

## Right Upper Lobe Atelectasis in Mechanically Ventilated Pediatric Patients

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Occurrence of atelectasis in mechanically ventilated children has a high frequency. The typical site is right upper lobe. Factors re-

sponsible for the development of atelectasis in this part of the lung and prophylaxis/therapy are presented and discussed.

**Key words:** atelectasis, mechanically ventilated pediatric patients, right upper lobe

Atelectasis in different lobes of the right lung occurs in more than 70% of children with asthma, cystic fibrosis and tuberculosis, who develop lung collapse. In contrast, the left lower lobe is the most common location for atelectasis associated with acute upper or lower respiratory infection (3). It is interesting that in neonates who have been intubated, atelectasis usually occurs in right upper lobe as postendotracheal extubation complication (4, 5). The objective of this study was to ascertain the frequency and localization of atelectasis in intubated, mechanically ventilated pediatric patients.

### MATERIALS AND METHODS

The records and radiographs of 21 infants and children (aged 3 months to 12 years) treated in intensive care unit during an 18-month period were reviewed. Acute respiratory infection was underlying disease in 12, meningitis and sepsis in 7 and CNS depression in 2 patients. Fifteen patients were ventilated for a period of 1 - 4 days, three for a period of 8 - 24 hours and three of them were ventilated between 4 and 8 days. All patients were ventilated with a volume controlled respirator.

### RESULTS

Nine patients out of 21 developed atelectasis. In 8 cases atelectasis was localised in the right upper lobe and in only one case in the left lower lobe (the reason was malplacement of tube). Duration

of atelectasis varied between 2 hours and 6 days. The therapy applied consisted of intermittent ventilation with high tidal volume, PEEP and frequent tracheal suction. In extubated patients, right upper lobe atelectasis disappeared on intermittently applied CPAP by mask after 24-48 hours.

### DISCUSSION

In spite of correct endotracheal tube placement and proper ventilation, the occurrence of atelectasis in mechanically ventilated pediatric patients has a high frequency. Regardless of the pathology leading to respiratory insufficiency, the typical location of atelectasis is right upper lobe. In our opinion, there are two main reasons why the right upper lobe is most often involved. First, due to anatomical relations, during volume controlled ventilation the adjacent hyperexpanding right middle and right lower lobes squeeze the right upper lobe into its collapsed state (1). Secondly, hypoventilation of the right upper lobe can result from maldistribution of air-flow caused by turbulence and uneven division of flow (2) in the upper part of the right primary bronchus. Beside the general principles of management of intubated pediatric patients, it is of great importance to improve ventilation and to help mobilize secretions from the bronchial tree of the right upper lobe. It can be achieved by:

1. Increase of inspiratory/expiratory ratio and increase of pause-time given by respirator (I:E Ratio 1.1:1 or 1.7:1)

**TABLE 1.**  
Patients' age, diagnosis, duration of atelectasis and period of intermittent positive-pressure ventilation.

**TABLICA 1.**  
Dob pacijenata, dijagnoza, trajanje atelektaze i razdoblje isprekidane ventilacije pozitivnim tlakom

RIGHT UPPER LOBE ATELECTASIS ATELEKTAZA GORNJEG PLUJNOG KRILA				
Pt. Pacijent	Age Dob	Duration Trajanje	IPPV (volume contr.) Ventilacija	Diagnosis Dijagnoza
1.	8 yrs/g.	7 hours/sati	2 days/dana	meningitis
2.	2 1/2	2 hours/sati	3 days/dana	pneumonia
3.	2	12 hours/sati	6 days/dana	meningitis
4.	1 1/4	6 hours/sati	4 days/dana	pneumonia
5.	1 1/6	2x2 days/dana	4 days/dana	sepsis-meni
6.	1	1 day/dan	3 days/dana	meningitis

2. Postural drainage including positions which facilitate drainage from the apical, anterior and posterior segment of the right upper lobe,  
3. Early extubation; i.e. the presence of right upper lobe atelectasis alone should not hinder extubation unless there are other reasons demanding the opposite.

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#### Sažetak

### ATELEKTAZA GORNJEG DESNOG PLUĆNOG KRILA U DJECE LIJEČENE MEHANIČKOM VENTILACIJOM

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Atelektaza se vrlo često javlja u mehanički ventilirane djece. Tipično je locirana na gornjem desnom plućnom krilu. U radu se razmatraju čimbenici koji dovode do razvoja atelektaze na tom dijelu pluća te profilaksa i terapija.

**Ključne riječi:** atelektaza, djeca, mehanička ventilacija, pluća