Gene Therapy:
where is it headed and how do we prepare for it?

2018 CADTH Symposium
Panel Discussion
Agenda

1. Introduction of moderator and panellists – 5 min

2. Setting-the-stage presentation – 5 min

3. Opening remarks from panellists – 5 x 5 min

4. Q&A and discussions – 30 min

5. Closing remarks from panellists – 5 x 2 min
Introduction

• Moderator:
  – Dr. Tammy Clifford, Chief Scientist and VP, Evidence Standards, CADTH

• Panellists:
  – Dr. Avram Denburg, Staff Oncologist, The Hospital for Sick Children
  – Helen Trifonopoulos, Head, Health Policy and Patient Access, Novartis Oncology
  – Mark Skinner, President, World Federation of Hemophilia USA
  – Dr. Michèle de Guise, Directrice des services de santé et de l'évaluation des technologies, INESSS
  – Scott Gavura, Director, Provincial Drug Reimbursement Programs, Cancer Care Ontario
SETTING THE STAGE

DEFINITION, CURRENT LANDSCAPE, AND IMPLEMENTATION CONSIDERATIONS FOR GENE THERAPY
Definition & Classification

• Definition of gene therapy:
  – (US FDA) broadly “the administration of genetic material to modify or manipulate the expression of a gene product or to alter the biological properties of living cells for therapeutic use”
  – (American Society of Gene & Cell Therapy) more specifically “a set of strategies that modify the expression of an individual’s genes or repair abnormal genes”

• Classification of gene therapy:
  – Both US and Canada regulate it as a biologic drug
  – Other jurisdictions, such as Europe, have a separate regulatory pathway
Approaches to Gene Therapy

*in vivo vs ex vivo*, transfer vs edit, viral vs other vectors...

## Current Landscape – Approved Products

<table>
<thead>
<tr>
<th>Gene Therapy</th>
<th>Country</th>
<th>Indication</th>
<th>Approval Year</th>
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</thead>
<tbody>
<tr>
<td>Tisagenlecleucel/Kymriah</td>
<td>US</td>
<td>r/r ALL or DLBCL</td>
<td>2017</td>
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<tr>
<td>Axicabtagene ciloleucel/Yescarta</td>
<td>US</td>
<td>r/r BCL</td>
<td>2017</td>
</tr>
<tr>
<td>Voretigene neparvovec/Luxturna</td>
<td>US</td>
<td><em>RPE65</em>-caused vision loss</td>
<td>2018</td>
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<tr>
<td>Gencidine</td>
<td>China</td>
<td>Head and neck cancer</td>
<td>2003</td>
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<tr>
<td>Oncorine</td>
<td>China</td>
<td>Head, neck, and esophagus cancer</td>
<td>2005</td>
</tr>
<tr>
<td>Neovasculgen</td>
<td>Russia</td>
<td>Critical limb ischemia</td>
<td>2011</td>
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<tr>
<td>Talimogene laherparepvec/Imlygic</td>
<td>EU</td>
<td>Melanoma</td>
<td>2015</td>
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<tr>
<td>Strimvelis</td>
<td>EU</td>
<td>ADA-SCID</td>
<td>2016</td>
</tr>
<tr>
<td>Tonogenchoncel-L/Invossa</td>
<td>Korea</td>
<td>Osteoarthritis</td>
<td>2017</td>
</tr>
</tbody>
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MIT’s NEWDIGS Projections

• By 2022, 39 gene therapy products to gain US regulatory approval

![Pie chart showing the percentage of gene therapy products for different types of diseases: 45% for Cancer, 34% for Orphan diseases, 17% for Common diseases, and 4% for Extremely rare diseases.]
Promise of Gene Therapy

• Potential to revolutionize paradigms of care
  – Address unmet need
    • Offers options when no effective treatment is available (e.g., relapsed or refractory cancer)
  – Adopt a whole-of-life approach
    • One-time treatment to replace intensive and onerous maintenance therapy using enzyme or protein replacement (e.g., hemophilia)
Implementation Considerations

• Adequacy of Evidence for Decision-Making
  – Early evidence from small size, uncontrolled, and short-term trials
  – Need for patient registries?
  – Need for ongoing review or reassessment?

• Cost of therapy
  – US$65,000-US$1M for therapy, plus associated expenses with travels and aftercare
  – Short-term affordability? Innovative financing strategies?
Implementation Considerations

• Health system needs
  – Need for specialized manufacturing facilities, care centres, and trained staff
  – Develop at-home capacity or send out of country? Designated centres of excellence for delivering therapy?

• Legal and ethical concerns
  – Need for fair and timely access to innovative therapy
  – Need to consider specific needs of various population groups and address potential misuse for genetic enhancements
OPENING REMARKS

PERSPECTIVES AND
WHAT DOES GENE THERAPY MEAN TO YOU?
Q&A AND DISCUSSIONS
CLOSING REMARKS