And shepherds we shall be,
for Thee, my Lord, for Thee.
Power hath descended forth from Thy hand,
that our feet may swiftly carry out Thy command.
So we shall flow a river forth to Thee
and teeming with souls shall it ever be.
In nomine Patris, et Fili, Spiritus Sancti.

VERITAS AÉQUITAS
ON THE OTHER SIDE:

OPTIMIZING TOXICITY MANAGEMENT IN CONCURRENT RAD-
CHEMOTHERAPY AND THE ROLE OF SURVIVORSHIP
PROGRAMS FOR HEAD & NECK CANCERS

BRENT D. MURPHY, MS, DABR
CERTIFIED MEDICAL PHYSICIST
DISCLOSURES

• HILLBILLY FROM INDIANA
• PRESIDENT, RADIOLOGICAL TECHNOLOGIES UNIVERSITY
• PRESIDENT, ADVANCED RADIOTHERAPY CONSULTING
• INITIATIVE INTERESTS
  • DOSIMETRY PRACTITIONER CERTIFICATION
  • INTERNATIONAL ASSOCIATION OF MEDICAL DOSIMETRY
  • ARC-EDGE: 35 HOUR VIRTUAL ADVANCE PLANNING COURSE POWERED BY ProKnow
THE CURRENT BATTLEFIELD

• INTEGRATIVE CARE: SURGERY, CHEMOTHERAPY, RADIATION THERAPY
  • NEW PROCEDURES
  • NEW DRUGS
  • NEW TECHNOLOGIES

• INFORMATICS
  • TUMOR BOARDS
  • CASE WORKERS
  • ELECTRONIC MEDICAL RECORDS

• WHAT ABOUT TOXICITY MANAGEMENT?
  • REACTIVE NOT PROACTIVE
  • NURSE TRAINING

• WHAT ABOUT SURVIVORSHIP?
  • RECOVERY → SURVIVORSHIP
  • NO REVENUE GENERATION
  • RESOURCE DRAIN
OUTLINE & OBJECTIVES

- OUTLINE
- CASE PRESENTATION
- TOXICITY MANAGEMENT
- SURVIVORSHIP

- OBJECTIVES
- A FEW TECHNICAL REMINDERS
- UNDERSTAND WHAT ARE PATIENTS GO THROUGH
- SURVIVORSHIP RESOURCES
- ROLE OF DOSIMETRY IN THIS → WHAT IS IMPORTANT!
CASE STUDY: PATIENT BACKGROUND

- 49 YR OLD WHITE MALE
- NON SYMPTOMATIC
- SINUS INFECTIONS
- WORN DOWN FROM INTERNATIONAL TRAVELS
- CYST / PIMPLE ON NECK
  - DISMISSED BY NP
  - 2ND AND 3RD POPPED UP
  - SURGICAL ONCOLOGIST
- BIOPSY ON NECK CAME BACK POSITIVE
INITIALLY, THE FIRST 72 HOURS:

- THURSDAY: 3 PHONE CALLS
- THURSDAY: TEACHING ARC STUDENTS
- THURSDAY NIGHT: ST. ELMO’S
- FRIDAY: WORKING WITH PROCURE
- SAT/SUN: PREP WITH FAMILY
  - THE PLAN & DISTRIBUTION
- INITIAL THOUGHTS
- CHARLIE MIKE: CONTINUE MISSION
- THE CALL TO MOM ON DRIVE TO INDY
- NO FEAR
  - GLAD I HAD IT
  - WHAT CAN I LEARN / TEACH
WHY NO FEAR

- CENTER FOR CANCER CARE, GOSHEN, IN
- COMPREHENSIVE CANCER CARE CENTER
- HOME OF RADIATION ONCOLOGY RESOURCES
- HIRED AND TRAINED THE TEAM
  - RAD ONC, PHYSICS, DOSIMETRY, THERAPISTS
  - RAD ONC NURSES, CHEMO NURSES
- TOMOTHERAPY: TRAINED UNDER INVENTOR
THE WORK UP: MARCH 4, 2013

- CHEST X-RAY
- EKG
- 3 CONSULTS (SURGERY, CHEMO, RT)
- DIAGNOSTIC CT
- MRI
- PET-CT
- CT-SIMULATION (DISCUSS)
- BIOPSY X 4
- SCOPE
- SPEECH THERAPIST
- PORT PLACEMENT
FINDINGS

• BIOPSY & IMAGING
• T-4AN2MO SCC
• BASE OF TONGUE CANCER
• TONSILLAR CANCER
• ALL 4 QUADRANTS HOT
• BILATERAL LYMPH NODES
  • 14 NODES

• PTV 70: 596 CC
TREATMENT STRATEGY

• **INDUCTION CHEMO**
• **3 ROUNDS OF 3 WEEKS**
• **TPF**
  - **TAXOTERE**
  - **CISPLATIN**
  - **5-FU DRIP**
• **1 WEEK BREAK**

• **RT / CHEMOTHERAPY**
• **7 WEEKS RT DAILY**
  - **IGRT**
  - **TOMOTHERAPY**
  - **ADAPTIVE PLANNING**
• **WEEKLY CISPLATIN**
THE DEAL WITH THE RAD ONC

• THE PLAN: 70/63/56 INTEGRATED BOOST

• WHAT I WANTED
  • MEAN PTV70 DOSE OF 75 GY
  • BID ON FRIDAYS
  • SBRT BOOST IF POST TX PET > 2.5
  • SBRT BOOST DOSE: 15-20 GY

• DOC: “BRENT, I AM GOING TO HURT YOU. AND THEN, I WILL TREAT YOUR PROSTATE IN 30 YEARS”

• BRENT: “YOU HAVE A DEAL, THANK YOU SIR”
**TAXOTERE**

- **BINDS TO THE B SUBUNIT OF TUBULIN AND STABILIZES MICROTUBULES**
- **INTERRUPTS MITOSIS → CELL DEATH**

**MY PERSPECTIVE:**
- BAD ASS
- SPECIFIC
- IMAGERY: FELT EVERY NODE

**SIDE EFFECTS**
- ANEMIA & LOW PLATELET COUNT
- NAUSEA, VOMITING, DIARRHEA
- FATIGUE
- MOUTH SORES
- HAIR LOSS
- NEUROPATHY
- SKIN REACTIONS

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**CISPLATIN (PLATINOL)**

- Binds to guanine on DNA, forming inter and intra-strand crosslinks, inhibiting DNA synthesis

- My perspective:
  - Distant metastases
  - Metallic taste

- Severe nausea and vomiting
- Nephrotoxicity
- Ototoxicity – high frequency hearing loss
- Neurotoxicity - paresthesias, loss of proprioception
- Mild hematologic toxicity – allows combination of other chemo
5 FU

- ANTIMETABOLITE
- DEPRIVES CELLS OF ESSENTIAL PRECURSORS OF DNA SYNTHESIS
- LACK OF THYMIDINE $\rightarrow$ IMBALANCE CELL GROWTH $\rightarrow$ DEATH

- MUCOSITIS
- BONE MARROW SUPPRESSION
- DIARRHEA, NAUSEA, VOMITING, PAIN
- HAIR LOSS
- ANOREXIA
RT / CHEMOTHERAPY

- RT PRESCRIPTION
  - TOMOTHERAPY: 6MV HELICAL IMRT
  - 35 FRACTIONS
  - DOSE: 70 GY / 63 GY / 56 GY
  - THE PLAN: RUN HOT! THE DISCUSSION!
  - GOAL: NO BREAKS
  - FEEDING TUBE
- CHEMOTHERAPY: WEEKLY CISPLATIN (PLATINOL)
DOSE CLOUDS: PLANS RUN BY ROR
DOSE METRICS

• PTV70: MEAN DOSE: 73 GY
• PTV63: MEAN DOSE: 69 GY
• PTV56: MEAN DOSE: 61 GY

• HOT SPOTS PUSHED INTO GTV-PET

• MY THOUGHTS ON DOSE HOMOGENEITY

• RT PAROTID: MEAN: 46 GY
• LT PAROTID: MEAN: 41 GY
• RT SUBMANDIBULAR: MEAN: 71 GY
• LT SUBMANDIBULAR: MEAN: 71 GY
• CORD: MAX 23 GY
• LARYNX: MEAN: 55 GY
ON THE OTHER SIDE

- MUST BE A COOPERATIVE PATIENT
- MENTAL PREPARATION → MENTAL OPTIMIZATION
  - WARRIOR
  - BOONDOCK SAINT
- MIND/BODY/SCIENCE → OPTIMIZATION WAS KEY
  - MENTAL PREP
  - FITNESS
  - TECHNOLOGIES
  - NATUROPATHY
NATUROPATHIC MEDICINE: GOSHEN

• HERBAL MEDICINES
• VITAMINS & MINERAL SUPPLEMENTS
• DIET & NUTRITION
• IMAGERY
• ACUPUNCTURE
• PSYCHO-SOCIAL
TREATMENT SIDE EFFECTS (SUBSET) INDUCTION CHEMO (30 OF 31)

- SKIN REACTION
- RINGING EAR
- HEARING SENSITIVITY
- MUCOSITIS
- MALICE
- CHANGE IN TASTE
- NEUROPATHY
- INTESTINAL PAIN
- BLOOD COUNT
- HAIR LOSS
- CHEMO BRAIN (OZZY)
HOW MANAGED

• ***TOXICITY TOOL CHEST***
• EXERCISE / WEIGHT MANAGEMENT
• BASELINE TESTING
• MENTAL PREPARATION
• LIVING IN THE BUBBLE
• TX PREP

• TOXICITY TOOL CHEST
• 2-5 DEEP IN ACTION ITEMS
• 1 AND DONE, NO NONSENSE
• BLENDING
  • LITERATURE
  • TECHNOLOGY
  • NATUROPATHIC MEDICINE
  • OUT OF THE BOX THINKING
INTESTINAL PAIN

• CONVENTIONAL CHEMO ADMINISTERED
• PATIENT IN A RECLINER FOR 2 – 6 HOURS
• MANY EXPERIENCE ABDOMINAL PAINS, CRAMPING, NAUSEA, DIARRHEA
• TOXICITY TOOL CHEST
  • BIKE
  • WALK AROUND
  • GLUTAMINE
  • ICE CHIPS
  • HYDRATION
MUCOSITIS

- TOXICITY TOOL CHEST
- HYDRATION AND IV’S
- MOUTH CARE: SALT WATER
- GLUTAMINE RINSES
- ZINC LOZINGERS
- WATER PIC
RINGING EAR

- TOXICITY TOOL CHEST
- IMMEDIATELY ATTACK IT
- DIVING EXERCISES
  - NOSE, JAW, EAR
  - BODY POSITION
- MENTALLY DEFEAT IT
PALACE MALICE (JUNE, 2013)

PALACE MALICE is an American Thoroughbred racehorse best known for winning the 2013 Belmont Stakes.
MALICE

• THE INTENTION OR DESIRE TO DO EVIL
• MY PERSONAL MISSION: FURTHER THE SUCCESSES OF OTHERS
• NEVER EVER WANTED TO HURT ANYONE
• FORTUNATELY, FOCUS WAS ON HURTING THINGS: MATERIAL THINGS

• TOOL CHEST
• MY BAT
• MY GUNS
• SOLUTION: IMMEDIATELY ADDRESS
TOOL CHEST: MALICE
BLOOD COUNTS

• CHEMOTHERAPY SUPPRESSED BLOOD COUNTS
• BLOOD COUNTS WERE A KEY: WEEKLY CHECK
• NO HOSPITALIZATION

• TOOL CHEST
• HEAVY WEIGHTS
• NATURAL WAYS
  • RBC: IRON RICH FOODS
  • WBC: VITAMINS / MINERALS
• BEET JUICE
TREATMENT SIDE EFFECTS
CONCURRENT RT AND CHEMO

- SIDE EFFECTS
- SKIN REACTION
- MOUTH SORES
- MUCOSITIS
- LOSS OF SWALLOWING
- LOSS OF VOICE
- FATIGUE
- MALICE
PRE TREATMENT ROUTINE: 20 MIN

- POWER OF PRAYER
- SKIN CARE: ALL DRY
- MOUTH CARE: CLEAN, GARGLES
- MEDITATION & IMAGERY
- IN THE TOMO ROOM: VERITAS AND AEOQUITAS
POST TREATMENT ROUTINE: 20 MIN

• MOUTH CARE: RINSES
• SKIN CARE: TEA EXTRACTS
• SWALLOWING DRILLS
• 40 SWINGS: NECK AND SHOULDER EXERCISES
• MAGIC GEL
SKIN EFFECTS: CHEMO

- TOXITY TOOL CHEST
- COCONUT OIL
- GREEN TEA
- DANDELION TEA
SKIN EFFECTS: RADIATION

- TARGET SIZE AND PROXIMITY TO SKIN
- TOMOTHERAPY SKIN DOSE
- RADIATION SKIN EFFECTS
- SYNERGY WITH CHEMOTHERAPY
TREATMENT SIDE EFFECTS MANAGED!
CONCURRENT RT AND CHEMO
COOL MAGIC HYDROGEL

• SEMI-OCCULSIVE: ALLOWS FLOW OF OXYGEN
• PREVENTS BACTERIA AND FOREIGN MATTER FROM ENTERING WOUND
• HYDROPHILIC AND ABSORPTIVE – ABSORBS THREE TIMES ITS WEIGHT
• COOLS LIVE NERVE ENDINGS DUE TO 90% WATER-10% POLYETHYLENE FORMULATION
• WILL NOT DAMAGE TISSUE WHEN REMOVED
BACK TO SCIENCE: PRE & POST CHEMO PET
THE PET-CT SCAN: SUV DEPENDENCIES

- Region of Interest Defined
- Activity Injected
- Plasma Glucose Levels
- Competition with Endogenous Glucose
- Rate of Phosphorylation
- Body Size and Body Composition
- Tumor Type
- Scanner SNR Properties
- Image Reconstruction Algorithm
- Time Between Image Injection and Acquisition
**SUV & GTV DELINEATION: HEAD / NECK CASES**

<table>
<thead>
<tr>
<th>Author (Ref)</th>
<th>Method of Target Delineation</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paulino</td>
<td>50% Isointensity Level</td>
<td>25% of Patients under-treated with IMRT when PET-GTV not used</td>
</tr>
<tr>
<td>Heron</td>
<td>Visualization</td>
<td>40% Patients had additional disease not visualized on CT</td>
</tr>
<tr>
<td>Wang</td>
<td>SUV 2.5</td>
<td>In 50% of cases, PET-CT based GTV different from CT-based GTV</td>
</tr>
<tr>
<td>Ashamalla</td>
<td>Halo</td>
<td>68% had significant GTV modification based on use of PET/CT</td>
</tr>
<tr>
<td>Geets</td>
<td>Segmentation Algorithm</td>
<td>PET-GTV significantly smaller than CT or MRI based GTV. Decreased dose to ipsilateral parotid glands.</td>
</tr>
</tbody>
</table>
PET-CT GTV REDUCTION AFTER 3 ROUNDS OF CHEMO
BACK TO SCIENCE: POST-CHEMO PET
WHAT IS THIS?

- PET-CT GTV REDUCTION AFTER 3 ROUNDS CHEMOTHERAPY
- NEUPOGEN GIVEN DURING CHEMOTHERAPY TO INCREASE BLOOD COUNTS
- LESS UPTAKE IN THE BRAIN
- HIGH UPTAKE IN THE VERTEBRAE
BACK TO SCIENCE: POST-RT PET

- **SUV HISTORY**

- **PRE TREATMENT PET:** SUV MAX: 7.6
  - 4 QUADRANT TONSILLARY / BASE OF TONGUE
  - 14 NODES WITH SUV > 3.3

- **POST CHEMO PET:** SUV MAX: 3.3
  - LIMITED VOLUME

- **POST RT-CHEMO PET:** NO VOLUME > SUV 2.5
WINNING THE TREATMENT BATTLE: THE TOP 10

- TIME, PLAN, LOG
- SUPPORT TEAM
- TOXICITY TOOL CHEST
- HYDRATION
- CALORIES (5,000 - 6,000)
- ENSURE
- MAGIC GEL
- COCONUT OIL
- GLUTAMINE
- SALT WATER
WINNING THE TREATMENT BATTLE: QUESTIONABLE POSITIVE ATTRIBUTES

- GUINNESS THROUGH THE NG TUBE
- ABSOLUTE CRANBERRY THROUGH THE NG TUBE
- MENTAL DISCUSSIONS WITH THE
- THE WIFE’S PRAYER
- BOONDOCK SAINTS ROUTINE
- HAVING FUN WITH IT
- SWORD SWALLOWERS ASSOCIATION
WHAT MY POOR WIFE WOULD COME HOME TO....DID IT HELP?
WHY DON’T ALL PATIENTS DO THIS

• TIME: 4-6 HOURS A DAY
• SUPPORT
• KNOWLEDGE
• RESOURCES

• DAILY ROUTINE
• EXERCISE: 90 MINUTES
• PREP / TREAT / POST
• TOXICITY TOOL BOXES
RECOVERY INITIAL THOUGHTS

• INDUCTION CHEMO: FOUGHT THROUGH AND WON
• RT/CHEMO: NO BREAKS: FOUGHT THROUGH AND WON
• NO WEIGHT LOSS!
  • AVERAGE OVER 5,000 CALORIES PER DAY
  • BLENDED MEALS AND ENSURE

• RECOVERY:
  • WE ARE DONE.
  • WE KILLED CANCER.
  • WE ARE HOME FREE.
  • SHOULD BE GOOD IN 2 WEEKS.
TRANSITION TREATMENT TO RECOVERY

• THE DIFFERENCE
  • TREATMENT: REGIMENTED SCHEDULE AND OBJECTIVES IN PLACE
  • RECOVERY: NOT KNOWING WHAT TO EXPECT

• CHALLENGES THAT I COMPLETELY UNDERESTIMATED.
  • FATIGUE
  • MENTAL
RECOVERY
EMOTIONAL SPECTRUM

• FEARS
  • WHY NOT FEELING BETTER?
  • IS THE CANCER WINNING?
• ANXIETY FOR EVENTS
  • FAMILY FUNCTIONS
  • WORK
  • FULL EXERCISE

• MALICE
  • PATIENCE LEVEL
  • ANGER MANAGEMENT
  • DEADBEATS
  • STUPIDNESS
  • STAGNANT ACTIVITIES
  • JUST THINGS
RECOVERY
CAN YOU FEEL NORMAL

• NORMAL BEFORE:
  • 10-14 HOUR WORKDAYS
  • FAMILY EVENTS ON THE FLY
  • 4-5 HOURS SLEEP

• DEFINING THE NEW NORMAL
  • WORKDAYS: 6-8 HOURS
  • FAMILY: PLANNED, SCHEDULE
  • SLEEP: 6-8 HOURS SLEEP AND NAPS

• WHAT HELPS
  • DAILY REMINDERS
RECOVERY
SIDE EFFECTS PART I: < 2MONTHS POST

• GENERAL FATIGUE AND UNPREDICTABLE TIREDNESS
• THROAT RAW (NO SWALLOWING)
• INCREASED MUCOSITIS
• INCREASED DRY MOUTH
• WEIGHT LOSS (30 POUNDS) → NEED TO INCREASE CALORIE INTAKE TO 6,000+ CALORIES PER DAY
• SLEEP DIFFICULTIES
• CAN APPRECIATE HOW PEOPLE GET DEPRESSED
RECOVERY
SIDE EFFECTS PART II: > 2 MONTHS POST

• FATIGUE MORE PREDICTABLE
• MOUTH HEALING SLOWLY
• WEIGHT MAINTAINING
• GREAT! I GOT THE 31ST TOXICITY.
  • NEUROPATHY IN FEET.
• RINGING EAR IS BACK. WTF.
SURVIVORSHIP: H&N CANCERS

- 62,000 NEW H/N CASES PER YEAR
- 436,000 SURVIVORS (3% OF ALL CASES)
- JUST STARTING INITIATIVES AND AWARENESS
- 4 YEARS OUT

RESOURCES
- ACS HEAD & NECK CANCER SURVIVORSHIP CARE GUIDELINES
- ONCOLIFE: PERSONALIZED CARE PLANS
- LOCAL SUPPORT GROUPS
ACS H/N SURVIVORSHIP GUIDELINES

• SURVEILLANCE FOR HNC RECURRENCE
• SCREENING FOR SECOND PRIMARY CANCERS
• ASSESSMENT AND MANAGEMENT OF PHYSICAL AND PSYCHOSOCIAL LONG TERM AND LATE EFFECTS
• HEALTH PROMOTION
• CARE COORDINATION AND PRACTICE IMPLICATIONS
HNC SECOND PRIMARY CANCERS (SPC)

- 23% of survivors will develop one or multiple SPC
- Surveillance, screening, lifestyle are keys
- Sites of highest risk: 89%
  - Lung
  - Head / Neck
  - Esophagus
LATE EFFECTS: RADIATION

- FATIGUE
- XEROSTOMIA
- MALICE
- ALTERED TASTE
- DERMATITIS
- LYMPHEDEMA
- PULMONARY FIBROSIS
- OSTEONECROSIS
- HEARING LOSS
LATE EFFECTS: CHEMOTHERAPY

• FATIGUE
• NEUROPATHY
• ANEMIA
• CARDIAC ABNORMALITY
• VERTIGO
• COGNITIVE DYSFUNCTION
PSYCHOSOCIAL LONG TERM EFFECTS

• DEPRESSION
• WORRY AND DISTRESS
• FEAR OF RECURRENCE
• SELF IMAGE & SOCIAL ROLE DIFFICULTIES
• RETURN TO WORK ISSUES
CRF: CANCER RELATED FATIGUE

- AFFECTS UP TO 90% OF PATIENTS
- PRESENT DURING TREATMENT AND FOR YEARS AFTER TREATMENT
- CRF IS DIFFICULT TO ADDRESS
  - MULTIFACTORIAL: DYSREGULATION OF SYSTEMS:
    - PHYSICOLOGICAL
    - BIOCHEMICAL
    - PSYCHOLOGICAL
  - PHASE OF DISEASE DEPENDENT
  - TREATMENT DEPENDENT
ETIOLOGY OF CRF

- **SEROTONIN DYSREGULATION**: APPETITE, SLEEP, MEMORY, MOOD, DEPRESSION
- **HYPOTHALAMUS DYSREGULATION**: LOWERS CORTISOL → BP, CARBOHYDRATE METABOLISM, IMMUNE
- **CIRCADIAN RHYTHM DISRUPTION**: “BODY’S BIOLOGICAL CLOCK”
- **ATP DYSREGULATION**: MUSCLE METABOLISM
- **VAGAL AFFERENT NERVE ACTIVATION**: NEUROACTIVE AGENTS → “SICKNESS BEHAVIOR”
- **CO-MORBID CONDITIONS**: ANEMIA, DEPRESSION, SLEEP DISORDER
SUMMARY

• TREATMENT
• SUPPORT TEAM IS A MUST
• WARRIORS ARE A MUST
• EDUCATION IS A MUST
• TOXICITY TOOL CHEST IS A MUST
• LIVING IS A MUST

• RECOVERY ????? → SURVIVING
• AS IMPORTANT AS TREATMENT
• WHEN AND HOW TO EDUCATE?
• SURVIVORSHIP PROGRAMS!
• WE MUST DEFINE THEM AND PROMOTE THEM
#1 CERTIFIED CANCER COACH
WHAT SHE DID! ALLOWED THIS!

• 4 OF 8 KIDS WEDDINGS
• #5 WEDDING THIS SEPTEMBER
• 2 COLLEGE GRADUATIONS
• FOLKS 50TH WEDDING ANNIVERSARY
• 9 YR OLD THREW FOR 1ST TOUCHDOWN
• PASSIONATE TEACHING (RTU, ARC)
THANK YOU

- LMURPHY@RTUVT.EDU
- LINKS FOR YOUR NURSING TEAM
  - THIS PRESENTATION
  - 3 AUDIO TAPES (10 MIN EACH)
  - TOXICITY TOOL CHEST
  - LINKS TO H/N SURVIVORSHIP RESOURCES