



Blood Day for Primary Care

When do I work up an elevated
White Blood Cell count?

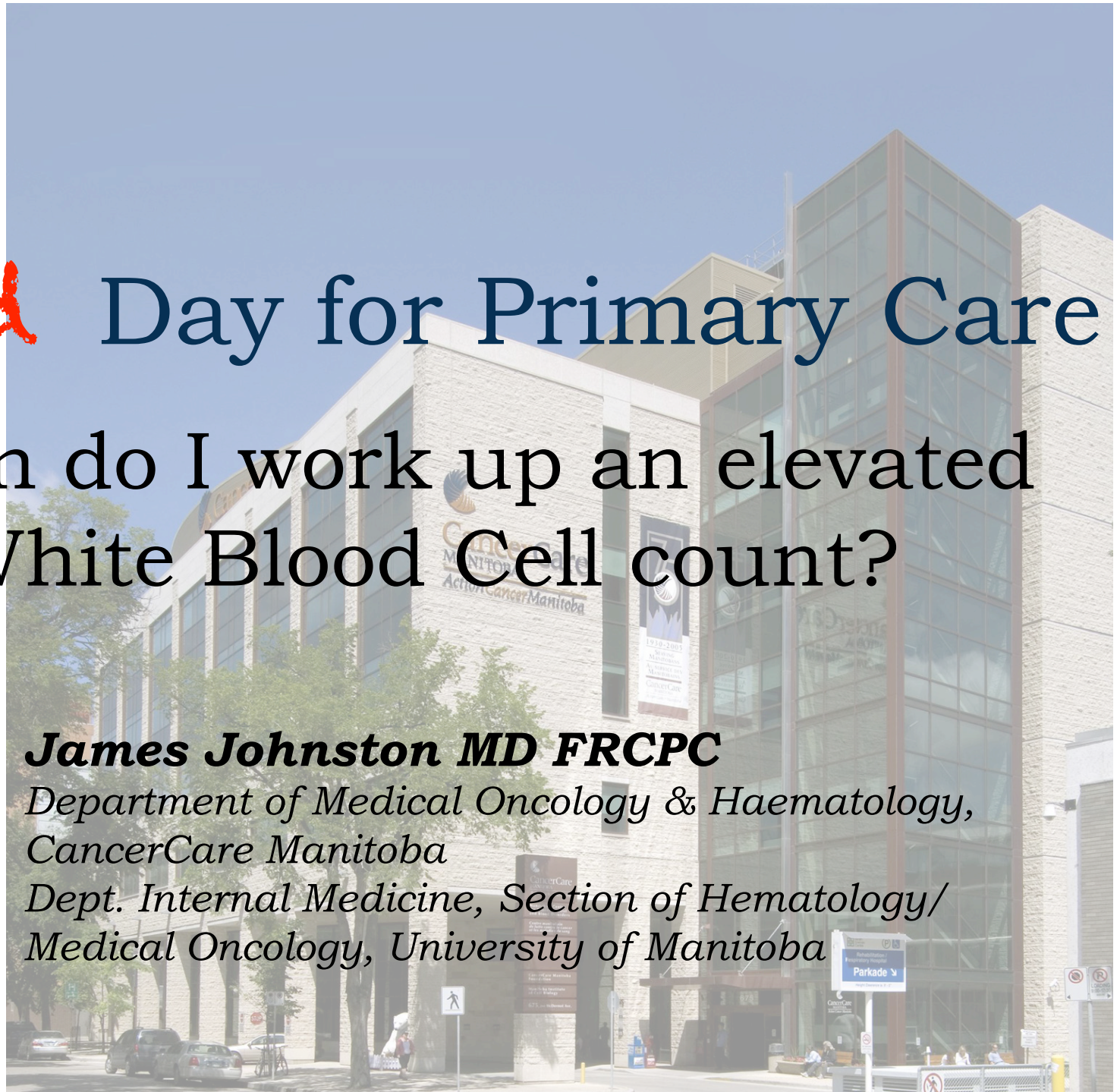
James Johnston MD FRCPC

*Department of Medical Oncology & Haematology,
CancerCare Manitoba*

*Dept. Internal Medicine, Section of Hematology/
Medical Oncology, University of Manitoba*



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Disclosures

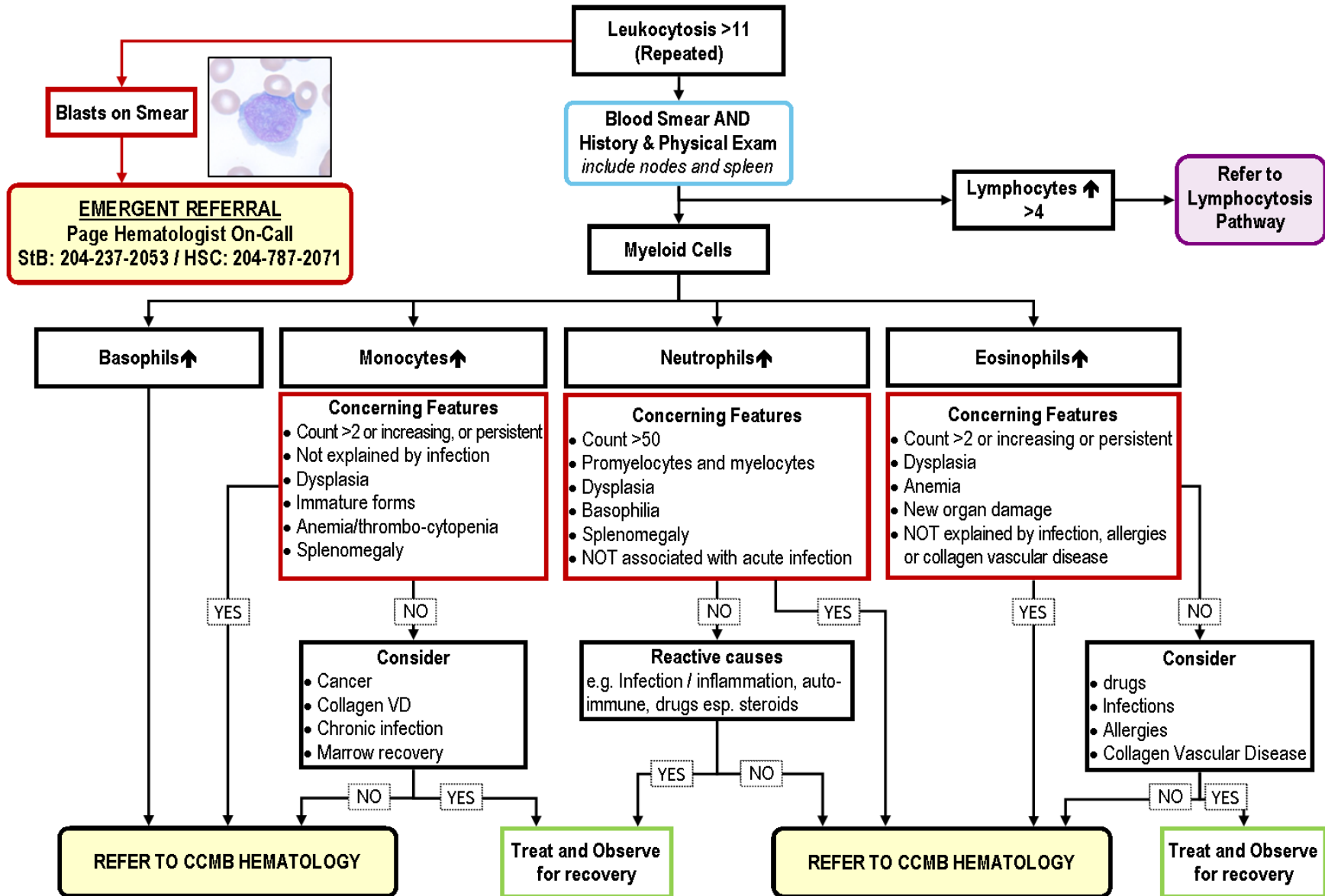
1. Grant support from Roche, Lundbeck, Gilead and Johnson & Johnson pharmaceuticals
2. Advisory boards for Roche, Lundbeck, Gilead and Johnson & Johnson pharmaceuticals
3. Participate in clinical trials sponsored by Roche, Gilead and Millenium
4. Canadian CLL Research Meeting supported by Roche, Gilead, Lundbeck, Johnson & Johnson and Glaxo-Smith Kline



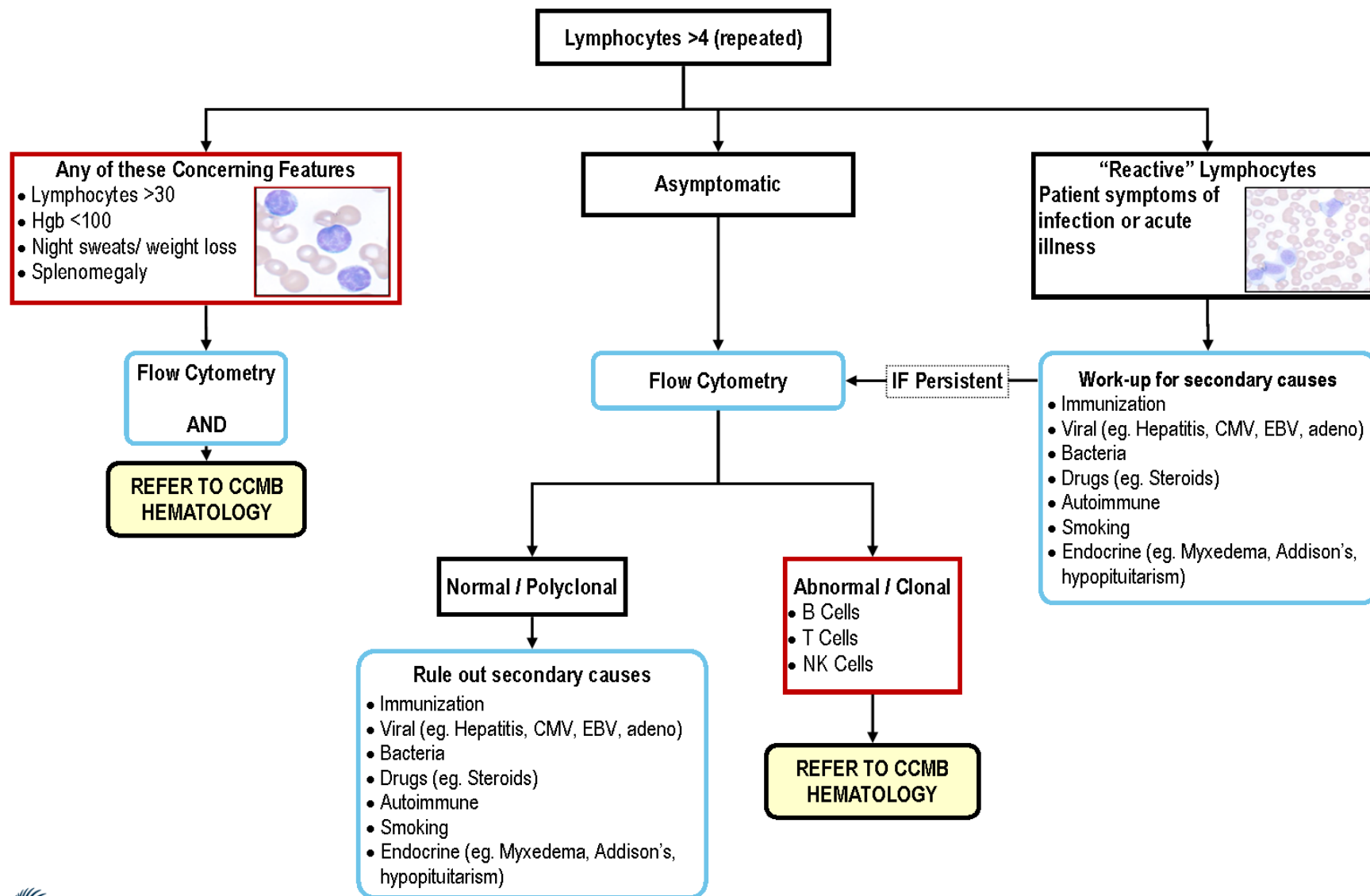
Objectives

1. To know how to work up a case of leukocytosis
2. To know what flow cytometry is and how/when to order this test
3. To know when to refer a patient with leukocytosis

Work-Up of LEUKOCYTOSIS



Work-Up of LYMPHOCYTOSIS





Secondary lymphocytosis

1. Immunization
2. Viral (eg hepatitis, CMV, EBV, adeno)
3. Bacterial
4. Drugs, eg, steroids
5. Autoimmune
6. Smoking
7. Endocrine (myxedema, Addison' s, hypopituitarism)

May be B cell, T cell or NK cell



Malignant Lymphocytosis

1. B cell

1. Chronic lymphocytic leukemia (CLL)/small lymphocytic lymphoma (SLL)
2. Lymphomas with leukemic involvement

2. T cell

1. Large granular lymphocytic leukemia
2. Lymphomas with leukemic involvement

3. NK cells

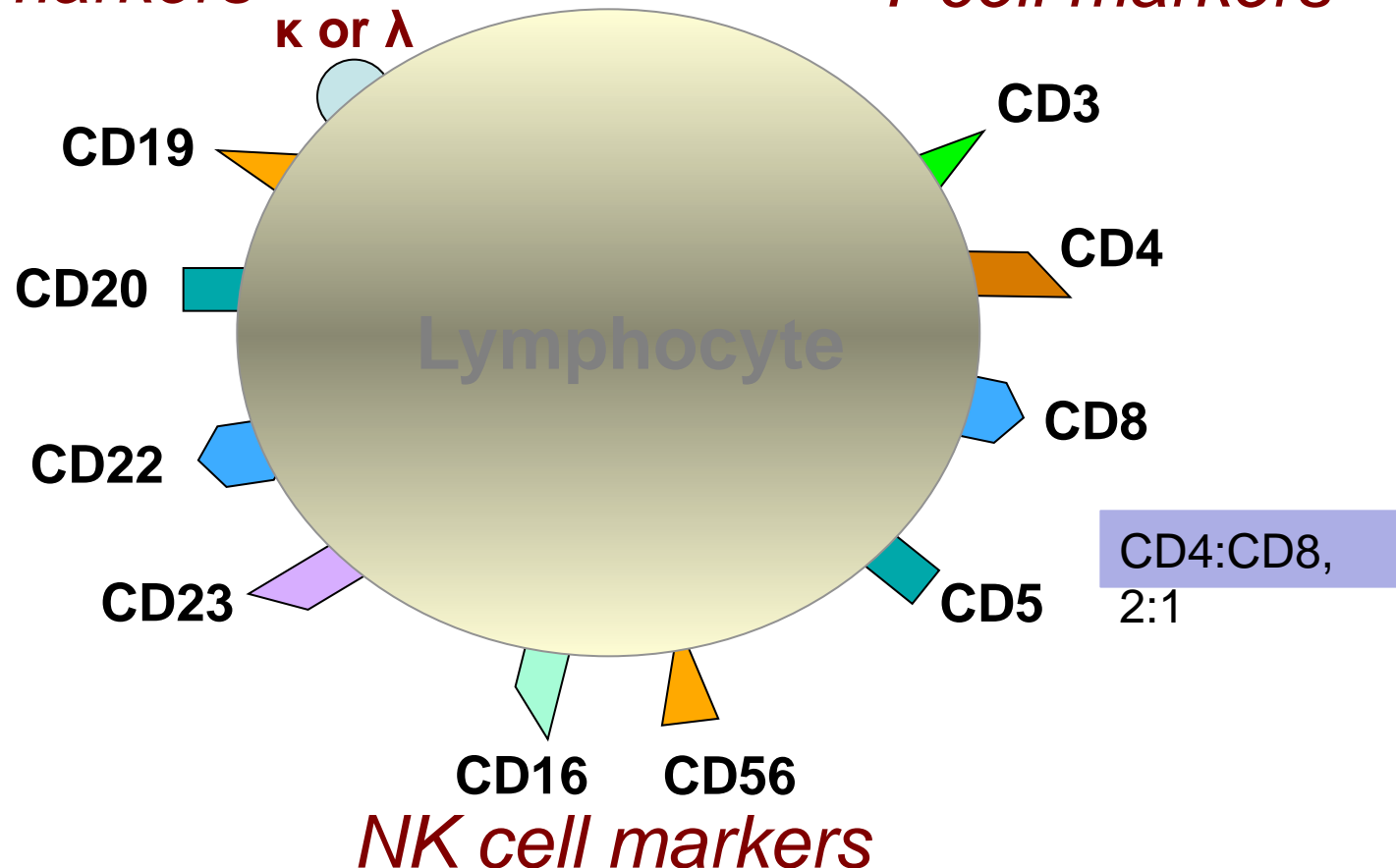
1. NK cell leukemia

Andrews et al. Leuk Lymph, 49:1731, 2008

Flow cytometry for lymphocytes

B cell markers

T cell markers



- About 150 cluster differentiation (CD) markers to differentiate blood cell of origin
- Performed at HSC or St B. Ensure you state what you are looking for!



Flow Cytometry

| | CD19 | CD5 | CD23 | CD10 | CD25 | CD79b | FMC7 | CD103 |
|-----------------------------|------|-----|------|------|------|-------|------|-------|
| CLL | ++ | ++ | ++ | - | +/- | - | -/+ | - |
| Follicular lymphoma | ++ | -/+ | -/+ | ++ | - | ++ | ++ | - |
| Mantle cell lymphoma | ++ | ++ | - | -/+ | - | ++ | ++ | - |
| Marginal zone lymphoma | + | - | +/- | - | - | ++ | + | - |
| Hairy cell leukemia | +++ | - | - | - | +++ | + | +++ | +++ |
| Lymphoplasmacytoid lymphoma | ++ | - | - | - | -/+ | + | + | - |
| Marginal zone lymphoma | + | - | +/- | - | - | ++ | + | - |

Cells must be monoclonal for kappa or lambda light chains!

Typical Referral

Hematology CBC

| Test Name | 03/12/2014 11:00 | | REFERENCE RANGE | UNITS |
|-----------|---------------------|---|-----------------|----------|
| WBC | → 9.6 | | 4.5-11.0 | x10E9/L |
| RBC | 3.43 | L | 4.4-5.9 | x10E12/L |
| HB | → 92 | L | 140-180 | g/L |
| HCT | 0.304 | L | 0.4-0.52 | L/L |
| MCV | 88.6 | | 80-98 | fL |
| MCH | 26.8 | | 26-34 | pg |
| MCHC | 303 | L | 320-365 | g/L |
| RDW-CV | 19.5 | H | 11.4-14.4 | % |
| PLT | → 180 | | 140-440 | x10E9/L |
| MPV | 9.2 | L | 9.4-12.4 | fL |
| % NEUTS | → 2.0 | | 1.8-5.4 | x10E9/L |
| % LYMPHS | → 6.8 | H | 1.3-3.2 | x10E9/L |

Hematology CBC

| Test Name | 03/12/2014 11:00 | REFERENCE RANGE | UNITS |
|--------------------------------|---------------------|-----------------|-------|
| HEMATOPATHOLOGIST SMEAR REVIEW | SEE COMMENT | | |

HEMATOPATHOLOGIST INTERPRETATION: RECOMMEND RECOLLECTION OF PERIPHERAL BLOOD FOR FLOW CYTOMETRY IMMUNOPHENOTYPIC ANALYSIS TO RULE OUT A LYMPHOPROLIFERATIVE DISORDER REVIEWED BY DR. PING SUN (PH:204-258-1114, PAGER:204-935-2908) .



Immunophenotype for 71 Normal Individuals >50 years with Lymphocytes >4

| Diagnosis | % |
|---------------------|-----|
| Normal | 41% |
| CLL immunophenotype | 38% |
| Other lymphomas | 7% |
| NK cells | 7% |
| T-cell LGL | 7% |

Likelihood of being abnormal increases with:

- patient age
- lymphocyte count

Andrews JM et al. Leuk Lymph 49:1731, 2008



Take-Home Message

- If blasts on smear phone ‘hematologist-on-call’ at SBGH or HSC
- Most leukocytosis are transient and are a response to infection, inflammation or drugs
- Mild peripheral lymphocytosis is common in older patients and cause can be diagnosed by flow cytometry



Interactive Question

1. Question: An asymptomatic 72 year old man is found on routine blood work to have a lymphocyte count of 56. Physical exam normal. What would be your next option:
 - a) Screen for EBV and HIV
 - b) Bone marrow
 - c) CT scans of chest and abdomen
 - d) Flow cytometry ✓



Questions?

James Johnston
james.johnston@cancercare.mb.ca

