Comparison Of Dry & Wet Thawing Methods For Fresh Frozen Plasma (FFP)

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Background

• Preservation of coagulation factors is a point of concern
  – Preparation, storage and thawing of FFPs

• We have been using traditional water bath (wet method) to thaw FFP.

• Main drawbacks of water bath
  – Risk of bacterial contamination
  – Protein denaturation
Plasmatherm® is a novel technology to thaw FFP using dry method.

- FFP is interposed between two silicon cushions filled with water.
- Heat transfer is through contact warming.
- Eliminates the risk of bacterial contamination.
Rationale

Newer Technology

No Study Was Done Comparing Plasmatherm With Water Bath
Aims & Objectives

• Primary
  – To compare & evaluate the quality of FFPs thawed by wet and dry methods

• Secondary
  – To study other factors associated with thawing process of both the methods
Prospective Observational Study

42 group ‘O’ FFP prepared by PRP method

Materials & Methods

Snap frozen within 8 hrs of collection at -80°C and stored at -40°C

Removed all the confounding factors except inter unit variability which was nullified by randomization
We also compared – Throughput – Accessibility – Ease of use

42 FFP

21 FFP thawed
water bath
37°C for 20min

21 FFP thawed
Plasmatherm
45°C for 15 mins

Automated Coagulation Analyser
(ACL TOP 300)

PT
aPTT
Fibrinogen
Factor VIII

PT
aPTT
Fibrinogen
Factor VIII
Results

- FFP volume was comparable in both groups

Mean Volume of FFP

- WATER BATH: 211.8 ml
- PLASMATHERM: 213.4 ml

Normal Volume: 200-220 ml (DGHS)
There is a statistically significant difference in coagulation parameters after thawing but within normal limits.
There is a statistically significant reduction in the coagulation factors after thawing.

<table>
<thead>
<tr>
<th>GROUP</th>
<th>FACTOR VIII (Pre –Post)</th>
<th>FIBRINOGEN (Pre-Post)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PLASMATHERM</td>
<td>P value 0.0001</td>
<td>0.001</td>
</tr>
<tr>
<td>WATER BATH</td>
<td>P value 0.001</td>
<td>0.001</td>
</tr>
</tbody>
</table>
Water bath Vs Plasmatherm

• Analyzed with independent sample ‘t’ test

<table>
<thead>
<tr>
<th></th>
<th>t</th>
<th>df</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>aPTT</td>
<td>1.826</td>
<td>22.736</td>
<td>0.081(&gt;0.05)</td>
</tr>
<tr>
<td>PT</td>
<td>0.093</td>
<td>24.901</td>
<td>0.926(&gt;0.05)</td>
</tr>
<tr>
<td>FACTOR VIII</td>
<td>0.719</td>
<td>33.540</td>
<td>0.477(&gt;0.05)</td>
</tr>
<tr>
<td>FIBRINOGEN</td>
<td>0.991</td>
<td>28.125</td>
<td>0.330(&gt;0.05)</td>
</tr>
</tbody>
</table>

Comparing both techniques, the activity of coagulation factors was not statistically significant.
Thawing Temperature & Duration

- **WATER BATH**
  - Temperature: 37°C
  - Duration: 30 mins/multiple bags

- **PLASMATHERM**
  - Temperature: 45°C
  - Duration: 12 mins/bag & 15 mins/4 bags

- **Other**
  - 30 mins/multiple bags
  - 12 mins/bag & 15 mins/4 bags
Sterility Testing

- Mixed bacterial growth were observed from culturing of multiple swabs taken from the water bath.
Discussion

• Both methods were comparable as there was no significant reduction in the coagulation factor activity.

• Our study supports the findings of Thompson et al and Plotz et al. They compared FFP thawing in 37°C (WATERBATH) and 45°C (MICROWAVE OVEN) proved that no statistical difference in coagulation parameters in these temperatures.

• In-contrast to study by Luff et al. There is a decrement in coagulation parameters with increased temperatures.
• In both methods there is significant reduction in clotting parameters after thawing.
  – There is decrease in clotting factors upon storage and thawing

• Though thawing time for Plasmatherm was less compared to water bath, only fewer FFPs could be thawed at a time.

• Culture reports from the water bath showed mixed bacterial growths
  – Similar to report by Rhame et al - reported three cases of pseudomonal septicaemia related to thawing of cryoprecipitate in a water bath
## Plasmatherm Vs Water bath

<table>
<thead>
<tr>
<th><strong>PLASMATHERM</strong></th>
<th><strong>WATERBATH</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>No risk of bacterial contamination as there is Micropur tablets in thawing water</td>
<td>Chance of Bacterial contamination</td>
</tr>
<tr>
<td>RBC and stem cell warming at 37°C</td>
<td>Only FFP can be thawed</td>
</tr>
<tr>
<td>Needs weekly cleaning process – 5 minutes</td>
<td>Daily cleaning, 30-45 minutes</td>
</tr>
<tr>
<td>Water change – once a year</td>
<td>Daily water change</td>
</tr>
<tr>
<td>Leakage sensing alarm</td>
<td>High throughput(10-15)</td>
</tr>
<tr>
<td>Thawing stops after specified time</td>
<td></td>
</tr>
<tr>
<td>Less power consumption (1300 W)</td>
<td>More power consumption (3000 W)</td>
</tr>
<tr>
<td>Paddle system - continuous undulation of FFP</td>
<td>Stirrer for continuous movement of water</td>
</tr>
<tr>
<td>Can be connected to LAN, Log printer &amp; barcode scanner</td>
<td></td>
</tr>
<tr>
<td>Expensive, but low running expenditure</td>
<td>Cheaper</td>
</tr>
<tr>
<td>Batch</td>
<td>Random</td>
</tr>
</tbody>
</table>
• Comparable coagulation parameters were observed after thawing by both equipments

• Higher temperatures had no significant impact on clotting parameters

• Chance of bacterial contamination is lesser with Plasmatherm
Conclusion

1. The Plasmatherm allows a comfortable and hygienic thawing of FFP when compared to water bath
2. The Plasmatherm was found superior to waterbath in ease of use and maintainence
3. The plasmatherm can be used as a blood warmer in scenarios like exchange, massive transfusions and in cold agglutinin disease.
4. Higher temperatures for thawing could be further studied so as to reduce the thawing times
Limitations

• We have not assessed Factor V
• Larger sample size could have been studied
Higher temperature may be safely applied to thaw FFP in plasmatherm without much impact on clotting factors with lesser turn round time, especially in emergencies thus increasing the safety and efficiency of transfusion service
References


the question must be asked whether it is the only one possible. We ourselves hold that another, simpler, explanation is possible

KARL LANDSTEINER