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Application Problems and Countermeasures of External Diaphragm Pacer in Elderly Patients with Lung Cancer after Surgery

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Abstract

This article summarized the nursing problems and corresponding nursing strategies of 18 cases of external diaphragm pacemakers in the application of elderly patients with lung cancer after thoracic surgery. Timely psychological care, correct operation, close observation and infection prevention during treatment can effectively optimize the use of external diaphragm pacemakers, improve respiratory muscle function, and the quality of life after lung cancer surgery in elderly patients.

Keywords

External Diaphragm Pacemaker, Pulmonary Rehabilitation, Lung Cancer Surgery, Nursing Problems, Countermeasures

1. Introduction

Lung cancer is a malignant tumor with the highest incidence and mortality in China [1], which occurs most frequently between the ages of 40 - 70 [2], and about 68% of patients develop it after the age of 65; the elderly patients with lung cancer have become a common population for thoracic tumor treatment. Due to organ failure and low physiological function in the elderly, and chronic diseases such as hypertension, coronary atherosclerotic heart disease, and chronic obstructive pulmonary disease are often complicated before surgery, the tolerance to surgery is poor; what's worse, the incidence of postoperative complications such as pulmonary infection, pulmonary atelectasis, and hypoxemia is also high due to the resection of pulmonary and the loss of pulmonary function and di-

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aphragm function after surgery [3]. Many factors make the prognosis and quality of life of elderly patients with lung cancer not optimistic. Therefore, for elderly patients with lung cancer after surgery, how to improve their respiratory function, promote lung rehabilitation, improve their life quality and ensure patient safety at the same time is an urgent problem to be solved.

Diaphragm pacing is a technique that through a functionally electrical stimulation to the phrenic nerve, regularly contract and diastole the phrenic nerve, increase diaphragm mobility, maintains natural negative pressure breathing in patients with diaphragm dysfunction, improve lung ventilation function and gradually restore the diaphragmatic function of patients [4]. According to the electrode placement position, it can be divided into the implanted diaphragm pacer (IDP) and the external diaphragm pacer (EDP) [5]. Due to its advantages of being non-invasive, simple and reliable, being able to effectively improve ventilation, good patient compliance, good feasibility and applicability, EDP has been widely used in patients with COPD, intractable hiccups, cerebral hemorrhage, cerebral stroke and paraplegia [6] [7] [8] [9] [10], and the treatment effect is pretty good. The department adheres to the indications of the EDP and applies it to elderly patients with lung cancer surgery in order to improve lung ventilation, improve exercise tolerance, reduce pulmonary infection, and assist expectoration. However, in the process of clinical nursing, there are also problems such as bad mood in patients, inaccurate operation positioning, and poor fixation of electrode patches. The nursing problems and application countermeasures are summarized as follows.

2. Method

2.1. Study and Sample

The lung cancer patients' eligibility criteria were as follows: 1) diagnosis of lung cancer through pathological examination in patients who underwent surgery, 2) aged 18 years or older, 3) alert and able to understand/speak Mandarin or Cantonese, 4) willing to participate in this study. The exclusion criteria were: 1) diagnosis of other types of cancer, 2) alcohol or drug abuse, 3) having a mental disease; and 4) at the end of life or being discharged to a care facility for the elderly.

A total of 60 elderly patients with lung cancer after surgery who were admitted to the Department of Thoracic Surgery, Sun Yat-sen University Cancer Center from May 2020 to July 2020 were selected, including 38 males and 22 females, with an age range of 65 - 74 and an average age of 68. 45 patients were treated with surgery alone, and 15 patients were treated with neoadjuvant radiotherapy and chemoradiotherapy combined with surgery.

2.2. Application of EDP and the Observation of Outcomes

All 60 patients had different degrees of pulmonary insufficiency, chest tightness, shortness of breath, cough, expectoration and other symptoms. After discussing

with the doctor and obtaining the consent of the patient, an external diaphragm pacer (Guangzhou Arahelio Biotechnology Co., Ltd.) was used for continuous treatment for 2 weeks. The pulse was adjusted to 40 Hz, the number of pacing times was 9 times/min, the stimulation intensity was gradually increased from 7 units to the range that the patient could tolerate, each time lasted 20 minutes, 2 times/d, and during the treatment, the patient's vital signs were closely observed. Pulmonary function tests, including PaO_2, $PaCO_2$, PaO_2/FiO_2, FEV1/FVC, FEV1, and dyspnea score (MMRC), were performed on the patients before the treatment and after two weeks of treatment.

2.3. Result of the Application of EDP

After 2 weeks of treatment, PaO_2, $PaCO_2$, PaO_2/FiO_2, FEV1/FVC, and FEV1 were all improved in 60 patients, and the differences were statistically significant ($P < 0.05$). The MMRC score was higher than that before the treatment ($\chi^2 = 4.50$, $P < 0.05$).

3. Discussion—the Problems and Countermeasures during the Application of EDP

3.1. Psychological Problems and Nursing before the Treatment

Because the patients in the first-time treatment have doubts about the external diaphragm pacer, most patients will be nervous and anxious; especially the elderly patients with lung cancer who are more psychologically vulnerable to lacking access to relevant knowledge. All the patients in this study indicated that they were completely unaware of the external diaphragm pacer, and 83.3% of the patients felt nervous. We took three approaches to relieve nervous mood: 1) Before the treatment, introduce the working principle and advantages of the external diaphragm pacer to the patient, and inform the patient in advance that it will occur vibration, formication, numbness and pressure when using it, it will increase the frequency of coughing and expectoration, and it may add the patient's pain, so as to make the patient make prepare psychologically in advance; 2) Communication with peers, inviting patients who have successfully treated by the external diaphragm pacer to speak out; 3) Teach the patient to take deep inspiration and pursed lip breathing to make preparation. When using it for the first time, use the manual button to stimulate several times in advance so that the patient can gradually adapt.

3.2. Operation Problems and Nursing during the Treatment

3.2.1. The Electrode Is Easy to Loosen

Inform the patient not to use skin care products where the electrodes are attached, clean the patch site before use, wipe it with an alcohol cotton ball, wait for 1 - 2 minutes, and then start the patch after the alcohol and water have fully volatilized. Keep the electrode clean. It will affect the viscosity and use effect when there is dust on the viscose surface of the electrode, which the new elec-

trode should be replaced in time. Inform the patient to remove the protective film before use, keep it properly, and stick it back after use. After the treatment, the electrodes should be stuck back to the transparent film in time. Do not stick the two electrodes together without the protective film. Otherwise, it will affect the next use of the electrodes and affect the treatment effect.

3.2.2. The Electrode Patch and Skin Have Bad Contact

For particularly thin patients whose annular clavicle is concave-convex obviously, it is difficult for the electrode to fully fit the skin, which adhesive tapes should be used to fix the small electrode. In this study, there was 1 patient with a BMI < 18.5 and a thin body. After fixing the electrode with adhesive tape, the effect was good.

3.2.3. Electrode Position Is Not Accurate

The electrodes are attached to the patient as instructed, and the two small electrodes are negative and attached to the 1/3 under the lateral border of the sternocleidomastoid on both sides of the neck respectively. The small electrode should be stuck along the "road", the midpoint of the medial border of the small electrode should be aligned with the core point and stuck about 3 mm on the muscle along the shape of the muscle. Because the muscle is oblique inward, the two small electrodes should be in a "V" shape. If the orientation of the two electrodes is vertical, it may stimulate the internal carotid sinus. The large electrode should be attached to the patient's Feishu. In order to prevent position deviation, it should be operated by a special person as much as possible, and the initial position should be marked with the surgical pen. If the patient has symptoms such as shrug, blurred vision, generalized muscular weakness and other adverse reactions during the treatment, meaning the positioning is inaccurate, we should turn off the pacer immediately, remove the electrodes, assist the patient in lying down on the bed, and then reposition after half an hour.

3.2.4. Patients Are Easy to Feel Pain

Due to the reasons for the survey itself of patients with lung cancer and the decline of the physiological function of the elderly, some patients feel severe pain after surgery. In view of this situation, we should instruct patients to take a comfortable position, try to keep quiet and relax, reduce speech, head turning and other behaviors during the treatment to prevent the loosening of the electrodes from affecting the treatment effect or prevent local current from causing strong stimulation and pain; We can also instruct patients to distract themselves by listening to music, watching TV, or chatting. In addition, if patients with lung cancer after surgery often use painkillers, we can choose to treat them half an hour to an hour after the patients take painkillers to relieve the pain.

3.2.5. Internal Jugular CVC Affects the Normal Use of EDP

The indwelling internal jugular CVC is routinely used in patients with lung cancer after surgery, which affects the use of EDP. If only one side is treated, the

treatment effect is much worse than that of the two sides, and when the electrical stimulation is concentrated on one side, the patient will feel more numbness, which will add to the patient's pain. Therefore, indwelling clavicle CVC can be preferred without affecting the surgery and treatment in consultation with the anesthesiologist before surgery.

3.3. Prevent the Cross Infection

Each patient should use their own electrode and cannot mix with each other to avoid cross infection. And the machine should be fixed as far as possible in the case of sufficient EDP.

4. Conclusion

External diaphragm pacing technology is an effective method for assisting breathing. It is simple and safe, and has a great significance for removing sputum in patients, improving pulmonary function, enhancing patients' activities of daily living, and enhancing clinical treatment effects [11]. With the popularization of the fast track surgery (FTS) concept, patients are more and more advised to get out of bed as soon as possible, improve their activity of daily living, and shorten their hospital stay. The application of an external diaphragm pacer can help elderly patients with lung cancer after surgery to recover sooner, and it will become more and more common in elderly patients with lung cancer. By taking mental nursing before treatment and comprehensive nursing measures for various operational problems during treatment, this study pays attention to every detail so as to ensure the treatment effect of external diaphragm pacer, promote the rapid rehabilitation process, and ultimately improve the quality of life of patients, which can be used for reference and promotion. However, this study has certain shortcomings; that is, the sample size is relatively small and there is no control. It is hoped that more rigorous randomized controlled trials will be implemented in future research, and the sample size will be increased to provide a more comprehensive basis for the results.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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