A CLINICAL MANAGEMENT CENTRE VALUE IN TRIAGE OF COPD TELEMONITORING PATIENTS

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Abstract

Telemonitoring is the systematic collection of clinical data from the patient's home and its examination by a healthcare team. Chronic obstructive pulmonary disease COPD exacerbations contribute to disease progression and worse prognosis. Aim: to determine the benefits achieved by early detection of acute exacerbations of COPD (AECOPD) by telemonitoring, describing the experience of a specialised clinical management centre (CMC) which triaged the received alerts, confirmed the AECOPD, stratified them according to their level of severity and notified the doctors. Methods: 15 male COPD patients, all "C" and "D" GOLD groups were monitored of spO_2, heart rate, blood pressure and skin temperature. For each patient, individual clinical alert thresholds were defined and calculated. Clinical alerts resulted in the CMC phoning the patient, completing a clinical questionnaire and confirming the presence of AECOPD and stratifying its severity. Only true positives were referred to a doctor. Results: During 18 months, 1,137 clinical alerts were detected but only 4.3% were true positives. Of these, 55.1% were level I, 36.7% level II and 8.2% level III. Conclusion: The study demonstrates the essential role of a clinical management centre in identifying, categorising and appropriately acting upon only real alerts to ensure that patients with AECOPD receive the right treatment as quickly and efficiently as possible.

Keywords: telemonitoring; COPD; clinical management centre

Introduction

Chronic Obstructive Pulmonary Disease (COPD) is currently the fourth leading cause of death in the world but is projected to become the third by 2020. It is a chronic disease characterised by respiratory symptoms and airflow limitation due to airway and/or alveolar abnormalities. Chronic inflammation results in structural changes, narrowing of the small airways and parenchymal destruction. Acute exacerbations of COPD (AECOPD) are common and are defined as an acute event characterised by a worsening of the patient's respiratory symptoms that is beyond normal day-to-day variations and leads to a change in medication. epeated AECOPDs contribute considerably to disease progression, a worsening prognosis and even death. Early detection and treatment of AECOPD may minimise the severity of the episode and prevent or minimise sequelae.[1]

Telemonitoring is the systematic collection of vital signs and symptomatic data from the patient's home and its examination by healthcare professionals may enable earlier identification and treatment of AECOPD (before the onset of severe clinical deterioration), thus reducing the severity of the acute episode (e.g. as measured by mortality, morbidity, treatment intensity, emergency attendance/hospitalisation rates or duration), frequency of repeat episodes and longer term deterioration.[2]

The use of telemonitoring has been increasing in a broad range of clinical conditions ranging from heart failure to the management of chronic respiratory disease.[2-4] It is particularly valuable for patients who live in remote and rural areas

because the daily collection and real time appraisal of clinical information mitigates geographic/social access to care issues and permits the faster identification of clinical events and provision of appropriate care.[2,5]

The aim of this study was to determine the benefits achieved, if any, by an early detection of AECOPD by telemonitoring, describing the experience of a specialised clinical management centre (CMC) composed of a multidisciplinary healthcare professional team (allied respiratory physiologists, nurses and pharmacists), which triaged the received alerts, confirmed the AECOPD, stratified them according to their level of severity and notified the doctors.

Methods

Fifteen male COPD patients, all "C" and "D" GOLD groups[1] were monitored over a period of 18 months. Patients had a mean age of 69±3.9 years and lived in Alentejo, a rural region of south-central and southern Portugal. Prior to inclusion to the telemonitoring, all patients had been confirmed to be in a stable condition.

At the onset of the study (April 2014), telemonitoring devices and a tablet hub (Samsung Tab 10®) were delivered to each patient and a healthcare professional trained and instructed the patients on their correct use, and confirmed their (or their caregivers) competence. Once set up, the system allowed patients to remotely measure and transmit the following vital signs: spO_2, heart rate, blood pressure and skin temperature. Measurements were taken on a once daily in the morning, following consumption of their usual medication including home oxygen therapy (if applicable) and after 20 minutes at rest. The data were transmitted by bluetooth to the tablet and the measurements were received via GSM/3G, assessed, prioritised and followed-up by CMC's team using dedicated software (Vitalmobile®, Ultraponto, Portugal).

For each patient, individual clinical alert thresholds were defined and calculated from the average of the first three measurements. If the condition of the patients changed (e.g. oxygen therapy implementation), thresholds were recalculated. A clinical alert was defined as occurring when at least one vital sign reading was confirmed to be above or below the calculated threshold for the patient ($\downarrow spO_2 \geq 3\%$ of basal; $\uparrow BP \geq 15$mmHg of basal; $45bpm \leq HR > 100bpm$; temperature > 37ºC). Clinical alerts resulted in the CMC telephoning the patient the same day and using a standardised questionnaire to evaluate symptoms and their severity. Evaluation of the patient's reported symptoms and other clinical criteria (more than two affirmative answers to five questions) resulted in a presumptive diagnosis of an AECOPD. For the purposes of appropriate management and onward referral, AECOPD was further categorised as being level I, II or III depending on the extent of deviation of vital signs from thresholds and the answers to the clinical questionnaire:

- Level I – remote therapy optimisation; telephone follow-up with patient after 48 hours.
- Level II – doctor appointment scheduled for the next 24 hours
- Level III – direct referral to emergency department of a hospital.

In all scenarios the responsible physician was contacted by phone call by CMC's team.

If a technical alert was detected, defined as the absence of at least one of the four measurements, the patient was contacted by phone to confirm measurement values and provide remote problem solving support or home assistance.

Results and Discussion

During 18 months of follow-up, our team recorded 31,615 measurements. 2,339 alerts were generated of which 1,137 (48.6%) were clinical alerts and 1,202 (51.4%) were technical alerts. The patients were compliant with the daily monitoring frequency, with only 4.4% (53) of technical alerts due to demotivation.

Alerts caused by misuse of the technology platform decreased throughout the study period, reflecting patient competence improvement in managing the home based components of the system throughout the time.

After clinical triage by the CMC, only 4.3% (49) of "clinical alerts" were confirmed as true clinical alerts (i.e. presumptive AECOPD). Of these,

27 (55.1%) were level I, 18 (36.7%) were level II and 4 (8.2%) were level III.

Advanced COPD is one of the most common reasons for patients to be referred for home health care (the provision of clinical services and equipment that enable patients to stay in their homes). The general goals of home care for these patients are to increase survival, decrease morbidity, improve function and quality of life, support independence and self-management and encourage positive health behaviours. In most situations, family members will provide the majority of direct patient care.[6]

Despite this support, advanced COPD remains a complex disease that ideally requires management by a multidisciplinary health team. Within this context, telemonitoring of vital signs, effective assessment of alerts and subsequent triage of exacerbations by healthcare professionals should contribute to improving the timeliness and effectiveness of medical interventions.[3] The importance of caregivers should not be underestimated in telemonitoring as they become the prime partner with CMC's clinical team in ensuring adherence to therapy, care routines, daily vital signs collection and the detection/resolution of technical issues.

Numerous telemonitoring approaches have been used in COPD, often to reduce the use of health resources associated with AECOPD,[2,3,5] however shifting the paradigm of care from acute rescue to proactive management and prevention requires models that effectively integrate CMC review and referral to a physician.[2,6] Although the results of COPD telemonitoring programmes do not show a significant effect,[1] improvements in patient symptom identification, disease knowledge and self-management and adoption of healthy behaviours are much more consistently seen.[1,5]

In our study, the most common clinical alert was the decrease in average spO_2, which occurred in 78% of level II exacerbations and 100% of level III. This reflects the hypoxaemia and altered ventilator drive often seen in AECOPD. During AECOPD, expiratory flow limitation causes increasing dynamic hyperinflation and contributes to the syndrome of neuromechanical dissociation (which has been implicated in the development of dyspnoea), deteriorating gas exchange, mechanical disadvantage and right ventricular dysfunction, which may precipitate left ventricular diastolic dysfunction.[7] We are currently analysing the data to establish if other vital signs are useful in earlier detection of AECOPD. Respiratory rate is known to increase at least 48 hours before AECOPD,[8] and the exacerbation may precipitate or worsen dysrhythmias (usually atrial fibrillation) leading to acute decompensation and poor outcomes especially in the elderly cohort of patients managed by telemonitoring programmes.[9]

Conclusion

The present study shows that only a modest proportion of vital signs deviations beyond threshold values are associated with AECOPD, however these can, with the aid of a clinical triage service in close contact with the patients, be reliably identified and promptly acted upon. The study clearly demonstrates the essential role of a clinical management centre in identifying, categorising and appropriately acting upon only real alerts to ensure that patients with AECOPD receive the right treatment as quickly and efficiently as possible. Effective triage of the alerts and patients is best performed by specialised units with healthcare professionals with high technology/coaching skills and patient familiarity dedicated to the task. Further analysis to fine tune individual alert thresholds is being considered for the future, as is the integration of other vital signs that could improve the sensitivity, specificity and lead times for identifying AECOPD. Also further studies on the quantification of disease exacerbations, hospital admissions and health costs with these patients may reveal additional benefits achieved by the telemonitoring and clinical triage of COPD patients.

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