

# Invisible funnel chest

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<b>Registration date</b> 21/06/2022	<b>Overall study status</b> Completed	<input type="checkbox"/> Statistical analysis plan <input checked="" type="checkbox"/> Results
<b>Last Edited</b> 26/07/2023	<b>Condition category</b> Circulatory System	<input type="checkbox"/> Individual participant data

## Plain English Summary

Background and study aims

Pectus excavatum (PE) is a defect of the chest cartilage that causes a hollow in the sternum and thus tightness in the chest. Patients with PE are less able to exercise and often have abnormalities of the heart. There are patients who complain of cardiac symptoms without visible evidence of PE, but who have anatomical conditions on cardiac magnetic resonance (CMR) imaging, suggesting PE with an elevated Haller-Index, which measures chest cavity size.

Who can participate?

Adult patients undergoing CMR for further evaluation of the heart due to cardiac symptoms (such as palpitations, dyspnea, atypical chest pain, syncope)

What does the study involve?

Biventricular global strain analysis is assessed using feature tracking (CMR-FT). ECG and in some cases Holter recordings are performed to detect rhythm events. Cardiac symptoms are evaluated in detail using a questionnaire.

What are the possible benefits and risks of participating?

Participation in the study is not associated with any risk. In the study, MRI data collected as part of routine clinical practice will be correlated with clinical data collected using questionnaires. Further interventions are not planned. Study participation can be withdrawn at any time without giving reasons. Furthermore, there are no costs for the patients. Participation is of course voluntary. No direct benefit is expected for the individual, however, patients receive an additional free study-related visit.

Where is the study run from?

University Medical Centre Mannheim (Germany)

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

October 2019 to February 2022

Who is funding the study?

Investigator initiated and funded

Who is the main contact?  
Dr Anna Hohneck  
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## Contact information

**Type(s)**  
Scientific

**Contact name**  
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## Additional identifiers

**EudraCT/CTIS number**  
Nil known

**IRAS number**

**ClinicalTrials.gov number**  
Nil known

**Secondary identifying numbers**  
Nil known

## Study information

**Scientific Title**  
Thoracic constriction without evidence of the typical funnel-shaped depression – the invisible pectus excavatum

**Study hypothesis**  
Pectus excavatum (PE) is a congenital deformity that leads to a funnel-shaped depression of the anterior chest wall. This pathognomonic feature gives the disease its common name, funnel chest. For a long time, it was assumed that PE was an inconsequential condition with symptoms

rather than of a cosmetic character. However, the deformity can lead to reduced physical performance, especially during exercise, mainly caused by compression of the right ventricle. In several studies, reduced lung volumes associated with lower airway obstruction could also be observed. While the PE diagnosis can typically be made at a glance, there are patients who show only discrete indications to no visible external changes and unobtrusive echocardiography but present with non-specific cardiac symptoms. In cardiac magnetic resonance imaging (CMR), however, there is evidence of PE, with an increased Haller index, which measures chest cavity size, but without the typical funnel-shaped sternal depression. The current study investigated a case series of patients with cardiac symptoms who have received a CMR for work-up, showing thoracic constriction in terms of an invisible pectus excavatum.

### **Ethics approval required**

Old ethics approval format

### **Ethics approval(s)**

Approved 14/01/2020, Medical Ethics Commission II, Faculty of Medicine Mannheim, University of Heidelberg (House 42 - Level 3, Theodor-Kutzer-Ufer 1-3, 68167, Mannheim, Germany; +49 621 /383-71775; ethikkommission-II@medma.uni-heidelberg.de), ref: 2020-800R

### **Study design**

Monocentric observational trial

### **Primary study design**

Observational

### **Secondary study design**

Case series

### **Study setting(s)**

Hospital

### **Study type(s)**

Screening

### **Participant information sheet**

Not available in web format

### **Condition**

Patients with cardiac symptoms and elevated Haller-Index in cardiac magnetic resonance imaging

### **Interventions**

Biventricular global strain analysis is assessed using cardiac magnetic resonance feature tracking (CMR-FT). ECG and in some cases Holter recordings are performed to detect rhythm events. Cardiac symptoms are evaluated in detail using a questionnaire.

### **Intervention Type**

Other

### **Primary outcome measure**

Determination of the Haller index, defined as the ratio of the transverse thoracic diameter divided by the frontodorsal diameter of the chest, by analyzing magnetic resonance imaging

(MRI) data, measured at the time of study inclusion. For this, only two distances are measured on the MRI image and related to each other.

### **Secondary outcome measures**

1. Correction index, measured by cardiac magnetic resonance imaging (CMR) at the time of study inclusion. The correction index is defined as the minimum distance between the posterior sternum and anterior spine and the maximum distance between the anterior spine and most anterior portion of the chest. The difference between the two is divided by the latter ( $\times 100$ ) to give the percentage of chest depth the defect represents.
2. Depression index, measured by CMR at the time of study inclusion. The depression index is derived from the absolute measurement of sternal depression using the transverse vertebral body diameter as a surrogate for height.
3. Intracardiac angles, measured by CMR at the time of study inclusion. Intracardiac angles were determined to describe the deviation of the heart axis by measuring three different intracardiac angles, including the angle between the perpendicular of the thorax and the apex of the right ventricular/insertion of the two ventricles/apex of the left ventricle.

### **Overall study start date**

01/10/2019

### **Overall study end date**

01/02/2022

## **Eligibility**

### **Participant inclusion criteria**

Patients who undergo cardiac magnetic resonance imaging for further evaluation of the heart due to cardiac symptoms (such as palpitations, dyspnea, atypical chest pain, syncope) and unobtrusive echocardiography, with relative thoracic constriction due to an elevated Haller-Index.

### **Participant type(s)**

Patient

### **Age group**

Adult

### **Sex**

Both

### **Target number of participants**

100

### **Total final enrolment**

88

### **Participant exclusion criteria**

1. Inability to give informed consent
2. Definitive cardiac diagnosis

**Recruitment start date**

01/02/2020

**Recruitment end date**

01/02/2021

## Locations

**Countries of recruitment**

Germany

**Study participating centre****University Medical Centre Mannheim**

Medical Faculty Mannheim

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## Sponsor information

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**Sponsor type**

University/education

**Website**

<https://www.umm.de/i-medizinische-klinik/forschung-lehre/studienzentrum/>

**ROR**

<https://ror.org/05sxbyd35>

## Funder(s)

**Funder type**

Other

**Funder Name**

Investigator initiated and funded

## Results and Publications

**Publication and dissemination plan**

Submission progress for publication in Journal of Cardiovascular Magnetic Resonance (JCMR).

**Intention to publish date**

01/11/2022

**Individual participant data (IPD) sharing plan**

The datasets generated during and/or analysed during the current study are/will be available upon request from the Principal Investigator of the study Dr Anna Hohneck, annalena.hohneck@umm.de. These data are available in anonymized form so that no conclusions can be drawn about patient data. A general transfer of data to third parties is not intended. The data are archived by us for a period of 10 years and are available within this period for further analyses (e.g. as part of a meta-analysis or similar).

**IPD sharing plan summary**

Available on request

**Study outputs**

Output type	Details	Date created	Date added	Peer reviewed?	Patient-facing?
<a href="#">Results article</a>		25/07/2023	26/07/2023	Yes	No