Clinical characteristics, prenatal diagnosis, and neonatal complications in infants with Down syndrome: What is driving the need for ICU care?

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Background

➢Trisomy 21 is the most common aneuploidy in live born infants, with an incidence of about 1 in 800 live births in the United States[1]

➢Highly sensitive screening methods and diagnostic tests exist for the detection of a fetus with Trisomy 21[2]

➢Down syndrome is associated with a host of neonatal complications affecting multiple organ systems[3,4]

➢These comorbidities place infants with Down syndrome at increased risk of requiring admission to an intensive care unit compared to the general population[5,6]

➢The rate of intensive care unit (ICU) admission for newborns with Down syndrome is unknown

➢It is also unknown whether there are clinical or demographic factors that influence the likelihood that an infant with Trisomy 21 will require intensive care in the newborn period or whether specific maternal or fetal characteristics are associated with prenatal diagnosis status

Objectives

➢To determine the incidence of ICU admission in a cohort of infants with Down syndrome cared for in a children's hospital and assess rates of prenatal diagnosis in this population

➢To identify clinical and demographic factors associated with the need for intensive care in the neonatal period

➢To describe the early medical and surgical complications associated with Trisomy 21 and evaluate their impact on ICU utilization

Methods

➢A retrospective, population-based cohort study was performed at Cincinnati Children's Hospital Medical Center for all children with a diagnosis of Down syndrome born between 2013-2014 who sought care at our institution during the first year of life

➢Electronic medical records were reviewed and data was extracted regarding prenatal diagnosis, maternal age, gestational age, birth weight, need for ICU care in the neonatal period, medical and surgical diagnoses, and demographic information

➢Statistical analysis was performed using the Fisher exact test to compare categorical variables and the two-tailed student's T test to compare the means of two populations with assumed unequal variance. A *p* value of <0.05 considered statistically significant

Results

Figure 1. Medical Diagnoses Among Patients Requiring ICU Care

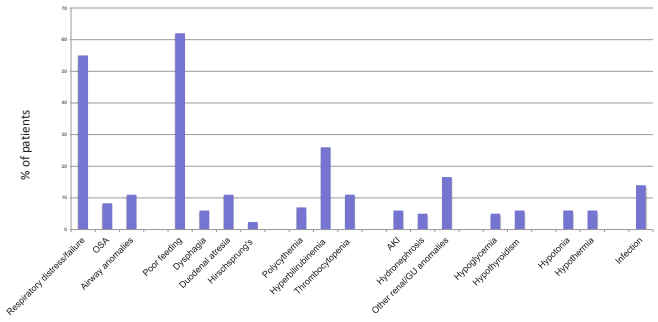

Table 1. Demographics and perinatal characteristics by ICU admission status

	ICU Admission: Yes n (%)	No n (%)	Total n (%)	*p*
Study cohort	84 (65)	45 (35)	129 (100)	
Sex				0.27
Male	46 (70)	20 (30)	66 (51)	
Female	38 (60)	25 (40)	63 (49)	
Race				0.2
White	66 (62)	41 (38)	107 (83)	
Black	11 (92)	1 (8)	12 (9)	
Asian	2 (100)	0 (0)	2 (2)	
Other/Unknown	5 (63)	3 (37)	8 (6)	
Maternal Age (years)				0.43
<35	48 (68)	23 (32)	71 (55)	
≥35	29 (60)	19 (40)	48 (37)	
Unknown	7 (70)	3 (30)	10 (8)	
Prenatal diagnosis				**<0.001**
Yes	10 (100)	0 (0)	10 (8)	
Suspected	30 (77)	9 (23)	39 (30)	
No	33 (52)	31 (48)	64 (50)	
Unknown	11 (69)	5 (31)	16 (12)	
Birth weight category				0.14
SGA	18 (82)	4 (18)	22 (17)	
AGA	62 (61)	39 (39)	101 (78)	
LGA	2 (50)	2 (50)	4 (3)	
Unknown	2 (100)	0 (0)	2 (2)	
Birth weight (grams)				0.25
<1500	5 (100)	0 (0)	5 (4)	
1500-2500	17 (77)	5 (13)	22 (17)	
>2500	60 (60)	40 (40)	100 (78)	
Unknown	2 (100)	0 (0)	2 (1)	
Gestational Age (weeks)				0.06
≥37	64 (62)	39 (38)	103 (80)	
34-36	11 (65)	6 (35)	17 (13)	
<34	9 (100)	0 (0)	9 (7)	
1st year mortality	4 (100)	0 (0)	4 (3)	

Table 2. Effect of congenital heart disease on ICU admission status

	ICU Admission: Yes n (%)	No n (%)	Total n (%)	*p*	95% CI
Any heart disease	77 (68)	37 (32)	114 (88)	0.15	
Complex lesion	13 (93)	1 (7)	14 (12)	**<.01**	(0.66, 1.00)
AV canal	22 (88)	3 (12)	25 (22)	**<0.01**	(0.69, 0.97)
ASD, VSD, PDA	32 (50)	32 (50)	64 (56)	1	(0.38, 0.63)
Other	9 (82)	2 (18)	11 (10)	**0.04**	(0.52, 0.98)
Pulmonary hypertension	20 (91)	2 (9)	22 (17)	**<0.01**	(0.71, 0.99)
Heart failure	11 (100)	0 (0)	11 (8.5)	**<0.01**	(0.72, 1.00)

Table 3. Prenatal diagnosis predictors

	Prenatal Diagnosis Status: Confirmed n (%)	Suspected n (%)	No n (%)	Unknown n (%)	*p*
Study cohort	10 (8)	39 (30)	64 (50)	16 (12)	
Maternal Age (years)					0.35
<35	6 (8)	19 (27)	41 (58)	5 (7)	
≥35	4 (8)	20 (42)	20 (42)	4 (8)	
Unknown	0	0	3 (30)	7 (70)	
Service Market					0.15
Primary	3 (4)	25 (36)	39 (56)	3 (4)	
Referral	7 (12)	14 (24)	25 (42)	13 (22)	
Race					0.09
White	7 (7)	30 (28)	54 (51)	16 (14)	
Black	2 (17)	6 (50)	4 (33)	0 (0)	
Asian	1 (50)	0 (0)	1 (50)	0 (0)	
Other/unknown	0 (0)	3 (38)	5 (62)	0 (0)	
Structural heart defect					**<0.01**
Complex lesion	4 (29)	7 (50)	2 (14)	1 (7)	
AV canal	4 (16)	12 (48)	6 (24)	3 (12)	
ASD, VSD, PDA	0 (0)	15 (23)	42 (66)	7 (11)	
Other	1 (9)	3 (27)	6 (55)	1 (9)	
Duodenal atresia	1 (12)	3 (33)	2 (22)	3 (33)	0.13

Conclusions and Clinical Implications

➢In this cohort of 129 live-born infants with Down syndrome, a majority (65%) required intensive care in the newborn period

- The mean length of stay was 29.3 ± 30.5 days (range 1-134 days)
- Despite high rates of prematurity in the cohort (20%), neither birth weight nor gestational age were significantly associated with need for ICU admission and 62% of term infants required intensive care
- The most common non-cardiac indications for admission were poor feeding (39%), respiratory disorders (34%), jaundice (16%), and infection (9%)

➢The burden of congenital heart disease in our study population was significantly greater than the ~50% risk reported in the literature[3]

- Infants with complex CHD or AV canal defect had a 90% ICU admission rate despite a minority (7 patients) requiring surgical intervention in the neonatal period
- Pulmonary hypertension and heart failure were also significantly associated with the need for ICU care (p <0.01)

➢A large proportion of patients (50%) were not even suspected to have had Down syndrome prenatally

- The only variable significantly associated with prenatal diagnosis status was the presence of a structural heart defect (p <0.01)
- Further study is needed to understand why prenatal diagnosis rates for live born infants with Down syndrome is so low despite the widespread availability of highly sensitive, non-invasive screening modalities

References

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