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

WHAT ARE PLATELETS?

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

PLATELETS: INTRO

- Reference range: 150,000 - 400,000/µL
- Principal function: prevent bleeding
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
MEGA KARYOCYTE 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
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

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**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

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**REVIEW: CENTRIFUGING WHOLE BLOOD**

1. Withdraw blood and place in tube
2. Centrifuge the blood sample

Plasma
- 5% of whole blood
- Large donor component
- Buffy coat
- Leucocytes and platelets
- PLTs

Fibrinogen
- 40% of whole blood
- Most donor component

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**PROCESS OF PRP THERAPY**

1. Collect blood
2. Centrifuge the blood sample
3. Extract platelet-rich plasma

Platelet-rich plasma
- Grown from plasma

Platelet-depleted plasma
- Used in PRP therapy

**Platelet-Rich Plasma (PRP) Therapy**

[Image of PRP therapy process]
HOW TO MAKE PRP: LET US COUNT THE WAYS!

HOW TO MAKE PRP

• https://binged.io/2hhj46

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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THANK YOU!