ISRCTN13488607 https://doi.org/10.1186/ISRCTN13488607

A study to monitor changes in body shape in children during treatment for leukaemia to identify if body fat increases the risk of poor response to chemotherapy

Submission date
04/10/2023

Recruitment status
Recruiting

Registration date
24/01/2024

Overall study status
Ongoing

Last Edited
21/01/2026

Condition category
Cancer

[X] Prospectively registered
[_] Protocol
[_] Statistical analysis plan
[_] Results
[_] Individual participant data
[X] Record updated in last year

Plain English summary of protocol

Background and study aims
Acute lymphoblastic leukemia (ALL) is a type of blood cancer where the body produces too many immature white blood cells, leading to problems with healthy blood cell production. It commonly affects children and requires treatment like chemotherapy to target and eliminate the abnormal cells.

The purpose of this study is to investigate how treatment for acute lymphoblastic leukaemia (ALL) affects the nutritional health of children. We're planning the first big study that will track changes in body composition and how much energy the body uses at rest during the entire ALL treatment in kids. We also want to figure out when sarcopenic obesity, a condition where fat increases and muscle decreases, starts to happen, and when kids start changing their eating habits in a way that makes it worse. The data we collect could help doctors give better advice on diet and lifestyle to prevent problems related to sarcopenic obesity. It's important to note that being overweight or obese can increase the chances of ALL coming back, so understanding this is crucial.

So far, past studies have missed out on measuring these things properly in children with ALL. They either used old methods or didn't look at the full picture. We want to change that by using a reliable and non-invasive method called Bioelectrical Impedance Analysis (BIA) to measure body composition. BIA measures how electricity moves through different parts of the body to estimate things like fat and muscle. We also want to measure how much energy the body uses when it's at rest, which is a big part of how much energy we use every day.

Apart from treatment, we know that lifestyle factors, like sitting too much and not being active, can make kids gain weight. Sometimes, the treatment itself can make it harder to be active. So, we're also interested in looking at ways to encourage healthier habits in kids going through this treatment, especially when they're taking dexamethasone, a medicine that can affect their eating and activity.

However, previous reviews of studies haven't given us clear answers about what works best for helping these kids. We need more well-designed trials to figure out the best ways to manage their nutrition and lifestyle. This study aims to fill that gap and hopefully make life better for children with ALL.

Who can participate?
Children aged 6 -14 years with ALL.

What does the study involve?
A DEXA scan is a type of X-ray that measures the structures within the bone. This can take up to 20mins
Bioelectrical-Impedance: measure muscle and fat level. It has 4 leads that are attached to your ankles and wrists and takes 10mins to collect information at baseline, 6 weeks, 6 months and 12 months
Indirect Calorimetry measures energy requirements by placing a space hood over the head to measure breathing and takes 10 minutes to collect information at baseline, 6 weeks, 6 months and 12 months

What are the possible benefits and risks of participating?
There are no advantages at this early stage of the study but the results may provide insight and information to identify children who are at greater risk of developing sarcopenia during and after treatment and therefore ensure appropriate medical and dietetic intervention is accessed. By monitoring and understanding when these changes occur throughout drug treatment, we hope to be able to reduce the development of sarcopenia, which will make the drugs work better and improve your child’s recovery.

Where is the study run from?
Great Ormond Street Hospital for Children NHS Foundation Trust (UK)

When is the study starting and how long is it expected to run for?
October 2023 to October 2027

Who is funding the study?
King Abdulaziz University (Saudi Arabia)

Who is the main contact?
Dr Graeme.O'Connor, Graeme.O'Connor@gosh.nhs.uk

Contact information

Type(s)
Public, Scientific, Principal investigator

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Additional identifiers

Clinical Trials Information System (CTIS)
Nil known

Integrated Research Application System (IRAS)
334875

ClinicalTrials.gov (NCT)
Nil known

Protocol serial number
IRAS 334875

Study information

Scientific Title
Nutritional status of children undergoing treatment for acute lymphoblastic leukaemia: longitudinal observational study

Study objectives
Research Questions
1. In which period of treatment do changes in body size, body composition, resting energy expenditure and lipidaemia arise?
2. Which factors contribute to those physiological changes in body size, body composition, resting energy expenditure and lipidaemia?

Aim: observe the pathophysiological impact of ALL treatment on the development of sarcopenic obesity

Ethics approval required
Ethics approval required

Ethics approval(s)
approved 14/03/2024, North of Scotland Research Ethics Committee (Summerfield House, 2 Eday Road, Aberdeen, AB15 6RE, United Kingdom; +44 (0)1224558458; gram.nosres@nhs.scot), ref: 24/NS/0023

Study design
Longitudinal prospective observational study

Primary study design

Observational

Study type(s)
Diagnostic

Health condition(s) or problem(s) studied
Children with acute lymphoblastic leukaemia

Interventions
Anthropometry (data collection: T0 baseline; T1 remission induction 6 weeks; T2 Consolidation 4 months; T3 maintenance 12 months)
Weight will be determined to the nearest 0.1 kg, with subjects dressed in light clothing or ward gown among patients, using a Model 880 electronic scale (Seca, Hamburg, Germany) after voiding. Height will be measured to the nearest 0.1 cm without socks or shoes, using a Model 206 wall-mounted stadiometer (Seca). Body mass index (BMI) will calculate using the standard formula (kg m–2). Weight and height will be measured following standard procedures. Body mass index will be calculated as weight in kilograms divided by height in meters squared, and BMI SDS will be obtained from the WHO reference curves. BMI and standard deviations scores (SDS) will be calculated using WHO as reference data.
Obesity will be confirmed when the percentile is higher than 99.9th on the WHO Child Growth Standards Curve, or the z-score was higher than +3 (Cole et al., 2000). Children older than 5 years, with BMI between the 85th and 97th percentiles on the WHO Child Growth Standards Curve, will be classified as overweight, and as obese when the percentile is higher than the 97th or the z-score is higher than +2.
Mid upper arm circumference (MUAC) will be measured halfway between the tip of the acromion and olecranon process using a non-stretchable measuring tape SECA 212 to the nearest 0.1 cm
Body Composition – 4 lead bioelectro impedance (BIA) measurements: (data collection: T0 baseline; T1 remission induction 6 weeks; T2 Consolidation 4 months; T3 maintenance 12 months)
Body composition measurements will be performed with the InBody S10® (InBody Co., Ltd., Seoul, Korea). This multi-frequency, segmental impedance analyser requires height, weight, and sex as input parameters. Measurements will be performed in a seated or supine position with reusable electrodes attached to the left and right thumb and index finger and both ankles. The measurements typically take 3–5 min.
The InBody S10 uses segmental impedance and reactance at multiple frequencies to determine total body water (TBW), (segmental) extracellular water (ECW), and the individual ECW/TBW-ratio. High-frequency currents pass through the TBW, whereas low-frequency currents cannot penetrate cell membranes and flow exclusively through the ECW. Henceforth, it uses validated methods to estimate fat-free mass (FFM), (segmental) soft lean mass (SLM), mineral mass, bone mineral content (BMC), percentage body fat (PBF), visceral fat area (VFA), (segmental) skeletal muscle mass (SMM) and protein mass, in addition to several ratios.
Dual energy X-ray absorptiometry (DEXA) (data collection: T0 baseline; T3 maintenance 12 months)
Whole body DEXA will be performed with a Hologic densitometer (Discovery A, Hologic Inc., Bedford, MA). DEXA analysis will be used for determination of Fat Mass, Free Fat Mass, as well as Bone Mineral Density of the whole body and lumbar spine (LS). Measures of LS BMD, the common metric of bone mineralization, will be provided as Z scores in subjects below 18 years of age (based on locally generated normative data and adjusted for height and weight). Osteopenia is classified as Z or T scores between −1 and −2.5 and osteoporosis as −2.5 or lower, although a cut-off of −2 has been recommended for children (Athale et al., 2021).
Indirect Calorimetry Measurements (data collection: T0 baseline; T1 remission induction 6

weeks; T2 Consolidation 4 months; T3 maintenance 12 months)
Indirect calorimetry will measure resting energy expenditure (REE) and respiratory quotient (RQ). An open-circuit ventilated-hood system calorimetric measurements using a portable metabolic cart (Q-NRG+ RMR, COSMED). It measures resting oxygen consumption (Vo2), carbon dioxide production (Vco2), and respiratory quotient. REE will be auto calculated from these parameters using Weir equation. COSMED Indirect calorimetry will be calibrated monthly, using a 2-point calibration method based on two separate mixtures of known gas content. Measurements will be taken after an 8-h overnight fast to eliminate nutrient thermogenesis. Children will lay awake, supine on a bed in a thermally neutral environment (24C) and will be distracted by a portable screen to watch cartoons/ videos etc.
Dietary data collection and instruments: 3 day food history diary (data collection: T0 baseline; T1 remission induction 6 weeks; T2 Consolidation 4 months; T3 maintenance 12 months)
Three-day food records will be used to assess dietary intake and enteral nutrition of children. Parents or caregivers were instructed on how to record the food and beverage consumption of their child using household measures to estimate portion sizes and food type (including brand names of foods, if applicable) in a diary provided. Dietary records will be kept for two weekdays and one weekend day. Analysis of dietary intake will be performed using Nutritics nutritional analysis software (Dublin, Republic of Ireland). Energy and nutrient intake of children will be compared against the SAGN 2017 guidelines.
Vitamin D, bone profile and lipid profile (data collection: T0 baseline; T1 remission induction 6 weeks; T2 Consolidation 4 months; T3 maintenance 12 months)
Blood cholesterol concentrations (total, low density lipoprotein and high-density lipoprotein) in plasma will be collected after age appropriate overnight fast. Blood will be centrifuged for 10 min at 1000g and 4°C to separate plasma from RBC stored at −80°C until analysed. HDL, LDL cholesterol and TG efflux capacity (CEC) will be measured by a validated ex vivo system involving the incubation of macrophages with apolipoprotein B-depleted serum from sub
Physical activity (data collection: T0 baseline; T1 remission induction 6 weeks; T2 Consolidation 4 months; T3 maintenance 12 months)
The activity diary is a reliable instrument for measuring physical activity in children, activity for 3 days of activity including a weekend day, recorded as 15 minute activity slots (Bouchard et al., 1983). Categories of activities and the formulas for energy expenditure
Categories of activities for the activity diary
1 = sleeping or resting in bed; 2 = sitting, eating, writing, etc.; 3 = standing, washing, combing, etc.; 4 = walking indoors (< 4 km/h), light home activities; 5 = walking outdoors (4–6 km/h), cleaning bedroom, easy outdoor playing; 6 = recreational sports and leisure time activities with low intensity; 7 = recreational sports and leisure time activities with moderate intensity; 8 = recreational sports and leisure time activities with high intensity; and 9 = sports competitions.
Equations to calculate energy expenditure
Rest time refers to activities that do not increase energy expenditure substantially above resting level, such as sleeping, lying down, and seated activities. These are represented by categories 1 and 2, and the energy costs are 0.98*basal metabolic rate (BMR) and 1.5*BMR, respectively. Intensity thresholds between light physical activity (LPA) and moderate to vigorous physical activity (MVPA) are around 4 metabolic equivalents of tasks25. Therefore, LPA is represented by categories 3, 4, and 5, with an energy cost of 2.0, 2.8, and 3.3*BMR, respectively. MVPA is category 6 and higher, with an energy cost of 4.4, 6.5, 10.0, and 15.0*BMR, respectively (Ulf et al., 2011).

Other sources of data collection:
Impact of Chemotherapy
- Length of intestinal mucositis
- Length of time of parenteral (intravenous) nutrition
- Length of time on enteral nutrition including nutritional composition of formula

- Infection and antibiotic use
- Any other significant medical event related to treatment

Intervention Type
Other

Primary outcome(s)
1. Change in body composition will be measured using 4-lead bioelectrical impedance at baseline, 6 weeks, 6 month and 12months. Additionally, a DEXA scan will also measure changes in body composition at baseline and 12 months to compare the two methods
2. Change in energy expenditure with be measured using indirect calorimetry at baseline, 6 weeks, 6 month and 12months
3. Change in nutrition intake will be measured using 4-day food diary and Nutritics nutritional analysis programme at baseline, 6 weeks, 6 month and 12months

Key secondary outcome(s))
There are no secondary outcome measures

Completion date
03/10/2027

Eligibility

Key inclusion criteria
1. Consented to partake in the study
2. Diagnosed with Acute lymphoblastic Leukemia
3. On vitamin D supplementation standard of practice when receiving corticosteroids
4. Aged 4 - 16 years

Participant type(s)
Patient

Healthy volunteers allowed
No

Age group
Child

Lower age limit
4 years

Upper age limit
16 years

Sex
All

Total final enrolment
0

Key exclusion criteria
1. 17 years old +
2. Neuro-muscular disease

Date of first enrolment
01/02/2024

Date of final enrolment
30/06/2026

Locations

Countries of recruitment
United Kingdom

England

Study participating centre
Great Ormond Street Hospital
Great Ormond Street
London
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Sponsor information

Organisation
Great Ormond Street Hospital for Children NHS Foundation Trust

ROR
https://ror.org/03zydm450

Funder(s)

Funder type
University/education

Funder Name
King Abdulaziz University

Alternative Name(s)

, L'université du Roi Abdulaziz, La Universidad Rey Abdulaziz, King Abdulaziz University of Saudi Arabia, KAU

Funding Body Type
Government organisation

Funding Body Subtype
Local government

Location
Saudi Arabia

Results and Publications

Individual participant data (IPD) sharing plan
The datasets generated during and/or analysed during the current study are available from the corresponding author on reasonable request.
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IPD sharing plan summary
Available on request

Study outputs

Output type	Details	Date created	Date added	Peer reviewed?	Patient-facing?
Participant information sheet	version 1.0	06/10/2023	24/10/2023	No	Yes