



Surgical correction of pectus carinatum improves perceived body image, mental health and self-esteem☆



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ABSTRACT

Purpose: The purpose of this study was to assess the effects of surgical correction of pectus carinatum on health-related quality of life and self-esteem.

Methods: Between May 2012 and May 2013, a prospective observational single-center cohort study was conducted on consecutive patients undergoing surgical correction of pectus carinatum at our institution. Patients filled in questionnaires on health-related quality of life and self-esteem before and six months after surgery.

Results: Disease-specific health-related quality of life was improved by 33% (95% CI: 23; 44%) according to responses to the Nuss Questionnaire modified for Adults. The improvement for generic mental health-related quality of life was 7% (95% CI: 3; 12%) in responses to the Short Form-36 Questionnaire. The improvement in self-esteem was 9% (95% CI: 2; 17%) as assessed with the Rosenberg Self-Esteem Scale. A Single Step Questionnaire supported the improvements in health-related quality of life and self-esteem six months postsurgery.

Conclusion: This study confirms positive effects of surgical correction of pectus carinatum on health-related quality of life and self-esteem. Patients were to a greater extent self-satisfied about chest appearance following surgery, indicating this to be a step in the right direction toward improved body image, mental health and self-esteem.

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Pectus carinatum (PC) is an anterior chest wall deformity caused by an outward displacement of the sternum and/or an abnormal protrusion of the ribs [1,2]. The deformity becomes often more apparent during early puberty, a period characterized by great physical, social and emotional changes [2,3]. The psychological effects of the disfigurement can be severe and may influence patients' physical, mental and social function [1,2]; also termed Health-Related Quality of Life (HRQoL) [4]. Patients often express body image concerns about the unusual chest contour, and they experience low self-esteem with embarrassment and shame because of their physical appearance [1–3,5]. Defensive camouflaging with poor posture and folded arms and an unwillingness to be seen without a shirt or to participate in sports or social activities is common [3,5]. In the literature, the deformity has shown a tendency to affect cosmetic appearance and impact negatively on patients' HRQoL and self-esteem. Steinmann *et al.* found a significantly impaired body image, reduced mental HRQoL and low self-esteem in 19 patients with

PC compared to healthy age-matched subjects [3]. However, the study was only based on preoperative data. To the best of our knowledge, only a single study has previously evaluated patient-reported outcome of surgical correction of PC [6]. Bostanci *et al.* found evaluation of body image and physical appearance significantly improved in 30 patients with PC six months after surgery [6]. Thus, the mental and physical health consequences of surgical correction of PC remain poorly characterized. The purpose of this study was to assess the effects of surgical correction of PC on body image, HRQoL and self-esteem.

1. Materials and methods

1.1. Study design

A prospective observational single-center cohort study was conducted on consecutive patients undergoing surgical correction of PC between May 2012 and May 2013 with six months follow-up.

1.2. Participants

All patients undergoing the modified Ravitch procedure of PC from May 2012 to May 2013 at the Department of Cardiothoracic and Vascular Surgery, Aarhus University Hospital in Denmark were invited to participate [7]. Exclusion criterion was inability to speak and understand Danish.

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1.3. Recruitment

Patients were verbally invited to participate in the study the day before scheduled surgery before taking part in the standard preoperative preparation program. If accepting to participate, patients filled in three questionnaires on generic and disease-specific HRQoL and self-esteem. Questionnaires and a supplemental questionnaire were forwarded six months after surgery by mail together with a prepaid envelope. In case of no response, a first reminder was forwarded after two weeks by e-mail followed by a phone call. Contact to participants about missing questionnaires was attempted up to three times. The study was closed at 1 November 2013.

1.4. Questionnaires

1.4.1. The Nuss Questionnaire modified for Adults

The Nuss Questionnaire modified for Adults (NQ-mA) was used to assess disease-specific HRQoL [8]. The NQ-mA consists of 12 questions: nine questions about body image and three about physical function. The score ranges from 0 to 48 points, higher scores indicating higher disease-specific HRQoL.

1.4.2. The Short Form-36 Health Survey

The Short Form-36 Health Survey (SF-36) was used to assess generic HRQoL. The questionnaire consists of 36 questions of which 20 questions refer to the last four weeks and 16 questions are about the current situation [9]. On the basis on the 36 questions, eight subscales, a Physical Component Score (PCS), and a Mental Component Score (MCS) are generated. All subscale and summary scores range from 0 to 100 points, higher scores indicating higher HRQoL.

1.4.3. The Rosenberg Self-Esteem Scale

The Rosenberg Self-Esteem Scale (RSES) was used to assess self-esteem. The scale consists of 10 questions with five positively and five negatively worded questions. The score ranges from 0 to 30 points, higher scores indicating higher self-esteem [10]. A score between 15 and 25 points are within the normal range, whereas a score below 15 reflects low self-esteem [11].

1.4.4. Single Step Questionnaire

The Single Step Questionnaire (SSQ) was used to supplement assessment of HRQoL and self-esteem six months postsurgery [8]. SSQ is a disease-specific questionnaire, originally developed for patients with pectus excavatum by Krasopoulos *et al.* [8]. It consists of 16 questions regarding physical, mental and social functioning, self-esteem, pain and overall satisfaction with physical appearance after surgery. One of the questions is directly related to the surgical correction of pectus excavatum; this question was not relevant to our study population, and was thus excluded from the questionnaire.

1.5. Statistics

All statistical analyses were performed in Stata/IC 12.1 (StataCorp, College Station, TX, USA). Continuous normally distributed data are presented as mean \pm standard deviation (SD). Continuous non-normally distributed data are presented with median and range. The relative differences in sum scores for each questionnaire from baseline to follow-up were analyzed using unpaired t-test stratified by patient characteristics (body mass index, self-reported primary indication for surgery, and pectus type). Statistical analyses were restricted to participants completing the six months follow-up assessments (complete-case-analysis). A *P*-value < 0.05 was considered as statistically significant.

1.6. Ethics

All participants received written information about the study and were guaranteed confidentiality. Written informed consent was obtained from all patients > 18 years, whereas written consent was obtained in association with the parents to participants aged 15–17 years. According to Danish law, approval was not required from The Central Denmark Region Committees on Biomedical Research Ethics. The study was approved by the Danish Data Protection Agency (file no. 2012-41-0397) and registered in the ClinicalTrials.gov database (ClinicalTrials.gov Identifier: NCT01692392). Participants and collaborators/authors did not have any financial interests to complete the study.

2. Results

2.1. Participants

Forty patients were eligible for inclusion into the study of which 36 patients (90%) accepted to participate; 28 participants (78%) completed the follow-up assessment. No differences in demographics were identified between participants and non-participants. Dropouts at follow-up did not differ significantly in baseline demographics and questionnaire responses (Table 1). Hospitalization was 4 ± 1 days. No postoperative complications were recorded (e.g. infection, pneumothorax or pneumonia).

2.2. Disease-specific HRQoL

The total score for the NQ-mA was 34 ± 5 points at baseline and 44 ± 5 points at follow-up. The NQ-mA score improved significantly by 33% (95% CI: 23; 44%) at six months after surgery. A total of 20 participants (72%) were unhappy (mostly/very unhappy) about the appearance of their chest without shirt before surgery (Table 2). At six months after surgery, four participants (15%) were unhappy, and 24 (85%) were happy (very/mostly happy) about chest appearance. Before surgery, 27 participants (96%) were unhappy (mostly/very unhappy) about accepting appearance of their chest for the rest of their life. Six months later, two (7%) answered they were unhappy (very/mostly

Table 1

Demographics of respondents and participants lost to follow-up (N = 36).

| Characteristics | Respondents n = 28 | Lost to follow-up n = 8 | P |
|---|-----------------------|-------------------------------|--------------------|
| Age, median (range) | 16 (13–23) | 16 (14–19) | 0.415 ^c |
| Body mass index, median (range) | 19 (16–24) | 19 (15–23) | 0.798 ^c |
| Gender, no. (%) | | | |
| Male | 25 (89) | 7 (88) | 0.156 ^d |
| Female | 3 (11) | 1 (12) | |
| Body mass index (kg/m ²) ^a , no. (%) | | | |
| < 18.5 | 9 (33) | 3 (38) | 0.827 ^d |
| ≥ 18.5 | 18 (67) | 5 (62) | |
| Self-reported primary indication for surgery, no. (%) | | | |
| Physical reason | 7 (25) | 4 (50) | 0.176 ^d |
| Cosmetic reason | 21 (75) | 4 (50) | |
| Pectus type, no. (%) | | | |
| Asymmetric | 8 (29) | 2 (25) | 0.842 ^d |
| Symmetric | 20 (71) | 6 (75) | |
| Comorbidity ^b , no. (%) | | | |
| Epilepsy | - | 1 (12) | |
| Attention deficit hyperactivity disorder | 1 (4) | - | |
| Asthma | 3 (11) | - | |

Demographics of patients undergoing surgical correction of pectus carinatum at Aarhus University Hospital in Denmark between May 2012 and May 2013.

^a One missing.

^b None of the participants had more than one comorbidity.

^c Mann-Whitney test.

^d Chi-square test.

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