Evaluation of leak pressure and closure time of interrupted vs. continuous double layer esophagotomy closure

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Background

- Foreign body retrieval is the most common indication for esophageal surgery in dogs[1]
- Esophageal surgeries carry a higher incidence rate of complications than any other portion of the GI tract[2]
  - Common complications: incisional dehiscence, stricture formation, regurgitation, and aspiration pneumonia[1-4]
- Optimizing closure can improve mucosal apposition and reduce incisional tension thus reducing complications[2-5]
- There is currently no definite consensus on the proper method of esophagotomy closure
- Double layer closure patterns lead to better healing and higher postoperative leak pressure, but are technically challenging and slow relative to single layer patterns[6]
- A double layer simple continuous pattern has not been investigated

Hypothesis

- Double layer simple continuous closure will be faster to complete than double layer simple interrupted.
- Double layer simple continuous closure will achieve a similar leak pressure as double layer simple interrupted.

Methods

- Segments of intrathoracic esophagus were harvested from 28 healthy 8-9 week old swine .
- A cylindrical foreign body was passed through the lumen and positioned in the center of the segment.
- Each end of each segment was occluded and suspended with Rochester Pean forceps.
- Longitudinal 3-cm esophagotomy incisions were performed and the foreign body was removed.
- Two catheters were placed through the wall of the esophagus into the lumen; one connected to a fluid pump and the other to a pressure transducer.
- The incisions were closed according to their assigned group:
  - Group 1: Double layer simple interrupted closure
  - Group 2: Double layer simple continuous closure
- The time taken to close and postoperative leak pressure was recorded and compared between groups.

Simple interrupted takes more time to close

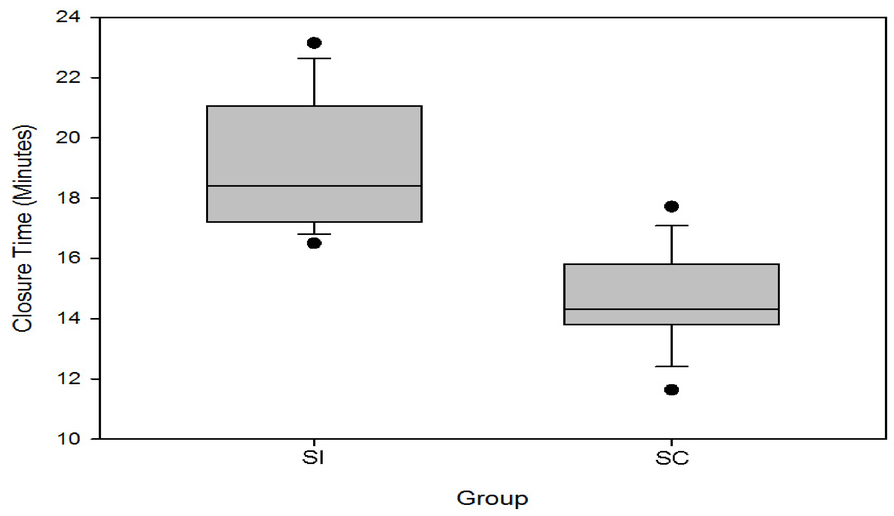

Figure 1:Comparison of closure time between simple interrupted (SI) and simple continuous (SC) closure patterns. Mean (±standard deviation) closure times were 19.2 min ± 2.0 min for Group 1 (SI) and 14.7 min ± 1.5 min for Group 2 (SC) ($P < 0.01$).

Simple interrupted achieves lower leak pressures

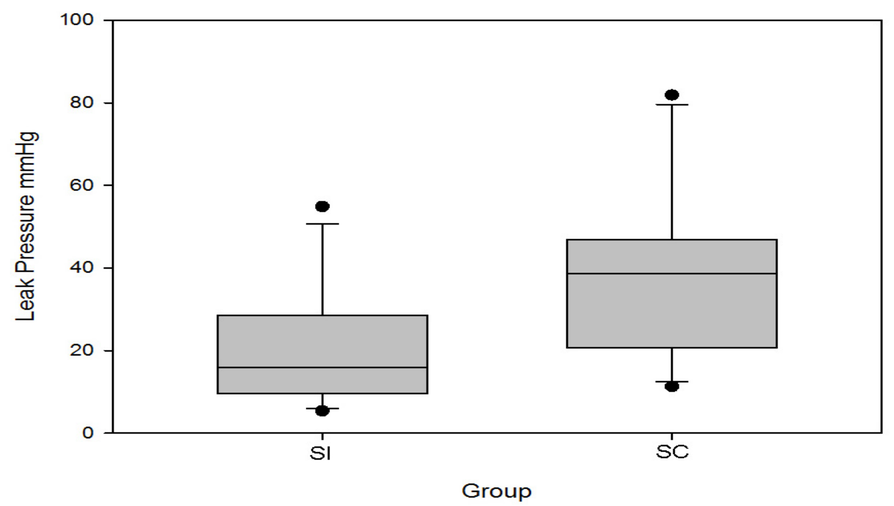

Figure 2: Comparison of postoperative leak pressure between simple interrupted (SI) and simple continuous (SC) closure patterns. Median (range) leak pressure was 16.0 mmHg (5.4-54.9 mmHg) for Group 1 (SI) and 38.7 mmHg (11.29-81.9 mmHg) for Group 2 (SC) ($P = 0.03$).

Conclusions

- The simple continuous pattern was significantly faster than the simple interrupted pattern while maintaining a better immediate seal as shown by the significantly higher median leak pressure
- The double layer simple continuous closure pattern may be superior to simple interrupted closure for repair of an esophageal incision or tear

Future Directions

- Further study in a live animal model is necessary to assess the effect of inflammation and the healing process across closure patterns
- Anatomic structural differences between species may warrant additional study using tissue from other species
- Assessment of closure patterns in other surgical procedures of the esophagus such as an esophageal resection
- Effect of the passage of a bolus on incision failure

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References

1. Sutton JS, Culp WTN, Scotti K, et al. "Perioperative Morbidity and Outcome of Esophageal Surgery in Dogs and Cats: 72 Cases (1993-2013)" *JAVMA*. 249:7, 787-793 2016.
2. Fossum TW, Hedlund CS, Hulse DA, et al. "*Surgery of the Esophagus*". Small Animal Surgery, Second Edition, Chapter 21, 2002, pgs 307-337.
3. Flanders JA. Problems and complications associated with esophageal surgery. *Probl Vet Med* 1989; 1:183–194.
4. Tobias KM and Johnston SA. "Esophagus" *Veterinary Surgery: Small Animal*. 2012, Chapter 90, 1461-1483.
5. Griffon D, Hamaide A. "Esophagoscopy and Esophageal Surgery". *Complications in Small Animal Surgery*. Chapter 43, pages 319-322. 2016
6. Oakes MG, et al. "Esophagotomy closure in the dog: a comparison of a double-layer appositional and two single-layer appositional techniques". *Vet Surg* 21:451, 1993.