CASE REPORT

Difficulty with cuff deflation of reinforced tracheal tube caused by inflation line occlusion with silk thread ligation and fixation

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SUMMARY

A reinforced tracheal tube, ligated with silk threads, was inserted into a tracheostomy orifice and fixed to the skin. The cuff inflation line of the reinforced tracheal tube became occluded. Reinforced 'armoured' tracheal tubes have a spiral of wire embedded into the wall of the tube to give strength and flexibility, and may be sharply bent without compromising the tube lumen. The tracheal cuff attached to the tube is inflated by injecting air through a narrow-diameter tube welded to the outside of the tracheal tube. When a reinforced tracheal tube is ligated and fixed with silk threads, it should be confirmed whether the tracheal tube cuff can be deflated and inflated after fixation. Moreover, because occlusion can be eliminated by removing all silk threads used to ligate a tracheal tube, they should be removed before extubation.

BACKGROUND

A reinforced tracheal tube, ligated with silk threads, was inserted into a tracheostomy orifice and fixed to the skin in a patient undergoing otolaryngological surgery. The cuff inflation line of the reinforced tracheal tube became constricted and occluded, resulting in difficulty with cuff deflation, which could possibly pose a risk to the patient or make the tracheal tube difficult to extubate. We report our experience with this case.

CASE PRESENTATION

A 54-year-old man was scheduled to undergo emergency surgery for a severe neck abscess. The cricothyroid membrane had been urgently incised, and a tracheal cannula (KOKEN Neo Breath Single-Tube Type, KOKEN Co, Tokyo, Japan) had already been inserted by an emergency room doctor. Before the surgery, we discussed airway management during the procedure with the operator. The operator had a plan to excise and irrigate very close to the area of the tracheal tube insertion site. Therefore, we chose using the reinforced tracheal tube during surgery because of its flexibility and because it would allow us to change the position of the tube during surgery. General anaesthesia was induced with 5% sevoflurane and rocuronium (50 mg). Employing a Tube Exchanger (COOK MEDICAL, Bloomington, Indiana, USA), the tracheal cannula was replaced with a reinforced tracheal tube (inner diameter: 6.5 mm, PHYCON Wire Reinforced Endotracheal Tube, Fuji Systems Corporation, Tokyo, Japan) through the cricothyroid membrane orifice. The

absence of cuff leakage was confirmed by injecting 7 mL of air into the cuff. The tracheal tube was sutured and fixed to the skin with 2-0 silk threads (Nescosuture Silk Suture, Alfresa Pharma Corporation, Osaka, Japan) 2 cm above the cuff.

In the middle of surgery, irrigation and debridement around the cricothyroid area required removal of the tracheal tube from the incision in the cricothyroid membrane and reinsertion of a tracheal tube in a newly formed tracheostomy orifice between the second and third tracheal rings. Deflation of the tracheal tube cuff was attempted in order to exchange tubes. Although the pilot balloon at the tracheal tube was deflated, the tracheal tube cuff was not. Because it was clearly visible from the incision in the cricothyroid membrane, we attempted to remove the tube without deflating the cuff. The tube was, in fact, successfully removed without damaging tissues. A new reinforced tracheal tube (inner diameter: 6 mm) was inserted into the second to third tracheal rings and surgery was continued. After completion of the operation, the tracheal tube was removed and a tracheal cannula was inserted between the second and third tracheal rings, and the patient was uneventfully awakened. The patient was then transferred to the intensive care unit, where he was given artificial respiration support for 2 weeks because the abscess was very severe and covered a large area of the neck.

After completion of the operation, the tracheal tube responsible for failure of cuff deflation was inspected ([figure 1](#)). The inflation line of the tracheal tube, which is located outside of the metal reinforced structure, was constricted between the reinforced structure and the silk thread, resulting in occlusion.

Figure 1 Photograph of the reinforced tracheal tube that caused the confinement of the inflation line. The pilot balloon was ready to be completely deflated, but the tracheal tube cuff remained swollen and could not be deflated.

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Figure 2 (A) A schematic image of the inflation line of the cuff confinement. It is thought that an inflation line of cuff located outside of a metal reinforced by the ligation of the tracheal tube with silk thread caused the confinement. (B) Photograph of a section of the reinforced tracheal tube. It was confirmed that an inflation line of the cuff was located outside of the metal reinforced.

DISCUSSION

There have been no reports describing constriction of the cuff inflation line of a reinforced tube causing extubation problems. In general, a tracheal tube is fixed with tape or a fixation device.¹ However, in the case of tracheostomy intubation, it is common for a tracheal tube to be tied with silk threads for fixation. In head and neck surgery, such as oral and plastic surgical procedures, fixation with silk threads or wire is also performed for oral intubation.² In our case, although the cuff remained inflated due to the cuff deflation failure, we were able to remove the tube because it had been inserted from a tracheostomy orifice. If the cuff cannot be deflated in cases managed with conventional oral or nasal intubation, it may not be possible to remove the tracheal tube that passes through the glottis because of the possible risk of damaging the glottis.^{3 4} Reinforced 'armoured' tracheal tubes have a spiral of wire embedded into the wall of the tube to give strength and flexibility, and may be sharply bent without compromising the tube lumen. The tracheal cuff attached to the tube is inflated by injecting air through a narrow-diameter tube welded to the outside of the tracheal tube (figure 2A, B). The cuff inflation line is located

outside of the metal structure of the reinforced tracheal tube. Therefore, the cuff inflation line of the reinforced tracheal tube is apparently prone to occlusion when fixed with silk threads (figure 2A, B).

We experienced a case in which, when a reinforced tube, ligated with silk threads, was inserted into a tracheostomy orifice and fixed to the skin, the cuff inflation line of the tracheal tube became occluded, resulting in difficulty with cuff deflation. When a reinforced tube is ligated and fixed with silk threads, whether the tracheal tube cuff can be deflated and inflated after fixation should be confirmed. Moreover, because occlusion can be eliminated by removing all silk threads used to ligate a tracheal tube, they should be removed before extubation.

Learning points

- ▶ The cuff inflation line is located outside of the metal structure of the reinforced tracheal tube, therefore it is apparently prone to occlusion when fixed with silk threads.
- ▶ When a reinforced tube is ligated and fixed with silk threads, whether the tracheal tube cuff can be deflated and inflated after fixation should be confirmed.
- ▶ All silk threads used to ligate a tracheal tube should be removed before extubation.

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Competing interests None.

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REFERENCES

- 1 Gardner A, Hughes D, Cook R, *et al.* Best practice in stabilisation of oral endotracheal tubes: a systematic review. *Aust Crit Care* 2005;18:160–5.
- 2 Xue FS, Luo MP, Liao X, *et al.* Intraoral fixation of endotracheal tubes using a suture in edentulous patients undergoing maxillofacial surgery. *Cleft Palate Craniofac J* 2010;47:322–3.
- 3 Grant T. Do current methods for endotracheal tube cuff inflation create pressures above the recommended range? A review of the evidence. *J Perioper Pract* 2013;23:292–5.
- 4 Wason R, Gupta P, Gogia AR. Bilateral adductor vocal cord paresis following endotracheal intubation for general anaesthesia. *Anaesth Intensive Care* 2004;32:417–18.

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