Bone health in adolescents and young adults after allogeneic hematopoietic stem cell transplantation in childhood
A single center cross-sectional study

Kathleen De Waele, Lloyd Tack, Victoria Bordon, Sophie Van Lancker, Catharina Dhooge and Martine Cools
Ghent University Hospital, Ghent, Belgium

KEY MESSAGES
✓ Bone geometry and bone strength are impaired in adolescent and young adult males after childhood alloHSCT
✓ Both males and females had a disturbed body composition
✓ No relation was found between the suboptimal body composition and impaired bone health

INTRODUCTION
It is assumed that bone mass and strength accrual during puberty are impaired after allogeneic hematopoietic stem cell transplantation (alloHSCT) due to toxicity of treatments, prolonged inactivity and disturbed body composition.

OBJECTIVES
Cross-sectional study of bone geometry, bone strength and its relation with body composition.

METHODS
Bone strength, mass, size, density (BMD) and body composition were determined by dual-energy X-ray absorptiometry and peripheral quantitative computed tomography.

Participants
Inclusion criteria:
- Boys and girls of 15 to 25 years
- AlloHSCT: ≥2-year interval since alloHSCT
- Controls: healthy volunteers

Cases:
- AlloHSCT: n=22 (11 males, 11 females)
- Controls: n=22 (11 males, 11 females)

Diagnosis and treatment:
- Age at alloHSCT: 9.2±4.91 years.
- Diagnosis:
  ▪ Acute lymphoblastic leukemia: n=16
  ▪ Acute & chronic myeloid leukemia: n=2 & n=2
  ▪ Anaplastic large cell lymphoma and myelodysplastic syndrome: n=1 & n=1
- Myeloablative conditioning regimen:
  ▪ Total body irradiation based (1200 cGy): n=15
  ▪ Busulfan based: n=7
  ▪ Cyclophosphamide (≥ 120 mg/kg): n=10
  ▪ Acute GVHD (grade II to IV): n=8
  ▪ Chronic GVHD: n=1

RESULTS

Dual-energy X-ray absorptiometry
Bone
▪ In males whole body BMD and BMD at spine was lower as compared to controls (p=0.003 & 0.058, respectively)
▪ In females no difference was seen (p=0.916 & 0.475)

Body composition
▪ Despite similar BMI, in both males and females, significantly higher fat mass and lower muscle mass was seen in alloHSCT survivors as compared to controls

Peripheral quantitative computed tomography
Males:
▪ Lower trabecular BMD at both radius and tibia (4%)  
  ▪ Smaller cortical areas at both radius (66%) and tibia (38%)
  ▪ Smaller periostal circumferences were present at tibia
  ▪ Lower strength strain at both radius and tibia (Fig A & B)
▪ No correlations were found with lean and fat mass

Females:
▪ No significant differences in bone geometry and bone strength as compared to controls

CONCLUSIONS
Bone geometry and bone strength are impaired in males. As no relation was found with the suboptimal body composition, a revalidation program must contain specific bone-promoting measures such as weight bearing exercise on top of promoting a healthy diet and lifestyle.