COMMONWEALTH OF AUSTRALIA

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Introduction to Cancer Medicine

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Learning objectives

At the completion of this session students should be able to:

• describe the biology of a cancer cell
• describe the principles of diagnosis and staging in cancer patients
• describe the principles of treating cancer patients
• define the difference between treatment with curative intent and palliative intent
• describe the concept of the cancer patient journey and multidisciplinary care
• summarise the general principles of cancer medicine.
For discussion

• Some background
• A case study
• Oncology principles
• Some oncology definitions
• The critical role of pathology
• The evolving role of molecular biology
• Treatment advances
The aging population

Longevity increases by 10 years every 40 years

- Age decade          Incidence of Cancer
  50 - 59              1 : 20
  60 - 69              1 : 10
  70 - 79              1 : 5
  80+                  1 : 3

- Average age of cancer patient increasing by 2020 (77 years)

- BUT clinical trials focus on younger patients
<table>
<thead>
<tr>
<th>Year</th>
<th>New cancer patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>1975</td>
<td>≈ 40,000</td>
</tr>
<tr>
<td>1990</td>
<td>≈ 60,000</td>
</tr>
<tr>
<td>2005</td>
<td>≈ 90,000</td>
</tr>
<tr>
<td>2020</td>
<td>≈ 135,000</td>
</tr>
</tbody>
</table>
Improvements in Cancer Medicine?
Improvements in Cancer Medicine

• Prevention
  – Smoking cessation and Sun smart

• Screening
  – Pap smears, Mammography and Faecal occult blood
  – Ongoing controversies: prostate, lung

• Diagnosis
  – Imaging and Pathology

• Treatment
  – Surgical techniques
  – Radiotherapy techniques
  – Novel systemic therapies

• “Holistic” approach
What is cancer?
Hallmarks of cancer

- Transformation from a cell of origin
- Acquisition of invasive properties
- Activation of cellular proliferative signals
- Abrogation of cell cycle control
- Up-regulation of angiogenesis
- Further clonal evolution

Hanahan and Weinburg Cell 2005
A case study
Presenting Complaint

• 52 year old woman
  – Notices a possible lump in the left breast
  – Otherwise very well
  – Presents to LMO

• What does the Doctor need to do?
Possible lump

• Take a full history
  – Family history of cancer
  – History of the “lump”

• Perform a full examination

• Assess breast mass itself
  – The lump itself (hard vs soft; regular vs irregular)
  – Skin changes; nipple retraction

• Imaging
  • Ultrasound
  • Mammography

• Referral to a Breast Surgeon
  • Biopsy
  • FNA (positive)
Cancer treatment

• What are the next steps?
Cancer treatments

• Local therapies
  – Surgery
  – Radiotherapy

• Systemic therapies
  – Chemotherapy
  – Hormone therapy
  – Immunotherapy
  – Molecular therapy

• Clinical Trials
Cancer treatments

- Local problem requires a local therapy

- Systemic problem requires a Systemic therapy

- Treatment may be “multi-modality”
Breast cancer treatment

• What are the next steps?

  – Local therapy (surgical excision)
Breast cancer treatment

• She elects to have a lumpectomy and sentinel node biopsy

• **Pathology:** 24mm, Grade 3, Lymph node negative

• What other information is needed from the pathology specimen itself?

• What other information is needed?
Breast cancer treatment

• **Molecular Pathology:**
  – Oestrogen receptor positive in 80% of cells
  – Progesterone receptor positive in 50% of cells
  – Her-2 negative
  – (Gene arrays)

• **Staging**
  – Tumour (T) 2
  – Nodes (N) 0
  – Metastases (M) 0
Some definitions

Cancer may be:

• Localised

• Locally Advanced

• Metastatic
What is the intent of treatment?
What is the intent of treatment?

• Cure vs incurable?
Additional treatment?
What is adjuvant therapy?
Adjuvant therapy

• Adjuvant Radiotherapy to breast

• Adjuvant Systemic therapy
Adjuvant treatment

- Breast / Colon / Lung / Sarcomas
- Reduces the risk of local recurrence
- Reduces the risk of systemic recurrence
- Improves overall survival
- Finite therapy
- Large numbers of patients treated for some individuals to benefit
- Tolerate some toxicity
5 years later....

• One month of:
  – Mild right hypochondrial pain
  – 4kg weight loss
  – Mild fatigue

• What’s going on?

• Next steps?
Next steps?

• Full history and full examination
  – Enlarged liver

• Imaging
  – What?
Enlarged liver

Multiple Hypodense metastases

Normal spleen

Normal kidney
What next?
What next?

• **Refer** to a Medical Oncologist

• **Biopsy** liver lesion
  – Confirms metastatic adenocarcinoma of the breast

• **Systemic problem requires a systemic treatment**
  – Chemotherapy
  – Hormone therapy
  – Immunotherapy
  – Molecular therapy
  – Clinical trial?
How has treatment intent changed?
How has treatment intent changed?

• Disease is now incurable

• Treatment is now “palliative”

• Emphasis is on quality of life
Cure versus Incurable

• Generally an easy decision

• Metastatic disease may be cured

• Localised disease may be incurable
Cure versus Incurable

• Generally an easy decision

• Metastatic disease may be cured
  – Testis cancer
  – Lymphomas

• Localised disease may be incurable
  – Glioblastoma
Chemotherapy for metastatic disease

- Germ cell / NHL / Leukemias
- Curative
- Tolerate significant toxicity (even mortality)
Some guiding principles:

• Biopsy is critical
• Refer to the appropriate Clinicians
• Define the disease extent
• What is the intent of treatment?
  – Cure or Palliation?
• Local problem requires a local treatment
• Systemic problem requires a systemic treatment
• Performance status is more important than age
• Care should be multi-disciplinary
Who looks after the patients?

- LMO
- Surgical oncologist
- Radiation Oncologist
- Medical Oncologist
- Palliative care physician
- Nurses
- Allied Health
  - Multi-disciplinary care
Palliative (non curative) treatment

- Incurable cancers
- Quality of life is primary objective
- Prolongation of life is a secondary objective
- Toxicity not tolerated
- Not synonymous with “terminal care”
Quality Of Life (QOL)

Response

Toxicity
Molecular targeting

<table>
<thead>
<tr>
<th>Target</th>
<th>Drug</th>
<th>Cancer Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bcr-Abl</td>
<td>Glivec</td>
<td>CML / GIST</td>
</tr>
<tr>
<td>Anti-EGFR</td>
<td>Iressa</td>
<td>LUNG</td>
</tr>
<tr>
<td>VEGFRi</td>
<td>Bevacizumab</td>
<td>COLON</td>
</tr>
<tr>
<td>VEGFRi</td>
<td>Sunitinib</td>
<td>RENAL</td>
</tr>
<tr>
<td>Her-2</td>
<td>Herceptin</td>
<td>BREAST</td>
</tr>
<tr>
<td>Anti-CD20</td>
<td>Mabthera</td>
<td>LYMPHOMA</td>
</tr>
<tr>
<td>B-Rafi</td>
<td>Vemurafinib</td>
<td>MELANOMA</td>
</tr>
<tr>
<td>ALKi</td>
<td>Crizotinib</td>
<td>LUNG</td>
</tr>
</tbody>
</table>
Conclusions

• Dramatic improvements in Cancer Medicine
  – Prevention, screening, molecular pathology, imaging, treatment and multi-disciplinary care

• Critical principles:
  – Biopsy
  – Define the disease extent
  – Therapeutic decisions based on cure vs palliation
  – Performance status
  – Local problem → local treatment
  – Systemic problem → systemic treatment

• Critical role of Molecular pathology and treatment targeting