Nutritional Management of Children with Cancer

Sarah Ashley-Jones
Clinical Specialist Dietitian
Children's Cancer Centre
Royal Children's Hospital
Melbourne, Australia

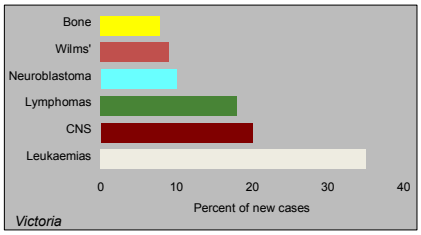
Cancer incidence in childhood

- 1 in 300 males
- 1 in 333 females
- Leading cause of disease related mortality in childhood
- 1960's - 5 year survival rate 5%
- 1990's - 5 year survival rate 65%
- Current data - 5 year survival rate 70-80%
- Development of new treatments

Sala etal (2004)

2

Leading Childhood Cancers Males and Females 0-15 yrs



Cancer in Childhood: Causes

- Most causes unknown
- Some genetic conditions predispose to certain types of cancer
  - Downs Syndrome – Leukaemia's
  - Beckwith Wiedemann – Wilms tumours and Hepatoblastoma
  - Fanconi Anaemia – AML
  - Retinoblastoma

4

Cancer in Childhood; Survival rate

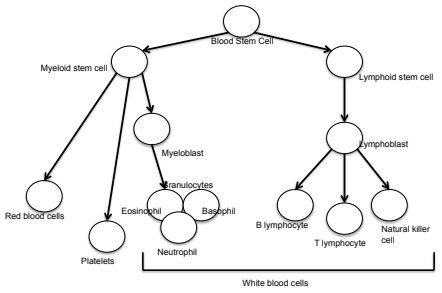
- Survival in certain cancers improved significantly – e.g.. ALL and Lymphoma's – now up to 95% survival for low risk
- Worst survival rate in Adolescent and males
- Survival in some other tumour types remains poor – ongoing research vital
- Despite best efforts approximately 30 children die of cancer in Victoria each year

5

Leukaemia's

- Most common malignancy in childhood
- Significant increase in survival over past 20 years
- Acute Lymphoblastic Leukaemia (ALL)
- Other less common leukaemia's include
  - Acute myeloid leukaemia (AML)
  - Chronic Myeloid Leukaemia (CML)
  - Juvenile Chronic Myeloid Leukaemia (JCML)

6



7

Acute Lymphoblastic Leukaemia

- Chemotherapy
  - Induction, consolidation then maintenance
  - 2 Years Girls
  - 3 Years Boys
- Systemic chemotherapy
- Intrathecal chemotherapy
- CNS irradiation
- Bone Marrow Transplantation

8

Solid Tumours

- Non-Hodgkin's lymphoma (NHL)
- Hodgkin's disease
- Brain (Medulloblastoma most common)
- Neuroblastoma
- Wilms' tumour
- Rhabdomyosarcoma
- Ewing's sarcoma
- Osteosarcoma
- Retinoblastoma
- Germ cells tumours
- Malignant liver tumours

9

Cancer in Childhood; Treatments

- Treatment often multi-modal
  - Observation
  - Chemotherapy
  - Surgery
  - Radiotherapy
  - Monoclonal antibody therapy
  - Stem cell transplant (Autologous)
  - Bone marrow transplant (Allogenic)

10

Monoclonal Antibody Therapy

- Make cancer cells more visable to the immune system eg Rituximab
- Block growth signals eg Cetuximab
- Stop new blood vessels from forming eg. Bevacizumab
- Deliver radiation to cancer cells eg Ibritumomab
- Deliver chemotherapy to cancer cells

11

Car T Cell Therapy

- Since 2006 there has been very little progress made with treatments for relapsed leukemia's.
- Now looking to ‘immunotherapies’
- Blinatumomab (BITE Antibody)
- Genetically modifying T cells by adding a Chimeric Antigen Receptor (CAR) to the T cell.
- These cells specifically recognize and destroy CD19 cells.
- Takes 6-8 weeks to process CAR T cells
- Side effects – CRS (Cytokine release Syndrome)

12

Chemotherapy

- Affects all rapidly dividing cells in the body

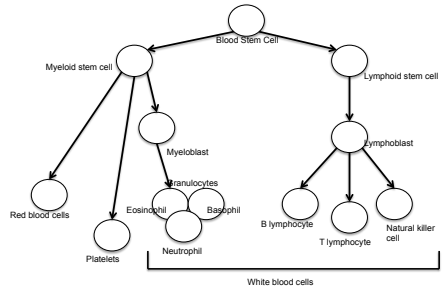
- Myelosuppression vs. myeloablative
- Hair loss
- Gastrointestinal tract – diarrhoea and constipation
- Nausea/Vomiting

13

Myelosuppression

- Reduced ability of the bone marrow to produce blood cells
- Affects red blood cells, white blood cells and platelets
- White cells – part of the immune system & help fight infection and defend body from foreign materials
- WCC include: **neutrophils**, lymphocytes, eosinophils, basophils and monocytes

14



15

Neutropenia

- A type of white blood cell that protects us from bacterial infections (unable to produce 'pus')
- Sepsis leading to death if a febrile child is not treated urgently
- Often the neutropaenic child will present with severe mucositis, loose bowel actions and sometimes nausea and vomiting
- Even if the child could eat often they have no appetite

16

ID:	09221933	09224134	09224825	09218109	09218289		
Collection Date:	19/11/2009	20/11/2009	21/11/2009	22/11/2009	23/11/2009		
Collection Time:	06:20	05:10	05:50	05:15	03:30	Units:	Ref. Range:
Haemoglobin:	97 L*	98 L*	97 L*	91 L*	82 L*	g/L	110-140
Haematocrit:	0.27 L*	0.27 L*	0.27 L*	0.25 L*	0.23 L*		0.34-0.42
RCC:	3.28 L*	3.25 L*	3.28 L*	3.06 L*	2.77 L*	x10e12/L	3.9-5.3
MCH:	29.6	30.0	29.7	29.7	29.8	pg	24-30
MCV:	84	84	83	82	83	fL	75-90
RDW:	20.2 *H	20.0 *H	20.1 *H	19.8 *H	19.2 *H	%	11-14
Nuc RBC:	-	0.0	-	-	-	x10e9/L	0-0
Platelets:	122 L*	124 L*	123 L*	101 L*	84 L*	x10e9/L	150-400
W.C.C:	6.2	5.4 L*	3.7 L*	2.7 L*	2.1 L*	x10e9/L	6.0-17.0
I/T Ratio:	0.11	0.04	0.02	0.03	0.15 *H		<0.12
Neut seg:	2.05	1.46 L*	1.52	1.57	1.18 L*	x10e9/L	1.5-8.5
Lymphocytes:	2.54 L*	3.02	1.30 L*	0.65 L*	0.34 L*	x10e9/L	3.0-9.5
Monocytes:	0.37	0.49	0.07 L*	0.14	0.13	x10e9/L	0.1-1.0
Eosinophils:	0.81	0.32	0.70	0.30	0.25	x10e9/L	0-0.8
Basophils:	0.12 *H	-	-	-	-	x10e9/L	0-0.1
Bands:	0.12	0.05	0.04	0.05	0.21	x10e9/L	0-0.5
Meta:	0.12	-	-	-	-	x10e9/L	
Blasts:	0.06	0.05	0.07	-	-	x10e9/	

Who is most at risk?

- Infants < 1yr
- Stage 3 and 4 disease
- Metastatic disease
- AML- Acute Myeloid Leukaemia
- Brain & spinal tumours
- Gastrointestinal tumours
- Bone marrow transplants
- Intensive, high risk therapy protocols

Bauer etal (2011)

18

Why is nutrition important?

- Diagnosis at a crucial growing time
- Long term treatments
- Treatment often intensive
- GIT related side effects of treatment
- Frequent hospitalisation
- Family life disruptions
- Disturbance to common eating behaviour

19

Consequences of poor nutrition

- Prevalence of malnutrition up to 60%
- Children who are over/underweight at diagnosis have poorer outcomes
- Increased rate of relapse (solid tumours)
- Increases risk of infection
- Increased drug dose reductions and therapy delays
- Improved survival if good nutritional status at diagnosis

Van Eys etal (1998); Ladas etal (2012)

20

Goals of nutrition support:

- Prevent or reverse existing nutritional deficiencies
- To ensure adequate and optimal growth
- To improve resistance to infection
- To repair tissues damaged by treatment
- To reduce treatments side effects
- To accelerate bone marrow recovery
- To enhance quality of life

21

Barriers to optimal nutrition support

- Behavioural and psychological factors
- Anorexia (loss of appetite)
- Nausea and vomiting
- Mucositis
- Taste changes
- Diarrhoea\malabsorption
- Organ damage and nutrient loss
- Increased energy expenditure
- Mechanical gut problems
- Fluid restrictions

22

Ideal Body Weight

- Plot the recent weights and height on a percentile chart
- Determine ideal body weight (IBW) by matching the height percentile to the 'ideal' weight percentile.
- Identify the weight that is in the ideal weight percentile, this is the ideal body weight
- Calculate percentage of IBW by the following equation
- $$\% \text{ IBW} = 100 \times \frac{\text{Current body weight (kg)}}{\text{Ideal body weight (kg)}}$$

23

Percent Weight Loss

- Calculate percentage of weight loss by the following equation
- Usually over 1 month period

$$\frac{\text{Previous weight (kg)} - \text{Current weight(kg)}}{\text{Previous weight (kg)}}$$

24

Estimating requirements

It is essential to consider the following factors when estimating requirements…

- Weight & height history
- Pre-diagnosis weight
- Pre-post op changes to weight
- Organomegaly / ascites
- Treatment intensity
- Tumor type/outcome
- Symptoms
- Palliative care

25

Estimating requirements

As a starting point…..

- Energy = Schofield (BMR x SF/AF b/w 1.3-1.6)
- Protein = 1.2-1.5g/kg/day
- Fluids = RDI
- Micronutrients = RDI

26

Options for nutritional support

- Oral
- Enteral
- Parenteral
- Combination

- Megestrol acetate (Megace)

27

Indications for oral support:

- Low risk diagnosis
- Maintenance phase of treatment
- Functioning GIT
- Insignificant nausea, vomiting, diarrhoea or mucositis
- Poor oral intake or loss of appetite
- Weight loss $\leq$ 5% body weight
- Home support

28

Oral support

- Regular, small meals
- Snacking essential
- Solids first at mealtimes
- Increased energy density foods
- Commercial supplements as required
- Behaviour modification techniques
  - Fussy eating advice
  - Parental support

29

Indications for enteral support

- Functioning GIT
- Mild to moderate nausea, vomiting, diarrhoea, mucositis
- Poor oral intake and loss of appetite
- Weight loss $\geq$ 5% body weight
- Home nutrition support (HEN)

Sacks etal (2014)

30

Enteral feeding solutions

Infant formula
- Standard IF 280kJ
- Concentrated – 350kJ / 420kJ
- Lactose free – Delact / Digestelact
- Extensively hydrolysed – Peptijunior

Older Children
- Standard polymeric eg. Nutrini, Nutrison
- Semi elemental formula e.g. Peptamen Junior, MCT Peptide
- Elemental formula e.g. Paediatric Vivonex

31

Methods of enteral feeding

Route
- Naso-gastric
- Naso-jejunal
- Gastrostomy

Regime
- Bolus
- Gravity
- Continuous
- Intermittent

32

Starting of feeds

A guide to getting started…..

- Depends on age & symptoms
- Often continuous feeding

- 5-10mls/hr increasing 6-8hourly as tolerated, towards target rate

33

Symptom management while on feeds

Vomiting
- Maximise antiemetics
- Continuous feeds
- Reduce rate
- Jejunal feeding

Diarrhoea
- Hydrolysed feeds
- Continuous
- Reduce rate
- Ensure appropriate bottom care

34

Grading back to oral

1. Continuous overnight feeds & encourage oral during the day
2. Grade to bolus feeds and deliver at the end of mealtimes
3. Cease enteral feeds and commence oral – ‘cold turkey’

35

Indications for parenteral nutrition

- Non functioning GIT
- Severe vomiting, nausea, diarrhoea or mucositis
- Severe thrombocytopenia preventing tube placement

Requires
- Comprehensive monitoring of biochemistry and drug compatibility
- Adequate IV fluid allowance

- Very important to have some enteral feeds running / oral intake where possible (trophic feeding e.g. 5mls/ hr)

36

Breastfed infants

- Smaller frequent feeds - may become a snacky / comfort feeder
- Encourage mother to express breast milk (EBM) when infant is fasting or refusing feeds
- Use EBM when available as NG top ups (as tolerated)
- Store EBM when not tolerated due to GIT related side effects (and a hydrolysed feed is required)

37

Enteral feeds - Infants

- An infant may be 'topped up' with breast milk or formula (oral or NG)
- Often hydrolysed formula is used via NG if breast milk or std formula is poorly tolerated
- Hydrolysed formula (oral/NG) may be given in conjunction with comfort breast feeding
- Periods of hydrolysed formula during unwell times may be needed combined with std formula and/or breastfeeding when well

38

Megestrol acetate (Megace)

- Loss of appetite
- Minimal gastro-intestinal symptoms
- Not currently on steroids
- Need to be supplemented with hydrocortisone

- Can be on supplemental enteral feeds
- Encourage high energy and nutrient dense foods

Orme etal (2003)

39

Clean diets (low microbial diet)

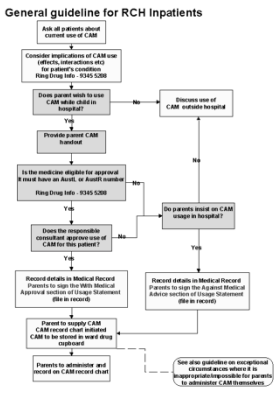
- During & 3 months post BMTx a low microbial diet is used to reduce the risk of contamination from food when the bodies natural immunity is greatly reduced
- Varies from centre to centre worldwide
- Diet is more restricted for inpatients
- Incorporates food choice, preparation, storage and personal hygiene

40

Complementary & Alternative Therapies (CAM's)

- Increasing prevalence
- Oncology patients are the highest users of CAM
- 31-84% of children with cancer using CAM
- Acceptance of CAM by the general public is high

41



RCH Policy – Use of CAM by Inpatients at RCH

42

Late Effects

- 1 in 900 adults 19-45yrs are now survivors of childhood cancer
- 10x risk of mortality then the general population
- As treatments improve, survival rates increase as does morbidity rates associated with treatment

Oeffinger etal (2009)

43

Late Effects

- Obesity
- Lower bone density
- Behavioural eating problems in toddlers
- Oral hypersensitivity in babies
- Delayed solid introduction
- Gastrointestinal recovery (food intolerances)
- Ongoing dysphagia
- Long term enteral feeds

44

Recent updates

- Obese children with cancer;
  - have an increased risk of treatment related toxicity and mortality (AML).
  - have an increase risk of relapse (ALL)
  - who undergo BMT have reduced survival rates.
- Children with cancer have a much lower lean body mass. We need to consider activity recommendations as part of our 'healthy lifestyle treatments' both on and off treatment.
- Probiotics are safe and very likely to be beneficial in the paediatric immunocompromised oncology population.
- Vitamin A, D and Zinc deficiencies are prevalent in our oncology population and are often not monitored.

Ladas (2012)

45