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Original Contributions

THE USE OF END-TIDAL CAPNOGRAPHY TO MONITOR NON-INTUBATED PATIENTS PRESENTING WITH ACUTE EXACERBATION OF ASTHMA IN THE EMERGENCY DEPARTMENT

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INTRODUCTION

- Capnography comprises the continuous analysis and recording of carbon dioxide (CO2) concentrations in respiratory gases.
- This allows for visual inspection of changes in CO2 concentrations by means of a waveform display

- capnography is now used in Emergency Medicine
  - Confirm endotracheal tube placement
  - Monitor ventilatory status
  - Monitor ventilation of patients during sedation
  - Evaluate ventilator settings
  - Assess cardiopulmonary resuscitation
  - Early detection of changes in airway resistance and circulatory collapse

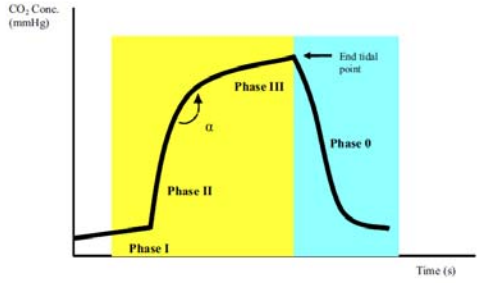


Figure 1. The single breath capnographic waveform.

The slope and plateau lines together would create an obtuse angle, and this we referred to as “angle alpha”

- In asthma, airway obstruction causes regional decreases in airflow and alveolar ventilation.
- On the capnogram, this causes deformation of the normal curve.

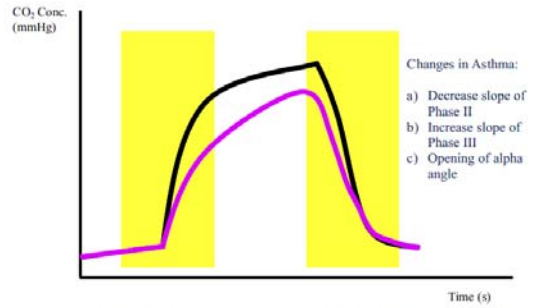


Figure 2. The capnographic waveform: changes in asthma.

TARGET

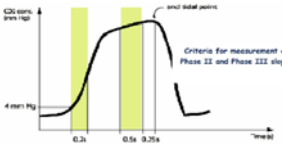
- Record and analyze the expiratory capnographic waveform for acute asthma patient in ER
- Analyze the changes in the capnographic waveform after treatment

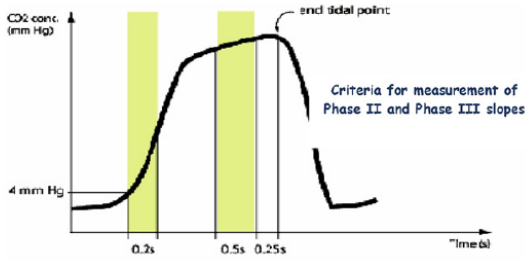
METHODS

- A prospective case series study
- This study was conducted in the ED of Hospital Universiti Sains Malaysia in Kubang Kerian, Malaysia.
- The patients selected were initially examined clinically by ED and were managed as departmental protocols
- The decision to treat by the attending doctor was not influenced by the researcher

DATA COLLECTION AND PROCESSING

- We decided to study the slope of Phase II as measured for 0.25 s from the first point when the measured CO2 rises above 4 mm Hg
- The slope of Phase III as measured for 0.75 s to 0.25 s (total time 0.5 s) from the end-tidal peak to ensure the consistency of points of measurement.





RESULTS

- A total of 36 patients were initially enrolled in this study
- Four patients were eliminated from the study due to inability to analyze their capnographic records
- Two other patients were excluded due to missing or incomplete data.

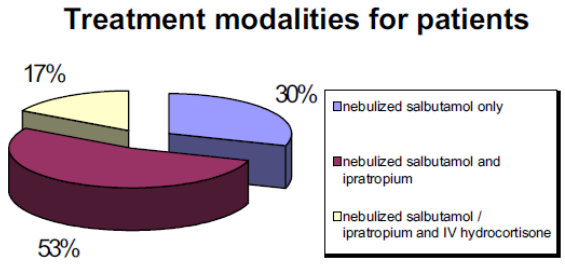


Figure 4. Treatment modalities for patients in the study population.

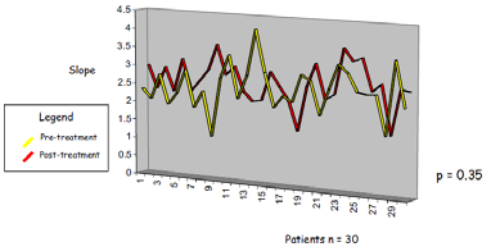


Figure 5. Phase II changes pre-treatment and post-treatment.

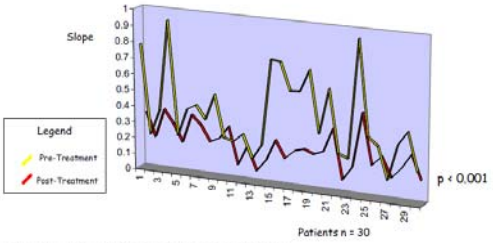


Figure 6. Phase III slope changes pre-treatment and post-treatment.

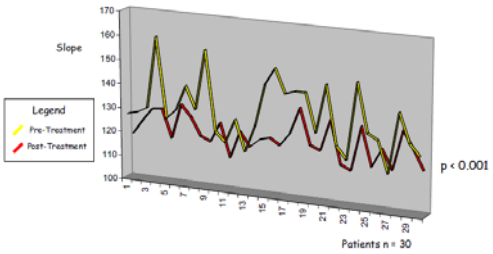


Figure 7. Alpha angle (Q) changes pre-treatment and post-treatment.

DISCUSSION

- Most doctors rely on the presence of breathlessness and an expiratory wheeze to diagnose a patient with an acute attack of asthma
- Improvement being defined as improvement of symptoms and absence of wheeze

- FEV1 or FEV1/forced vital capacity (FVC) could reflects the smaller airways.
- FEV1 and FEV1/FVC are technically difficult to perform within the ED and involve cumbersome equipment.
- The capnographic waveform shows changes in bronchospasm that reflect the heterogeneity of the expired air.

- Phase II slopes did not show any significant change pre-treatment vs. post-treatment (*p* 0.35).
- This may be due in part to the mistaken selection of the point of 4 mm Hg
- Dependent on the end-tidal carbon dioxide level and the respiratory rate

- Capnography has the added advantage of providing a more objective evaluation of the patients' condition, an evaluation less influenced by patient factors

LIMITATIONS

- The study population was small
- Distributions with respect to age and sex were not noted
- There was a selection bias

CONCLUSION

- The study showed that capnographic waveform indices can indicate improvements in airway diameter in acute asthma at ED
- The production of a suitable algorithm, perhaps followed later by the development of capnometers