

# The 5W's of the critical CBC

*When, how, and how fast to consult your friendly neighborhood hematologist*

May 14 2021  
Vi Dao

# Presenter Disclosure

- **Faculty / Speaker's name: Vi Dao**
- **Relationships with commercial interests:**
  - **Grants/Research Support: none**
  - **Speakers Bureau/Honoraria: none**
  - **Consulting Fees: none**
  - **Other: none**

# Mitigating Potential Bias

- Not Applicable

# Learning Objectives

1. Recognize critical patterns on CBC
2. Initiate work up and seek urgent management of critical patterns on CBC

## Hematology referrals in Manitoba

### HOW (2 ways)

CCMB Central Intake  
Fax to 204 786 0621

Digital Health E-Consult  
Sign up at  
<https://mbtelehealth.ca/>

### TRIAGE by PRIORITIES

- Wait time varies from <24 hours to >6 months for in person or virtual appointments
- ~50% will receive a letter response (~13 days) if an appointment is not required to address the question in the referral

- Appropriate for referrals that do not need direct patient involvement
- Response time ~ 3 days

### Urgent Referrals

- Please page us
  - HSC: 204 787 2071
  - SBGH: 204 237 2053

# Case 1:

CBC Auto & Manual Diff						
WBC	L		2.3	x10E9/L		4.5-11
RBC			4.38	x10E12/L		3.8-5.2
HGB	L		118	g/L		120-160
HCT	L		0.346	L/L		0.35-0.47
MCV	L		79.0	fL		80-98
MCH			26.9	pg		26-34
MCHC			341	g/L		320-365
RDW	H		19.4	%		11.4-14.4
Platelet Count			312	x10E9/L		140-440
MPV	L		9.0	fL		9.4-12.4
IPF (Immature Plt Fraction)			1.8	%		1-7
Lymphocytes			1.67	X10E9/L		1.3-3.2
Monocytes	L		0.16	X10E9/L		0.3-0.8
Eosinophils	H		0.44	X10E9/L		0-0.4
Lymphocytes %	H		73.6	%		22-52
Monocytes %			7.0	%		5.0-12.0
Eosinophils %	H		19.4	%		0.0-5.0
Retic Count %			0.8	%		0.5-1.5
Retic Count Abs.			37	X10E9/L		20-100
IRF (Immature Retic Fraction)			10.6	%		3.0-15.9
Ret-He			31.4	pg		28.2-36.6

# Case 1

CBC Auto & Manual Diff

WBC	L	2.3	x10E9/L	4.5-11
RBC		4.38	x10E12/L	3.8-5.2
HGB	L	118	g/L	120-160
HCT	L	0.346	L/L	0.35-0.47
MCV	L	79.0	fL	80-98
MCH				
MCHC				
RDW				
Platelet C				
MPV				
IPF (Imma				
Lymphoc				
Monocyte				
Eosinoph				
Lymphoc				
Monocyte				
Eosinoph				
Retic Col				
Retic Col				
IRF (Immature Retic Fraction)		10.6	%	3.0-15.9
Ret-He		31.4	pg	28.2-36.6

**CBC Comment Result**

Critical/alert value(s) called to: Alana on 10-13-2020 at 1557, WBC=2.3, HGB=118, PLT=312, ANC=0 Result(s) have been read back.

Close

## Case 1: Agranulocytosis (ANC <0.5)

- All patients with neutropenia (ANC<1) with findings of infection require immediate attention, often hospitalization for emergent management (e.g. antibiotic within 60 minutes)
- Asymptomatic patients with unexplained ANC < 0.5 should have a repeat CBC ASAP and urgent Hematology assessment within 2 weeks



# Case 2

05-Sep-2019 10:15		CBC	
WBC	7.9	[4.5-11 x10E9/L]	
RBC	2.63 ↓	[4.4-5.9 x10E12/L]	
HGB	81 ↓	[140-180 g/L]	
HCT	0.249 ↓	[0.40-0.52 L/L]	
MCV	94.7	[80-98 fL]	
MCH	30.8	[26-34 pg]	
MCHC	325	[320-365 g/L]	
RDW	14.0	[11.4-14.4 %]	
PLT	304	[140-440 x10E9/L]	
MPV	10.5	[9.4-12.4 fL]	
Neutrophils percent	68.8 ↑	[34-68 %]	
Lymphocytes percent	17.8 ↓	[22-52 %]	
Monocytes percent	6.8	[5.0-12.0 %]	
Eosinophils percent	5.2 ↑	[0.0-5.0 %]	
Basophils percent	1.3 ↑	[0.0-1.0 %]	
Immature Gran percent	0.1	[%]	
Abs Neutrophils	5.43 ↑	[1.8-5.4 X10E9/L]	
Abs Lymphocytes	1.41	[1.3-3.2 X10E9/L]	
Abs Monocytes	0.54	[0.3-0.8 X10E9/L]	
Abs Eosinophils	0.41 ↑	[0-0.4 X10E9/L]	
Abs Basophils	0.10	[0.0-0.1 X10E9/L]	
Abs Immature Gran	0.01	[X10E9/L]	

# Case 2

Date/Time	Test	Value	Reference Range
05-Sep-2019 10:15	CBC		
	WBC	7.9	[4.5-11 x10E9/L]
	RBC	2.63 ↓	[4.4-5.9 x10E12/L]
	HGB	81 ↓	[140-180 g/L]
	HCT	0.249 ↓	[0.40-0.52 L/L]
	MCV	94.7	[80-98 fL]
23-Sep-2019 17:35	CBC		
	WBC	7.1	[4.5-11 x10E9/L]
	RBC	1.91 ↓	[4.4-5.9 x10E12/L]
	HGB	58 ↓	[140-180 g/L]
	HCT	0.178 ↓	[0.40-0.52 L/L]
	MCV	93.2	[80-98 fL]
	MCH	30.4	[26-34 pg]
	MCHC	326	[320-365 g/L]
	RDW	13.2	[11.4-14.4 %]
	PLT	301	[140-440 x10E9/L]
	Immature Gran percent	0.1	[%]
	Abs Neutrophils	5.43 ↑	[1.8-5.4 X10E9/L]
	Abs Lymphocytes	1.41	[1.3-3.2 X10E9/L]
	Abs Monocytes	0.54	[0.3-0.8 X10E9/L]
	Abs Eosinophils	0.41 ↑	[0-0.4 X10E9/L]
	Abs Basophils	0.10	[0.0-0.1 X10E9/L]
	Abs Immature Gran	0.01	[X10E9/L]

# Case 2

05-Sep-2019 10:15		CBC
WBC		7.9 [4.5-11 x10E9/L]
RBC		2.63 ↓ [4.4-5.9 x10E12/L]
HGB		81 ↓ [140-180 g/L]
HCT		0.249 ↓ [0.40-0.52 L/L]
MCV		94.7 [80-98 fL]
23-Sep-2019 17:35		CBC
WBC		7.1 [4.5-11 x10E9/L]
RBC		1.91 ↓ [4.4-5.9 x10E12/L]
HGB		58 ↓ [140-180 g/L]
HCT		0.178 ↓ [0.40-0.52 L/L]
MCV		93.2 [80-98 fL]
CBC Comment auto	<input type="checkbox"/>	Critical result has been called to MELANIE KISCHUK by Alison Kremski on 23 09 19 at 18:55, Critical result has been called to MELANIE KISCHUK by Alison Kremski on 23 09 19 at 18:55,
Neutrophils percent	<input type="checkbox"/>	61.9 [34-68 %]
Lymphocytes percent	<input type="checkbox"/>	21.9 ↓ [22-52 %]
Monocytes percent	<input type="checkbox"/>	8.7 [5.0-12.0 %]
Eosinophils percent	<input type="checkbox"/>	6.0 ↑ [0.0-5.0 %]
Basophils percent	<input type="checkbox"/>	1.4 ↑ [0.0-1.0 %]
Immature Gran percent	<input type="checkbox"/>	0.1 [%]
Abs Neutrophils	<input type="checkbox"/>	4.41 [1.8-5.4 X10E9/L]
Abs Lymphocytes	<input type="checkbox"/>	1.56 [1.3-3.2 X10E9/L]
Abs Monocytes	<input type="checkbox"/>	0.62 [0.3-0.8 X10E9/L]
Abs Eosinophils	<input type="checkbox"/>	0.43 ↑ [0-0.4 X10E9/L]
Abs Basophils	<input type="checkbox"/>	0.10 [0.0-0.1 X10E9/L]
Abs Immature Gran	<input type="checkbox"/>	0.01 [X10E9/L]
Comment RBC		Red cell morphology consistent with reported indices.
Comment Platelet		Platelets appear normal in number on smear.
Differential Comment	<input type="checkbox"/>	Differential confirmed following microscopic slide review.










# Case 2

23-Sep-2019 17:35		CBC	
WBC	7.1	[4.5-11 x10E9/L]	
RBC	1.91 ↓	[4.4-5.9 x10E12/L]	
HGB	58 ↓	[140-180 g/L]	
HCT	0.178 ↓	[0.40-0.52 L/L]	
MCV	93.2	[80-98 fL]	
MCH	30.4	[26-34 pg]	
MCHC	326	[320-365 g/L]	
RDW	13.2	[11.4-14.4 %]	
PLT	301	[140-440 x10E9/L]	
MPV	10.0	[9.4-12.4 fL]	
IPF	1.7	[1-7 %]	
% Retic count - automated	0.1 ↓	[0.5-1.5 %]	
Abs Retic count - automated	1 ↓	[20-100 X10E9/L]	

## Case 2: Severe anemia (Hb<70)

- If symptomatic severe anemia (Hb<70), will need transfusion  
→ can refer to ER or Emergent Hematology outpatient assessment depending on availability
- Do not need urgent Hematology referral if \*bleeding\* or due to iron deficiency
- *Low reticulocyte count* is specific for hypoproliferative anemia
  - Do not need bleeding work up
  - Need Urgent Hematology assessment for bone marrow/management

# Case 3

Test	17-May-2017	23-Mar-2017
Hematology, Routine Hematology		
Leukocytes 	<u>11.1 x10E9/L</u> 12:45 <u>10.1 x10E9/L</u> 18:00	<u>9.1 x10E9/L</u>
Erythrocytes 	<u>1.81 x10E12/L</u> 12:45 <u>1.74 x10E12/L</u> 18:00	<u>3.35 x10E12/L</u>
Hemoglobin 	<u>61 g/L</u> 12:45 <u>58 g/L</u> 18:00	<u>102 g/L</u>
Hematocrit 	<u>0.192 L/L</u> 12:45 <u>0.186 L/L</u> 18:00	<u>0.291 L/L</u>
MCV 	<u>106.1 fL</u> 12:45 <u>106.9 fL</u> 18:00	<u>86.9 fL</u>
MCH 	<u>33.7 pg</u> 12:45 <u>33.3 pg</u> 18:00	<u>30.4 pg</u>
MCHC 	<u>318 g/L</u> 12:45 <u>312 g/L</u> 18:00	<u>351 g/L</u>
Erythrocyte Distribution Width (RDW) 	<u>27.1 %</u> 12:45 <u>27.6 %</u> 18:00	<u>17.3 %</u>
Platelets 	<u>323 x10E9/L</u> 12:45 <u>315 x10E9/L</u> 18:00	<u>327 x10E9/L</u>

# Case 3

Test	17-May-2017	17-May-2017	23-Mar-2017
<b>Hematology, Routine Hematology</b>			
Leukocytes	<u>11.1 x10E9/L</u> 12:45 <u>10.1 x10E9/L</u> 18:00	Erythrocytes Nucleated/100 Leukocytes <u>20.6 /100 WBC</u> 18:00	<u>1.8 /100 WBC</u>
Erythrocytes	<u>1.81 x10E12/L</u> 12:45 <u>1.74 x10E12/L</u> 18:00	Erythrocytes Nucleated <u>2.40 x10E9/L</u> 12:45 <u>2.09 x10E9/L</u> 18:00	<u>0.16 x10E9/L</u>
Hemoglobin	<u>61 g/L</u> 12:45 <u>58 g/L</u> 18:00	Reticulocytes/100 Erythrocytes <u>29.4 %</u> 12:45 <u>28.1 %</u> 18:00	
Hematocrit	<u>0.192 L/L</u> 12:45 <u>0.186 L/L</u> 18:00	<b>Reticulocytes</b> <u>532 x10E9/L</u> 12:45 <u>490 x10E9/L</u> 18:00	
MCV	<u>106.1 fL</u> 12:45 <u>106.9 fL</u> 18:00	Reticulocytes Immature/Total Reticulocytes <u>43.9 %</u> 12:45 <u>48.1 %</u> 18:00	
MCH	<u>33.7 pg</u> 12:45 <u>33.3 pg</u> 18:00	Hemoglobin In Reticulocytes <u>34.9 pg</u> 12:45 <u>35.8 pg</u> 18:00	
MCHC	<u>318 g/L</u> 12:45 <u>312 g/L</u> 18:00	Neutrophils/100 Leukocytes <u>50.3 %</u> 12:45 <u>29.5 %</u> 18:00	<u>64.7 %</u>
Erythrocyte Distribution Width (RDW)	<u>27.1 %</u> 12:45 <u>27.6 %</u> 18:00	Lymphocytes/100 Leukocytes <u>36.9 %</u> 12:45 <u>59.8 %</u> 18:00	<u>27.2 %</u>
Platelets	<u>323 x10E9/L</u> 12:45 <u>315 x10E9/L</u> 18:00	Monocytes/100 Leukocytes <u>7.8 %</u> 12:45 <u>6.1 %</u> 18:00	<u>4.4 %</u>
		Eosinophils/100 Leukocytes <u>2.9 %</u> 12:45 <u>2.6 %</u> 18:00	<u>2.8 %</u>
		Basophils/100 Leukocytes <u>0.7 %</u> 12:45	<u>0.6 %</u>

# Case 3

Test	17-May-2017	17-May-2017	23-Mar-2017
Hematology, Routine Hematology			
Leukocytes	<u>11.1 x10E9/L</u> 12:45 <u>10.1 x10E9/L</u> 18:00	<u>20.6 /100 WBC</u> 18:00	<u>1.8 /100 WBC</u>
Erythrocytes	<u>1.81 x10E12/L</u> 12:45 <u>1.74 x10E12/L</u> 18:00	<u>2.40 x10E9/L</u> 12:45 <u>2.09 x10E9/L</u> 18:00	<u>0.16 x10E9/L</u>
Hemoglobin	<u>61 g/L</u> 12:45	<u>29.4 g</u> 12:45 <u>28.1 g</u> 18:00	

Lab Results History Details [ Drag window border to resize ] -- Webpage Dialog

<b>Test:</b>	Erythrocytes; Morphology	<b>Specimen:</b>	
<b>Collected:</b>	17-May-2017 12:45	<b>Resulted:</b>	19-May-2017 09:58
<b>Facility:</b>	St. Boniface General Hospital	<b>Status:</b>	Final
<b>Result:</b>	Howell Jolly Bodies present. Markedly increased polychromasia. 4 to 10 spherocytes/HPF. Red cell morphology consistent with reported indices.		
<b>Range:</b>		<b>HIL:</b>	

Erythrocyte Distribution Width (RDW)	<u>27.1 g</u> 12:45 <u>27.6 g</u> 18:00	Leukocytes	<u>59.8 g</u> 18:00	
Platelets	<u>323 x10E9/L</u> 12:45 <u>315 x10E9/L</u> 18:00	Monocytes/100 Leukocytes	<u>7.8 g</u> 12:45 <u>6.1 g</u> 18:00	<u>4.4 g</u>
		Eosinophils/100 Leukocytes	<u>2.9 g</u> 12:45 <u>2.6 g</u> 18:00	<u>2.8 g</u>
		Basophils/100	<u>0.7 g</u> 12:45	<u>0.6 g</u>



# Case 3

Test	17-May-2017	17-May-2017	23-Mar-2017
Hematology, Routine Hematology			
Leukocytes	<u>11.1 x10E9/L</u> 12:45 <u>10.1 x10E9/L</u> 18:00	<u>20.6 /100 WBC</u> 18:00	<u>1.8 /100 WBC</u>
Erythrocytes	<u>1.81 x10E12/L</u> 12:45 <u>1.74 x10E12/L</u> 18:00	<u>2.40 x10E9/L</u> 12:45 <u>2.09 x10E9/L</u> 18:00	<u>0.16 x10E9/L</u>
Hemoglobin	<u>61 g/L</u> 12:45	<u>29.4 g</u> 12:45 <u>28.1 g</u> 18:00	

Lab Results History Details [ Drag window border to resize ] -- Webpage Dialog

<b>Test:</b>	Erythrocytes; Morphology	<b>Specimen:</b>	
<b>Collected:</b>	17-May-2017 12:45	<b>Resulted:</b>	19-May-2017 09:58
<b>Facility:</b>	St. Boniface General Hospital	<b>Status:</b>	Final
<b>Result:</b>	Howell Jolly Bodies present. Markedly increased polychromasia. 4 to 10 spherocytes/HPF. Red cell morphology consistent with reported indices.		
<b>Range:</b>		<b>HIL:</b>	

Erythrocyte Distribution Width (RDW)	<u>27.1 g</u> 12:45 <u>27.6 g</u> 18:00	Leukocytes	<u>59.8 g</u> 18:00	
Platelets	<u>323 x10E9/L</u> 12:45 <u>315 x10E9/L</u> 18:00	Monocytes/100 Leukocytes	<u>7.8 g</u> 12:45 <u>6.1 g</u> 18:00	<u>4.4 g</u>
		Eosinophils/100 Leukocytes	<u>2.9 g</u> 12:45 <u>2.6 g</u> 18:00	<u>2.8 g</u>
		Basophils/100 Leukocytes	<u>0.7 g</u> 12:45	<u>0.6 g</u>

# Case 3

Test	17-May-2017	23-Mar-2017
<b>Bilirubin, Total</b>	<u>39 umol/L</u>	<u>61 umol/L</u>
<b>Bilirubin, Direct</b>	<u>9 umol/L</u>	<u>24 umol/L</u>
<b>Aspartate Aminotransferase (AST)</b>	<u>32 U/L</u>	<u>443 U/L</u>
<b>Alanine Aminotransferase (ALT)</b>	<u>13 U/L</u>	<u>805 U/L</u>
<b>Lactate Dehydrogenase (LD)</b>	<u>875 U/L</u>	<u>534 U/L</u>
<b>Gamma Glutamyl Transferase (GGT)</b>	<u>24 U/L</u>	<u>498 U/L</u>
<b>Alkaline Phosphatase (ALP)</b>	<u>69 U/L</u>	<u>277 U/L</u>
Test	17-May-2017	23-Mar-2017
<b>Haptoglobin</b>	<u>&lt;0.1 g/L</u>	
<b>Thiopurine Methyltransferase; RBC</b>		
<b>Iron Saturation</b>	<u>29 %</u> 12:45 <u>39 %</u> 18:00	
<b>Ferritin</b>	<u>229 ug/L</u>	

## Case 3: Severe anemia

- *High reticulocyte count with spherocytes*
  - *Need hemolysis work up: total and direct bilirubin, LDH and haptoglobin*
    - *high LDH and high bilirubin is suggestive of autoimmune hemolysis (AIHA) and Direct antiglobulin test (DAT)*
  - Emergent Hematology assessment (steroid, IVIg etc)

# Case 4

24-Feb-2021 17:03		CBC	Corrected
WBC		8.0	[4.5-11 x10E9/L]
RBC		5.17	[4.4-5.9 x10E12/L]
HGB		160	[140-180 g/L]
HCT		0.466	[0.40-0.52 L/L]
MCV		90.1	[80-98 fL]
MCH		30.9	[26-34 pg]
MCHC		343	[320-365 g/L]
RDW		12.8	[11.4-14.4 %]
PLT		1 ↓	[140-440 x10E9/L]
IPF		29.3 ↑	[1-7 %]
CBC Comment auto		Test repeated to verify results. Critical result has been called to NICKLE POLLUCK by Lena Dib on 24 02 21 at 17:57, and has been read back. PLT=1	
Neutrophils percent	H	61.6	[34-68 %]
Lymphocytes percent	H	24.8	[22-52 %]
Monocytes percent	H	7.8	[5.0-12.0 %]
Eosinophils percent	H	4.9	[0.0-5.0 %]
Basophils percent	H	0.5	[0.0-1.0 %]
Immature Gran percent	H	0.4	[%]
Abs Neutrophils	H	4.95	[1.8-5.4 X10E9/L]
Abs Lymphocytes	H	1.99	[1.3-3.2 X10E9/L]
Abs Monocytes	H	0.63	[0.3-0.8 X10E9/L]
Abs Eosinophils	H	0.39	[0-0.4 X10E9/L]
Abs Basophils	H	0.04	[0.0-0.1 X10E9/L]
Abs Immature Gran	H	0.03	[X10E9/L]
Comment RBC		Red cell morphology consistent with reported indices.	
Comment Platelet		Platelets appear significantly decreased on smear.	
Differential Comment	H	Differential confirmed following microscopic slide review.	
Hematopathologist Interpretation	H	Please note the isolated thrombocytopenia ??cause Clinical correlation is required. Reviewed by Dr.C.Musuka (Ph:204-237-2471, Cell:204-509-0456).	

## Case 4: Isolated thrombocytopenia

- Probable ITP with severe thrombocytopenia (Platelet <30)
  - Emergent management in ER if bleeding (IVIg, steroid, tranexamic acid etc)
    - rarely need platelet transfusion
  - If asymptomatic (other than bruising/petechia)
    - Emergent Hematology consultation as outpatient
      - Medication review (including over the counter drugs)
- If COVID19 vaccination with viral vector vaccine within last 4-28 days, especially if suspected “thrombosis”/*Vaccine induced thrombocytopenia/thrombosis (VITT)* → Emergent Hematology consultation with *any degree* of thrombocytopenia (Platelet <150)

# Case 5


















Test	04-Mar-2021	21-Jan-2021	13-Jan-2021
<b>Hematology, Routine Hematology</b>			
Leukocytes	<a href="#">9.3 x10E9/L</a>	<a href="#">9.6 x10E9/L</a>	<a href="#">10.4 x10E9/L</a>
Erythrocytes	<a href="#">6.00 x10E12/L</a>	<a href="#">5.93 x10E12/L</a>	<a href="#">5.72 x10E12/L</a>
Hemoglobin	<a href="#">204 g/L</a>	<a href="#">205 g/L</a>	<a href="#">195 g/L</a>
Hematocrit	<a href="#">0.630 L/L</a>	<a href="#">0.622 L/L</a>	<a href="#">0.591 L/L</a>
MCV	<a href="#">103.3 fL</a>	<a href="#">104.9 fL</a>	<a href="#">103.3 fL</a>
MCH	<a href="#">34.0 pg</a>	<a href="#">34.6 pg</a>	<a href="#">34.1 pg</a>
MCHC	<a href="#">329 g/L</a>	<a href="#">330 g/L</a>	<a href="#">330 g/L</a>
Erythrocyte Distribution Width (RDW)	<a href="#">14.5 %</a>	<a href="#">15.2 %</a>	<a href="#">15.2 %</a>
Platelets	<a href="#">137 x10E9/L</a>	<a href="#">152 x10E9/L</a>	<a href="#">143 x10E9/L</a>
MPV	<a href="#">11.4 fL</a>	<a href="#">11.0 fL</a>	<a href="#">10.9 fL</a>
Reticulocytes/100 Erythrocytes	<a href="#">2.8 %</a>		<a href="#">3.0 %</a>
Reticulocytes	<a href="#">169 x10E9/L</a>		<a href="#">174 x10E9/L</a>
<b>Test</b>	<b>04-Mar-2021</b>	<b>21-Jan-2021</b>	<b>13-Jan-2021</b>
Comment; JAK2 gene.p.V617F			<a href="#">See Remarks</a>
Hematopathologist Name; JAK2 gene p.V617F			<a href="#">PARK, PAUL</a>
Erythropoietin			<a href="#">289 mIU/mL</a>

## Case 5: Polycythemia

- If polycythemia is *associated with thrombosis* → emergent Hematology consult for therapeutic phlebotomy
- Review history to look for secondary causes (smoking, androgen use, hypoxia, OSA etc)
  - Can start ASA if no contraindication
  - If no secondary causes found and Hb >200 → send for EPO, Jak2 mutation along with Urgent Hematology referral

# Case 6










Test	04-May-2021
<b>Hematology, Routine Hematology</b>	
Leukocytes 	<a href="#">9.9 x10E9/L</a>
Erythrocytes 	<a href="#">4.71 x10E12/L</a>
Hemoglobin 	<a href="#">141 g/L</a>
Hematocrit 	<a href="#">0.438 L/L</a>
MCV 	<a href="#">93.0 fL</a>
MCH 	<a href="#">29.9 pg</a>
MCHC 	<a href="#">322 g/L</a>
Erythrocyte Distribution Width (RDW) 	<a href="#">14.1 %</a>
Platelets 	<a href="#">2614 x10E9/L</a>
MPV 	<a href="#">9.3 fL</a>
Platelets Reticulated/100 Platelets 	<a href="#">1.9 %</a>
Erythrocytes Nucleated/100 Leukocytes 	
Erythrocytes Nucleated 	
Reticulocytes/100 Erythrocytes 	<a href="#">1.3 %</a>
Reticulocytes 	<a href="#">62 x10E9/L</a>





## Case 6: Thrombocytosis

- Extreme thrombocytosis (Platelet  $>1000$ )
  - Can be associated with bleeding (e.g acquired von Willebrand deficiency) or thrombosis
  - Emergent Hematology referral if bleeding or thrombosis
- In asymptomatic patients
  - Rule out secondary causes such as infection, inflammation, blood loss, iron deficiency anemia, post splenectomy state
  - If no secondary causes found → send for Jak2 and bcr-abl mutation as well as Urgent Hematology referral

# Case 7




Test	27-Apr-2021	26-Apr-2021
<b>Hematology, Routine Hematology</b>		
Leukocytes 	<a href="#">4.5 x10E9/L</a> 08:15 <a href="#">5.1 x10E9/L</a> 15:44	<a href="#">5.0 x10E9/L</a>
Erythrocytes 	<a href="#">2.24 x10E12/L</a> 08:15 <a href="#">2.61 x10E12/L</a> 15:44	<a href="#">2.48 x10E12/L</a>
Hemoglobin 	<a href="#">64 g/L</a> 08:15 <a href="#">76 g/L</a> 15:44	<a href="#">73 g/L</a>
Hematocrit 	<a href="#">0.200 L/L</a> 08:15 <a href="#">0.237 L/L</a> 15:44	<a href="#">0.221 L/L</a>
MCV 	<a href="#">89.3 fL</a> 08:15 <a href="#">90.8 fL</a> 15:44	<a href="#">89.1 fL</a>
MCH 	<a href="#">28.6 pg</a> 08:15 <a href="#">29.1 pg</a> 15:44	<a href="#">29.4 pg</a>
MCHC 	<a href="#">320 g/L</a> 08:15 <a href="#">321 g/L</a> 15:44	<a href="#">330 g/L</a>
Erythrocyte Distribution Width (RDW) 	<a href="#">18.0 %</a> 08:15 <a href="#">17.7 %</a> 15:44	<a href="#">17.9 %</a>
Platelets 	<a href="#">79 x10E9/L</a> 08:15 <a href="#">82 x10E9/L</a> 15:44	<a href="#">121 x10E9/L</a>

# Case 7

Test	27-Apr-2021	26-Apr-2021
Hematology, Routine Hematology		
Leukocytes 	<a href="#">4.5 x10E9/L</a> 08:15 <a href="#">5.1 x10E9/L</a> 15:44	<a href="#">5.0 x10E9/L</a>
Erythrocytes 	<a href="#">2.24 x10E12/L</a> 08:15	<a href="#">2.48 x10E12/L</a>

Lab Results History Details [ Drag window border to resize ] -- Webpage Dialog

<b>Test:</b>	Erythrocytes; Morphology	<b>Specimen:</b>	
<b>Collected:</b>	25-Apr-2021 13:55	<b>Resulted:</b>	26-Apr-2021 10:32
<b>Facility:</b>	St. Boniface General Hospital	<b>Status:</b>	Final
<b>Result:</b>	Marked rouleaux present. 1 to 3 schistocytes/HPF. Red cell morphology consistent with reported indices.		
<b>Range:</b>	H/L:		

MCHC 	<a href="#">320 g/L</a> 08:15 <a href="#">321 g/L</a> 15:44	<a href="#">330 g/L</a>
Erythrocyte Distribution Width (RDW) 	<a href="#">18.0 %</a> 08:15 <a href="#">17.7 %</a> 15:44	<a href="#">17.9 %</a>
Platelets 	<a href="#">79 x10E9/L</a> 08:15 <a href="#">82 x10E9/L</a> 15:44	<a href="#">121 x10E9/L</a>

# Case 7

Test	27-Apr-2021	26-Apr-2021
Hematology, Routine Hematology		

Bilirubin, Total	<a href="#">14 umol/L</a>		<a href="#">17 umol/L</a> 06:00 <a href="#">13 umol/L</a> 13:55
Bilirubin, Direct	<a href="#">5 umol/L</a>		<a href="#">6 umol/L</a> 06:00 <a href="#">4 umol/L</a> 13:55
hs Troponin T			<a href="#">47 ng/L</a>
NT-proBNP			<a href="#">12167 pg/ml</a>
Aspartate Aminotransferase (AST)	<a href="#">67 U/L</a>		<a href="#">109 U/L</a>
Alanine Aminotransferase (ALT)	<a href="#">19 U/L</a>		<a href="#">20 U/L</a> 06:00 <a href="#">23 U/L</a> 13:55
Lactate Dehydrogenase (LD)	<a href="#">411 U/L</a>		<a href="#">996 U/L</a> 06:00 <a href="#">1094 U/L</a> 13:55
Haptoglobin			<a href="#">&lt;0.1 g/L</a> 06:00 <a href="#">&lt;0.1 g/L</a> 13:55
Distribution Width (RDW)	<a href="#">17.7 %</a> 15:44		
Platelets	<a href="#">79 x10E9/L</a> 08:15 <a href="#">82 x10E9/L</a> 15:44	<a href="#">121 x10E9/L</a>	

Lab Results

Test:

Collected:

Facility:

Result:










Range:

rted

Case 7: Anemia with thrombocytopenia AND **schistocytes** on smear

- Needs rapid confirmation of thrombocytopenia and microangiopathic hemolytic anemia (MAHA)
- Thrombotic microangiopathy (TMA) syndromes should be suspected if systemic disorders are ruled out (e.g DIC, sepsis, pregnancy, malignant hypertension, cancer, SLE/vasculitis, drugs, post stem cell transplant, rejection etc)

# Case 8















Test	18-Apr-2021	14-Apr-2021	29-Mar-2021
<b>Hematology, Routine Hematology</b>			
Leukocytes 	<u>13.3 (Corrected)...</u>	<u>9.1 x10E9/L</u>	<u>8.2 (Corrected) ...</u>
Erythrocytes 	<u>2.94 x10E12/L</u>	<u>2.97 x10E12/L</u>	<u>3.12 x10E12/L</u>
Hemoglobin 	<u>79 g/L</u>	<u>79 g/L</u>	<u>84 g/L</u>
Hematocrit 	<u>0.289 L/L</u>	<u>0.282 L/L</u>	<u>0.299 L/L</u>
MCV 	<u>98.3 fL</u>	<u>94.9 fL</u>	<u>95.8 fL</u>
MCH 	<u>26.9 pg</u>	<u>26.6 pg</u>	<u>26.9 pg</u>
MCHC 	<u>273 g/L</u>	<u>280 g/L</u>	<u>281 g/L</u>
Erythrocyte Distribution Width (RDW) 	<u>22.5 %</u>	<u>22.7 %</u>	<u>22.6 %</u>
Platelets 	<u>32 x10E9/L</u>	<u>48 x10E9/L</u>	<u>47 x10E9/L</u>

# Case 8

LEUCO-ERYTHROBLASTIC PICTURE

Test	18-Apr-2021	14-Apr-2021	29-Mar-2021
Leukocytes			
Blasts/100 Leukocytes	<u>3.0 %</u>	<u>2.0 %</u>	<u>3.0 %</u>
Neutrophils	<u>3.54 x10E9/L</u>	<u>4.00 x10E9/L</u>	<u>3.14 x10E9/L</u>
Lymphocytes	<u>4.13 x10E9/L</u>	<u>2.36 x10E9/L</u>	<u>2.06 x10E9/L</u>
Monocytes	<u>4.72 x10E9/L</u>	<u>1.45 x10E9/L</u>	<u>1.82 x10E9/L</u>
Eosinophils	<u>0.89 x10E9/L</u>	<u>0.91 x10E9/L</u>	<u>0.58 x10E9/L</u>
Metamyelocytes	<u>1.03 x10E9/L</u>	<u>0.18 x10E9/L</u>	<u>0.08 x10E9/L</u>
Blasts	<u>0.44 x10E9/L</u>	<u>0.18 x10E9/L</u>	<u>0.25 x10E9/L</u>
Erythrocytes Nucleated; Manual	<u>1.47 x10E9/L</u>		<u>1.65 x10E9/L</u>
Erythrocytes; Morphology	<u>Increased polych...</u>	<u>Red cell morphol...</u>	<u>Red cell morphol...</u>
Leukocytes; Morphology	<u>Left shift.</u>		
Platelets; Morphology	<u>Platelets appear...</u>	<u>Platelets appear...</u>	<u>Platelets appear...</u>








# Case 8

Test	Mar-2021	29-Mar-2021	28-Mar-2021
Neutrophils 		<a href="#">3.14 x10E9/L</a>	<a href="#">3.93 x10E9/L</a>
Lymphocytes 		<a href="#">2.06 x10E9/L</a>	<a href="#">2.34 x10E9/L</a>
Monocytes 		<a href="#">1.82 x10E9/L</a>	<a href="#">1.78 x10E9/L</a>
Eosinophils 		<a href="#">0.58 x10E9/L</a>	<a href="#">0.93 x10E9/L</a>
Basophils 			
Metamyelocytes 		<a href="#">0.08 x10E9/L</a>	
Myelocytes 		<a href="#">0.33 x10E9/L</a>	<a href="#">0.19 x10E9/L</a>
Promyelocytes 			
Blasts 		<a href="#">0.25 x10E9/L</a>	<a href="#">0.19 x10E9/L</a>
Erythrocytes Nucleated; Manual 		<a href="#">1.65 x10E9/L</a>	<a href="#">2.05 x10E9/L</a>
Erythrocytes; Morphology 		<a href="#">Red cell morphol...</a>	<a href="#">Increased polych...</a>
Leukocytes; Morphology 			<a href="#">Left shift.</a>
Platelets; Morphology 		<a href="#">Platelets appear...</a>	<a href="#">Platelets appear...</a>
Hematopathologist Interpretation 		<a href="#">See Remarks</a>	<a href="#">See Remarks</a>








# Case 8

Test	Mar-2021	29-Mar-2021	28-Mar-2021
Neutrophils 		<a href="#">3.14 x10E9/L</a>	<a href="#">3.93 x10E9/L</a>
Lymphocytes 		<a href="#">2.06 x10E9/L</a>	<a href="#">2.34 x10E9/L</a>
Monocytes 		<a href="#">1.82 x10E9/L</a>	<a href="#">1.78 x10E9/L</a>
Eosinophils 		<a href="#">0.58 x10E9/L</a>	<a href="#">0.93 x10E9/L</a>
Basophils 			
Metamyelocytes 		<a href="#">0.08 x10E9/L</a>	
Myelocytes 		<a href="#">0.33 x10E9/L</a>	<a href="#">0.19 x10E9/L</a>

Lab Results History Details [ Drag window border to resize ] -- Webpage Dialog

<b>Test:</b>	Hematopathologist Interpretation	<b>Specimen:</b>	
<b>Collected:</b>	29-Mar-2021 06:25	<b>Resulted:</b>	29-Mar-2021 13:25
<b>Facility:</b>	Grace Hospital	<b>Status:</b>	Corrected
<b>Result:</b>	THESE RESULTS ARE AMENDED, PLEASE DISREGARD PREVIOUS RESULTS ON THIS SAMPLE. The blood film shows dysplastic changes in neutrophils and rare circulating blast cells. Bone marrow examination to rule out myelodysplasia is required. Reviewed by Dr.C.Musuka (Ph:204-237-2471, Cell:204-509-0456).		
<b>Range:</b>		<b>HIL:</b>	

Interpretation 			
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## Case 8: The leuco-erythroblastic smear

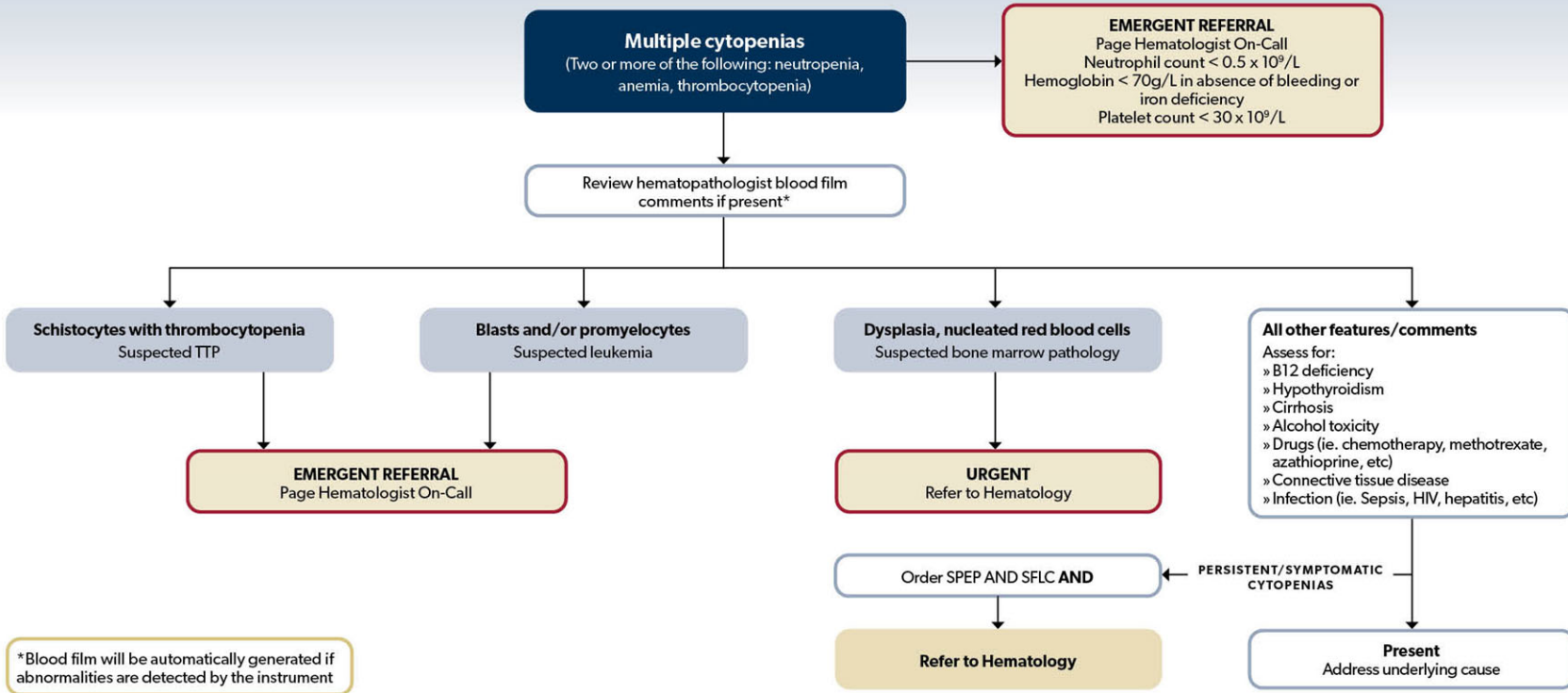
- The combined presence of tear drop red cell, nRBC and early WBC (e.g left shift, including blasts) suggest marrow fibrosis and/or marrow invasion
  - Unless obvious cause has been identified, will need Urgent Hematology assessment with bone marrow
  - If blast, promyelocytes or plasma cell seen → need Emergent Hematology assessment

# Barriers to Practice Change

- Timely electronic review of CBC may not be possible
  - E.g. Differential of the WBC may come later that will report blasts
  - Hematopathologist (or hematologist) review of smear isn't always possible if not on site

# Take home message(s)

- Complete review of “high yield” indices on CBC **AND** blood smear give important clues to the urgency of the referral
- Examples of Emergent referral that the Hematologist should be page to discuss include:
  1. Severe cytopenias
    - Neutropenia ( $ANC < 0.5 \times 10^9/L$ )
    - Anemia ( $Hb < 70$ ) *that is not due to bleeding or iron deficiency*
      - Look at reticulocyte count and smear for clues for underlying cause
    - Thrombocytopenia (Platelet  $< 30$ )
  2. Combined anemia/thrombocytopenia with schistocytes → suspicious for microangiopathic hemolytic anemia (MAHA)
  3. Blast/promyelocytes/plasma cell on smear review is suggestive of acute leukemia
    - Leucoerythroblastic blood film (tear drops, dysplastic changes, nRBC with left shift including metamyelocyte, myelocytes) is suggestive of marrow fibrosis or marrow invasion → Urgent Hematology referral (but not Emergent)



\*Blood film will be automatically generated if abnormalities are detected by the instrument

SPEP = Serum protein electrophoresis  
SFLC = Serum free light chain

TTP = Thrombotic thrombocytopenic purpura

© Blood Disorder Day  
Pathways are subject to clinical judgement and actual practice patterns may not always follow the proposed steps in this pathway.

Referral assignment	Examples
<p><b>Priority 1-Emergent</b></p> <p><b>Assess within 24-72 hours</b></p> <p><b>PLEASE PAGE US</b></p>	<ul style="list-style-type: none"> <li>• Acute leukemia</li> <li>• TTP/DIC</li> <li>• Severe cytopenias               <ul style="list-style-type: none"> <li>• Plt &lt; 30 OR Plt &lt;50 AND bleeding or needs urgent procedures</li> <li>• Hb&lt;70 (not yet transfused)</li> <li>• ANC &lt;0.5 with infection</li> </ul> </li> </ul>
<p><b>Priority 2-Urgent</b></p> <p><b>Assess within 2 weeks</b></p>	<ul style="list-style-type: none"> <li>• Severe cytopenias but asymptomatic               <ul style="list-style-type: none"> <li>○ ANC &lt;0.5</li> <li>○ Hb&lt;70</li> </ul> </li> <li>• Myeloproliferative disorders               <ul style="list-style-type: none"> <li>• Polycythemia: Hb &gt; 200</li> <li>• Thrombocytosis: Platelet &gt; 1000</li> </ul> </li> </ul>

*Thank you*

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