

Clinical outcomes of tracheoesophageal diversion and laryngotracheal separation in neurologically impaired children

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ABSTRACT

Objective: Outcomes of tracheoesophageal diversion and laryngotracheal separation were evaluated in 15 neurologically impaired children treated for intractable aspiration.

Methods: A retrospective analysis of the hospital records was carried out in 15 consecutive pediatric patients who underwent either tracheoesophageal diversion or laryngotracheal separation with trumpet-shaped tracheotomy from 1999 to 2006 in Kagawa Children's Hospital.

Results: The number of hospital admissions for aspiration pneumonia after surgery was significantly decreased in 6 patients who were cared for at home. The parent-reported number of secretion suctioning was decreased after surgery especially in patients with pre-operative tracheotomy or intubation. Four patients fed through naso-gastric tube progressed with oral diet post-operatively, whereas 3 patients who had pre-operative tracheotomy developed temporary post-operative tracheocutaneous fistula that was managed by local wound care.

Conclusion: It is suggested that tracheoesophageal diversion and laryngotracheal separation decrease the morbidity of pediatric patients and improve their quality of life and that of their parents. It is suggested that the risk of developing post-operative fistula is higher in pediatric patients with than without pre-operative tracheotomy.

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1. Introduction

Chronic pulmonary aspiration is frequently observed in neurologically impaired children. The intractable aspiration is a life-threatening medical problem and often results in increased suction requirement, repeated hospitalizations for aspiration pneumonia, expensive nursing care and decreased the quality of life in both patients and their parents.

Various techniques have been proposed to control intractable aspiration. These include the tracheoesophageal diversion reported by Lindeman in 1975 [1] and its variant, the laryngotracheal separation reported in 1976 [2]. These two procedures have become the standard procedures to intractable/chronic aspiration of oral/gastric secretions into the lower respiratory system by the separation of the digestive and respiratory tracts. Tracheoesophageal diversion connects the upper trachea to the cervical esophagus, while laryngotracheal separation includes

closure of the proximal trachea. Additionally, both procedures that preserve the structural integrity and motor and sensory innervations of the larynx are potentially reversible.

In the present study, outcomes of tracheoesophageal diversion and laryngotracheal separation were evaluated in 15 neurologically impaired children. The number of hospital admissions for aspiration pneumonia, the frequency of secretion suctioning by their parents, dietary route and post-operative complications were examined retrospectively.

2. Methods

2.1. Patients

A retrospective analysis of the hospital records was carried out in 15 consecutive neurologically impaired children who underwent either tracheoesophageal diversion or laryngotracheal separation for the treatment of intractable aspiration pneumonia from 1999 to 2006 in Kagawa Children's Hospital. Ten patients (9 males and 1 females; 3–20 years old; mean age: 12.3 years) were submitted to tracheoesophageal diversion and five patients (5 males; 4–14 years old; mean age: 8.6 years) to laryngotracheal

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separation. Their underlying medical conditions contributing to aspiration include anoxic injury at birth (3 cases), anoxic injury after near drowning (3 cases), anoxic injury during cardiac operation (1 case), cerebral palsy (4 cases), congenital hydrocephalus (2 cases) and Gaucher's disease (2 cases).

2.2. Operative procedures

Tracheoesophageal diversion was performed in 10 patients, including 4 patients who underwent tracheotomy prior to the surgery. Laryngotracheal separation was performed in 5 patients, including 3 patients with pre-operative tracheotomy.

The tracheoesophageal diversion was preferred initially, because the tracheoesophageal anastomosis allows the drainage of secretions from the larynx into the esophagus. The laryngotracheal separation was chosen in patients with high tracheotomy [3] or those with a thoracic deformity such as scoliosis or retroflexion to avoid the tension of tracheoesophageal anastomosis.

Under general anesthesia, inverse triangular skin flap was made between the caudal end of the thyroid cartilage and the rostral end of the sternum. After the thyroid isthmus was divided in the midline and its lobes separated, the recurrent laryngeal nerves were identified and carefully preserved. During the tracheoesophageal diversion, the trachea was divided at the level between the third and fourth tracheal rings obliquely upward on the second tracheal ring or at the level of the tracheostomy after

exposing the cervical esophagus posterior to it (Figs. 1a and 2a). After an inverse U-shaped incision was made in the anterior cervical esophagus (Fig. 1b), the mucomuscular flap of the cervical esophagus was anastomosed to the proximal trachea reflected superiorly in an end-to-side fashion (Fig. 1c and d). The anastomosis was then reinforced with the thyroid lobes (Fig. 1e) and covered with the cervical inverse triangular skin flap (Fig. 1f). The inferior cervical skin was invertedly sutured to cover the cartilaginous portion of the distal trachea. A midline vertical incision (1 cm) was made in the membranous portion of the distal trachea (Fig. 2b) and the V-shaped superior skin flap was inserted into the incision and sutured to the membranous flaps (Y-V plasty) (Fig. 2c), creating a trumpet-shaped tracheostomy (Fig. 2d).

During the laryngotracheal separation, the trachea was divided horizontally between the first and second tracheal rings or at the level of the tracheostomy. The proximal tracheal lumen was sutured to close posteroanteriorly in several layers so as to invert the tracheal mucosa into the tracheal lumen. The closure was then reinforced by strap muscles and subcutaneous tissues over the tracheal stump. The inferior cervical skin was invertedly sutured to cover the cartilaginous portion of the distal trachea. A midline vertical incision (1 cm) was made in the membranous portion of the distal trachea and the V-shaped superior skin flap was inserted into the incision and sutured to the membranous flaps (Y-V plasty), creating a trumpet-shaped tracheostomy.

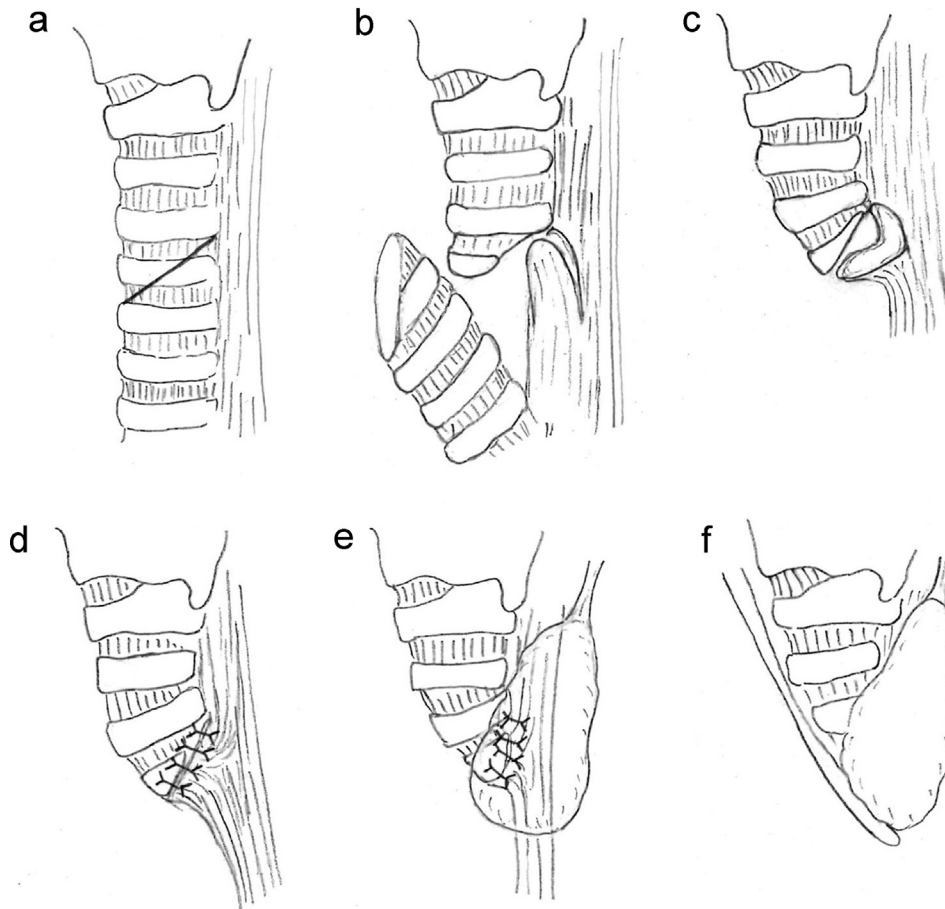


Fig. 1. Operative procedures tracheoesophageal diversion in the proximal trachea. (a) The trachea was divided obliquely after exposing the cervical esophagus posterior to it. (b) An inverse U-shaped incision was made in the anterior cervical esophagus. (c and d) The mucomuscular flap of the cervical esophagus was anastomosed to the proximal trachea reflected superiorly in an end-to-side fashion. (e and f) The anastomosis was then reinforced with the thyroid lobes and covered with the cervical inverse triangular skin flap.

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