The role of neonatal chest physiotherapy in preventing postextubation atelectasis

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We retrospectively assessed atelectasis in 297 postextubation radiographs from 220 babies who underwent ventilation over a 2-year period. All 95 babies in the first year received peri-extubation chest physiotherapy; none of the 125 babies in the second year received chest physiotherapy. There was no difference in the incidence of postextubation atelectasis between the two groups. (J Pediatr 1998;133:269-71)

Recent surveys reported that 75% of neonatal units in Australia and New Zealand routinely use chest physiotherapy. Approximately half of these units have specific peri-extubation protocols aimed at reducing postextubation atelectasis,[1,2] which has been reported to occur in 10% to 50% of cases.[3,4] A randomized trial found that neonatal peri-extubation CPT greatly reduced the incidence of PEA.[3] A more recent trial of similar size found no benefit, but with little power to detect a type 2 error.[5]

CPT was routinely used in our nursery until December 1994, when an association between CPT treatments and destructive intracerebral lesions, encephaloclastic porencephaly, became apparent.[6] CPT was discontinued, and no further cases of encephaloclastic porencephaly were identified. We continued to take postextubation radiographs, and our clinical impression over the ensuing year was that the incidence of PEA had not increased. Because CPT was discontinued as the result of an adverse effect, we could not perform a prospective trial and have therefore performed a retrospective cohort study to determine the incidence of PEA with and without CPT.

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Submitted for publication June 2, 1997; revision received Feb 11, 1998; accepted Mar 23, 1998.

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0022-3476/98/$5.00 + 0 **9/22/90615**

Methods

Two groups of babies were studied: those treated in the 12 months to December 1994 who received peri-extubation CPT and an inspiratory chest radiograph 4 hours after extubation ("CPT" group) and those treated in the next 12 months who did not receive CPT but did have a postextubation radiograph ("no CPT" group). During both years most babies (and all very low birth weight babies) underwent extubation to nasopharyngeal continuous positive airway pressure.

Postextubation radiographs were identified from the radiology request forms; if a baby underwent extubation on more than 1 occasion, each episode was eligible. The chest radiograph before extubation was also selected. Unidentified radiographs were read randomly and independently by two radiologists who coded each film for generalized, lobar, segmental, and subsegmental atelectasis and consolidation.

Statistical analysis was by Student *t* test or the Mann Whitney U test for continuous variables and the chi-squared test for noncontinuous data (Statview, Abacus Concepts, Inc., Berkeley, Calif.). The 95% confidence intervals for the power of the study were calculated with the method of Detsky and Sackett.[7] All analyses were performed on all babies and on the subset of VLBW babies (birth weight <1500 g). Values are given as median (range) or mean (95% CI).

CI	Confidence intervals
CPT	Chest physiotherapy
PEA	Postextubation atelectasis
VLBW	Very low birth weight

Results

A total of 220 babies had 297 postextubation radiographs (Table I). One hundred forty-nine babies were VLBW (221 postextubation radiographs). Two hundred eighty-eight preextubation films were assessed. Babies in the no CPT group received more surfactant and underwent extubation earlier than those in the CPT group (Table I). However, there were no differences between groups in the fraction of inspired oxygen at extubation (Table I) or in the incidence of atelectasis before extubation (Table II).

There were no differences in the incidence of PEA between the 2 years, whether any atelectasis or only focal atelectasis was considered, with an overall incidence of any atelectasis of approxi-

Table I. Subjects

	All babies		VLBW babies	
	CPT	No CPT	CPT	No CPT
No. of babies	95	125	64	85
Birth weight (g)	1100 (580-4595)	1143 (520-4180)	957 (580-1460)	1010 (520-1475)
Gestational age (wk)	29 (24-40)	29 (24-42)	27 (24-34)	27 (24-33)
Caucasian(%)	60	62	59	68
Male (%)	61	54	59	48
Antenatal steroids >24 h before delivery (%)	42.9	51.3	52.5	63.3
Postnatal steroids (%)	16.5	16.2	25.4	22.8
Surfactant (%)	61.5	70.9	67.8	86.1*
CLD (%)	17.2	11.6	21.0	13.6
Age at extubation (d)	10 (1-119)	6 (1-90)*	17 (1-119)	11.5 (1-90)
Fraction of inspired oxygen at extubation	0.21 (0.21-1.0)	0.21 (0.21-0.75)	0.21 (0.21-0.78)	0.21 (0.21-0.70)

CLD, Chronic lung disease (oxygen requirement at 36 weeks postmenstrual age or 28 days postnatal age, whichever is the later).
Values are median (range).
*$P < .05$ compared with the CPT group.

Table II. Atelectasis and volume loss (atelectasis, consolidation, or both) in all babies and VLBW babies both before and after extubation

	All babies		VLBW babies	
	CPT	No CPT	CPT	No CPT
Preextubation atelectasis (%)	32/137 (23)	22/151 (15)	24/101 (24)	18/115 (16)
Postextubation atelectasis				
Overall (%)	27/139 (19)	25/158 (16)	23/107 (21)	20/114 (18)
Extubated <28 d (%)	13/100 (13)	14/121 (12)	9/70 (13)	10/78 (13)
Extubated ≥28 d (%)	14/39 (36)†	11/37 (30)*	14/37 (38)†	10/36 (30)*
Volume loss				
Preextubation (%)	53/137 (39)	56/151 (37)	38/101 (38)	43/115 (37)
Postextubation (%)	58/139 (42)	55/158 (35)	43/107 (40)	42/114 (37)

*$P < .05$ compared with the CPT group.
†$P < .01$ compared with same group extubated before 28 days of age.

mately 20% (Table II). Because atelectasis and consolidation in this population are difficult to distinguish, they were amalgamated as "volume loss." Once again, there was no difference in incidence between the two groups and no change in either atelectasis or volume loss from the preextubation to the postextubation films in either group (Table II). Subgroup analyses looking at consolidation alone and non-VLBW babies alone failed to find a benefit of CPT. Although babies who underwent extubation before 28 days of age had an incidence of PEA approximately half that in those who underwent extubation after this age, there was no difference in incidence between babies from the two groups (Table II). There was no significant difference in the incidence of chronic lung disease between babies from the 2 years (Table I).

DISCUSSION

Our findings indicate that neonatal CPT was not effective at preventing postextubation atelectasis in our population. This result is consistent with a recent randomized trial in neonates[5] and also with a trial in postoperative children that found an increased incidence of PEA with CPT.[8]

The population we studied is representative of that found in many neonatal intensive care units today, and the physiotherapy techniques we used are common to many other units.[1,3]

Although the no CPT group received more surfactant and underwent extubation earlier, there were no differences in the fraction of inspired oxygen at extubation or in the incidence of atelectasis or volume loss in the preextubation films. Thus although this is a retrospective study with control groups separated by time, we believe the two populations are

comparable. The large number of babies and films in this study far exceeds those in other studies of the efficacy of peri-extubation CPT.[3,5]

We calculated the 95% CI for the power of the study retrospectively,[7] because we suspected that published incidences for PEA did not apply to our population. For all babies the 95% CI for the power of the study are a 27% decrease to an 82% increase and for VLBW babies a 36% decrease to an 80% increase. This means that if physiotherapy caused a reduction in the incidence of PEA of 27% or greater (36% in VLBW babies), this study had a 95% chance of detecting that beneficial effect. Similarly, if CPT caused an 82% or greater (80% for VLBW babies) increase in the incidence of PEA, this study had a 95% chance of detecting that. Our study is sufficiently large that the 95% CI for the power of the study probably encompass clinically significant reductions in PEA. A 27% reduction would reduce the incidence of PEA from 20% to 14.6%; many clinicians may consider that a smaller difference than this is not of sufficient clinical significance to warrant further study to assess the efficacy of CPT in this situation.

In conclusion, our data suggest that neonatal CPT is not effective at preventing PEA, although the study is limited by being retrospective and using historical control groups. We propose that neonatal CPT should cease to be standard practice until a well-designed randomized trial demonstrates that the treatment has benefit.

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