Clinical Manifestations of Constriction Band Syndrome

Ana G. Starcevich, MS[1], Leah R.F. Demetri, MD[2]; Mary Claire B. Manske, MD[3]; Michelle A. James, MD[3]

School of Medicine, University of California, Davis, Sacramento, CA[1], Department of Orthopaedic Surgery, University of California, San Francisco, San Francisco, CA[2], Department of Orthopaedic Surgery, Shriner's Hospital for Children – Northern California, Sacramento, CA[3]

INTRODUCTION

- Constriction band syndrome (CBS) comprises a heterogenous collection of congenital anomalies that affect the extremities. Infants present with constriction bands causing skin indentations, limb amputations, and syndactyly.
- Due to the highly variable presentation, there are currently no clear diagnostic criteria. A standardized diagnostic criteria would help physicians distinguish CBS from other terminal deficiencies

OBJECTIVES

1. Characterize the clinical manifestations of CBS by retrospectively analyzing a large cohort of patients
2. Use this data to propose diagnostic criteria to standardize the diagnosis of CBS and help differentiate CBS from other congenital limb conditions
3. Evaluate possible risk factors for CBS

METHODS

- Retrospective chart review of all children with CBS presenting at our tertiary care hospital. Patients were identified via ICD 9/ICD 10 codes.

Inclusion criteria

- Treated between January 1,1998 and December 31, 2018
- Clear, detailed description of clinical findings by a pediatric orthopedic surgeon
- Presence of one or more pathognomonic findings:
  - Constriction bands
  - Acrosyndactyly (syndactyly with a proximal sinus)
  - Non-adjacent syndactyly
  - Bony overgrowth of an amputated limb or digit
- Pattern of limb involvement was aggregated from clinical notes, photographs, radiographs. Associated diagnoses, demographics, and birth history were collected from the medical record

Data Analysis

- Basic statistics (mean, SD) completed for demographics
- Bivariate statistical analysis to assess whether non-CBS diagnoses were associated with the severity of limb involvement; to evaluate the demographics and prenatal histories of patients with CBS differ from those of the general population
- Student's t test used for parametric continuous variables and Mann-Whitney U test and Kruskal-Wallis for nonparametric continuous variables

RESULTS

TABLE 1 Characterization of limb involvement and clinical presentation (n=128)

Feature	Frequency (%)
Upper extremity involvement	83%
Lower extremity involvement	80%
Constriction band	96%
Limb or digit amputations	88%
Syndactyly/acrosyndactyly	69%
Associated diagnosis	52%
Clubfoot	34%
Craniofacial anomalies	12%
Genitourinary abnormalities	6%
Cleft palate	3%
Cardiac anomalies	3%

- The average number of involved extremities was 2.6 limbs per child. 23% of children had involvement of only one limb.
- Children with at least one additional diagnosis had more limbs affected by CBS than those who were otherwise healthy (2, IQR 1-3 vs. 3, IQR 2-4, p=0.006)

FIGURE 1 Pathognomonic findings of CBS

FIGURE 2 Central digits were affected more frequently than peripheral digits

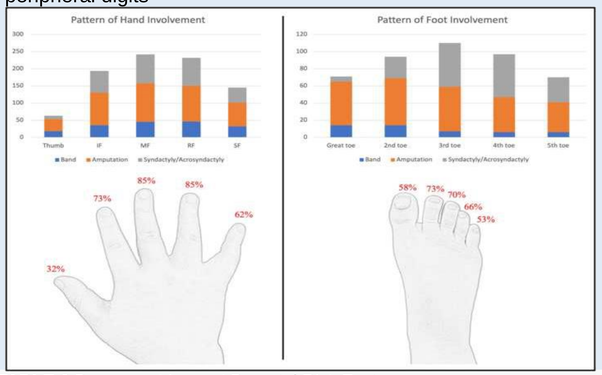

TABLE 2 Demographics and Prenatal Risk Factors

Patient characteristic	CBS (n=128)	CA newborn population[2–4]	p-value
Male[3]	52%	52%	0.94
Maternal age at patient's birth[4]	25.6 years	28.3 years	<0.001
15-19	12%	6%	
20-34	68%	77%	
35+	20%	16%	
Paternal age at patient's birth	28 years	-	-
Race/Ethnicity[3]			
White	47%	45%	0.81
Black	10%	9%	0.89
Asian	10%	16%	0.03
Hispanic	25%	29%	0.21
American Indian/Alaska Native	9%	-	-
Language[3]			
English	87%	77%	0.002
Other	13%	23%	0.002
Insurance[3]			
Private	33%	37%	0.32
Public	57%	58%	0.83
Uninsured	10%	6%	0.12
Area Deprivation Index[2]			
National percentile	39%	50%	<0.001
State decile	7.5	5	<0.001
Gestational trauma	43/112 (38%)	-	-
Premature[3]	49/106 (46%)	9%	<0.001
Low Birth Weight[3]	19/67 (28%)	7%	<0.001
First born	36/84 (43%)	-	-

DISCUSSION

Proposed diagnostic criteria

1. Presence of one or more pathognomonic findings: constriction bands, acrosyndactyly or non-adjacent syndactyly, and bony overgrowth of an amputated limb or digit (Figure 3)
2. If congenital amputations are present, the bones proximal to the level of amputation are usually normal (not malformed or dysplastic)

Risk Factors

- We found high rates of gestational trauma, prematurity, and low-birth weight, suggesting intrauterine trauma may play a role in CBS.
- Maternal age was frequently at the extreme ends of the spectrum (≤ 19 *and* ≥ 35 *years old*), which are known to be associated with pregnancy complications.[4]
- Children with CBS were significantly more disadvantaged than the state average. This supports previous research suggesting low economic status may be a risk factor for CBS.[5-7]
- Further research of prenatal risk factors is needed.

ACKNOWLEDGEMENTS

Thank you to Dr. Michelle James, Dr. Claire Manske and Ms. Elizabeth Peterson at Shriners Hospital for Children, Northern California and Dr. Leah Demetri at UC San Francisco.

REFERENCES

1. Kind AJH, Buckingham WR. Making Neighborhood-Disadvantage Metrics Accessible — The Neighborhood Atlas. N Engl J Med. 2018;378(26):2456. doi:10.1056/NEJMP1802313
2. 2012 MIHA Regional Report: A Summary Report of Regional Snapshots and Geographic Comparisons from the Maternal and Infant Health Assessment Survey.; 2014.
3. Natality Public-Use Data on CBC WONDER Online Database, for Years 2007-2019 Available October 2020.
4. Cavazos-Rehg PA, Krauss MJ, Spitznagel EL, et al. Maternal age and risk of labor and delivery complications. Matern Child Health J. 2015;19(6):1202. doi:10.1007/S10995-014-1624-7
5. Czeizel AE, Vitez M, Kodaj I, Lenz W. Study of isolated apparent amniogenic limb deficiency in Hungary, 1975-1984. Am J Med Genet. 1993;46(4):372-378. doi:10.1002/AJMG.1320460406
6. Bower C, Norwood F, Knowles S, Chambers H, Haan E, Chan A. Amniotic band syndrome: a population-based study in two Australian states. Paediatr Perinat Epidemiol. 1993;7(4):395-403. doi:10.1111/J.1365-3016.1993.TB00421.X
7. Garza A, Cordero JF, Mulinare J, Garza A. Epidemiology of the early amnion rupture spectrum of defects. Am J Dis Child. 1988;142(5):541-544. doi:10.1001/ARCHPEDI.1988.02150050079037