PLATELET-RICH PLASMA AS A TREATMENT: VALUABLE OR JUST PLAIN EXPENSIVE?

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OBJECTIVES:
• Discuss the field of regenerative medicine.
• Review the formation of platelets and their structure and functions in the body.
• Discuss platelet-rich plasma as a possible medical treatment.

WHAT IS REGENERATIVE MEDICINE?
• Regenerative medicine (RM) involves using cells, tissues, or genetic material to treat and manage diseases.
• Emerging field that aims to repair, replace, or regenerate human cells, tissues, or organs to restore or establish normal function.
• Stem cell therapy
• Gene therapy
• Tissue engineering
• Platelet-rich plasma (PRP) therapy
• Big business: 5000+ clinical trials worldwide.

STEM CELL THERAPY

GENE THERAPY

TISSUE ENGINEERING
PLATELET-RICH PLASMA THERAPY

WHAT IS IT?

PLATELET RICH PLASMA

PLATELET POOR PLASMA

PLATELET RICH PLASMA

RED BLOOD CELLS

EMERGING POPULARITY OF PRP TREATMENTS

PLATELETS: INTRO

WHAT ARE PLATELETS?

- Small, anuclear ‘cells’ with azurophilic granules
- Fragments of megakaryocyte (MK) cytoplasm in bone marrow (BM) released to peripheral blood (PB)

WHAT ARE PLATELETS?

POLYPHYLETIC THEORY

www.umn.edu/hema
HOW DOES IT REALLY HAPPEN?

- Hematopoiesis is responsible for replacement of peripheral blood cells.
- In healthy adults, occurs primarily in the bone marrow.
- Like any other organ, blood vessels supply nutrients and gases to the marrow.
- Nutrient artery
- Central vein
- Blood cells pass through gaps in intravascular lining to enter circulation

MEGAKARYOCYTE

- Occurs in bone marrow
- Morphologic alterations in the megakaryocyte:
  - Vast increase in cell size with maturation
  - Nucleus goes from round to bi-lobed to multi-lobed
  - Diffusely granulated cytoplasm
  - Mitosis, followed by endomitosis
  - Endomitosis: Doubling of DNA content without nuclear division or cell division
MEGAKARYOCYTE WITH PROPLATELETS

- Survival: 7-10 days
- Non-viable or aged platelets removed by spleen & liver
- Platelets released from the BM (no reserve in BM)
  - 2/3 of platelets circulate in the PB
  - 1/3 are sequestered in the spleen

PLATELETS

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PLATELET STRUCTURE
- PLT surface has membranous channels that extend deep into PLT.
- PLT ultrastructure:
  - Peripheral zone
  - Structural/Sol-Gel zone
  - Organelle zone
  - Membrane systems

PLATELETS DO MANY JOBS...
- Interact with injured vessel
- Interact with other platelets
- Interact with coagulation factors/proteins

PRIMARY HEMOSTASIS
1. Adhesion → PLT attach to injured vessel
2. Activation → PLT function & shape change
3. Secretion → Release of PLT granules
4. Aggregation → PLT attach to each other

OTHER PLATELET ROLES
1. Surveillance of blood vessel integrity
2. Platelet-endothelium interactions
3. Platelet-platelet interactions
4. Platelet-coagulation proteins interactions
5. Aid in healing of injured tissue
**PLATELET GRANULES**

- Maintain integrity of blood vessels
- Passive surveillance of vessel endothelial cell lining for gaps
- Releases platelet-derived growth factor (PDGF)
- A decrease in platelets results in blood leaking into tissues
- Aid in healing injured vessels and tissue
- Contain proangiogenic cytokines and growth factors

**CAN WE USE PLATELETS TO TREAT WHAT AILS US?**

- Dental procedures
- Sports medicine
- Orthopedic injuries
  - Tendons
  - Ligaments
  - Joints
  - Pain
- Osteoarthritis
- Wound healing
- Dermatology concerns
- Hair growth
- Sexual dysfunction

**REVIEW: CENTRIFUGING WHOLE BLOOD**

Plasma - 55% of whole blood
- Blood donor component
- Buffy coat
  - Leukocytes and platelets
  - 45% of whole blood
- Erythrocytes
  - 45% of whole blood
- Blood donor component

**PROCESS OF PRP THERAPY**

1. Collect blood from patient
2. Centrifuge platelets
3. Remove platelets
4. Platelet-rich plasma injected into tissue
5. Additional layering as needed for better accuracy
HOW TO MAKE PRP: LET US COUNT THE WAYS!

- [https://binged.it/2lhH0f6](https://binged.it/2lhH0f6)

COST

- $300-$2000/injection
- Multiple injections often recommended
- Most insurance does not cover

SAFETY?

- FDA oversight?
- "off-label use"
- Autologous = "natural" = safe?
- Platelet "dosage" – is more always better?
- Adverse reactions
- Cross-contamination from equipment?
- Two HIV cases

RESEARCH?

- Most studies are far from rigorous
- Very small sample size – anecdotal evidence?
- Lack of standardization of PRP prep or of injection procedure
- Few randomized, controlled trials – funding shortage for non-drug treatments?
- PRP vs. whole blood?
- Several high quality studies show no significant benefit
- Placebo effect?

RESEARCH, CONT.

- This just in…
  - Bacterial cystitis in women
  - Androgenetic alopecia in men
  - MRSA treatment in canine wounds
- Nearly all studies acknowledge a need for more research.
THOUGHTS, QUESTIONS OR EXPERIENCES?

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Share Your Thoughts!

THANK YOU!