ChristianaCare

Department of Pathology & Laboratory Medicine

LabScope

December 2nd, 2024

A Day In The Life Of A Platelet Product

What is a platelet?

Platelets are small, microscopic cellular fragments that circulate in the bloodstream which, when activated, assist with clot formation in the event of vessel injury. The life span of a platelet in the human body is just 8-12 days. As such, the expirations of donated platelet products are either 5 or 7 days (dependent upon collection technology used). With such a short 'shelf-life', one can imagine how difficult it is to maintain an on-hand inventory without experiencing a high degree of wastage. The plateletpheresis products are maintained in room temperature storage units with constant agitation to maintain the platelets in motion to prevent the formation of clumps.

How is a platelet product collected?

It all starts with having an active donor base. A plateletpheresis donor can safely donate as often as every two weeks. An ideal plateletpheresis donor is someone who normally has a platelet count of 250 (10^3/µL) or greater (normal PLT count range is 150-400 10^3/µL). Nearly all platelet products used for transfusion in the United States today are created from plateletpheresis donations. A plateletpheresis donation involves a sophisticated automated collection instrument which intermittently collects whole blood from the donor, spins the blood by centrifugal force to separate and collect only the platelet layer, and then returns saline along with all other constituents of the donor's blood back to them. With the addition of saline solution, the donor leaves a plateletpheresis donation event with a blood volume equal prior to collection. A single donation can be enough to generate either 1, 2, or even 3 adult doses of platelets for transfusion!

Is platelet transfusion safe?

Platelets are maintained at room temperature, which increases their susceptibility to bacterial contamination. Therefore, platelet products must undergo bacterial screening testing or a sterilization processing (if applicable) prior to becoming eligible for distribution to hospitals for transfusion. Bacterial testing procedures require 36-48 hours to complete, dropping the practical shelf-life of plateletpheresis at the hospital to just 3-5 days from 5-7 days!

Processing includes completion of infectious disease testing, bacterial screening and, in some cases, psoralen treatment. Psoralen treatment is somewhat new to the blood industry. It involves adding a psoralen agent (amotosalen) to the platelet product. Amotosalen will infiltrate and bind to RNA and DNA of viruses, bacteria, or WBCs that may be present in the product. When exposed to UVA light, a permanent bond forms between the psoralen and the RNA/DNA; rendering any viral and/or bacterial RNA/DNA unable to replicate. Therefore, the process essentially 'sterilizes' the platelet product against the rare instance of a donor having a low-level infection that was unable to be detected by routine donor screening testing. WBC DNA is also inhibited in the same manner, making a psoralen product equivalent to irradiated. Excess amotosalen is removed from the platelet product, following the UVA light treatment as a final step in the treatment process. This innovative technology is a 'game changer' as it relates to transfusion safety and prevention of transfusion-transmitted disease. At this time, about 40% of platelet products transfused at ChristianaCare are psoralen treated.

How many platelets are kept onsite?

Blood bank laboratories maintain specific par levels for all blood products. Par levels are determined by frequency of product usage, level of care provided by the facility, as well as current product expiration experience (%). For example, Christiana Hospital maintains a par inventory of 12 plateletpheresis products, while Wilmington maintains just 2 plateletpheresis products at any given time.

How are platelets selected?

When a provider places a 'Give' order for platelets to be transfused to a patient, the order will print in the blood bank laboratory. The blood bank medical laboratory scientist will select the most appropriate product from the available inventory, considering factors, such as, product expiration (use 'oldest' first), donor and patient ABO/Rh compatibility, and any other special requirements such as irradiation. If a platelet pheresis product is not transfused before its expiration date, it's status will be updated to 'DISCARDED'. Such a circumstance contributes to waste, as ChrisitanaCare does not receive credit for unused plateletpheresis products from Blood Bank of Delmarva. As such, we in the blood bank laboratory strive to be the best stewards of the blood supply by taking action(s) to minimize wastage experience and encourage blood donation. For anyone interested in becoming a platelet pheresis donor, we encourage you to contact Blood Bank of Delmarva at 1-888-8-BLOOD-8 to make a donation appointment today.

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Updates from our Laboratories……

Point of Care Testing….

ED and ICU areas at Cecil Campus have recently implemented use of iSTAT for blood gases, lactate, and electrolyte testing. Use of iSTAT in additional areas of Cecil campus is planned; stay tuned!

The NICU on Christiana Campus is actively converting from ePOC to iSTAT for blood gas, lactate and electrolyte testing on neonates.

Microbiology….

Update on QuantiFERON-TB Gold+ Testing for Tuberculosis Exposure

The Microbiology Laboratory continues to offer QuantiFERON-TB Gold+ (QFT) testing as a more modern approach to detection of previous exposure to tuberculosis. QFT testing is an interferon-gamma (IFN-γ) release assay or an IGRA, meaning that a quantifiable immune response is generated within the blood collection tubes. Once a blood sample is collected, it is placed into four specific antigen-coated tubes, sent to the laboratory within 16 hours, and incubated at 37°C for 18 hours before testing. During this time, T-cell lymphocytes from individuals who have been exposed to Mycobacterium tuberculosis will produce significant amounts of IFN-γ cytokines. These cytokines are detectable by enzyme-linked immunosorbent assay (ELISA), generating a positive result.

The QFT assay is widely preferred over the previously used TST or PPD skin test. QFT only requires one patient visit to a provider rather than two and as opposed to the skin test, QFT is not affected by a previous Bacille Calmette-Guerin (BCG) vaccine. The BCG vaccine is commonly used against tuberculosis in countries where tuberculosis and leprosy are prevalent. As with the skin test, an individual who is immunosuppressed may not be able to provide a strong enough immune response to generate a true positive or negative QFT result. Indeterminate results may also be caused by delays in transportation to the laboratory or incorrect incubation times. If clinically indicated, repeat testing should be performed on patients with indeterminate results after 8 weeks from the original result. The mycobacterial antigens stimulating the release of IFN-γ are also present in M. kansasii, M. szulgai, and M. marinum and so an individual exposed to these other Mycobacteria species may present with a false positive result.

The number of QFT tests performed at ChristianaCare has increased over recent years with approximately 4500 tests performed in 2022, 5500 in 2023, and over 3000 tests already performed in the first half of 2024. The majority of testing is performed on outpatients, with approximately half of all testing comprising of screens collected by Caregiver Health Services. The majority of people infected with M. tuberculosis are asymptomatic so a positive QFT result should always be used in conjunction with radiography and risk assessments.

General Laboratories…

pH and Specific Gravity on Urine Drug Screen

In September 2024, laboratories across ChristianaCare stopped performing and reporting pH and Specific Gravity (SG) on Urine Drug Screen (UDS). This change standardized our UDS panel with other benchmark laboratories and eliminated the need to run UDS sample on urinalysis analyzer for pH and SG reducing the hands-on time and cost of testing.

Urine drug screen performed by immunoassay at ChristianaCare laboratories provide presumptive and unconfirmed results for medical purposes only. Positive and negative test results are based on assay specific cut-off values provided by the manufacturer. A list of cut-off values along with the cross-reactivity with different drugs and metabolites is found on the ChristianaCare Test Catalog. A more specific alternative chemical method such as Gas Chromatography or Liquid Chromatography/Mass Spectrometry (GC/MS or LC/MS) should be used for confirmation of positive results if indicated clinically.

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Q & A

Strike ~~up~~ the band!

In the imagined stepwise ontogeny of neutrophils, the step just prior to the fully mature form is referred to as the band neutrophil, based on its nuclear shape. The presence of a significant number of bands in circulation has had a time-honored place in clinical evaluation as a sign of sepsis or other extreme stress. But neutrophil maturation is linear, not stepwise, and it has long been recognized on the laboratory side that enumerating bands in an accurate and reproducible way is a fraught undertaking. With this in mind, we have recently made a change to our WBC differential reporting, dropping band reporting in most clinical settings.

Why is a change being made at this time?

Although this is not a new issue in Lab medicine, a recent study by members of the Hematology committee of the College of American Pathology included a survey and morphologic challenge to >5000 labs. This study and subsequent publication reinforced the extremely poor reproducibility of band counting. The publication was accompanied by a mandate from the authors to reconsider reporting bands.

Why can't automation in the laboratory address this issue?

On automated cell sorters, the physical and immunologic profiles of bands are nearly identical to mature neutrophils, limiting its ability to supplant manual differentials. Bands have never been a part of an automated differential.

Can lab tech training improve band counting?

Not much! Institutions have demonstrated no improvement in reproducibility when comparing before and after data following educational and standardization efforts.

Will this change compromise our detection of sepsis?

For adult patients, it should not. Although "bandemia" appeared in older sepsis alert models, in recognition of the lab challenges and lack of specificity, it has been dropped from contemporary sepsis alerts in favor of better performing biomarkers.

Is ChristianaCare alone in making this change?

No, not at all. Many other hospitals have stopped, and large national reference labs such as LabCorp and Mayo labs stopped long ago. The survey did demonstrate that a surprising number of hospital labs are still reporting bands, though these data will hopefully change that.

What is meant by "most clinical settings"? Are there situations where band counting is still helpful despite these limitations?

A: Neonatal sepsis can be an extremely challenging diagnosis. In neonatology, clearly superior biomarkers have been slower to be defined, and the presence of bands is still felt to be a valuable clue. As such, at Christiana for the time being we will still report band counts for NICU babies (and newborns at several other geographic locations). Outside of these settings, band reporting will disappear at our institution.

If you have any laboratory questions or suggestions for future LabScope Q&A sections, you can submit it here:

Laboratory Q&A Submission Form

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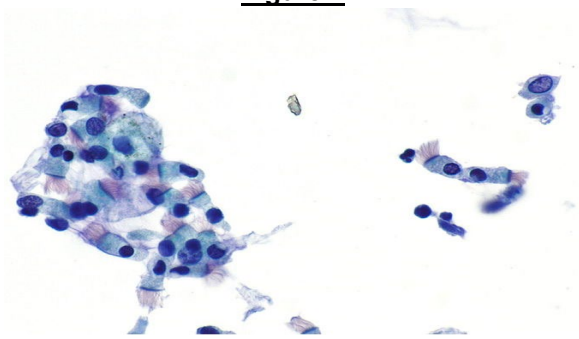
Picture of the Month:

ANATOMIC PATHOLOGY CASE STUDY

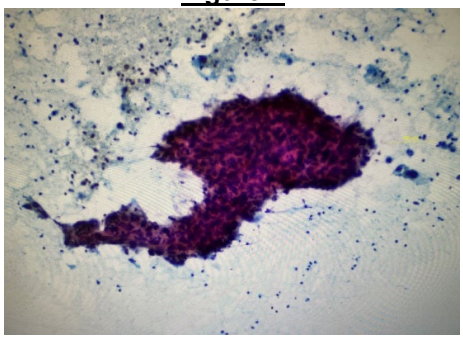
The Cytology/Histology laboratories often work together to facilitate a patient diagnosis. The patient visits their clinician with a complaint of prolonged coughing and shortness of breath. The clinician orders a CT scan to check for any abnormal findings. The results of the CT scan show a mass in the left lower lobe of the lung. This finding is concerning for malignancy and a bronchoscopy is ordered. During the bronchoscopy the Cytotechnologist assists the Radiologist with collecting a lung sample which will be sent to the Cytology Preparation Lab to be processed and stained by the Papanicolaou method.

Figure 1



depicts normal lung cells – Cytology

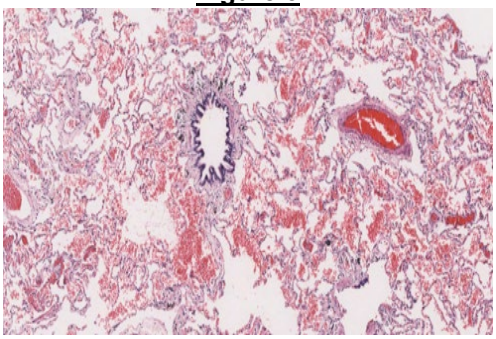
Figure 2



Cells that were collected during the FNA (Fine Needle Aspiration) depicting Squamous Cell Carcinoma of the Lung - Cytology

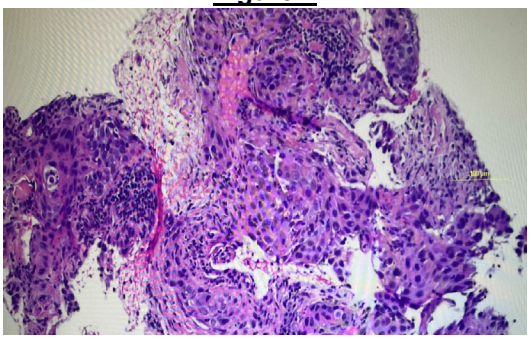
During the bronchoscopy, tissue is also collected and sent to the Histology Lab to be processed as a surgical biopsy by utilizing the methods of tissue preparation – tissue dissection (performed by the Pathologist Assistant), tissue processing, embedding in paraffin, microtomy and slide staining by the Hematoxylin and Eosin (H&E) staining method (performed by the Histology Technician).

Figure 3



Normal lung tissue-Histology

Figure 4



Hematoxylin and Eosin (H&E) stained tissue section of lung showing Squamous Cell Carcinoma of the Lung - Histology

The Pathologist receives the slides and correlates the Cytology and Histology cases to render a diagnosis for the patient. Based on the Cytology and Surgical Pathology reports, the clinician is able to provide a treatment plan for the patient.