

An aerial night view of a city skyline. A prominent building in the center-left has 'mindray' and '迈瑞' (Mǎi Ruì) illuminated on its facade. The sky is a mix of orange, yellow, and blue, suggesting sunset or sunrise. Several stylized, glowing blue butterflies are flying across the scene.

mindray 迈瑞

Case Study Hematology

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Case Background

Analyzer : CAL 6000

Problem : Abnormal Delta check seen in one sample for WBC parameter.

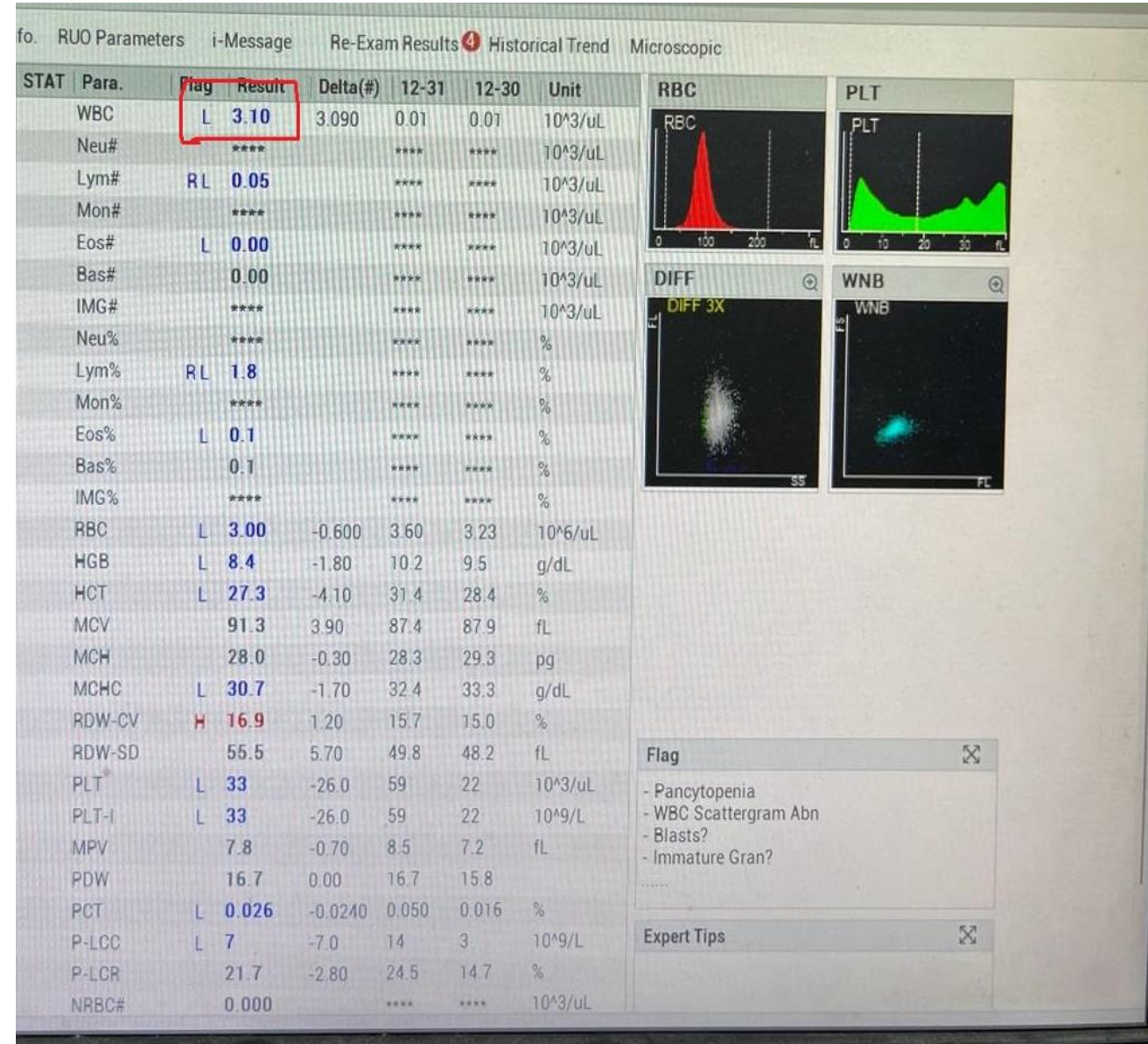
Background : The patient is suffering from Acute Myeloid Leukemia and admitted to hospital for Bone marrow transplant. So patient is having the history of Low WBC count.

Case Ideas

Abnormal Delta check seen in one sample for WBC Parameter.

Case Description :

- A female patient with age 22 years having AML (Acute Myeloid Leukemia).
- This patient's sample run on our analyzer on 01 January 2024 in Morning. The result was **3100u/L** for WBC.
- When doctor checked the result, it is brought to notice that the result was wrong as per patient history.
- So, customer raise this issue to Mindray team.



Patient History :

- The patient admitted to hospital for BMT (Bone Marrow Transplant). The transplant done at end of November 2023 and engraftment done on 4th December 2023.
- The infection started with other complications on 28th December 2023. So, patient shifted to ICU on 29th December 2023.
- From 28th December 2023 the WBC count is continuously low below 100.
- on 1st January 2024 when this patient's sample came to lab for run, after running it the result for WBC suddenly raised to **3100/uL**.
- when we see on slide it is showing **100/uL**.
- The Patient Died of IC Bleed on 1st January 2024.

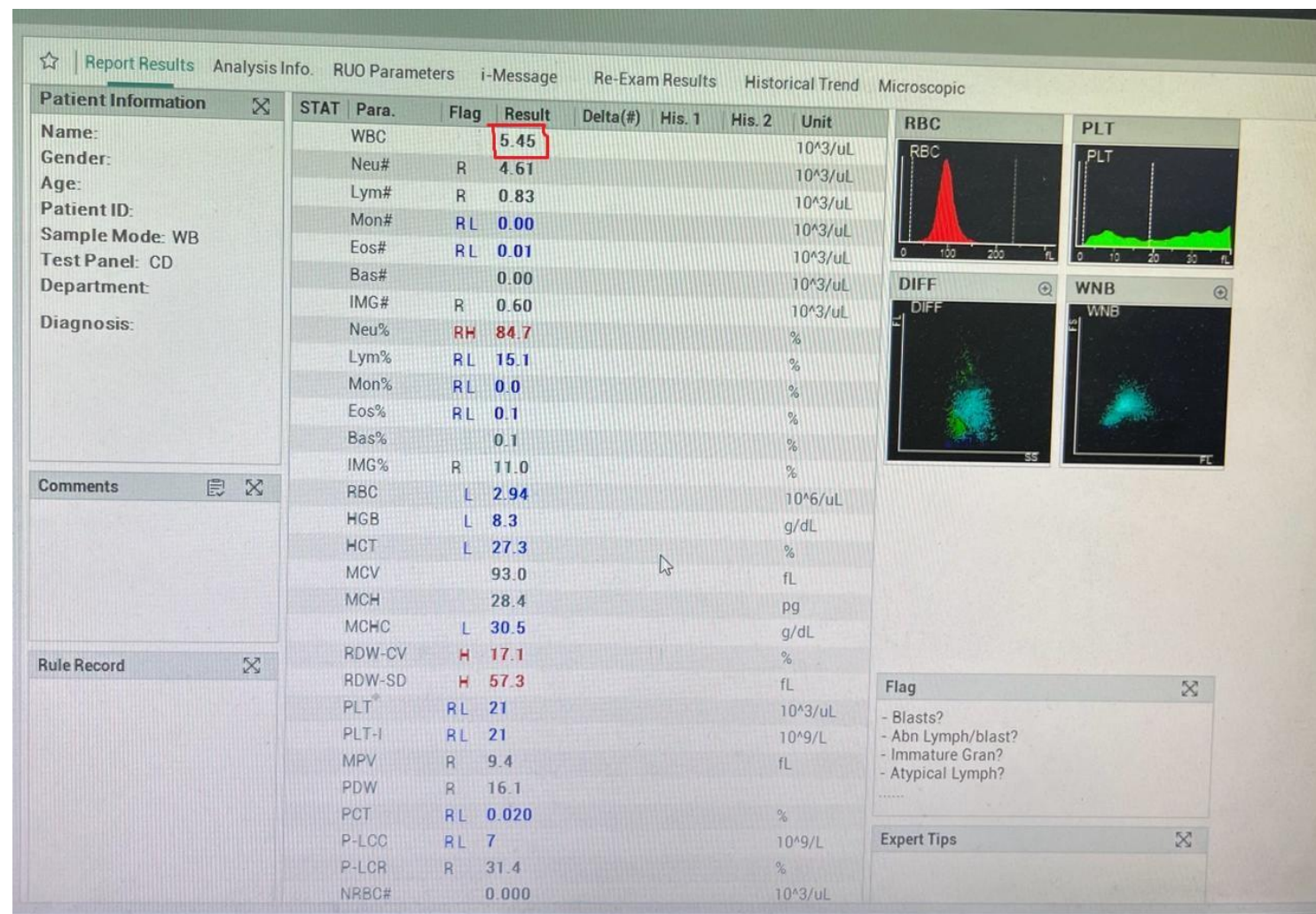
CBC (COMPLETE BLOOD COUNT)

Date	Unit	Bio.Ref.Range	01/Jan/24 12:40AM	31/Dec/23 12:40AM	30/Dec/23 01:14PM	30/Dec/23 04:38AM	29/Dec/23 01:42AM	28/Dec/23 02:30AM	27/Dec/23 04:56AM
Haemoglobin	g/dl	12 - 15	8.4	10.1	7.0	9.5	8.3	9.0	7.3
Packed Cell, Volume	%	36 - 46	27.3	31.0	21.4	28.4	24.3	27.2	22.1
Haemoglobin	g/dl	12 - 15	8.4	10.1	7.0	9.5	8.3	9.0	7.3
Total Leucocyte Count (TLC)	/μL	4000 -10000	100	10	10	10	10	10	20
Packed Cell, Volume	%	36 - 46	27.3	31.0	21.4	28.4	24.3	27.2	22.1
Nucleated RBCs									
Total Leucocyte Count (TLC)	/μL	4000 -10000	100	10	10	10	10	10	20
Haemoglobin	g/dl	12 - 15	8.4	10.1	7.0	9.5	8.3	9.0	7.3
RBC Count	mill/μL	3.8 - 4.8	3.00	3.55	2.40	3.23	2.74	3.10	2.49
Packed Cell, Volume	%	36 - 46	27.3	31.0	21.4	28.4	24.3	27.2	22.1

MacData Tested Provisional ReRun Forwarded Approved Printed Hold Rejected

Case Solution

- ❑ On 2nd January 2024 I visited there for this issue. I repeated that same sample and the result were **5450/uL**.
- ❑ So, after checking the result I found that there is grey zone in Differential scatter also in WNB scatter the WBCs shifted to left.



Case Solution

Bone Marrow Report :

- ❖ As per bone marrow report it is found that there is no granulomas, hemoparasite or foreign cells seen. **Many macrophages seen and some of which show evidence of hemophagocytosis.**

Impression :

- ❖ Mildly hypocellular bone marrow showing **hemophagocytosis**, post BMT day 35.

MATERIAL RECEIVED : BMA & Imprint smears + EDTA & Heparin tubes

CLINICAL DETAILS : D 35 ,post allogeneic BMT, new onset pancytopenia.

PERIPHERAL SMEAR EXAMINATION : CBC – Hb: 9.0 g/dl; RBC: 3.14 mill/micL; PCV:27.1 %; MCV:86.4 fl; MCH:28.6 pg; MCHC: 33.1 g/dl; RDW: 15.7 %; Platelets: 15000/micL & TLC:230 /micL.

DLC: Neutrophils 87 %, lymphocytes 12 %, monocytes 00 % , eosinophils 01 %,basophils 00%, nRBCs 05 /100WBCs.

RBC: Normocytic normochromic. WBC TLC- Leucopenia & DLC –No abnormal cells. Platelets- reduced, MP not seen.

CELLULARITY: Particulate marrow, hypocellular for age, showing cellular trails.

M:E RATIO: 2.2 :1

ERYTHROPOIESIS: Normoblastic erythropoiesis , mild dysplasia noted.

IRON : 4+, no ring sideroblasts.

MYELOPOIESIS: Orderly maturation of granulocytic precursors . Blasts not increased.

MYELOGRAM:

Differential count in % - Blasts-00 ,Promyelocytes-00 ,Myelocytes-29 ,Metamyelocytes-06 ,Band cells-01 ,Neutrophils-31 ,Lymphocytes-02 ,Plasma Cells-01 ,Eosinophils-00 ,Erythroid cells-30

LYMPHOPOIESIS: Within normal limits with mature morphological features

MEGAKARYOPOIESIS: Reduced in number and normal in morphology.

OTHERS: No granulomas , hemoparasite or foreign cells seen . Many macrophages are noted some of which show evidence of hemophagocytosis.

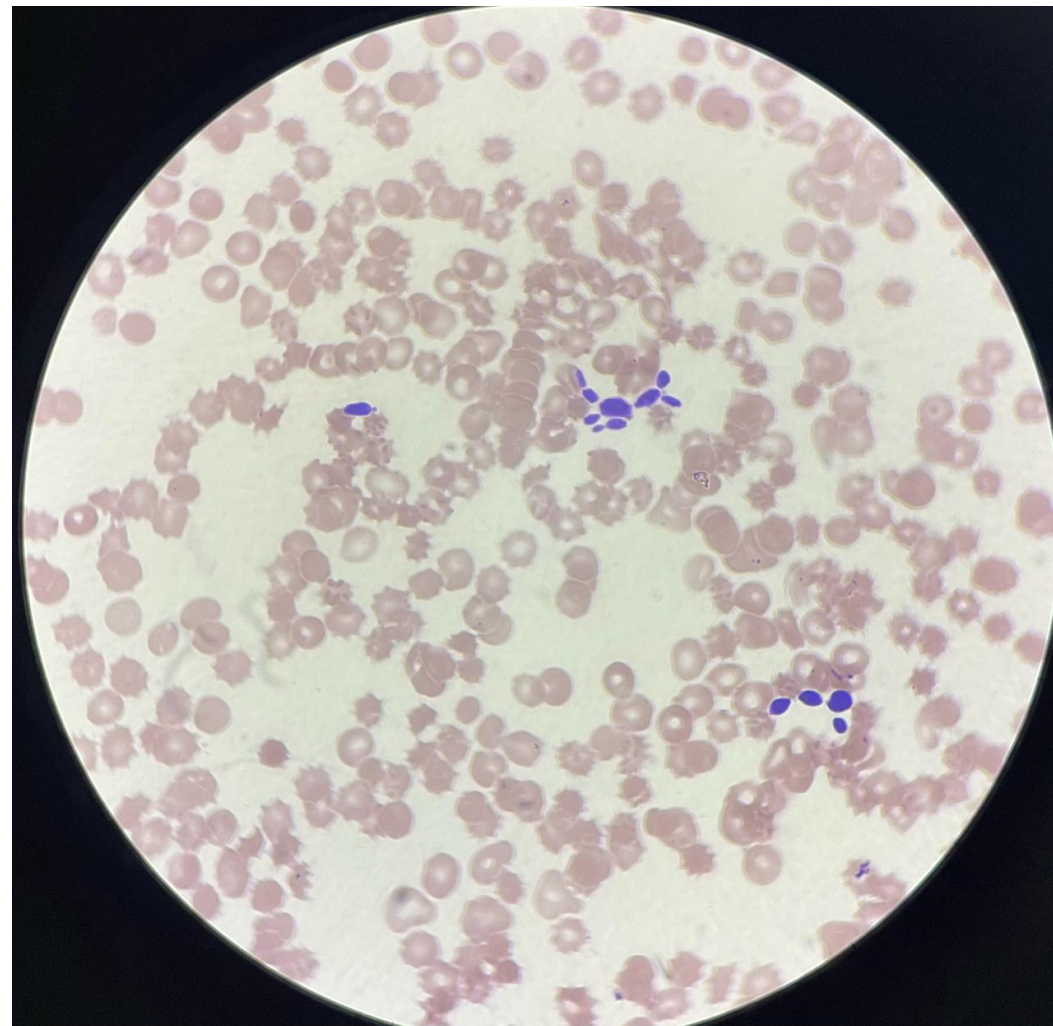
IMPRESSION: Mildly hypocellular bone marrow showing hemophagocytosis , post BMT day 35.

Kidney correlates with clinical findings

Case Solution

- I carried this sample with me to cross check at other site and found that on other BC 6200 also it giving same results.
- I prepare the slide and checked by microscopy. It is found that the sample contains budding yeast.
- According to some research papers it is observed that the PLT can effectively kill Yeast after thrombin stimulation.
- So, in this case also the PLT were actively working to eliminate the Yeast from Blood stream which led to Thrombocytosis.

Microscopy by Normal Microscope



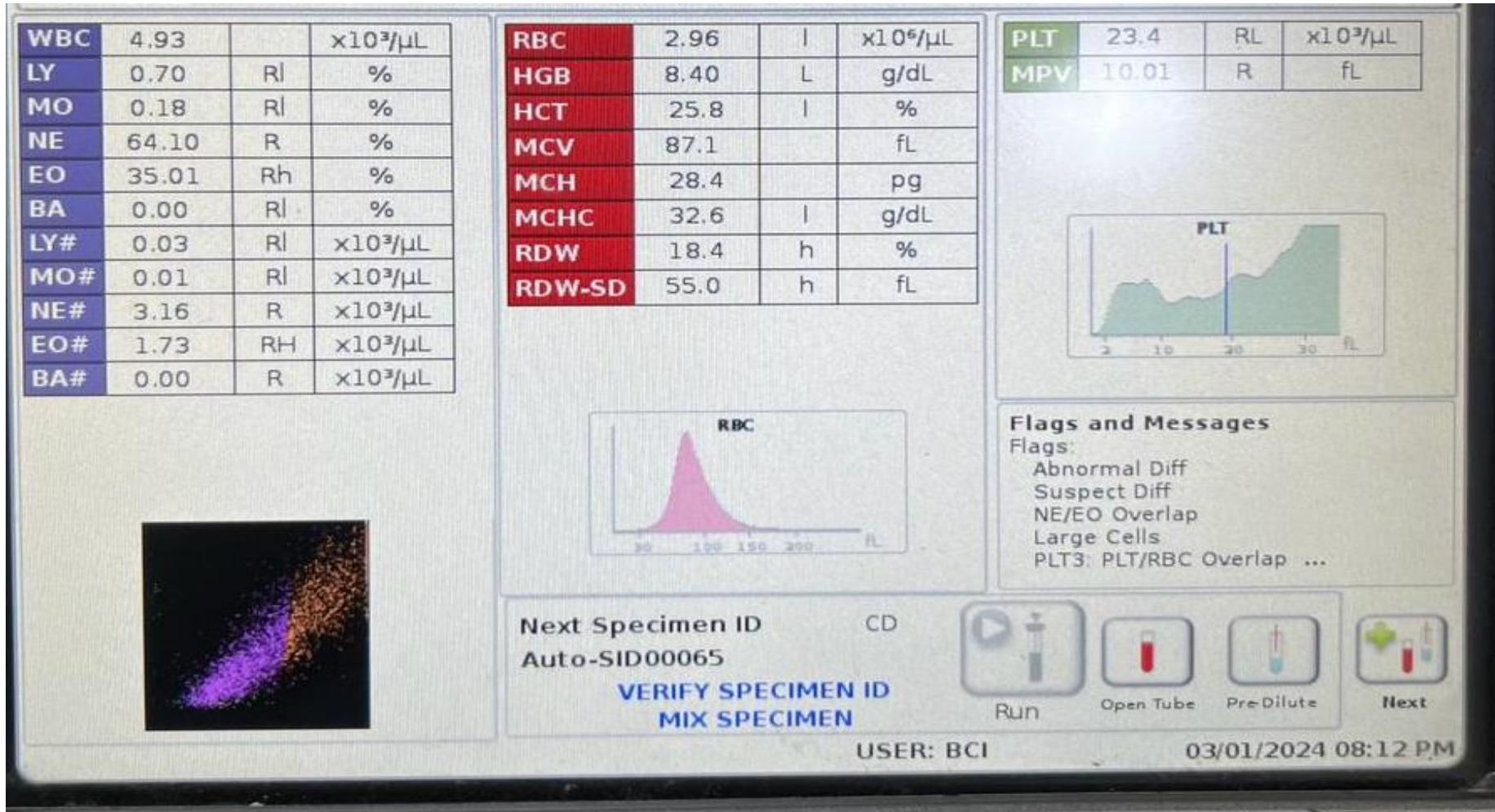
Case Solution

➤ The following are the reasons for the Thrombocytosis:

- Bone marrow disorder
- Kidney disorder
- Acute bleeding and blood loss
- Allergic reactions
- Surgery or trauma
- Hemolytic anemia
- Vitamin and iron deficiency
- Removal of spleen
- Coronary artery bypass
- Heart attack
- Cancer
- Inflammatory disorders, such as rheumatoid arthritis, sarcoidosis or inflammatory bowel disease.

Beckman Coulter Result

This sample I cross checked on our competitor also Beckman coulter and on that also the result were 4930/uL.

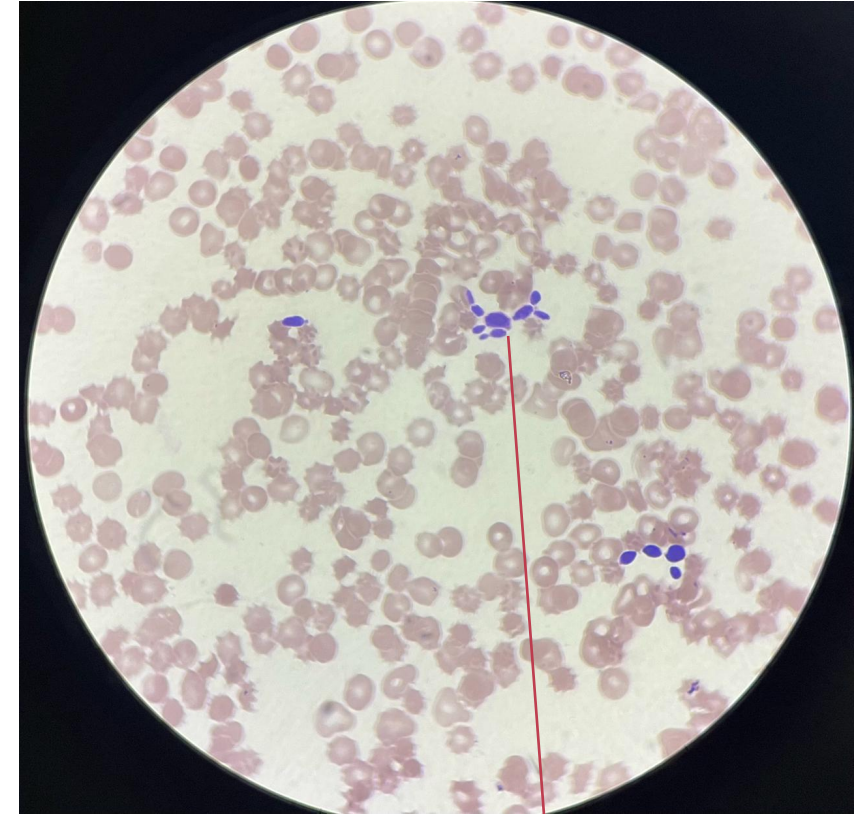


Case Summary

In the patient sample, the **Yeast** is measured as a WBC because yeast is having a same size and the fluorescence as yeast.

Conclusion :

- ✓ The Patient history, Historical Trend, Flags and microscopy is the key factor here which need to be checked by the technicians and doctors while reporting the results.



Budding Yeast

Reference Paper

- This is an article which is stated that there is a patient 54 yrs female suffering from metastatic Carcinoma Brest.
- It is seen neutrophilic leukocytosis and adequate platelets in Hemogram.
- Peripheral Blood Smear showed numerous intracellular (within Neutrophils and monocyte) yeast forms which were morphologically difficult to differentiate from histoplasma species.
- They perform the blood culture with fresh blood on Vitec 2 and found that it is **Candida Tropicalis**.

IMAGES

Budding Yeast Forms on Peripheral Blood Smear: An Intriguing Finding

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Received: 6 June 2017 / Accepted: 14 July 2017
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54-year-old female, case of metastatic carcinoma breast presented to the emergency in semi-conscious state. Investigations revealed normal renal and mildly deranged liver functions. Hemogram done from central line sample showed Hb 9.7 of g%, neutrophilic leukocytosis and adequate platelets. Peripheral blood smear (PBS) showed numerous intracellular (within neutrophils and monocytes) yeast forms (Fig. 1) which were morphologically difficult to differentiate from histoplasma species. The organisms were positive for PAS and Gomori methanamine silver (GMS) stain and negative for mucicarmine & India ink preparation. Fresh blood and tracheal secretion culture revealed yeast within 24 h of incubation. Subculture streaking revealed dry, dull creamy white lumped up colonies of *Candida*. Identification was done on Vitec-2 which revealed *Candida tropicalis*. The patient succumbed to her metastatic disease and bacterial sepsis developing during ICU stay 7 days later.

Candida is common cause of blood stream fungal infection but still it is rarely reported in PBS [1]. This is because $1-5 \times 10^3$ CFU/mL organisms are required to detect them on PBS [2]. An awareness of morphology of these organisms is essential for identification and

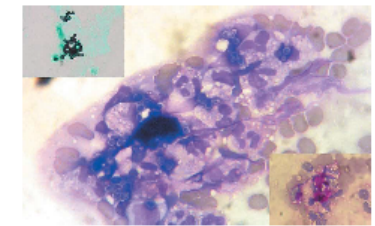


Fig. 1 Multiple intracellular yeast forms of candida sp. in peripheral smear (x400, Giemsa stain) positive for GMS (x400, left upper inset) and periodic acid-Schiff (x400, right lower inset)

differentiation from other causes of blood stream fungal infections like *Histoplasma* and *Cryptococcus*.

Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no conflict of interest.

Disclaimer The identity of the patient is not disclosed here in this case.

Funding The study is the retrospective analysis of the data of patients at the Rajiv Gandhi Cancer Hospital and Research Institute. No funding received.

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Thank you