

High-flow nasal cannula therapy for children and adolescents with obstructive sleep apnoea: abridged secondary publication

KCC Chan *, CT Au, KL Kwok, AM Li

KEY MESSAGES

1. The efficacies of high-flow nasal cannula (HFNC) and continuous positive airway pressure (CPAP) therapies are similar in reducing disease severity among children and adolescents with moderate-to-severe obstructive sleep apnoea.
2. Self-reported adherence is higher with CPAP therapy than with HFNC therapy.
3. Both HFNC and CPAP therapies significantly improved disease-specific quality-of-life scores, but not behavioural measures.

Hong Kong Med J 2025;31(Suppl 7):S29-31

HMRF project number: 06170456

¹ KCC Chan, ^{1,2} CT Au, ³ KL Kwok, ¹ AM Li

¹ Department of Paediatrics, Faculty of Medicine, The Chinese University of Hong Kong, Hong Kong SAR, China

² Translational Medicine, Research Institute, The Hospital for Sick Children, Toronto, Ontario, Canada

³ Department of Paediatrics, Kwong Wah Hospital, Hong Kong SAR, China

* Principal applicant and corresponding author: katechan@cuhk.edu.hk

Introduction

Childhood obstructive sleep apnoea (OSA) is a prevalent sleep-related breathing disorder associated with a variety of morbidities,¹ and timely interventions are essential. Its most common cause is adenotonsillar hypertrophy, and adenotonsillectomy is recommended as the first-line therapy. Continuous positive airway pressure (CPAP) therapy is an alternative for patients with persistent moderate-to-severe OSA (MS-OSA) after adenotonsillectomy, for those without surgically modifiable or correctable causes, and for those with contraindications to surgery. However, low adherence remains a major obstacle in paediatric populations.²

High-flow nasal cannula (HFNC) therapy is a non-invasive respiratory support for acute and chronic respiratory failure. It has been used in CPAP-intolerant children and in those with comorbid obesity and/or medical complexities.³ Its efficacy is comparable to that of CPAP in improving OSA severity among children with MS-OSA.⁴ This study aimed to compare HFNC with CPAP in children and adolescents with MS-OSA in terms of efficacy, treatment adherence, quality of life, and behavioural outcomes.

Methods

Children and adolescents aged 6 to 18 years who were diagnosed with MS-OSA (Obstructive Apnoea Hypopnoea Index [OAH] ≥ 5 events/hour) and recommended for CPAP therapy were invited to participate between 2019 and 2023. Participants underwent HFNC and CPAP titration

with polysomnography. If both HFNC and CPAP therapies were efficacious in reducing the OAH to <5 events/hour, participants were invited for home interventions, with 3 months each of HFNC therapy and CPAP therapy. The sequence was randomly assigned.

HFNC therapy was initiated at a flow of 5 or 15 L/min for paediatric or adult-sized cannulas, respectively, then gradually titrated in 5 or 10 L/min increments, respectively, based on symptoms of snoring, laboured respirations, and oxygen desaturations. The titration lasted 10 to 30 minutes, depending on the participants' tolerance and response to treatment,⁵ until either disordered breathing was normalised or the maximum recommended flow (25 and 50 L/min, respectively) was reached.

CPAP therapy was started at a pressure of 4 cm H₂O and increased in 1 cm H₂O increments as tolerated, up to a maximum of 12 cm H₂O, or until all OSAs and hypopnoeas were eliminated, or respiratory event-related arousals and snoring were minimised.

Participants and parents were asked to complete a self-administered questionnaire at baseline and at 3 months regarding OSA-related quality of life (OSA-18), daytime sleepiness (Modified Epworth Sleepiness Scale), quality of life (Paediatric Quality of Life Inventory), and behaviours (Child Behaviour Checklist). Parents or caregivers were also asked to complete daily records of CPAP/HFNC usage for adherence.

Paired *t* tests and Wilcoxon signed-rank tests were used to compare outcome measures between HFNC and CPAP therapies for parametric and

non-parametric variables, respectively. Adherence, quality of life, and behavioural parameters were analysed using a linear mixed model adjusted for treatment order, age, sex, and maternal education.

Results

In total, 26 male and three female participants (mean±standard deviation age, 12.8±3.0 years) completed the titration. Both HFNC and CPAP

TABLE 1. Titration of high-flow nasal cannula (HFNC) and continuous positive airway pressure (CPAP) therapies in children and adolescents with obstructive sleep apnoea (n=29).

Polysomnography parameters	Change from baseline					Change in HFNC vs change in CPAP*	P value
	Baseline*	HFNC*	P value	CPAP*	P value		
Obstructive Apnoea Hypopnoea Index, events/h	12.60±12.23	-7.16 (-9.23 to -5.09)	<0.001	-9.01 (-12.16 to -5.86)	<0.001	1.85 (-1.60 to 5.30)	0.281
Obstructive Apnoea Index, events/h	5.37±10.82	-4.16 (-6.96 to -1.35)	0.005	-4.96 (-8.76 to -1.15)	0.013	0.80 (-0.35 to 1.95)	0.167
Obstructive Hypopnoea Index, events/h	7.22±4.25	-3.95 (-6.08 to -1.82)	0.001	-4.37 (-6.50 to -2.24)	<0.001	0.42 (-1.51 to 2.34)	0.660
Central Apnoea Hypopnoea Index, events/h	1.89±3.50	1.43 (-0.11 to 2.97)	0.068	1.62 (-1.63 to 4.87)	0.316	-0.19 (-3.99 to 3.61)	0.919
Oxygen Desaturation Index, events/h	9.83±14.46	-4.56 (-6.33 to -2.78)	<0.001	-5.86 (-9.27 to -2.46)	0.001	1.30 (-2.70 to 5.31)	0.510
Nadir oxygen saturation, %	88.38±4.78	4.59 (3.29 to 5.88)	<0.001	6.41 (4.78 to 8.05)	<0.001	-1.83 (-3.26 to -0.39)	0.014
Total Arousal Index, events/h	19.22±11.45	-8.26 (-11.48 to -5.04)	<0.001	-6.43 (-11.10 to -1.76)	0.009	-1.83 (-7.02 to 3.36)	0.476
Sleep efficiency, %	88.15±7.65	2.36 (-3.00 to 7.73)	0.374	-0.08 (-5.56 to 5.40)	0.976	2.44 (-1.69 to 6.58)	0.236

* Data are presented as mean±standard deviation or mean (95% confidence interval).

TABLE 2. High-flow nasal cannula (HFNC) therapy versus continuous positive airway pressure (CPAP) therapy among children and adolescents with obstructive sleep apnoea.

Variables	Baseline (n=22)*	HFNC (n=21)*	P value	CPAP (n=21)*	P value	P value (HFNC vs CPAP)
Modified Epworth Sleepiness Scale	7.5 (4.0-11.3)	6.0 (4.0-8.8)	0.271	6.0 (3.0-8.5)	0.132	0.552
Obstructive Sleep Apnoea-18	57.9±15.1	48.7±13.4	0.009	45.2±12.6	<0.001	0.147
Paediatric Quality of Life Inventory						
Child Psychosocial Health Summary	78.5±9.8	81.4±10.7	0.475	78.3±10.3	0.932	0.562
Child Physical Health Summary	83.7±10.4	89.4±9.7	0.101	82.7±15.6	0.829	0.257
Child Paediatric Quality of Life Inventory	80.3±8.8	84.2±9.9	0.203	79.8±10.5	0.952	0.366
Parent Psychosocial Health Summary	71.7±13.9	75.7±13.3	0.189	73.4±13.8	0.311	0.609
Parent Physical Health Summary	78.4±16.1	87.5±9.8	0.005	82.4±16.6	0.244	0.292
Parent Paediatric Quality of Life Inventory	74.0±13.2	79.8±11.4	0.014	76.6±14.3	0.209	0.397
Child Behaviour Checklist						
Anxious/depressed	53.8±5.9	53.7±6.6	0.767	54.8±9.1	0.141	0.833
Withdrawn/depressed	57.6±7.4	56.7±7.7	0.804	57.4±8.5	0.920	0.579
Somatic complaints	59.3±6.7	58.7±7.0	0.565	59.2±7.8	0.855	0.925
Social problems	58.6±8.9	57.8±9.3	0.945	56.5±8.8	0.167	0.317
Thought problems	58.9±7.6	56.6±6.8	0.618	57.3±6.8	0.623	0.536
Attention problems	59.7±6.4	57.9±6.5	0.163	57.6±5.0	0.143	0.240
Rule-breaking behaviours	56.5±6.3	53.9±5.7	0.121	54.1±6.0	0.159	0.636
Aggressive behaviours	58.1±7.9	58.0±8.1	0.863	57.3±8.2	0.607	0.739
Internalising problems	54.1±10.2	53.3±9.8	0.760	53.0±12.6	0.879	0.632
Externalising problems	56.6±8.3	55.1±8.5	0.595	53.0±10.8	0.168	0.306
Total problems	57.2±9.5	56.4±9.2	0.883	54.5±11.6	0.272	0.193

* Data are presented as mean±standard deviation or mean (95% confidence interval).

TABLE 3. Comparison of adherence between high-flow nasal cannula (HFNC) therapy and continuous positive airway pressure (CPAP) therapy.

Adherence	β (difference between HFNC and CPAP)	Standard error	P value (HFNC vs CPAP)	P value (treatment order)
Self-reported adherence rate (% of nights ≥ 4 hours use)				
Unadjusted	-17.058	7.013	0.026	0.008
Adjusted for age and sex	-14.929	8.283	0.092	0.009
Adjusted for age, sex, and maternal education	-14.890	8.331	0.095	0.010
Self-reported average number of hours used per night				
Unadjusted	-1.703	0.527	0.005	0.004
Adjusted for age and sex	-1.508	0.639	0.033	0.009
Adjusted for age, sex, and maternal education	-1.505	0.643	0.034	0.010

therapies achieved significant improvements in OAH1 (-7.16 vs -9.01, $P=0.281$, Table 1), Obstructive Apnoea Index, Oxygen Desaturation Index, nadir oxygen saturation, and Total Arousal Index.

Of the participants, 22 were recruited for home interventions, with 3 months each of HFNC therapy and CPAP therapy. Both HFNC and CPAP therapies achieved significant improvement in the OSA-18 score ($P=0.009$ and $P<0.001$, respectively, Table 2), but both therapies were comparable in terms of scores on the Modified Epworth Sleepiness Scale, Paediatric Quality of Life Inventory, and Child Behaviour Checklist.

Self-reported adherence (average number of hours of usage per night) was higher with CPAP than with HFNC ($\beta = -1.505$, $P=0.034$), even after adjustments for age, sex, and maternal education (Table 3). None of the participants reported serious adverse effects.

Discussion

Both HFNC and CPAP therapies were effective in improving most polysomnographic parameters and OSA-18 scores among children and adolescents with MS-OSA. HFNC therapy did not provide additional benefits compared to CPAP therapy. Although HFNC therapy can be an effective alternative to CPAP therapy, its treatment adherence was lower. Given that the benefits of HFNC and CPAP therapies are strongly associated with adherence, additional efforts are needed to improve treatment adherence.

Our study had some limitations. First, treatment efficacy data were collected for only one night in a laboratory environment; thus, the variability of HFNC efficacy over several nights remains unknown. Second, the small sample size did not provide sufficient statistical power for subgroup analyses or identification of factors associated with outcome improvement or adherence. Studies with larger cohorts are needed to validate our findings and explore differences between subgroups.

Conclusion

HFNC therapy is an effective alternative to CPAP therapy for children and adolescents with MS-OSA. However, treatment adherence with HFNC therapy is not superior relative to that with CPAP therapy.

Funding

This study was supported by the Health and Medical Research Fund, Health Bureau, Hong Kong SAR Government (#06170456). The full report is available from the Health and Medical Research Fund website (<https://rfs1.healthbureau.gov.hk>).

Disclosure

The results of this research have been previously published in:

1. Chan KC, Au CT, Kwok KL, et al. Efficacy of high-flow nasal cannula therapy and its effectiveness in home settings for paediatric obstructive sleep apnoea. *Sleep Med* 2025;133:106637.

References

1. Chan KCC, Au CT, Hui LL, Wing YK, Li AM. Childhood OSA is an independent determinant of blood pressure in adulthood: longitudinal follow-up study. *Thorax* 2020;75:422-31.
2. Hawkins SMM, Jensen EL, Simon SL, Friedman NR. Correlates of pediatric CPAP adherence. *J Clin Sleep Med* 2016;12:879-84.
3. Du F, Gu YH, He YC, Deng WF, Liu ZZ. High-flow nasal cannula therapy for pediatric obstructive sleep apnea: a systematic review and meta-analysis. *Eur Rev Med Pharmacol Sci* 2022;26:4583-91.
4. Fishman H, Al-Shamli N, Sunkonkit K, et al. Heated humidified high flow nasal cannula therapy in children with obstructive sleep apnea: a randomized cross-over trial. *Sleep Med* 2023;107:81-8.
5. Hawkins S, Huston S, Campbell K, Halbower A. High-flow, heated, humidified air via nasal cannula treats CPAP-intolerant children with obstructive sleep apnea. *J Clin Sleep Med* 2017;13:981-9.