Comprehensive Rehabilitation for Epiglottis Dysfunction Due to Cut Injury of Neck with Respiratory and Swallowing Problems

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Abstract: An interesting case was referred to the Physical Medicine and Rehabilitation (PMR) department with neglected 'vulnus scissum at the left side of the neck with exposed larynx and partially cut epiglottis'. Assessment of the patient showed epiglottis dysfunction, which caused the problem of swallowing, persistent coughing with lots of sputum, and the risk of aspiration. This was resulted in malnutrition, and prolonged hospitalization lead to deconditioning. Rehabilitation program was initiated cautiously, begun with improving the general condition, nutritional status and airway protection. Rhino-Laryngo Fiberscope (RLF) was done several times to assess the function of the epiglottis. Pulmonary rehabilitation consisted of exercise for effective coughing, airway clearance, chest wall mobilization or chest expansion and trunk flexibility. Posture training was added to achieve proper position needed for feeding. Rehabilitation of the deconditioning syndrome is also essential for functional recovery. Seven weeks of rehabilitation resulted in improvement of the general condition, including nutritional status. RLF showed a functional epiglottis, which ensured normal swallowing. This case and all its effects, required a comprehensive rehabilitation program, implemented step by step to manage all problems. At the end, the goal of medical rehabilitation in improving quality of life in this patient was achieved.

1 INTRODUCTION

Patient with injury to the anterior part of the neck bears a high risk of morbidity associated with the aerodigestive tract and vascular structure in that area (Panchappa, 2014). Due to its position which is close to the surface and therefore unprotected, the larynx is one of the most vulnerable organ in the neck area, aAnd as such is commonly injured in trauma to the neck, especially penetrating injuries. Since the larynx is a structure with essential function in both respiratory and digestive systems, it is related to high morbidity and prolonged hospitalization. Therefore, after life saving management of the emergency condition, a comprehensive rehabilitation program should be implemented for patients with injury to the larynx. After surgical repair, carefull evaluation of all functions of the larynx should be carried out, identifying existing dysfunction caused by the injury, which will be the basis to plan an appropiate rehabilitative management.

Larynx is the intersection where the processes of breathing and swallowing take place. During the swallowing process, the larynx moves upward and forward, to open the esophagus for the passage of the swallowed material. An important structure of the larynx is the epiglottis, which is essential in airway protection during pharyngeal phase of swallowing (Steele and Cichero, 2014). Epiglottis is a thin leaf-shaped cartilage functioning as a valve to protect the larynx from aspiration of food and liquids which pass the larynx to enter the esophagus (Akai, 2015). Abnormal movement and position of the epiglottis, with various etiologies from neuromuscular diseases to traumatic injury, may lead to aspiration of the respiratory system (Garon et al. 2002). Even though cases of laryngeal injury, and specifically epiglottic injury, are rare (Savinsky and Roshchin, 2006; Sritama and Sharma, 2016)), the injury will affect the function of swallowing, phonation and breathing which are essentials for daily functioning of the patient.

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In injury cases, the role of rehabilitation medicine is to optimize function and regaining quality of life after surgical repair of injury. This case report reviews the rehabilitation program for the airway and swallowing problems of a patient diagnosed with neglected 'vulnus scissum of colli sinistra with exposed larynx and partially sliced epiglottis' after surgical repair.

2 CASE DESCRIPTION

Patient, a twenty-five years old male, was referred to the PM&R department on the 15th April 2010 with diagnosis of 'Post-surgical laryngeal repair of vulnus scissum at the neck with exposed larynx'. His chief complaint was difficulty in swallowing, persistent cough with a lot of sputum and general weakness.

History of his condition showed that on 28th January 2010, his throat was cut in a homicide attempt while he was sleeping in his workplace in Palembang, a city on Sumatra, an island west of Java. His throat was exposed, but he remained conscious. He was brought to the nearest hospital in Palembang, where the wound in his neck was closed. Although the wound was closed with sutures, fluid leaked out between the sutures everytime he drank or ate.

In this condition he went back to Sukabumi, his home town located in West Java region. There he went to the local hospital, a type 'D' hospital without fascilities for surgery, neither digestive, thorax or ENT surgeons, so he was referred to Hasan Sadikin General Hospital in Bandung, 96.4 km from Sukabumi.

On 4th February 2010 he was admitted, and the first surgery was done, consisting of wound debridement, placing a tracheostomy and gastrostomy. During surgery it was found that the vocal cords and the base of epiglottis were partially cut. Two days later, ENT surgeons repaired the larynx. A nasogastric tube was inserted and nutrition administered through the NGT. Follow up using Rhino-Laryngo Fiberscope (RLF) was performed the next day and showed the presence of posteriorly-bended epiglottis and laryngeal edema. RLF was repeated after 1 week, showing that the laryngeal inlet was not covered completely by the epiglottis and the sutures in the inner part of epiglottis were exposed.

Since the patient was still in the risk of aspiration and deconditioning, rehabilitation program was designed to assist airway protection and prevent deteriorating of patient condition caused by immobilization, consisting of exercises for the epiglottis and oromotor, exercise for chest expansion, along with ROM exercises and mobilization to the upright sitting position.

Because leakage from the wound still continued, three days after the last RLF, he underwent subsequent laryngeal repair surgery followed by immobilization in cervical flexion position ('nod position'). The patient was discharged on March 19th 2010, with instructions to continue medicamentous therapy (antibiotics, analgetics) and exercises.

On 15th April 2010, the patient came to the PMR department. The wound on his neck was closed, but he still used the nasogastric tube for feeding. Patient looked weak and thin, and on questioning told that all he had was 6 glasses @ 250 cc of ensure milk, one glass of cereals and one glass of fruit juice daily. He also complained that he was not able to sleep at night because of the persisting cough with lots of secretion. Because of his inability to swallow, he also complained about excessive sputum he had to spit out. He tired easily when walking 10-15 metres, but there was no shortness of breath. For communication he used gestures because of his hoarseness.

The patient was underweight with the BMI of 14,06. Blood pressure was normal with slight increase in heart rate 130-140 beat per minute (bpm). Tracheostomy and nasogastric tube were in place, as was the unused gastrostomy. The laryngeal disruption and tracheostomy also caused dysphonia. Thorax examination showed decreased chest expansion (1/0,5/1 cm), and sputum retention all over both lungs, which explained his persisting coughing. Sputum retention in the patient might be caused by dysfunction of swallowing, aspiration and immobility and by the use of tracheostomy (Antonello et al, 2015). Manual Muscle Testing (MMT) of all four extremities showed a decrease in strength with a score of 4. Decreased muscle strength, increased heart rate and sputum retention, indicated deconditioning syndrome which affected cardiovascular and musculoskeletal system (Joyner 2008; Joyner 2012). This condition explained his complaint of fatigue (Parry and Puthucheary 2015). Initial assessment was to measure his endurance using the 6-minutes walking test (6MWT). Heart rate 170 bpm was unexpected event, but then we stopped the 6MWT. And try the next 6MWT if the heart rate below 120 bpm. Assessment of basic activity of daily living (BADL) used the Barthel Index (BI) showed a low score of 19 (Katz, 2003; Yang, 2014). Laboratory examination showed low

albumin (3,2g/dL) and low hemoglobin concentration (12,2 g/dL), and low hematocrit (37%). Although structural repair had been done, RLF showed incomplete closure of laryngeal inlet due to abnormal position and movement of the epiglottis. This structural abnormality can cause dysphagia with the threat of aspiration (Matsuo and Palmer, 2008; Halczy-Kowalik et al., 2012; Steele and Cichero, 2014).

It can be concluded that there were dysfunction of communication, phonation (hoarseness), and swallowing in this patient, were caused by the dysfunctional epiglottis, aggravated by the presence of deconditioning syndrome, malnutrition and suspicion of aspiration.

3 INTERVENTIONS

Interventions are directed to overcome disabilities and regain function. Rehabilitation program consisted of exercises to improve swallowing and respiratory function, and conditioning exercises began with Range of Motion (ROM) exercise to improve functional capacity. The patient was also given a nutritional drink as meal replacement with high-calorie and high-protein for nutritional enhancement. At the beginning, we gave supraglottic exercise to improve swallowing, but then changed to double swallowing exercise due to difficulty in doing the supraglottic exercise. Other exercise was posture training, it was also help for positioning while feeding.

Effective coughing, chest wall mobilization or chest expansion, and trunk flexibility were given to overcome respiratory problems.

Six MWT was perform to assess functional capacity of the patient.

4 OUTCOMES

During the first three weeks the wound in the neck began to heal, body weight increased 4 kg, but the coughing persisted caused by secret retention in the lungs. RLF showed an intact and posteriorly-bended epiglottis with abnormal movements. As for the general condition, signs of deconditioning still showed, with a resting heart rate of 98 bpm, respiratory rate 24 times per minute, and the score of muscle strength of the extremities was 4.

At the end of six weeks, wound healing occured along with increased body weight for as much as 5 kg, reaching a BMI of 17.58. There was improvement in sputum retention, as the patient was found to be less coughing and needing less frequent mechanical suction. The patient could speak for 5 minutes at a time although his voice was still hoarse. RLF showed that the epiglottis was erect in its position, with good movement during swallowing. General condition showed the heart rate 80 bpm, respiratory rate 18-20 times per minute, strength of lower extremities increased. Because of the improved condition, the 6MWT for endurance was done and showed a Metz of 4.40

After 7 weeks, a swallow test was done which showed an improvement, as he could swallow semisolid food. Swallow test with water was also successfull. Because this function was considered adequate, the tracheostomy and nasogastric tube were taken out at the end of the 7th week. He could speak, but his voice was still hoarse. Coughing was lessening and suction was done sparingly.

The RLF showed an erect epiglottis with upward movement and without any edema. The patient was given a home program consisting of diaphragmatic breathing and double swallow exercise until the subsequent visit in the next 2 weeks. Unfortunately the patient did not come so we could not ascertain the final condition of the patient.

5 DISCUSSIONS

Nutritional status is important in any rehabilitation program because its connection to general condition, and wound healing. Since the nutritional status was very worrying, as shown by the BMI, anemia, hypoalbuminemia, the feeding problem should be attended to in the first place before proceeding with exercises and mobilization

Improvement of nutritional status was focused on increasing caloric intake with adequate protein composition. Nasogastric tube was still preserved as the route of feeding until airway protection function of the epiglottis could be assured. For a malnourished patient with medical problems, the caloric need could be as high as 150%-200% of Basal Energy Expenditure (BEE). According to Harris-Benedict formula, the BEE of this patient was 1189,2, and so the caloric need of the patient was in the range of 1783,8 - 2675,7 kilocalories per day. The patient got his nutrition's need from nutritional drink (400 calories and 9,4 gram protein per 200 ml of serving) 5 times a day. The expected outcome was improvement in body weight, which would mean improvement of BMI.

Supraglottic exercise was chosen for this patient with epiglottic dysfunction because this technique was designed to voluntarily close the airway and prevent aspiration before and during swallowing, indicated for patients with impaired laryngeal closure (Langmore and Pisegna, 2015). Unfortunately, the patient found it difficult to do the supraglottic exercise. Therefore, double swallowing exercise was conducted to strengthen the pharyngeal muscles. This exercise will increase the efficiency of bolus passage through the aerodigestive tract and prevent aspiration. RLF was done several times during these weeks to follow the function of the epiglottis

Pulmonary rehabilitation consisted of exercise for effective coughing, because the ability to cough effectively is also one of the important criterion to be fulfilled for patients with tracheostomy to be decannulated (Antonello, 2015). To manage sputum retention and promote airway clearance, tapping and clapping of the chest wall were scheduled (Makhabah and Ambrosino, 2013). Other exercises were given for chest wall mobilization or chest expansion and trunk flexibility. Posture training to decrease his kyphotic posture to aid a proper position needed for feeding was given with visual biofeedback using a mirror (In et al., 2016)

Rehabilitation of the deconditioning syndrome is also essential for functional recovery. The effect of short-term exercise to improve physical fitness and cardiovascular response in a deconditioned patient was already proven (Shibata et al., 2012). The patient could begin ROM-exercises of all extremities, as ROM exercise has proven to have a positive effect in an immobilized patient (Matsuzaki et al., 2013). Only ROM of the neck was painfull and restricted, needing gentle exercise.

6 CONCLUSIONS

Rehabilitation program for this patient with epiglottic injury after surgical repair was divided in two phases. First we had to focus on the general condition of the patient, especially his nutritional status, while preventing aspiration. This phase resulted in improved nutritional status, which supported wound healing. Next, rehabilitation focused on the aerodigestive tract. For function of swallowing, consisted of double swallowing exercises and exercises to strengthen the epiglottis, while pulmonary rehabilitation focused on airway clearance and breathing exercises.

At the end of the 7th week, the patient was released from the rehabilitation program after resuming normal and safe swallowing and removal of the tracheostomy and nasogastric tube.

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