TRANSFUSION MEDICINE ILLUSTRATED

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CLPC SEMINARS - SPRING 2021

OBJECTIVES

- REVIEW VARIOUS CASE STUDIES INVOLVING TRANSFUSION MEDICINE
- DESCRIBE THE UNDERLYING PROBLEM FOR EACH CASE
- LIST THE SOLUTIONS OR THERAPIES USED TO CORRECT THE UNDERLYING PROBLEM IN EACH CASE PRESENTED

TRANSFUSION JOURNAL

- AABB'S SCHOLARLY, PEER-REVIEWED MONTHLY JOURNAL
- EACH ISSUE HAS ARTICLE UNDER "TRANSFUSION MEDICINE ILLUSTRATED"
  - CASE STUDY
  - HISTORICAL RECORD
  - PHOTOGRAPH OR STATISTICAL GRAPH

THIS BLOOD IS NO GOOD!

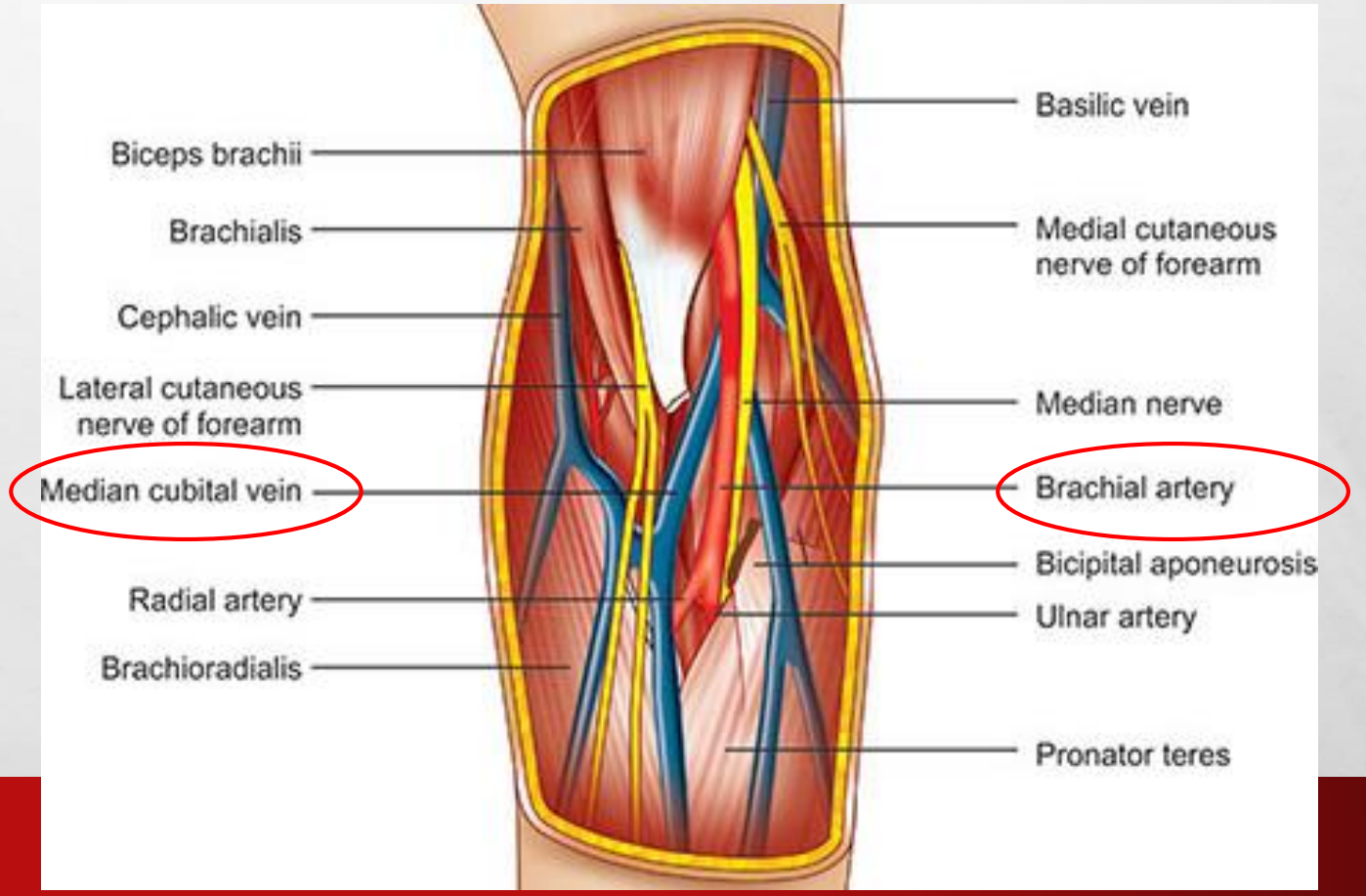
- PARSONS, J. ROSENBAUM, L. CROOKSTON, K. & KAMEL, H. (2014) INCIDENTAL ARTERIAL PHELOBOTOMY OF A WHOLE BLOOD DONOR. *TRANSFUSION, 54*, 1220.

THIS BLOOD IS NO GOOD!

- LEFT RBC UNIT COLLECTED FROM BRACHIAL ARTERY
- RIGHT RBC UNIT COLLECTED FROM MEDIAN CUBITAL VEIN

THIS BLOOD IS NO GOOD!

- MEDIAN CUBITAL VEIN VS. BRACHIAL ARTERY
- DON'T FORGET ABOUT NERVE DAMAGE AS WELL!



THIS BLOOD IS NO GOOD!

- MOST COMMON COMPLICATION FROM ARTERIAL PHLEBOTOMY ARE HEMATOMAS
  - 33% ARTERIAL PUNCTURES VS. 0.35% IN GENERAL DONOR POPULATION
- RANGE OF ARTERIAL PHLEBOTOMY IS 1:9000 – 1:34,000
  - DEPENDS ON PHLEBOTOMISTS' EXPERIENCE AND DONOR'S UNIQUE ANATOMY

THIS BLOOD IS NO GOOD!

- ARTERIAL-DERIVED BLOOD IS <u>ACCEPTABLE</u> TO USE
- MOST BLOOD CENTERS HAVE PHLEBOTOMISTS REMOVE NEEDLE AND APPLY PRESSURE FOR 10 MINUTES
- DONORS WITH WAXING AND WANING HEMATOMAS SHOULD BE EVALUATED FOR PSEUDOANEURYSM BY ULTRASOUND

GREEN WITH ENVY?

- BERGLUND, D. LINDVALL, P. & LUBENOW, N. (2014) GREEN PLASMA. *TRANSFUSION, 55*, 245.

GREEN WITH ENVY?

- 64-YEAR OLD WOMAN WITH BREAST CANCER
- EDTA SAMPLE COLLECTED PRIOR TO SURGERY FOR TYPE AND SCREEN (LEFT SAMPLE)
  - CENTRIFUGED SAMPLE DEMONSTRATED BRIGHT GREEN PLASMA
- REPEAT BLOOD COLLECTION 24 HOURS LATER SHOWED NORMAL YELLOW PLASMA COLOR (RIGHT SAMPLE)

GREEN WITH ENVY?

- TYPE AND SCREEN RESULTS WERE NORMAL
  - USED GEL-BASED MICROTYPING SYSTEM
- PATIENT'S SURGERY WAS MAPPING AND REMOVAL OF MALIGNANT TUMORS IN LYMPH NODES
  - PATENT BLUE V USED TO IDENTIFY LYMPH DRAINAGE PASSAGEWAYS

GREEN WITH ENVY?

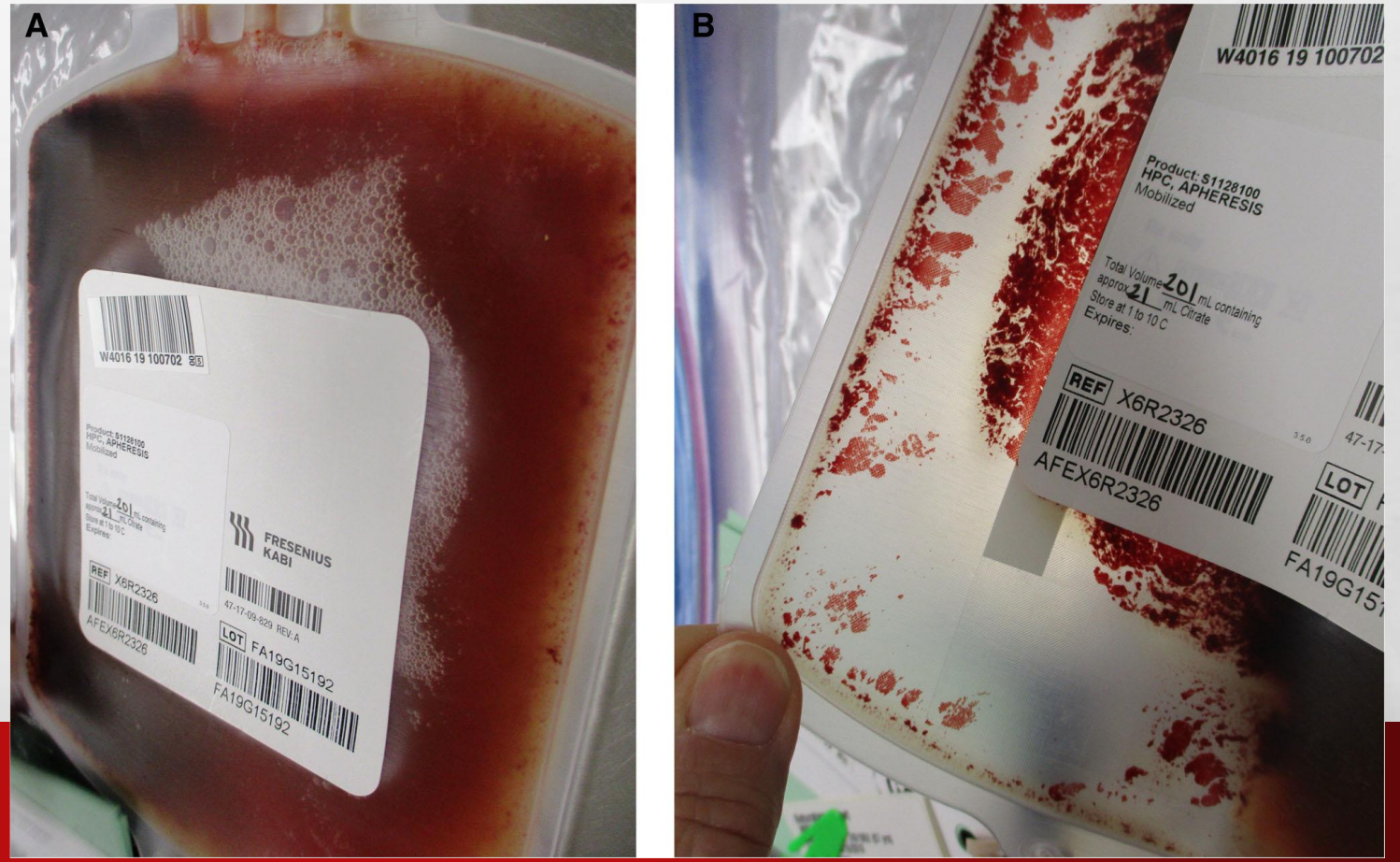
- PATENT BLUE V USED IN LYMPHANGIOGRAPHY AND SENTINEL NODE BIOPSIES AS A DYE TO COLOR LYMPH VESSELS
  - BRIEFLY GIVES PLASMA GREEN COLOR BY ADDING BLUE TO NORMAL YELLOW PLASMA
  - CAN CAUSE SEVERE ALLERGIC REACTIONS
  - CAN INTERFERE WITH O_2 SATURATION LEVELS USING PULSE OXIMETRY

GREEN WITH ENVY?

- GREEN PLASMA IS ALSO SEEN IN INCREASED CERULOPLASMIN LEVELS
  - ASSOCIATED WITH ESTROGEN-CONTAINING BIRTH CONTROL PILLS

CLUMPING IN THE COLD

- YUAN, S. ZHUANG, L. STINSON, S. BARTON, P. NOELLER, J. GARCIA, A. & WANG, S. (2020) RED CELL CLUMPING IN STEM CELL COLLECTION BAG. *TRANSFUSION, 60*, 673-674.



CLUMPING IN THE COLD

- 67-YEAR OLD MALE WITH DIFFUSE LARGE B-CELL LYMPHOMA (DLBCL)
- AUTOLOGOUS PERIPHERAL BLOOD STEM CELL (PBSC) COLLECTION WAS PERFORMED
  - 60 ML/MIN FLOW RATE WITH TOTAL VOLUME OF 12.6 L PROCESSED

CLUMPING IN THE COLD

- PBSC COLLECTION WAS UNREMARKABLE AND NO ABNORMALITIES OF PRODUCT WERE NOTED DURING OR AFTER COLLECTION
- FINAL PRODUCT WAS STORED AT 4°C FOR 20 MINUTES AWAITING PICKUP FROM LAB PERSONNEL
- UPON PICKUP, AGGLUTINATION WAS OBSERVED IN PRODUCT

CLUMPING IN THE COLD

- NO HISTORY OF COLD AGGLUTININ DISEASE OR HEMOLYTIC ANEMIA
- ANTIBODY SCREEN SHOWED 2+ PANAGGLUTINATION AT ROOM TEMP
  - NO AGGLUTINATION AT AHG
- DAT POSITIVE FOR C3 ONLY
- COLD AGGLUTININ SUSPECTED

CLUMPING IN THE COLD

- NEW BLOOD SAMPLE TESTED REVEALING:
  - COLD AGGLUTININS WITH HIGH TITERS
  - BROAD THERMAL AMPLITUDE
  - RELATIVE ANTI-I SPECIFICITY
  - WEAK RBC AUTOAGGLUTINATION AT 30°C

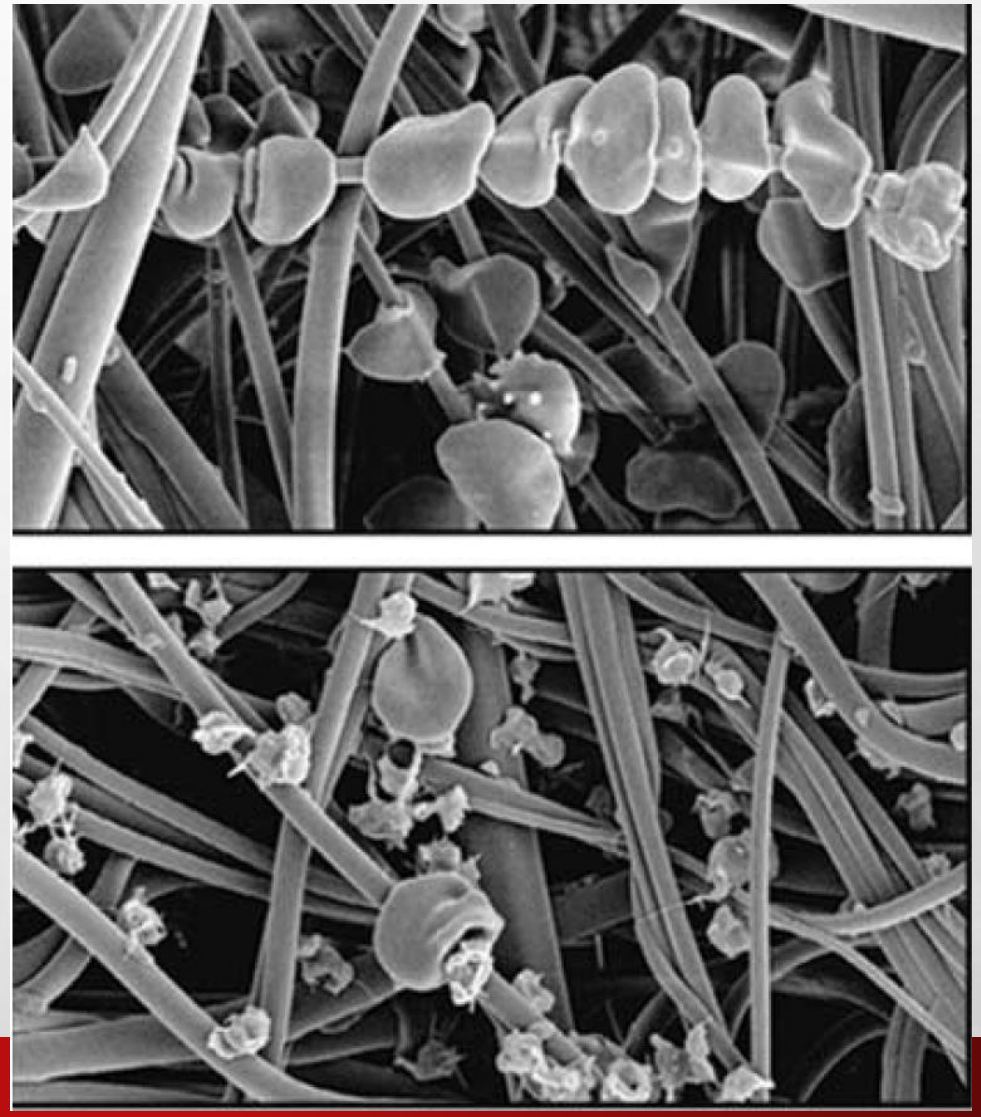
	4°C	22°C	30°C	37°C
Group O RBCs (I)	256	8	1	0
Group O Cord RBCs (i)	2048	128	1	0
Patient's RBCs	256	8	1	0

CLUMPING IN THE COLD

- RBC CLUMPING CAN LEAD TO INSUFFICIENT PBSC QUALITY PRODUCTS
- APPROPRIATE PRECAUTIONS CAN BE TAKEN IF COLD AGGLUTININS ARE SUSPECTED AHEAD OF TIME

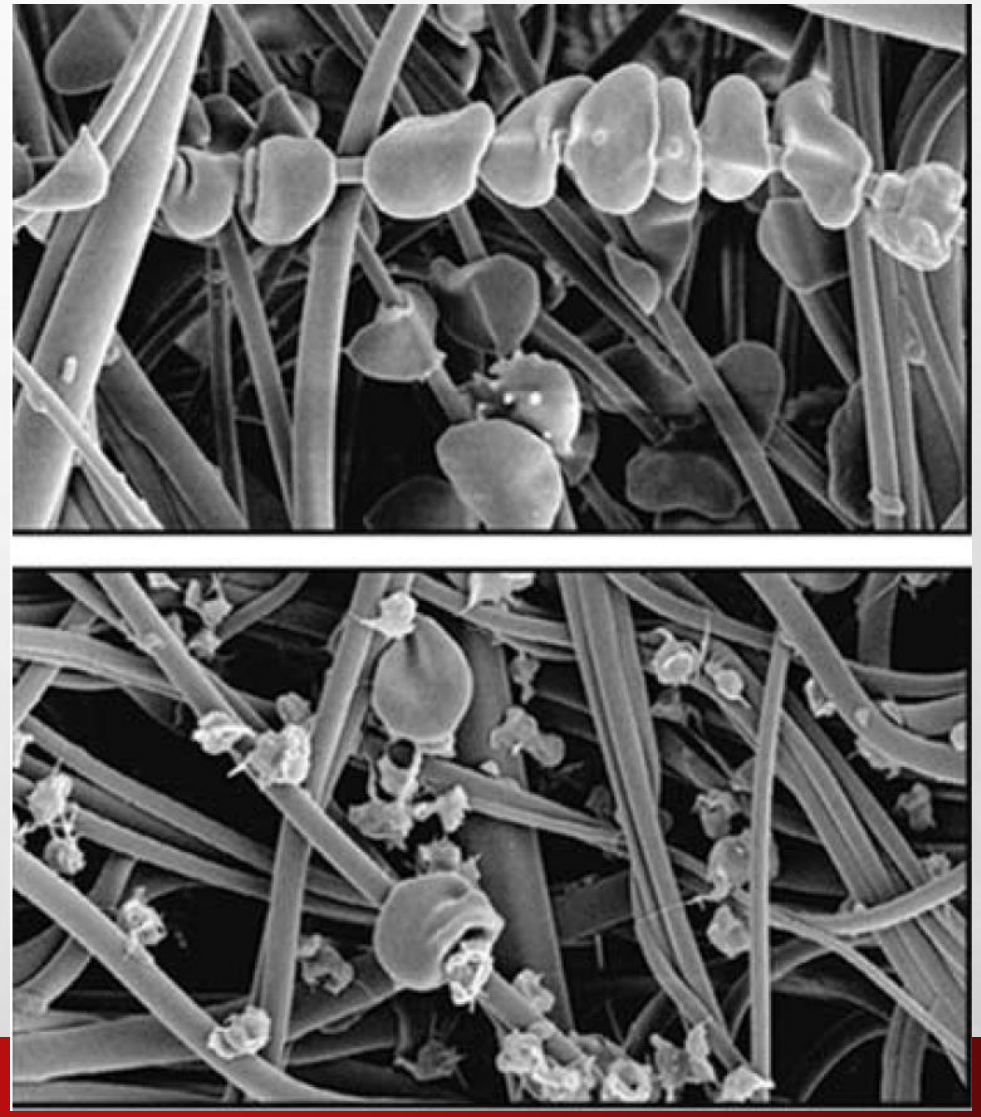
A STICKY SITUATION

- GORLIN, J. & GUDINO, M. (2001) A STICKY SITUATION: WBC REDUCTION OF RBCS FROM DONORS WITH SICKLE CELL TRAIT. *TRANSFUSION, 41*, 1192.



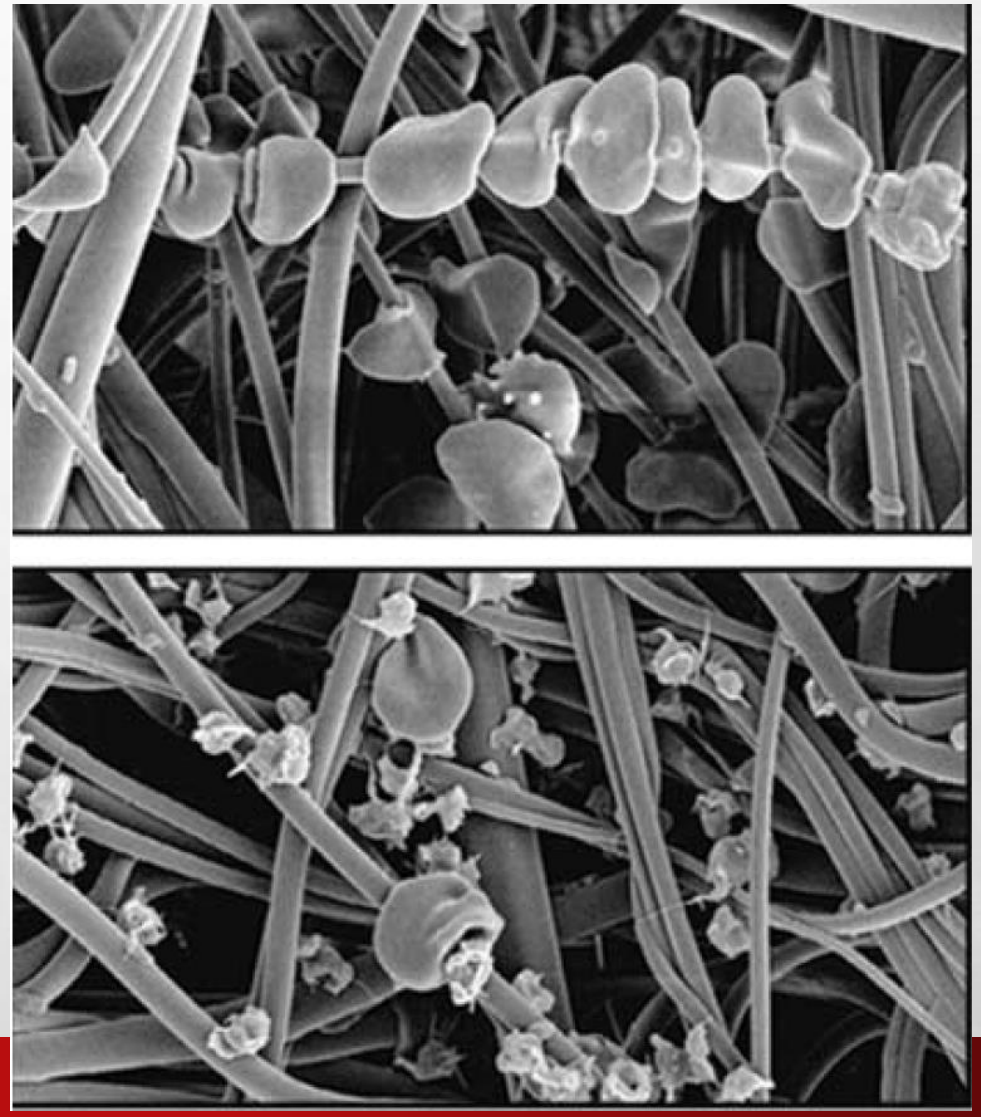
A STICKY SITUATION

- HALF OF UNITS FROM DONORS WITH SICKLE CELL TRAIT FAIL TO COMPLETE WBC FILTRATION
  - APPARENT “CLOGGING” OF FILTER
  - UNIT IS DISCARDED
- THOSE UNITS THAT COMPLETE FILTRATION DO NOT MEET STANDARDS FOR WBC REDUCTION



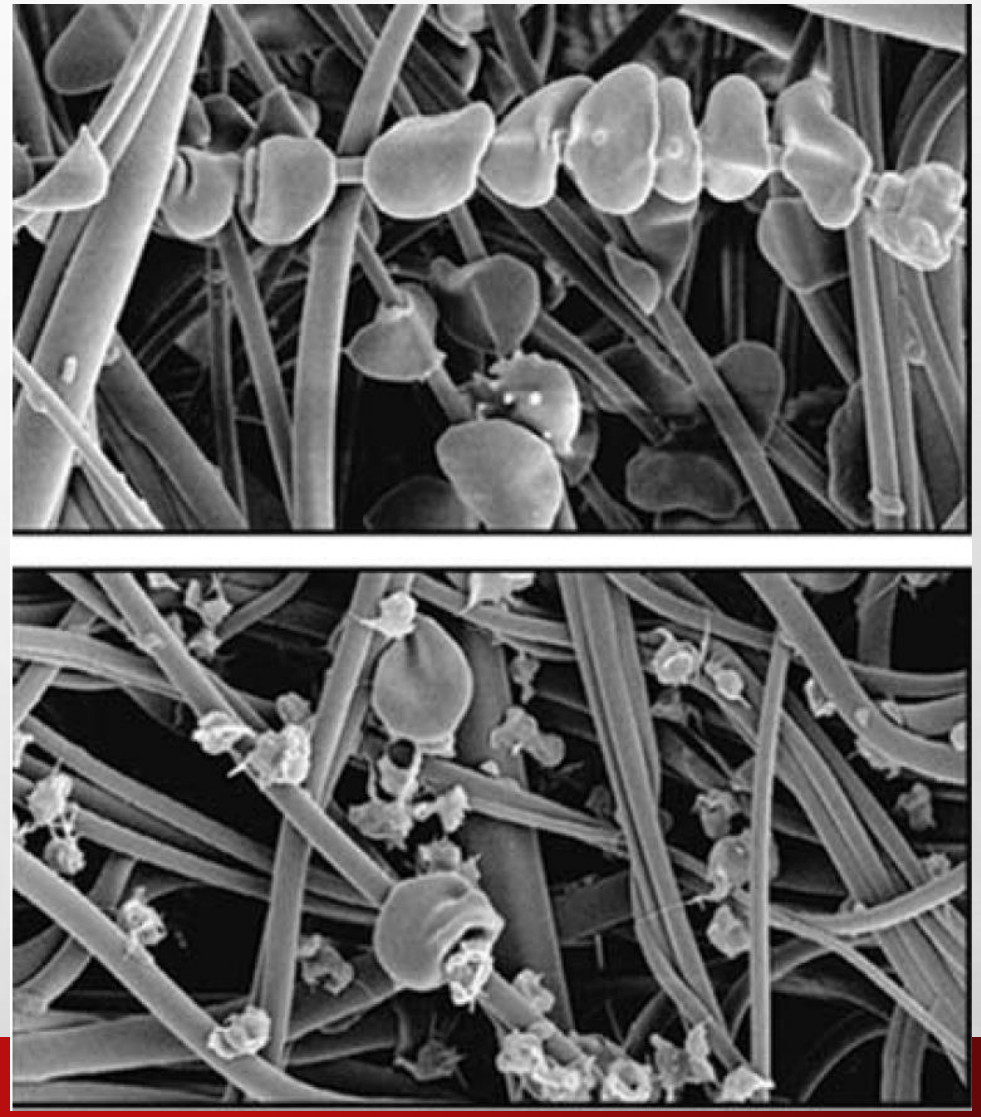
A STICKY SITUATION

- TOP PICTURE – DONOR WITH SICKLE CELL TRAIT
- BOTTOM PICTURE – DONOR WITHOUT SICKLE CELL TRAIT (CONTROL)
- BOTH WHOLE BLOOD UNITS FILTERED WITHIN 2 HOURS OF COLLECTION
  - CONTROL UNIT COMPLETED FILTRATION IN 12 MINUTES
  - SICKLE CELL TRAIT UNIT CLOGGED FILTER IN 7 MINUTES WITH ONLY 15% RBC RECOVERY



A STICKY SITUATION

- BOTH FILTERS WASHED WITH BUFFER AND CHEMICALLY FIXED
- IMAGED AT 5KV ON FIELD EMISSION SCANNING ELECTRON MICROSCOPE
- EXTENSIVE RBC ADHESION TO WBC REDUCTION FIBERS IN SICKLE TRAIT UNIT COMPARED TO CONTROL UNIT



INTRACELLULAR ASSASSIN

- GOEL, R. VASOVIC, L. WESTBLADE, L. HARRIS, R. D'AMBROSIA, D. EMMONS, F. LO, D. HSU, Y. JENKINS, S. & CUSHING, M. (2018) THE POWER OF A TRAINED EYE: FATAL TRANSFUSION-TRANSMITTED ANAPLASMOSIS AND A CASE STUDY IN INVESTIGATIVE WORK. *TRANSFUSION, 59*, 444-445.

INTRACELLULAR ASSASSIN

- 78-YEAR OLD MALE WITH HISTORY OF CORONARY ARTERY DISEASE, DIABETES, AND CHRONIC KIDNEY DISEASE
- ADMITTED FOR ELECTIVE UROONCOLOGIC PROCEDURE
- PATIENT TRANSFUSED WITH MULTIPLE UNITS PREOPERATIVELY AND POSTOPERATIVELY FOR BLEEDING AND CORRECT SYMPTOMATIC ANEMIA
- SPIKED FEVER ON DAY +20 AND STARTED ON BROAD-SPECTRUM ANTIBIOTICS

INTRACELLULAR ASSASSIN

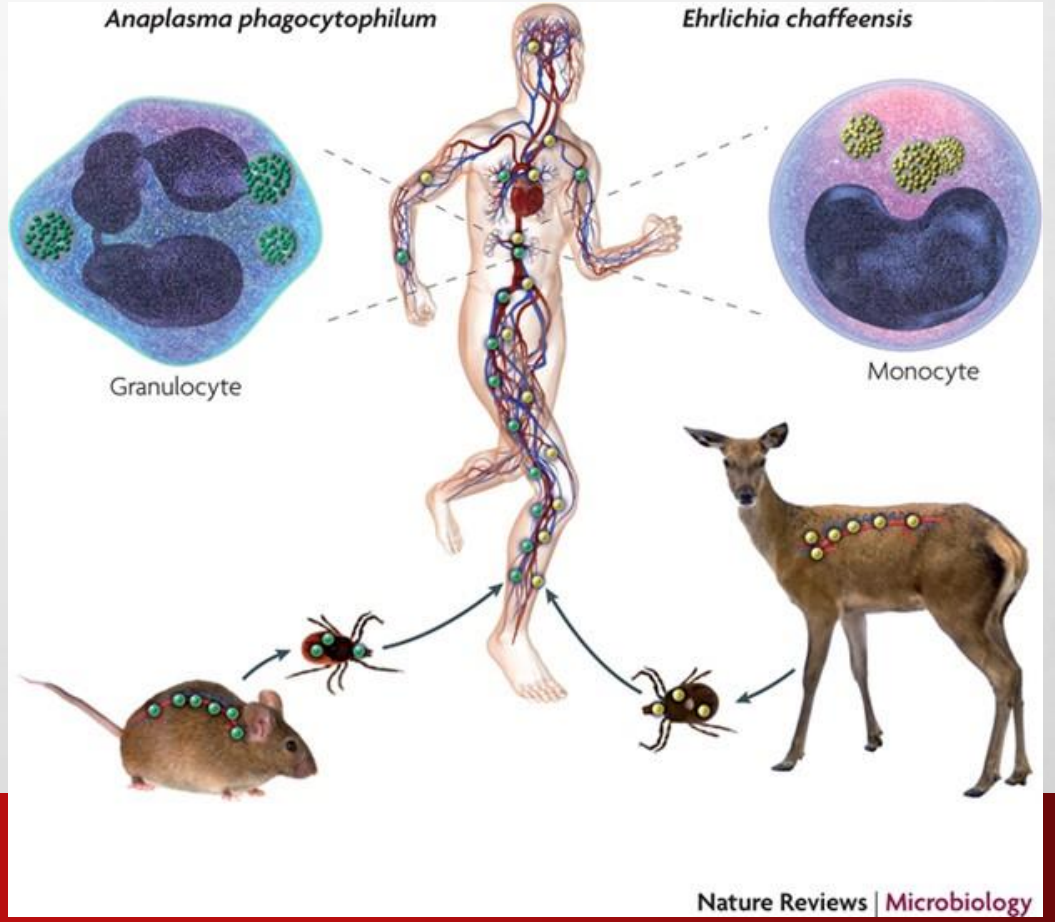
- BLOOD, URINE, THROAT CULTURES ALL NEGATIVE
- CONTINUED HIGH FEVER WITH HYPOXIA, HYPOTENSION, AND INCREASED TROPONIN
- TRANSFERRED TO ICU FOR CULTURE-NEGATIVE SEPSIS
- DAY 4 OF FEVER: HEMATOLOGY TECH OBSERVED GRANULOCYTIC INCLUSIONS ON PERIPHERAL SMEAR
  - CONSISTENT WITH *ANAPLASMA PHAGOCYTOPHILUM* MORULAE

INTRACELLULAR ASSASSIN

- ID CONSULTANT INITIATED DOXYCYCLINE IMMEDIATELY
  - PATIENT DIED OF SEPTIC SHOCK ON DAY +25
- BLOOD BANK REVEALED SEGMENT FROM LEUKOREDUCED RBC UNIT TRANSFUSED ON DAY +11 WAS POSITIVE FOR *A. PHAGOCYTOPHILUM*
- PATIENT'S SPECIMENS BEGINNING DAY +7 AFTER TRANSFUSION WERE ALSO POSITIVE
  - MORULAE FIRST SEEN ON PERIPHERAL SMEAR DAY +12 POST-TRANSFUSION

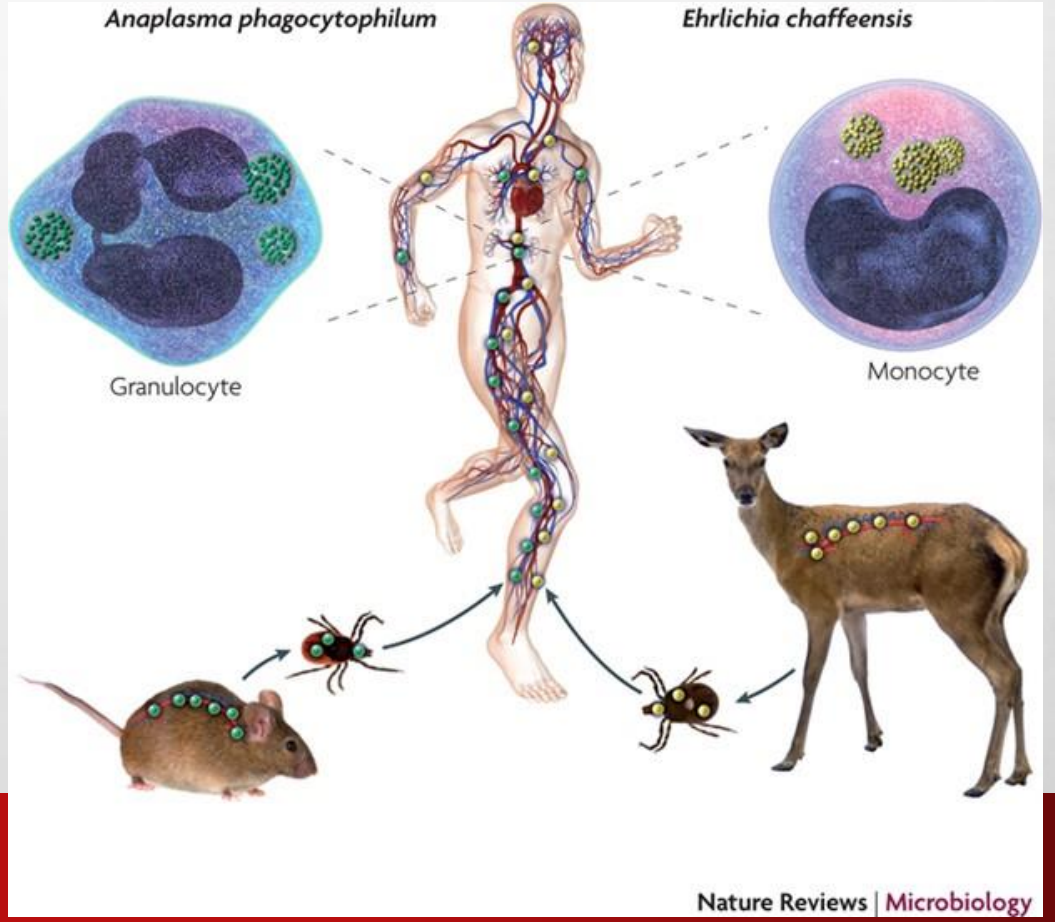
INTRACELLULAR ASSASSIN

- ***A. PHAGOCYTOPHILUM***
  - OBLIGATE INTRACELLULAR BACTERIUM
  - WILD MICE ARE HOSTS WHICH TRANSMIT TO HUMANS VIA TICK BITES
  - LACK GENES FOR BIOSYNTHESIS OF THE LIPOPOLYSACCHARIDES/PEPTIDOGLYCANS THAT ACTIVATE HOST LEUKOCYTES
  - ACQUIRE HOST CHOLESTEROL FROM THE LOW-DENSITY-LIPOPROTEIN UPTAKE PATHWAY



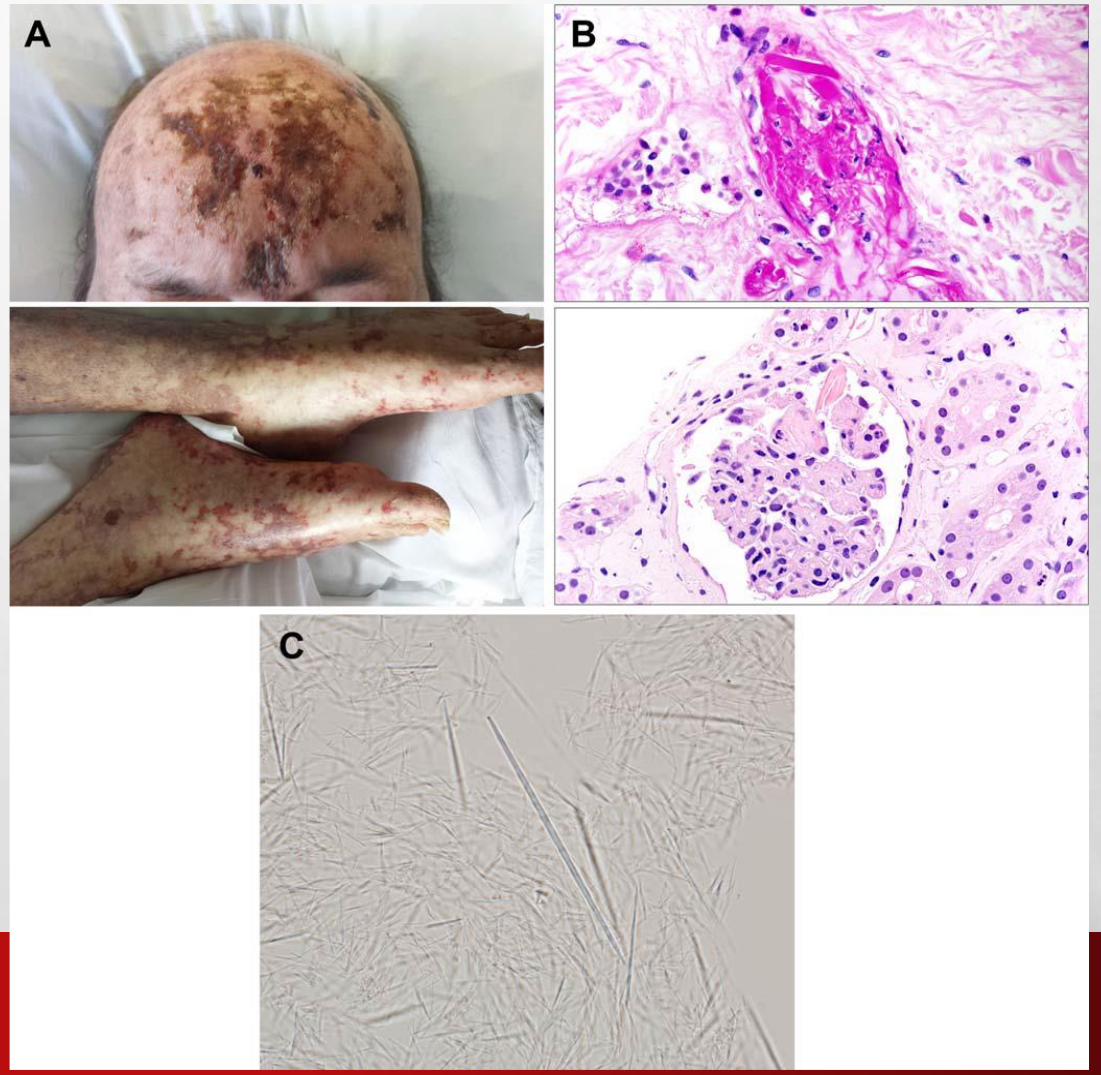
INTRACELLULAR ASSASSIN

- ***A. PHAGOCYTOPHILUM***
  - CAVEOLAE-MEDIATED ENDOCYTOSIS DIRECTS BACTERIA TO AN INTRACELLULAR COMPARTMENT, OR INCLUSION
  - INCLUSION DOES NOT ACQUIRE COMPONENTS OF NADPH OXIDASE NOR SHOW SIMILARITY TO LATE ENDOSOMES OR LYSOSOMES
  - ***A. PHAGOCYTOPHILUM*** INCLUSIONS ACQUIRE EARLY-AUTOPHAGOSOME CHARACTERISTICS



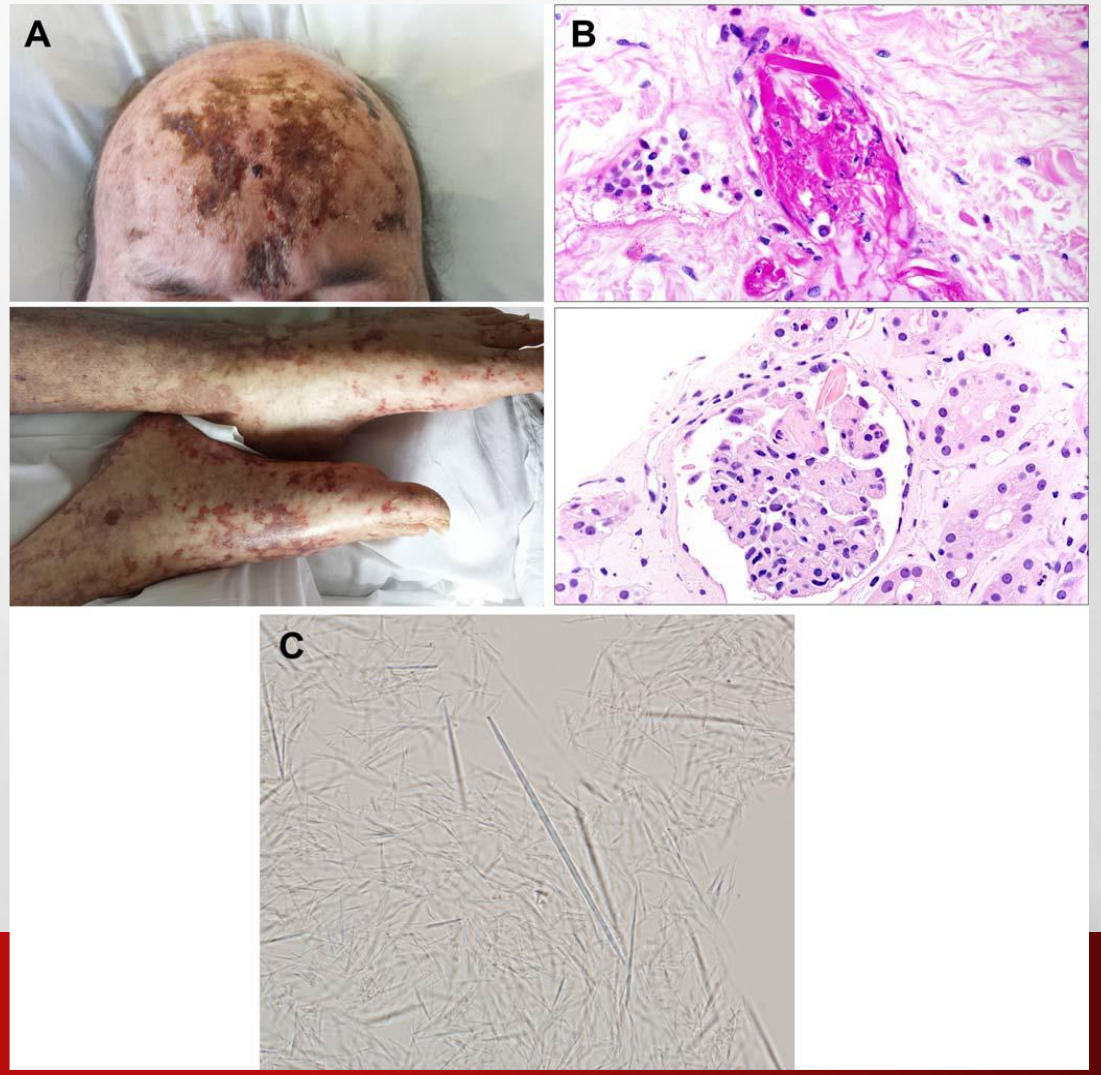
CRYSTAL DEATH

- AVEDSCHMIDT, S. FARKASH, E. & YAMADA, C. (2016) A CASE OF CRYOCRYSTALGLOBULINEMIA. *TRANSFUSION, 56*, 1678-1679.



CRYSTAL DEATH

- 52-YEAR OLD MALE WITH MULTIPLE HOSPITALIZATIONS DUE TO:
  - COPD
  - RESPIRATORY/RENAL FAILURE
  - DEEP VEIN THROMBOSIS
  - BASAL GANGLIA HEMORRHAGE
  - SEPSIS
- IGGK MONOCLONAL GAMMOPATHY
  - SERUM PROTEIN ELECTROPHORESIS – 0.1G/DL M-PROTEIN

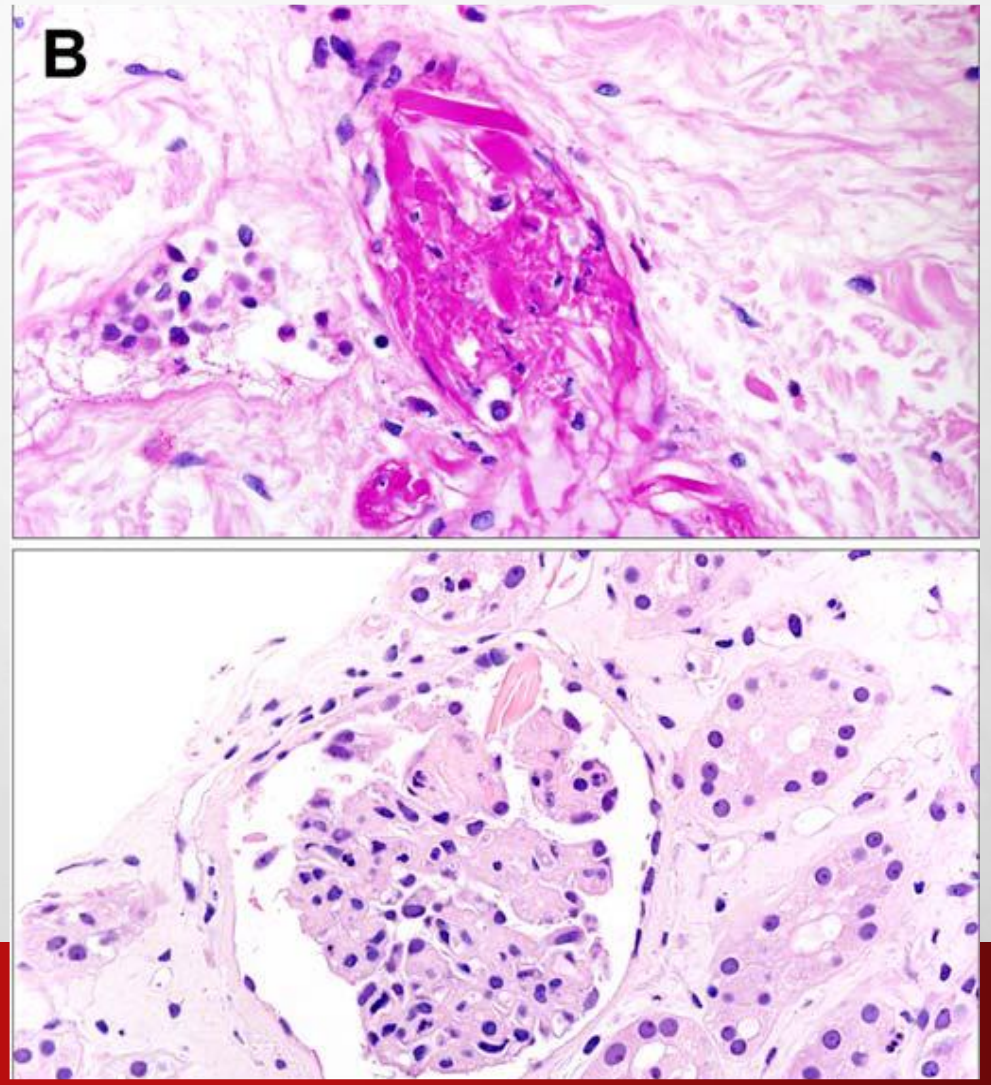


CRYSTAL DEATH

- 7 MONTHS LATER PRESENTED WITH DIFFUSE PURPURIC RASH, RENAL FAILURE, MILD THROMBOCYTOPENIA
  - IAT AND DAT WERE NEGATIVE
  - HEMOLYSIS LABS WERE NEGATIVE
  - BM BIOPSY WAS UNREMARKABLE
  - ADAMTS13 WAS 53% (NORMAL IS >68%)

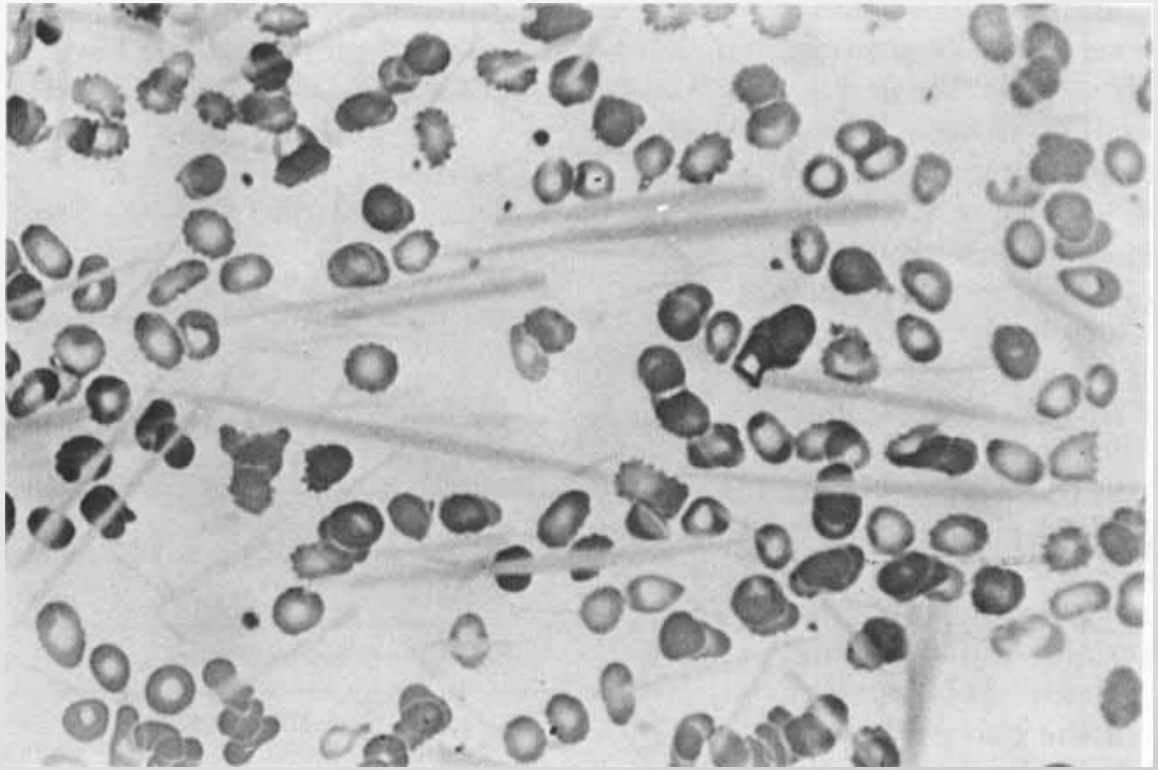
CRYSTAL DEATH

- SKIN BIOPSY SHOWED NEUTOPHILIC THROMBOTIC VASCULOPATHY WITH CRYSTALS (TOP)
- KIDNEY BIOPSY SHOWED CORTICAL NECROSIS, FIBROCELLULAR CRESCENTS, ARTERIAL THROMBI, EXTENSIVE TUBULAR INJURY WITH OCCASIONAL TUBULAR/GLOMERULAR CRYSTALS (BOTTOM)
- CRYOCRIT WAS 12% (NORMAL <1%)
  - DIAGNOSED WITH TYPE I CRYOCRYSTALGLOBULINEMIA



CRYSTAL DEATH

- CRYOCRYSTALGLOBULINEMIA
  - RARE TYPE OF CRYOGLOBULINEMIA
  - RESULTS IN MICROVASCULAR LESIONS
  - CRYSTALLIZATION OF MONOCLONAL IMMUNOGLOBULINS CAUSES MORE SEVERE MANIFISTATIONS
- TREATMENT BY THERAPEUTIC PLASMA EXCHANGE (TPE) – CATEGORY I APPLICATION FROM ASA

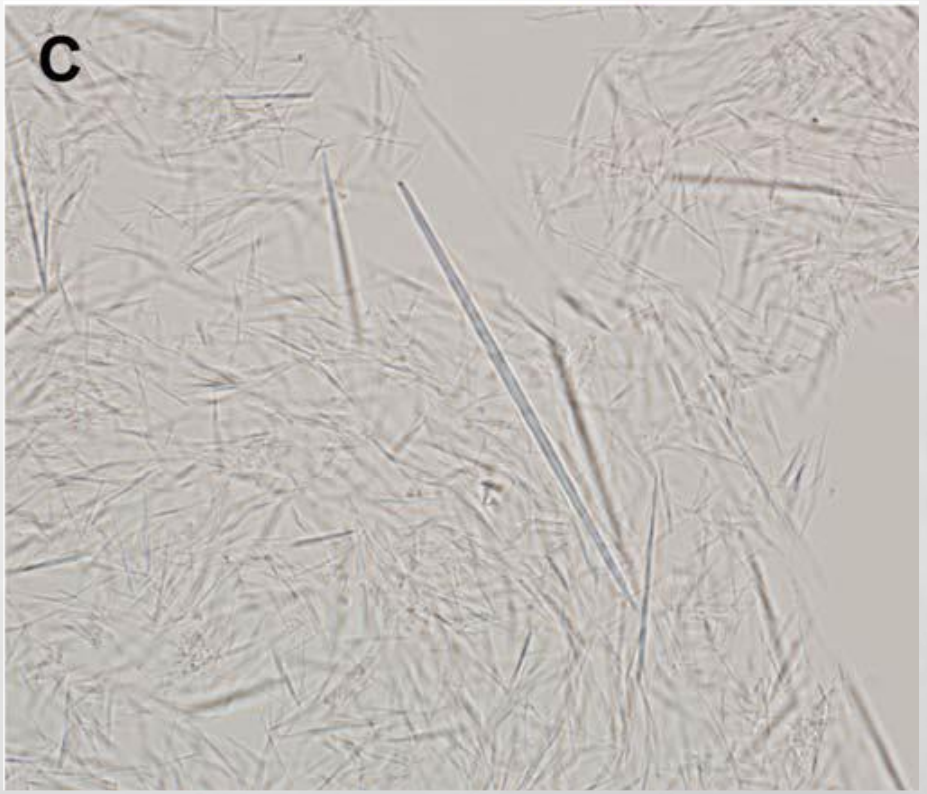


CRYSTAL DEATH

- PATIENT UNDERWENT 8 TPE PROCEDURES WITH STEROID, CYCLOPHOSPHAMIDE AND BORTEZOMIB THERAPY FOR 1 MONTH
  - CRYOGLOBULIN LEVEL UNDETECTABLE
  - RENAL FUNCTION IMPROVED
- UNFORTUNATELY DEVELOPED GI BLEEDING FROM CRYOGLOBULINEMIC VASCULOPATHY
  - RELAPSED WITH CRYOCRIT OF 42%, RENAL/RESPIRATORY DYSFUNCTION, MENTAL STATUS CHANGE

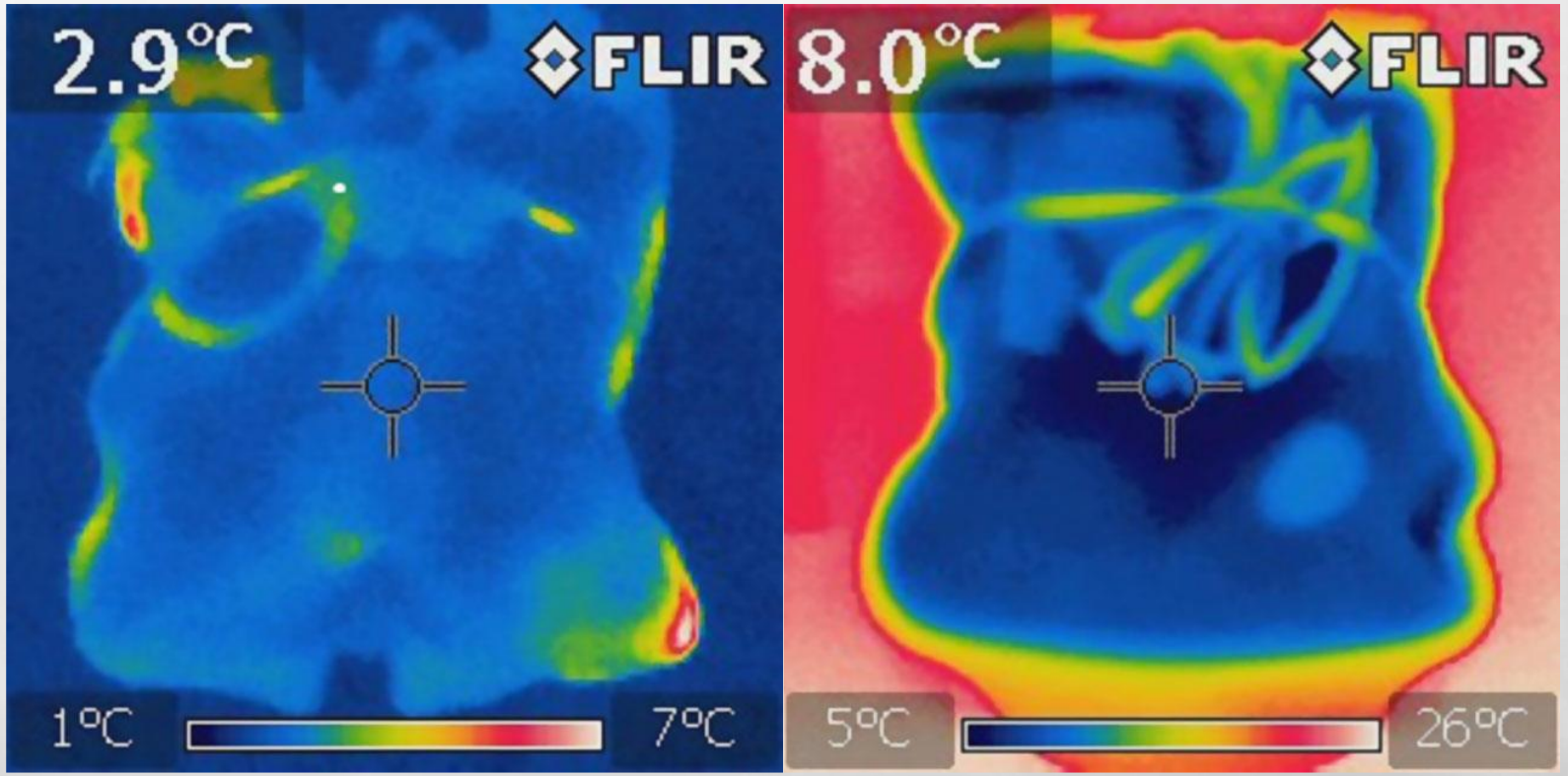
CRYSTAL DEATH

- CRYOPRECIPITATE FROM CRYOCRIT SHOWED SPINDLED CRYSTALS
- PATIENT UNDERWENT 11 MORE TPE PROCEDURES WITH MEDICATION THERAPY AND DIALYSIS OVER 1 MONTH
  - CRYOCRIT DECREASED TO 5%
  - MENTAL STATUS IMPROVED
  - ORGAN FUNCTION DID NOT IMPROVE
- PATIENT WITHDREW FROM FURTHER TREATMENTS AND EXPIRED 12 MONTHS AFTER INITIAL DIAGNOSIS



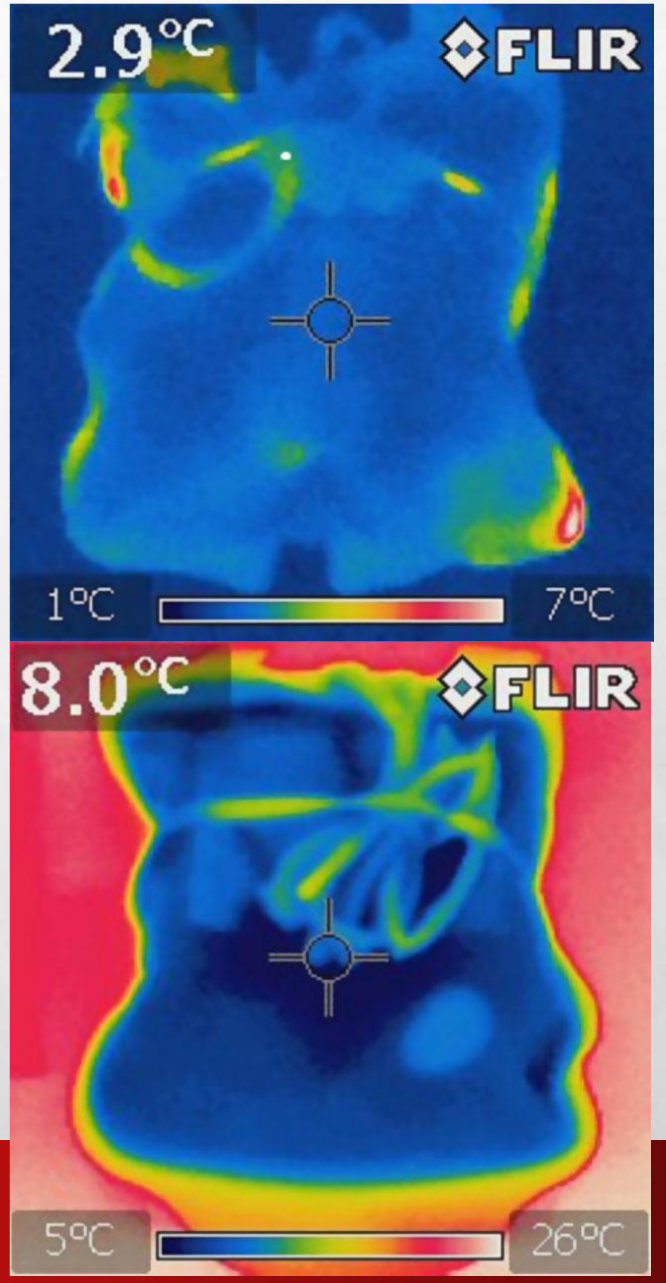
THE 30-MINUTE RULE

- BOOTH, G. SPAIN, T, & GEHRIE, E. (2014) THERMAL IMAGING OF A RED BLOOD CELL UNIT DURING STORAGE AND AT TIME OF ISSUE. *TRANSFUSION, 54*, 2803.



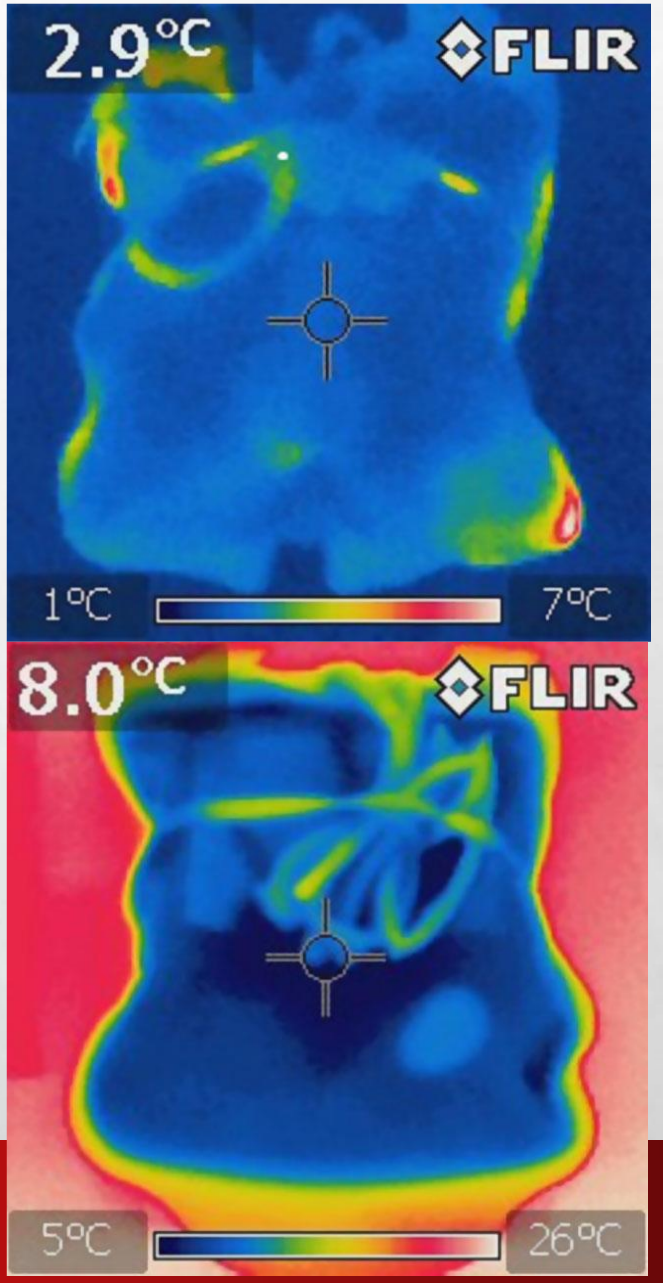
THE 30-MINUTE RULE

- THERMAL IMAGES OF RED BLOOD CELL PRODUCTS
  - RBC UNIT TEMPERATURE DURING STORAGE IN TEMPERATURE-CONTROLLED WALK-IN REFRIGERATOR (TOP)
  - RBC UNIT TEMPERATURE AT TIME OF ISSUE BEFORE RELEASE AND AFTER ELECTRONIC CROSSMATCH (BOTTOM)
- ELECTRONIC CROSSMATCH ONLY REQUIRED 10 MINUTES
  - EFFECT OF EXPOSURE TO ROOM TEMPERATURE ON RBC UNIT
  - DEMONSTRATES LOGISTICAL CHALLENGE ADHERING TO FDA/AABB GUIDELINES



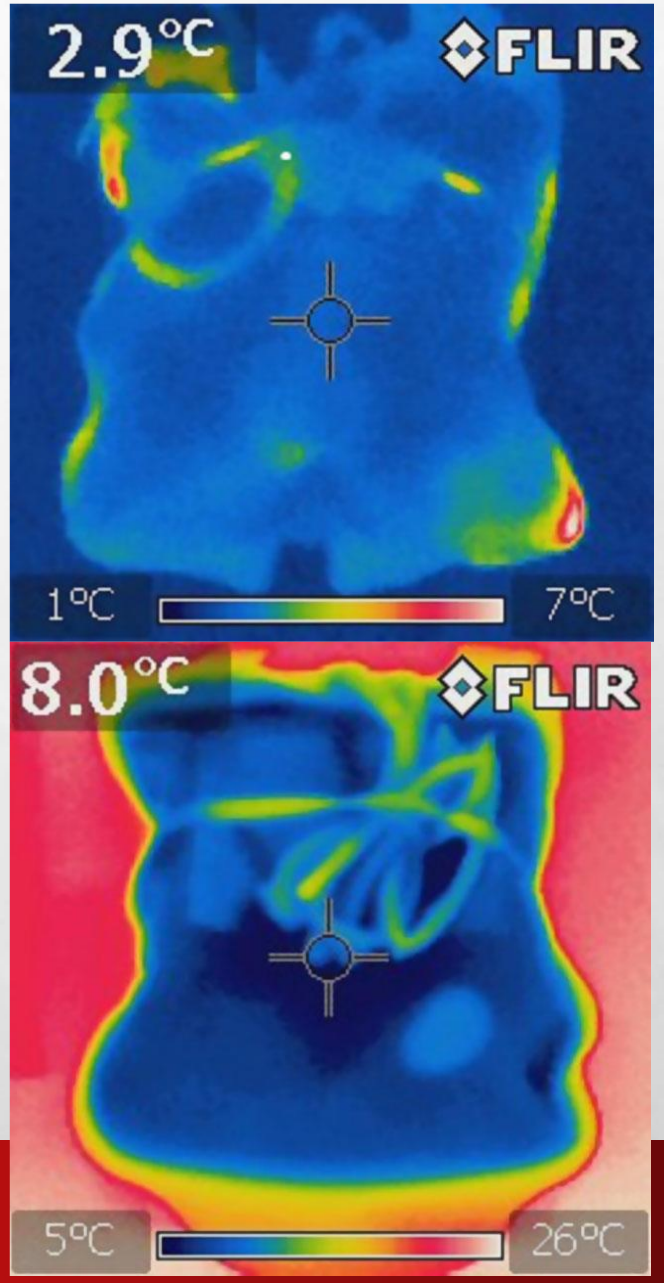
THE 30-MINUTE RULE

- "30-MINUTE RULE"
  - PERHAPS DERIVED FROM ARMY IN EARLY 20TH CENTURY
  - OLD WIVES TALE
- MUST VALIDATE PROCESS FOR TRANSPORT OF PRODUCTS AND ACCEPTABILITY BACK INTO INVENTORY
  - STORAGE VS. TRANSPORT



THE 30-MINUTE RULE

- FDA TITLE 21, SECTION 640
  - LAW OF THE LAND
- AABB 32ND EDITION OF BB/TS STANDARDS
  - 5.1.8A – TABLE LISTING ACCEPTABLE STORAGE AND TRANSPORT TEMPERATURES FOR BLOOD AND BLOOD COMPONENTS
  - 5.6.5 – TRANSPORT FROM COLLECTION SITE TO PROCESSING SITE
  - 5.26 – REISSUE OF BLOOD AND BLOOD COMPONENTS



THROMBUS AMONG US

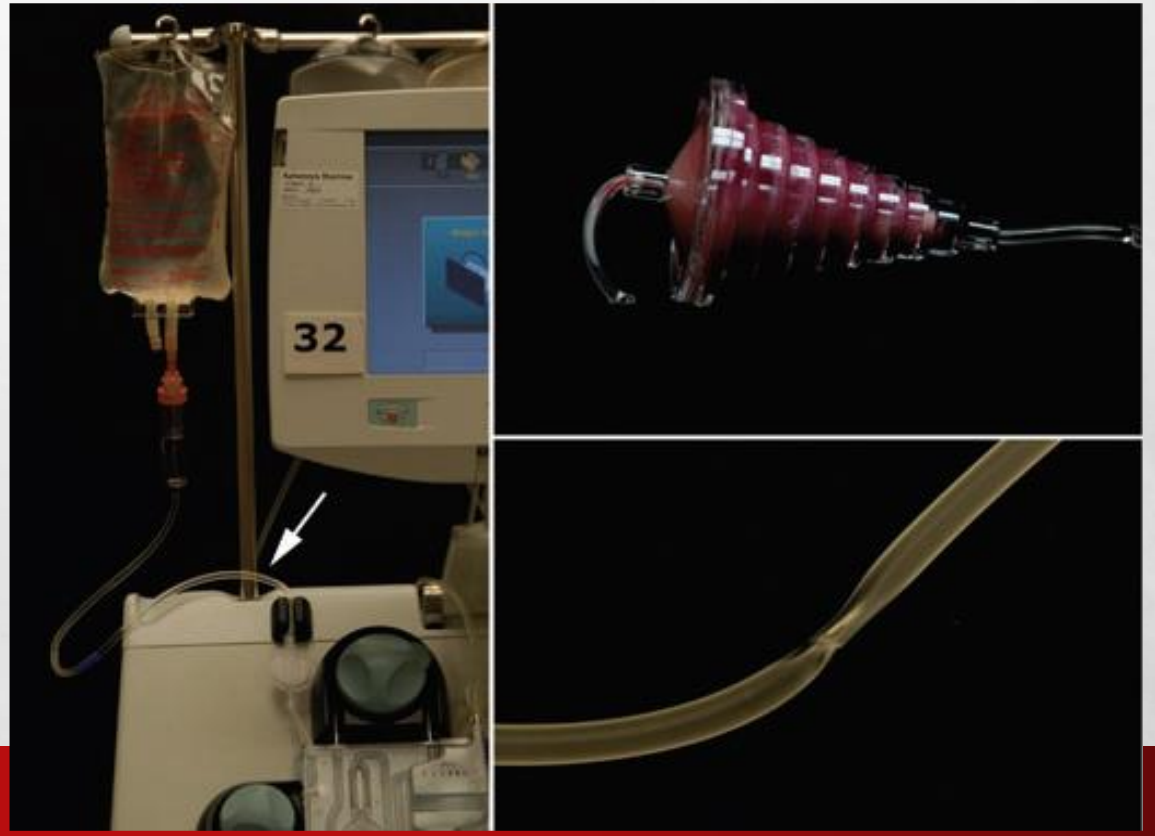
- JACOB, E. BURGSTALER, E. WINTERS, J. STUBBS, J. & GANDHI, M. (2009) THROMBUS FORMATION DURING PLATELET DONATION. *TRANSFUSION, 49*, 2021.

THROMBUS AMONG US

- AUTOMATED PLATELET DONATION USING COBE SPECTRA
- ALARM SOUNDED INDICATING LOW PLATELET COUNT IN COLLECTION LINE
- DONATION STOPPED AND INVESTIGATION INTIATED

THROMBUS AMONG US

- COMPRESSION NOTED IN ANTICOAGULANT TUBING LINE (BOTTOM RIGHT)
  - LOCATION INDICATED IN LEFT PICTURE
- COMPRESSION RESULTED IN INADEQUATE ANTICOAGULATION
  - THROMBI FORMED IN LEUKOREDUCTION CHAMBER (TOP RIGHT)

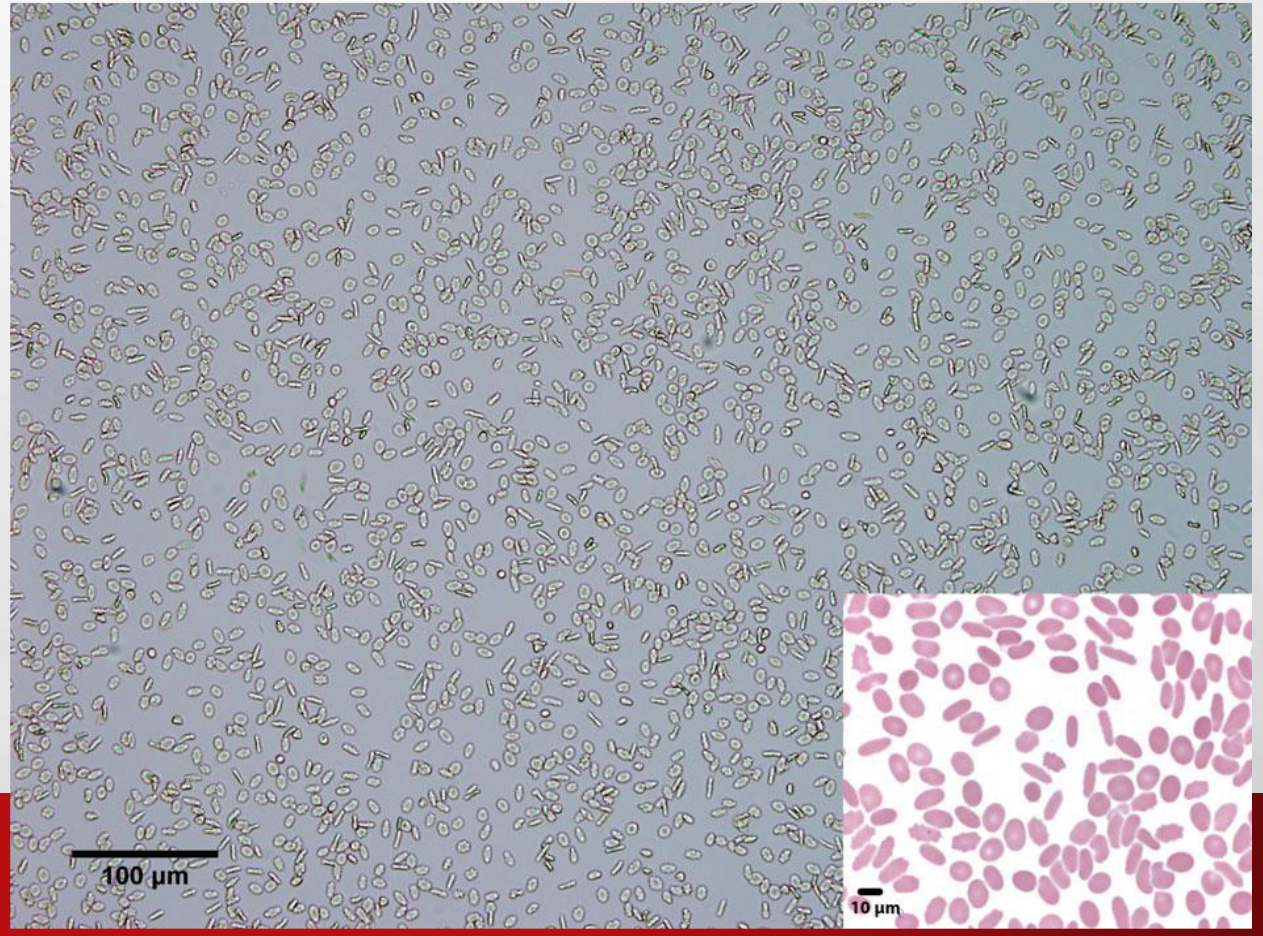


THROMBUS AMONG US

- SENSOR FROM LEUKOREDUCTION CHAMBER TRIGGERED
- THROMBI FORMED IN COLLECTION BAG
- NO THROMBI NOTED AT RETURN SITE
  - DONOR SUFFERED NO COMPLICATIONS
- COMPRESSIONS SHOULD BE NOTED AND CORRECTED USING DISPOSABLES DURING BLOOD COLLECTION

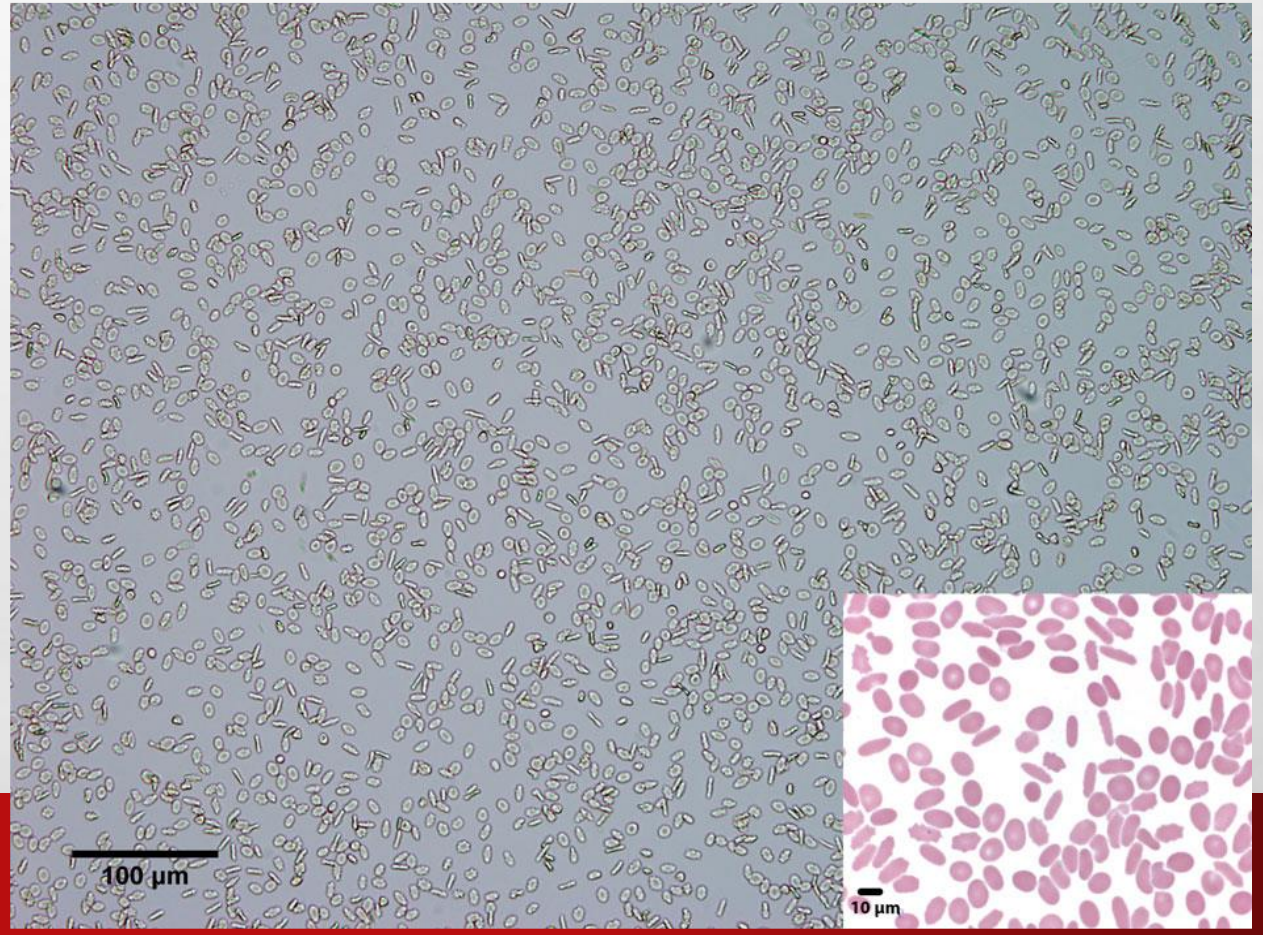
ELLIPTICAL TRAINING

- DESIMONE, R. ONG, S. CROWLEY, K. VASOVIC, L. SENALDI, E. KESSLER, D. GOEL, R. & HSU, Y. (2018) HEREDITARY ELLIPTOCYTOSIS OF DONOR RED BLOOD CELL UNIT DETECTED DURING COOMBS CROSSMATCH. *TRANSFUSION, 59*, 446-447.



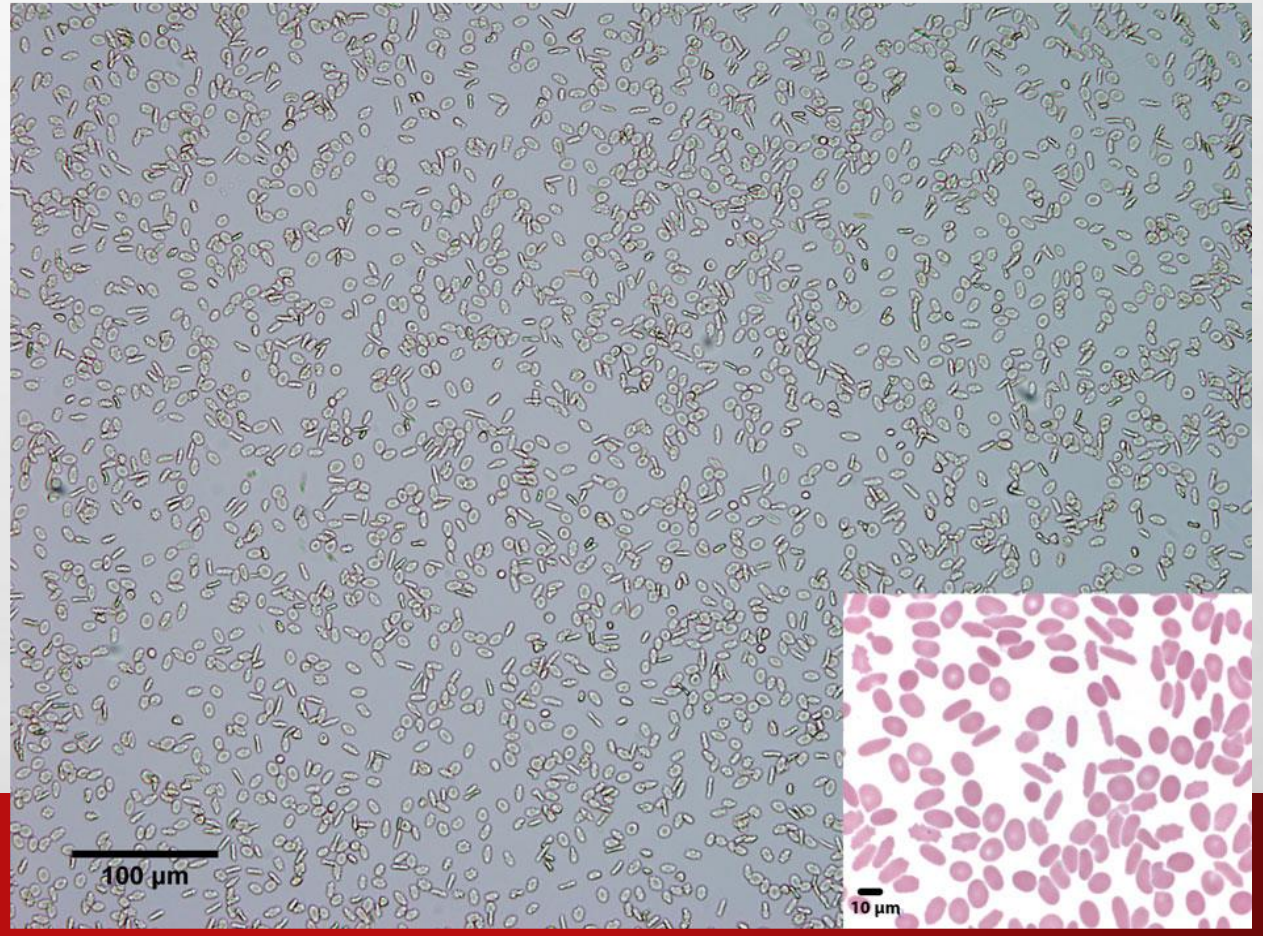
ELLIPTICAL TRAINING

- RBC TRANSFUSION ORDERED FOR PATIENT
  - NEGATIVE IAT
  - HISTORY OF RBC ALLOANTIBODIES
- FULL CROSSMATCH WAS NEGATIVE
  - MICROSCOPIC EXAM SHOWED NUMEROUS PENCIL-SHAPED RBCS
- PERIPHERAL SMEAR FROM SEGMENT REVEALED 50% ELLIPTOCYTES



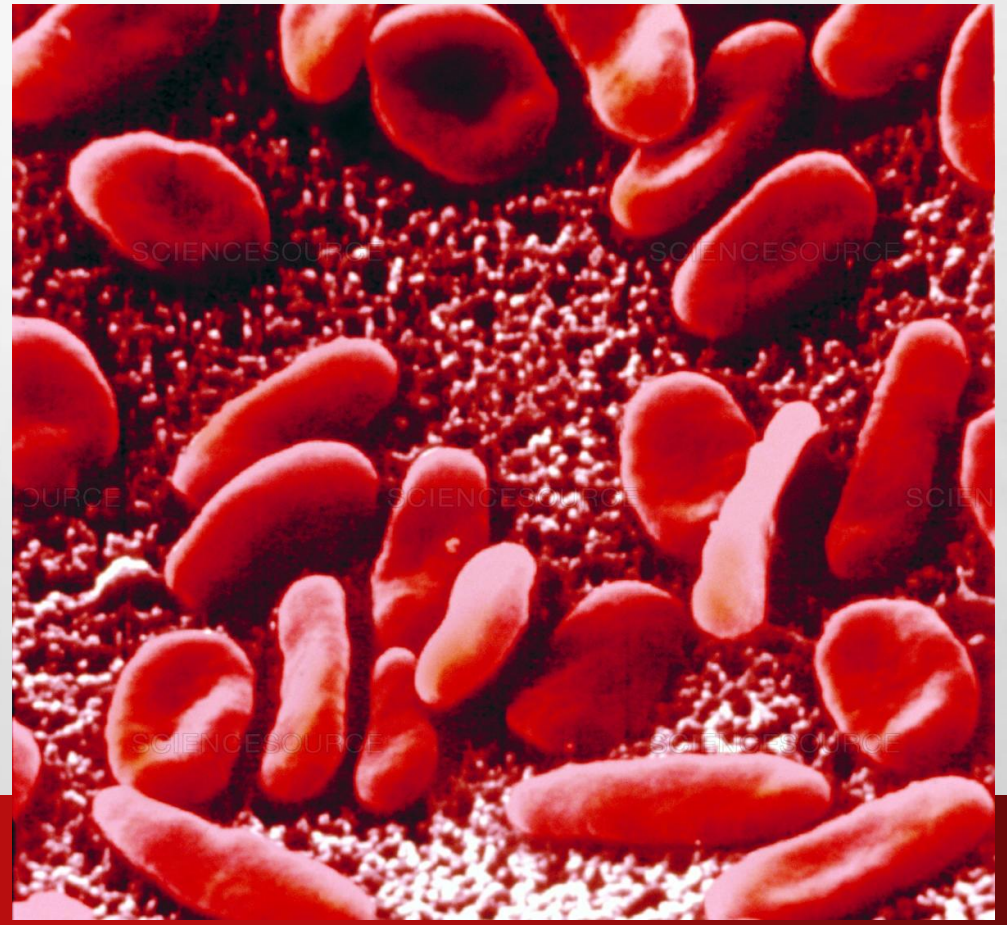
ELLIPTICAL TRAINING

- DONOR WAS HEALTHY 22-YEAR OLD ASIAN FEMALE
  - 2X WB DONOR
  - PRE-DONATION HCT = 39%
  - DEFERRED FROM FUTURE DONATIONS
- LATER LEARNED FATHER AND SISTER HAVE HEREDITARY ELLIPTOCYTOSIS (HE)



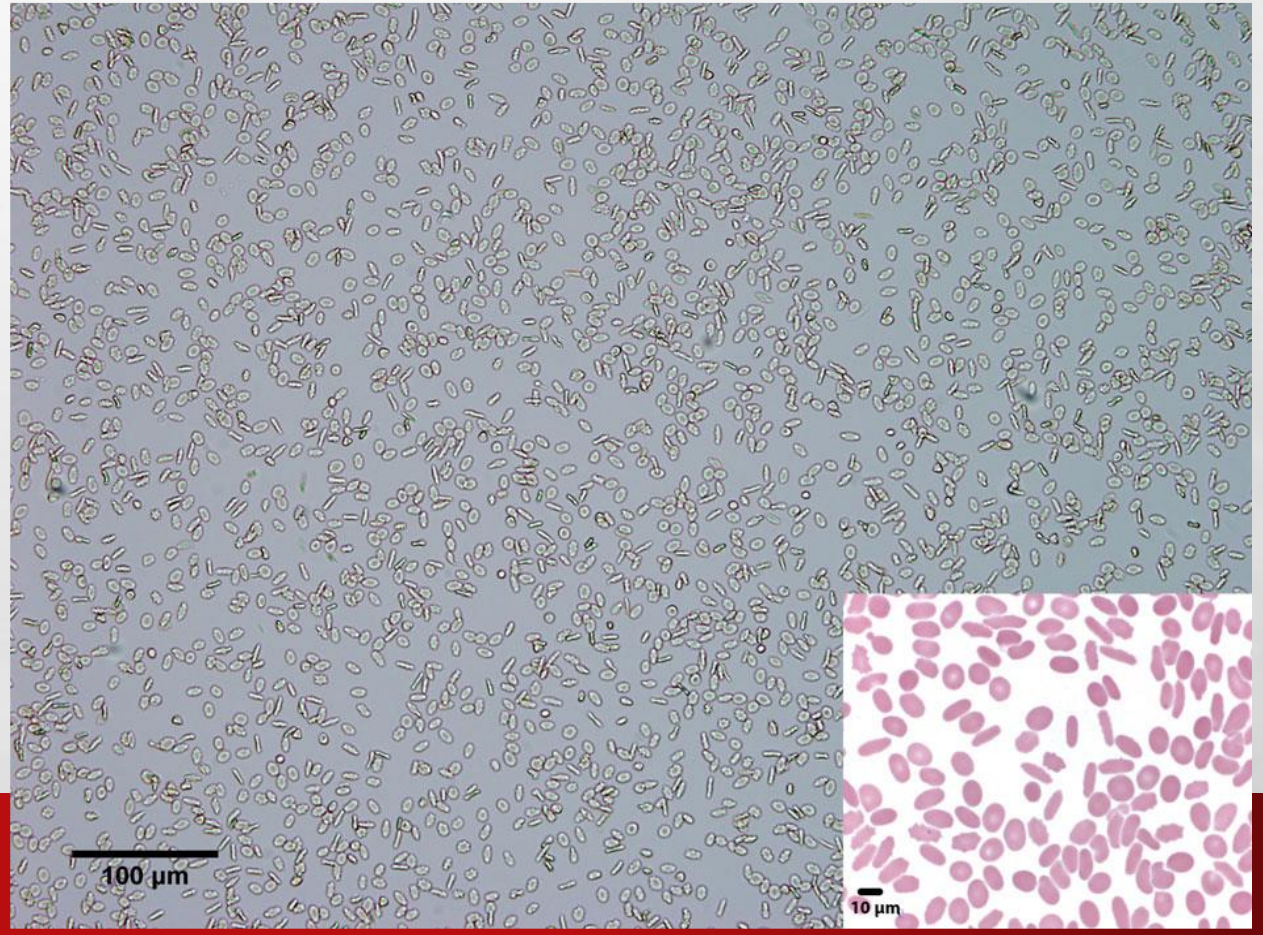
ELLIPTICAL TRAINING

- ELLIPTOCYTOSIS CAN BE:
  - ACQUIRED (IRON, VITAMIN B12, OR FOLATE DEFICIENCY)
  - MALIGNANT (MDS OR MYELOPTHISIC ANEMIA)
  - HEREDITARY (SPECTRIN/PROTEIN MUTATIONS)
- PEOPLE WITH HE ARE USUALLY ASYMPTOMATIC AND NOT ANEMIC
- RBCS FROM HE DONORS HAVE BEEN SHOWN TO HAVE REDUCED SURVIVAL (19-21 DAY HALF-LIFE *IN VIVO*)



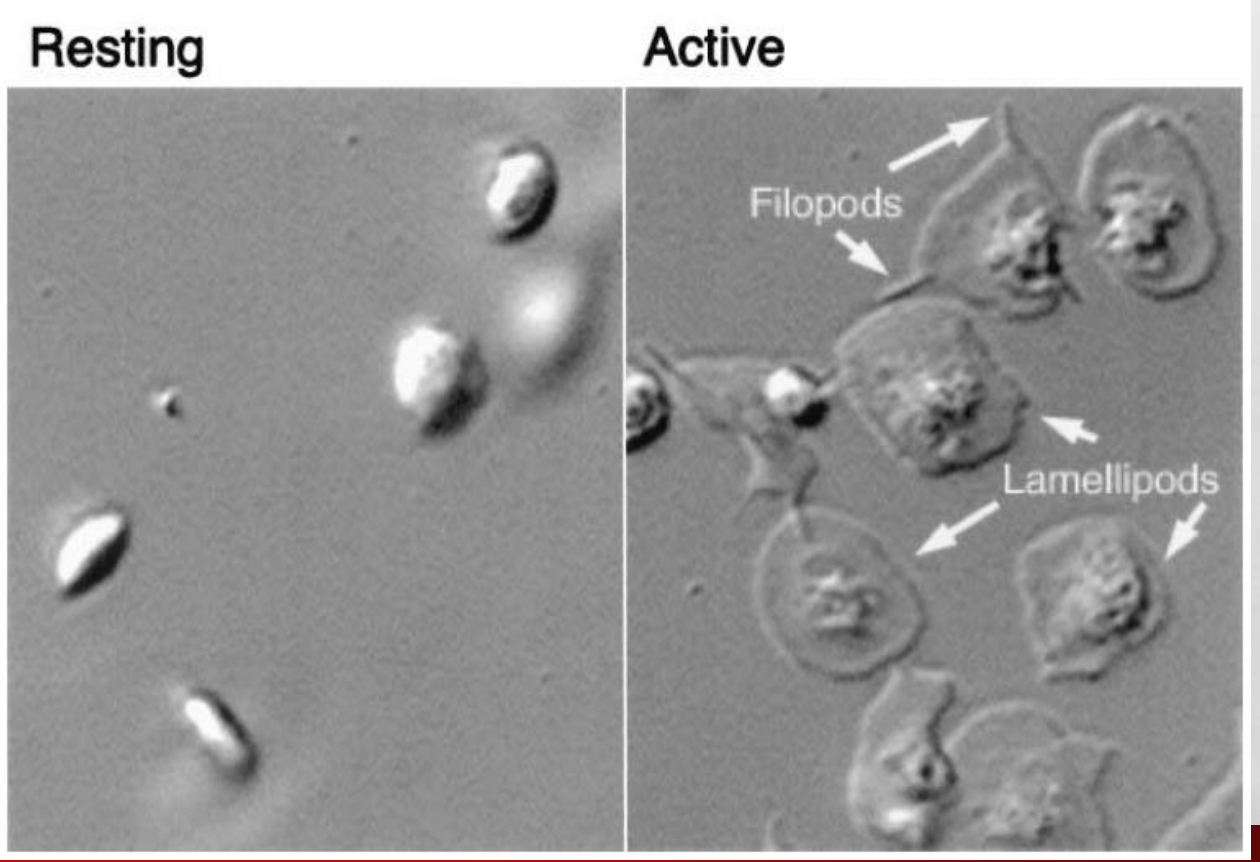
ELLIPTICAL TRAINING

- DONOR UNIT WAS QUARANTINED AND NOT ISSUED
- UNKNOWN IF PATIENTS WITH INHERITED RBC DEFECTS OR HEMOGLOBINOPATHIES CAN TOLERATE RBC UNITS WITH ELLIPTOCYTES
- RBC MORPHOLOGY NOT ACTIVELY SCREENED IN DONORS



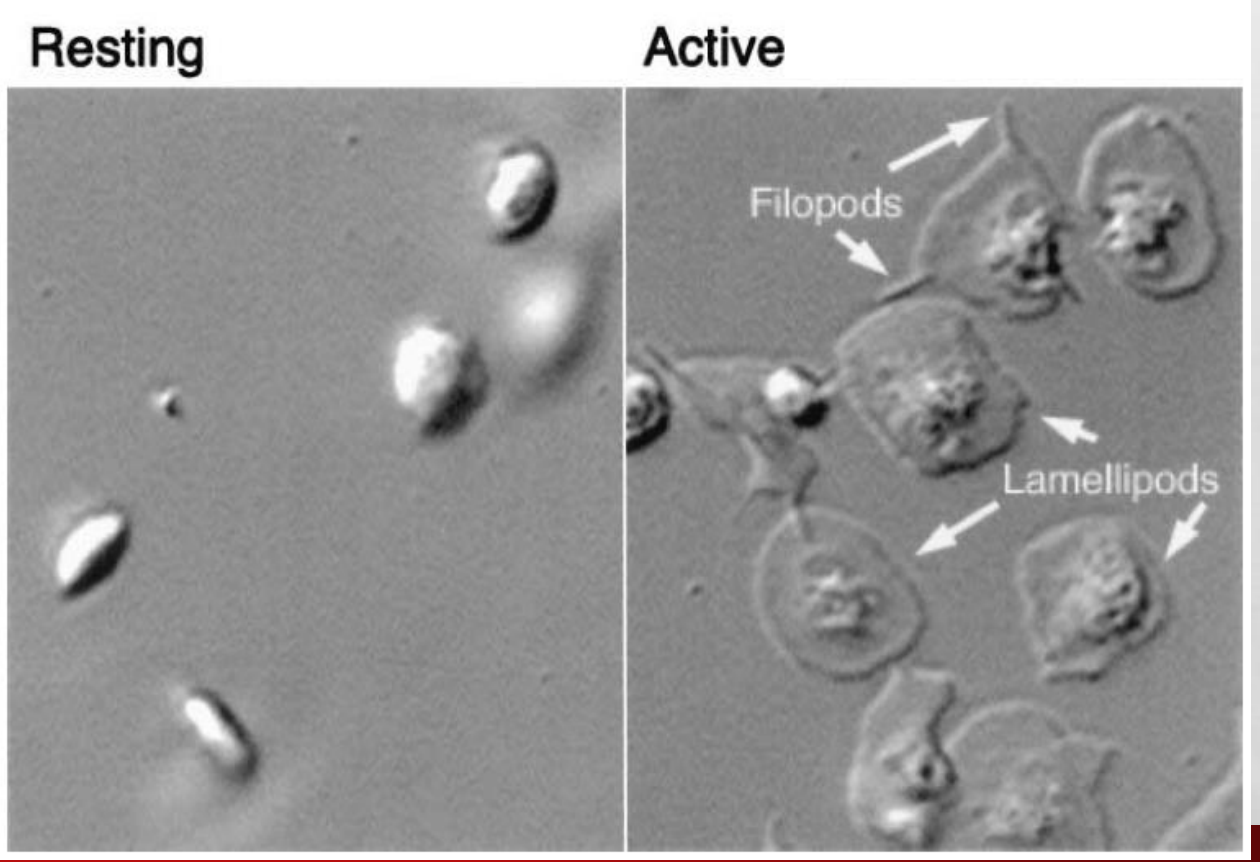
REACHING OUT

- HARTWIG, J. (2001) THE HUMAN BLOOD PLATELET, RESTING AND ACTIVE. *TRANSFUSION, 41*, 723.



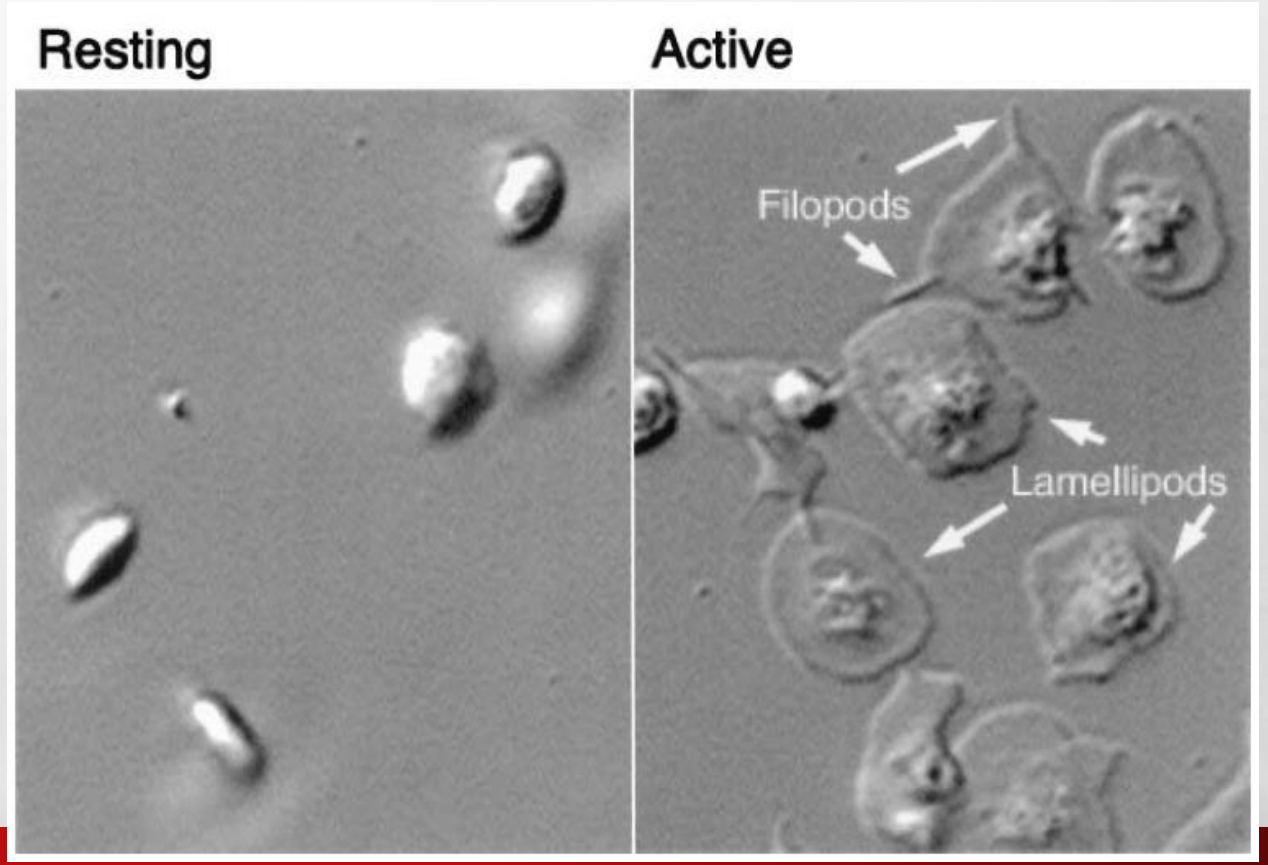
REACHING OUT

- RESTING PLATELETS CIRCULATE AS SMALL NUCLEATED DISCS
  - PHOTOGRAPHED IN SUSPENSION USING DIFFERENTIAL INTERFERENCE CONTRAST OPTICS



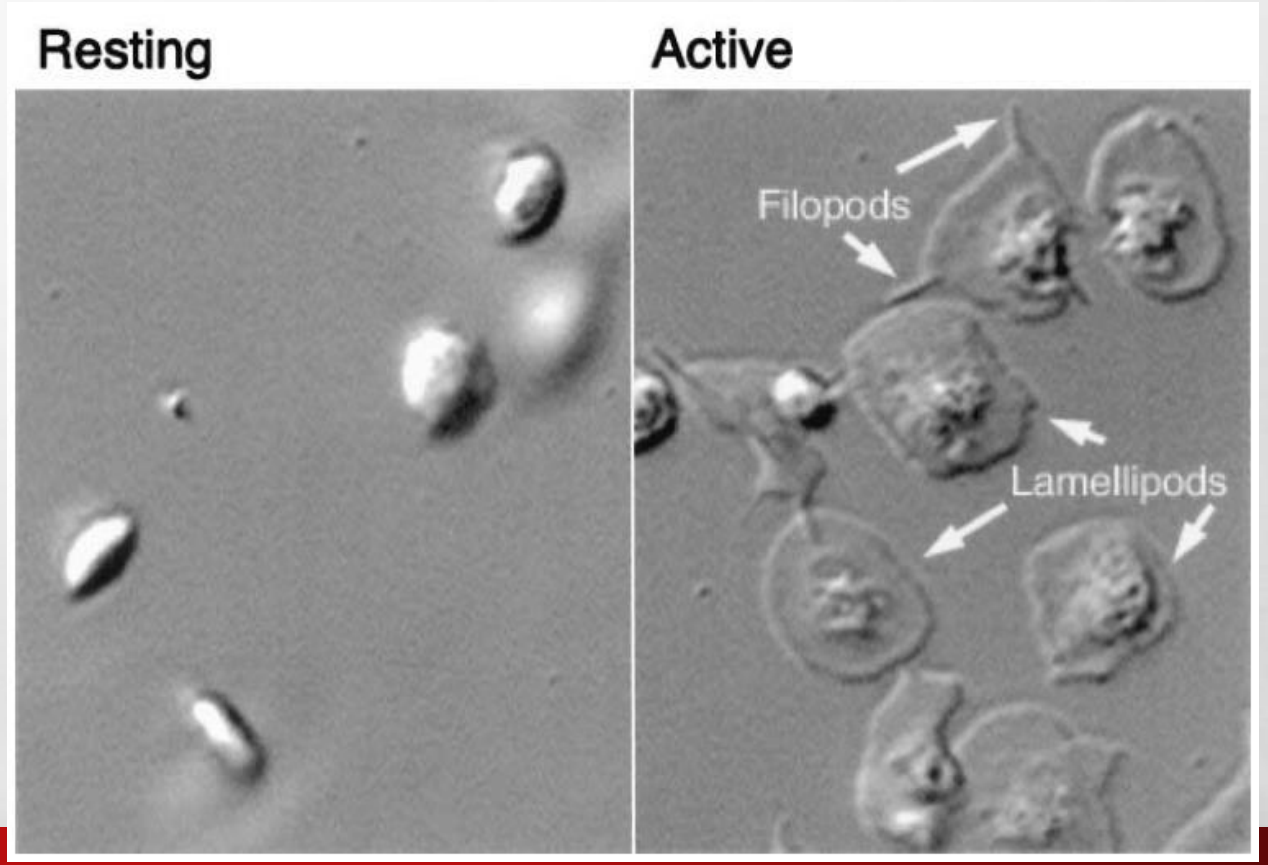
REACHING OUT

- PLATELETS ACTIVATED BY ATTACHMENT TO SURFACE COATED WITH CRP-LIGAND FOR COLLAGEN RECEPTOR (GPVI)
- ACTIVATED PLATELETS ELABORATE FILOPODIA
  - TRAVEL AROUND CELL PERIPHERY THEN SPREAD USING LARGE FLAT LAMELLAE
  - ASSEMBLY OF CORTICAL ACTIN FILAMENTS DRIVES BOTH GROWTH OF FILOPODIA AND SPREADING OF CELLS



REACHING OUT

- FILOPODIA ARE USED BY PLATELETS TO FIND AND BIND FIBERS OF FIBRIN AND RECRUIT PLATELETS TO AREA OF DAMAGE
- SPREADING OF PLATELETS MAXIMIZES AMOUNT OF DAMAGED SURFACE COVERED BY PLATELETS



ADD A LITTLE DROP

- PINEYROA, J. GOMEZ-HERNANDO, M. RODRIGUEZ-ALIBERAS, M. CID, J. MOLINA, A. & LOZANO, M. (2020) HEMOLYSIS IN THE PLASMA OF A SPECIMEN? ADD A DROP TO CLARIFY IT. *TRANSFUSION, 60*, 2783-2784.

ADD A LITTLE DROP

- 38-YEAR OLD FEMALE WITH APLASTIC ANEMIA
  - ADMITTED FOR 3-WEEK HISTORY OF EPIGASTRIC PAIN AND WEIGHT LOSS
- TRANSFUSION REQUEST AND SPECIMEN SUBMITTED TO BLOOD BANK
  - SPECIMEN SHOWED HEMOLYSIS AFTER CENTRIFUGATION
  - RECOLLECT SAMPLE SHOWED SAME HEMOLYSIS
  - NO SIGNIFICANT INTERFERENCE IN TESTING

ADD A LITTLE DROP

- MD WAS CONTACTED ABOUT CONCERN FOR HEMOLYSIS
  - PATIENT WAS ASYMPTOMATIC AND BEING DISCHARGED
- OTHER LAB VALUES NORMAL:
  - LDH, BILIRUBIN, HAPTOGLOBIN
  - NO HEMOGLOBINURIA DETECTED

ADD A LITTLE DROP

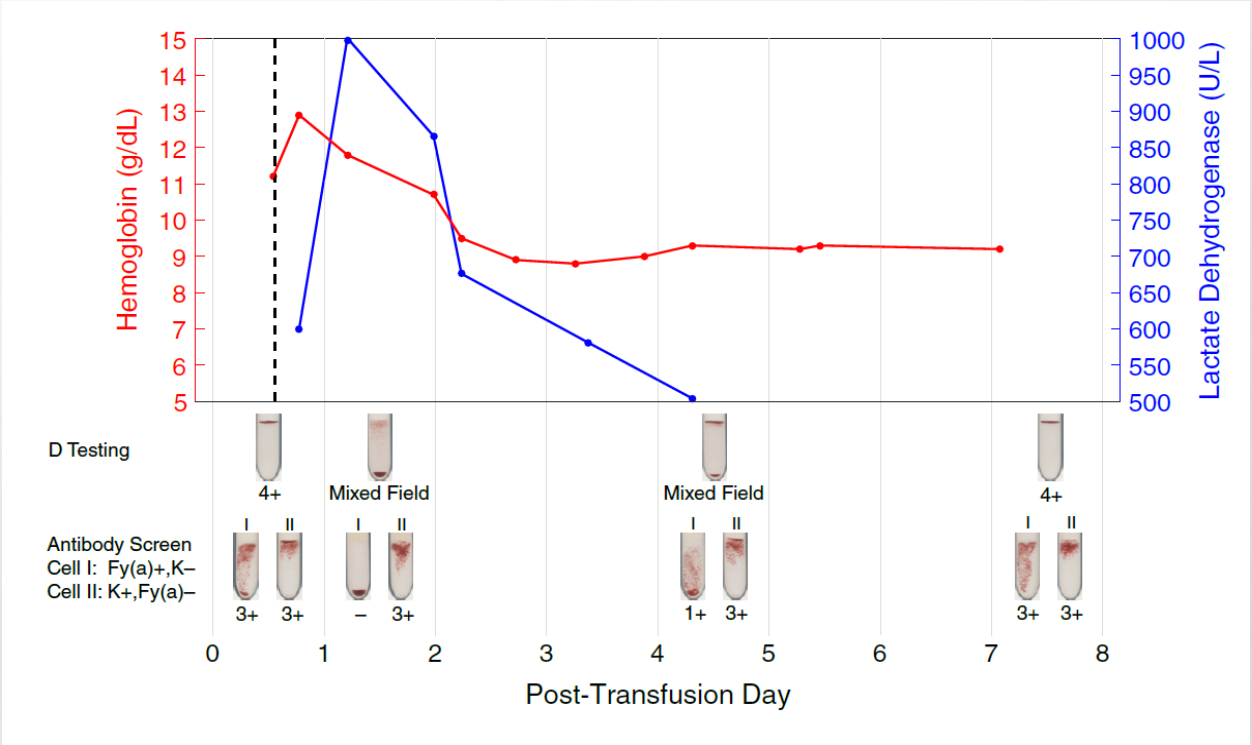
- PATIENT'S MEDICATIONS:
  - CYCLOSPORINE, CLONAZEPAM, PANTOPRAZOL, ELTROMBOPAG
- ELTROMBOPAG HAS BEEN REPORTED TO CAUSE DARK BROWN PLASMA AT HIGH DOSES
  - ORAL THROMBOPOIETIN RECEPTOR AGONIST
  - DIACID WITH CARBOXYL & PHENOLIC FUNCTIONAL GROUPS
  - COLOR IN SOLUTION VARIES BY PH

ADD A LITTLE DROP

- LAB CONDUCTED EXPERIMENT:
  - RIGHT TUBE – PATIENT'S PLASMA
  - MIDDLE TUBE – PT'S PLASMA + 6M HCL
  - LEFT TUBE – PT'S PLASMA + 6M NAOH
- COLOR CHANGE DUE TO ACIDIFICATION/ALKALINATION OF PLASMA CONFIRMED ELTROMBOPAG WAS CAUSE OF ABNORMAL PLASMA COLOR
- ADDING ACIDIC SOLUTION TO HEMOLYZED SAMPLE CAUSES WHITE PRECIPITATE TO APPEAR

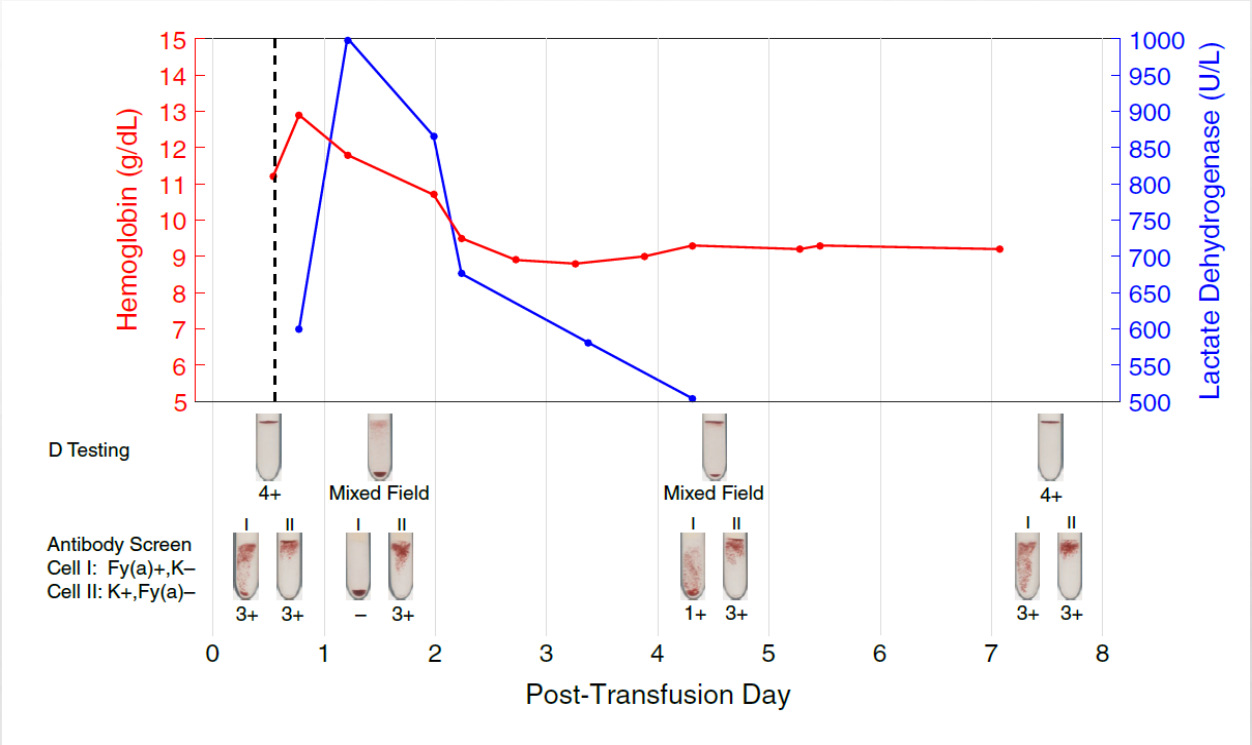
DONOR CLEARANCE

- CANVER, M. CUSHING, M. VAGELATOS, G. & VASOVIC, L. (2019) VISUAL EVIDENCE OF A HEMOLYTIC TRANSFUSION REACTION IDENTIFIED BY BLOOD BANK TESTING AFTER EMERGENCY BLOOD TRANSFUSION. *TRANSFUSION, 59*, 3301-3302.



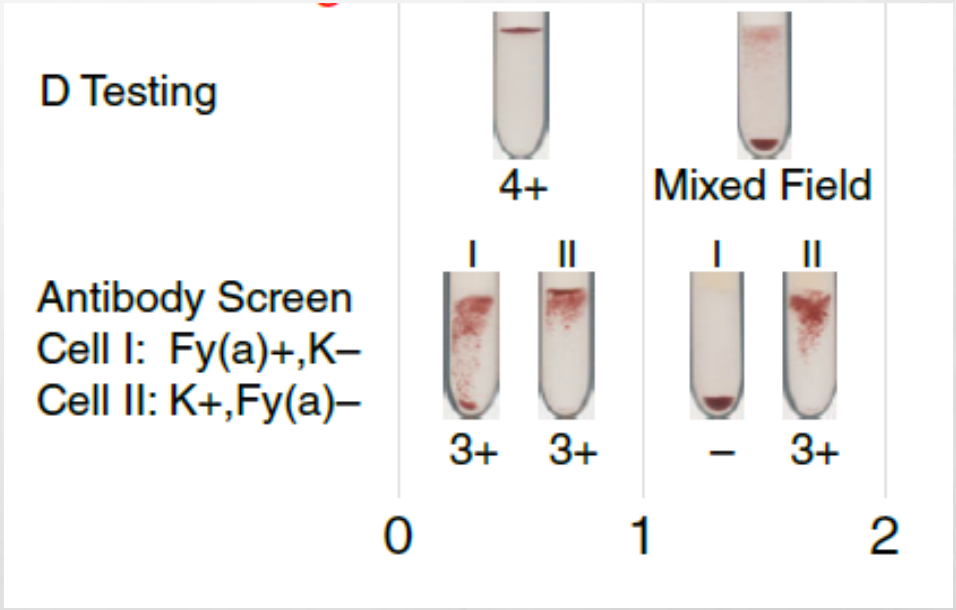
DONOR CLEARANCE

- 76-YEAR OLD O+ FEMALE WITH HEMATEMESIS, HYPOTENSION, AND TACHYCARDIA
  - HISTORY OF GASTRITIS
  - BROUGHT TO EMERGENCY DEPARTMENT
- BP IMPROVED WITH NORMAL SALINE INFUSION
- 2 UNITS OF O- RBCS TRANSFUSED EMERGENTLY
  - BP WAS 101/70 AT TIME OF INFUSION



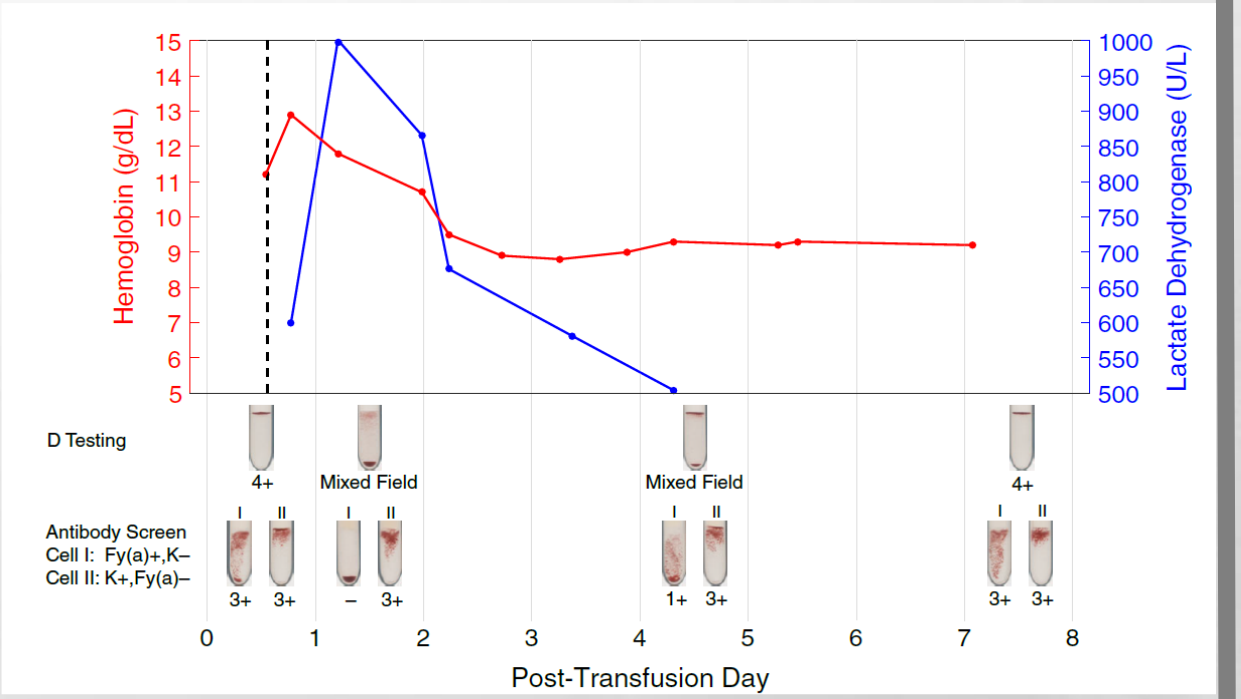
DONOR CLEARANCE

- PATIENT HAD HISTORY OF ANTI-K AND ANTI-FYA
- ABSC AND ABID WERE POSITIVE FOR ANTI-K AND ANTI-FYA
- POST-TX SAMPLE HAD POSITIVE DAT
  - ANTI-K AND ANTI-FYA IDENTIFIED IN ELUATE
- RETROSPECTIVE XM SHOWED INCOMPATIBILITY WITH TRANSFUSED UNITS
  - ONE TYPED K+, FY(A-); OTHER K-, FY(A+)



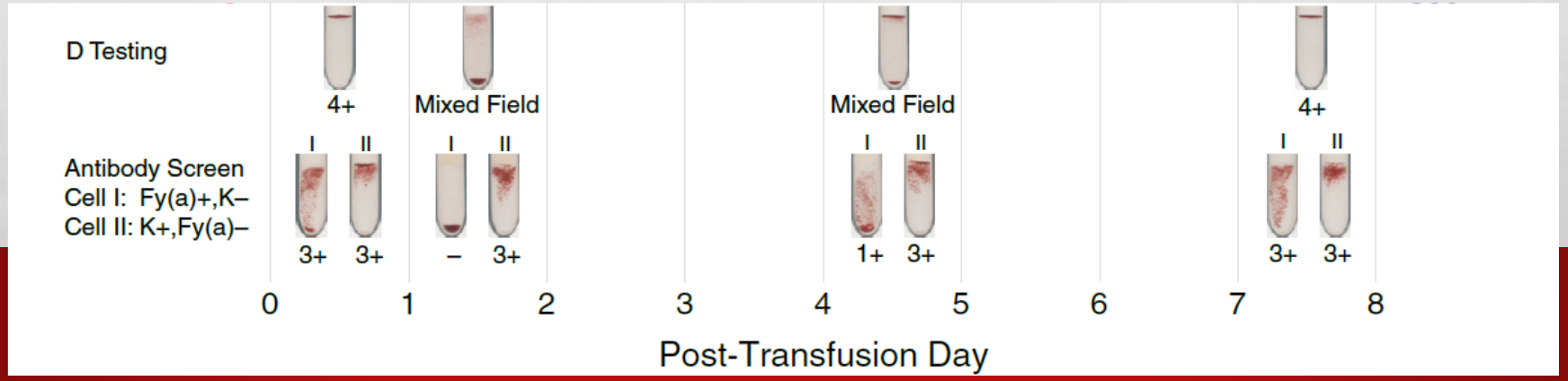
DONOR CLEARANCE

- PATIENT DEVELOPED HEMOLYTIC TRANSFUSION REACTION FOLLOWING TRANSFUSION
  - PRE-HGB WAS 11.2 G/DL; POST-HGB WAS 12.9 G/DL
  - HGB DECREASED DESPITE NO ADDITIONAL BLEEDING
  - LACTATE DEHYDROGENASE INCREASED
  - TOTAL BILIRUBIN INCREASED 0.3 TO 1.3 G/DL
  - CREATININE INCREASED 0.8 TO 1.14 MG/DL
  - HAPTOGLOBIN WAS 86 MG/DL 5 HOURS POST-TX AND BECAME UNDETECTABLE WITHIN 48 HOURS



DONOR CLEARANCE

- PATIENT WAS AFEBRILE THROUGHOUT HOSPITALIZATION WITH NO SIGNS/SYMPTOMS OF HEMOLYSIS
- D-TYPING FROM DAYS 1-4 SHOWED MIXED FIELD AGGLUTINATION
- DAY 7 SHOWED NO MIXED FIELD AGGLUTINATION DUE TO HEMOLYSIS OF ALL DONOR RBCS
- SCI WAS NON-REACTIVE ON DAY 1 DUE TO *IN VIVO* ADSORPTION OF ANTI-FYA ONTO DONOR CELLS
  - SCI BECAME POSITIVE AGAIN ON DAY 4



THAT'S A LOT OF BLOOD!

- HULSE, M. FADER, A. SHAN, H. BENNEH, M. & TOBIAN, A. (2016) MASSIVE TRANSFUSION IN AN OBSTETRIC EMERGENCY. *TRANSFUSION, 56,* 23.

THAT'S A LOT OF BLOOD!

- HEALTHY 37-YEAR OLD FEMALE
  - GRAVIDA 3, PARA 2 (2 PRIOR CESAREAN SECTIONS)
  - BLOOD GROUP A+ WITH NO ALLOANTIBODIES
  - DIAGNOSED WITH PLACENTA ACCRETA AND HIGH SUSPICION OF PLACENTA PERCRETA

THAT'S A LOT OF BLOOD!

- PLACENTA ACCRETA OCCURS WHEN THE PLACENTA GROWS TOO DEEPLY INTO THE UTERINE WALL
  - PART OR ALL OF PLACENTA REMAINS ATTACHED TO UTERINE WALL AFTER BIRTH
  - CAN CAUSE SEVERE BLOOD LOSS AFTER DELIVERY
- PLACENTA PERCRETA INVOLVES INVASION OF CHORIONIC VILLI THROUGH THE MYOMETRIUM
  - OCCASIONALLY INTO OTHER ORGANS
  - CAUSES SIGNIFICANT MATERNAL MORBIDITY AND MORTALITY

THAT'S A LOT OF BLOOD!

- PATIENT SCHEDULED FOR PLANNED C-SECTION AND HYSTERECTOMY
- WENT INTO SPONTANEOUS LABOR AT 34 WEEKS
  - PRESENTED WITH PROFUSE VAGINAL BLEEDING
- EMERGENT C-SECTION DELIVERY AND EXTENSIVE ABDOMINAL OPERATION WAS PERFORMED
  - SAFE, HEALTHY INFANT DELIVERED SUCCESSFULLY

THAT'S A LOT OF BLOOD!

- SURGICAL TEAM FOUND EXTENSIVE PLACENTAL INVASION THOUGH:
  - BLADDER
  - VAGINA
  - BILATERAL PARAMETRIA
  - UTERUS
  - PELVIC SIDEWALL INCLUDING MAJOR VASCULATURE STRUCTURES

THAT'S A LOT OF BLOOD!

- SURGICAL TEAM COLLABORATED WITH OBSTETRICS, GYNECOLOGIC ONCOLOGY, TRAUMA SURGERY, UROLOGY, INTERVENTIONAL RADIOLOGY, AND VASCULAR SURGERY TEAMS
- PATIENT HAD TOTAL ABDOMINAL HYSTERECTOMY, UPPER VAGINECTOMY, BILATERAL ILIAC ARTERY EMBOLIZATION, RIGHT URETERAL STENT, LEFT URETERAL LIGATION, TRIGONAL BLADDER RESECTION, AND INFRARENAL AORTA REPAIR

THAT'S A LOT OF BLOOD!

- MASSIVE TRANSFUSION PROTOCOL WAS INITIATED AT SURGERY BEGINNING AND REMAINED ACTIVE FOR 15 HOURS
- PATIENT TRANSFUSED WITH:
  - 195 RBCS
  - 155 PLASMAS
  - 26 APHERESIS PLATELETS
  - 8 CRYOPRECIPITATE POOLS
  - 3 DOSES OF FVIIA
  - 7L OF CELL SAVER

THAT'S A LOT OF BLOOD!

- ESTIMATED BLOOD LOSS WAS 180L
- INTRAOPERATIVE HGB VALUES RANGED BETWEEN 8.1 – 13.9 G/DL
  - NEAR NORMAL COAGULATION PROFILE OBSERVED
- HEMOSTASIS ACHIEVED AFTER 14 HOUR SURGERY
  - PATIENT TRANSFERRED TO SURGICAL ICU WITHOUT VASOPRESSOR SUPPORT
  - PATIENT EXTUBATED POST-OP DAY 3 AND MET HEALTHY NEWBORN

THAT'S A LOT OF BLOOD!

- PATIENT UNDERWENT ADDITIONAL BLADDER RECONSTRUCTION SURGERY
- PATIENT DID WELL AND HAD UNEVENTFUL HOSPITAL COURSE
- MASSIVE TRANSFUSION PROTOCOLS HELP BLOOD BANKS ISSUE CORRECT QUANTITY AND PROPORTION OF BLOOD PRODUCTS IN STRESSFUL SITUTATIONS

BLOODY EMULSION

- MAYER, R. WARD, M. MERRILL, V. PEISACH, N. SHIMER, L. & MURPHY, C. (2020) AN INTRAOSSEOUS SAMPLE INITIALLY RESEMBLING PERIPHERAL BLOOD. *TRANSFUSION, 60,* 1346-1347.

BLOODY EMULSION

- BLOOD BANK RECEIVED SAMPLE LABELED “PERIPHERAL BLOOD” FROM TRAUMA PATIENT
  - PATIENT HAD OPEN BOOK PELVIC RING DISRUPTING FRACTURE
- SAMPLE APPEARED NORMAL AFTER CENTRIFUGATION
  - MANUAL TUBE TESTING WAS PERFORMED

BLOODY EMULSION

- PATIENT'S BACKTYPE SHOWED "SALAD DRESSING"-LIKE APPEARANCE OF FAT DROPLETS
- BLOOD BANK MD SUSPECTED SAMPLE WAS INTRAOSSEOUS (IO) SAMPLE
  - CONFIRMED BY TRAUMA UNIT
  - DRAWN FROM LEFT TIBIAL PLATEAU IO DEVICE

BLOODY EMULSION

- PATIENT TYPED A+ WITH MIXED-FIELD IN THE FORWARD ANTI-A REACTION
  - DUE TO 6 O+ RBCS EMERGENCY RELEASED PRIOR TO TESTING
- NEGATIVE ANTIBODY SCREEN
- FAT DROPLETS ONLY APPARENT IN TUBE TESTING
- IO SAMPLE CONSIDERED INVALID
  - O+ RBCS / A OR AB PLASMA ISSUED DURING INITIAL RESUSCITATION

BLOODY EMULSION

- PATIENT TYPED A+ WITH NEGATIVE ANTIBODY SCREEN ON A PERIPHERAL BLOOD SAMPLE ON DAY 4
- BONE MARROW ASPIRATES ALSO HAVE BEEN PREVIOUSLY SHOWN TO BE CONCORDANT WITH PERIPHERAL BLOOD

PETECHIAE-AY-AY!

- PRITCHARD, A. & LOCKHART, E. (2017) RUMPEL-LEEDE PHENOMENON IN A PATIENT BEING TREATED WITH PRASUGREL. *TRANSFUSION, 57,* 1642.

PETECHIAE-AY-AY!

- 73-YEAR OLD MALE WITH WALDENSTROM MACROGLOBULINEMIA
- UNDERGOING THERAPEUTIC PLASMA EXCHANGE FOR HYPERVISCOSITY
- DEVELOPED RUMPEL-LEEDE SIGN AFTER PLACEMENT OF BLOOD PRESSURE CUFF

PETECHIAE-AY-AY!

- PATIENT'S HISTORY:
  - MYOCARDIAL INFARCTION
  - TAKING ASPIRIN AND PRASUGREL
  - NORMAL PLT COUNT AND NORMOTENSIVE
  - NO HISTORY OF DIABETES, CONNECTIVE TISSUE DISORDERS, OR BRUISING/BLEEDING ISSUES
- PATIENT DEVELOPED DIFFUSE PETECHIAE AND SCATTERED PURPURA DISTAL TO BP CUFF INFLATION
  - RESOLVED WITHIN 1 WEEK

PETECHIAE-AY-AY!

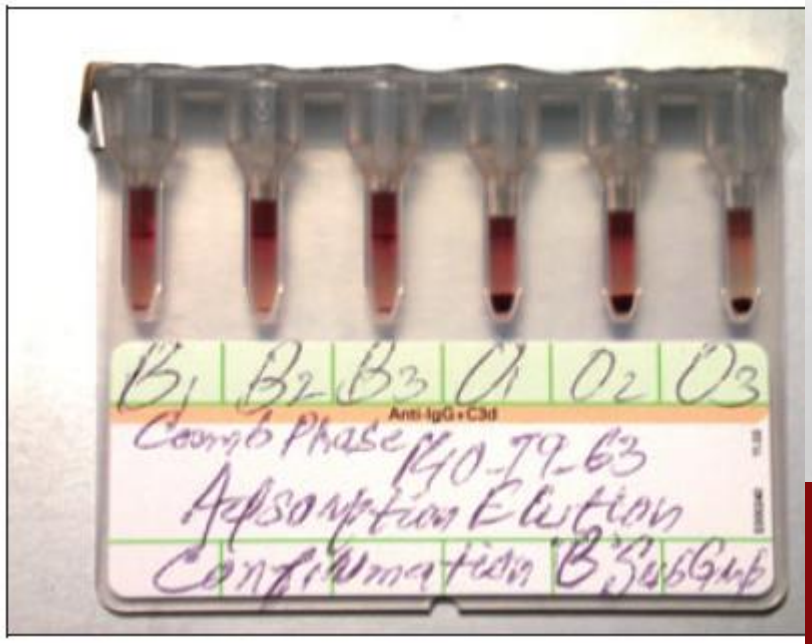
- RUMPEL-LEEDE SIGN IS ACUTE DERMIS CAPILLARY RUPTURE
  - DEVELOPMENT OF PETECHIAE AFTER SUDDEN INCREASES IN VENOUS PRESSURE (SUCH AS TOURNIQUET OR BP CUFF)
  - ASSOCIATED WITH THROMBOCYTOPENIA, PLT DYSFUNCTION, AND CAPILLARY FRAGILITY
  - PREVIOUSLY DESCRIBED IN PATIENTS WITH DIABETES, EHLERS-DANLOS SYNDROME, AND HYPERTENSION

PETECHIAE-AY-AY!

- IN THIS PATIENT, IT WAS SUSPECTED THE ASPIRIN AND PRASUGREL'S ANTI-PLT ACTIVITY MAY HAVE CONTRIBUTED TO DEVELOPMENT OF HIS RUMPEL-LEEDE SIGN
  - WALDENSTROM MACROGLOBULINEMIA-ASSOCIATED HYPERVISCOSITY COULD NOT BE RULED OUT AS A FACTOR

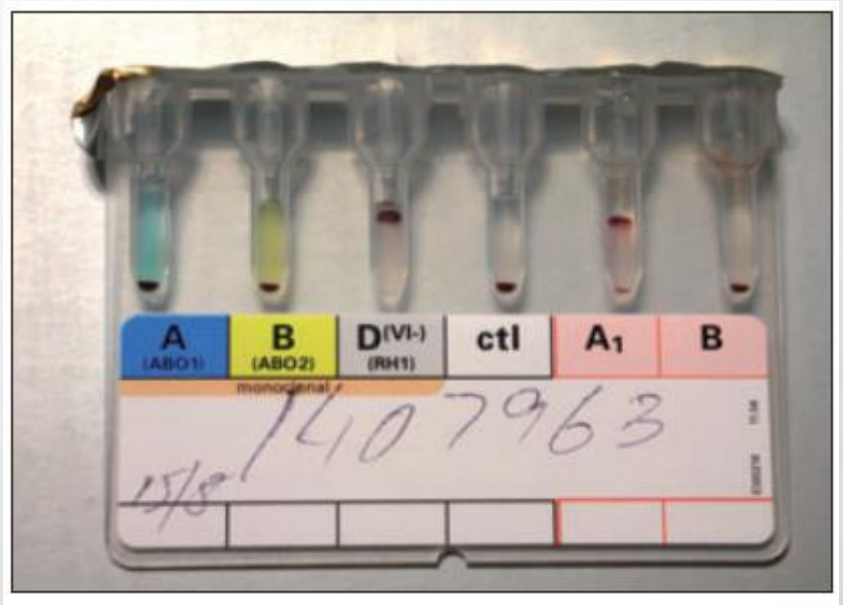
NO, THAT IS INCORRECT

- MOIZ, B. ADIL, S. & SULEMAN, M. B SUBGROUP MISTYPED AS O. (2007) *TRANSFUSION, 47*, 753



NO, THAT IS INCORRECT

- 44-YEAR OLD MALE PRESENTED TO EXECUTIVE CLINIC WITH CHEST PAIN
- MD REQUESTED ABORH ALONG WITH OTHER VARIOUS ROUTINE LAB TESTING
- PATIENT'S PREVIOUS ABORH TYPINGS BY VARIOUS LABS ALL REPORTED AS O POSITIVE
- GEL TYPING SHOWED FRONT TYPE AS O POS, BUT BACK TYPE AS B

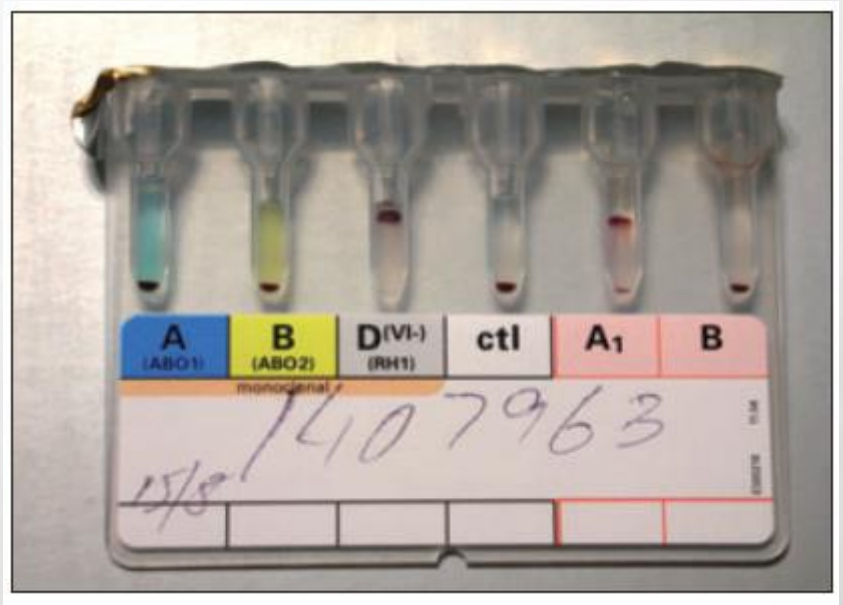


NO, THAT IS INCORRECT

- AUTOCONTROL WAS NEGATIVE AND PROVISIONAL INTERPRETATION WAS B SUBGROUP OR O WITH LOW-LEVEL ANTI-B
- RECOLLECT REQUESTED AND TESTED USING MANUAL TUBE AND GEL METHODS WITH INCLUSION OF ANTI-A,B
  - RECOLLECT RESULTED IN AGREEMENT WITH PREVIOUS RESULT

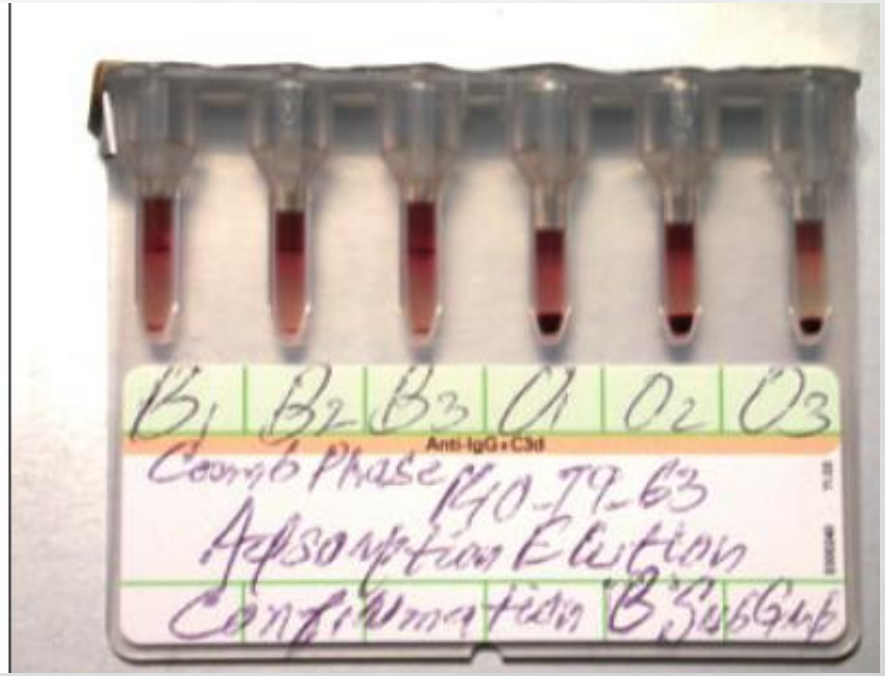
NO, THAT IS INCORRECT

- WEAK AGGLUTINATION OBSERVED IN ANTI-B AND ANTI-A,B TUBES AFTER 4-6 HOUR INCUBATION AT ROOM TEMPERATURE
- PROLONGED INCUBATION OF REVERSE GROUPING AND AUTOCONTROL AT RT AND 4°C DID NOT ALTER RESULTS
  - BOTH RESULTS SUGGEST PATIENT HAS WEAK B SUBGROUP



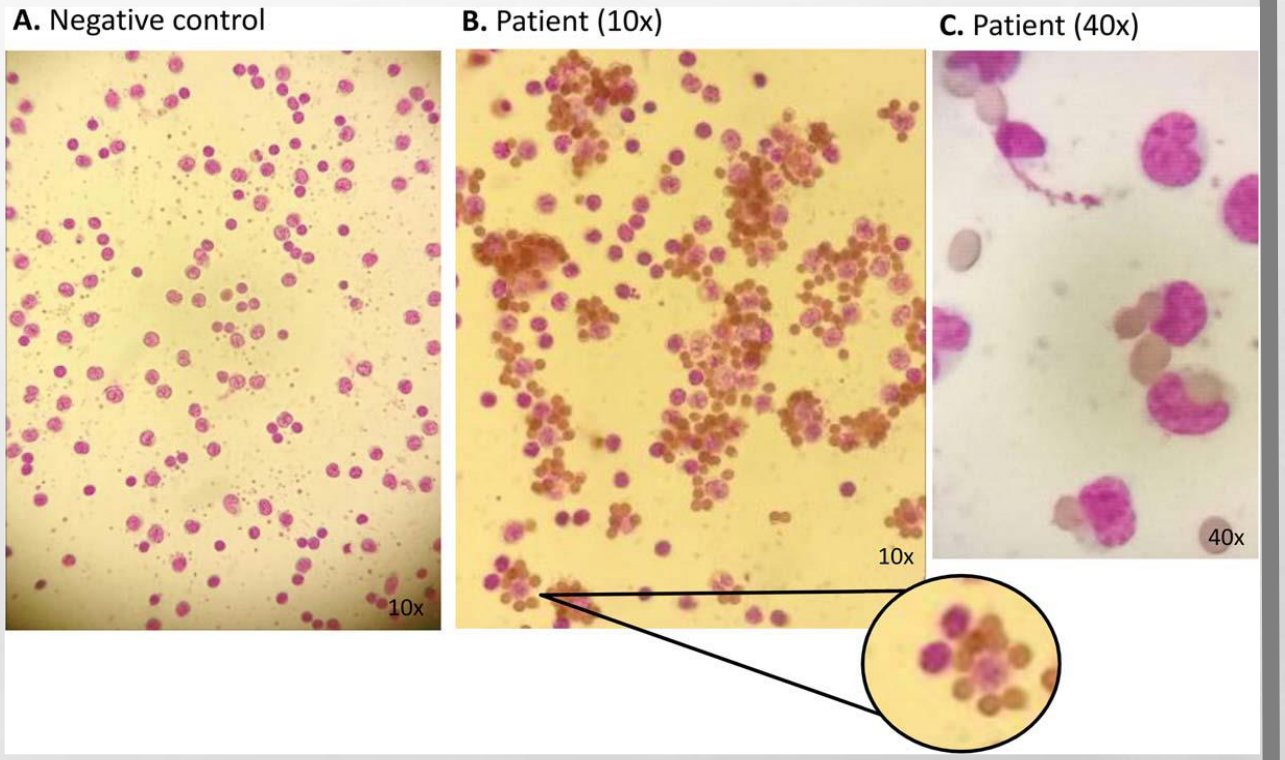
NO, THAT IS INCORRECT

- ADSORPTION AND ELUTION STUDIES WITH ANTI-B ANTISERA SHOWED PRESENCE OF B ANTIGEN ON PATIENT'S RBCS
  - ELUATES REACTED WITH 3 B TEST CELLS BUT NON-REACTIVE WITH 3 GROUP O CELLS
- B SUBGROUPS ARE INFREQUENT BUT RECOGNITION OF THEM IS IMPORTANT
  - FAMILY STUDIES AND/OR MOLECULAR GENETICS CAN ALSO BE USEFUL TOOLS FOR ABORH TYPING RESOLUTIONS



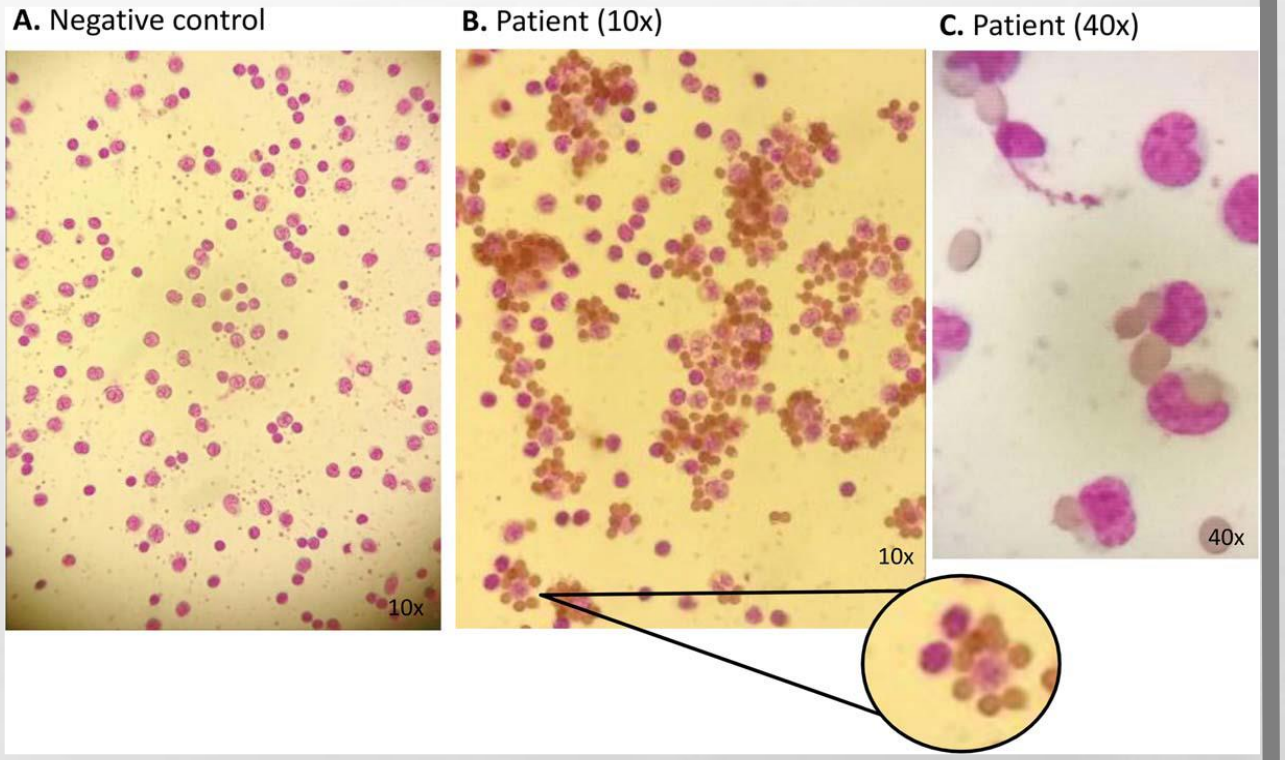
MMA IN THE BLOOD BANK

- CONRADO, M. BONIFACIO, S. NOGUEIRA, F. SARAIVA-FILHO, J. DEZAN, M. CHINOCA, K. GOMES, F. FONSECA, G. GUALANDRO, S. ROCHA, V. MENDRONE-JUNIOR, A. & DINARDO, C. (2018) MASSIVE AUTOIMMUNE HEMOLYSIS DOCUMENTED BY MONOCYTE MONOLAYER ASSAY IN A MULTIPLY TRANSFUSED PATIENT USING RETICULOCYTES ISOLATED BY SIMPLE CENTRIFUGATION IN MICROHEMATOCRIT TUBES. *TRANSFUSION, 58,* 1578-1579.



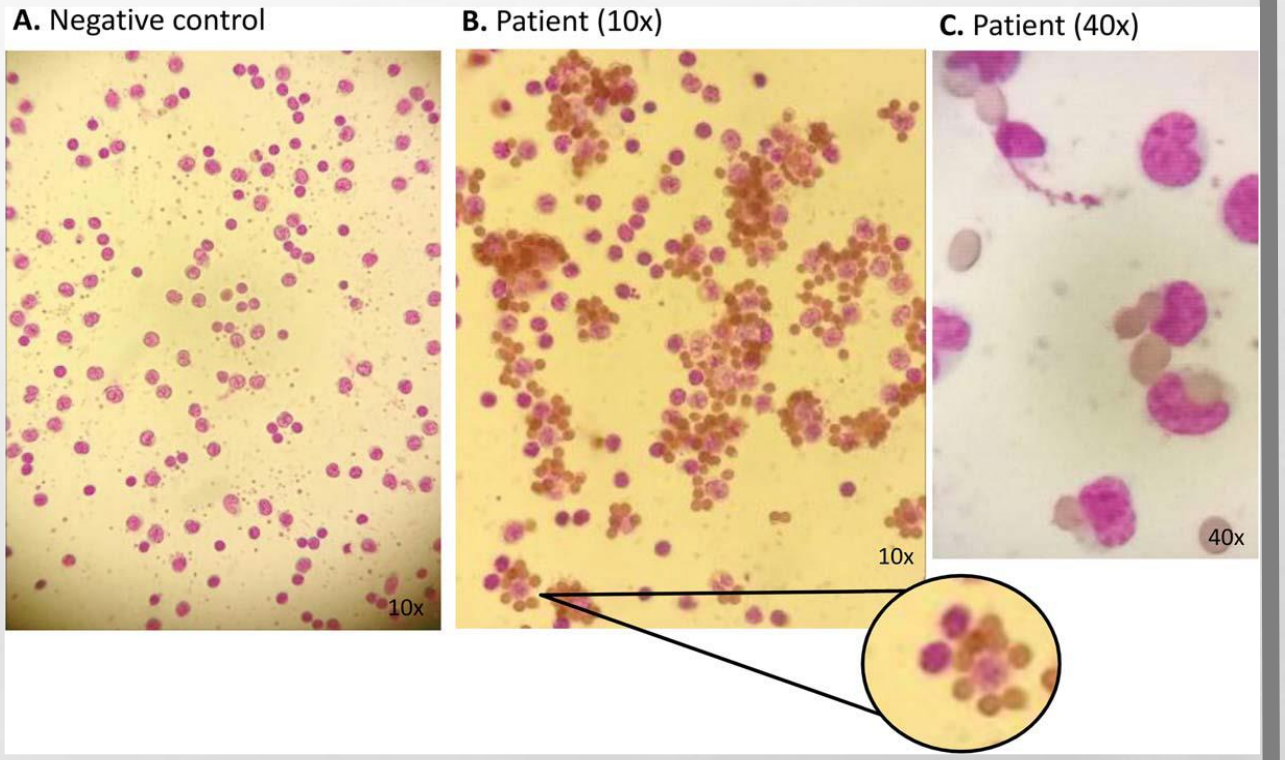
MMA IN THE BLOOD BANK

- 34-YEAR OLD MALE POSITIVE FOR HIV ADMITTED FOR INTENSE ANEMIA AND HEMODYNAMIC INSTABILITY
  - HGB WAS 1 G/DL, MCV WAS 110 FL/CELL, AND RETICULOCYTE COUNT WAS 12K /MM^3
- TRANSFUSED WITH 5 GENOTYPE-COMPATIBLE RBCS
  - RORO (RHD*01N.01), FY(A-), JK(B-), S-



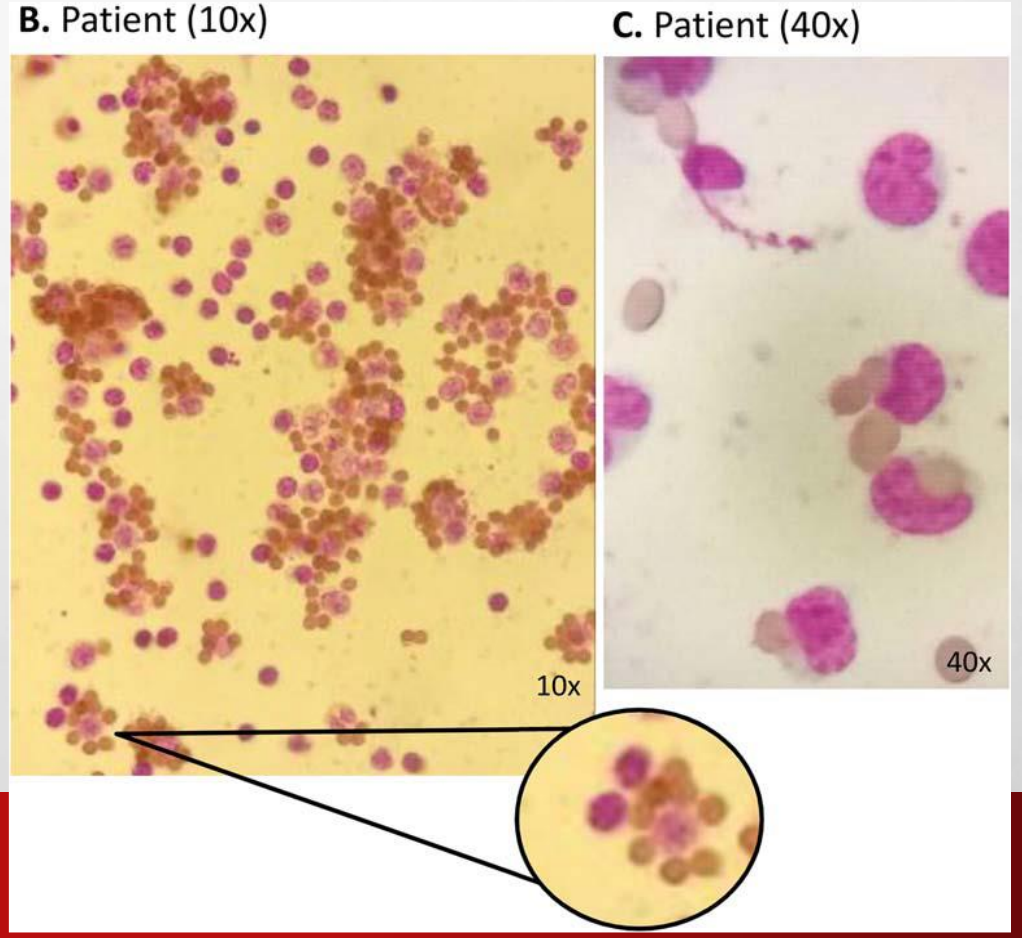
MMA IN THE BLOOD BANK

- PRE-TRANSFUSION TESTING:
  - 4+ DAT (IGG, IGM, AND C3)
  - 4+ AUTOCONTROL
  - SERUM PANAGGLUTINATION
- PERIPHERAL BLOOD SMEAR REVEALED INTENSE ANISOCYTOSIS BUT NO ERYTHROPHAGOCYTOSIS
- MONOCYTE MONOLAYER ASSAY (MMA) TESTING INDICATED FOR AUTOIMMUNE RBC LYSIS



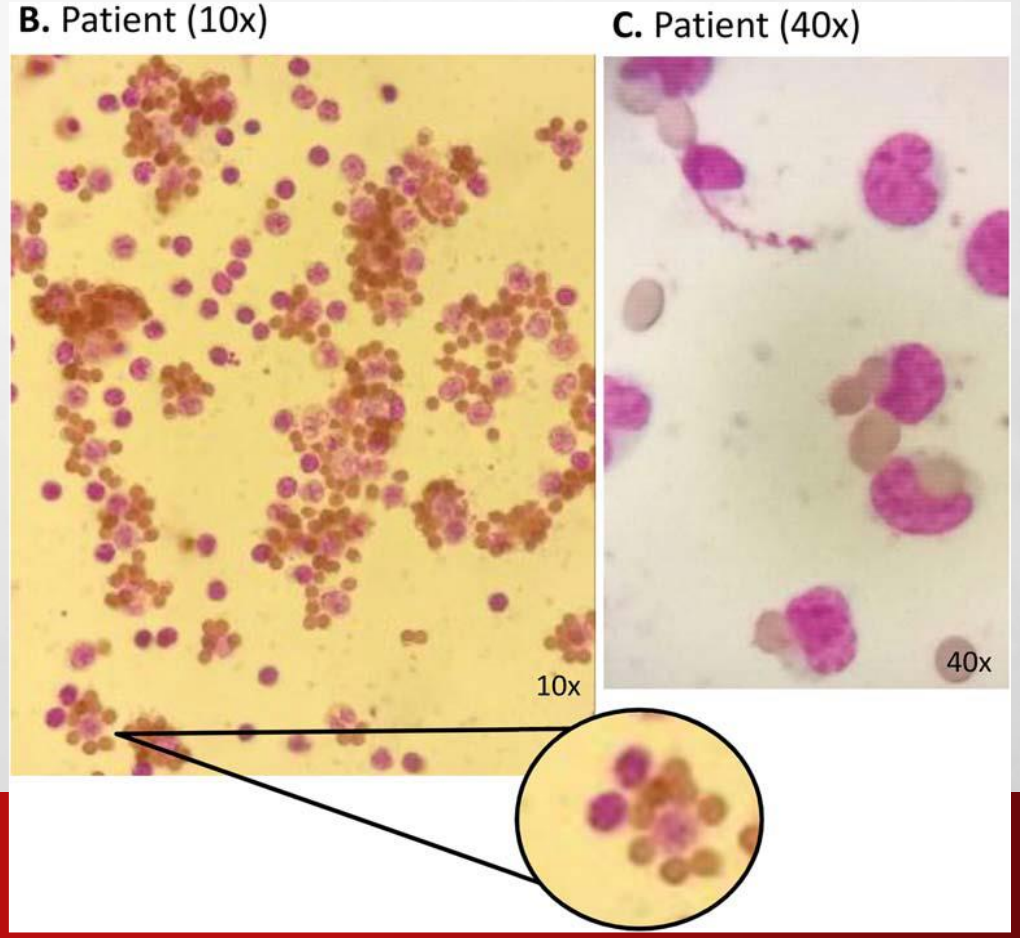
MMA IN THE BLOOD BANK

- MMA TEST TYPICALLY USED TO GAUGE *IN VIVO* REACTIVITY OF DONOR RBCS WITH PATIENT'S SERUM
  - HIGH-PREVALENCE ANTIBODY
- PATIENT SERUM MIXED WITH DONOR RBCS AND DONOR MACROPHAGES
  - PT AB ATTACHED TO DONOR RBCS
  - MACROPHAGES ATTACH (ROSETTES) AND PHAGOCYTIZE DONOR RBCS



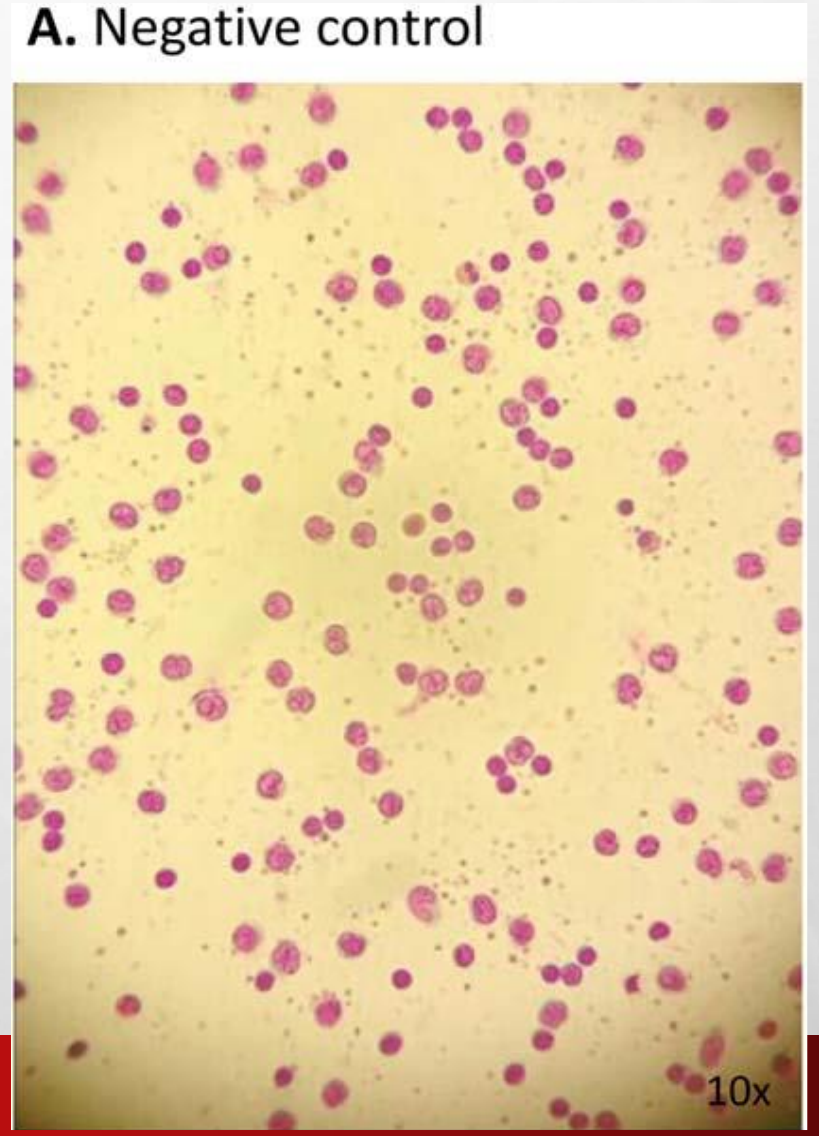
MMA IN THE BLOOD BANK

- IN THIS CASE, PATIENT RBCS USED INSTEAD OF DONOR RBCS
  - RECENTLY TRANSFUSED
  - RETICULOCYTES ISOLATED FROM PATIENT SAMPLE USING CENTRIFUGED MICROHEMATOCRIT TUBES
- MMA OBTAINED IMPRESSIVE RESULTS
  - ALMOST ALL RBCS WERE PHAGOCYTIZED OR FORMED ROSETTES



MMA IN THE BLOOD BANK

- MMA TEST USING NORMAL RETICULOCYTES WAS NEGATIVE
- DIAGNOSIS OF AGGRESSIVE AUTOIMMUNE HEMOLYSIS WAS CONFIRMED



QUESTIONS?

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