Inadvertent endobronchial intubation: A sentinel event

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A B S T R A C T

Background: Unintentional bronchial intubation may result in serious complications such as lung collapse or pneumothorax. These complications amount to sentinel events should be reported, and a hospital sentinel event policy should be implemented, including corrective actions to prevent recurrence. Methods: A 12-month prospective observational study in a multidisciplinary adult intensive care unit (ICU) to estimate the frequency of inadvertent bronchial intubation and its major sequels in intubated patients admitted to the unit. Complications will be reported as sentinel events attracting investigation by root cause analysis method, action plan, and follow-up. Results: There were 36 (12.9%) cases of inadvertent bronchial intubations in 279 orally-intubated patients admitted to the ICU during the study period (1.5.2010 - 30.4.2011), 2 (0.7%) of them already developed total left lung collapse. The hospital sentinel event policy was activated followed by action plan, which included raising the awareness of the problem, presentations, and regular checking on the position of the tube following tracheal intubation at different location in the hospital. Conclusion: Early detection and correction of endobronchial intubation will prevent complications developing. Applying sentinel event policy on complications of inadvertent bronchial intubation will encourage finding permanent solution to an old and preventable problem. Anesthetic and resuscitative regulatory bodies should incorporate methods of checking on correct position of tracheal tubes in their training programs. Knowing that the tube may advance into a bronchus, they should insist on regular checking of the tube in a manner similar to monitoring patient’s vital signs.

Key words: Endobronchial, intubation, sentinel event

INTRODUCTION

Tracheal intubation is carried out routinely in anesthetic, critical care and emergency practice by clinicians and paramedics with different levels of experience in airway management. Inadvertent placement of the tracheal tube in the mainstem bronchus may result in serious complications, such as atelectasis and hypoxemia, hyperinflation and barotrauma of the ventilated lung with possible development of pneumothorax.[1] The pneumothorax will be of the life-threatening tension type if the patient is receiving positive pressure ventilation. The incidence of unintentional bronchial intubation varies depending on the experience of the operator, and ranges between 3.7%[2] and 10.7%.[3] In intensive care setting, accidental endobronchial intubation occurs in about 5%,[4] 28% of them following cardiac arrest.[5] Furthermore, bronchial intubation accounts for 2% of adverse respiratory claims in adults and 4% in children.[6,][7]

A sentinel event is an unexpected occurrence to a patient involving death or serious physical or psychological injury. Such events are called “sentinel” because they signal the need for immediate investigation and response.[8]

Inadvertent endobronchial intubation complicated by atelectasis of the non-ventilated lung warrants immediate investigation to trace the cause and to work towards prevention of its recurrence. A hospital sentinel event policy deals with such problem.

METHODS

Our 20-bedded adult multidisciplinary intensive care unit (ICU) admits critically ill patients from different sources
including operating and emergency rooms, hospital wards, and referrals from other health facilities in the region. Only orally intubated patients were included in this prospective study, which lasted 12 months. The study was also part of preparation of the hospital for accreditation by quality accrediting organization. Approval of hospital ethics and research committee was obtained for the study.

Assessment of patients takes place routinely once admitted into the ICU, including chest radiography. Checking on the proper position of the tip of the tracheal tube above the carina, clinically by auscultation and radiographically by chest X-ray, is part of the assessment. Checking and adjustment of the tracheal tube continue on regular basis as long as the patient remains intubated. Any degree of radiological signs of atelectatic changes in the lungs are noted and correlated with the position of the tube and compared with the pre-intubation chest radiograph.

RESULTS

During the period from 1.5.2010 to 30.4.2011, there were 336 critically ill adult patients admitted to the ICU at Armed Forces Hospital, Southern Region, Saudi Arabia; 279 of them were orally intubated. Results of initial checking on the position of the tracheal tube on admission are shown in Table 1. There were a total of 36 cases of endobronchial intubation. In all of them, the tip of the tracheal tube was in the right main bronchus, and in all of them, readjustment of the tracheal tube took place at the time of an initial assessment. 2 mechanically-ventilated cases of them showed radiological signs of complete opacity of the left lung. The first case was admitted from the hospital operating room following emergency laparotomy, and the opacity was cleared within 3 hours of positive pressure ventilation, adjustment of tracheal tube, and bronchial suction. Patient discharged to the ward after 12 hrs stay in the ICU. The second patient was brought to the emergency room in sickle cell crisis, including bilateral chest infiltrates. While awaiting transfer to the ICU, the patient’s respiratory condition deteriorated and was intubated and mechanically ventilated. On admission to the ICU, the tube was well-advanced in the right main bronchus with total collapse of the left lung [Figure 1]. Following correction of the tracheal tube’s position and respiratory therapy, the lung took 10 hrs to expand while the bilateral chest infiltrates remained.

In both cases, a sentinel event policy was implemented. Families were informed about the reasons for admission to the ICU. A Sentinel Event Form was completed, and copies were sent to administration (hospital and medical) and to the Hospital’s Department of Quality Improvement and Patient Safety (CQI and PS). A Root Cause Analysis (RCA) was initiated and was completed in 2 days. Documents were kept in patients’ files, lodged with administration, and in a special file in CQI & PS Department. Recommendations were distributed to concerned departments, and their staff members attended a presentation on the subject. Twice follow-up clinical audit was conducted, which proved substantial compliance with recommendations.

DISCUSSION

Sentinel events are relatively infrequent events but result in unnecessary outcomes for patients and families, and for the hospital. Occurring independently of a patient’s condition, they commonly reflect hospital system and process deficiencies. Sentinel events - unexpected occurrences that result in death or serious physical or psychological injury, or the risk of their later occurrence - can happen anywhere along the healthcare continuum, in any setting. Statistics from the Joint Commission on Accreditation of Healthcare Organizations (JCAHO) of USA, however, show that 68% occur in general hospitals and another

| Source of admission | Total no. of patients admitted | No. of orally intubated patients | No. with bronchial intubation (% of total intubated) | No. with lung collapse |
|---------------------|-------------------------------|---------------------------------|---------------------------------------------------|-----------------------|
| Emergency room      | 128                           | 113                             | 14 (5)                                            | 1                     |
| Wards               | 53                            | 42                              | 5 (1.8)                                           | _                     |
| Operating room      | 127                           | 101                             | 11 (3.9)                                          | 1                     |
| Transferred         | 28                            | 23                              | 6 (2.1)                                           | _                     |
| Total admission     | 336                           | 279                             | 36 (12.9)                                         | 2 (0.7%)              |

Figure 1: Tracheal tube well advanced in right main bronchus with total left lung collapse (Case 2)
11% occur in psychiatric hospitals. JCAHO tracked the sentinel events they reviewed from 2004 to end of 2010 and found that the most commonly reported sentinel events for the year 2010 were unintended retention of foreign body; delay in treatment; wrong-patient, site, or procedure; operative/postoperative complications; patient suicide – in that order. Of the total number of cases reviewed, 61.8% resulted in the death of the patient and 9.4% cases resulted in loss of function.[10]

Standards related to quality and safety requires healthcare organization to establish which unanticipated events are significant and the process for their intense analysis.[8] JCAHO periodically adds more events to the definition of its reviewable list. Some healthcare authorities consider subjecting a near-miss sentinel event to the same processes as an actual event.[9] The availability of a comprehensive sentinel events policy has certain positive goals to achieve. First, to improve patient care and safety, management, and prevention of future occurrence of the event. Second, by investigating the circumstances of the event, it is possible to understand the causes of the underlying problem. This should naturally lead to changes in the organization’s systems and processes to reduce the probability of such an event in the future. Thirdly, it maintains the confidence of the public in the healthcare system as a whole. An appropriate response includes conducting a timely, thorough, and credible RCA, being the preferred approach to health care incident investigation; developing an action plan designed to implement improvements to reduce risk; implementing the improvements; and monitoring the effectiveness of those improvements.[8] The presence and implementation of sentinel events policy is believed to result in reduction of sentinel events due to examining the settings in which they occur and identifying system changes needed.

RCA is a process for identifying the basis or causal factors that result in change in performance, including the occurrence or possible occurrence of a sentinel event. It focuses primarily on systems and processes, not on individual performance. The result of RCA is an action plan to be implemented in order to reduce or prevent the risk of similar events occurring in the future. The plan should address responsibility for implementation, oversight, pilot testing as appropriate, time lines, and strategies for measuring the effectiveness of the actions. We frequently utilize Deming’s PDCA (Plan-Do-Check-Act) cycle when applying action plans.[11]

RCA has certain limitations. Although it is a structured approach to investigation, using tried and tested principles from industry, it is unlikely to be a panacea for all of the problem linked with serious incident inquiries.[12] Its value has not been confirmed in carefully conducted clinical trials in a healthcare environment, does not always lead to root cause identification when the cause is unknown, and the inability of the method to distinguish between causal factors and root causes.[13]

The specialty of anesthesia has been acknowledged as the leading medical specialty in addressing patient safety.[14-16] The problem of unintentional endobronchial intubation is as old as the time of introducing tracheal intubation in anesthetic clinical practice. All anesthetists, and many non-anesthetists, are aware of the problem and the available methods of its avoidance. Recognizing collapse of a lung, resulting from inadvertent bronchial intubation, as a sentinel event, and the subsequent utilization of the RCA process, are likely to send a clear signal to the anesthetic profession that it is long overdue solving the problem of unintentional bronchial intubation. Training on methods of confirmation of tracheal tube's position should include also all those involved in emergency intubation. Sustaining a culture of safety and promoting continual performance improvement can help prevent adverse outcomes.

CONCLUSION

Applying sentinel event policy on complications of inadvertent bronchial intubation will encourage finding permanent solution to an old and preventable problem. Anesthetic and resuscitative regulatory bodies should incorporate methods of checking on correct position of tracheal tubes in their training programs. Knowing that the tube frequently advances into a bronchus, they should insist on regular checking of the tube in a manner similar to monitoring patient’s vital signs.

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