Development of a reflex cough test equipment

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Abstract

Introduction: The risk factors of the aspiration pneumonia include silent aspiration caused by advanced age, cerebral stroke, and neuromuscular disorders. It has been reported that the reflex cough test using tartaric acid is useful for the detection of silent aspiration. To assess the risk of aspiration pneumonia, the power of cough as well as the reflex cough test was needed. Method: We developed new testing equipment that could easily measure the cough reflex and the power of the cough simultaneously. This equipment consists of a special pipe with double lumen, ultrasonic nebulizer, electronic spirometer, and mouthpiece. The solution used was a 20% solution of prescription-grade L-tartaric acid to initiate the cough reflex. The solution is placed in the ultrasonic nebulizer and inhaled as a micro aerosol. The mouthpiece was asked to take the mouthpiece and take an inhalation. Induced cough flew through the pipe and peak cough flow was measured by the spirometer. Result: The average time to cough reflex was 1.0sec in healthy subjects (normal) and 24sec in the patient with a history of the aspiration pneumonia more than two times (abnormal). The average peak cough flow was 4.25ml/sec in normal and 0.37ml/sec in abnormal. The time to cough reflex and peak cough flow showed a significant difference between two groups. Conclusion: This equipment can easily measure the cough reflex and the power of the involuntary cough simultaneously, and assess the risk of the aspiration pneumonia. This is the first system that can measure the power of involuntary cough.

Introduction

- The risk factors for aspiration pneumonia include silent aspiration caused by advanced age, cerebral stroke, and neuromuscular disorders. It has been reported that the reflex cough test using tartaric acid is useful for the detection of silent aspiration.
- To assess the risk of aspiration pneumonia, accurate assessment of cough power as well as cough reflex is required.
- The original method of reflex cough testing is problematic due to the subjective assessment of cough power.

Object

- To measure the time until the cough reflex and the power of the cough (peak cough flow: PCF) easily and simultaneously in a short time.
- To accurately quantify the power of the involuntary cough.
- To attain these objectives, we developed new testing equipment and a new examination method. We named this examination the protective airway reflex test (PART).

Method

- 1. Nasal clip is placed on the subject’s nose to prevent the air leaking from the nose.
- 2. 20% tartaric acid is delivered from the nebulizer in the form of an aerosol.
- 3. The subject is instructed to hold the mouthpiece firmly in the mouth and breathe deeply.
- 4. The time until the cough reflex and the peak cough flow were measured using the spirometer.

Examination procedure (PART)

- Group A: healthy adult person (control)
- Group B: Patients with a history of aspiration pneumonia
- Group C: Patients without a history of aspiration pneumonia

Groups A, B and C were tested as described (the Examination Procedure (PART)). The peak cough flow (PCF) and the time until cough reflex were measured.

Advantage

This equipment can:
- quantify the strength of the cough
- measure cough reflex (perception) and the strength of the cough simultaneously in a short time
- measure involuntary coughs
- be sterilized

Conclusions

- Silent aspiration is an important risk factor for aspiration pneumonia, but it is difficult to detect the silent aspiration with traditional screening examination methods.
- With PART, the cough reflex and power of involuntary coughs can be measured easily and simultaneously, and the risk of aspiration pneumonia assessed accurately. This is also the first system for measuring the power of involuntary coughs.
- This equipment and the associated procedure may be in high demand at welfare institutions that have many patients with characteristics associated with risk of silent aspiration.
- The relationship between the risk of aspiration pneumonia and the data obtained from examination with this equipment needs to be needs to be determined and validated.
- It is hoped this equipment can be miniaturized and simplified for use without assistance by any medical staff members.

References