

Obstructive Sleep Apnea in Pediatric Patients with Fontan Circulation: A Database Driven Analysis

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Background

- Obstructive sleep apnea (OSA) adversely affects children, especially those with Fontan circulation
- Fontan physiology encompasses single-ventricle congenital defects
 - (e.g., hypoplastic left heart syndrome, tricuspid atresia, pulmonary atresia with intact ventricular septum, double-inlet left ventricle, unbalanced atrioventricular canal defects, Ebstein anomaly, double-outlet right ventricle, and congenitally corrected transposition of the great arteries)
 - Associated with multiple comorbidities and systemic complications
- OSA can worsen complications but is poorly studied in this population.
- This study investigates the incidence of OSA in Fontan patients and compares their complications and management to non-Fontan peers.

Study Design

- TriNetX, a large de-identified EHR database, was queried for pediatric patients who underwent Norwood, Glenn, or Fontan procedures.
- Data was stratified using ICD-10 and CPT codes
- OSA was diagnosed in these patients, excluding those with congenital risk factors for OSA.
- Fontan patients were age-matched to non-Fontan patients.
- BMI, OSA diagnostic methods, treatment, and complications like pulmonary hypertension (PH), ADHD, anxiety, and depression were compared.

Results

- Of the 4303 patients with Fontan circulation, 309 (7.18%) were diagnosed with OSA, compared to 260,519 (1.09%) non-Fontan pediatric patients with OSA.
- Of the BMI stratifications, a greater proportion of Fontan patients were classified as underweight and healthy weight compared to the non-Fontan cohort ($p<0.001$).
- Fontan patients were more likely to undergo polysomnography (PSG) for OSA ($p<0.0001$), but use of PSG with titration did not differ ($p=0.427$).
- Surgical interventions (adenoidectomy and tonsillectomy) were less common in Fontan patients ($p<0.0001$), who used CPAP more often ($p<0.0001$).
- Fontan patients had higher rates of PH ($p<0.0001$) and anxiety ($p<0.0001$), but similar rates of ADHD ($p=0.314$) or depression ($p=0.135$).

	With Fontan Physiology (n=309)	Without Fontan Physiology (n=260,519)	P-value
Complications			
Pulmonary HTN	73	1582	<0.0001
ADHD	40	29,087	0.314
Anxiety	61	29,175	<0.0001*
Depression	16	9386	0.135
Diagnosis			
With Polysomnography	102	54,707	<0.0001*
With Titration	11	7336	0.427
Treatment			
Surgical	55	79,555	<0.0001*
Non-surgical (CPAP use)	25	5873	<0.0001*
T&A	45	71,141	<0.0001*

Table 1: Associated rates of comorbidities, ways of diagnosis and treatments in Obstructive Sleep Apnea patients with and without Fontan physiology. Abbreviations: HTN, hypertension; ADHD, Attention-Deficit/Hyperactivity Disorder; CPAP, continuous positive airway pressure. Statistically significant values are those that are starred.

Conclusions

- This study is one of the largest to explore OSA outcomes in Fontan patients, highlighting key differences in diagnosis, treatment, and complications compared to the general population.
- Despite a lower prevalence of obesity, Fontan patients experience a similar or greater burden of OSA-related complications.
- The higher percentage of PSG and lower percentage of surgical intervention in those with Fontan physiology is related to risk of undergoing surgery in these children, so PSG is performed to ensure surgery is necessary.
- The increased use of PSG and CPAP offers valuable insights for tailored management strategies, helping providers implement targeted screening and interventions for Fontan patients.

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