Wednesday, March 25th, 2020
Zoom Controls

1. Click Raise Hand in the Webinar Controls.

2. The host will be notified that you've raised your hand.

3. Click Lower Hand to lower it if needed.

1. If the host allows you to talk, you will receive a notification.

   The host would like you to unmute your microphone

   Stay muted  Unmute myself

2. Your audio settings will now change to a Mute/Unmute button. You can still access the audio settings by click on the ^ arrow next to the Unmute/Mute button.
NCODA WEBINAR SERIES

Supporting Patients and Practices Through the COVID-19 Pandemic

Hear From 3 Expert Panelists
Student Educational Talks Agenda

- NCODA Mission and Vision Statements
  - Madison Motzner, PharmD Candidate 2022, Washington State University
    NCODA Professional Student Organization National President-Elect

- Pediatric Cancer Overview
  - Anthony Cirincione, PharmD, Memorial Sloan Kettering

- Oral Agents in Lung Cancer
  - Christine Ibarra, PharmD, BCOP, Baptist Health

- NCODA Spring Forum Virtual E-Meeting
  - Maren Campbell, PharmD Candidate 2021, University of Minnesota
    NCODA Professional Student Organization National Vice President of International Meetings
Mission Statement

Our focus is to advance the value of dispensing practices for oncology physicians.

We will provide leadership, expertise, quality standards, and sharing of best practices with all members.

We will deliver positive outcomes through collaboration with all stakeholders involved in the care of oncology patients.
Vision Statement

Our vision is to be the world leader in oral oncology by building a patient-centered medically integrated community whose focus is to innovate the continuity of cancer care so every patient receives the maximum benefit from their cancer treatment.
Welcome Established NCODA PSO Chapters

1. South University (SC & GA)
2. University of Rhode Island (RI)
3. Midwestern University (IL)
4. North Texas University (TX)
5. Washington State University (WA)
6. Texas Tech University (TX)
7. Purdue University (IN)
8. Nova Southeastern University (FL)
9. Massachusetts College of Pharmacy and Health Sciences University (MA)
10. University of Minnesota (MN)
11. University of Toledo (OH)
12. Albany College of Pharmacy and Health Sciences (NY)
13. University of Iowa (IA)
14. Lake Erie College of Osteopathic Medicine (FL)
15. Auburn University (AL)
16. University of Missouri-Kansas City (MO)
Welcome “In-Progress” NCODA PSO Chapters

1. Mercer University (GA)
2. Notre Dame University of Maryland (MD)
3. Oregon State University (OR)
4. South Dakota State University (SD)
5. Texas Southern University (TX)
6. The Ohio State University (OH)
7. University of Florida (FL)
8. University of Houston (TX)
9. University of Illinois at Chicago (IL)
10. University of Kansas (KS)
11. University of Maryland Eastern Shore (MD)
12. University of Mississippi (MS)
13. University of New Mexico (NM)
14. University of Tennessee (TN)
15. University of Wyoming (WY)
Welcome all Students!
2,160 + Members and 480 + Practices Strong!

Working together, we become stronger.
Introduction to Pediatric Oncology

Anthony Cirincione, PharmD
PGY2 Pediatric Oncology Resident
Memorial Sloan Kettering Cancer Center
Incidence

- Childhood cancer accounts for <1% of all cancer diagnosis.
- Highest cause of disease-related death in patients < 14 years.
- Average age of diagnosis is 6 years.
- In 2017, an estimated 10,270 new cancer diagnosis in children < 14 years.
- Approximately 12% mortality rate.
- Mortality rates have decreased up to 70% of over the past 4 decades.
Types of cancer in children

- Leukaemias 31%
- Brain and spinal tumours 26%
- Lymphomas 10%
- Soft tissue sarcomas 7%
- Neuroblastoma 6%
- Kidney tumours 5%
- Bone tumours 4%
- Germ cell tumours 3%
- Retinoblastoma 3%
- Liver tumours 2%
- Other 4%
Adult vs Pediatric Cancers

- Childhood cancers are usually a result of cellular DNA changes that occur early in life.
- Not usually strongly linked to lifestyle or environmental risk factors.
- Some children inherit DNA changes (mutations) from a parent that increase their risk of cancer, but most cancers are not caused by inherited DNA mutations.
- Most gene mutations are acquired mutations that can happen during DNA replication at any time in life.
- Can be precipitated by DNA changes that turn on oncogenes and turn off tumor suppressor genes.
Genetic Predisposition

- Germline mutations identified in 8.5% of pediatric patients
  - TP53, RET, RB1, APC, NF1, RUNX1
- Family history is not always identified
- Germline mutations can lead to cancer predisposition syndromes
  - Li Fraumeni
  - Neurofibromatosis
<table>
<thead>
<tr>
<th>Tumor Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carcinoma</td>
<td>Derived from epithelial cells</td>
</tr>
<tr>
<td>Sarcoma</td>
<td>Derived from mesenchymal cells outside of bone marrow, arising in connective tissue (i.e. bone, cartilage, nerve, fat)</td>
</tr>
<tr>
<td>Lymphoma/Leukemia</td>
<td>Arising in precursors of blood cells</td>
</tr>
<tr>
<td>Germ Cell Tumors</td>
<td>Derived from pluripotent cells, usually in ovary or testes</td>
</tr>
<tr>
<td>Blastoma</td>
<td>Derived from early embryonal cells: pre-cursor cells that are incompletely differentiated</td>
</tr>
</tbody>
</table>
# Pediatric Cancers

<table>
<thead>
<tr>
<th>&lt; 5 years</th>
<th>5 – 9 years</th>
<th>10 – 14 years</th>
<th>15 – 20 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leukemia</td>
<td>CNS Tumors:</td>
<td>Ewing Sarcoma</td>
<td>Ewing Sarcoma</td>
</tr>
<tr>
<td>Hepatoblastoma</td>
<td>-Medulloblastoma</td>
<td>Osteosarcoma</td>
<td>Osteosarcoma Lymphomas:</td>
</tr>
<tr>
<td>Neuroblastoma</td>
<td>-Astrocytoma,</td>
<td>Lymphoma: NHL, Burkitt</td>
<td>Hodgkins</td>
</tr>
<tr>
<td>Retinoblastoma</td>
<td>-Gliomas</td>
<td></td>
<td>Germ Cell Tumors</td>
</tr>
<tr>
<td>Rhabdomyosarcoma</td>
<td></td>
<td></td>
<td>DSRCT</td>
</tr>
<tr>
<td>Wilms Tumor</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ependymoma</td>
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</table>
Treatment of Pediatric Cancers

- Children have a higher tenency to respond to chemotherapy
- Children handle treatment better than adults, hence can often tolerate higher doses
- Treatment-related effects necessitate medical follow-up into adult years
What About Screening?

- There are no established screening tests for any of the pediatric malignancies, nor are there any well established modifiable risk factors to prevent cancer
Acute Lymphoblastic Leukemia

- The most common pediatric cancer diagnosis in patients < 15 years
- Characterization based on morphology, immunophenotyping, and cytogenetics

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**Standard Risk**
- Age 1-10
- WBC < 50,000

**High Risk**
- Age <1 year or >10 years
- WBC ≥ 50,000
Acute Lymphoblastic Leukemia

- Complete treatment duration is 2-3 years
- Backbone of remission induction therapy = Vincristine + Prednisone + Pegasparagase
- A pediatric success story...cure rates of > 85% !!!
Small Round Blue Tumors

- Descriptive category describing a large number of malignant tumors in pediatrics
- Histological appearance of small round blue cells

- Neuroblastoma
- Hepatoblastoma
- Wilms tumor
- Ewing sarcoma
- Rhabdomyosarcoma
- Desmoplastic small round cell tumor (DSRCT)
- Medulloblastoma
- Retinoblastoma
- Lymphomas (select)
Neuroblastoma

- The most extracranial solid tumor in children
- Embryonal tumor of autonomic nervous system (derived from neural crest tissues)
- Multimodality treatment

Common sites of mets: bones, bone marrow, lungs, liver, brain, soft tissue
CNS Tumors

- Most common solid tumor malignancy of childhood
- Represents a heterogenous group of cancers
  - Astrocytomas (52%)
  - Medulloblastoma/PNET (21%)
  - Brainstem gliomas (15%)
  - Ependymomas (9%)
- Treatment consist of surgery, radiation, and chemotherapy (certain tumor types)
  - Radiation usually reserved for children >3 years of age
Pediatric Oncology Treatment

- Care centered around clinical trials
- No centralized guidelines
- Pediatric cancer research organizations/consortiums driven trials

**NCI-supported cooperative group**

**Largest organization for pediatric cancer research in the work**

- Formed in 2000, when CCG and POG joined forces
  - Also with the IRSG & NWTSG
Pediatric Clinical Trials

- Smaller study; fewer patients enrolled
- Often combine ≥1 intervention in a single trial
- Often will assess multiple primary and secondary endpoints
- Increased utilization of “window therapy”
  - Requires careful patient selection to assess risk vs benefit
Pediatric Chemotherapy Dosing

- Most antineoplastic medications are dosed using BSA (mg/m^2)
- Standard BSA-dosing tolerated in children may be too toxic for infants (<12 months)

THE 30 RULE

Dose in mg/kg = 30 x dose in mg/m^2
Considerations...

- No defined cancer screening recommendations in the pediatric population
- No modifiable cancer risk factors
- Developing pediatric friendly formulations
- Differences in chemotherapy dosing
- Differences in supportive care recommendations
- *Children are not just little adults!*
Pediatric Cancer Survival

- Overall, 5-year survival rate in children with pediatric cancer has increased to >60%.
- Challenge is to improve cure rates for the higher risk, difficult to treat cancers.
- Childhood cancer survivors have many late effects of treatment:
  - Impaired organ or tissue function (e.g. cardiac, pulmonary, renal, etc)
  - Secondary malignancies
  - Neurocognitive effects
  - Impairment to growth and development
  - Social and psychological stress
On the Treatment Frontier...

- Advances in molecular therapies for target genetic lesions
- Novel drug formulations for available agents
- Evolving role of immunotherapy
- Increased understanding of pharmacogenomics/genetics
- Need for improvement in treatment for childhood AML, CNS tumors, and infant ALL
Pediatrics at MSK

- We treat every child, teen, and young adult with the expectation that he or she will survive cancer and return to a life focused on family, friends, and the future.

- Our goal is to cure, while at the same time making sure that the patient remains emotionally and psychologically healthy during the treatment journey and beyond.

- Multi-disciplinary teams consisting of LIPs, pharmacists, social work, integrative medicine, child-life services, and teachers.
Questions?
Stay up to date: Follow our Facebook Page!

https://www.facebook.com/NCODAPhysicalStudentOrganizations/
EGFR Inhibition in Lung Cancer

Christine Ibarra Pharm.D., BCPS
Clinical Pharmacy Specialist- Thoracic Clinic
Miami Cancer Institute
Miami, FL
Objectives

• Review treatment modalities in Non-Small Cell Lung Cancer
• Acknowledge the importance of driver mutations in NSCLC
• Become familiar with oral treatment options
• Differentiate between the EGFR Inhibitors
Non-Small Cell Lung Cancer (NSCLC)

• Lung cancer is the leading cause of cancer death in the US
  o 228,820 new cases diagnosed in 2020
  o 135,720 deaths

• 2009-2015 overall 5 year survival 19%

• Patients with metastatic lung cancer treated with targeted therapy or immunotherapies are now surviving longer
  o 15-50% depending on biomarker
Treatment Overview NSCLC

Stage I
- Surgery

Stage II
- Surgery
- IV Chemotherapy

Stage III
- Surgery
- Radiation
- IV Chemotherapy ± immunotherapy

Stage IV
- IV Chemotherapy ± immunotherapy
- IV Immunotherapy
- PO Targeted Therapy
# Targeted Treatment in NSCLC

## EGFR Mutation
- Afatinib
- Erlotinib ± chemo
- Dacomitinib
- Gefitinib
- Osimertinib

## ALK Rearrangement
- Alectinib
- Brigatinib
- Ceritinib
- Crizotinib
- Lorlatinib

## ROS1 Rearrangement
- Ceritinib
- Crizotinib
- Entrectinib

## BRAF V600E
- Dabrafenib + trametinib

## NTRK Fusion
- Larotrectinib
- Entrectinib

## PD-L1
- Pembrolizumab ± chemo
- Nivolumab + ipilimumab
**EGFR Inhibition**

- Transmembrane protein
- Belongs to HER/erbB family
- Tyrosine kinase activity may be dysregulated
  - Mutations
  - Increased gene number
  - EGFR protein overexpression
# EGFR Inhibitors

<table>
<thead>
<tr>
<th>Drug</th>
<th>Generation</th>
<th>Binding</th>
<th>Indication</th>
</tr>
</thead>
<tbody>
<tr>
<td>Erlotinib (Tarceva)</td>
<td>1&lt;sup&gt;st&lt;/sup&gt;</td>
<td>Reversible</td>
<td>Exon 19 deletions&lt;br&gt;Exon 21 L858R substitution mutations</td>
</tr>
<tr>
<td>Gefitinib (Iressa)</td>
<td>1&lt;sup&gt;st&lt;/sup&gt;</td>
<td>Reversible</td>
<td>Exon 19 deletions&lt;br&gt;Exon 21 L858R substitution mutations</td>
</tr>
<tr>
<td>Dacomitinib (Vizimpro)</td>
<td>2&lt;sup&gt;nd&lt;/sup&gt;</td>
<td>Irreversible</td>
<td>Exon 19 deletion&lt;br&gt;Exon 21 L858R substitution mutation</td>
</tr>
<tr>
<td>Afatinib (Gilotrif)</td>
<td>2&lt;sup&gt;nd&lt;/sup&gt;</td>
<td>Irreversible</td>
<td>Exon 19 deletion&lt;br&gt;Exon 21 L858R substitution mutation</td>
</tr>
<tr>
<td>Osimertinib (Tagrisso)</td>
<td>3&lt;sup&gt;rd&lt;/sup&gt;</td>
<td>Irreversible</td>
<td>Exon 19 deletion&lt;br&gt;Exon 21 L858R substitution mutation&lt;br&gt;T790M EGFR mutation-positive</td>
</tr>
</tbody>
</table>
EGFR Inhibition 1st Generation

Randomized Phase III Study Comparing Gefitinib With Erlotinib in Patients With Previously Treated Advanced Lung Adenocarcinoma: WJOG 5108L

Yoshiko Urata, Nobuyuki Katakami, Satoshi Morita, Reiko Kaji, Hiroshige Yoshioka, Takashi Seto, Miyako Satouchi, Yasuo Iwamoto, Masashi Kanehara, Doichi Fujimoto, Norihiko Ikeda, Haruyasu Murakami, Haruko Daga, Tetsuya Oguri, Isao Goto, Fumio Imamura, Shunichi Sugawara, Hideo Saka, Naoyuki Nogami, Shunichi Negoro, Kazuhiko Nakagawa, and Yoichi Nakanishi

See accompanying editorial on page 3233
Afatinib versus gefitinib as first-line treatment of patients with EGFR mutation-positive non-small-cell lung cancer (LUX-Lung 7): a phase 2B, open-label, randomised controlled trial

Keunchil Park, Eng-Huat Tan, Ken O’Byrne, Li Zhang, Michael Boyer, Tony Mok, Vera Hirsch, James Chih-Hsin Yang, Ki Hyeong Lee, Shun Lu, Yuankai Shi, Song We Kim, Janessa Leskin, Dong Wan Kim, Catherine Dubos Arvis, Karl Kolbeck, Scott A Laurie, Chun Ming Tsai, Mehdi Shahidi, Miyoung Kim, Dan Messey, Victoria Zazulina, Luis Paz-Ares
EGFR Inhibition 1\textsuperscript{st} vs 3\textsuperscript{rd} Generation

Overall Survival with Osimertinib in Untreated, EGFR-Mutated Advanced NSCLC

# EGFR Inhibitors

<table>
<thead>
<tr>
<th>Drug</th>
<th>Dosing</th>
<th>Administration</th>
<th>Comments/ Pertinent DDI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Erlotinib (Tarceva)</td>
<td>150 mg daily</td>
<td>Empty stomach</td>
<td>Avoid PPI H2RA: administer 10 hrs after and ≥ 2 hrs prior to Antacid: separate by several hours Tablets may be dissolved</td>
</tr>
<tr>
<td>Gefitinib (Iressa)</td>
<td>250 mg daily</td>
<td>With / without food</td>
<td>PPI: administer gefitinib 12 hrs before/after Tablets may be dissolved</td>
</tr>
<tr>
<td>Dacomitinib (Vizimpro)</td>
<td>45 mg daily</td>
<td>With / without food</td>
<td>Avoid PPI H2RA/ antacid: administer ≥ 6 hrs before / 10 hrs after</td>
</tr>
<tr>
<td>Afatinib (Gilotrif)</td>
<td>40 mg daily</td>
<td>Empty stomach</td>
<td>P-glycoprotein/ABCB1 inducers/ inhibitors</td>
</tr>
<tr>
<td>Osimertinib (Tagrisso)</td>
<td>80 mg daily</td>
<td>With / without food</td>
<td>Tablets may be dissolved</td>
</tr>
</tbody>
</table>

PPI: proton pump inhibitors H2RA: H₂-receptor antagonist

[ncoda.org](https://ncoda.org)
 EGFR Class Side Effects

**Common**
- Acneiform Rash
  - Topical Steroid
  - Oral antibiotic (minocycline, doxycycline)
  - Sun Avoidance
- Diarrhea
  - Loperimide
  - Hydration
  - Dietary

**Less Common, Concerning**
- Cardiac
  - ECHO
  - EKG
- Interstitial lung disease
  - Counseling

ncoda.org
Conclusion

• NSCLC patients are managed with multimodality treatment
• Driver mutations (ALK, EGFR, ROS1, BRAF, NTRK) are pivotal when choosing treatment in end stage NSCLC patients
• Pharmacist is key when initiating patient on oral oncolytics
  o Dosing/ administration
  o Drug interactions
  o Monitoring
  o Education
  o Acquisition
References

• Tarceva (erlotinib) [prescribing information]. South San Francisco, CA: Genetech USA Inc; October 2016.
• Iressa (gefitinib) [prescribing information]. Wilmington, DE: AstraZeneca Pharmaceuticals LP; May 2019.
• Vizimpro (dacomitinib) [prescribing information]. New York, NY: Pfizer Labs; October 2018.
• Tagrisso (osimertinib) [prescribing information]. Wilmington, DE: AstraZeneca Pharmaceuticals; December 2019.
• Urata Y, Katakami N, Morita S et al. Randomized phase 3 study comparing gefitinib with erlotinib in patients with previously treated advanced lung adenocarcinoma. JCO. Sept 2016. 34. 27. 3248-3257.
• Park PF Tan EH, O’Byrne PF et al. Afatinib versus gefitinib as first line treatment of patients with EGFR mutation positive non-small cell lung Cancer. The Lancet Oncology. 17.5 p577-589.
Questions?

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Miami, FL
NCODA’s Spring Forum
Virtual E-Meeting

Maren Campbell
PharmD Candidate 2021
University of Minnesota
NCODA PSO National Vice President of International Meetings
NCODA’s National Meetings
Spring Forum Agenda: The Morning

• Clinical Considerations in Patients with Intermediate- or High-Risk Myelofibrosis: A Case-Based Presentation
  • Dr. Chara Reid, PharmD, Dupage Medical Group

• Treating Breast Cancer in 2020: an Expert’s Perspective
  • Dr. Joyce O’Shaughnessy, MD, Texas Oncology

• Industry Update on COVID-19 Response
  • Dr. Mike Ybarra, MD, PhRMA

• Managing Dermatological Toxicities from I-O & TKI Therapies Including Adoption of Treatment Support Kits
  • Drs. Mario Lacouture MD and Allison Betof MD, Memorial Sloan Kettering Cancer Center

• Managing AML via the BCL-2 Pathway
  • M. Yair Levy MD, Texas Oncology
Spring Forum Agenda: The Afternoon

• Biosimilars in Value Based Care
  • Drs. Robert Rifkin MD, Rocky Mountain Cancer Centers and Kashyap Patel MD, Carolina Blood and Cancer Care Associates

• ICLUSIG® (ponatinib): Rethink Your Approach to Treating TKI-Resistant/Intolerant CML
  • M. Yair Levy MD, Texas Oncology

• Immuno-Oncology Teach™ A Therapy Option and Proactive Patient Management Information for Patients with Unrespectable or Metastatic Melanoma or Intermediate or Poor Risk, Previously, Untreated Advanced Renal Cell Carcinoma
  • Marilyn Garcia BS, RN, MSN, APRN, NP-C, OCN, Bristol Myers Squibb

• Putting Positive Quality Interventions into Action: Consistent Clinical Standards for Medically Integrated Teams
  • Kirollos Hanna PharmD, BCPS, BCOP, University of Minnesota Medical Center and Mayo Clinic, Stacey McCollough PharmD and Jared Crumb PharmD, Tennessee Oncology, Raquel Rhone PharmD and Donnell Hale BSN, RN, OCN, Texas Oncology

• Explore CAR T for Patients in Your Practice
  • Christopher Maisel MD, Texas Oncology
Congratulations to our inaugural NCODA PSO National Executive Board!

National President-Elect
Madison Motzner
Washington State University

National President
Jason Darmanin
University of Rhode Island

National Vice President of Communications
Tara Magallon
University of North Texas

National Vice President of Community Service
Manny Alfonso
Nova Southeastern University

National Vice President of International Meetings
Maren Campbell
University of Minnesota
Spring Forum Agenda: The Keynote

• 2020 Legislative Update within Medically Integrated Dispensing on the Federal Level
  (Dr.) Senator Bill Cassidy, MD
  U.S. Senator of Louisiana
  
  • In 2014, he was elected to the U.S. Senate.
  
  • He serves on the Finance Committee, the Health, Education, Labor, & Pensions Committee, the Energy and Natural Resources Committee, and the Veterans Affairs committees.

• S.2543 - Prescription Drug Pricing Reduction Act of 2019
2020 NCODA Fall Summit

October 21-23, 2020
Scottsdale, Arizona
Join us next Wednesday April 1st at 8 PM EST:

A Night with Future Industry Pharmacists

Colin Dimond
PharmD Candidate 2020
Fellow 2020-2021
Early Clinical Development

Alexandra Jarvais
PharmD Candidate 2020
Fellow 2020-2021
US Medical Affairs

ncoda.org
Thank you for attending!

Join us next month on April 29th at 8 PM EST!