								
Date/Time	**UA-UROBI**	**UA-NIT**	**LEUK-EST**					
08/15/2014 11:39(1)	**NEG** (0-0)	**NEG** (0-0)	**NEG** (0-0)					

Flag Key: * (Abnormal Value) # (Significant Change) C (Corrected)

Laboratory from 1/1/2004 through 12/29/2014 (cont)

(1)surgery date 08/19/2014

08/13/2014 12:52	**NEG** (0-0)	**NEG** (0-0)	**NEG** (0-0)					
Date/Time	**UAS-RBC**	**UAS-WBC**	**UAS-BACT**	**UAS-SQHI**	**OCAST**	**HCAST**	**UAS-CRYS**	**UA-EPIS**
08/15/2014 11:39(1)	**NEG** (0-3)	**NEG** (0-4)	**TR**	**NEG**	**NEG** (0-0)	**0** (0-2)	**NEG**	**NEG**

(1)surgery date 08/19/2014

Date/Time	**UAS-COM**							
08/15/2014 11:39(1)	**NEG**							

(1)surgery date 08/19/2014

BLOOD BANK

Date/Time	**BB Sp**							
08/15/2014 08:53	SEE DETAIL(1)							

(1)EXP: 08/18/2014 23:59

Date/Time	**ABO**	**Rh**	**ABSCRN**					
08/15/2014 08:53	**O**	**Positive**	**Negative**					
Date/Time	**ABO #2**	**Rh #2**						
08/15/2014 08:53	**O**	**Positive**						

Microbiology From 1/1/2004 through 12/29/2014

08/20/2014 02:26 **RECTAL SWAB FOR VANCOMYCIN RESISTANCE SCREENING** **F**

Specimen: 3482159 Collected 19-Aug-14 18:00
Received 20-Aug-14 02:26
Ordering Provider:
Specimen Group: RECTAL
Specimen Type: RECTAL SWAB FOR VANCOMYCIN RESISTANCE SCREENING

VANCOMYCIN-RESISTANT ENTEROCOCCUS SCREEN (ADULTS)

Reported: 21-Aug-14
NO VANCOMYCIN-RESISTANT ENTEROCOCCI ISOLATED

Microbiology from 1/1/2004 through 12/29/2014 (cont)

08/20/2014 01:24 NARES FOR MRSA F

Specimen: 3482127 Collected 19-Aug-14 18:00
Received 20-Aug-14 01:24
Ordering Provider:
Specimen Group: NOSE/NASOPHARYNX
Specimen Type: NARES FOR MRSA

MRSA CULTURE (ADULTS)
Reported: 21-Aug-14
NO METHICILLIN-RESISTANT STAPHYLOCOCCUS AUREUS ISOLATED

Microbiology from 1/1/2004 through 12/29/2014 (cont)

08/15/2014 10:13 URINE F

Specimen: 3480190 Collected 15-Aug-14 08:53
Received 15-Aug-14 10:13
Ordering Provider: CHIOCCA, ENNIO A. Dr. M.D.
Specimen Group: URINE
Specimen Type: URINE
Specimen Comment: surgery date 08/19/2014

AEROBIC CULTURE, URINE
Reported: 17-Aug-14
NO GROWTH

Microbiology from 1/1/2004 through 12/29/2014 (cont)

08/13/2014 13:38 URINE F

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Specimen: 3479163              Collected 13-Aug-14 12:12
                               Received  13-Aug-14 13:38
Ordering Provider: TRIGGS, DANIEL VENANCE N.P.
Specimen Group:    URINE
Specimen Type:     URINE

AEROBIC CULTURE, URINE
  Reported: 14-Aug-14
  Total Colony Count 1,000
  MIXED FLORA (3 OR MORE COLONY TYPES)
```

Notes From 1/1/2004 through 12/29/2014

10/07/2014 **Neuropsychological Evaluation** **Final** **Humphreys, Clare T., Ph.D.**

Patient: KEATING,STEVEN WH) 04/29/88 U
Author: Electronically Signed by Clare T. Humphreys, Ph.D.

Signed 10/30/2014 13:35
Visit Date: 10/07/2014

Dana-Farber Cancer Institute
Division of Medical Oncology
Brigham and Women's Hospital
Division of Cognitive & Behavioral Neurology & Neuropsychology

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NEUROPSYCHOLOGICAL EVALUATION
Keating, Steven
BWH #
DOB 4/29/88
DOE 10/7/14

Identifying information/reason for referral: Steven Keating is 26-year-old R-handed man with newly diagnosed left frontal diffuse astrocytoma who presents for evaluation of cognitive functioning. He was referred by Dr. Patrick Wen in light of medical history and to establish a cognitive baseline. Today's evaluation consisted of a review of available medical records, a clinical interview, and the completion of a battery of neuropsychological tests. There is no history of prior neuropsychological testing. All background information was obtained from the patient or from the longitudinal medical record (LMR).

History of presenting concerns: Medical history is well documented in LMR and in Dr. Wen's recent notes, which I have reviewed. In brief summary, Mr. Keating was a voluntary participant in an fMRI research study in December 2007, and was notified that there was an abnormality on his scan. A brain MRI was obtained, which demonstrated a small left inferior frontal T2/FLAIR hyperintensity felt to be possibly consistent with cortical dysplasia or low grade glial neoplasm. A follow-up scan in several years was recommended. He had a repeat brain MRI in 2010 and was told that the lesion was stable. He was then in his usual state of health until about one year ago, when he began to notice severe headaches after vigorous exercise. Starting in mid-June 2014, he began to experience frequent stereotyped episodes of 20 seconds of light-headedness and a feeling of "questioning my own reality," followed by about a minute of smelling a strong acidic smell, light-headedness and L>R eyelid twitching without convulsive movements or loss of consciousness. These spells occurred every few days, with as many as three spells in one day, and were followed by a dull headache for about 20 minutes. He presented to a neurologist for evaluation and was started on Keppra 250mg BID and referred for MRI of the brain, which demonstrated a large non-enhancing left frontal mass lesion. He underwent resection of this lesion on August 19, 2014 (Dr. Ennio Chiocca) with pathology consistent with a diffuse astrocytoma, WHO Grade II, and is now followed by Dr. Wen (DFCI Neuro-oncology) for treatment planning. On interview today, he reported that his primary concerns post-surgically have been significant insomnia and increased anxiety. With respect to sleep, he has difficulty primarily with maintenance, awakening for periods of 30-60 minutes in the early morning hours. This has improved slightly but remains problematic. In addition, he reported the onset of understandable anxiety symptoms since his diagnosis, which include thoughts running through his head, vigilance regarding physical symptoms (e.g. those that might be related to his tumor), and a sense of inability to "trust" his own mind due to his experience of olfactory hallucinations in the past. He finds that he does relatively well when distracted or around others, but experiences more acute anxiety during the nighttime hours or when alone. He denied symptoms of depression, describing his mood as "contemplative" rather than sad. When questioned regarding cognitive domains, he generally denied post-surgical changes in functioning. The sold areas endorsed included mild inattention (which he attributes to his ongoing anxiety and degree of preoccupation) and a slight increase in typographical errors, which has led him to check his emails more carefully. He noted that he experienced some paraphasic errors immediately after surgery, but this resolved within days.

All aspects of ADLs are intact. He has good medication adherence and uses a pill organizer. He does not have a car and uses public transportation. He used a bicycle in the past and always wears a helmet. He is managing his finances with no difficulty. He is making efforts to exercise daily and has noted some benefit in terms of his sleep. He reported good social and family support.

Oncology History

- December 2007: small left inferior frontal T2/FLAIR hyperintensity found incidentally on fMRI study

Notes from 1/1/2004 through 12/29/2014 (cont)

Patient: KEATING,STEVEN WH) 04/29/88 U Signed 10/30/2014 13:35
Author: Electronically Signed by Clare T. Humphreys, Ph.D. Visit Date: 10/07/2014

- 2010: follow up MRI with stable lesion
- Spring/summer 2013: began to notice severe headaches after vigorous exercise
- July 2014: presented to neurologist for evaluation of 6 week history of stereotyped episodes of acidic smell, derealization, light-headedness and L>R eyelid twitching. MR brain obtained, demonstrating large primarily non-enhancing left frontal mass lesion
- 8/19/14: underwent resection of L frontal tumor (Dr. Ennio Chiocca). Path: Diffuse Astrocytoma, WHO Grade II

Additional Medical History: Unremarkable. He had a loss of consciousness in high school while engaged in a breath-holding context and chipped a tooth, but has no concussion history. No seizure symptoms post-surgically although he occasionally has mild "aura-like" symptoms.

Neuroimaging/Prior Studies: Recent MRI available in LMR; Postsurgical changes with a resection cavity in the left frontal lobe, with regions of T2 abnormality medial and posterior to the cavity. Mild linear enhancement along cavity most likely postsurgical. No evidence of enhancing, hypervascular or hypercellular tumor progression.

Psychiatric History: There is no history of psychiatric diagnosis or treatment, no history of psychotropic medication trials, and no history of participation in psychotherapy.

Relevant Family History:
History of Meniere's disease in his mother, as well as migraines and a question of bipolar disorder (due to what may have been a single manic episode as well as depressive episodes per description).

Current Medications:
Keppra (LEVETIRACETAM) 500MG TABLET Take 1 Tablet(s) PO BID
Tylenol Extra Strength (ACETAMINOPHEN Extra Strength) 500 MG TABLET as directed, as needed
Melatonin
Valerian
Omega 3 supplement

Social History: Mr. Keating was born and raised in Calgary, Canada and currently lives with roommates while attending MIT. He has been in a relationship with his girlfriend for seven months, and described this as a significant source of support. He has not used caffeine since his surgery, and drinks alcohol occasionally (once per week at maximum). He does not use any other substances.

Educational/Occupational History: Early development was unremarkable to the best of his knowledge. He was generally an excellent student who earned A grades and graduated at the top of his high school class. He went on to complete a bachelor's degree in Mechanical Engineering and Film at Queen's University. He is currently in his fifth year of graduate study at MIT, with all coursework completed. He is considering whether to delay his thesis work due to his diagnosis and potential need for treatment. His performance has been excellent throughout grad school, with a GPA of 4.9. He holds a research assistant position at MIT, and is otherwise a full time student.

Relevant Review of Systems:
Sleep: Bedtime 11pm-12am, uses computer in bed with light filter. Sleep onset within 15-20 minutes. Awakening between 3-4 am for 30-60 minutes, again at 6 am. Using blackout blinds. No snoring or abnormal movement reported. Possible increased urination at night which may contribute.
Appetite/Weight: Recent 5 pound weight loss, eating a healthy diet.
Sensory functioning: Increased sensitivity to sound and decreased olfactory acuity post-surgically. Scalp numbness, cold hands and feet.

Notes from 1/1/2004 through 12/29/2014 (cont)

Patient: KEATING,STEVEN WH) 04/29/88 U Signed 10/30/2014 13:35
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Motor functioning: No changes in gait, balance, or coordination. No tremor.
Headache: Occasional, possibly associated with dehydration. Endorsed related anxiety/vigilance
Nausea: Denies
Pain: Denies

MENTAL STATUS EXAMINATION

Appearance: Well dressed, well groomed, arrived on time and unaccompanied for appointment.
Behavior: Pleasant and cooperative. Social graces and comportment were intact. Rapport was readily established.
Speech: Fluent and normal in rate, volume, and tone.
Motor (strength, tone, gait and abnormal movements): No abnormalities noted. Patient ambulated independently between waiting area and exam room. Gross and fine motor control were intact
Mood: "contemplative"
Affect: Full range, congruent with mood and topics discussed
Thought process: Logical and goal directed; excellent personal historian
Thought content: Appropriate to topic
Insight: Good
Judgment: Intact

Cognitive Exam (orientation, memory, attention, language, fund of knowledge): Fully oriented to date and location. Easily registered 3/3 words at first attempt, and recalled 3/3 after brief distraction. Serial seven subtractions were performed efficiently and without error. Naming, repetition, comprehension, and basic reading and writing skills were intact. Verbal fluency was above average for phonemic and semantic trials. Visual construction skills were intact on figure copy tasks (intersecting pentagons and wire cube) and clock drawing was within normal limits. There was no evidence of visual or perceptual difficulties on screening. 10 minute delayed recall for a name and address was 5/7, and improved to 7/7 with multiple choice cues. MMSE = 30/30; ACE-R = 97/100

Suicidal ideation: [x] no clinical indicators to suggest
[x] denies [ ] present (explain intent, plan, access to means)
Homicidal Ideation: [x] no clinical indicators to suggest
[ ] denies [ ] present (explain intent, specificity of target, access to means

Multi-axial Diagnosis
Axis I: 294.9 Cognitive Disorder NOS
Axis II: Deferred
Axis III: Brain tumor
Axis IV: Moderate (Medical and academic stressors)
Axis V (GAF) Current: 75

Recommendation/plan: As a result of this diagnostic evaluation, it is recommended that Mr. Keating proceed to neuropsychological testing to include a comprehensive battery of tests of cognitive function, mood, and personality. He understands and is in agreement with this plan. He is motivated and fully capable of participating in the evaluation process.

Neuropsychological Testing (Initial): the examination consisted of record review, testing, scoring, interpretation, integration and report writing by psychologist [96118: 5 hours; Addenbrooke's Cognitive Examination-Revised: Attention & Orientation, Memory, Fluency, Language, and Visuospatial subscales] and selected testing and scoring by technician-Sara Rushia, B.A. [96119: 3 hours; Test of Premorbid Functioning (TOPF), Wechsler Adult Intelligence Scale-IV (WAIS-IV: Similarities, Digit Span, Digit Symbol-Coding, Matrix Reasoning), Wechsler Memory Scale-IV (WMS-IV: Logical Memory, Visual Reproduction), California Verbal Learning Test-II, Rey-Osterreith Complex Figure test, Delis-Kaplan Executive Function System (DKEFS Verbal Fluency, Trail Making, Color-Word, Tower), Conners' Continuous Performance Test-II, Boston Naming Test, Narrative Writing Sample, Grooved Pegboard, Beck Depression Inventory-II, Beck Anxiety Inventory]

Behavioral Observations during Testing:
Mr. Keating was alert, engaged, and easily established rapport with the examiners. He expressed interest in the testing process and was highly motivated. Comprehension was intact for all task instructions and he worked independently without need for

Notes from 1/1/2004 through 12/29/2014 (cont)

Patient: KEATING,STEVEN WH) 04/29/88 U Signed 10/30/2014 13:35
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prompting or redirection. He asked appropriate questions about the tasks when he required additional clarity. He occasionally provided more complex responses than required on less structured tasks. He showed an appropriate range of emotional expression and intact frustration tolerance. He occasionally appeared disappointed in his performance or mild anxious, but this did not significantly affect his ability to engage in the presented tasks. He was slightly restless at times (e.g. shifting in his seat) and showed some evidence of fatigue (yawning, mild inattention) toward the end of the lengthy testing session. However, he continued to put forth excellent effort and the presented results can be considered a valid estimate of his current cognitive functioning.

Summary of Test Results (please also see attached table):

Baseline intellectual functioning was estimated to fall within the superior range, and performance on selected verbal and visual intellectual tasks were superior and consistent with this estimate. Specific subtest performances are discussed further below.

Basic auditory attention and working memory were consistently within the average range, with spans of 7 digits repeated, 5 digits backward, and 6 digits (variably) sequenced. This represents a mild weakness relative to Mr. Keating's superior level of intellectual functioning. Processing speed on a digit-symbol coding task with demands on divided visual attention and working memory was high average. Speed was superior on paper-and-pencil tasks of visual scanning and number and letter sequencing, and speed remained above average when cognitive set-shifting demands were introduced (letter-number sequencing). All of the above tasks were performed without error. Activation and sustained retrieval were superior and very superior (respectively) on timed verbal fluency tasks requiring generation of words in response to phonemic (first letter) and semantic (category) prompts. When cognitive flexibility demands were increased (generation of responses from alternating semantic categories), speed of generation remained in the superior range. He made a slightly elevated number of repetition errors, but this was in the context of a very high number of total responses. Verbally-mediated processing speed on timed word reading and color naming tasks was average to high average. Speed remained high average when response inhibition demands were introduced (color-word condition) on a subsequent inhibition/set-shifting condition. Accuracy was also above average with 0 errors across conditions.

On an extended task requiring attention, sustained concentration, vigilance, and response inhibition performance was within normal limits, with faster than average response times, low error rate, and intact ability to adapt to changes in task demand. The sole area of weakness was mild loss of response consistency as the task progressed over time, but the overall results were within the non-clinical range, without indication of clinically significant attentional problems.

Performance on a problem-solving task requiring spatial planning, rule learning, and maintenance of cognitive set (Tower task) was above average. All items were completed correctly and within the time allowed, and the majority were completed within or near the optimal number of moves. Mr. Keating correctly recognized when an error led to the need for a higher number or moves to complete a trial, and expressed some disappointment in his performance. However, his overall score was above average and completion speed and accuracy were well within normal limits. Abstract verbal reasoning was in the superior range, as was performance on a visual abstract reasoning task requiring completion of increasingly complex patterns.

Learning and memory performances were generally high average to superior. On a list learning task, initial encoding of a 16-word list was average at the first of five learning trials with an intact learning curve and superior encoding for learning trials 1-5. After presentation of a distracter list, recall remained superior at 15/16 words, while learning of the distracter list (which is presented only once) was average at 6/16. After a 20-minute distraction filled delay, recall for the original list was high average (14/16), and improved to 15/16 with category cues. Recognition discrimination was intact (high average range) and error free. Recall for contextual verbal material (detailed short stories) was high average immediately following presentation and remained high average after 25-minute delay, 100% retention over time. Recognition discrimination for story details was intact within normal limits. Visual memory for briefly presented geometric designs was high average immediately following presentation, and superior after 25-minute delay with 98% percent retention over time. Recognition discrimination was error-free. Incidental recall of a previously copied complex figure was average after brief distraction, and remained average after 20-minute delay, with 100% retention. Mr. Keating showed good recall of the overall figure gestalt and major components, with some loss of internal detail at the level of initial encoding. However, as shown by his percent retention, information storage over time was entirely intact.

Language was entirely within normal limits with regard to comprehension, repetition, and word reading. Narrative writing was legible, well-composed, free from errors, and accurately described character roles and other relevant aspects of a visual scene. Performance on a confrontation naming task was within normal limits.

Patient: KEATING,STEVEN WH) 04/29/88 U
Author: Electronically Signed by Clare T. Humphreys, Ph.D.

Signed 10/30/2014 13:35
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Visuospatial functions were entirely intact. There was no evidence of difficulty with visual perception, and visual construction on a complex figure copy task was in the superior range. He produced a highly precise and error-free copy. As mentioned above, performance on a visual pattern completion task was also in the superior range.

Fine motor speed and dexterity were high average bilaterally, with a typical dominant hand advantage. Basic graphomotor speed on a line tracing task (dominant hand) was in the superior range.

Responses to self-report inventories indicated minimal depressive symptoms, and fell below the cut-off for symptoms of worry typically associated with generalized anxiety.

Impressions and Recommendations: In summary, Mr. Keating is a 26-year-old man with a history of recently diagnosed left frontal astrocytoma referred for evaluation by his neuro-oncologist. Results of today's evaluation describe him as a man of superior estimated premorbid functioning who demonstrates mild relative weaknesses in attention and working memory. A very mild was also noted in single-trial learning and initial encoding of information with high organizational demands, which is likely reciprocally related to attentional functioning. However, it is important to emphasize that these scores were still within normal limits for age and education, and represent areas of weakness only in relation to superior range functioning in other areas. Mr. Keating's cognitive profile is primarily one of strengths, with above average to superior scores across domains and across most administered tasks today, consistent with his estimated premorbid abilities. He has also demonstrated considerable emotional resilience in response to this significant health challenge. He is experiencing understandable anxiety that appears to be circumstantial/situational rather than representing a primary anxiety disorder. However, these symptoms are causing him distress and potentially interfering with sleep. In terms of etiology of mild cognitive weaknesses, anxiety symptoms are likely to be contributory, and weaknesses in attention and working memory can also be associated with disrupted sleep. In addition, his frontally located tumor and associated disruption of frontal-subcortical networks may be contributory as well. Again, however, these weaknesses were mild in nature and occur in the context of multiple areas of cognitive strength, suggesting that Mr. Keating is functioning at or near his baseline level. He is motivated to address and improve his anxiety symptoms and sleep, and this will likely have a beneficial impact on attention and concentration in daily life. The following recommendations are provided:

1) There are several available DFCI resources that may be extremely helpful to Mr. Keating. Consultation with psychosocial oncology is a recommended initial first step, for additional evaluation of and input regarding anxiety symptoms. Mr. Keating indicated a preference for non-pharmacological treatments today, and a referral to the Young Adult Program (http://dana-farber-yap.org/) and Karen Fasciano, PsyD, is also recommended. Mr. Keating is insightful and motivated and will be an excellent candidate for cognitive-behavioral treatment of anxiety symptoms, as well as benefitting from additional support and normalization of his experience. Complementary approaches to stress management may also be a useful addition to Mr. Keating's treatment. Services in this area are available through the DFCI Zakim Center **).** Mindfulness-based meditation and stress reduction practices are also recommended. In addition to benefits for stress and anxiety, these techniques have also been associated with improvement in aspects of cognitive function such as attention and working memory. Recommended resources include the UMass Medical School Center for Mindfulness website (www.umassmed.edu/cfm), "Mindfulness for Beginners" by Jon Kabat Zinn, and the book "The Mindful Way Through Anxiety" by Orsillo and Roemer.

2) Continued work to improve and consolidate sleep will be helpful for mood and cognition. Mr. Keating was encouraged to try a week-long behavioral experiment and eliminate computer use in bed. He will also continue to benefit from daily physical exercise and the use of good environmental sleep strategies (which he has implemented independently). If insomnia symptoms do not improve, he may also wish to consider beginning a bed time relation routine. This can take many forms and he should determine which is the best fit for him. Approaches include mediation, using a guided imagery or relaxation protocol (for example, see free downloads available through MITMedical at http://medweb.mit.edu/wellness/resources/downloads.html), and using a journal to write and record worries, tasks, and other aspects of the day that may be interfering with relaxation. "Externalizing" these factors by acknowledging and writing them down can help to calm anxious thoughts. For additional strategies, resources such as "The Insomnia Workbook" by Stephanie Silberman can be helpful. In addition, there are psychologists with specialized expertise in cognitive behavioral treatment of insomnia, including Lisa Strauss, PhD (and Claudia Toth, PsyD (Dana-Farber also offers the "Sleep 8 Feel Great" program beginning in January. Call , or

Notes from 1/1/2004 through 12/29/2014 (cont)

Patient: KEATING,STEVEN WH) 04/29/88 U
Signed 10/30/2014 13:35
Author: Electronically Signed by Clare T. Humphreys, Ph.D.
Visit Date: 10/07/2014

email**dfci_adultsurvivors@dfci.harvard.edu** for more information or to register.

3) Today's results will serve as a helpful cognitive baseline, and I would like to see Mr. Keating in 12 months for updated evaluation. This will allow for assessment of any interval change and provision of updated recommendations.

It was a pleasure to meet and work with this very bright and resilient man. I appreciate the opportunity to participate in his care. Please do not hesitate to contact me at with any questions regarding this report or the accompanying recommendations.

_____

Clare Humphreys, Ph.D.
Clinical Neuropsychologist
Dana-Farber Cancer Institute
Division of Medical Oncology
Brigham and Women's Hospital
Division of Cognitive & Behavioral Neurology

Name	**Steven Keating**
MRN	
DOB	04/29/88
DOE	10/07/14
Age	26
Edu	20
Hand	Right
Sex	Male

NEUROPSYCHOLOGICAL EXAMINATION	Raw	z	T	SS	%	Classification
INTELLECTUAL ABILITY						
Wechsler Adult Intelligence Scale - 4th ed. (WAIS-IV)						
Verbal Comprehension						
Similarities	31	1.33		14	91	Superior
Perceptual Reasoning						
Matrix Reasoning	24	1.67		15	95	Superior
Working Memory						
Digit Span	27	-0.33		9	37	Average
Processing Speed						
Coding	84	0.67		12	75	High Average
ESTIMATED PREMORBID INTELLIGENCE						
Test of Premorbid Functioning	50	0.60		109	73	Average
COGNITIVE SCREEN						
Mini Mental Status Exam (MMSE)	30	1.11	61	117	86	High Average
ACE-R (Scored as Age 50)						
Total (/100)	97				11	Points Above Cutoff
Attention and Orientation (/18)	18				1	Points Above Cutoff
Memory (/26)	24				6	Points Above Cutoff
Fluency (/14)	13				4	Points Above Cutoff
Language (/26)	26				2	Points Above Cutoff
Visuospatial (/16)	16				1	Points Above Cutoff

Notes from 1/1/2004 through 12/29/2014 (cont)

Patient: KEATING,STEVEN WH) 04/29/88 U
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Visit Date: 10/07/2014

EXECUTIVE FUNCTIONS					
Wechsler Adult Intelligence Scale - 4th ed. (WAIS-IV)					
Digit Span Forward	10	-0.33	9	37	Average
Digit Span Backward	8	-0.33	9	37	Average
Digit Span Sequencing	9	0.00	10	50	Average
Longest Digit Forward	7				
Longest Digit Backward	5v				
Longest Digit Sequence	6v				
Delis-Kaplan Executive Function System (D-KEFS)					
Trail Making Test					
Visual Scanning	11	1.33	14	91	Superior
Number Sequencing	15	1.33	14	91	Superior
Letter Sequencing	17	1.33	14	91	Superior
Number-Letter Switching	46	0.67	12	75	High Average
Motor Speed	10	1.33	14	91	Superior
Total Switching Errors	0	0.67	12	75	High Average
Verbal Fluency					
Total Letter	55	1.67	15	95	Superior
Total Category	63	3.00	19	99	Very Superior
Category Switching Total	18	1.67	15	95	Superior
Category Switching Accuracy	16	1.33	14	91	Superior
Total Set-Loss Errors	6	-1.67	5	5	Borderline
Total Repetition Errors	5	-1.67	5	5	Borderline
Color-Word Interference					
Color Naming	26	0.33	11	63	Average
Word Reading	17	1.00	13	84	High Average
Inhibition	38	1.00	13	84	High Average
Inhibition/Switching	41	1.00	13	84	High Average
Total Inhibition Errors	0	0.67	12	75	High Average
Total Inhibition/Switching Errors	0	0.67	12	75	High Average
Tower					
Total Achievement Score	21	1.00	13	84	High Average
Conners' Continuous Performance Test (CPT-II)					
Clinical Profile, Confidence Index	51.93				Non-Clinical
For the following subtests, only clinically elevated scores are reported					
Omissions	1		44	30.41	good performance
Hit RT	341.1		44	29.62	a little fast
Response Style	0.01		42	23.83	mildly atypical
Perseverations	0		45	32.79	good performance
Hit SE Block Change	0.07		59	83.87	MILDLY ATYPICAL
Hit RT ISI Change	0.03		45	32.72	good performance
MEMORY					
Wechsler Memory Scale - 4th ed. (WMS-IV)					
Story Learning and Recall					
Logical Memory I	29	0.67	12	75	High Average
Logical Memory II	29	0.67	12	75	High Average
Percent Retention	100				
Recognition (/30)	26			51-75	
Figure Learning and Recall					
Visual Reproduction I	42	1.00	13	84	High Average
Visual Reproduction II	41	1.67	15	95	Superior
Percent Retention	98				
Recognition (/7)	7			>75	
California Verbal Learning Test - 2nd ed. (CVLT-II)					

Notes from 1/1/2004 through 12/29/2014 (cont)

Patient: KEATING,STEVEN WH) 04/29/88 U
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Signed 10/30/2014 13:35
Visit Date: 10/07/2014

Trial 1	8	0.50	55	108	68	Average
Trial 2	11	0.50				
Trial 3	13	0.50				
Trial 4	13	0.50				
Trial 5	16	1.50	65	123	93	Superior
Trials 1-5 Total	61	1.10	61	117	86	High Average
Learning Slope Trials 1-5	1.8	0.50	55	108	68	Average
Trial B	6	-0.50	45	93	30	Average
Short Delay Free Recall	15	1.50	65	123	93	Superior
Short Delay Cued Recall	14	1.00	60	115	84	High Average
Long Delay Free Recall	14	1.00	60	115	84	High Average
Long Delay Cued Recall	15	1.00	60	115	84	High Average
Semantic Clustering	1	0.50	55	108	68	
Serial Clustering	0.2	-0.50	45	93	30	
Total Repetitions*	15	2.00	70	130	98	
Total Intrusions*	1	-0.50	45	93	30	
Recognition Hits	16	0.50	55	108	68	Average
False Positives*	0	-0.50	45	93	30	
Recognition Discriminability	4	1.00	60	115	84	High Average

** error score with lower score indicating higher performance*

Rey-Osterrieth Complex Figure Test

Immediate Recall	22.5	-0.40	46	94	34	Average
Delayed Recall	22.5	0.11	51	102	55	Average
Percent Retention	100					

LANGUAGE

Wechsler Adult Intelligence Scale - 4th ed. (WAIS-IV)
Verbal Comprehension

Similarities	31	1.33		14	91	Superior

Boston Naming Test	57	0.39	54	106	63	Average
# Correct with Phonemic Cue	1					

Narrative Writing — See Body of Report

VISUOSPATIAL AND QUANTITATIVE

Wechsler Adult Intelligence Scale - 4th ed. (WAIS-IV)
Perceptual Reasoning

Matrix Reasoning	24	1.67		15	95	Superior

Rey-Osterrieth Complex Figure Test

Copy	36		64	122	93	Superior

SYMPTOM VALIDITY

California Verbal Learning Test - 2nd ed. (CVLT-II)
Forced Choice Recognition 16/16

MOTOR

Grooved Pegboard

Dominant	55	0.89	59	113	81	High Average
Non-Dominant	59	0.81	58	112	79	High Average

EMOTIONAL, BEHAVIORAL, AND ADAPTIVE

Beck Depression Inventory (BDI-II) 6 — Minimal

PSWQ 34 — Below Cutoff

z-scores have a mean of 0 and a standard deviation of 1.
Standard Scores (SS) have a mean of 100 and a standard deviation of 15.

Notes from 1/1/2004 through 12/29/2014 (cont)

Patient: KEATING,STEVEN WH) 04/29/88 U
Author: Electronically Signed by Clare T. Humphreys, Ph.D.

Signed 10/30/2014 13:35
Visit Date: 10/07/2014

Scaled Scores have a mean of 10 and a standard deviation of 3.
T-scores have a mean of 50 and a standard deviation of 10

Notes from 1/1/2004 through 12/29/2014 (cont)

08/29/2014 **Patient Note** **Final** **Triggs, Daniel Venance,N.P.**

Patient: KEATING,STEVEN WH) 04/29/88 U
Author: Electronically Signed by Daniel Venance Triggs,N.P.

Signed 08/29/2014 12:46
Visit Date: 08/29/2014

August 29,2014

Steven Keating
MRN#

Mr Keating, with his parents and girlfriend, were seen in clinic today for suture removal. His suture line was clean, dry and intact without signs of infection. We discussed post suture care, including keeping the site open to air and keeping it dry for another 24 hours. He was instructed to call the clinic for tempuature greater than 101.5, any drainage or reddness.

We discussed that his pathology was still pending and that I would notify him with the pathology once it is available. We also discussed that he wil be followed by Dr. Wen at DFCI for which he already has an appointment in early September.

He has a good understanding of the above instructions.

_____
Daniel Triggs, ANP-BC
Nurse Practitioner
Dept. of Neurosurgery

Notes from 1/1/2004 through 12/29/2014 (cont)

08/14/2014 **Patient Note** **Final** **Sobieszczyk, Piotr S., M.D.**

Patient: KEATING,STEVEN WH) 04/29/88 U Signed 08/18/2014 15:51
Author: Electronically Signed by Piotr S. Sobieszczyk, M.D. Visit Date: 08/14/2014

I have evaluated Mr. Keating briefly in the recovery room after cerebral angiography. I was examining a different patient and was asked for assistance by the nursing staff. Mr. Keating had an earlier vasovagal episode and had another episode with nausea, diaphoresis and feeling faint. By the time I walked over, he was alert, oriented with normal heart rate, normal pressure, bounding pulses. He reported that this episode felt like the earlier vasovagal event immediately after the angiogram. There was no evidence of arrhythmia. He was stable and no further cardiac evaluation was deemed necessary.

Notes from 1/1/2004 through 12/29/2014 (cont)

08/07/2014 **Note** **Final** **Chiocca, Ennio A., M.D., Ph.D.**

Patient: KEATING,STEVEN WH) 04/29/88 U
Author: Electronically Signed by Ennio A. Chiocca, M.D., Ph.D.

Signed 08/16/2014 10:17
Visit Date: 08/07/2014

Patient: KEATING,STEVEN [ ] M
Date of Visit: 08/07/2014

08/07/2014

RE: KEATING, STEVEN
MRN:

Leigh Firn, MD
MIT Medical
77 Massachusetts Avenue, E23
Cambridge, MA 02139

Dear Dr. Firn,

I am seeing today in followup, Mr. Keating. He decided to undergo surgery. We had a functional MRI showing that his speech area has been pushed by the tumor from its usual location. We discussed with him the risks and complications of the surgery. We will plan to do this with him awake to monitor speech, and also within the Amigo intraoperative MRI suite. I will obtain a CT angiogram to confirm the lenticulo striate vessels are pushed away from the tumor.

All his questions were answered, as well as questions related to the disposition of his tissues for research and other genetic testing.

Sincerely,

_____
Ennio Chiocca, MD, PhD

_____
Ennio A. Chiocca, M.D., Ph.D.

Notes from 1/1/2004 through 12/29/2014 (cont)

08/01/2014 **Note** **Final** **Chiocca, Ennio A., M.D., Ph.D.**

Patient: KEATING,STEVEN WH) 04/29/88 U
Author: Electronically Signed by Ennio A. Chiocca, M.D., Ph.D.

Signed 08/05/2014 13:08
Visit Date: 08/01/2014

Patient: KEATING,STEVEN J [29604774(BWH)] M
Date of Visit: 08/01/2014

08/01/2014

RE: KEATING, STEVEN
MRN:

Leigh Firn, MD
MIT Medical
77 Massachusetts Avenue, E23
Cambridge, MA 02139

Dear Dr. Firn,

This is a 26-year-old right-handed white male who used to live in Canada. In 2007, he participated in a functional MRI research study. At that time, he was called back saying that this was a lesion in his left frontal area. He was told that this lesion could be followed because it was small. Over the years, he has had serial MRI scans, the last one in Canada in October 2010 did not show growth of the lesion. He was then lost to follow up. However, in the last week, he developed the equivalent of a seizure-like activity. This has involved lightheadedness, deja vu type feelings, smells, and left eye twitching. He had no loss of consciousness. These episodes were followed by dull headaches. He was started on Keppra and then on MRI scan was performed. This showed a large left frontal and insular lesion. He comes in today for followup. They obtained my name from a neurosurgeon that knows his PhD advisor. He otherwise has had no speech issues. He had no memory issues.

MEDICATIONS: He is currently taking Keppra 50 mg p.o. twice a day.

FAMILY HISTORY: There is no family history of brain disease of brain cancer.

SOCIAL HISTORY: He does not use of tobacco. He is currently a PhD student and works on 3D printing. He occasionally drinks. He is here not only with his PhD advisor, but also with his parents and other relatives.

PHYSICAL EXAMINATION: On examination, he is completely awake and alert. There are no focal neurological symptoms or signs that I can tell.

IMAGING: His MRI scan shows a large left frontal and insular lesion that involves the operculum in the front where it seems to be involving Broca's area. There is a little bit of the tumor in the left anterior temporal lobe as well. The tumor is T2 and FLAIR hyperintense. It does put pressure with some left and right shift of the brain, particularly anteriorly.

ASSESSSMENT AND PLAN: I had a long discussion with the patient. This is likely a low-grade glioma. We discussed potential approaches. I think we should proceed with a functional MRI as well as a 2HG MRI scan. The functional MRI would be for presurgical planning to distinguish where Broca's area is. Based on this, it would be helpful to also figure out if the functional MRI showed that his speech is totally on the left side, which is what I expect. We will also get a CT angiogram to see where the lenticulostriate vessels are. The plan will be for him to proceed with an attempted gross total resection of the lesion. This could be done with the patient awake and also potentially in the intraoperative MRI suite.

I did discuss some of the risks and complications from the surgery as well. I did tell him that after the functional MRI scan and a CT angiogram, we should meet again at least 1 more time to go over the potential risks. They want to think about their options. They also have a consultation pending or they have already obtained this yesterday from Massachusetts General Hospital. I have told him that either place will be well suited for this operation.

Notes from 1/1/2004 through 12/29/2014 (cont)

Patient: KEATING,STEVEN WH) 04/29/88 U
Signed 08/05/2014 13:08
Author: Electronically Signed by Ennio A. Chiocca, M.D., Ph.D.
Visit Date: 08/01/2014

I did spend over half of the 60-minute visit counseling the patient.

Sincerely,

_____
Ennio Chiocca, MD, PhD

_____
Ennio A. Chiocca, M.D., Ph.D.

Operative Report From 1/1/2004 through 12/29/2014

08/19/2014 **1. Awake left frontotempo** **Signed**

Date of Operation: 08/19/14 Report Status: Signed

SURGEON: CHIOCCA, ENNIO MD

ASSISTANT:
Peleg Horowitz, MD

PREOPERATIVE DIAGNOSIS:
Left frontal insular glioma.

POSTOPERATIVE DIAGNOSIS:
Left frontal insular glioma.

OPERATION:
1. Awake left frontotemporal craniotomy for resection of low-grade glioma (Extensive approach and dissection).
2. Use of intraoperative MRI.
3. Computer assisted stereotactic navigation with the BrainLAB device.
4. Use of microscope.

ESTIMATED BLOOD LOSS:
Less than 100 mL.

SPECIMEN REMOVED:
Left frontal and insular low-grade glioma.

INDICATIONS FOR PROCEDURE:
This is a 27-year-old student who is a student at MIT. Several years ago, he a low-grade glioma diagnosed by MRI scan, which has been followed. The last scan was in 2010. A few weeks ago, he had a seizure and an MRI scan was performed revealing that this tumor has enlarged considerably and this time it involves most of his left frontal lobe, most of his left insula and is generating left to right subfalcine herniation. A functional MRI was performed showing that his speech/Broca's area was displaced superiorly, but there is also speech in the superior temporal gyrus right inferior to the insula as expected. He is brought to surgery for resection of tumor.

DESCRIPTION OF PROCEDURE:
After obtaining informed consent, the patient was brought down to the operating room (AMIGO suite). After the provision of MAC anesthesia, we proceeded to anesthetize areas in his scalp. We provided to perform both a scalp block as well as anesthesia in 3 areas for the pins. This allowed us to fixate his head in a Mayfield cranial pin apparatus. We then proceeded to pin his head onto the Mayfield. His head was slightly turned with the left side up. We then made sure that all of his body parts were well padded and then we proceeded to obtain BrainLAB coordinates. After obtaining the BrainLAB coordinates, we proceeded to prep and drape the left side of his scalp in usual sterile fashion. We then proceeded to anesthesize the area of incision, and then proceeded to make a left frontotemporal incision. We turned the scalp flap over a roll of sponges and a little cuff of temporalis muscles was also incised. We then proceeded to place bur holes in the temporal area and in the frontal area next to the keel. This allowed us to turn a frontotemporal

Operative Report from 1/1/2004 through 12/29/2014 (cont)

craniotomy. After removing the bone flap, we proceeded to bite down from the temporal bone inferiorly as well as some of the frontal bone next to the sphenoid wing. After removing a large piece of sphenoid keel, we proceeded to tent the dura circumferentially. We then proceeded to cut the dura in a circumferential fashion. The brain appeared to be relatively full and therefore, the patient was given mannitol and also Lasix. Preoperatively, he was also given some Decadron. I could see discoloration in the left frontal area in front of the pars triangularis. We proceeded to use the electrocortical stimulator to stimulate and to see whether there was any speech arrest and none was obtained. I then proceeded to make a generous 5-cm corticectomy in his left inferior frontal gyrus. Then tediously over the course of several hours, we painstakingly proceeded to dissect the tumor in a subpial fashion. Inferiorly, we proceeded to dissect the tumor from the base of the frontal lobe until we encountered the olfactory nerve and then proceeded to go further, and then encountered the gyrus rectus and proceeded to remove tumor from the gyrus rectus, until the midline structures were encountered. Inferiorly, I proceeded to dissect tumor off of the sylvian fissure until we proceeded to encounter the insula. I entered the insula in between the perysilvian vessel and proceeded to dissect tumor from this area as well. The patient was speaking well throughout this, but on several instances, especially as I was dissecting superiorly and close to where the corona radiata was, there were instances in which he had more trouble with speech in terms of speech intelligibility. I would then stop and wait for a while and his speech would return to almost normal. However, after several hours of doing this, he was clearly getting very tired. By this time, I dissected the tumor and a couple very large pieces were sent off for pathology as well as additional genetic studies and we had the tumor dissected completely off the anterior cranial fossa in a subpial fashion. I was also removing tumor anteriorly and got into the anterior temporal lobe and proceeded to remove tumor off the anterior temporal lobe. I was able to identify in a subpial fashion, the carotid artery, and then proceeded to dissect the tumor all the way from the top of the ICA to the middle cerebral artery from proximal to distal. We finally encountered the lenticulostriate vessels denoting the medial-inferior part of the tumot. All this part was done using the microscope. Additional dissection more superiorly, led us to encounter the ventricle. There was a small opening in the ventricle, but most of the ventricle wall was left intact. I removed some tumor from the body of the ventricle lateral as well as superior and a little bit inferior. At this point, the patient was still speaking relatively well. We proceeded therefore to obtain intraoperative MRI. The intraoperative MRI appeared to show that we had a greater than 90% resection. There was some T2 abnormalities to the left in the corona radiata as well as posteriorly along the sylvian fissure and along the insula rim.

So we went back into the cavity and when I looked at this, it clearly was a clot rather than tumor in all these areas that I thought were tumor. After removing the clot with the BrainLAB, it seemed that these T2 bright areas were mor consistent with edematous brain or potentially infiltrated brain that potentially could have been eloquent. I therefore desisted from further surgery in this area. We then proceeded to line the cavity with

Operative Report from 1/1/2004 through 12/29/2014 (cont)

large sheets of Surgicel. We made sure the Surgicel was over the edges of the cortex in all directions. After, made sure that there was good hemostasis, I proceeded to close. The dura was closed primarily using interrupted sutures. After closing the dura primarily, the bone flap was put back in position using titanium plates and the middle of the bone flap was tented to the dura. After doing this, we proceeded to irrigate again and proceeded to close temporalis muscle, muscle fascia galea and skin as per routine.

ATTESTATION:
I was present and scrubbed for the entire operation.

eScription documen HSSten Tel

Dictated By: CHIOCCA, ENNIO
Surgeon: CHIOCCA, ENNIO
Dictation ID
D: 08/19/14
T: 08/19/14
Electronically signed by ENNIO A. CHIOCCA, M.D., PH.D. on 08/25/14

Pathology From 1/1/2004 through 12/29/2014

08/22/2014 **Interpretive Lab Test** **Final**

Accession Number: BL14K30690 Report Status: Final
Type: Interpretive Lab Test
Specimen Type: Paraffin embedded brain biopsy / BS14-N41488-B2
Procedure Date: 08/22/2014
Ordering Provider: ENNIO A. CHIOCCA M.D.

CASE: BL-14-K30690
PATIENT: STEVEN KEATING

Pathologist: Lynette M Sholl, M.D.

CLINICAL DATA:

Clinical History: None given.
Clinical Diagnosis: Astrocytoma

DNA was isolated from a brain tumor biopsy, BS14-41488-B2. DNA methylation patterns in the CpG island of the MGMT gene (Genbank accession number AL355531 nt46931-47011) was determined by chemical (bisulfite) modification of unmethylated, but not methylated, cytosines to uracil and subsequent PCR using primers specific for either methylated or the modified unmethylated DNA (Esteller et al. Cancer Res. 1999;59:793-797.) The PCR products were analyzed in duplicate parallel runs by capillary gel electrophoresis. The sensitivity of the assay based on DNA dilutions studies is at least 1:1000.

RESULT:
The analyzed region of the MGMT promoter is partially METHYLATED (1 of 2 aliquots).

INTERPRETATION:
MGMT (O6-methylguanine DNA methyltransferase) is a DNA repair gene. Methylation of the promotor leads to gene silencing and loss of MGMT expression. A recent study that tested the methylation status of the same region of the MGMT promoter in glioblastomas found that MGMT promoter methylation was an independent favorable prognostic factor and was associated with a survival benefit in patients treated with temozolamide and radiotherapy. (Hegi M, Diserans A, Gorlia T et al. MGMT Gene Silencing and Benefit from Temozolomide in Glioblastoma. N Engl J Med 2005;352:997-1003.)

These tests were developed and their performance characteristics determined by the Molecular Diagnostics Laboratory, Brigham and Women's Hospital. They have not been cleared or approved by the U.S. Food and Drug Administration. The FDA has determined that such clearance or approval is not necessary.

Final Diagnosis by Lynette M Sholl M.D., Electronically signed on Wednesday September 03, 2014 at 04:53:20PM

Pathology from 1/1/2004 through 12/29/2014 (cont)

08/19/2014 **Surgical Pathology** **Amend/Addenda**

Accession Number: BS14N41488 Report Status: Amend/Addenda
Type: Surgical Pathology
Specimen Type: LEFT FRONTAL TUMOR
Procedure Date: 08/19/2014
Ordering Provider: ENNIO A. CHIOCCA M.D.

CASE: BS-14-N41488
PATIENT: STEVEN KEATING

********** Addended Report **********
Resident: David Meredith, M.D., Ph.D.
Pathologist: Umberto De Girolami, M.D.

PATHOLOGIC DIAGNOSIS:

A-D. SPECIMEN DESIGNATED "LEFT FRONTAL TUMOR" (FSA, SMA):

NEWLY DIAGNOSED TUMOR (Surgery #1)

DIFFUSE ASTROCYTOMA, W.H.O. Grade 2 (ICD-0 9400/3)

IDH1(R132H) MUTATION POSITIVE (by IHC)
TP53 PROTEIN POSITIVE (by IHC, suggestive of mutation)
BRAF(V600E) NOT DETECTED (by IHC)

NOTE:
There is evidence that the tumor may lie at the higher end of the grade 2 spectrum with focal regions having slightly higher than average cellularity and atypia. Mitotic activity was detected in block B1, but this region was very small (only a few high power fields) and mitoses were not detected in other regions of the tumor. The proliferation rate in the region with mitotic activity and the vast majority of the tumor was low (not exceeding 4%). Therefore while grading as WHO Grade 3 was considered it was not felt to be warranted at this time given the overall findings in a well sampled tumor.

Classification of the tumor as MIXED GLIOMA, WHO GRADE 2 would also be appropriate given that reliable criteria for distinction of diffuse astrocytoma and mixed glioma have not been established and the clinical significance of distinguishing between these two entities is not clear.

The overall size of the resection is very large.
The tumor infiltrates adjacent brain parenchyma.

W.H.O. Histologic Grading Criteria
Cellularity: moderate
Atypia: moderate
Mitoses: present (but small focal region only)
Vascular Proliferation: not present
Necrosis: not present

Immunohistochemistry performed at BWH demonstrates the following staining profile in lesional cells (block B1):

OLIG2 positive (50% of cells, c/w astrocytoma)
GFAP positive (weak, variable)
IDH1(R132H) positive (possibly heterogeneous ~70% of cells)
TP53 positive (50% of cells)

Pathology from 1/1/2004 through 12/29/2014 (cont)

```
Synaptophysin       negative, no abnormal neurons
NeuN                     negative, no abnormal neurons
SMI31               negative, no abnormal neurons
BRAF(V600E)              negative
```

The formally quantified MIB-1 proliferation index is 2% (computer aided, block B1; 4/231 cells counted).

Analysis for MGMT promoter methylation status will be performed (block B2) and the results reported separately by the BWH Center for Advanced Molecular Diagnostics.

Array comparative genomic hybridization (Oncocopy) will be performed (block C1) and results reported separately by the Cytogenetics laboratory.

Somatic mutation profiling (Oncopanel) will be performed (patient consented to Oncopanel study 11-104).

```
Tumor Tissue Adequacy:              Large {>1.0 cm in multiple blocks}
Primary Advanced Study Block:       C1, 2.5 cm (t60 n00), scrolls ok
Secondary Advanced Study Blocks:    B1, 2.5 cm (t60 n00), scrolls ok
Clinical trial block:               C1
Tissue Microarray Block:            C1
MGMT block:                         B2
Tissue submitted to tissue bank:    Yes
Clinical frozen tissue:       Yes
Consent Status for Tissue Research:     Full 11-104, 10-417
```

The case was reviewed at the Neuropathology Staff Conference.

PATHOLOGY CLINICAL NOTES: 26 year old male with non-enhancing left frontal mass discovered in 2007 via research fMRI. Followed with serial scans until 2010. Now presents with seizure-like symptoms and increased size of the mass compared to last imaging in 2010.

CLINICAL DATA:
History: Not given.
Operation: Not given.
Operative Findings: Not given.
Clinical Diagnosis: Left frontal tumor.

TISSUE SUBMITTED:
A/1. Left frontal tumor.
B/2. Left frontal tumor.
C/3. Left frontal tumor.
D/4. Left frontal tumor.

O.R. CONSULTATION:
SPECIMEN LABELED "#1. LEFT FRONTAL TUMOR" (FSA, SMA):
Glioma without definite anaplastic features; further classification and final grading awaits permanent sections.

OR Consultation by: Umberto De Girolami, M.D.
Resident: David Meredith, M.D., Ph.D.

The senior physician certifies that he/she personally conducted a gross and/or microscopic examination of the described specimen(s) and rendered or confirmed the rapid diagnos(es) related thereto.

Pathology from 1/1/2004 through 12/29/2014 (cont)

GROSS DESCRIPTION:
The specimen is received fresh, in four parts, each labeled with the patient's name and unit number.

Part A, labeled "#1 Left frontal tumor" consists of an irregular, tan-pink, gelatinous soft tissue fragment (4.0 x 1.6 x 0.9 cm). A representative section is frozen as FSA and smeared as SMA. Representative sections are submitted for research and for Oncopanel.

Micro A1: FSA remnant, 1 frag, ESS.
Micro A2: Multi frags, ESS.

Part B, labeled "#2 Left frontal tumor" consists of an irregular, tan-white to tan-gray soft tissue fragment (4.5 x 2.5 x 2.0 cm). A representative section is given to the tissue bank, clinically frozen and given for research. The remainder is entirely submitted.

Micro B1-B2: Multi frags toto, ESS.

Part C, labeled "#3 Left frontal tumor" consists of multiple tan-pink soft tissue fragments (4.0 x 3.0 x 2.0 cm in aggregate). A representative section is given for research and clinically frozen. The remainder is entirely submitted.

Micro C1-C4: Multi frags toto, ESS.

Part D, labeled "#4 Left frontal tumor" consists of multiple irregular, tan-white soft tissue fragments (2.8 x 1.7 x 1.2 cm in aggregate), which are submitted in toto.

Micro D1-D2: Multi frags, ESS.

CASE NUMBER: 41488

Dictated by: Taft, Kristin

By his/her signature below, the senior physician certifies that he/she personally conducted a microscopic examination ("gross only" exam if so stated) of the described specimen(s) and rendered or confirmed the diagnosis(es) related thereto.

Final Diagnosis by Keith L Ligon M.D., Ph.D., Electronically signed on Saturday September 06, 2014 at 07:35:53PM

ADDENDUM:

Results of Oncocopy (array CGH) were reviewed and found to support the histopathologic diagnosis of a low grade glioma without unfavorable features.

INTEGRATIVE DIAGNOSIS (including histopathology, IHC, and array CGH results):

DIFFUSE ASTROCYTOMA
GRADE 2
IDH1(R132H) MUTATION POSITIVE

This concludes all planned clinical testing on the case.

Pathology from 1/1/2004 through 12/29/2014 (cont)

Addendum #1 by Keith L Ligon M.D., Ph.D., Electronically signed on Saturday September 06, 2014 at 07:39:30PM

Pathology from 1/1/2004 through 12/29/2014 (cont)

08/19/2014 **Cytogenetics** **Final**

Accession Number: CG14R05315 Report Status: Final
Type: Cytogenetics
Specimen Type: cg-FFPE
Procedure Date: 08/19/2014
Ordering Provider: ENNIO A. CHIOCCA M.D.

CASE: CG-14-R05315
PATIENT: STEVEN KEATING
Cytogeneticist: Ligon Ph.D., Azra Hadi

SOLID TUMOR ARRAY CGH ANALYSIS

RESULT:
arr[hg19]
3q26.31q28(171,681,429-188,500,069)x3,7p22.3q26.2(42,976-155,143,600)x3,(8)x3

INTERPRETATION:
Several copy number changes were identified following array comparative genomic hybridization (aCGH) of this formalin-fixed, paraffin-embedded (FFPE) primary brain tumor specimen. The following genomic imbalances were noted:

(1) a 16.8 Mb single copy gain of 3q, which includes PIK3CA and SOX2,

(2) polysomy 7

(3) polysomy 8

The findings are CONSISTENT the histopathologic diagnosis of a DIFFUSE ASTROCYTOMA WHO GRADE 2 or other low grade IDH-mutated astrocytoma/mixed glioma.

Gains involving Chr 7 and 8 are common in diffuse astrocytoma. In isolation however, they are not specific or diagnostic of low grade glioma or any other tumor type.

Aberrations commonly correlated with less favorable outcomes in diffuse astrocytoma (PTEN/10q loss, CDKN2A/9q loss, etc) are NOT DETECTED.

The findings are NOT CONSISTENT with an oligodendroglioma as there is no evidence for 1p/19q co-deletion.

See Table 1 (below) for a list of selected genes/regions that were evaluated specifically for this interpretation.

COMMENTS:
Array - based comparative genomic hybridization (aCGH) was performed using the stock 1x1M Agilent SurePrint G3 Human CGH Microarray chip to identify tumor - specific genomic copy number changes. Genomic DNA isolated from the FFPE specimen submitted was hybridized with genomic DNA isolated from a reference DNA sample representing a pool of karyotypically normal individuals (Promega, Madison, WI). The array platform contains 963,029 probes spaced across the human genome with a 2.1 kb overall median probe spacing and a 1.8 kb probe

spacing in RefSeq genes. A genomic imbalance is reported when a minimum of eight (8) consecutive probes, which correspond to approximately 14-16 kb, show an average log2 ratio above +0.18 or below -0.30. Amplifications are reported when an average log2 ratio for a given interval is equal to, or greater than, +2.0.

This assay cannot exclude: (1) chromosome imbalances when the proportion of tumor cells in the original sample is less than 50%; (2) chromosome imbalances smaller than the resolution of the chip, or (3) tumor heterogeneity, particularly if an abnormal clone is not sufficiently represented in the original sample. This assay is not designed to identify balanced chromosomal rearrangements (e.g., balanced reciprocal translocations, inversions or insertions), ploidy changes, uniparental disomy or DNA methylation. The composition of this array is based on the UCSC hg19 (GRCh37), Feb. 2009 (http://genome.ucsc.edu/cgi-bin/hgGateway). This test was developed and its performance determined by the BWH Cytogenetics Laboratory as required by the CLIA '88 regulations. This test is used for clinical purposes.

INDICATION FOR TEST:
Astrocytoma
BS14-N41488-C1

TABLE 1:

Gene/Region	Chromosome Band	Copy Number Change	Nucleotides (GRCh37//hg19)
MYCL1	1p34.2	No change detected	
CDKN2C	1p33	No change detected	
PIK3C2B	1q32.1	No change detected	
MDM4	1q32.1	No change detected	
AKT3	1q44	No change detected	
MYCN	2p24.3	No change detected	
PIK3CA	3q26.32	16.8 Mb single copy gain	chr3:171,681,429-188,500,069
SOX2	3q26.33	16.8 Mb single copy gain	chr3:171,681,429-188,500,069
FGFR3	4p16.3	No change detected	
PDGFRA	4q12	No change detected	
MYB	6q23.3	No change detected	
PARK2	6q26	No change detected	
EGFR	7p11.2	Single copy gain/polysomy	chr7:42,976-155,143,600
EGFRvIII	7p11.2	Not detected	
CDK6	7q21.2	Single copy gain/polysomy	chr7:42,976-155,143,600
MET	7q31.2	Single copy gain/polysomy	chr7:42,976-155,143,600
BRAF	7q34	Single copy gain/polysomy	chr7:42,976-155,143,600
FGFR1	8p11.23-p11.22	Single copy gain/polysomy	chr8:161,472-145,978,744
MYC	8q24.21	Single copy gain/polysomy	chr8:161,472-145,978,744
CDKN2A	9p21.3	No change detected	
PTEN	10q23.31	No change detected	
FGFR2	10q26.13	No change detected	
CCND2	12p13.32	No change detected	
CDK4	12q14.1	No change detected	
MDM2	12q15	No change detected	
RB1	13q14.2	No change detected	
TP53	17p13.1	No change detected	
NF1	17q11.2	No change detected	
INI1	22q11.23	No change detected	

Pathology from 1/1/2004 through 12/29/2014 (cont)

```
NF2  22q12.2   No change detected
1p-  N/A  Whole arm loss not detected
4p-  N/A  Whole arm loss not detected
Monosomy 6     N/A  Not detected
6q-  N/A  Whole arm loss not detected
Polysomy 7     N/A  Detected  chr7:42,976-155,143,600
7p-  N/A  Whole arm loss not detected
Monosomy 10    N/A  Not detected
10q- N/A  Whole arm loss not detected
11p- N/A  Whole arm loss not detected
Monosomy 14    N/A  Not detected
idic(17p11.2)  N/A  Not detected
18q- N/A  Whole arm loss not detected
19q- N/A  Whole arm loss not detected
Monosomy 22    N/A  Not detected

Other:
 Polysomy 8    N/A           Detected
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REPORT by Azra Hadi Ligon Ph.D., on Wednesday September 03, 2014 at 11:30:18AM
Final Diagnosis by Keith L Ligon M.D., Ph.D., Electronically signed on Saturday September 06, 2014 at 06:30:36PM

Radiology From 1/1/2004 through 12/29/2014

11/05/2014 17:11 MR Brain w/w/o Contrast AND FurSeq Final

Exam Number: A14026450 Report Status: Final
Type: MR Brain w/w/o Contrast AND FurSeq
Date/Time: 11/05/2014 17:11
Exam Code: MS0553
Ordering Provider: WEN MD, PATRICK YUNG
REPORT:

MRI BRAIN PRE AND POST IV CONTRAST

INDICATION: SSX:Perfusion imaging +/- Gad, flair, HX:Glioma. Per electronic medical record, patient is a 26-year-old male with history of left frontal astrocytoma grade 2 status post resection in August 19, 2014 currently in consideration for radiation therapy.

COMPARISON: December 5, 2007, August 8, 2014, August 20, 2014, and October 1, 2014

TECHNIQUE: Multiplanar, multisequence imaging of the brain was performed both pre- and post contrast administration.

24 mL of gadolinium contrast (Magnevist) was administered IV, uneventfully.

The following specific sequences were acquired: 3 plane localizer, sagittal T1, axial FLAIR, coronal FLAIR, sagittal T1 preand postcontrast, susceptibility weighted, axial T2, axial diffusion-weighted with ADC map, 3-D axial T1 MP rage with coronal and sagittal reformats, and perfusion sequences.

FINDINGS:
Postsurgical change related to prior left frontal craniotomy and resection of the nonenhancing mass is again seen with areas of susceptibility, consistent with hemorrhagic products from surgery. The small subdural collection layering along the left frontal lobe is again seen, which appears to have redistributed without significant change in size compared to prior exam and also demonstrates mild mass effect with partial effacement of sulci and mild 4 mm left to right midline shift. The resection cavity size has decreased in size compared to October 1, 2014. Minimal areas of dural enhancement and rim enhancement within the resection cavity is again seen, similar/slightly improved compared to prior exam and is likely related to postsurgical change. There is no evidence of enhancing masses or intermediate restricted diffusion to suggest high cellularity.

In the superior medial region of the resection cavity, the area of thickened, nodular nonenhancing T2 signal abnormality appears slightly increased compared to October 1, 2014 with evidence of gradual increase in size and diffusivity in comparison to August 8, 2014. There is also subtle increase in nonenhancing abnormal T2 prolongation within the right inferior medial frontal lobe in the region of anterior commissure in comparison to October 1, 2014 and also to August 18, 2014 which is concerning for minimal progression of infiltrative tumor.

There is no evidence of ependymal nodules or abnormal areas of dural enhancement or leptomeningeal spread of disease.

Radiology from 1/1/2004 through 12/29/2014 (cont)

There is no evidence of infarction. Similar linear CSF intensity lesions are seen within the corpus callosum, unchanged from 2007 and most likely represents anatomic variant of dilated perivascular space. The ventricles and sulci are mildly prominent, however is unchanged compared to prior exam. Right maxillary sinus mucus retention cyst. Otherwise rest of the visualized paranasal sinuses and mastoid air cells are clear. Orbits are unremarkable. There are normal flow-voids in the major intracranial vessels. The skull base and calvarium demonstrate normal signal.

Perfusion: There are no abnormal areas of increased blood volume.

IMPRESSION:
1. Gradual increase in volume of nodular low cellularity, low vascularity tumor at the left superior medial aspect of resection cavity since August 2014 with very slight increase in comparison to October 1, concerning for gradual progression of nonenhancing low grade tumor. Attention at follow up is suggested.
2. Very gradual increase in nonenhancing abnormal along the inferior medial right frontal lobe and anterior commissure concerning for very gradual infiltrative progression. Attention at follow up is suggested.
3. Interval decrease in size of the resection cavity likely related to evolution of postoperative findings and slight growth of nodular lesion along the left superior medial aspect of resection cavity.
4. Interval redistribution of left frontal subdural collection without definite change in size or mild mass effect and minimal midline shift.

I, the teaching physician, have reviewed the images and agree with the report as written.

1.

This report was electronically signed by GEOFFREY YOUNG MD(T)

RADIOLOGISTS:

KIM, (R), HANSOL MD
YOUNG, MD(T), GEOFFREY S

SIGNATURES:

YOUNG, MD(T), GEOFFREY S

Finalized on: 11/06/2014 18:28

Radiology from 1/1/2004 through 12/29/2014 (cont)

10/01/2014 16:22 MRI BRAIN W W/O CONTRAST 70553 Final

Exam Number: A13960521 Report Status: Final
Type: MRI BRAIN W W/O CONTRAST 70553
Date/Time: 10/01/2014 16:22
Exam Code: 77790
Ordering Provider: WEN MD, PATRICK YUNG
REPORT:

MRI BRAIN WITH AND WITHOUT IV CONTRAST

INDICATION: 26-year-old male with glioma.

COMPARISON: MRI from August 20, 2014

TECHNIQUE: Multiplanar, multisequence MRI of the brain was performed with and without IV contrast. The following sequences were obtained: 3 plane localizers, sagittal T1, coronal FLAIR, axial FLAIR, T1 weighed images were performed without contrast. During 22.5 ml Magnevist intravenous gadolinium contrast administration, dynamic perfusion axial EPI images with delayed axial T2, DWI, T1 and 3-D SPGR images with coronal and sagittal reformation were performed. Perfusion data was postprocessed off-line by the interpreting radiologists and CBV maps were produced.

FINDINGS:

Postoperative changes from prior left frontal craniotomy including a resection cavity in the left frontal lobe are noted with near complete resolution of blood product within the cavity and interval decrease in the size of cavity. The subdural collection along left convexity has slightly increased. The pneumocephalus has resolved. The regions of T2 prolongation surrounding the resection cavity has not significant changed, although the thickness of abnormality medially and posteriorly slightly increased which could be secondary to contraction of resection cavity. There is no focal decreased diffusivity. Following contrast administration, there is mild linear enhancement along the cavity.

Perfusion imaging shows no evidence of increased blood volume in the regions of signal abnormality or elsewhere in the brain.

IMPRESSION:

Postsurgical changes with a resection cavity in the left frontal lobe, with interval slight increase in the size of subdural collection along left convexity. The regions of T2 abnormality medial and posterior to the cavity appear slightly more prominent, which may be secondary to contraction of cavity versus nonenhancing tumor growth. Mild linear enhancement along cavity most likely postsurgical. No evidence of enhancing, hypervascular or hypercellular tumor progression.

Critical results were communicated and documented using the Alert Notification of Critical Radiology Results (ANCR) system.

Radiology from 1/1/2004 through 12/29/2014 (cont)

This report was electronically signed by RAYMOND HUANG MD(T)

RADIOLOGISTS:

HUANG, MD(T), RAYMOND

SIGNATURES:

HUANG, MD(T), RAYMOND

Finalized on: 10/01/2014 17:36