

# Diagnosing the metabolic syndrome in survivors of childhood haematopoietic stem cell transplantation and total body irradiation

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## Background

- Young adult survivors of childhood HSCT/TBI survivors have an increased cardiometabolic risk.
- The International Diabetes Federation (IDF) defines the metabolic syndrome as:
  - central adiposity using increased waist circumference or body mass index (BMI)
  - plus 2 additional features from the following:
    - ↑Triglycerides (TG)  $\geq 1.7$ mmol/L
    - ↓HDL (M<1.03mmol/L, F<1.29mmol/L)
    - ↑Blood Pressure (BP): SBP>130, DBP>85 mmHg
    - ↑fasting glucose (FG) >5.6 mmol/L or known diabetes.
- The metabolic syndrome may be under reported in HSCT survivors who may not have raised BMI and /or waist circumference.

## Aim

- To identify appropriate clinical methods to assess central adiposity in order to identify the Metabolic Syndrome in HSCT/TBI survivors.

## Method

**Participants** 3 Groups (aged 16-26):

- Group 1: BMT/TBI ALL survivors diagnosed at <18 yrs, in remission  $\geq 3$  yrs (n=21, 11M)
- Group 2: Standard chemotherapy treated ALL survivors diagnosed at <18 yrs in remission  $\geq 3$  yrs (n=31, 13M)
- Group 3: subjects with simple obesity (n=30, 10M)

### Assessments

- BP
- Auxology: height, weight, waist & hip circumferences
- Blood tests: Fasting glucose and Oral glucose tolerance test, HDL, TG

### Cut-offs for metabolic syndrome components

- ↑ Body Mass index (weight/height<sup>2</sup>) > 30kg/m<sup>2</sup>
- ↑ Waist-to-height Ratio: raised >0.5
- ↑ Waist-to-hip ratio: raised >0.8 female, >0.9 male
- ↑ BP, ↑ FG, ↑TG, ↓HDL as per IDF criteria
- Diabetes (WHO criteria): 120 minute glucose >11.1 mmol/L

**Statistics:** Odds ratios, confidence intervals, significance 5%

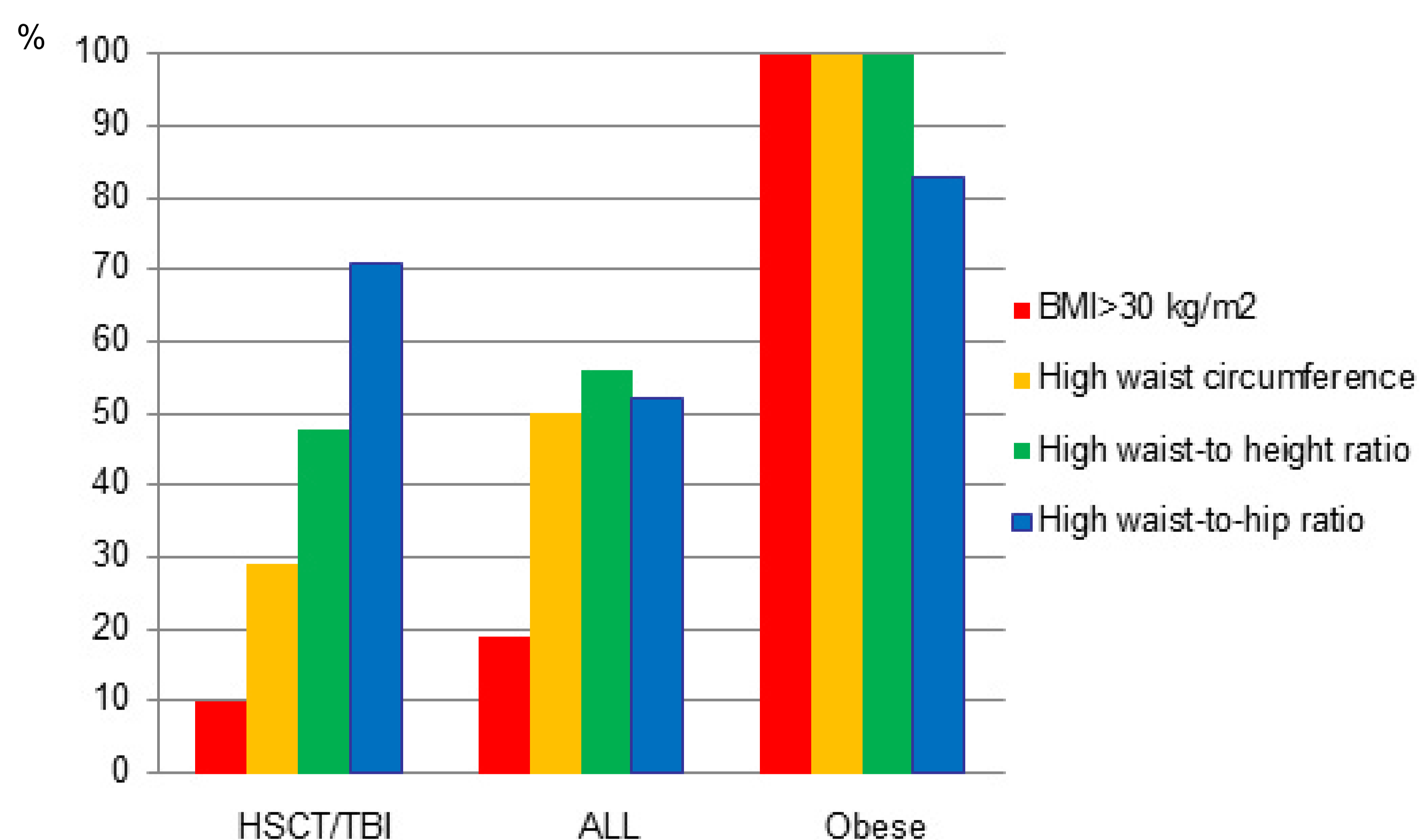
**Approval:** Regional Research Ethics Committee

## Results

**Table 1: Prevalence of hypertension, dyslipidaemia and impaired FG /diabetes in each group as per IDF criteria**

Group	HSCT/TBI 1	ALL 2	Obese 3	Odds ratios (CI) p values 1 vs. 2	Odds ratios (CI) p values 1 vs. 3
↑SBP or DBP	4/21 (18%)	4/31 (13%)	6/30 (20%)	1.6 (0.35-7.2) p=0.55	0.94 (0.23-3.9) p=0.93
↓HDL	12/21 (57%)	8/30 (27%)	16/30 (53%)	3.7 (1.1-12.0) p=0.003	1.2 (0.4-3.6) p=0.79
↑ TG	10/21 (48%)	3/30 (10%)	4/30 (13%)	8.2 (1.9-35.5) p=0.005	5.9 (1.5-23.0) p=0.001
↑ FG or diabetes	2/21 (9.5%)	0/30 (0%)	0/30 (0%)	7.8 (0.36-172) p=0.20	7.8 (0.36-172) p=0.20

**Figure 1: Central adiposity represented by different clinical methods**



In the HSCT/TBI Group, the percentage of patients with central adiposity was higher when this was defined by the waist-to-height or waist-to-hip ratios compared with BMI or waist circumference. This difference was not observed in obese controls.

**Table 2: Prevalence of metabolic syndrome using standard and modified IDF criteria.**

Group Definition	HSCT/TBI 1	ALL 2	Obesity 3	Odds ratios (CI) p values 1 vs. 2	Odds ratios (CI) p values 1 vs. 3
Standard IDF: central adiposity defined by ↑ waist circumference	4/21 (19%)	3/30 (10%)	5/30 (16.7%)	2.1 (0.4-10.7) p=0.40	1.2 (0.3-5.0) p=0.82
Modified IDF: central adiposity defined by ↑ waist-to-height ratio	8/21 (38%)	4/30 (13%)	5/30 (16.7%)	4.0 (1.0-15.8) p=0.047	3.1 (0.8-11.3) p=0.09
Modified IDF: central adiposity defined by ↑ waist-to-hip ratio	9/21 (43%)	3/30 (10%)	5/30 (16.7%)	6.8 (1.5-29.4) p=0.011	3.7 (1.0-13.6) p=0.044

The prevalence of metabolic syndrome in the BMT/TBI survivors was higher when central adiposity was defined using raised waist-to-height and waist-to-hip ratios than the measured waist circumference.

## Discussion and Conclusions

- HSCT have a high cardiometabolic risk without overt obesity
- BMI and uncorrected waist circumferences do not identify central adiposity in HSCT/TBI survivors.
- The standard IDF criteria of the metabolic syndrome underestimates HSCT/TBI survivors with increase metabolic risk
- The waist-to-hip ratio is more representative of central adiposity allowing identification of metabolic syndrome and risk in HSCT/TBI survivors, and may be useful in routine clinic follow-up in these patients.

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