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# Psychologic Effects, Body Image, and Pectus Excavatum and Carinatum

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## Introduction

Young people with pectus excavatum or carinatum seek treatment for physical symptoms, concerns about chest appearance, or both. It has long been recognized that the appearance of the chest is a major concern to patients with pectus excavatum. Although pectus excavatum was described in 1596, the first surgical correction was not even attempted until 1911. Surgical progress was rapid, however, and already by 1949, Charles W. Lester of New York wrote, “The psychological aspect of the situation is of great significance”. The girls do not pay much attention to the deformity until their breasts begin to develop and they start to wear a brassiere. Then they become conscious of it. The boys notice their deformity earlier probably because they run around unclad with other boys who take delight in calling attention to any deformity with derisive language. Many children take this teasing without trouble, but others cannot and they are entitled to a corrective operation [1]. In 1958, Adkins and Gwathmey of Washington, D.C. stated,

“The other and equally valid indication for surgical correction is for cosmetic and psychologic reasons. A depression or deformity of the chest wall may be a source of considerable embarrassment, especially during adolescence and young adulthood. Consequently, operative correction of such a deformity is well justified even in the absence of symptoms” [2]. Mark M. Ravitch, in the influential 1962 textbook, *Pediatric Surgery*, offered that, “Subject to more argument, perhaps, is the psychologic importance of the essentially cosmetic deformity. It...is very rare for parents to present the psychologic effects as reason for operation, or children either...they want the operation only if it is indicated for “reasons of health.” But after operation, attention is centered almost entirely on the visible correction of the deformity and the relief this gives, usually to three generations of the family. Many children, both males and females, come for operation in early adolescence, when they become reluctant to undress before their fellows” [3]. By the 1970’s, operations designed to restore the contour of the chest wall with implants illustrated the need to improve the appearance [4]. Lacquet and colleagues reported from the Netherlands in 1998 that surgical treatment of pectus excavatum affected patients’ self-perception: “The psychologic results were usually striking. In many cases it was only after the operation that patients admitted to having been distressed by their deformity. They lost all traces of an inferiority complex, and the boys rather proudly displayed

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their surgical scar. Generally most patients were very thankful and enjoyed the result of their operation” [5].

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## Body Image Concept

E. Einsiedel, a clinical psychologist from Mainz, Germany, wrote on the dual nature of patients concerns in 56 patients with funnel chest. He referred to this as “interlocking-systemic diagnosis”. He reported that children over 11 years old “display as a whole more psychological disorders. Along with specific embarrassment reactions, social anxiety, feelings of stigma, limited capacity for work, orientation toward failure, reduced tolerance of frustration and temptation, limited capacity for communication, and even markedly depressive reactions are observed.” The frequency of occurrence of each was reported, and varied from 58 to 94% of the children. Children less than 11 years old were much less frequently affected (4.5–40% depending on category) [6].

Physical attractiveness as a separate field of study within psychology was advanced by seminal work by Dr. Thomas F. Cash of Old Dominion University. He researched “the influences of various aspects of physical appearance on human behavior” [7]. He uncovered evidence that physical appearance had a major effect on physical and mental health and identified links between self-concept, social competence, and personality functioning. This work validated the concept that persons who believe themselves to be less attractive are less social, self-accepting, and independent [8]. Behavioral changes range from benign to maladaptive. Cash indicates that women who perceive themselves as obese use more facial makeup, for example [7]. Anorexia nervosa, on the other hand, is an example of a psychopathology induced by the same concerns. Depression is another psychopathology linked to adverse opinion of one’s attractiveness. There is an inverse relationship between body image and depression [7].

Successful treatment of congenital craniofacial deformities was developed in the 1960s and

70s by Paul Tessier in France, Milton Edgerton in Virginia, and others. These treatments were shown to have positive effects on body image [9–12]. The concerns of burn patients regarding body image have received increased attention as well [13].

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## Body Image in Pectus Excavatum

Given the many clinicians who noted psychological improvements in pectus patients after surgery, scientific investigation of these effects followed, at first on a small scale. In Vancouver, Canada, Roberts and colleagues conducted structured interviews of five children who had undergone the Nuss procedure, and their parents, studying then for a total of ten subjects. They used Keith and Schalock’s quality of life model. They concluded that the patients interviewed had a significant improvement in quality of life, which they attributed to the surgery [14].

In considering development of psychological evaluation, discussion of the clinical experience is a starting point. Surgeons find that adolescents and young adults who present for evaluation of pectus excavatum or carinatum often must be directly asked to remove their shirts for physical exam. For females, this may be due to modesty. Males do not typically exhibit such modesty issues; however, there remains a real reluctance to be examined. In contrast, after operation, boys often lie in bed recovering from operation with no shirt on, and no sheet over their chest. At clinic follow up 2 weeks postop, they are like Superman in a phone booth, rapidly removing their shirt, eager to show off their new chest.

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## Evaluation of Body Image in Pectus Excavatum

When approached about this phenomenon, Cash and associates developed a psychological tool, the Pectus Excavatum Evaluation Questionnaire, or PEEQ. This 24 question inventory includes questions concerning both physical symptoms and body image. It was designed to evaluate the

quality of life. To validate the new instrument, we administered a child and parent version of the questionnaire to 22 parents and 19 children (ages 8–18) before surgery and 6–12 months after repair by Nuss procedure. The instrument had high test-retest reliability. Children reported significant improvements in exercise intolerance, shortness of breath, and tiredness. Of nine questions asking the children how they feel or act about their bodies, all but one question showed significant improvement after surgery. Parents also reported significant improvements in their child's exercise tolerance, chest pain, shortness of breath, and tiredness, and decreases in the frequency of the child being frustrated, sad, self-conscious, and isolated. These data were reported by our group in 2003 [15].

Subsequently, as part of a multicenter study of pectus excavatum, the PEEQ was administered by the research coordinator, by telephone, to parents and patients (8–21 years of age) before and 1 year after Nuss or open surgery. From 2001 to 2006, 264 patients and 274 parents completed the postoperative questionnaire. Preoperative psychosocial functioning was unrelated to objective pectus excavatum severity (computed tomographic index). Patients and their parents reported significant postoperative changes. Improvements occurred in both physical and psychosocial functioning, including less social self-consciousness and a more-favorable body image. Ninety-seven percent of patients thought that surgery improved how their chest looked. We concluded that surgical repair of pectus excavatum can significantly improve both the body image difficulties and limitations on physical activity experienced by patients [16].

By request, we subsequently provided the PEEQ without cost to other investigators, who have confirmed these results.

The Vancouver group followed up their 2003 report in 2008 with an analysis of 43 patients who underwent surgery. They were studied both with the PEEQ and with the Child Health Questionnaire (CHQ-CF87). Results were compared to age-matched Australian norms. The majority of patients underwent the open operation, and 44% the Nuss procedure. The study

concluded that patients undergoing surgery for pectus excavatum by either Nuss or Ravitch procedure have similar clinical and health-related-quality of life (HRQL) outcomes. As a group the PE patients have poorer HRQL scores than age-matched population norms [17].

In London, England, the Royal Brompton Hospital Group used a modification of the PEEQ questionnaire (which they called NQ-mA for Nuss questionnaire modified for adults) and a new Single Step Questionnaire (SSQ) to assess 20 male patients with median age 18 years (range 14–37 years). The questionnaires were adequate to measure disease-specific quality of life changes after surgery and were able to confirm that the Nuss procedure improves the quality of life in young male adults with pectus excavatum [18]. Separately, they showed that the SSQ correlated with the PEEQ modified for an adult population.

Recently, there has been great deal of publication related to health-related quality of life with pectus excavatum. From Denmark, Jacobsen, Pilegaard and colleagues studied 172 children and adolescents ages 8–20 years, 86% of whom were males. They used the Child Health Questionnaire CHQ-CF87 for children and the CHQ-PF50 for adults. They also used the PEEQ modified for adults (NQ-mA) and the SSQ using an instrument other than the PEEQ have shown that in five subscales of self-esteem, behavior, emotional role, mental health and family activities, the PE group had a better HRQoL [19].

Ohno and colleagues from Osaka, Japan, evaluated 36 patients with pectus excavatum aged 1–22 years old. Respondents were asked whether they suffered psychological distress and if they wanted surgery. The severity of the deformity was measured radiographically. The severity of the deformity was worse in the patients who suffered psychological distress [20].

The group from Graz, Austria performed a comprehensive psychological investigation of 17 patients in 2003, and repeated the battery of tests in 2007 after Nuss operation to correct pectus excavatum at a mean age of 19.6 years. Nearly all patients' preoperative expectations were confirmed postop. Data from SCL-90-R, measuring mental exposure, had normal range. The authors

conclude that “the long-time follow-up can make us sure that the Nuss procedure as a physical treatment has positive effects on physical as well as psychologic aspects of young adults.” Patients were pleased with the cosmetic effects of operation [21].

In Erlangen, Germany, 90 patients and 82 controls were assessed with the PEEQ modified for adults, also the FKB-20 Body Image Questionnaire, the Dysmorphic Concern Questionnaire, and the Diagnostic Interview for Mental Disorders-Short Version (Mini-DIPS), the General Depression Scale, and a self-rating of self-esteem were used to evaluate general psychological impairment. The study reported that, compared with control group results, the physical quality of life was reduced in patients with pectus excavatum, while the mental quality of life was decreased in patients with pectus carinatum. Body image was highly disturbed in all the patients. Patients with pectus carinatum appeared to be less satisfied with their appearance than those with pectus excavatum. Body image did not influence physical quality of life. Patients displayed no elevated rates of mental disorders according to Diagnostic and Statistical Manual of Mental Disorder, fourth edition (DSM-IV) criteria. Based on mean scores, patients rated their appearance significantly more negatively than adult raters but only slightly different than other adolescent raters. Adolescent raters’ judgment was related to chest wall deformity characteristics. Self-rating seems to be related to psychosocial factors. The group suggests that effective interventions focusing on social interactions are needed, since adolescents’ evaluation of appearance might affect patients’ psychological functioning [22].

In Hanover, Germany, a study was conducted to demonstrate that the improvement of quality of life demonstrated following Nuss procedure persisted after removal of the bar. Forty patients were assessed a mean of 54 months following Nuss procedure. Patients were interviewed 6 months after the bar was put in, and then 23 months after bar removal on average. There was a high level of persistent satisfaction after bar removal, and the positive impact of MIRPE (Nuss procedure) on psychosocial and physical well-being was

documented, which persisted up to 4 years after bar removal [23].

A follow up from the group from Hanover evaluated correlation between general practitioner (GP) and patient evaluation of outcome. This was done because of concern that patient ratings may be biased by high preoperative patient expectations. Thirty-nine patients and their GPs were asked to complete a questionnaire to evaluate their opinion on psychosocial and physical well-being of the patients. Only 56 % of the GP’s completed the questionnaire, but there was a highly significant correlation between GP and patient ratings. Detailed analysis showed that GPs scored several items differently to their patients. GPs scored social activity and preoperative self-esteem lower, but pain and impairment of daily activities during the period with the implanted bar significantly higher than the patients [24].

In Sichuan, China, a study of 337 children aged 6–16 years over a 3 year period was performed. Psychosocial functioning was assessed by a Child Behavior Checklist. A Chinese Mandarin version of the 1991 CBCL, previously validated for reliability and discriminant validity in Chinese children, was used [25, 26]. Four hundred and fifteen patients were initially evaluated, but 38 patients did not complete the study, and 40 were later found to be ineligible. The deformity was first noted at 4, 5, or 6 years of age in 75 % of children. Only three patients first noted it after the age of 10 years. Dissatisfaction and being teased about the deformity were major factors in seeing treatment. Thirty-seven percent of patients asked their parents to be taken for treatment. Avoidance of exposing the chest in public was reported by 44 % of children. Teasing, always by non-family members, was reported by 23 % of children; notably, 97 % of the time teasing was perpetrated by other children. Age correlated strongly with psychosocial problems: compared with the group under 9 years, the group from 12 to 16 years was at higher risk for such problems. Multivariate analysis showed that age, severity of the malformation, and being teased correlated with psychosocial

problems. As the authors discussed, the correlation of psychosocial distress with severity of the depression stands in marked contrast to the CHKD/EVMS report [16]. The authors use a different tool to study the psychosocial distress. Mother's education was not a significant predictor or psychosocial problems. This work suggested that children with PE have more psychosocial problems than children from the general population. Multiple medical and psychosocial factors were associated with patients' impairment of psychosocial functioning [27].

## Body Image in Pectus Carinatum

There has been little publication concerning these effects in pectus carinatum. However, in 2013, a group from Istanbul, Turkey, studied 30 patients who had undergone minimally invasive repair of pectus carinatum using the PEEQ. There was found to be significant improvement following surgery, confirming for the first time that the findings in pectus excavatum were also seen in pectus carinatum [28].

### Conclusion

In summary, concerns about physical appearance are present in the vast majority of children and adults with pectus deformity; operation to improve chest wall contour improves body image.

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