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A model for investigation of survival of tracheal graft

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SUMMARY : A method to facilitate circulatory restoration of a long tracheal graft is remained to be developed to apply in reconstruction for an extended tracheal resection. An abdominal tracheal stoma model was devised to simplify the investigation and allow frequent bronchoscopy in conscious animal. In this model, a tracheal graft was wrapped with omentum ; with one end of graft opened and stitched to a round defect created at abdominal wall to make an abdominal tracheal stoma. This model allowed daily bronchoscopy without general anesthesia and negative factors affecting blood supply into omental flap can be excluded to simplify investigation and analysis.

A long tracheal graft can not survive without proper blood supply. Currently, a method to facilitate circulatory restoration of a long tracheal graft is remained to be developed to apply in reconstruction for an extended tracheal resection. Orthotopic implantation of tracheal graft wrapped with omental flap has been used for this kind of investigation (1, 2) ; however, general anesthesia which is necessary for frequent bronchoscopic observations is inconvenient and may be harmful. A model is devised to simplify the study and allow daily bronchoscopic observation of the graft from the first postoperative day without general anesthesia.

MATERIAL AND METHOD

Mongrel adult dog was anesthesized with intravenous administration of Nembutal (25㎎ /㎏), and the animal was then intubated and connected to ventilator. Thereafter, the animal was placed in supine position and a median abdominal incision was made to enter abdominal cavity to approach the omentum. The free portion of the omentum was pulled out of the wound and examined. The omentum was then put back to the abdominal cavity before cervical tracheal approach was begun. A longitudinal skin incision was made and cervical strap was split at the median line to expose the cervical trachea. A five-ring tracheal autograft was harvested and the tracheal continuity was reestablished with end-to-end anastomosis using 3-0 prolene suture. The tracheal graft was wrapped with the omentum and one end of the tracheal lumen was left opened. A round skin defect with 2 ㎝ in diameter was created lateral to the umbilicus at the left pararectal line. The fascia of the rectal muscle was then cut transversely and longitudinally. The rectal muscle was split and the peritoneum was

opened. The edges of the skin and the peritoneum were stitched together to create a round defect of the abdominal wall. The opened end of the tracheal graft was then brought into the abdominal defect, and stitches were placed between the edges of the graft and round abdominal defect to create a stoma. The abdominal wound was closed in two layers. Frequent endoscopy of the graft lumen was performed after operation, and the animal was sacrificed twenty-one days postoperatively.

RESULTS

Figure 1 shows the location of the tracheal stoma at the left side of the abdomen (arrow). With the conscious animal in right lateral position on table, a bronchoscope could be inserted into the stoma and the lumen of the tracheal graft was examined. At the first postoperative day, the external opening of the stoma was covered by fibrin substance and the mucosa was pale. From the second day, the mucosa became dark-red and edematous ; degree of these findings slightly decreased around the seventh day. Accumulation of secretion in the lumen was found at this point. At second weeks postoperatively, edema of the mucosa almost subsided, and the mucosal color was near normal.

Figure 2 shows the orifice of the tracheal stoma two weeks after operation. The orifice was open and the lumen of the tracheal graft was maintained. Three weeks after implantation, the animal was sacrificed. Figure 3 shows the omental flap which covered the graft and adhered to the peritoneum. Microscopically, ciliary epithelium and cartilaginous structure were maintained in the graft.

Fig. 1. Arrow indicates the site of the tracheal stoma at the abdomen.

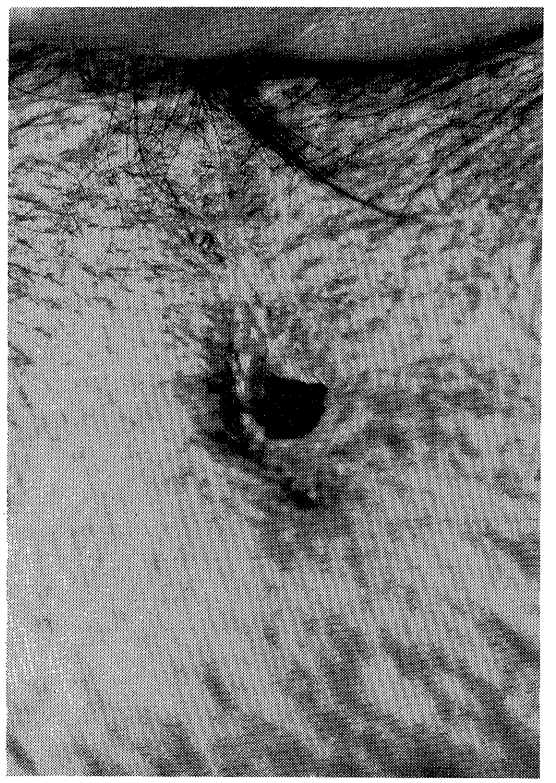

Fig. 2. Closed-up of the tracheal stoma.

DISCUSSION

In an orthotopic tracheal transplantation with omentopexy, blood supply to omental

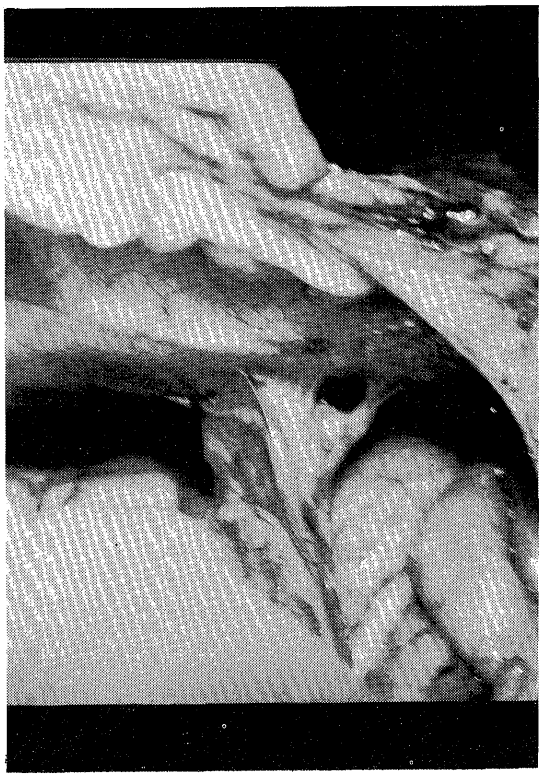

Fig. 3. At sacrifice, omental flap is shown covering the graft and adhering to the peritoneum three weeks after surgery.

flap may be decreased by an unsatisfactory preparation of omental pedicle, by compression from surrounding tissue such as the diaphragm and by over-extension of omental flap. Compared with the orthotopic tracheal transplant model, the present model is less invasive, and the above factors affecting blood supply into the omental flap can be excluded.

With one end of the tracheal graft opened to air, lumen of the graft is allowed to be easily observed without general anesthesia. In order to repeat safe and smooth investigation, it is important to select a well-trained and cooperative animal.

This model is considered to have potential to study limitation of length of a free transplanted tracheal graft which can be neovascularized and to develop a useful mehod to facilitate neovascularization into the tracheal graft.

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