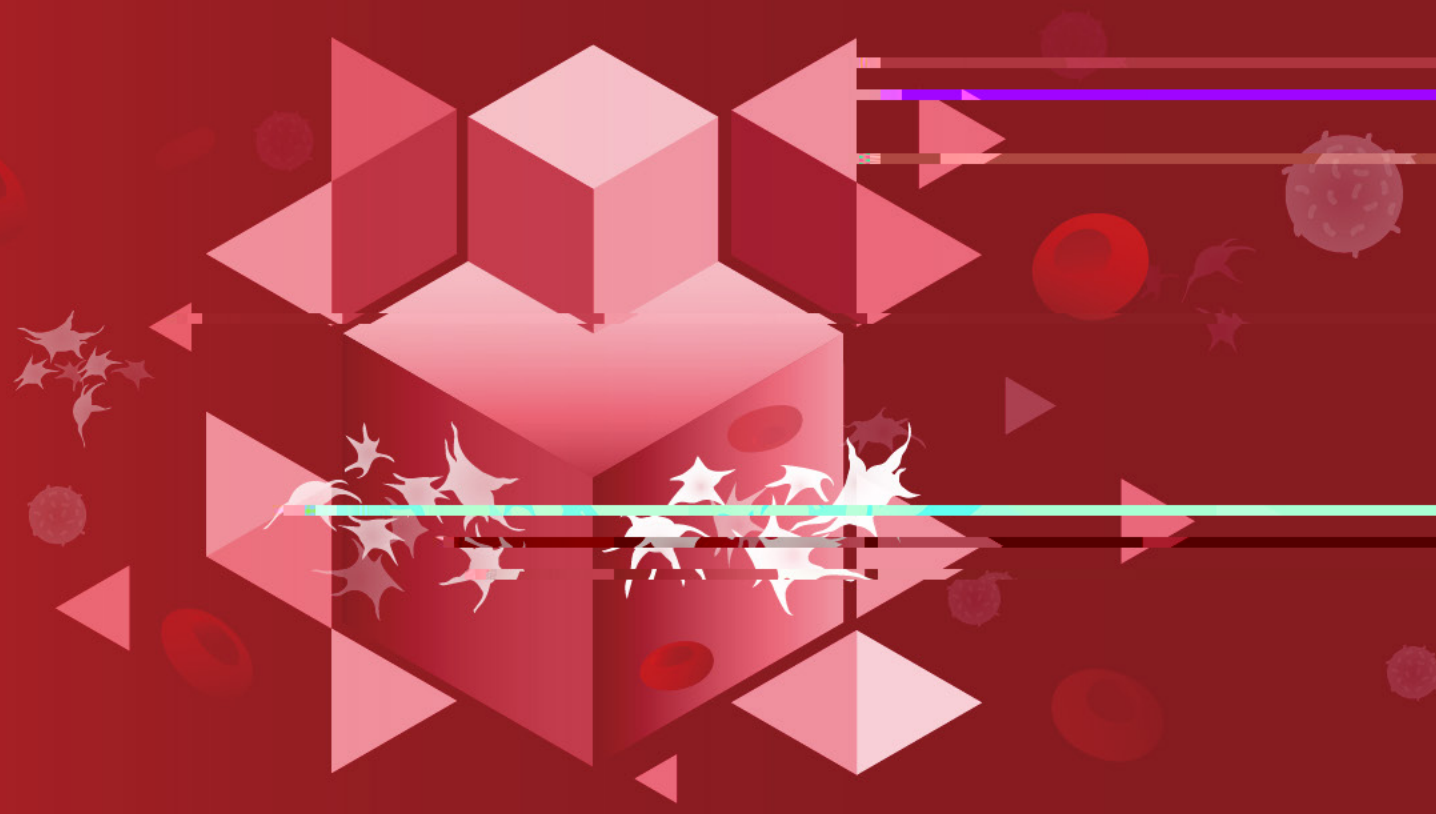
mindray



Platelet Series

COVID-19 Series

Morphology Series

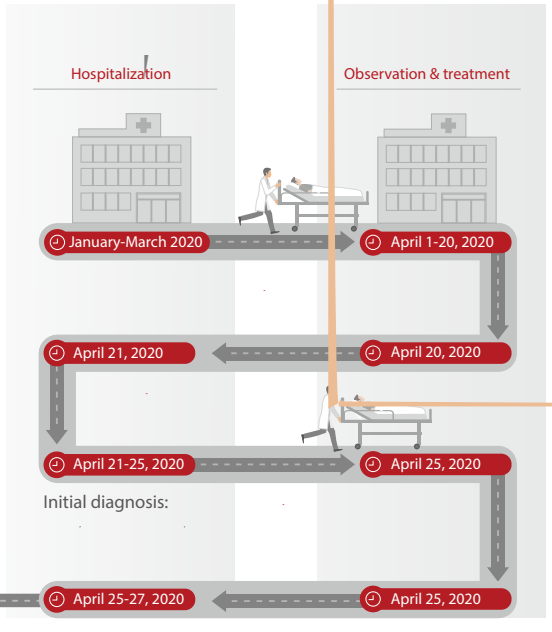
Thrombocytopenia is a condition characterized by abnormally low levels of platelets in the blood. However, falsely low platelet counts, or pseudothrombocytopenia (PTCP), though easily unrecognized, are found in clinical cases. It is an in vitro phenomenon caused by platelet clumping that results in reporting of a spuriously low platelet count by automatic hematology analyzers.

Resolving platelet clumping has been a headache for laboratory technicians. **Is there a hassle-free solution?**

Let's look at two clinical cases that happened during the COVID-19 pandemic.

The first case presented here was courtesy of San José Osorno Base Hospital in Chile. A patient had spent prolonged periods at the San José Osorno Base Hospital (HBSJO) between January and March 2020 without any history of thrombocytopenia. While at HBSJO, the patient needed care for an acute gastric ulcer bleed and a post-surgical infection. But as COVID-19 cases rose, so did the tensions and hospitalizations at HBSJO.

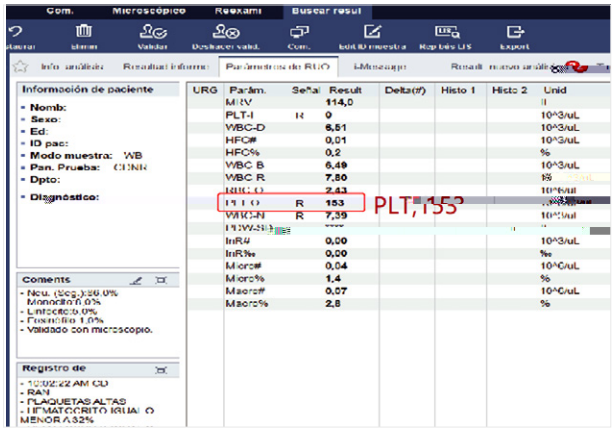
For their safety, all non-COVID-19 patients, including this patient, needed to be transferred to other hospitals. He was then moved to Purranque Hospital for continued treatment.



The truth and final conclusion

As can be seen, the patient' s clinical symptoms were not consistent with the test results that were given. In order to study the interference of anticoagulants on platelet counts, the laboratory staff from HBSJO collected two samples from the patient and conducted a study on Mindray CAL 8000 Cellular Analysis Line to test two different types of anticoagulants - EDTA and sodium citrate (3.2%). And the result was as follows:

CAL 8000 result		
Sample ID	4270198 (EDTA)	427199 (sodium citrate 3.2%)
First measurement	PLT-I: 1000/ul	3000/ul
Second measurement	PLT-I: 0 PLT-O: 153,000/ul	PLT-I: 3000/ul PLT-O: 161,000/ul



A PLT-I result was reported after the first measurement. After opening the RET channel, a PLT-O result was reported at the second measurement.

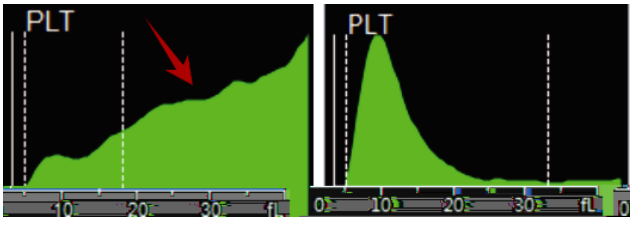
Looking at the results under a microscope, the truth was found. After an unforgettable back- and-forth between hospitals, the patient was finally given the right diagnosis and the correct medical treatment.

Here, on the other side of the planet, we had a case of a 23-year old male from China who was admitted to the Infectious Disease Department of a Chinese Hospital.

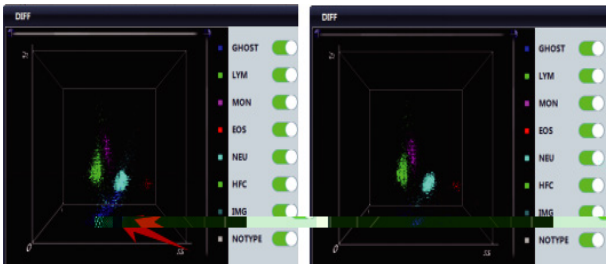
The patient had a CBC performed on Mindray CAL 8000 Cellular Analysis Line. According to the records, the platelet counts for this patient were usually 100+, but currently they were only at 61 which triggered a flag for "platelet clump" by CAL 8000. Under the microscope, however, no PLT aggregation was seen.

The laboratory technician did the first observation under a low-power lens, where no platelet aggregation was found.

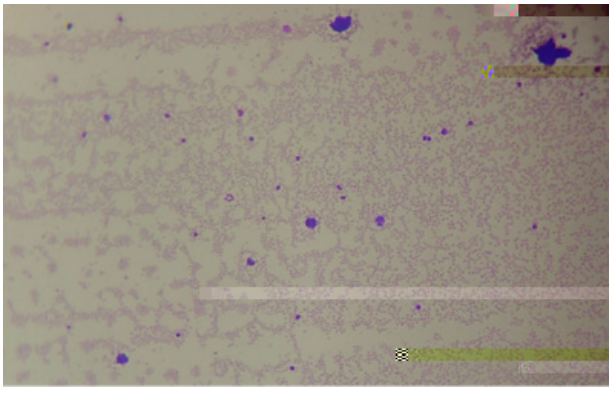
Using an oil microscope, the number of platelets were evaluated again. And there was still no noticeable evidence of clumped PLT.

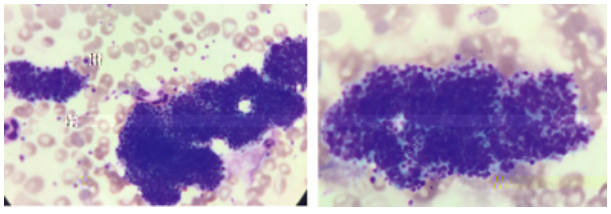


Looking at the histogram of the sample, it should indicate there were small red blood cells or fragments. Compared to the normal scatter plot, the sample' s scatter plot had a cluster of blue particles, which indicated there was platelet aggregation.



The technicians kept looking for clues, all the way at the edge of the microscope slide.





The RET channel on CAL 8000 was opened and a PLT-O result was reported.

WBC		6.45	2.720	3.73	6.95	10^9/L
Neu#	R	3.86	1.560	2.30	5.55	10^9/L
Lym#		2.26	0.920	1.17	3.69	10^9/L
Mon#		0.31	0.120	0.19	0.46	10^9/L
Eos#	R	0.10	0.060	0.04	0.08	10^9/L
Bas#	R	0.02	0.010	0.01	0.03	10^9/L
IMG#		0.19	0.190	0.00	0.06	10^9/L
Neu%	R	59.9	-1.70	61.6	79.9	%
Lym%		33.6	1.70	31.9	12.9	%
Mon%		4.8	-0.30	5.1	6.6	%
Eos%	R	1.5	0.40	1.1	0.2	%
Bas%	R	0.2	-0.10	0.3	0.4	%
IMG%		3.0	2.90	0.1	0.9	%
RBC		3.56	0.750	2.81	3.22	10^12/L
HGB	L	90	20.0	70	80	g/L
HCT	L	30.1	7.20	22.9	26.7	%
MCV		84.5	2.90	81.6	83.0	fL
MCH	L	25.2	0.10	25.1	25.0	pg
MCHC	L	298	2.90	297	301	g/L
RDW-CV	H	23.7	2.80	20.9	21.4	%
RDW-SD	H	71.0	10.10	60.9	63.2	fL
PLT	&R	193	15.0	178	178	10^9/L
MPV		****		9.2	****	fL
PDW		****		15.9	****	
PCT		****		0.172	****	%
P-LCC		****		56	****	10^9/L

PLT: 193

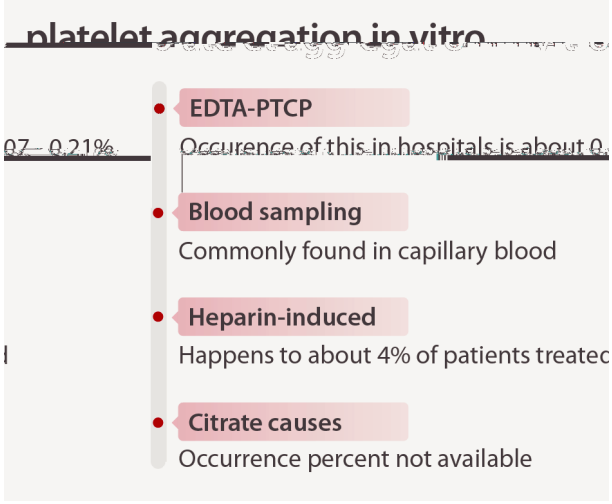
MRV		90.8			90.6	fL
PLT-I	R	60	-126.0	186	218	10^9/L
WBC-D		6.58	2.920	3.66	7.07	10^9/L
HFC#		0.01	0.010	0.00	0.00	10^9/L
HFC%		0.1	0.10	0.0	0.1	%
WBC-B		6.58	2.920	3.66	7.07	10^9/L
WBC-R		7.96			8.05	10^9/L
RBC-O		3.63			3.26	10^12/L
PLT-O	R	193			178	10^9/L
PDW-SD		****		17.6	****	fL
InR#		0.00	0.000	0.00	0.00	10^9/L
InR%		0.00	0.000	0.00	0.00	%
Micro#		0.45	0.080	0.37	0.40	10^12/L
Micro%		12.5	-0.90	13.4	12.4	%
Macro#		0.11	0.070	0.04	0.07	10^12/L
Macro%		3.40	1.50	1.5	2.1	%
RHE	L	27.1			27.1	pg

PLT-I: 60

PLT-O: 193

Based on the data, checking the PLT-O numbers can make it easy to identify a falsely low PLT reading caused by PLT aggregation - and easy to avoid a misdiagnosis.

In both clinical cases, pseudothrombocytopenia (PCTP) was caused by platelet aggregation. While platelet aggregation is caused by both in vivo and in vitro factors, these cases focused on in vitro.



EDTA-dependent pseudothrombocytopenia (EDTA-PTCP) induced by EDTA anticoagulants is a common laboratory phenomenon. So when it does happen and isn't quickly identified, it creates misinformation which may lead to a misdiagnosis and, ultimately, the wrong medical treatment for the patient.

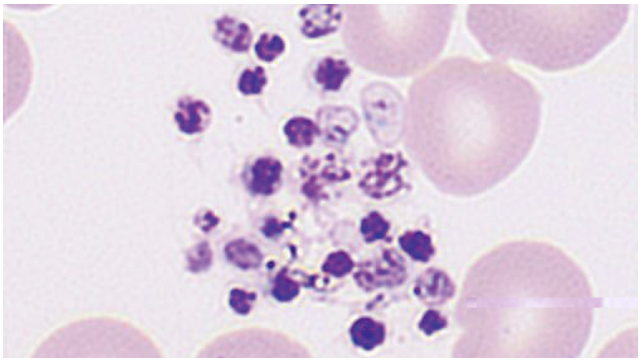
The good news is that, with technological advancements in laboratory medicine, more and more parameters can be added to the hematology analyzer to avoid situations like that. Currently, platelet testing can be done through PLT-I (based on DC sheath flow impedance) and PLT-O (based on nucleic acid fluorescent staining and done on the RET channel). When there is a blood sample with a high possibility of platelet aggregation, the PLT-O detection technology by the Mindray BC-6000 Series Auto Hematology Analyzer and the CAL8000/6000 Cellular Analysis Line can effectively correct PLT counts - especially when it comes to blood samples with pseudo-platelet reduction due to EDTA.

References:

Ethylenediaminetetraacetic Acid - Pseudothrombocytopenia (EDTA-PTCP) is a laboratory artifact that may lead to an incorrect evaluation and unnecessary treatment of patients.

Which of the following method (or methods) would you take to correct platelet counts in case of an EDTA-induced platelet aggregation in thrombocytopenia?

- Recheck with blood smear and estimate the platelet count
- Recheck with addition of amikacin
- Recheck after warming at 37°C
- Recheck immediately dilution without any anticoagulant
- Reexamine on another hematology device
- Recheck with other anticoagulants



Professional clinical laboratory doctors pursue accuracy and truth with the highest sense of responsibility. Nowadays, some clinical studies have been conducted to explore EDTA-PTCP solutions, suggesting that Mindray hematology systems with SF Cube technology would be an option to effectively assist lab technicians in identifying correct platelet counts.

The patient here is a 32-year-old female with infertility. After the patient's EDTA-anticoagulated blood was drawn, it was analyzed within fifty-five minutes, and it showed a low platelet count (28×10^9/L). The test was done by the impedance method (PLT-I) on a popular brand's hematology system (device A). Platelet aggregation was confirmed by microscopic examination of the smear, indicating pseudothrombocytopenia (PTCP). Shortly after, a reexamination of this sample was done using the CDR (PLT-O) method on the Mindray BC-6800Plus. The results showed a markedly higher platelet count with a value of 180×10^9/L.

It's suspected that the low platelet count obtained by device A was due to EDTA-induced PTCP. So, the patient was asked to consent for an additional test using a blood sample tube with sodium citrate this time. Thirty minutes after the sample was collected it was then analyzed. The resulting platelet parameters of the blood samples run through various testing methods and devices are listed in Table 1.

Under microscopic evaluation of the blood smear, the EDTA-anticoagulated blood showed platelet aggregation while the sodium citrate-anticoagulated blood showed none. The blood samples were analyzed within four hours from the time of collection, according to the manufacturer's instructions. In addition to that patient, the data from an additional five cases of EDTA-PTCP were collected and assessed (Table 2).

Samples that triggered the "PLT aggregation" flag on the hematology analyzer showed a typical serrated irregularity and a zigzag tail (Figure 1) on the platelet histogram. Also, under microscopic evaluation, the presence of platelet satellitism, or giant platelets, is not seen.

Twenty-three EDTA-PTCP samples in EDTA tubes (with platelet aggregation) were tested in the impedence (PLT-I (EDTA)) and retwoun33rgra fit4.6 (t4)-3.5 (w)5.7 .Tweoty

Optical fluorescence platelet counting is available in both high-end hematology analyzers (device B) and Mindray BC-6000 series hematology analyzers. In this method, a fluorescent dye is used to stain the nucleic acids in platelets, allowing the recognition of large platelets and excluding non-platelet particles such as erythrocyte debris, micro erythrocytes, or leukocyte debris.

To verify whether the dissociation effect of optical fluorescence platelet counting was dependent on fluorescent dye staining, 17 of those 23 EDTA-PTCP samples in EDTA tubes were also tested on device B' s reticulocyte channel and impedance channel., It was found that here was no significant difference between the platelet counts of reticulocyte channel and impedance channel (Figure 3). Only one of the 17 EDTA-PTCP samples showed a dissociation rate of more than 80%, with an average dissociation rate of 56% among all 17 EDTA-PTCP samples (Figure 3).

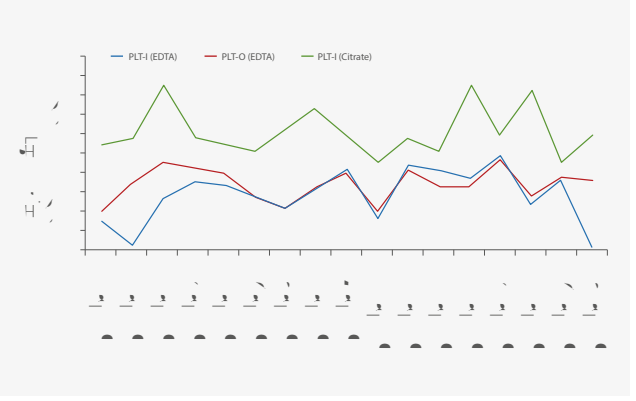


Figure 3:

In summary, the author concludes: Optical fluorescence platelet counting of the BC-6800 hematology analyzer is effective for the correction of spurious low platelet counts in EDTA-PTCP patients, and its dissociation effect on EDTA-PTCP samples is independent of fluorescent dye staining.

SF Cube

In the busy daily work of the laboratory, PTCP is an inevitable trouble. Mindray SF Cube technology provides PLT-O (based on nucleic acid fluorescent staining and done on the RET channel) to correct PLT counts when there is pseudo-platelet reduction due to EDTA. PLT-O is available on Mindray BC-6000 Series Auto Hematology Analyzer and the CAL 8000/6000 Cellular Analysis Line.

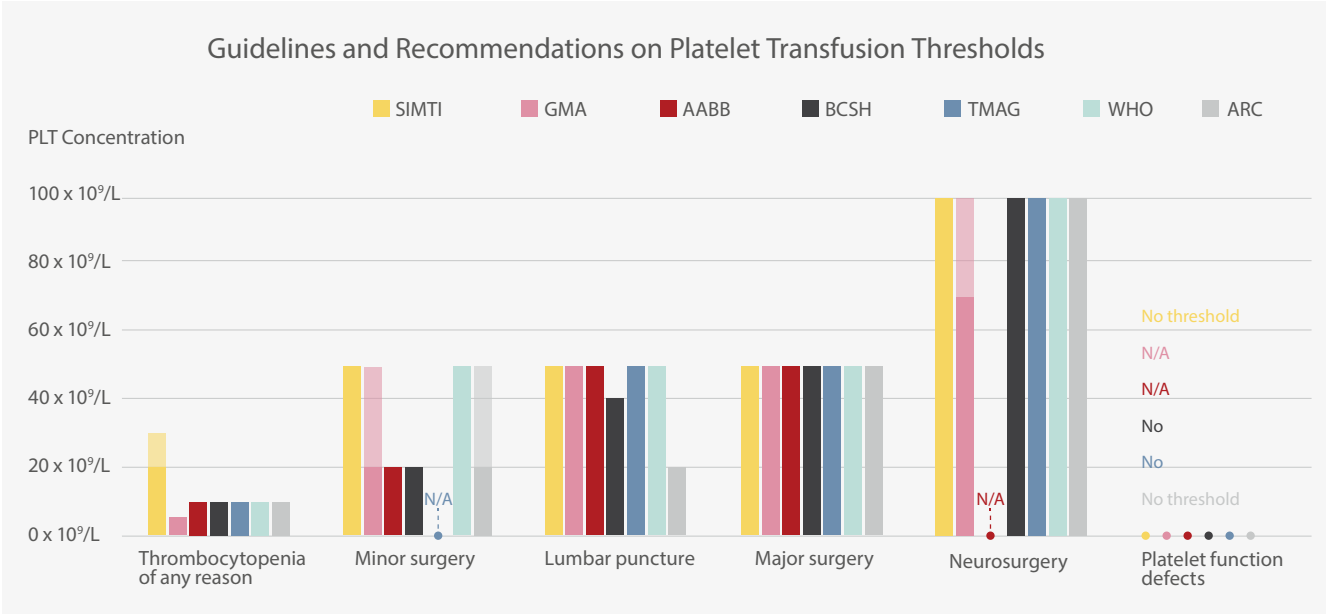
References:

Low Value? High Risk?

When the platelet value is low, patients are at risk of bleeding. Bleeding in vital organs is life-threatening.

According to Giuseppe Lippi and other professors, there is no universal agreement on the definition of platelet transfusion thresholds.[1] However, the degree of accuracy and imprecision of the vast majority of fully automated hematological analyzers appears unsatisfactory, especially in the lower thrombocytopenic range, i.e.,<50× 10^9/L .

The current guidelines and recommendations show that there is no consensus on the low PLT infusion threshold in several specific clinical situations, as shown in the following table. [1]



Low-value platelet counts also play an important role in evaluating the effectiveness of platelet transfusion. In the most common platelet transfusion formulas, including the post-transfusion platelet increment (PPI), the percentage platelet recovery (PPR), and the corrected count increment (CCI), the absolute count of platelet is one of the key calculation factors.[2] Among them, most clinicians use an estimate of transfused platelet content and average body surface area to calculate the CCI, and an absolute platelet increment of greater than 10×10^9/L at 1 or 24 hours is considered a successful transfusion, which is consistent with the previous formula.[3]

The platelet count results are still regarded as the mainstay for driving platelet transfusion practices, but the hematology analyzers, as the method, show different analytical performance. The Italian Working Group on Diagnostic Hematology of the Italian Society of Clinical Chemistry, Clinical Molecular Biology (WGDH-SIBioC) has conducted a multicenter study based on international guidelines, to verify the analytical performance of nine different types of hematology analyzers (HAs) in the automated platelet analysis. Let's take a look at the report below.

SF Cube

ORIGINAL ARTICLE

ISLH International Journal of Laboratory Hematology WILEY

Multicenter evaluation of analytical performances of plateletcounts and platelet parameters: Carryover, precision, and stability

Four hundred and eighty-six peripheral blood samples (PB), collected in K3EDTA tubes, were analyzed by ABX Pentra, ADVIA2120i, BC-6800, BC-6800Plus, Cell-DYN Sapphire, DxH800, XE-2100, XE-5000, and XN-20 with PLT-F App.

TABLE 1 Hematology analyzers and methods of platelet counts

Methods of platelet counts	Hematology analyzer								
	ABX Pentra	ADVIA 2120i	BC-6800	BC- 6800 Plus	Cell-DYN Sapphire	DxH800	XE-2100	XE-5000	XN-20 module with PLT-F App
Impedance method (PLT-I)	X		X	X	X	X	X	X	X
Optical method (PLT-O)		X	X	X	X		X	X	X
Fluorescence method (PLT-F)									X

TABLE 2 Carryover (CO) and low limit of quantification (LoQ)

	ABX Pentra		ADVIA2120i		BC-6800		BC-6800 Plus		DxH800		Cell-DYN Sapphire		XE-2100		XE-5000		XN-20 module	
	CO	LoQ	CO	LoQ	CO	LoQ	CO	LoQ	CO	LoQ	CO	LoQ	CO	LoQ	CO	LoQ	CO	LoQ
PLT-F ($x10^9$/L)	//	//	//	//	//	//	//	//	//	//	//	//	//	//	//	//	0.00%	4.0
PLT-I ($x10^9$/L)	0.00%	16.0	//	//	0.00%	19.0	0.00%	23	0.05%	8.0	0.03%	5	0.09%	18.6	0.05%	14.6	0.35%	9.0
PLT-O (x 10^9/L)	//	//	0.50%	2.50	0.00%	11.0	0.00%	4	//		0.09%	2	0.07%	11.5	0.07%	13.9	0.36%	12.0
IPF absolute value[a]($x10^9$/L)	//	//	//	//	//	//	//	//	//	//	//	//	0.00%	6.0	0.00%	11.8	0.00%	1.0
IPF relative value (%)	//	//	//	//	0.00%	//	0.00%	//	//	//	//	//	0.00%	//	0.00%	//	0.00%	//
PCT (%)	0.00%	//	//	//	0.00%	//	0.00%	//	0.040%	//	0.00%	//	0.05%	//	0.00%	//	0.00%	//
P-LCR or large PLT count (%)		//	0.30%	//	0.00%	//	0.00%	//	//	//	//	//	0.00%	//	0.00%	//	0.00%	//

Note: The PLT limit of acceptability for carryover is 0.5% according to Vis et al.[31]

The carry-over (CO) rates of BC-6800 and BC-6800Plus both meet the requirements, the lowest in the group. The limit of quantification (LoQ) of PLT-O of BC-6800 and BC-6800Plus is lower than that of PLT-I, and the LoQ of PLT-O of BC-6800Plus is as low as $4x10^9/L$, which is lower than PLT-O of XN-20, which is equivalent to PLT-F of XN-20. Interestingly, LoQ of PLT-I of XN-20 is lower than that of PLT-O.

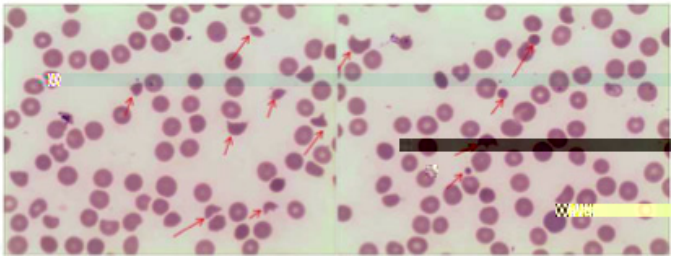
Among the cells of peripheral blood, platelets are the smallest, but as a population, the concentration of platelets plays an important role in hemostasis. To account for the risk of bleeding caused by low platelets, Mindray has introduced multi-fold PLT-O platfor(c 08 ua)4. a 5 (t-3.6 f C)17oo) oiclrehe 9or(c o)r(ic310.2 (q)36.7 (2r)-3.t (o)-.33.4 (up)7.8t)-11. 5 (o)-3.6 (r)5h1rd md263) oors pvic3

When the platelet (PLT) count is extremely low, is platelet transfusion really required? Let's analyze the following case, which tells us a different answer.

A 49-year-old woman went to the emergency department due to transient cognitive disorder. She had obvious paroxysmal headaches, with vomiting and epigastric pain. Brain CT revealed no abnormalities. The laboratory results revealed anemia and severe thrombocytopenia. What should be expected?

Blood test (Figure 1) showed low RBC count of 3.07×10^{12}/L and low HGB concentration, which indicated anemia. PLT-O count was 15×10^{9}

These abnormal results triggered the re-exam rule, and then the peripheral blood smear was reviewed (Figure 3). The result demonstrated evidence of intravascular hemolysis, which included schistocytes, a small number of spherocytes, helmet cells, and thrombocytopenia.



Erythrocytic cell lines 44%, Granulocytic cell lines 40%, G/E=0.91/1.

Undifferentiated erythroblasts were common in the bone marrow smear, and Howell-Jolly body were found. A total of 257 megakaryocytes were found in the smear, and 50 were differentiated, including 3 megakaryoblasts, 44 promegakaryocytes and 3 naked nucleus megakaryocytes. PLT was rarely seen. Such bone marrow smear showed a megakaryocytic thrombocytopenia, increased function of erythroid differentiation.

Name

Considering the cases with typical symptoms: (1) hemolytic anemia (schistocytes); (2) thrombocytopenia; (3) neurologic symptoms (transient mental disorder), thrombotic thrombocytopenia (TTP) disease is likely. The results and TTP diagnostic suggestion were transferred to doctors immediately. And Further ADAMTS13 testing confirmed TTP. Finally, plasma exchange instead of platelet transfusion was taken.

Hemolytic Anemia	Yes
Thrombocytopenia	Yes
Transient neurologic symptoms	Yes
Reduced kidney function	No

If the PLT level is lower than the decision-making threshold, experienced doctors will immediately recheck whether the specimen is qualified, the histogram and scattergram are normal or not, and any other abnormal cell counting results or significant flag messages, etc. Further confirmation will be carried out by blood smear examination under the microscope. Finally, after considering the patient's symptoms and medical history information, the laboratory can report the result and provide possible diagnosis.

Mindray's automatic 8x PLT-O counting (SF Cube technology) provides accurate and stable counting for thrombocytopenia samples. Together with high quality blood smear from SC-120 Auto Slide Maker, Mindray hematology solutions support efficient management of thrombocytopenia. PLT-O is available in Mindray BC-6000 Series Auto Hematology Analyzers, and the CAL 8000/6000 Cellular Analysis Lines.

Common causes of thrombocytopenia include decreased production in bone marrow, increased destruction in peripheral blood, and medication induced.

Thrombotic thrombocytopenia including TTP in this case, is a kind of disease caused by increased PLT destruction. Because of von Willebrand factor (VWF) cleavage protease (ADAMTS13) deficiency, VWF cannot be cut off normally, and ultra-large VWF (ULVWF) accumulate, resulting in abnormal PLT aggregation, microthrombosis and fragmented RBC[2]. Under such condition, platelet transfusion may accelerate thrombosis, leading to worsening symptoms[3]. So for thrombotic thrombocytopenia, the main treatment should be plasma exchange.

Acknowledgement

References:

Derived from megakaryocytes, platelets (PLT) are produced and matured in the bone marrow. Besides widely known thrombosis and wound repair, PLT also plays important roles in inflammation, immunity and cancer biology[1]. Normal reference intervals of PLT in peripheral blood varies in the range of 150-400×10⁹/L. When the PLT value is lower than 100×10⁹/L, a common clinical problem identified as thrombocytopenia (low PLT) may be the result[2].

There are several causes of thrombocytopenia including decreased PLT production, increased PLT destruction, increased splenic sequestration and dilution[3]. Currently, complete blood count (CBC) and blood smear reviews are essential diagnostic methods for the initial evaluation of thrombocytopenia samples[2]. Therefore, counting low PLT correctly by an auto hematology analyzer might be a prospective approach which will greatly reduce the blood smear rate, and save laborious time in the diagnostic lab, rapidly screening out thrombocytopenia samples.

However, counting low PLT correctly is not a simple process. How does Mindray's high-end auto-hematology analyzer deal with low PLT samples?

Fluorescent staining dye (FR dye) has been specially designed with

Also, Mindray's high-end hematology analyzer combines reflective light suppression technology with SiPM (Silicon photomultiplier), which is highly sensitive to fluorescence signals while simultaneously minimizing the background noise during optical detection. This greatly improves the detection limit of particles, and the lower limit for small particles reaching up to 1um (a diameter of 2 um is defined as small PLT), ensuring that the sample results are not interfered by small PLT or particles.

Pseudothrombocytopenia is caused by in vitro platelet clumping in EDTA-anticoagulated blood tube, which may lead to a falsely low PLT count[4]

G01N 15/10 (2006.01) G01N 33/48 (2006.01) G01N 15/14 (2006.01)

Prepare a first detection solution using a blood sample

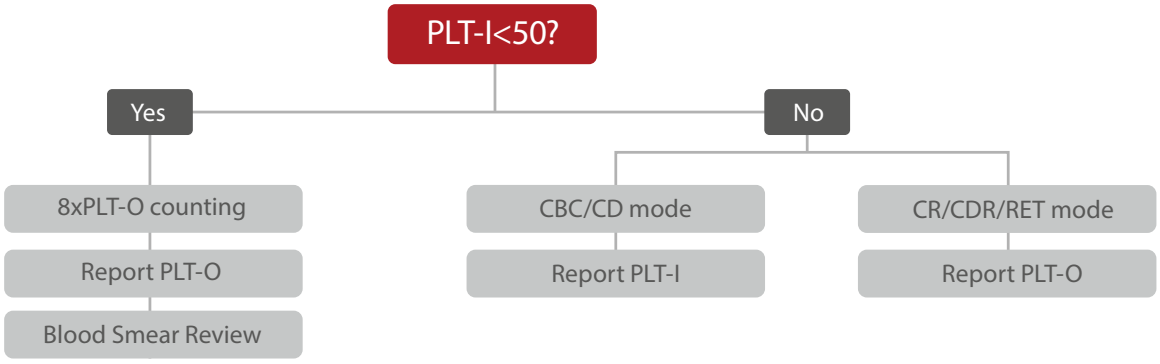
Control the first detection solution to pass through an impedance detection area

Perform platelet detection on the first detection solution in the impedance detection area with an impedance method to obtain a first platelet detection result

Prepare a second detection solution using the blood sample when the first platelet detection result is less than a preset platelet detection threshold

Control the second detection solution to pass through the impedance detection area

Perform platelet detection on the second detection solution in the impedance detection area with the impedance method to obtain a second platelet detection result



References:

EDTA-dependent pseudothrombocytopenia (EDTA-PTCP) induced by EDTA anticoagulants is a common laboratory phenomenon. It is caused by in-vitro PLT aggregation and may lead to a low PLT result and, ultimately, misdiagnosis and wrong medical treatment for the patient.

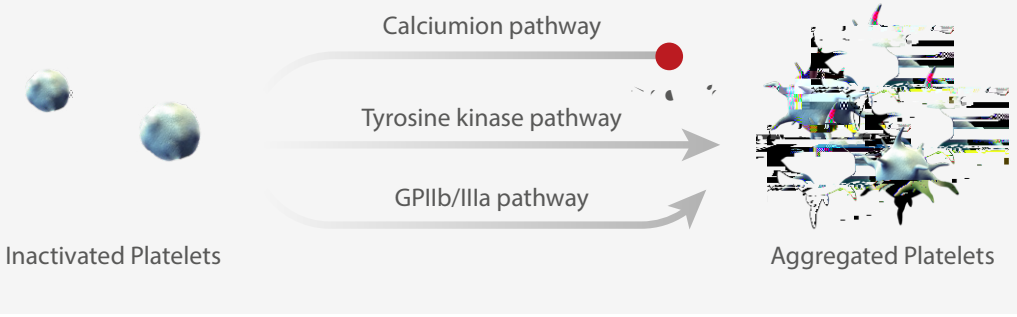
In the previous chapter (The Stories of Platelet Clump), we looked at two clinical cases which initially had incorrect low PLT results using the traditional PLT measurement principle. After re-running the samples in the Mindray hematology analyzer using RET mode, PLT-O showed a more reliable result and finally gave the correct diagnosis.

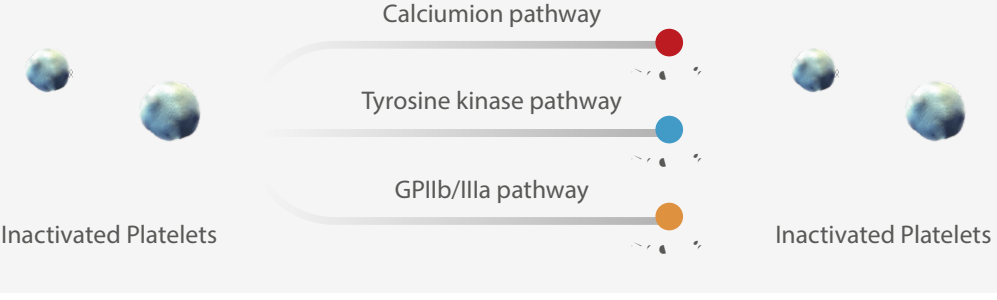
Today, let's explore how the Mindray solution solves the in-vitro PLT aggregation problem.

3 Stages During In-Vitro PLT Aggregation

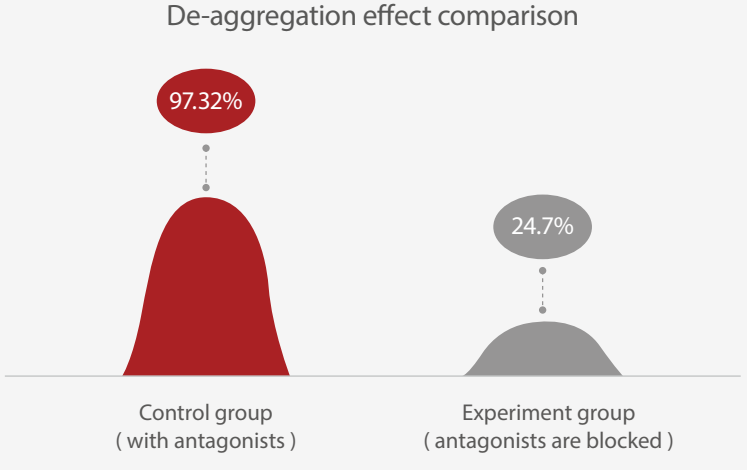
In addition, the corresponding receptor antagonist research has been done to block the regulatory pathway to achieve the aim of PLT de-aggregation. Several different kinds of receptor antagonists have been tried and found to perform well in blocking PLT aggregation.

A further study was done by combining the molecular biology method to explore the molecular mechanism and different radical group characteristics. Ultimately, from thousands of potential chemical compounds, a series of optimal compounds were found which contain specific radical groups which are highly efficient at blocking the three regulatory pathways.





In order to further prove their effects on PLT de-aggregation using those antagonists, a comparison experiment was performed between control group and the group where antagonists were blocked. The experiment results are shown below:



From the experiment, we have found that antagonists containing specific radical groups have an obvious effect on platelet de-aggregation.

Besides, there are also 3 critical factors (appropriate pH, temperature, mechanical mixing) that enhance the PLT de-aggregation. The superposition effect of these factors in de-aggregation is obvious. Thanks to the joint effects of multiple factors, the aggregation platelets are de-aggregated, and a reliable platelet value is obtained.

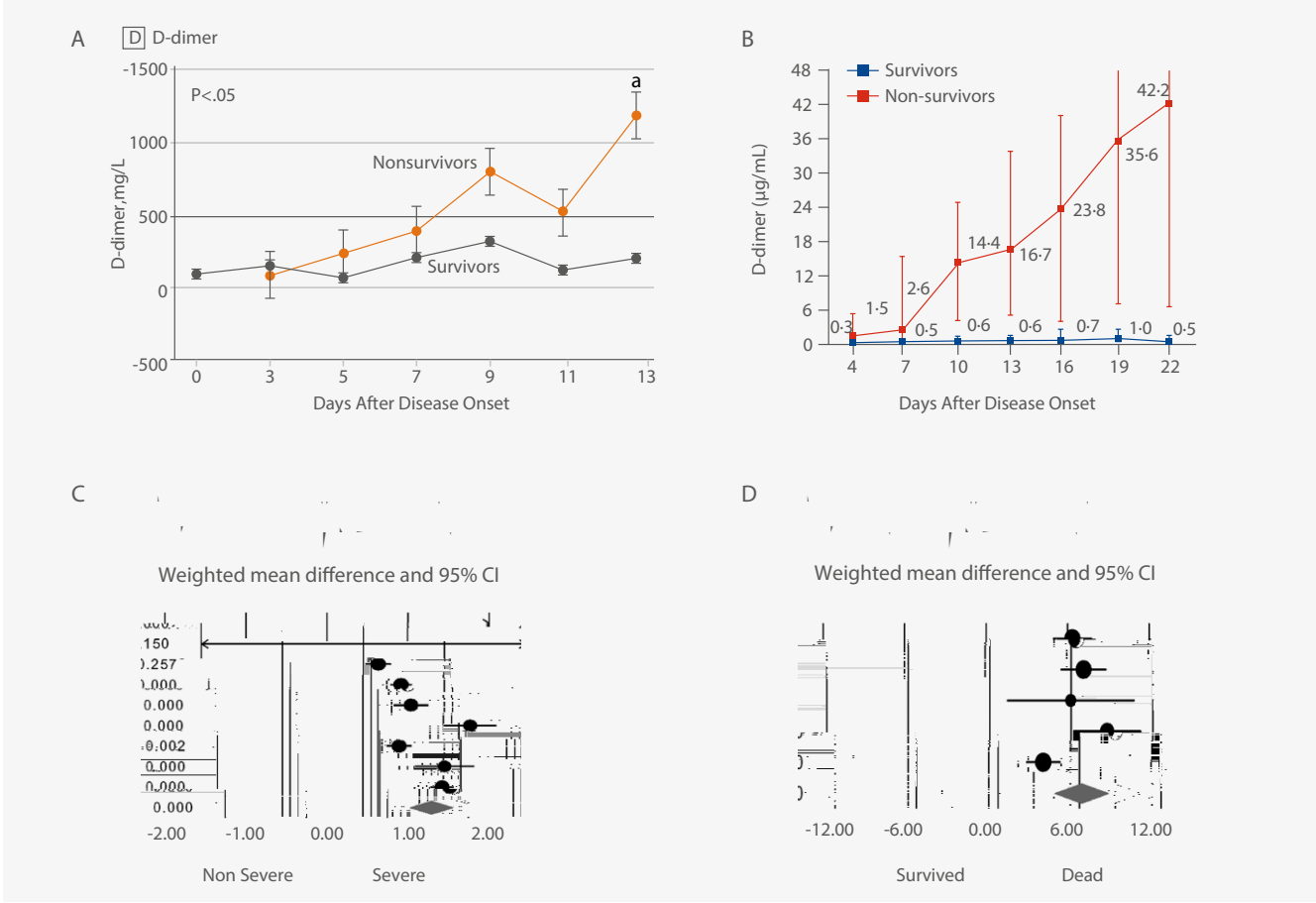
The PLT de-aggregation function was used in BC-6800/BC-6200/BC-6800Plus/CAL 6000/CAL 8000 in RET mode.

References :

[illegible]

As COVID-19 continues to swipe around the world, rapid diagnosis as well as prognosis and treatment of the COVID-19 patients has become an equally important topic among clinicians. Recently scientists have discovered that COVID-19 has a host cell receptor, Angiotensin Converting Enzyme II [1] or ACE2. With the help of ACE2, COVID-19 invades the human body rapidly by reproducing on its own at a massive rate, destroying normal cell, tissue and microvascular system, finally causing acute lung injury, multiple organ failure [2-4], and intravascular coagulation which occurs in 71.4% of patients who died from COVID-19 [5]. It is widely known that D-dimer is a significant bio-marker which correlates with hypercoagulability. More clinical studies have also revealed the relationship between D-dimer and COVID-19.

As published on Jama by Zhi Yong's Group, in the patients' death(non-survivor) group of novel coronavirus pneumonia, the D-dimer level initially increased as the disease developed, until the 7th day when the D-dimer level broke through the normal range, and finally plateaued at a high level [Figure 1 A] [6]. In comparison, the survivor group remained within the normal range consistently. Another article published in the Lancet also claims that there is a close correlation between the D-dimer level and the mortality rate of victims [Figure 1 B] [7]. The same conclusion was also drawn in Shah' s research, which utilized a systematic meta-analysis method (including results from 18 articles and a total of 3,682 patients) to draw the forest plots [Figure 1 C, D] [8]. To sum up, whether in severe or dead COVID-19 patients, the D-dimer level was higher than that which was found in non-severe or surviving patients.



According to the study by Zhang's group, D-dimer among all parameters tested in patients with COVID-19 had the highest C-index, which indicates that it has the highest prediction coincidence rate in routine lab testing methods [Figure 3A]. In addition, they also found the 2 μg/ml of D-dimer could be the cut-off value of mortality risk of COVID-19, as DD > 2 μg/ml the survival probability will decrease dramatically [Figure 2B]. Consequently, they based the evaluation of this value and manifested that when 2 μg/ml was set as the cut-off value, 92.3% of sensitivity and 83.3% of specificity is the optimum in all groups [Figure 2C] [9].

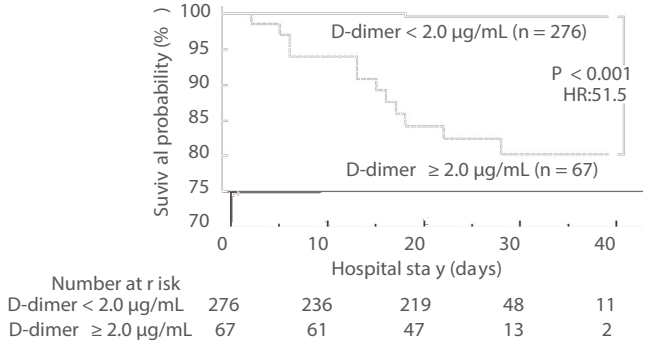
There has been evidence regarding an increased incidence of venous thromboembolic events (VTE) including deep vein thrombosis (DVT) and pulmonary embolism (PE), in patients with severe COVID-19 infection [9], and D-dimer can also be used as a monitoring indicator of VTE and PE with a cut-off value of 0.55 μg/ml. Furthermore, Yao not only found that patients with over 2 μg/ml D-dimer needed intensive care and early intervention, but suggested a cut-off value of 1 μg/ml could help doctors identify patients with a poor prognosis [10].

A

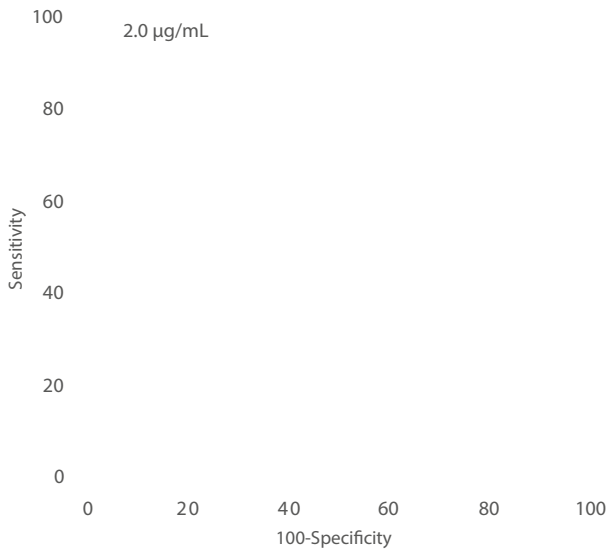
Routine Laboratory Tests	C-index	95% CI
D-dimer	0.883	0.842-0.916
Lymphocyte	0.872	0.832-0.906
Prothrombin time	0.858	0.814-0.895
C-reaction protein	0.844	0.799-0.882
Platelet	0.781	0.734-0.824
Neutrophil	0.773	0.725-0.817
White blood cell	0.625	0.571-0.676
Hemoglobin	0.583	0.528-0.635
Creatinine	0.567	0.510-0.623

Abbreviation: CI, confidential interval.

B

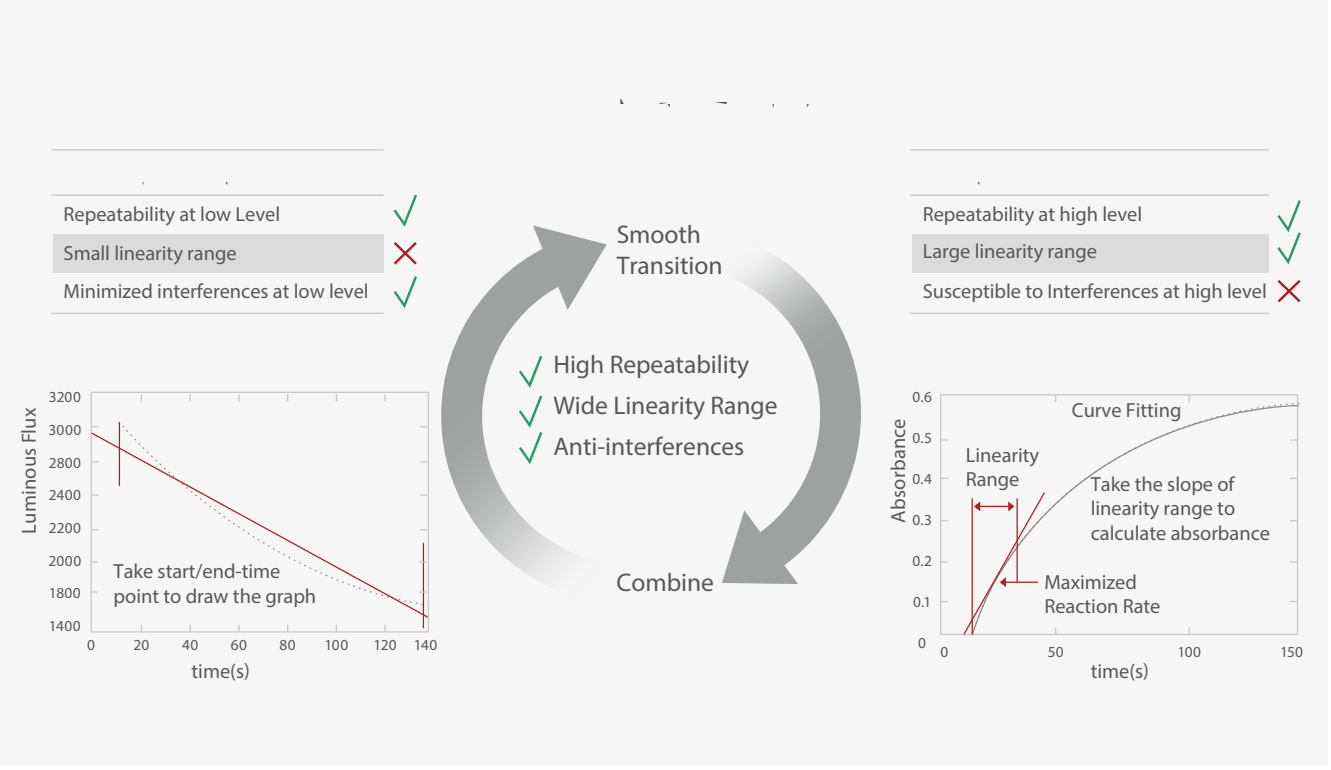


C



In conclusion, D-dimer has enormous clinical values in the treatment and prognosis of COVID-19 as a sensitive monitoring index. In consideration of disordered coagulation micro-environment in patients infected with COVID-19 or at high risk of VTE induced by reduced activity, increased bed time, or in people being quarantined for hospitalization, testing of D-dimer on a regular basis is necessary for rapid monitoring of disease treatment. While a cut-off value of over 2 ug/ml has been proved by many researchers monitoring patients' treatment, laboratories are still advised to set their own standard so the variation in demographics can be taken into account.

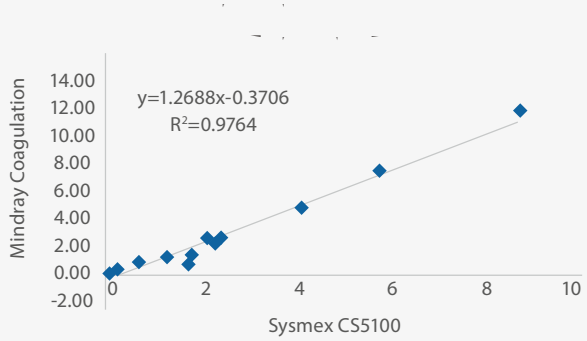
Mindray' s auto-coagulation analyzers C3100 & C3510 are equipped with both classic mechanical and optical detection mechanisms. The mechanical methodology is insensitive to interference from icteric, lipemic, chylus and hemolytic samples. Moreover, the patented VRIM(VLin-Rate Integrative Method) algorithm has also been developed to combine "Two Point End Method" at a low D-dimer concentration together with "Rate Method" at a higher level [Figure 3]. This has enabled a much wider linearity range of D-dimer results compared with other models on the market [Figure 4].



Manufacturer	Algorithm	Linearity Range (μg/ml)
Mindray	VRIM	0.20~8.0
Brand A	Rate	0.17~4.4
Brand B	Two Point End	0.15~3.7
Brand C	Two Point End	0.22~3.0

In addition, Mindray' s coagulation solution to D-dimer testing is less susceptible to common interferents. As is shown in [Figure 5], when the serum samples are added with bilirubin, hemoglobin, triglycerides and rheumatoid factors at respective concentration, D-dimer results remain at constant levels as before. The Comparison study with Sysmex CS5100 has also shown a good correlation with R2> 97% with interferents added.

Interferent (Concentration)	Before Adding	After Adding
Bilirubin (40 mg/dL)	2.43	2.38
Hemoglobin (200 mg/dL)	2.31	2.36
Triglycerides (1800 mg/dL)	2.39	2.25
Rheumatoid Factor (1300 IU/mL)	1.54	1.55



Mindray's D-dimer coagulation reagents are all manufactured in a bottled liquid state which are ready to use [Figure 6], while the majority of coagulation testing kits are made into powder. Simply by opening the cap and loading D-dimer reagents onto the analyzer, preparation can be set up rapidly with ease on Mindray' s coagulation analyzers.

C3100

- Throughput: up to test/h (PT), up to test/h (D-dimer)
- D-dimer tested with special optical channel
- sample position, 11 reagent position
- incubation channel, 4 mechanical testing channel
- Separate sample/reagent probe ensure low carry over

C3510

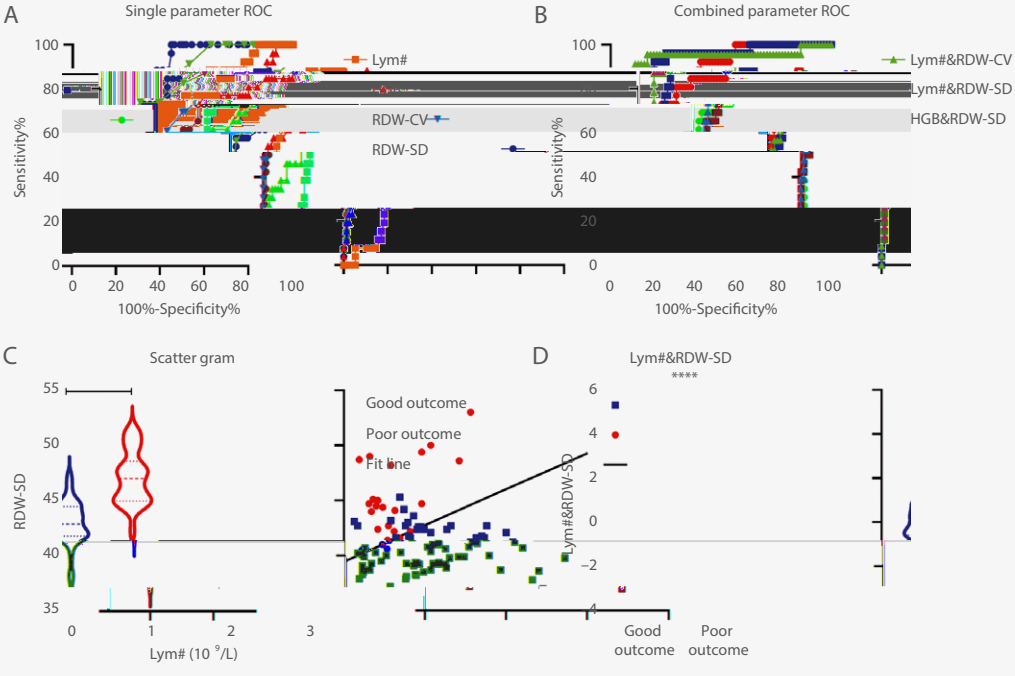
- Throughput: up to test/h(PT), up to test/h(D-dimer)
- D-dimer tested with special optical channel
- sample position, 24 (cooling) + 4 reagent position
- incubation channel, 4 mechanical+6 optical testing channel
- Separate sample/reagent probe ensure low carry over

References:

As of January 26th, 2021, the coronavirus disease 2019 (COVID-19) pandemic has affected over 100 million people worldwide. Vaccination would help improve the situation in future. However, at this time, identifying patients at highest risk for severe disease is important. In order to facilitate early intervention and to manage local hospital resources to mitigate the critical care crises, our smart doctors conduct research in routine, low-cost, and suggestive parameters to assist with COVID-19 prognosis and the identification of severe cases[1] [2] [3].

Inflammatory parameters, such as white blood cell count (WBC), neutrophil count, neutrophil-to-lymphocyte ratio (NLR) could support COVID-19 diagnosis and prognosis. How about red blood cells?

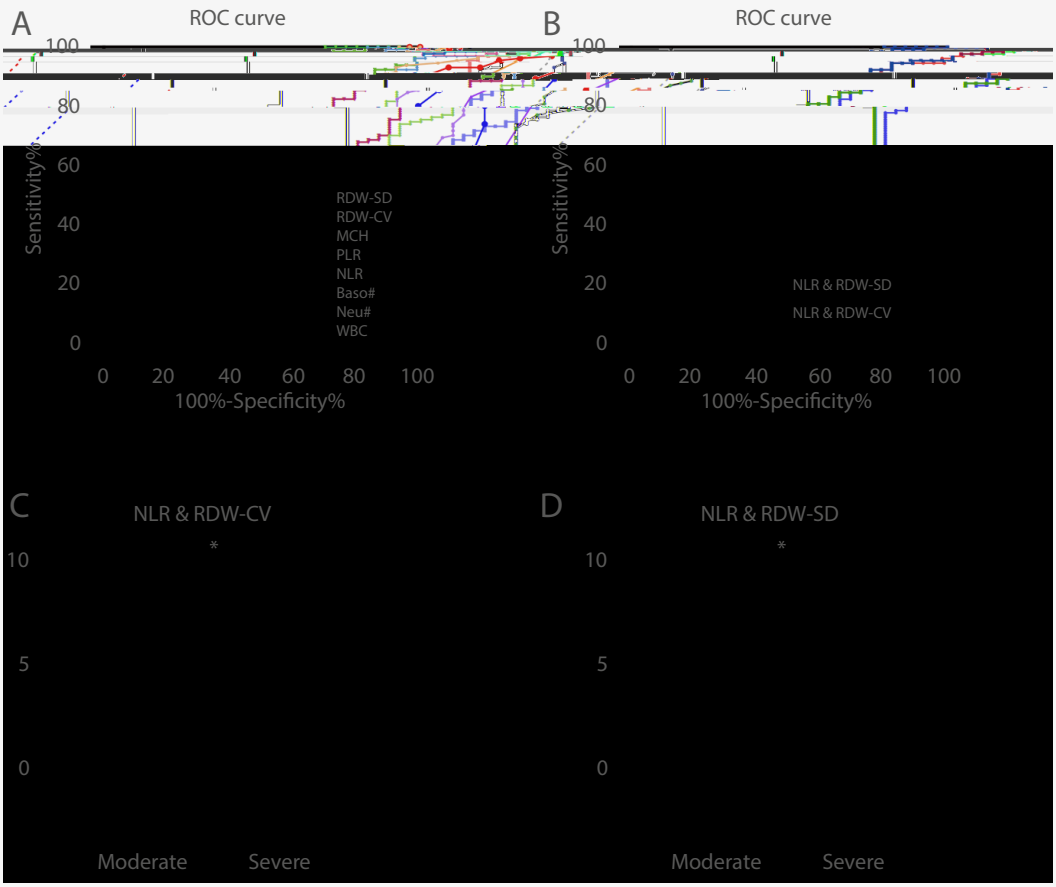
Dr. Wang compared hematological results from the good and poor outcome groups and found the best single parameter for predicting the prognosis of severe patients is RDW-SD[4,7]. What's more, combined parameters Lym# & RDW-CV as well as Lym# & RDW-SD are better for predicting the prognosis of severe COVID-19 (Figure 2)[7].

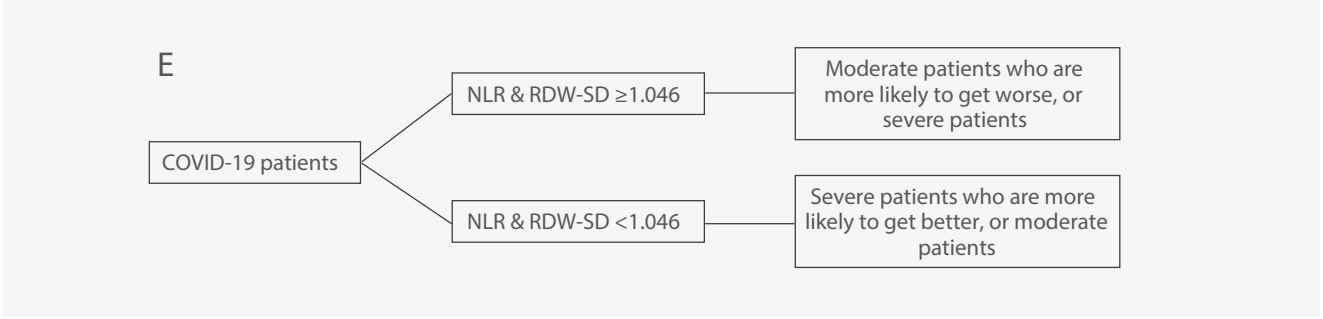


Dr. Zhang has found that HGB is lower in the severe group than in the moderate group[5]. New joint parameters Lym% & HGB have the best sensitivity and specificity (Table1). So Lym% & HGB can be used as indicators of disease prognosis..

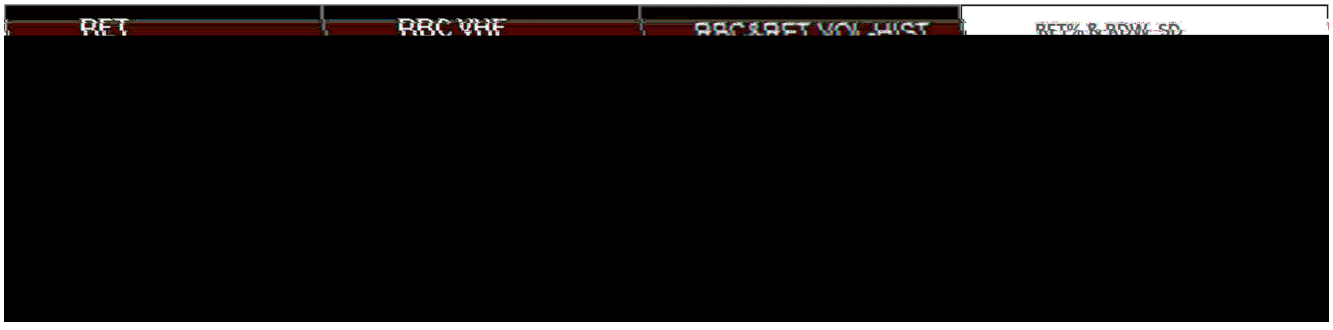
Parameter	AUC	95% CI	Cutoff	Sensitivity	Specificity	Predict value (+)	Predict value (-)
Lym (%)	0.89	0.88-0.91	18.8	85.6%	77.5%	0.83	0.81
HGB (g/L)	0.79	0.76-0.81	116	71.1%	77.2%	0.80	0.68
Lym% & HGB	0.92	0.91-0.94	0.481	88.9%	79.8%	0.85	0.85

Another article from Dr. Wang[6] described that many hematological parameters changed as the disease progressed, including NLR, RDW-CV, RDW-SD. The combined parameters of NLR & RDW-SD, as generated by linear fitting, had the better diagnostic efficiency (AUC =0.938), which was the best one among single parameters (Figure 3). When the cut-off value was 1.046, the sensitivity for distinguishing the severe cases from the moderate cases of COVID-19 was 90.0% while the specificity was 84.7%.





It's been found that the increase in RET may contribute to elevated RDW (Figure 4). As the disease progressed, MFR and HFR increased, so did RDW-SD. The increased RET in peripheral blood may cause an increase in anisocytosis.



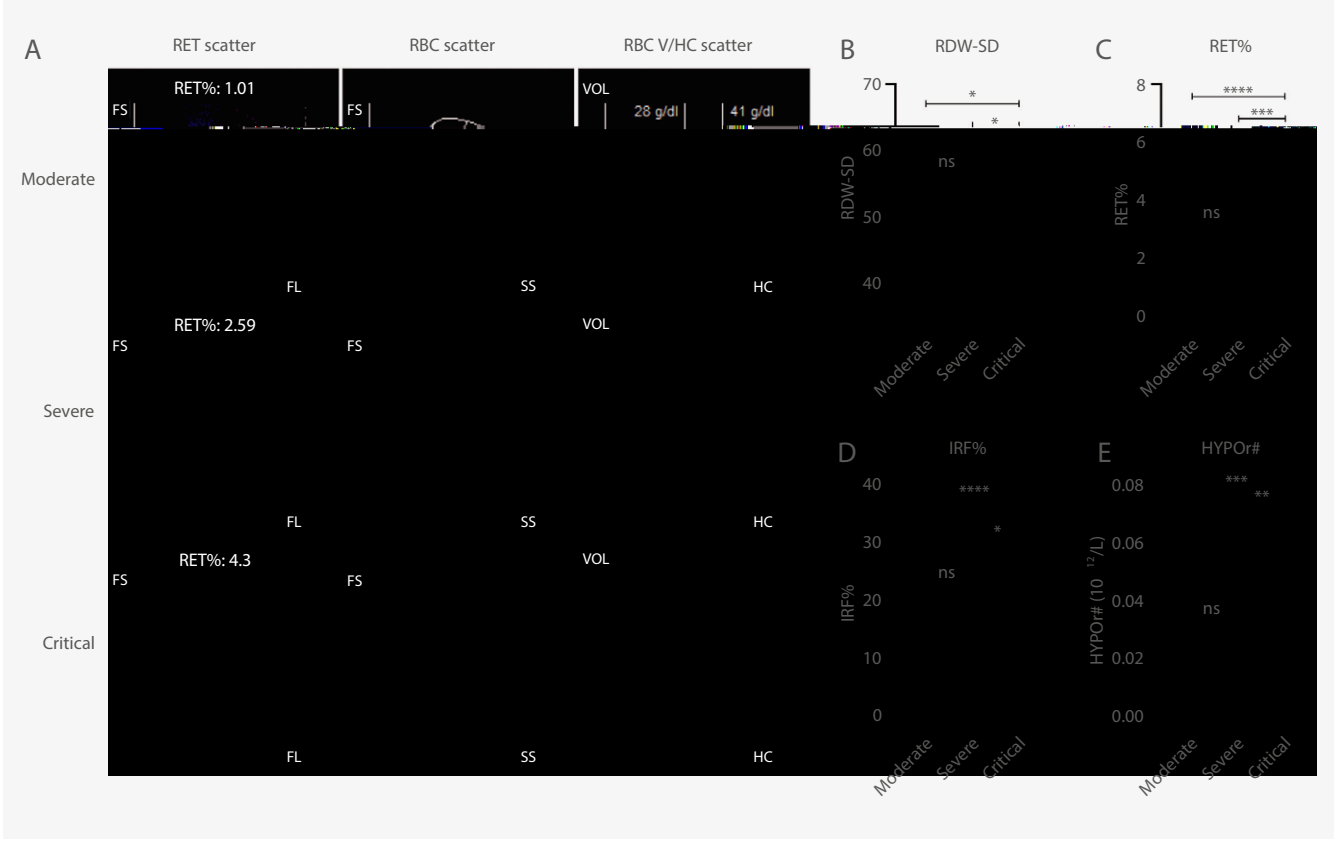
1. As the disease progressed, MFR and HFR increased, RDW-SD increased.

2. As the infection symptoms worsen, the level of oxidative stress in the body increases, oxygen free radicals increase. Insufficient circulating nutrients in patients may also lead to an increase in RBC membrane instability, followed by increased RDW.

1. Long-term hypoxia leads to increased synthesis of erythropoietin and active erythropoietin hyperplasia.

2. On the contrary, HGB synthesis is prevented in critically ill patients due to malnutrition or iron deficiency, resulting in low HGB and low-HC (hemoglobin concentration) RETs.

When we look at the 9-square scattergram, the RBC volume/hemoglobin concentration (V/HC) scattergram showed that the magenta scatters of critical patients were significantly left-skewed, indicating that RETs with a low HC (hemoglobin concentration) increased significantly, which may represent a unique pattern of erythroid hyperplasia in critical COVID-19 patients (Figure 6A)[7]. However, whether such low-HC RETs could be a diagnostic marker of critical COVID-19 still requires further investigation[7].



With advanced technologies, the newly combined hematological parameters, such as Lym% & RDW-SD, Lym# & HGB and NLR & RDW-SD, have been found as supportive predictors during COVID-19 prognostics. More and more covariates can be studied and developed on the Mindray BC-6000 series analyzers. Especially on BC-6800Plus, the RET channel can detect the number, size, and hemoglobin concentration of RBCs and RETs highly sensitive laser scattering technology. Thus, it's recommended to start using self-defined parameters for COVID-19 prognosis now.

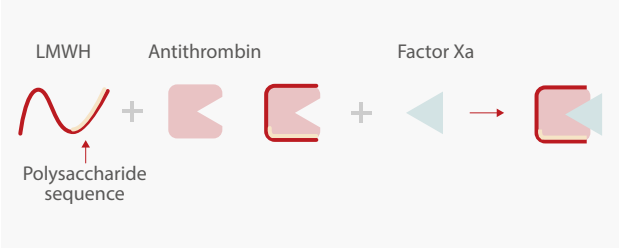
References:

Is prophylactic anticoagulant therapy a common treatment for clinicians to deal with thrombotic events in COVID-19?

Is there a connection between the eosinophil count and anticoagulation monitoring in COVID-19 patients?

Thrombosis has emerged as an important complication among hospitalized patients with COVID-19. A prothrombotic state induced by SARS-9(n)6 bɑ(p)-11.m.4 (o)-4 0a (f (p)-8.(t)6..1 (9 Tc 0.059 Tw 0 (m)-6.4 (o)-6t)-153.9 (e)-10n9 ((o (e)-10un)-3.4 -10.3 (

LMWH predominantly acts on factor Xa. For this reason, LMWH activity is monitored using serum anti-factor Xa activity (AFXa) levels instead of activated Partial Thromboplastin Time (aPTT) (Figure 2). [3]

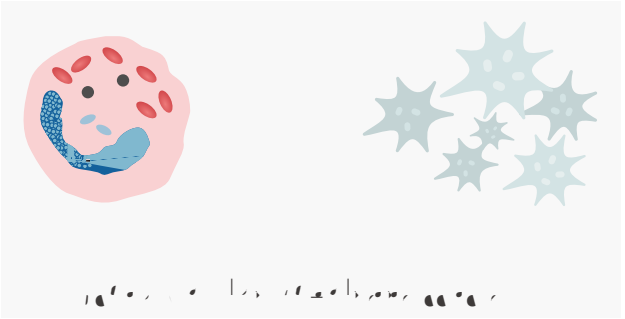


In the laboratory results, only eosinophil counts and AFXa are significantly different between subprophylactic anticoagulation group and prophylactic anticoagulation group when the patients are admitted to hospital (Table 1). [5]

Enoxaparin is one of the most important LMWH. The AFXa level reached peak 3-5 hours after administration. The AFXa levels below 0.2 IU/mL may increase the risk of VTE in COVID-19 patients, due to the hypercoagulability. [4]

Dr. Selma Ari has found the increased eosinophil count is associated with the level of subprophylactic anticoagulation in COVID-19 patients. [5]

Laboratory analysis collected before the discharge of patients revealed that eosinophil counts in subprophylactic anticoagulation group were higher than in prophylactic anticoagulation group , whereas AFXa were lower in subprophylactic anticoagulation group (Table 2). [5]



Eosinophil induces platelet aggregation and thrombus formation through the production of major basic protein (MBP) and eosinophil peroxidase (EPX). [6]

Enzymes released from eosinophils (peroxidases, cationic proteins, and neurotoxins) may decrease the anticoagulant activity of heparin. [7]

In this study, in subprophylactic anticoagulation group, high eosinophil levels had lower anticoagulant activity in COVID-19 patients. Eosinophil counts were examined with Mindray BC- 6800 auto hematology analyzer. Its SF Cube analysis technology can produce three-dimensional scattergram which can help doctors better identify and differentiate blood cell populations, especially to reveal abnormal cell population undetected by other techniques.

Nowadays, hematology analyzers are used widely in laboratories to automatically count and differentiate blood cells. Nevertheless, blood morphology examination for the presence of abnormal cells is still the ‘gold standard’ in the routine blood count. Microscopic examination is the most valuable procedure in the laboratory, which can suggest some disorders previously identified by the analyzer.

However, a skillful examination requires an experienced technician, can take a long time, and is very labor intensive. As a result, there is an increasing demand for digital morphology systems which help to optimize the labs’ workflow by:

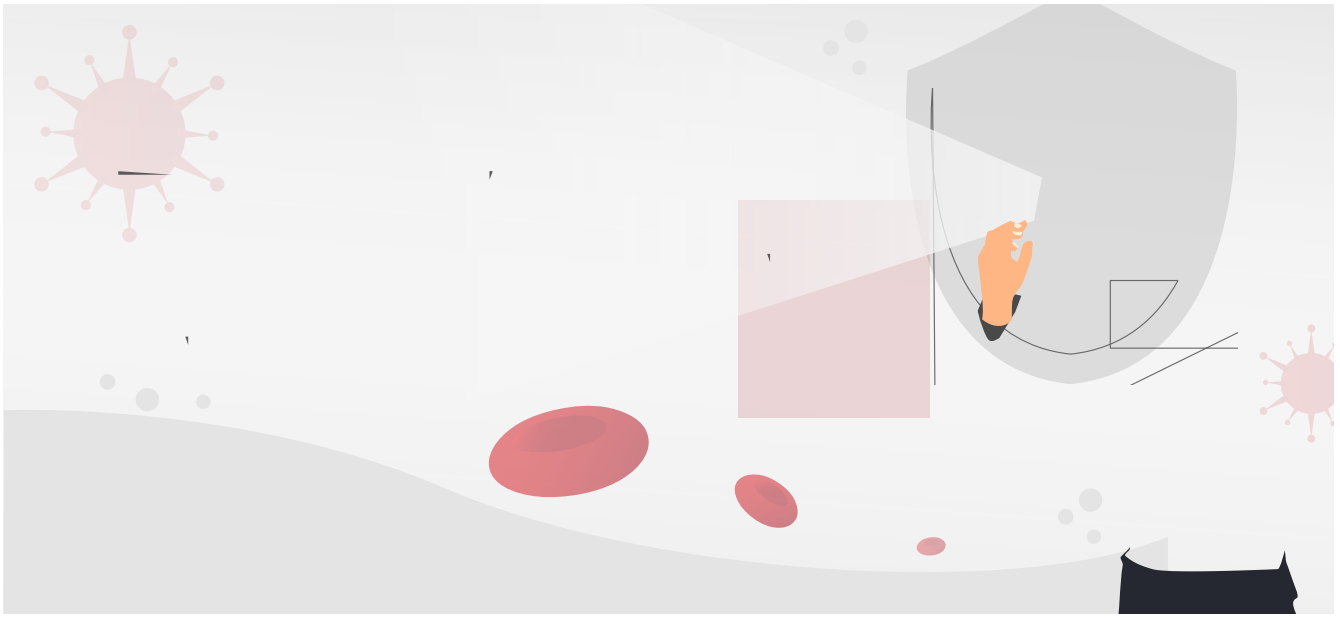
A digital morphology analyzer can automatically locate, capture, and identify cells, which helps technicians to check cell morphology easily on a big screen.

- With the help of intelligent algorithms, a digital morphology system can help to pre-classify different cells in different groups and give a reliable pre-classification result.

A digital , a digital

Today, an increasing number of advanced automated digital morphology systems have been developed and introduced to the laboratory. These digital morphology systems optimize the labs' workflow by improving lab quality assurance, reducing labor costs, providing the availability of morphology digitalization and enabling remote consultations.

Mindray is soon going to launch a brand new digital morphology system. Stay tuned as we bring you more updates!



A 43-year-old woman presented with persistent fever for two months. She had visited different hospitals more than three times, but there was no significant improvement in her symptoms. After being admitted to a top-tier hospital in China, she underwent a series of examinations. Her serology test was positive for human immunodeficiency virus (HIV) infection. Her chest computed tomography (CT) scan showed diffuse small nodules in both lungs. Disseminated *Talaromyces marneffei* infection was considered, based on the patient's symptom of fever, laboratory test and CT scan results. She was prescribed targeted anti-fungal treatment.

Unfortunately, she died four days after admission to the hospital as the infection worsened and her condition rapidly deteriorated. Seven hours after she died, hyphae-like structures were spotted on the gram stain of the positive bone marrow culture.

Talaromyces marneffei is a fungus that causes opportunistic systemic mycoses in patients with AIDS or other immunodeficiency syndromes. The fungus was first isolated from the hepatic lesions of a bamboo rats

Talaromyces marneffei is usually diagnosed by microscopic identification of the fungus in various clinical specimens and by standard microbiological culture, based on its morphological characteristics and thermally dimorphic properties between 25°C (mycelium form) and 37°C (yeast form) (Figure 3).

Talaromyces marneffei is endemic in Myanmar, Cambodia, Southern China, Indonesia, Laos, Malaysia, Thailand and Vietnam. Patients spread the AIDS and Talaromycosis all over the world through travel.

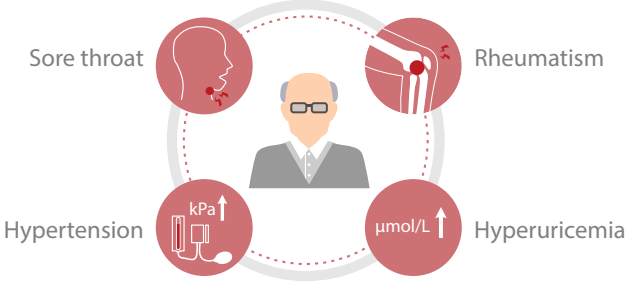
Talaromycosis is a potentially fatal infection causing rapid deterioration[4]. The main manifestations of

In the laboratory, what is the most common reason for you to gather with colleagues to look at and discuss samples or patient results on the screen or in a report?

The answers may vary. One of the reasons may be to discuss the special cell cases you find in a morphological examination. The routine hematology analysis is one of the most important screening tools among in-vitro diagnostics methods. The professionalism of the pathologist guarantees fast and accurate diagnosis based on the results from hematology analysis. Experienced and skilled cell morphology experts, in particular, play a vital role in it.

According to the IDF, there are approximately 232 million people with undiagnosed DM worldwide. Many guidelines tend to suggest DM screening in the population with or without specific medical conditions, and HbA1c is a convenient test to meet this objective. [2] Unlike glucose tests, HbA1c is not affected by recent food intake, so patients do not have to fast or intake certain quantities of glucose before the test. Accompanied with medical history and some auxiliary evidence, doctors can make the DM diagnosis if the patient's HbA1c matches the criteria.

The hematology results showed pancytopenia and flagged many causes for concern, including anemia, thrombocytopenia, white blood cell abnormal scattergram, and immature granulocytes.



The re-exam rule was triggered, so the doctor carried out the smear and stained it in the slide marker. The current digital cell morphology system read the blood smear automatically, and a high percentage of blasts and a few immature granulocytes were found.

White blood cell	Cell count	Percentage %
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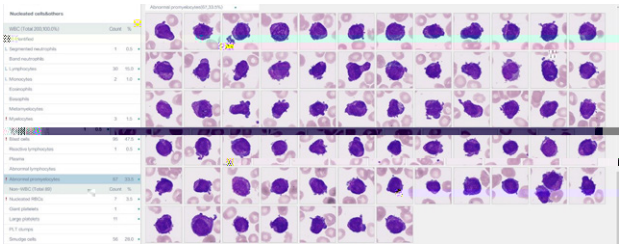
“My god! Look at this!” One technician exclaimed. He read the same slide on the hospital’s trial digital cell morphology system from Mindray, where he found a more critical signal. In addition to high numbers of blast cells, a new cell type-1.56tro3pn tom Myld26(.)7.5 (e)43.1 (r)1.2On ee-1.56 (n e)-r(a)3.1.3 (d)-4.20 -1.562 Td[(c)9.39 (n t)2.2 (h)-4.9 (5)-9.4 (4)46



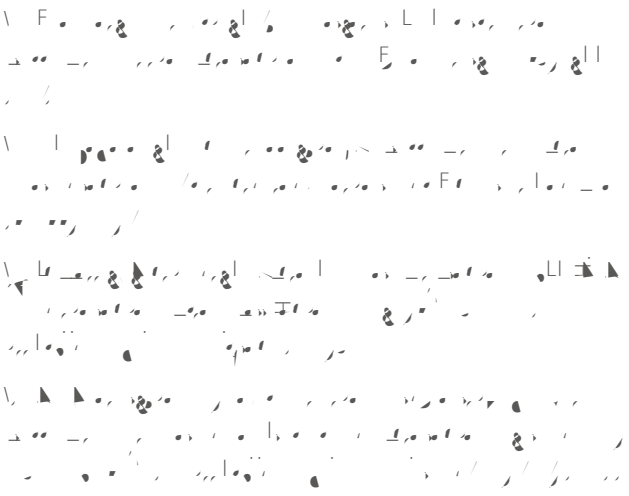
leukemia (APL) is the subtype AML-M3 using the French-American-British (FAB) classification.By taking into account many of the factors that are now known to affect prognosis, the World Health Organization (WHO) system updated the classification of AML in 2016. APL with the PML- RARα fusion gene was independently listed, as PML/RARα is the central leukemia-inducing lesion in APL. It is directly targeted by all trans retinoic acid (ATRA) and by arsenic, with both compounds able to induce complete remissions (CRs).

Clinically, it is critical that APL is distinguished from other AML subtypes quickly, because of:

- Its life-threatening bleeding disorders in case of delay in the proper treatment
- Its achievement of CRs in about 90% of APL patients upon ATRA treatment
- Its induction of CRs in 75–90% of APL patients upon exposure to low-dose arsenic trioxide

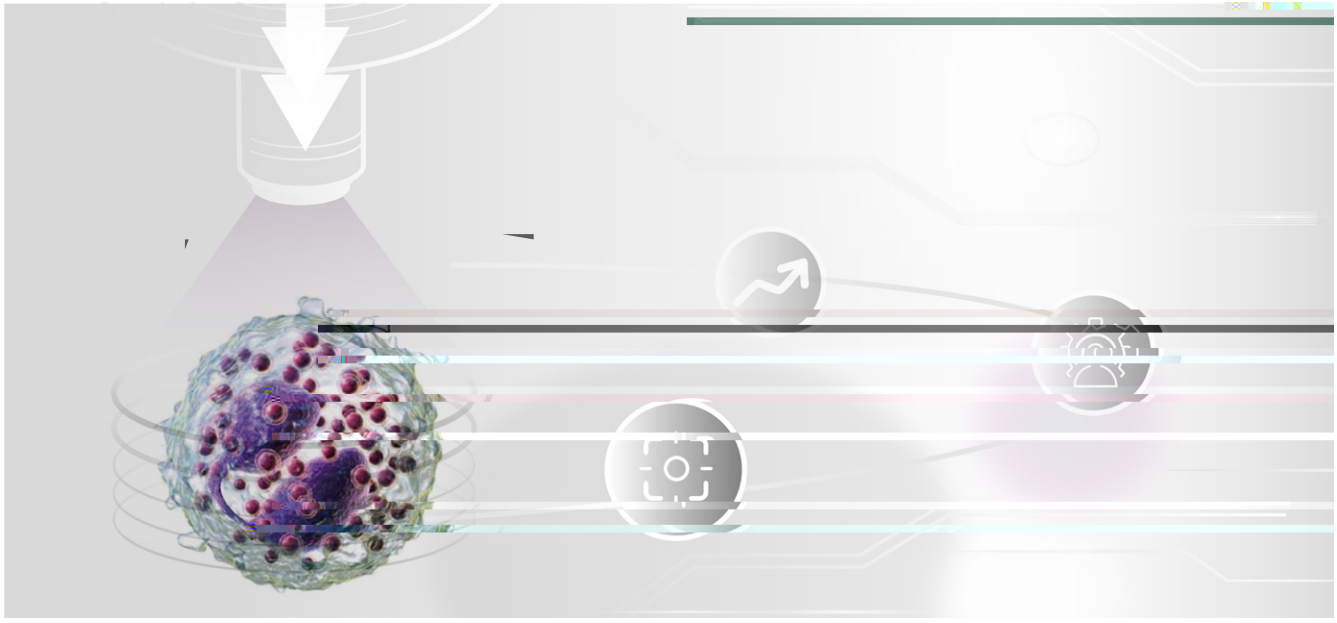
However, the low incidence of PML/RARα and the rapid deterioration of the disease mean that rapid diagnosis and the timely and successful treatment of patients are

References



Although there are a variety of digital cell morphology systems with automatic cell classification on the market, there are still problems with insufficient recognition ability and low levels of efficiency. It takes a lot of manpower to check and confirm abnormalities on the cell image, and even check the smear under the microscope again.

Mindray provides reliable hematology solutions that can deliver efficient, accurate information about the true conditions of patients, helping health professionals, especially morphology experts, to find abnormalities, identify emergencies, as well as treat and cure patients fast.



Many laboratories are troubled by problems such as lengthy analysis processes and less efficient microscopic examinations due to lacking of experts in cell morphology and inadequate equipment. This makes them hard to reach a 30% overall re-exam rate, a target recommended by the international consensus group for hematology review. Furthermore, the abilities of the laboratory staff are varied, leading to inconsistency in lab standards and results.

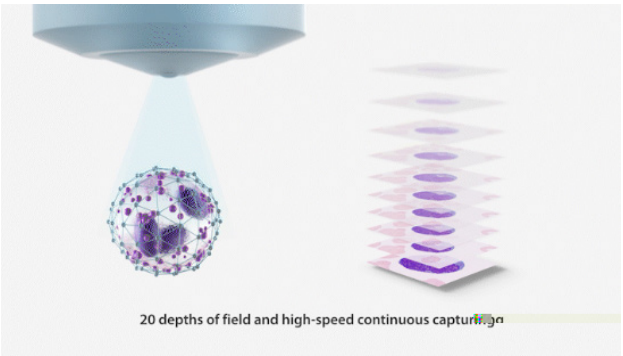
Mindray's MC-80 Automated Digital Cell Morphology Analyzer is designed to provide "More Clarity, More Intelligence, and More Productivity" for cell morphology analysis, with intelligent tools to help discover the truth about cells.

Committed to improving the efficiency and accuracy of laboratories, Mindray has been collaborating with experts and scholars in hospitals around the world since 2014. Based on intensive research, Mindray has come up with the innovative solutions in cell imaging such as Multi-layer fusion technology, "Solid Rock" Hyper-stable Anti-shake System, Fly-mode Technology, and many more.

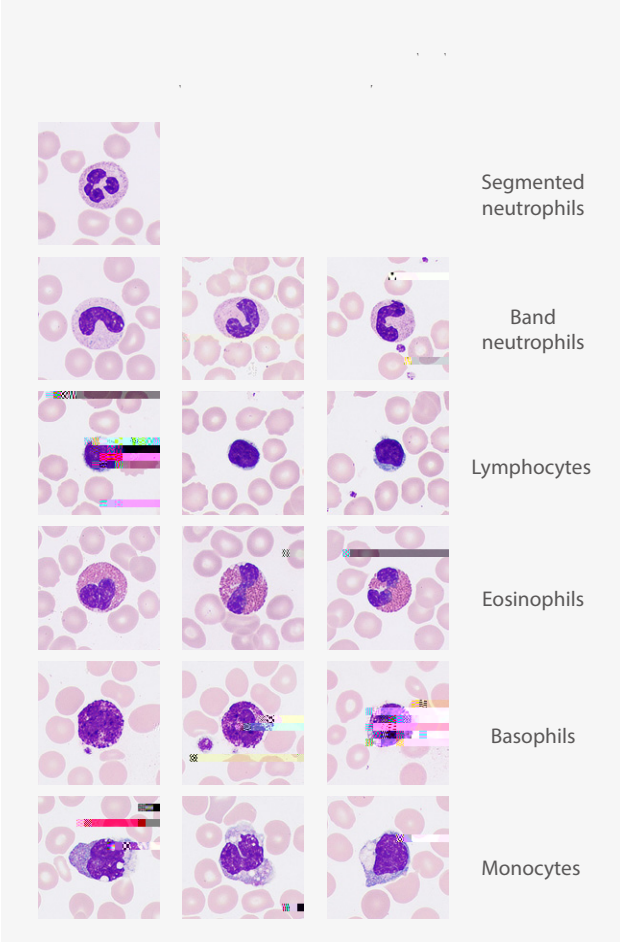
Cells are the basic units of life, and cell morphology test is one of the prime tools for detecting malignant diseases. Pathologists study the internal structure and details of the cells for various needs.

Currently in most laboratories, morphology experts observe the cell images of each re-examination sample manually with a microscope, making it a prolonged process when the test volume is large.

In order to effectively alleviate the workload of manual analysis with a microscope, cell morphology analyzers need to simulate the details captured by manual microscopy as clearly as possible. How can planar imaging of cells achieve this?

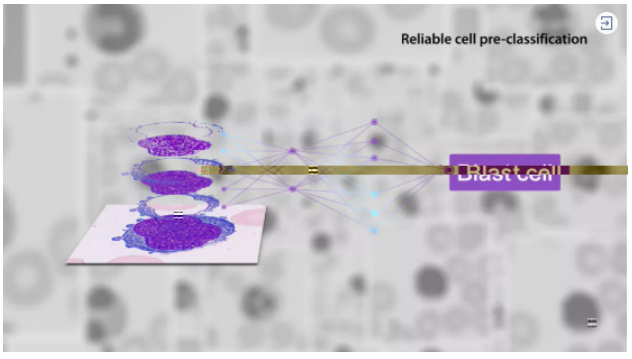


The essence of the multi-depth fusion technology is to recreate manual focusing normally performed by the doctor by superimposing the clear parts of the 20 images. In the cell imaging from the MC-80, the features and internal details of normal and abnormal cells can be clearly presented.

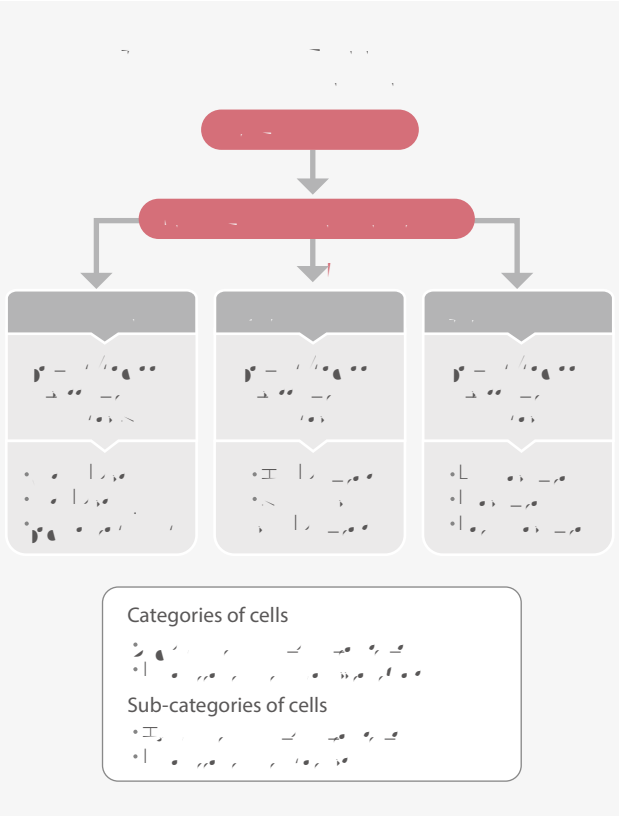


Therefore, doctors can gain insight into the pathological features of cells for more accurate early screening of blood disorders and infectious diseases, avoiding misdetection.

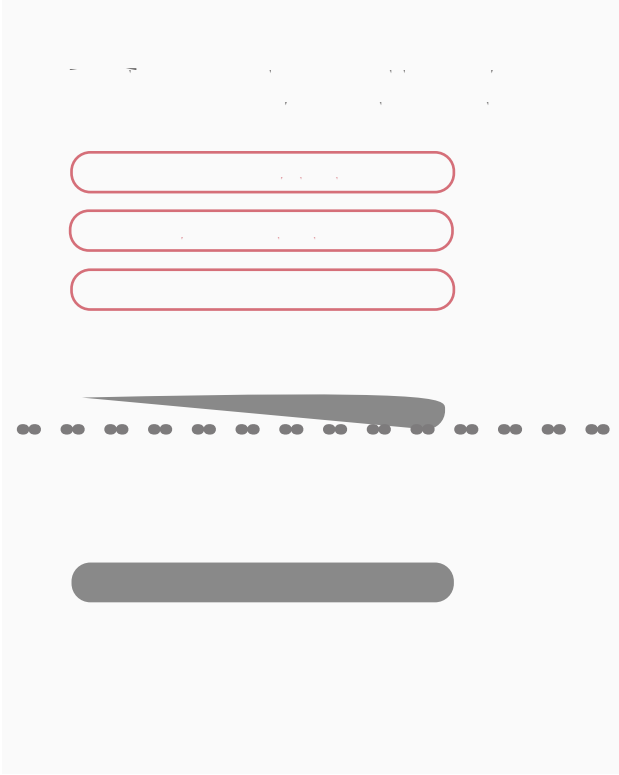
Collecting cell images is just the beginning. It is then necessary to classify each cell correctly to reflect the all-around view of the sample. When analyzing manually, the classification process is often recorded once at a time by the doctor. However, as the various types of cells are similar, doctors can only classify them based on their details. Over time, errors occur, affecting the accuracy and efficiency.



Accurate recognition is based on the accurate extraction of features from the digital images of cells. With the guidance of morphology and pathology experts in the early stage, Mindray team extracts the information regarding cell color, texture, and geometric characteristics on different scales. By improving the recognition rate of cells using cascade classification, pathologists can accurately confirm the types of cells through comparison within categories and subcategories.



For the falsely decreased platelet counts due to clumping, the MC-80, with its unique high-speed FLY-MODE, can scan the body, both sides, and tail of the smear within one minute, accurately identifying platelet clumping, avoiding time-consuming manual confirmation.



Until now, under stable lighting, capturing a clear image requires long exposure time and almost no camera movement. It seems that speed and clarity can't be achieved at the same time.

The same goes for cell morphology analysis. In addition to clarity, efficiency is also important for finding the truth faster. Traditional manual analysis takes 5-8 minutes for each sample. In large laboratories, the huge workload requires specialized personnel, resulting in high labor costs.

The erythrocyte sedimentation rate (ESR), which is determined by the Westergren method, measures how

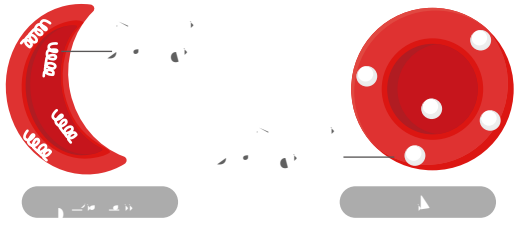
References

[illegible]

Before we move onto the next lesson, here are some take-home messages for you.

In general, ESR has higher sensitivity and negative predictive value (NPV) but lower specificity and positive predictive value (PPV).

- ESR is a very important means to rule out giant cell arteritis.
- In sickle cell disease → asymptomatic → ESR↓
  painful crises → inflammation → Fibrinogen↑ → ESR↑
- In sickle cell frait → no sickle cells → normal ESR



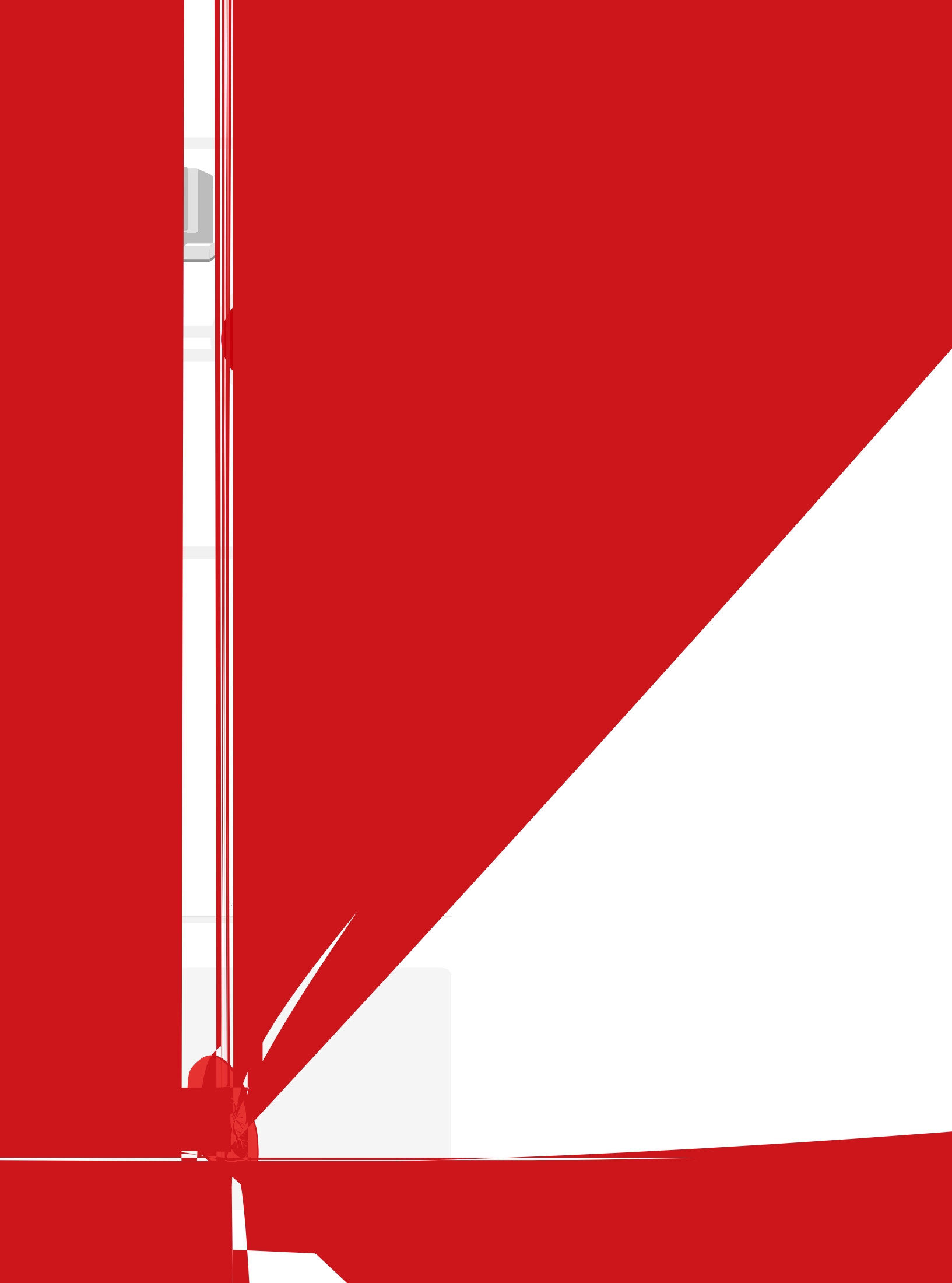
- Both ESR and CRP will be detected to elevate in the case of any inflammation.
- ESR starts to rise 24-48 hours after onset of inflammation.
- ESR elevation is one of the minor criteria for diagnosis of rheumatic fever.

Mindray is soon going to launch a new hematology series that incorporates both CBC and ESR analysis. Stay tuned for its global launch lunch event on March 1st!

Blood, urine and feces analysis are the three common tests in clinical laboratories. Among them, blood testing is the most important way to keep track of one's overall physical well-being.

In the past, routine blood tests were performed manually on a microscope, Neubauer's hemacytometer, Sahli's colorimeter and ESR tube rack.

In addition to complete blood count (CBC) and white blood cell differential (DIFF) count which have become fully automated, other simple but time-consuming blood tests like ESR and CRP also transform from manual methods to automated analysis. Integrated systems have been developed for easier operation.

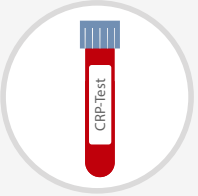


Diagnostic methods

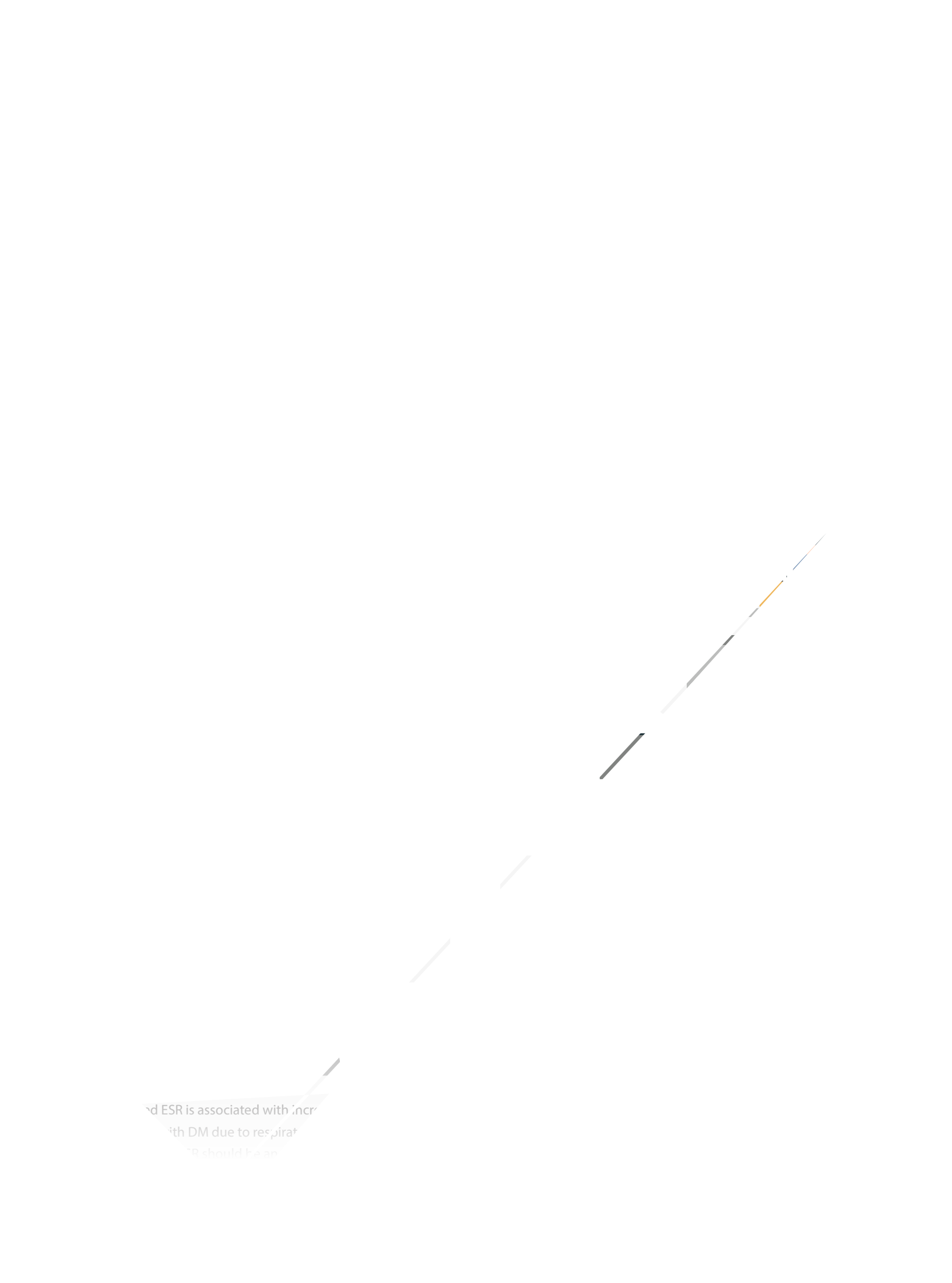
Elevated Erythrocyte Sedimentation Rate Is Predictive of Interstitial Lung Disease and Mortality in Dermatomyositis: A Korean Retrospective Cohort Study

Age group

Diagnosis of ILD: High resolution computed tomography (HRCT) scans



Examination of the association between elevated ESR and pulmonary impairment and mortality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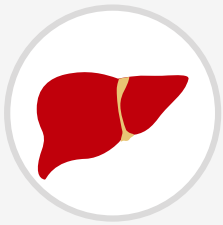
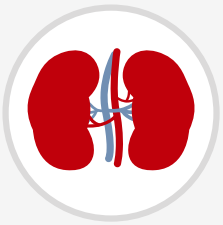
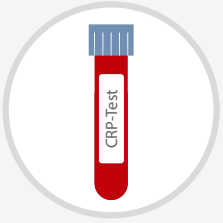


liver function tests (LFT)



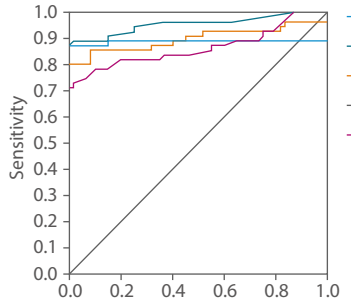
renal function tests (RFT)



complete blood count (CBC), CRP, ESR

Results

Lymphocytes % showed decrease to 9.2 (P-value=0.000) and significant increase in neutrophils to 83.05 (P-value=0.005), ESR to 65.54 (P-value=0.000) and CRP to 91.07 (P-value=0.000).



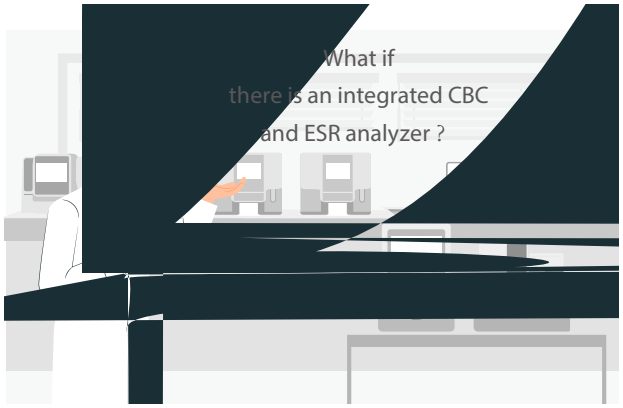
Diagonal segments are produced by ties.

The percent of detecting COVID-19 positive RT-PCR (98%) for suspected individuals using ROC showed best cutoff of ≤21.8 for lymphocytes %, ≥ 67.7 for neutrophils, ≥37.5 for ESR, ≥6.2 for CRP and ≥7.15 for WBCs.

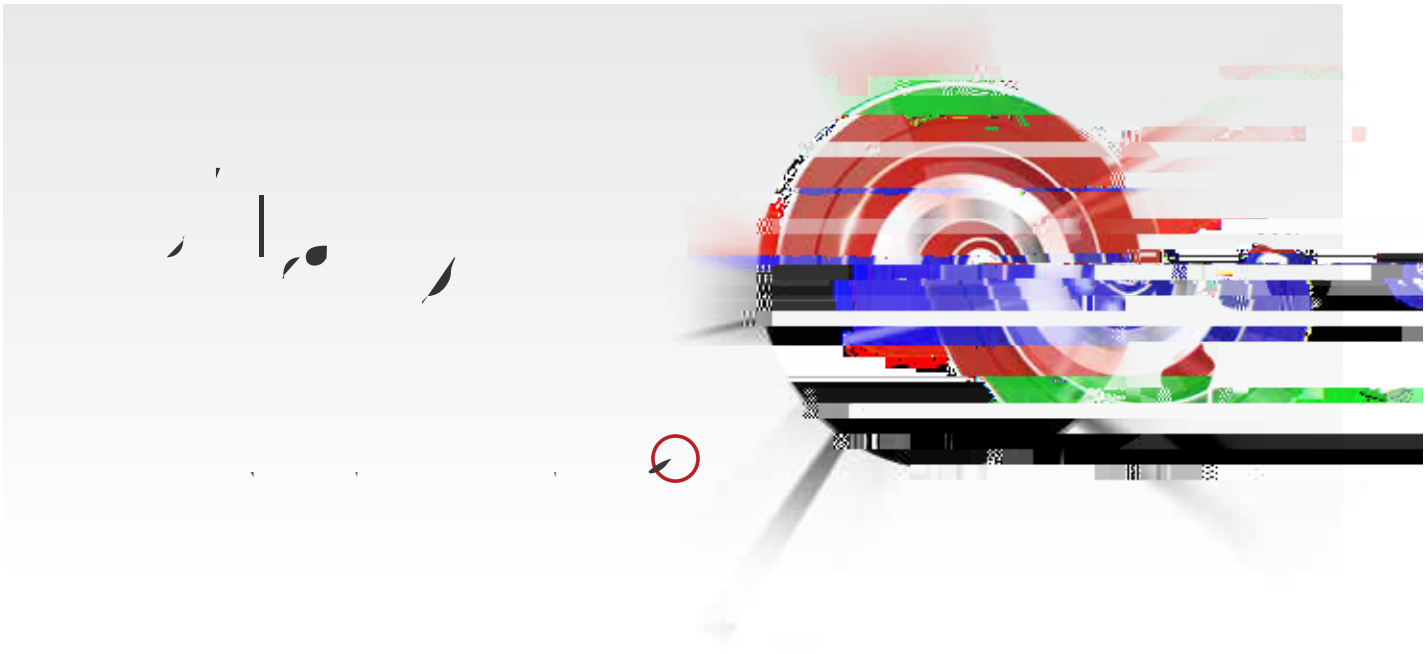
Conclusion

Lymphocyte percentages, neutrophils, CRP and ESR can be used as markers for COVID-19, helping in prioritizing individuals for rRT-PCR tests.

- ESR and CRP are traditional biomarkers of inflammation.
- Elevated levels only indicate that there is a focus of inflammation somewhere in the body, but the tests cannot pinpoint the exact location of inflammation.
- ESR and CRP can be used as routine aides to detect inflammation and monitor treatment effectiveness.
- After high levels are detected, the patient should undergo reexamination every 1 to 3 months to help determine whether the treatment is successful in reducing inflammation.



Mindray is going to launch a new hematology series that incorporates both CBC and ESR analysis. Stay tuned for our global launch lunch event on March 2 !



According to the World Health Organization (WHO), there were an estimated 241 million cases of malaria worldwide in 2020, and the estimated number of malaria deaths stood at 627,000 in that year. The African Region was home to 95% of malaria cases and 96% of malaria deaths. Children under 5 accounted for an estimated 80% of all malaria deaths in the Region.1

These tests should be performed immediately without delay when ordered by a health-care provider. It is vital that health-care providers receive results from these tests within hours in order to appropriately treat their patients infected with malaria.2

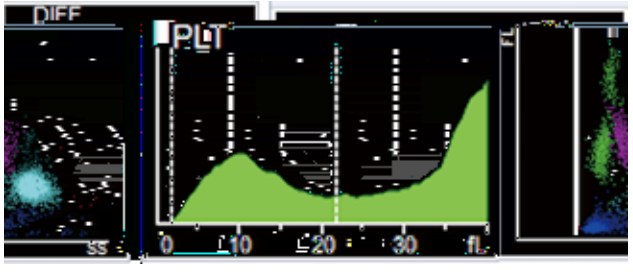
However, many factors can influence a laboratory's choice of microscopy as a diagnostic tool for malaria, including the skills of laboratory staff, patient sample testing load, and epidemiology of malaria and possible use of microscopy for other diseases.3

Quick, easy and clear visualization of parasites in blood cells through microscopy is key.

In Europe, around 8,000 cases of imported malaria are reported every year, the majority due to Plasmodium falciparum (P. falciparum).4 The rise in malaria infections has become a concern of Spain.5 6 It is important to get diagnosis clues through the microscopic results from front-line checks, so doctors can act quickly and provide effective treatment for the infected immigrants and summer travelers.

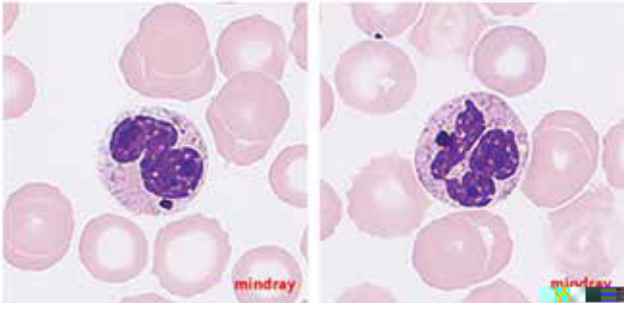
Dr. Anna Merino from the Core Laboratory, Hospital Clinic, in Barcelona, Spain, shared a recent case in her laboratory.

A 48-year-old man was admitted to the hospital with a high fever. A blood cell check was done on the Mindray BC-6800Plus hematology analyzer. The low platelet count result (66 x 109/L) and flags on immature granulocytes, atypical lymphocytes, and an abnormal PLT histogram triggered the re-exam rules.

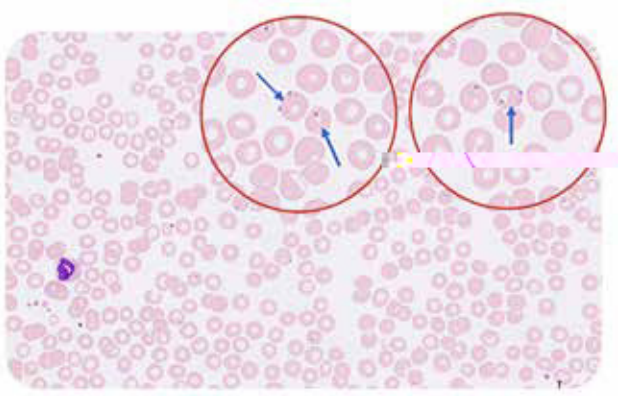


Therefore, a blood smear test was performed on the Mindray SC-120 Auto Slide Marker and Stainer. Then, the smear was loaded onto the MC-80 automatic digital morphology system. A couple of minutes later, the scanning was completed.

Several important morphological findings were revealed in validating the cells. The presence of inclusions within red blood cells (RBCs) was the first and most important finding, which corresponded to malaria-derived parasites. Another important finding was the malaria-derived pigments inside of neutrophils (Maurer pigments).



Atypical lymphocytes, as flagged by the hematology analyzer, were found in the smear. Some lymphocytes also contained malaria-derived pigments.



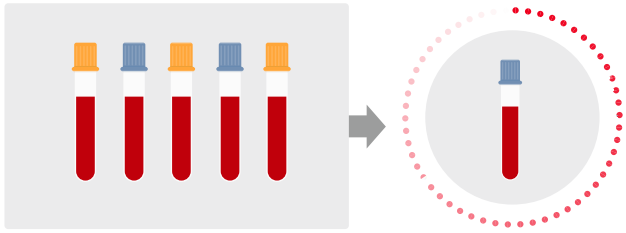
From Dr. Anna Merino's experience: "The image clearly shows a blood sample corresponding to a patient infected by malaria (P. falciparum species) as we can observe two or more parasites inside RBCs and two dots of chromatin." A quick report was made and handed to the clinicians. The anaylysis of a thick drop in the microbiology laboratory confirmed the diagnosis. During the following medical consulation, the patient admitted that he once travelled to the Ivory coast in western Africa. The patient received treatment with Artesunate (Eurartesim(R) 320/40 mg) immediately and recovered quickly as expected.

As a new digital morphology system, the Mindray MC-80 provides faster scanning and clearer visualization of the conditions to facilitate the traditional microscopic examination, enabling accurate diagnosis and effective treatment through modern clinical testing procedures.

In the last two chapters, we talked about what ESR is and the applications of ESR, CRP and CBC analysis. ESR is an acute phase reactant and serves as a marker for inflammation. It correlates with disease activity and response to therapy. We understand that single tests are not adequate to confirm any diagnosis, but they do give us important clues.

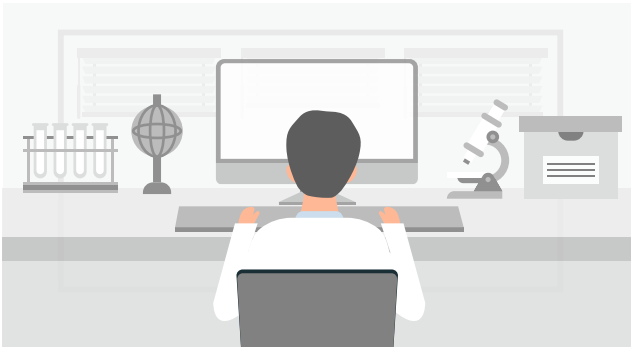
Today, all these tests can be performed via an automated analyzer. You do not have to do this by yourself anymore. This helps to streamline the workflow of the laboratory and allows patients to get the diagnosis in the earliest time possible.

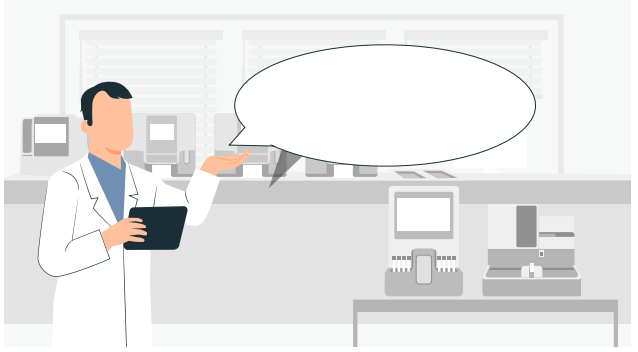
So, what are the advantages of automated measurement of ESR with CBC in one analysis from clinical laboratory perspectives?



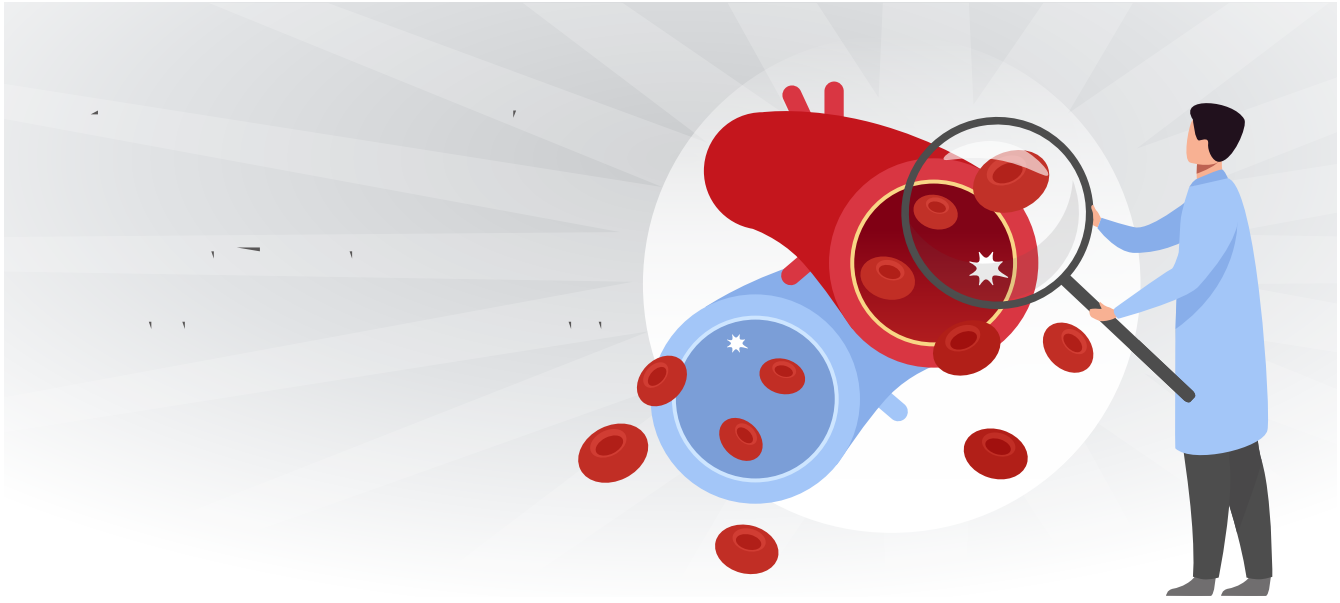
- Additional tubes
- Additional manpower
- Time consuming
- Potential biosafety hazards due to the blood exposure during the whole process

- Additional instrument cost
- Additional maintenance cost





Mindray has launched the new BC-700 Series, a revolutionary hematology analyzer series that incorporates both CBC and ESR tests. This series, including two open vial models BC-700/BC-720 and two autoloader models BC-760/BC-780, is designed to empower medium-volume laboratories with advanced diagnostics technologies that are applied in the premium products.

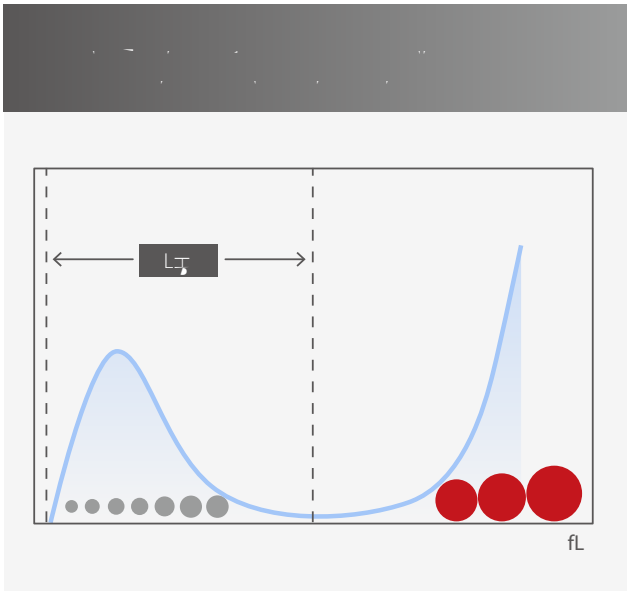


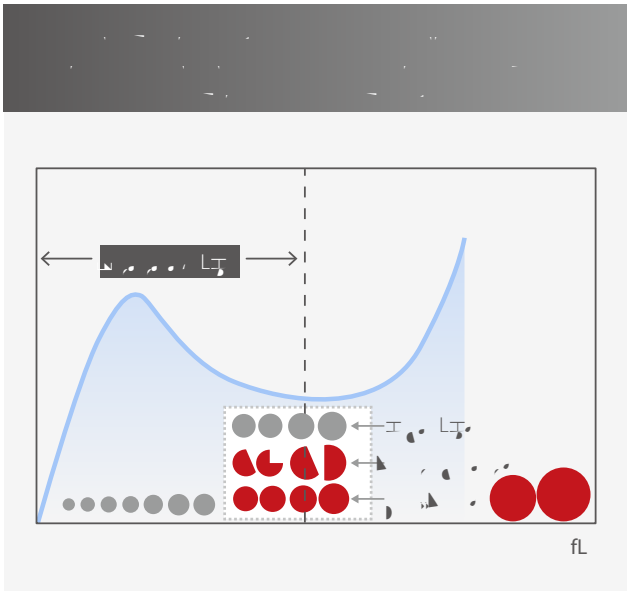
Hemostasis and coagulation are the main functions of platelets (PLTs). Thrombocytopenia is a common cause of bleeding. A PLT count from 20 to 50×10^9/L may indicate mild or surgical bleeding. If it is lower than 20×10^9/L, this may indicate severe bleeding. If it reduces to 5×10^9/L or lower, the patient may be experiencing a life-threatening condition.

Nowadays, laboratories usually count PLTs by using automatic hematology analyzers, which work based on various methods with different characteristics.

PLTs and red blood cells (RBCs) can be distinguished by the magnitude of the electrical impedance signal in normal samples. However, PLT-I is subject to the interference of microcytic RBCs, fragments, and large PLTs when it is used to differentiate PLTs by cell volume.

When microcytic RBCs and fragments are present in the blood, the result of PLT-I will be falsely high due to the interference of RBCs; when large PLTs or PLT aggregations are present in the blood, the PLT measurement result will be falsely low.

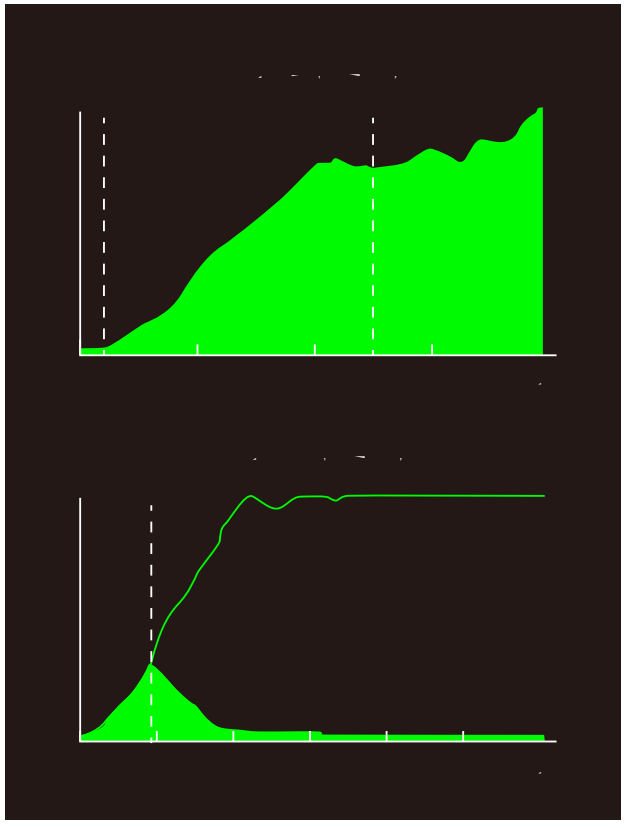




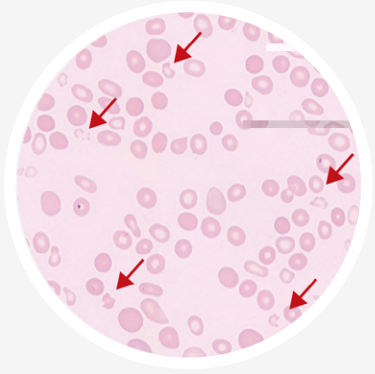
Although the PLT-O (optical platelet) method can be used to avoid the above inferences, it requires additional reagents for the analysis. PLT-H is a new parameter provided by Mindray BC-700 Series that can resist interferences in conventional PLT detection and requires no extra reagents in every CBC and DIFF analysis. Let's take a look at how PLT-H provides accurate PLT measurement results.

A patient with acute lymphoblastic leukemia, hospitalized for 11 months, was undergoing chemotherapy and preparing for bone marrow transplantation.

RBC	$3.23x10^{12}/L$
HGB	87g/L
MCV	76.7fL
RFC%	7.5%
PLT-I	$77×10^{9}/L$
PLT-H	$29×10^{9}/L$



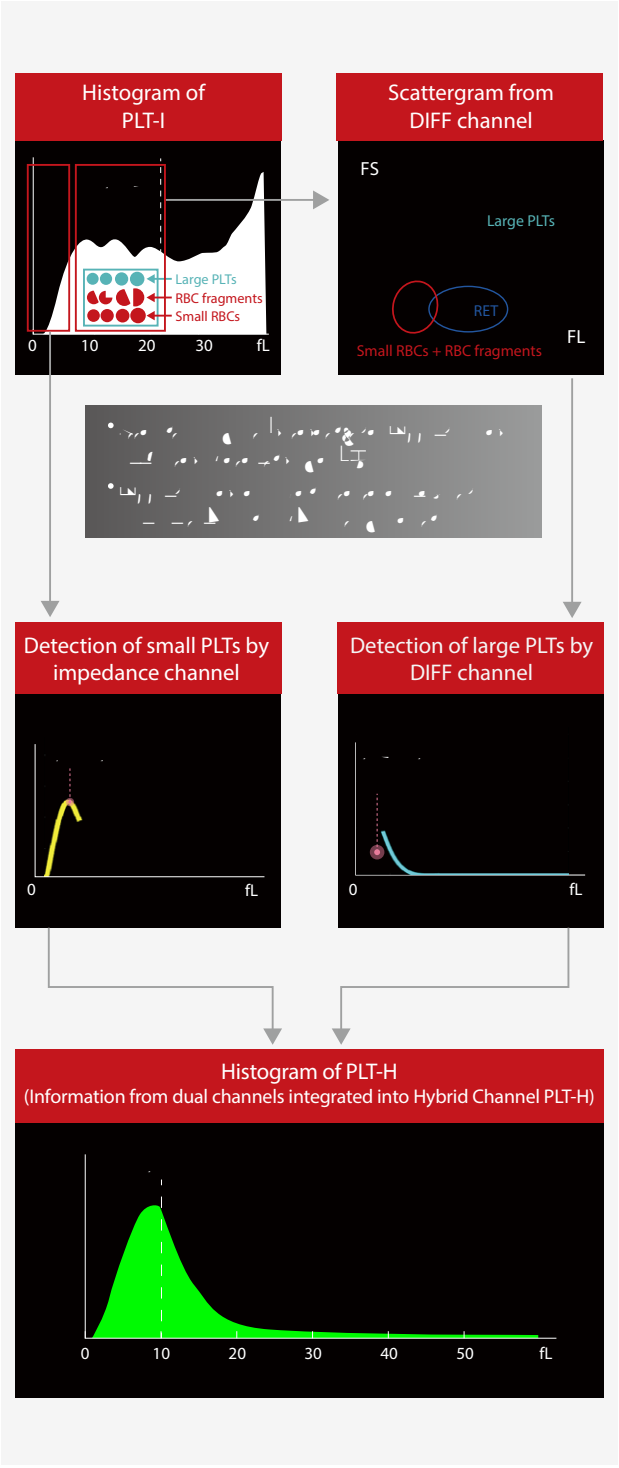
Microscopic examination revealed evident RBC fragments (arrows) in multiple high-power lens.



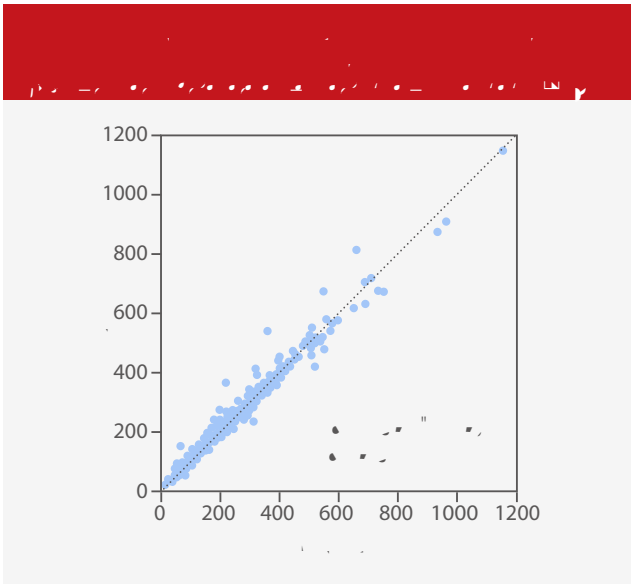
PLT($x10^{9}/L$)	77	29	27

The PLT count measured by flow cytometry was $27X10^{9}/L$, which was consistent with that by PLT-H.

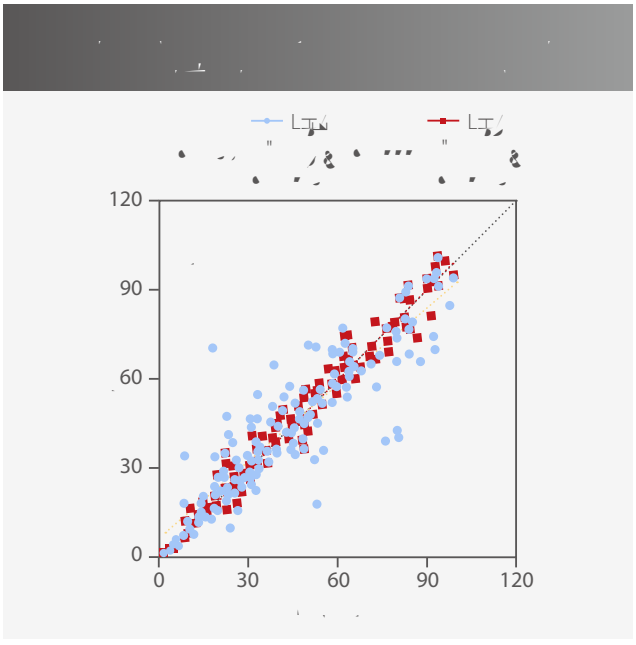
In this case, an RBC fragments alarm was triggered in the instrument, and the FRC value was 7.5%. The tail of the PLT histogram was elevated, suggesting that RBC fragments may be present in this sample, which would cause a false high value in PLT. During chemotherapy, patients usually exhibit a decrease in whole blood cells and an increase in cell fragility. Despite the presence of RBC fragments, PLT-H can accurately measure the PLT count and monitor the risk of bleeding in a timely manner.



In Thailand, 405 PLT samples were collected(excluding aggregation samples). As revealed by microscopic examination, 200 samples contained interfering factors, including large PLTs, microcytic RBCs and RBC fragments. The PLTs were detected by Mindray BC-760 and BD flow cytometers, respectively. BC-760 PLT-H had a good correlation with flow cytometry (r=0.9873, y=1.0179x+5.0894).



156 low PLT count [Please confrm the correct term.] samples were selected. Using flow detection (CD41+CD61) as the reference method, the correlation between PLT-H and PLT-I in the low-count [Please confirm the correct term.] segment of Mindray's hematology analyzer was analyzed, as shown in the figure. It can be seen from that PLT-H has a strong correlation with flow cytometry (r=0.9837, y=0.9995x+0.5101).



In conclusion, the use of PLT-H technology can significantly reduce the inaccurate counts caused by the interferences of RBC fragments, large PLTs, and small RBCs, helping greatly in generating accurate and reliable PLT detection reports for clinical purposes.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