UNIVERSITY of MARYLAND CHILDREN'S HOSPITAL

COUGH Peds - Clinical Outcomes of a Combined Genetics and Hematology Pediatric Clinic

Leah Hirschman[1], MD; Carol Greene[2], MD; Katharine Bisordi[2], MS, MGC, CGC; Alexandra Bowen[2], MS, CGC; Isabella Horton[3], MS1; Regina Macatangay[4], MD

[1]University of Maryland Children's Hospital, Baltimore, MD; [2]University of Maryland Medical Center, Division of Genetics; [3]University of Maryland School of Medicine, Baltimore, MD; [4]University of Maryland Children's Hospital, Division of Pediatric Hematology/Oncology

INTRODUCTION:

Multidisciplinary Clinics and Geneticists

Multidisciplinary clinics (combined clinics) are becoming more common and have been shown to have many benefits. Goals of multidisciplinary clinics include increasing access to subspecialty care, offering a standard model of care and testing, and increasing patient engagement with the medical team. For many patient populations, multidisciplinary clinics have been shown to reduce morbidity and mortality, improve subspecialty care utilization, improve clinical outcomes, and reduce hospital-based charges.

Genetic specialists are often involved in multidisciplinary clinics, have many different roles, and are in high demand. Genetic specialists may collect and analyze information provided by the patient and family (including lab results), provide information on testing, inheritance, prevention, and management of specific diagnoses, assess the change of disease occurrence or recurrence, provide resources, and guide patients and families on next best steps. Most patients are highly satisfied with the genetic counseling that they receive and find the time spent with genetic specialists to be helpful, informative, valuable, and a good use of resources.

The combined pediatric hematology/genetics clinic at the University of Maryland Children's Hospital began in 2013 and offers services to a wide variety of patients. This study aimed to highlight the benefits of this combined clinic.

Ehlers-Danlos Syndrome (EDS)

- Heterogeneous inherited connective tissue/multisystem disorder
  - Patients often benefit from seeing multiple specialists including a geneticist
- Worldwide incidence: 1 in 5000
- Caused by an underlying deficiency in collagen
- Three most common types of EDS: classical (cEDS), vascular (vEDS), and hypermobile (hEDS)
- Cardinal clinical features: tissue fragility (poor wound healing, dystrophic scars, easy bruising and bleeding), joint hypermobility, and skin hyperextensibility

METHODS:

- A database was created consisting of all patients who were seen in the combined clinic.
- All 15 patients who were referred for concerns for Ehlers-Danlos syndrome were selected for review.
- Chart review was completed for each patient and data was collected from 2013 to 2022.

Symptoms Leading to Referral	Number of Patients
Easy bleeding/bruising	12
Joint hyperextensibility	3
Joint pain	3
Menorrhagia	2
Clotting	1
Dizziness	1
Family history of hEDS	1
Multiple health issues	1

Table 1. Number of patients presenting with symptoms concerning for Ehlers-Danlos syndrome (EDS) that lead to referral to the combined clinic. EDS is a heterogeneous inherited connective tissue/multisystem disorder and patients may present with a wide variety of symptoms. The most common primary presenting symptom was easy bleeding and/or bruising.

Types of Referrals	Number of Patients
Referral after pediatric hematology/oncology appointment	8
Outside referral or self-referral	5
Referral after previously seeing a genetic specialist	1
Referral after inpatient admission	1

Table 2. Patients received referrals to the combined pediatric hematology/genetics clinic from various sources. The most common source of referral was a pediatric hematology/oncology specialist.

Beighton Score		
Passive dorsiflexion of the 5th metacarpophalangeal joint by at least 90 degrees	1 point for left side	1 point for right side
Able to oppose the thumb to the volar aspect of the ipsilateral forearm	1 point for left side	1 point for right side
Hyperextension of the elbow by at least 10 degrees	1 point for left side	1 point for right side
Hyperextension of the knee by at least 10 degrees	1 point for left side	1 point for right side
Able to place the hands flat on the floor without bending knees	1 point	

Table 3. Criteria involved in calculating the Beighton Score. Identifying generalized joint hypermobility depends on age; a score of 6 or greater identifies generalized joint hypermobility in children older than 3 years of age, a score of 5 or greater in adolescents and young adults, and a score of 4 or greater in adults aged 50 and over. These criteria are not appropriate to use in patients under three years of age (Malek S, Reinhold EJ, Pearce GS. The Beighton Score as a measure of generalised joint hypermobility. Rheumatol Int. 2021 Oct;41(10):1707-1716. doi: 10.1007/s00296-021-04832-4. Epub 2021 Mar 18. PMID: 33738549; PMCID: PMC8390395).

Diagnostic Outcome	Number of Patients
Diagnosis of hEDS	9
Family member with likely hEDS	5
No EDS	4
Diagnosis of likely hEDS	2

Table 4. Diagnostic outcomes of the combined pediatric hematology/genetics clinic. Nine patients received a diagnosis of hEDS. Five families received recommendations that family members of the patient should be evaluated for hEDS. Four patients who were evaluated were not diagnosed with EDS. Two patients were diagnosed with likely hEDS.

RESULTS:

- Fifteen patients evaluated due to concerns for EDS
- Most patients referred after a pediatric hematology/oncology appointment
- **Time between referral and appointment ranged from one month to twelve months; the average time between appointments was five months**
- Majority of patients were referred due to concerns for easy bleeding and bruising
- Other symptoms: joint abnormalities (joint hyperextensibility and/or pain), menorrhagia, clotting, dizziness, and a family history of EDS
- Nine patients diagnosed with hEDS, two patients were diagnosed with likely hEDS, and four patients were not diagnosed with EDS
- Five patients had family members (parents and/or siblings) who received a new likely diagnosis of hEDS

CONCLUSIONS:

1. As with other multidisciplinary clinics, this clinic has been able to increase accessibility to specialty care and shorten the time between referral and appointment.
2. By seeing a hematologist, geneticist, and genetic counselor at each visit, patients and families being evaluated for EDS were able to receive thorough evaluations and recommendations.
3. Geneticists are in high demand; wait time for a new pediatric patient to see a geneticist is variable based on urgency of evaluation. Patients who were referred to the combined clinic were able to see a geneticist on average within five months, with the shortest wait time being one month after referral.
4. Many other needs were identified during these visits including recommendations for follow up, referral to other specialists, imaging studies, and further genetic testing.
5. This clinic was able to provide advocacy and support to patients across different medical settings.

References:

1. Chiarelli N, Ritelli M, Zoppi N, Colombi M. Cellular and Molecular Mechanisms in the Pathogenesis of Classical, Vascular, and Hypermobile Ehlers–Danlos Syndromes. Genes (Basel). 2019 Aug 12;10(8):609. doi: 10.3390/genes10080609. PMID: 31409039; PMCID: PMC6723307.
2. DeMarco TA, Peshkin BN, Mars BD, Tercyak KP. Patient satisfaction with cancer genetic counseling: a psychometric analysis of the Genetic Counseling Satisfaction Scale. *J Genet Couns*. 2004;13(4):293-304. doi:10.1023/b:jogc.0000035523.96133.bc
3. Hudson PE, Zajo K, Gerhardt CA, Stanek J, Varga E. Defining the role of a genetic counselor within pediatric hematology and oncology comprehensive care teams: Perspectives of the provider team and patients. J Genet Couns. 2019;28:1139–1147. https://doi.org/10.1002/jgc4.1164
4. Miller E, Grosel JM. A review of Ehlers-Danlos syndrome. JAAPA. 2020 Apr;33(4):23-28. doi: 10.1097/01.JAA.0000657160.48246.91. PMID: 32175940.
5. Skirton H, Cordier C, Ingvoldstad C, Taris N, Benjamin C. The role of the genetic counsellor: a systematic review of research evidence. Eur J Hum Genet. 2015 Apr;23(4):452-8. doi: 10.1038/ejhg.2014.116. Epub 2014 Jun 11. PMID: 24916644; PMCID: PMC4666564.
6. Sobey G. Ehlers-Danlos syndrome: how to diagnose and when to perform genetic tests. Arch Dis Child. 2015 Jan;100(1):57-61. doi: 10.1136/archdischild-2013-304822. Epub 2014 Jul 3. PMID: 24994860.
7. Wolfe KR, Kelly SL, Liptzin DR, Brigham D, Rafferty C, Younoszai AK, Di Maria MV. Patient and Family Experience in a Multidisciplinary Clinic for Children With Single-Ventricle Heart Disease. J Patient Exp. 2020 Dec;7(6):1384-1390. doi: 10.1177/2374373520904214. Epub 2020 Mar 2. PMID: 33457591; PMCID: PMC7786718.

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