

Accidental Extubations during Respiratory Management in a Children's Hospital

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An investigation was conducted on the frequency of accidental extubations at Shizuoka Children's Hospital during the past 12 years. The study was performed on 150 randomly selected patients who received respiratory support for more than 24 hr. Fifteen accidental extubations occurred in 9 patients. Most of them (87%) occurred in the neonatal intensive care unit (NICU), and the rate was 1 per 54 days of intubation. The time at which these accidents happened varied, although they were more common during the day-time. The reasons of accidental extubation could not be specified in two-thirds of the cases. It became clear that more immature babies were more likely to suffer accidental extubation, perhaps reflecting the fact that most of the immature babies in the NICU were intubated orally, and that a larger proportion of them required a longer period of respiratory support. Therefore, early weaning from respiratory support is recommended if it is possible.

In conclusion, increased surveillance and more secure methods of taping of endotracheal tubes are crucial for preventing life-threatening accidental extubations during respiratory support. (Key words: accidental extubation, pediatric respiratory management, children's hospital)

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Accidental extubation during mechanical ventilation is a potentially life-threatening hazard that can lead to a catastrophic state or severe brain damage unless it is noticed early. The present study was designed to investigate whether there was any pattern in the accidents, with respect to time, age or other factors. If any trend were to be clarified, it was thought that possible means of preventing most of such accidents in advance might be considered. Therefore, with this aim, 150 patients who had received res-

piratory support with a ventilator over the past 12 years in this hospital were studied retrospectively.

Materials and Methods

We divided all inpatient files according to whether or not they had required respiratory support 50 parts and randomly picked out a total of 150 patients, equally 3 patients from each part, who had been managed with a ventilator for at least one day. As inpatient files consisted of physician's and nurses' charts, we counted the number of accidents referring to both sets of charts and recorded the background of the patients, including age, body weight, time at which the accidents occurred and the days after intubation, retrospectively. Statistical analysis of data

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Table 1. The incidence of accidental extubations at each ward

| ward | number of patients who needed respiratory support | number of accidental extubations |
|---|---|----------------------------------|
| cardiovascular surgery (includes 4 beds as I.C.U.) | 65 | 0 |
| NICU | 52 | 13 |
| pediatric surgery | 21 | 2 |
| pediatrics | 12 | 0 |

Table 2. The condition when the accidental extubations were noticed

| | |
|--|---|
| decreased heart rate and/or cyanosis | 7 |
| required resuscitation | 2 |
| no change | 6 |

was performed by chi-squared test and statistical significance was assigned at a *P* value of less than 0.05.

Results

The 150 patients ranged in age from 0 day to 9 years, were managed with a ventilator for 22.6 days on average, with a range of 2-76 days. The numbers of patients who underwent respiratory care with a ventilator in each ward are listed in table 1.

Although the cardiovascular surgical ward, which included the intensive care unit, dealt with the largest number of patients who required respiratory assistance, no patients experienced accidental extubation in this study.

Fifteen accidental extubations occurred in 9 patients, most of which (13 times in 8 patients) happened at the neonatal intensive care unit (NICU). Of these, 7 times of accident occurred in 5 patients who weighed under 1,000g and 6 times occurred in 3 patients who weighed between 1,000g and 2,000g. In the NICU, endotracheal intubation was performed exclusively by the orotracheal route

Table 3. The causes of accidental extubations

| | |
|-------------------------------|---|
| hygiene of endotracheal tubes | 3 |
| agitating | 2 |
| chest X-p | 1 |
| unknown | 9 |

by our neonatologists' preference. Contrast to that result, there was only one case of accidental extubation in the surgical ward for infants, and this patient had weighed over 3,000g and had been intubated via the nasal route. Fortunately, none of these accidents resulted in any neurological sequelae, although some patients had represented some clinical signs of hypoxia when the accidents were found. Seven patients showed a decreased heart rate and/or cyanosis and 2 required resuscitation. However, the other 6 patients revealed no clinical signs (table 2).

The causes of accidental extubation could not be specified in two-thirds of the cases. The causes are listed in table 3.

The time when the accidents occurred varied, but they were more common during the day-time, ironically when many nursing and medical staff were on duty.

Accidental extubations occurred 15 times during a total of 1,553 intubation days, giving an overall accident rate of 1 per 100 days of intubation. Of these, one accident happened for 54 days of intubation in the NICU and 2 for 235 days of intubation in the pediatric surgical ward. Therefore, the rate in the NICU was 2.2 times higher than that

in the pediatric surgical ward, although the difference was not statistically significant.

The time after the start of respiratory support at which these accidents happened ranged from 2 to 76 days, with an average of 22.6 days. Thirteen out of 15 cases (87%) of accidental extubation occurred on and after 5 days since the start of respiratory support, and 67% occurred on and after 10 days.

Upon investigating the duration of respiratory support in the cardiovascular surgical unit and the NICU, it was noticed that two-thirds of patients in the former unit were successfully extubated within less than 5 days, whereas two-thirds of patients in the latter unit required more than 5 days for weaning from respiratory support.

Discussion

It has become apparent that the smaller babies are, the more often accidental extubations occur in this survey. This may be based on the fact that more immature babies require more prolonged respiratory assistance¹. The overall rate of accidental extubation, 1 per 100 days of intubation in this hospital, was the same as that in the NICU at Hershey Medical Center². In the present study, we found that the rate in the NICU in our hospital was 2.2 times higher than that in the pediatric surgical ward, although even that rate, 1 per 54 days of intubation, was only half that reported in the NICU at Colorado Children's Hospital¹. The rate of 2 per 235 days of intubation in the pediatric surgical ward was the lowest we could find among the literature. This might be due to the fact that most babies who were managed for respiratory insufficiency in the pediatric surgical ward were usually intubated nasally. Several reasons why smaller babies suffer this kind of accident more often, have to be taken into consideration. These tiny babies are usually intubated orally, so that when the babies' activity increases in the recovery phase, the more often endotracheal tubes tend to slip off, even if medical staff tape the tubes firmly to prevent dislodging or restrain the babies' heads to prevent vigorous movement. Stewart et al.³ reported that neonatal

nasal intubation is certainly superior with respect to the stability of the endotracheal tube, though our neonatologists still prefer the oral route possibly because they are anxious about infection to nasal septum and eustachian tube when respiratory support is required for a long time. Furthermore some institutions insisted orotracheal intubation is a safe method of maintaining prolonged tracheal intubation in premature and term newborn infants. However, we noticed the more frequent accidental extubation with oral intubation in this study, hence we should not neglect the surveillance of those patients.

Another reason why the incidence of accidental extubation is higher in tiny babies with a body weight less than 2,500 g may be the short distance from the glottis to the carina. Therefore there is a limitation in the distance along which the tube can be advanced. Accordingly, there is an increased chance of extubation.

One further reason may depend how the patients are managed during respiratory support. Sedation and paralysis are scarcely used for neonates. However, in the cardiovascular surgical ward, many patients are often sedated or paralyzed while on mechanical respiratory support, and among these, hardly any cases of accidental extubation could be found from the charts we surveyed. We clarified that most cases of accidental extubation occurred insidiously. That is, these accidents were not noticed until a trivial clinical hypoxic sign had been exhibited, and thus some hypoxic state might already have existed beforehand. Unfortunately we know that some patients not listed here died of hypoxic brain damage or fell into a vegetative state due to tube trouble.

It is our most pressing task to prevent accidental extubation during mechanical respiratory support. It has also become apparent that this life-threatening accident can be diminished if the duration of intubation can be made shorter. We therefore recommend early weaning from respiratory support whenever it can be safely accomplished. Moreover, medical staff should pay more close attention to patients who have

becoming more active in their recovery phase not to allow the endotracheal tubes to be extracted by themselves or by their vigorous movement.

In conclusion, more intensive surveillance should be exercised for management of infants without life-threatening complications. Moreover, improvement in the stability of adhesive tape, especially for oral intubation, should also be carried out as Brown recommended¹.

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