



**ISBMT**

Indian Society for Blood & Marrow Transplantation

# **BMT MASTER CLASS**

**December 2025**

## **Indications for allogeneic HSCT for children**

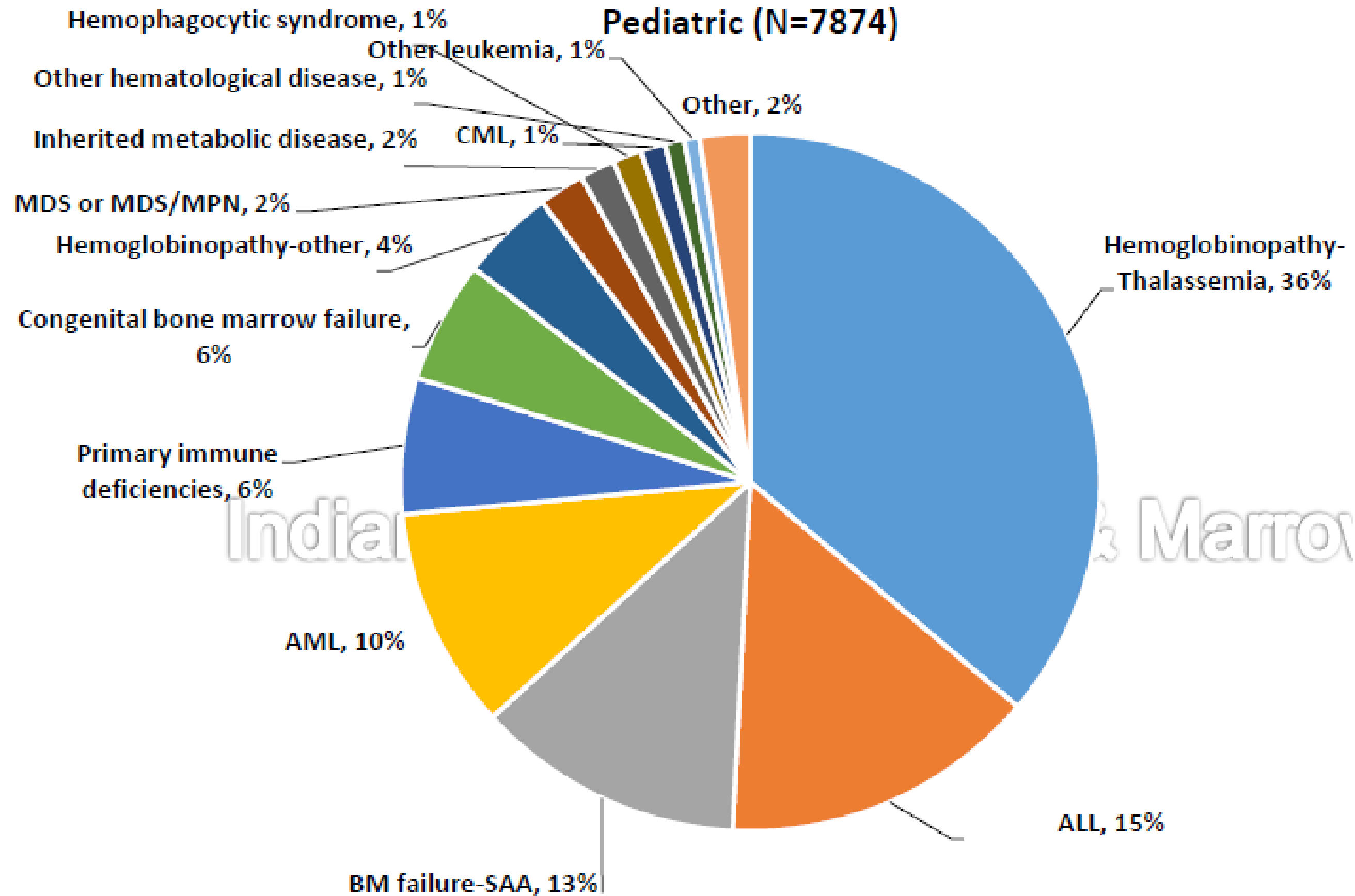
**Dr Vipin Khandelwal**

Senior consultant Pediatric Hemato-oncology and BMT  
Apollo Hospitals, Navi Mumbai, Maharashtra

- Allogeneic BMT offers a potentially curative path for children with severe, life-limiting blood-related conditions or cancers that haven't responded to standard treatments
- Innovative cellular and gene therapies have entered in activity across indications.

**ISBMT REGISTRY**  
2012 to 2023 - Activity report  
Indications for Allogeneic SCT

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# **MALIGNANT CAUSES**

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# Acute lymphoblastic leukemia

<b>Disease status and subtypes</b>	<b>MSD allo</b>	<b>MUD allo</b>	<b>MMAD allo</b>
CR1 (low risk) <sup>a</sup>	GNR/II	GNR/II	GNR/III
CR1 (high risk) <sup>a</sup>	S/II	S/II	CO/II
CR2	S/II	S/II	CO/II
>CR2	S/II	S/II	CO/II

# HSCT indications for pediatric ALL in CR1

- HSCT is indicated for B- or T-cell ALL in first remission in patients with an MRD positive by the end of the consolidation phase (i.e., after approximately 12 weeks of treatment)
- Children who fail induction therapy (M2/M3 marrow)
- ALL diagnosed before 6 months of age associated with MLL (KMT2A) rearrangement and with other risk factors, such as hyperleukocytosis ( $> 300,000/\text{mm}^3$ ) and non-response to corticosteroids.
- The current evidence does not support the use of HSCT in first remission for children with Ph+ (Bcr/Abl) ALL and hypodiploidy who have a good response to chemotherapy (CT).

# HSCT indications for pediatric ALL in CR2

- Early bone marrow (BM) relapse of B-cell ALL (< 36 months after first remission).
- In late BM or extramedullary relapse of B-cell ALL, CT and HSCT exhibit similar results, so HSCT should be preferred, except in cases with persisting MRD positivity.
- Any, early or late, medullary, or extramedullary, relapse of T-cell ALL

# Acute myeloid leukemia

Disease status and subtypes	MSD allo	MUD allo	MMAD allo
CR1 (low risk) <sup>a</sup>	GNR/II	GNR/II	GNR/III
CR1 (high and very high risk) <sup>a</sup>	S/II	S/II	CO/II
CR2	S/II	S/II	S/II
>CR2	S/II	CO/II	CO/II

# Chronic myeloid leukemia

<b>Disease status and subtypes</b>	<b>MSD allo</b>	<b>MUD allo</b>	<b>MMAD allo</b>
1st CP, failing 2nd or 3rd line TKI	S/II	S/II	CO/II
Accelerated phase, blast crisis or >1st CP	S/II	S/II	CO/II

# MDS JMML

<b>MSD allo</b>	<b>MUD allo</b>	<b>MMAD allo</b>
S/II	S/II	CO/III

- **Spontaneous Regression:** Some specific genetic types, like certain *CBL*-mutated JMML or some *NRAS*-mutated cases, can regress (go away) on their own without transplant.

# NHL

<b>Disease status and subtypes</b>	<b>MSD allo</b>	<b>MUD allo</b>	<b>MMAD allo</b>
CR1 (low risk)	GNR/II	GNR/II	GNR/II
CR1 (high risk)	CO/II	CO/II	CO/II
CR2	S/II	S/II	CO/II

# Hodgkins lymphoma

<b>Disease status and subtypes</b>	<b>MSD allo</b>	<b>MUD allo</b>	<b>MMAD allo</b>
CR1	GNR/II	GNR/II	GNR/II
1st relapse, CR2	CO/II	CO/III	CO/III

# PEDIATRIC SOLID TUMOURS

		MSD allo	MUD allo	MMAD allo
<b>Germ cell tumours (refractory)</b>		GNR	GNR	GNR
<b>Sarcoma</b>	Ewing's sarcoma (high risk or >CR1)	D/II	D/III	D/III
	Soft tissue sarcoma (high risk or >CR1)	GNR	GNR	GNR
	Osteogenic sarcoma	GNR/III	GNR/III	GNR/III
<b>Neuroblastoma</b>	High risk or >CR1	D	D	D
<b>Brain tumours</b>		GNR/III	GNR/III	GNR/III
<b>Wilms' tumour</b>	>CR1	GNR/III	GNR/III	GNR/III

# NON-MALIGNANT

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# Hemoglobinopathy

	<b>MSD allo</b>	<b>MUD allo</b>	<b>MMAD allo</b>
<b>TDT</b>	S/II	S/II	CO/II <sup>#</sup>
<b>SCD</b>	S/II	D/II	CO/II <sup>#</sup>

Matched sibling donor	Matched unrelated donor or minimally mismatched good quality cord product	Mismatched marrow donor, haploidentical donor
<p>Stroke</p> <p>Elevated TCD velocity</p> <p>Acute chest syndrome</p> <p>VOE</p> <p>Pulmonary hypertension/ Tricuspid regurgitation jet velocity &gt;2.5 m/s</p> <p>Osteonecrosis/AVN</p> <p>Red cell alloimmunization</p> <p>Silent stroke especially with cognitive impairment</p> <p>Recurrent priapism</p> <p>Sickle nephropathy</p>	<p>Stroke</p> <p>Elevated TCD velocity</p> <p>Recurrent acute chest syndrome despite supportive care</p> <p>Recurrent severe VOE despite supportive care</p> <p>Red cell alloimmunization despite intervention plus established indication for chronic transfusion therapy</p> <p>Pulmonary hypertension</p>	<p>Recurrent stroke despite adequate chronic transfusion therapy</p> <p>Inability to tolerate supportive care though strongly indicated, e.g. red cell alloimmunization, severe VOE and inability to tolerate hydroxyurea</p>

# APLASTIC ANEMIA

		MSD allo	MUD allo	MMAD allo
<b>IBMFS</b>		S/II	S/II	CO/II
<b>Acquired SAA</b>	Newly diagnosed	S/II	S/II	D/II
	Relapse/Refractory	S/I	S/II	CO/II

# Inborn error of immunity

	<b>MSD allo</b>	<b>MUD allo</b>	<b>MMAD allo</b>
SCID	S/II	S/II	S/II
Non-SCID CID	S/II	S/II	S or CO/II
Primary HLH S/II	S/II	S/II	S/II
Other primary ID	S/II	S/II	CO/II



# Inborn error of metabolism

Disorder	Enzyme/protein	Indication	Comments
<b>LYSOSOMAL STORAGE DISEASES</b>			
<b>Mucopolysaccharidoses</b>			
Hurler (MPS-IH)	Alpha-L-iduronidase	Standard	
Attenuated MPSI	Alpha-L-iduronidase	Option	ERT first-line therapy
Hunter: severe (MPS-IIA)	Iduronate-2-sulfatase	Investigational	Only early or asymptomatic, and ERT is often used for somatic disease in these patients
Hunter: attenuated (MPS-IIB)	Iduronate-2-sulfatase	Option	ERT first-line therapy
Maroteaux-Lamy (MPS-VI)	Arylsulfatase B	Option	ERT first-line therapy
Sly (MPS-VII)	Beta-glucuronidase	Option	ERT just licensed
<b>Sphingolipidoses</b>			
MLD: late infantile	Arylsulfatase A	Standard	Gene therapy is standard
MLD: early juvenile	Arylsulfatase A	Option	Consider gene therapy as option
MLD: late juvenile	Arylsulfatase A	Option	Consider gene therapy as option
MLD: adult onset	Arylsulfatase A	Standard	Only early or asymptomatic
GLD: early onset	Galactocerebrosidase	Option—only if patient is diagnosed in first weeks of life, is asymptomatic and family understands there will be significant disease manifestations	
GLD: late onset	Galactocerebrosidase	Standard	Only early or asymptomatic
Niemann pick: Type A	Acid sphingomyelinase	Investigational	
Niemann pick: Type B	Acid sphingomyelinase	Investigational	ERT available
Niemann pick: Type C1, C2	Cholesterol trafficking	No	Does not correct neurological progression even in C2
GM2 Gangliosidosis (Tay Sachs and Sandhoff): early onset	Hexosaminidase A and B	No 21	
GM2 Gangliosidosis (Tay Sachs and Sandhoff): late onset	Hexosaminidase A and B	Option	In known family
Farber	Ceramidase	Option	Especially for somatic disease
<b>Glycoproteinoses</b>			
Alpha-mannosidosis	Alpha-mannosidase	Option	
Fucosidosis	Fucosidase	Option	
Aspartylglucosaminuria	Aspartylglucosaminidase	Option	
<b>Other</b>			
Multiple sulfatase deficiency	Sulfatases	Investigational	Really no evidence to support transplant
Wolman syndrome	Lysosomal acid lipase	Option	ERT is likely first line
Pompe	Glucosidase	Investigational	ERT first-line therapy
<b>PEROXISOMAL DISEASES</b>			
X-ALD, cerebral	ALD protein	Standard in early phase of childhood cerebral inflammatory disease	No advanced disease, gene therapy option in trial
<b>MITOCHONDRIAL DISEASES</b>			
MNGIE	Thymidine phosphorylase	Option	No advanced disease, including minimal gastrointestinal involvement

# Inborn error of metabolism

		MSD allo	MUD allo	MMAD allo
<b>IEM</b>	MPS-IH	S/II	S/II	S/II
	Wolman disease <sup>b</sup>	CO/III	CO/III	CO/III
	MPSII-VII <sup>b</sup>	CO/II	CO/II	CO/II
	MLD	S/II	S/II	CO/II
<b>PSD</b>	X-ALD	S/II	S/II	CO/II
<b>Osteopetrosis</b>		S/II	S/II	S/II

- Cell therapy and gene therapy may modify indications for Hematopoietic Stem Cell Transplantation (HSCT) in children by offering curative options for genetic diseases like Sickle Cell Disease (SCD) and Thalassemia.
- Providing alternatives (like CAR-T cells) that reduce HSCT's toxicity and complications (like Graft-vs-Host Disease)

# QUESTION 1

- Which is not an indication for allogeneic HSCT in pediatric ALL ?
  - a) MRD positive at end of consolidation
  - b) Relapsed T cell ALL on maintenance.
  - c) Newly diagnosed ALL with Hypodiploidy
  - d) B cell ALL in CR3

# QUESTION 2

- Which is not a correct statement ?
  - a) Allogenic HSCT is a curative option in many inborn error of immunity.
  - b) Allogenic BMT should be considered in CR1 in high-risk AML
  - c) Allogenic HSCT can be done at any age in Hurlers syndrome
  - d) Allogenic HSCT can also be done in adults for Sickle cell disease.

**THANK YOU**