Prevalence of Nocturnal Hypoxemia in a Cohort of Adult Fontan Patients Living at Altitude

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Background

- Chronic mild hypoxemia is common following Fontan palliation, with unknown prevalence, degree and effect of nocturnal hypoxemia
- Sleep disordered breathing (SDB) encompasses a range of breathing disorders during sleep, including obstructive sleep apnea (OSA) and nocturnal hypoxemia
- SDB is common both in the general population and at very high altitude and has known cardiac sequelae, including hypoxia-induced pulmonary vasoconstriction
- Prevalence of SDB in Fontan palliated patients is unknown
- Any pulmonary process, including SDB, that increases pulmonary vascular resistance can add strain to the Fontan physiology, leading to decreased cardiac output

Methods

- Retrospective chart review of Fontan patients (≥18 yrs.) followed in our Adult Congenital Heart Disease program living at moderate altitude who had previous polysomnography (PSG) (N=22/55)
- Determined prevalence of SDB, with subcategories defined as:
  - Nocturnal hypoxemia (>5% desaturation from baseline)
  - Obstructive sleep apnea (AHI>5)
- Clinical and demographic variables were reviewed, as were PSG data including:
  - Apnea hypopnea index (AHI)
  - Baseline oxygen (O_2) saturation
  - Lowest O_2 desaturation
  - Sleep time spent below 88% O_2 saturation

Results

Patient Characteristics (N=22)

Average Age at PSG (yrs.)	29.0 ± 10.1
BMI (kg/m²)	25.5 ± 4.4
Male	10 (45.5%)
Fontan type	
Lateral tunnel	9 (40.9%)
Extracardiac	7 (31.8%)
Atrio-pulmonary	4 (18.2%)
Bjork	2 (9.1%)
Baseline O_2 status	
Supplemental O_2	6 (27.3%)
Room Air	16 (72.7%)
Average Baseline O_2 sat (%)	89.2 ± 5.2

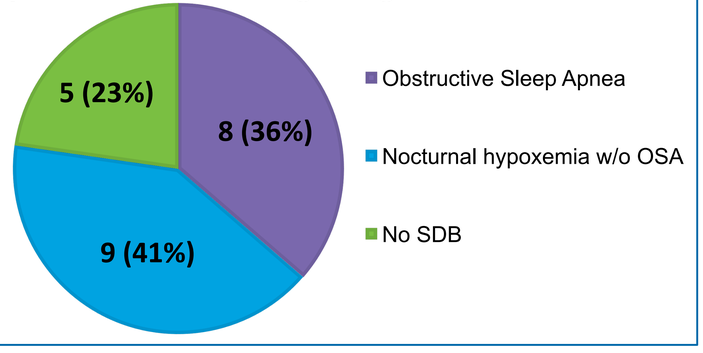
Polysomnography Results

Measure	Mean ± SD	Range
Baseline O_2 sat (%)	89.2 ± 5.2	73, 96
Lowest O_2 desaturation (%)	81.0 ± 4.9	66, 87
Desaturation from baseline	-8.2 ± - 3.6	0, -16
Time below 88% O_2 sat (%)	46.5 ± 34.1	2, 100

*BMI and age did not correlate with AHI (p=0.45, p=0.78) or with a normal or abnormal PSG (p=0.77, p=0.42)

Sleep Disordered Breathing Categories

*All patients with sleep apnea had obstructive sleep apnea, only two patients had a small contribution of central sleep apnea



Conclusions

- Sleep-disordered breathing (SDB) was present in 77% of our cohort, including 36% with OSA and 41% with nocturnal hypoxemia without OSA
- The high prevalence of nocturnal oxygen desaturation within our study population suggests that screening for SDB should be considered for all Fontan patients, especially those living at altitude
- Without a sub-pulmonary ventricle, Fontan patients are likely exquisitely sensitive to SDB-induced hypoxemia and pulmonary vasoconstriction
- SDB is an under-recognized complication in Fontan patients and may lead to suboptimal hemodynamics, worsened cognitive performance, and other morbidities

Future Directions

- Further study is needed to determine whether the apparently high prevalence of nocturnal hypoxemia in Fontan patients living at moderate altitude is associated with increased morbidity and mortality
- A larger cohort would enable study of clinical and hemodynamic parameters as correlates or predictors for presence and development of SDB
- Prevalence of SDB in Fontan patients living at sea level and lower altitudes should be determined
- Determine if treatment of SDB in these patients improves functional capacity and cognitive function

Disclosures: None