

Comparison of enterotomy leak pressure among fresh, cooled, and frozen/thawed swine jejunal segments



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Background:

- Secure enterotomy closure is essential because intestinal leakage may be fatal.
- Cadaveric tissue is used to test enterotomy closure techniques
- Postmortem autolysis alters tissue integrity and may influence results.
- Previous studies have used intestines within 5 hours after euthanasia.
- The dependability of intestine beyond 5 hours after death has not been evaluated.

Materials and Methods:

- Jejunum was harvested from 3 swine cadavers immediately following euthanasia for reasons independent of this study.
- Intestine harvested from each pig was transected into three sections and randomly assigned to a treatment group.
- Each section of jejunum was cut into 12 segments, giving 36 total segments for each of the three treatment groups:
 - Fresh – used within 4 hours of euthanasia
 - Cooled – refrigerated overnight
 - Frozen/thawed – frozen and then thawed 8 days later
- 8-cm sections were suspended and sealed on both ends with large Rochester-Péan forceps placed 6-cm apart.
- 2-cm incisions were made and closed with a simple continuous suture pattern using 4-0 poliglecaprone suture on an RB-1 taper needle.^a
- Lactated Ringer's solution was infused into each segment at a rate of 900 mL/hr and leak pressure was measured using a digital transducer.
- One-way analysis of variance was performed to determine whether there were differences in mean leak pressure between pigs and intestinal segments.
- Mean leak pressure was compared between treatment groups using one-way analysis of variance where leak pressure (mmHg) was the dependent variable and treatment groups (fresh, cooled, or frozen) was the independent variable.
- Bonferroni pair-wise comparisons were made when significance was detected.
- All analyses were deemed significant at $P < 0.05$.

a. Monocryl, Ethicon, Somerville, NJ

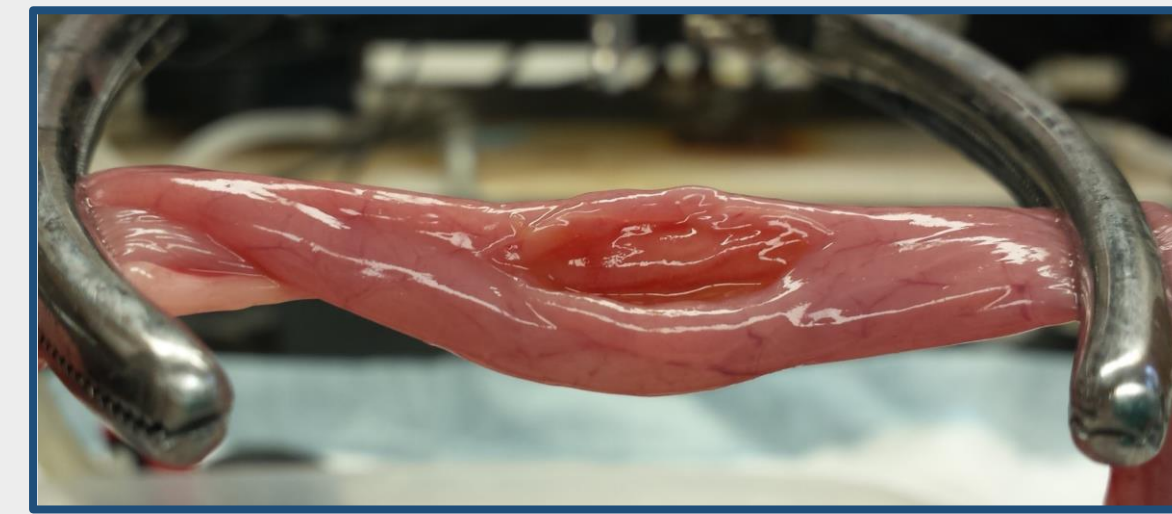


Figure 1. Suspended jejunal segment with incision.

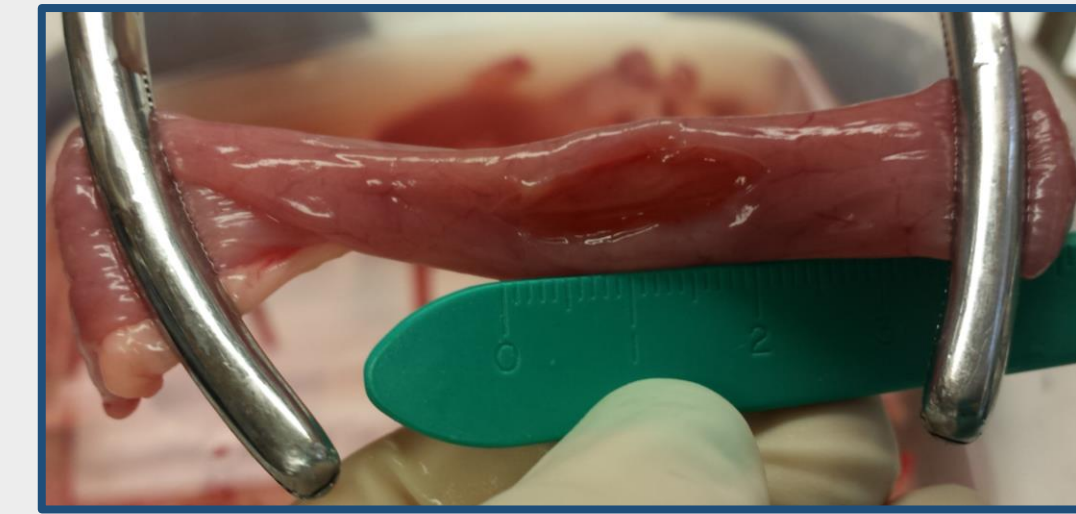


Figure 2. Documented 2 cm length of suspended jejunal segment.

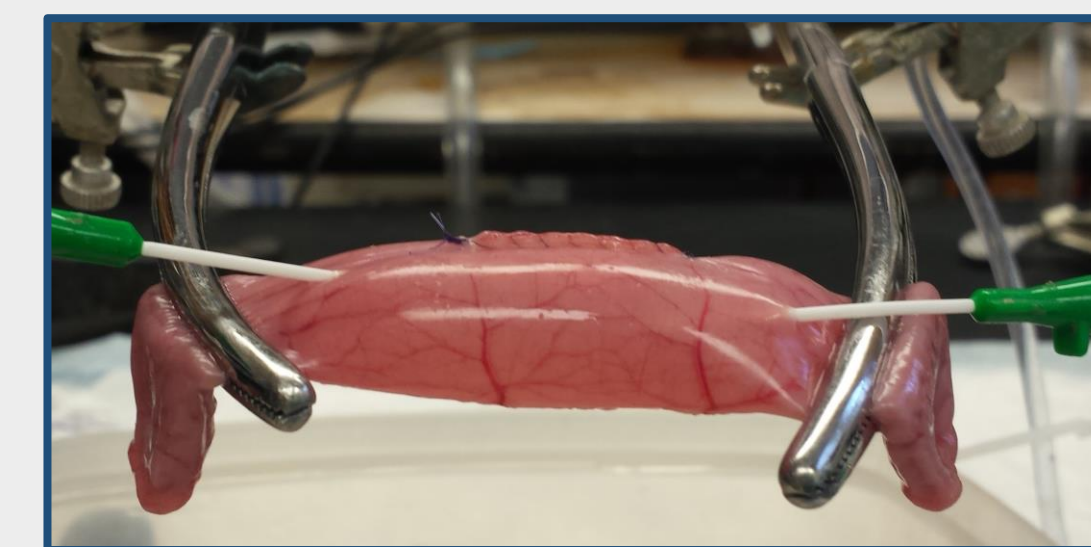


Figure 3. Fresh segment after enterotomy closure. Lactated Ringer's solution is being infused.



Figure 4. Cooled segment after enterotomy closure. Lactated Ringer's solution is being infused.



Figure 5. Frozen/thawed segment after enterotomy closure. Lactated Ringer's solution is being infused.

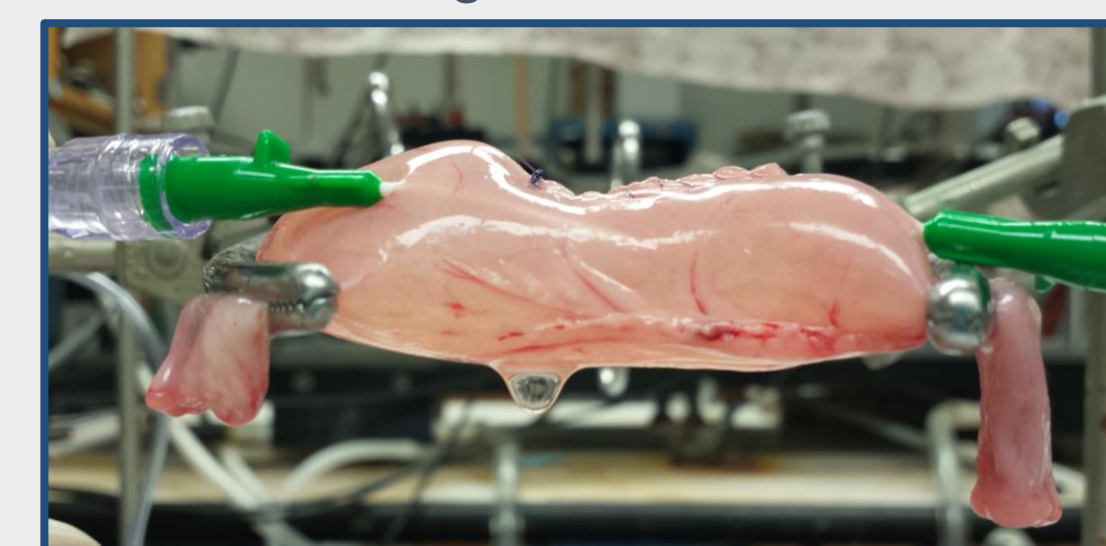


Figure 6. Fresh segment after enterotomy closure. Lactated Ringer's solution is being infused and leakage is noted.

Results:

Univariate analysis revealed no statistically significant differences between mean leak pressures for pigs and intestinal segments ($P = 0.08$ and $P = 0.70$, respectively). Hence a one-way analysis of variance was used to compare leak pressures between the three treatment groups (fresh, cooled, and frozen/thawed). There was a statistically significant difference in mean leak pressure between groups ($P < 0.01$). Mean (SD) leak pressures for fresh, cooled, and frozen samples were 68.3 (23.7), 55.3 (28.1), and 14.4 (14.8) mmHg, respectively (Figure 7). Bonferroni pairwise comparisons showed that frozen samples differed from fresh and cooled samples, but fresh and cooled samples did not differ from each other.

Discussion:

During peristalsis in dogs, there is a maximal intrajejunal pressure of 23 mmHg. The mean leak pressures of 68.3 and 55.3 mmHg for fresh and cooled samples, respectively, are well above this value. Frozen/thawed, with a mean leak pressure of 14.4 mmHg, falls below this threshold.

Conclusion:

Harvested jejunal segments cooled overnight may be used for intestinal leak pressure testing, whereas frozen/thawed specimens should not.

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Leak Pressure by Group

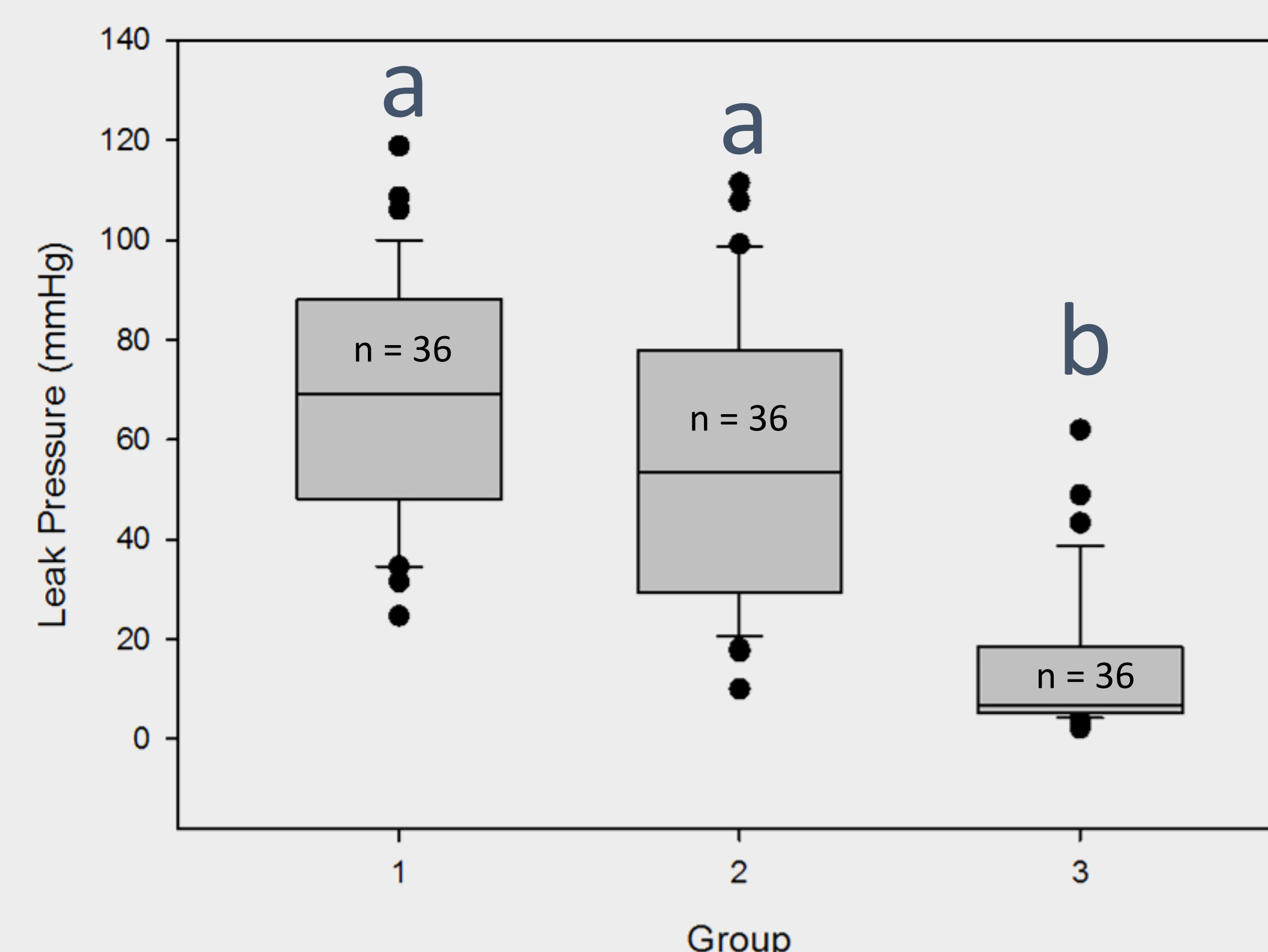


Figure 7. Groups 1, 2, and 3 represent fresh, cooled, and frozen/thawed treatments, respectively. Chart shows the mean leak pressure (mmHg) and standard deviations for each group. There is a statistically significant difference between groups labeled with different letters ($P < 0.01$).