Long-term health-related quality of life after complex and/or complicated esophageal atresia in adults and children registered in a German patient support group☆

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A B S T R A C T

Background: Health-related quality of life (HRQoL) after esophageal atresia (EA) repair is postulated to be good. However, little is known about the long-term results after repair of complex and/or complicated EA regarding HRQol. We investigated long-term HRQoL after delayed anastomosis, esophageal replacement, major revisions, or multiple dilatations in patients registered in a support group.

Methods: Patients registered in the German patient support group database (KEKS) were enrolled and allocated to subgroups according to surgical treatment and age. HRQoL was evaluated using validated questionnaires (GIQLI, WHO-5, KIDSCREEN27).

Results: Complete follow-up (mean 14.5 ± 9.8 years) was available for 90/92 patients. Patients were allocated to subgroups delayed anastomosis (n = 28), esophageal replacement (n = 27), major revisions (n = 15), and multiple dilatations (n = 20). Adult patients presented with impaired well-being according to WHO-score and gastrointestinal function (GIQLI). In contrast, HRQol of children was comparable to controls in most KIDSCREEN27-dimensions. Delayed anastomosis was associated with most-favourable HRQoL. Regarding physical well-being, these children scored significantly better than controls [64.01 ± 10.40 vs. 52.36 ± 8.73; p = 0.0011], children after replacement [51.40 ± 5.70; p = 0.008], repairs [52.04 ± 6.97; p = 0.026], and multiple dilatations [50.22 ± 9.67; p = 0.04].

Conclusions: HRQoL after complex and/or complicated EA is excellent in children registered in a patient support group. In adults, disease-specific symptoms negatively affect HRQoL. Our data indicate that saving the esophagus may achieve the best HRQoL.

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Esophageal atresia (EA) is a congenital condition characterized by absence of the normal continuity of the esophagus. Improvements in prenatal diagnosis, advances in surgical and neonatal care, pediatric anesthesia, and parenteral nutrition have increased the survival rate in EA in recent years to approximately 95% [1]. Nevertheless, there is an ongoing debate on the optimal surgical approaches in patients with “long gap” or a complicated course after EA repair [1–10].

A growing number of EA survivors are adults and therefore, interest in long-term outcomes in these patients is increasing [11]. It has been demonstrated that quality of life (QoL) in adult patients after primary anastomosis and uncomplicated course is excellent [12,13]. However, long-term follow-up studies have also shown that patients with EA may have considerable morbidity ranging from dysphagia, gastroesophageal reflux, respiratory disorders, and problems related to various associated anomalies [5,11,14–19]. Furthermore, a wide variety of surgical approaches to EA repair are employed in order to restore the intestinal continuity [1,5,9,11,12,15,20–23]. Some of these procedures are prone to complications and may impair QoL [15,19–23]. Limited data are available on the impact of these long-term sequelae on the overall well-being of EA patients [12,13,24], particularly those with a complicated course after EA repair [20,21].

In only a few studies, standardized questionnaires were used to assess HRQoL of EA survivors and most studies included adult patients [12–14,21,24]. Moreover, HRQoL measures of adult and pediatric patients had been obtained using self-assessment instruments [11,13,14,20,21,24,25]. We postulated that the type surgical treatment and its related morbidity have significant impact also on the patient’s families.
Patient support groups are important organizations for patients with chronic diseases and their families [18]. KEKS is a support group for patients with diseased esophagus. It has been established in Germany in 1984 and since then, has grown into the largest of its kind worldwide. However, only a minority of all parents of children with EA respectively adult patients join KEKS [18]. Due to this fact, children with poor outcome after EA repair might be overrepresented in this group. However, HRQoL of adults and children registered in such a patient support group has never been investigated.

This study aimed to evaluate long-term HRQoL in adult and pediatric patients registered in a patient support group with a complex form of EA and/or with a complicated course after primary repair of EA. For comparison, the scores of healthy individuals were involved. We hypothesized that these conditions of EA are associated with impairment of long-term HRQoL.

1. Patients and methods

This study was approved by the Institutional Ethics Committee (approval number 1245-2011).

All patients with cEA identified in the data base of the support group KEKS and treated between 10/1964 and 07/2011 were enrolled.

A signed informed consent was obtained from each patient or their guardians for their participation and to request their hospital records from the involved departments of pediatric surgery or general practitioners. Our study collective included patients with (1) delayed esophageal anastomosis, (2) esophageal replacement, (3) major surgical revision, (4) esophageal stenosis after anastomosis requiring >10 dilatations. These four subgroups were created according to surgical treatment. Some patients meet the criteria of more than one subgroup, i.e. if a patient underwent multiple dilatations after delayed anastomosis for long-gap EA. In such cases, the patients were allocated to the predominant problem they were currently or most recently treated for. Therefore, there is no overlap of patients in the groups of the present study.

Delayed anastomosis was defined as any primary anastomosis performed at age ≥ 3 months of life.

1.1. Assessment of patient data/Data on clinical course

Sociodemographic and clinical data were obtained from the KEKS database. Medical records and operative reports of each patient were requested from all surgical units involved and the patients’ general practitioners. In cases of missing data, the patients or their doctors were contacted directly via telephone interviews in order to complete the database. All patients received age-adapted validated questionnaires to evaluate HRQoL, emotions, medical care/support, disease-specific symptoms and organ functions.

1.2. Assessment of quality of life (QoL)

The QoL measures were self- and proxy-report measures completed in private and not in the presence of the interviewers. Pediatric and adult patients were assessed separately. The subjective perception of well-being of the patient was evaluated using three different validated instruments adapted to the patient’s age: The Gastrointestinal Quality of Life Index (GIQLI) for adult patients, the WHO-5 questionnaire for adult patients and parents of affected pediatric children (self-report), and the KIDSCREEN27 for pediatric patients (self-report) and their parents (proxy-report) (Fig. 1). Pediatric patients received a questionnaire including 63 items (self-report) respectively their parents (self- and proxy-report). Adult patients received a questionnaire including 65 items (self-report).

The Gastrointestinal Quality of Life Index (GIQLI), which has been established by Eypasch et al. [26], is a validated tool to assess HRQoL in patients with gastrointestinal disease and especially in those undergoing surgical treatment [27,28]. The questionnaire contains 36 items each with five response categories concerning gastrointestinal disease-related symptoms, physical status, emotions and psychosocial functions. It is a general gastrointestinal index and has not been developed for specific entities [27]. Each question is graded on a 5-point Likert scale from 0 to 4, with 4 implying the least dysfunction. The responses to questions are summed to give a numerical score, whereas the theoretical maximum score is 144 points reflecting unimpaired Qol. Incomplete questionnaires were excluded from the analysis. For comparison, we involved the historical GIQLI of a series of 168 healthy individuals who underwent investigation by Eypasch et al. [27].

The WHO-5 Well-being Index derives from a larger rating scale developed for a WHO project on QoL in patients suffering from diabetes [29]. During the first psychometric evaluation, 10 out of the original 28 items were selected due to the homogeneity they had shown across the various European countries participating [30]. Positive psychological well-being has to include positively worded

![Fig. 1. Graphic demonstrating study design of the applied questionnaire. Separate assessment of pediatric and adult patients. Questionnaire for adult patients included 65 items, questionnaires for pediatric patients respectively their parents included 63 items.](image-url)
items only. Therefore, these 10 items were then reduced to 5 items (WHO-5) which still covered positive mood (good spirits, relaxation), vitality (being active and waking up fresh and rested), and general interests (being interested in things) [31,32]. Each of the 5 items is rated on a 6-point Likert scale from 0 (= not present) to 5 (= constantly present). The theoretical raw score ranges from 0 to 25 and is transformed into a scale from 0 (worst thinkable well-being) to 100 (best thinkable well-being). Thus, higher scores mean better well-being. A score below 13 indicates poor well-being and is an indication for testing for depression.

The KIDSCREEN27 instrument assesses children’s and adolescents’ subjective health and well-being and allows detailed profile information for five Rasch scaled HRQoL dimensions: physical well-being (PHY), psychological well-being (PWB), autonomy & parents (PAR), peers & social support (SOC) and school environment (SCH). It has been developed as self-report measures applicable for healthy and chronically ill children and adolescents aged from 8 to 18 years as well as proxy-report versions applicable for their parents. [online supplement; http://dx.doi.org/10.1016/j.jpedsurg.2013.11.068]

In this study, also children < 12 months of age had been included. Inherent to measuring HRQoL in these children directly, it was necessary to use parental/proxy-reports. Questions asked for self-report are presented in the online supplement. As a result of their simultaneous development in 13 European countries, the KIDSCREEN instruments are truly cross-national HRQoL measures. A score can be calculated and t-values and percentages are available for each country. Our data were compared with the German reference population as most of the enrolled patients were from Germany.

1.3. Statistical analysis

Data were entered into a database and statistical analysis was performed using SPSS 20.0 (SPSS Inc., Chicago, IL). Patients were stratified into 4 subgroups according to type of surgical treatment and patient’s age. Data were first investigated by calculating descriptive statistics such as mean, median, standard deviation (SD) and variance. For all continuous variables, group differences were analysed using one-way of analysis of variance (ANOVA) and t-tests for independent samples. Categorical group data were tested by means of Pearson Chi-Square Test. The items of the KIDSCREEN versions fulfill the assumptions of the Rasch model (unidimensionality, homogeneity of items and persons, sufficiency of the sum score). Thus, they can be scored as Rasch scales. To make the interpretation more applicable, the scores of the Rasch scales were translated into t-values with scale means around 50 and standard deviations around 10 with higher values indicating higher HRQoL. Data were quoted as mean ± SD. Statistical differences were considered as significant for a p-value < 0.05.

2. Results

Ninety-two patients were accessible for follow-up. Ninety of these (98%; 63 children, 27 adults) agreed to participate, mean follow-up was 14.5 ± 9.8 years. Primary operations had been performed in 40 institutions. According to surgical treatment, patients were allocated to the subgroups delayed esophageal anastomosis (n = 28), esophageal replacement (n = 27), major surgical revisions (n = 15), and esophageal stenosis after anastomosis requiring > 10 dilatations (n = 20).

2.1. Patient characteristics

The answers for some questions were given in proxy-report (parental report) due to young age (n = 29 patients < 8 years of age) or due to intellectual disability (n = 5). Patient characteristics are described in Table 1. Thirty-three patients (36.7%) had EA without fistula, 4 patients (4.4%) had EA and proximal tracheo-esophageal fistula (TEF), 22 patients (24.4%) had EA and distal TEF, 7 patients (7.8%) had EA with both proximal and distal TEF, whereas in 24 patients (26.7%) a clear classification was not possible due to incomplete or inconsistent documentation in the patients’ records. Delayed esophageal anastomosis had been performed in 28 patients (31.1%) at a mean age of 3.6 ± 4.0 months. In pediatric patients, Foker’s lengthening technique had been performed in 3 patients (4.8%). Out of 27 patients (30%) who had undergone esophageal replacement, gastric interposition was performed in 22 patients (81.5%; 15 children, 7 adults) at a mean age of 11.8 ± 32.3 months. Colonic interposition had been performed in 5 patients (18.5%; 1 child, 4 adults) at a mean age of 5.0 ± 7.6 months. In 15 patients (16.7%), major surgical revisions had to be performed for various reasons such as recurrent TEF, anastomotic stricture, perforation, or leakage. Patients with > 10 dilatations after repair were analyzed as a separate group.

2.2. Disease-specific symptoms

Analyzing disease-specific symptoms, dysphagia and reflux symptoms occurred significantly more frequently in adult compared to pediatric patients (Table 2). There were no differences between the two groups for symptoms such as dumping, cough, or recurrent respiratory infections requiring antibiotic treatment.

2.3. Gastrointestinal Quality of Life Index (GIQLI) — Data in adult patients (self-report)

The mean GIQLI score of adults was significantly lower compared to healthy controls (105.1 ± 12.3 vs. 125.8 ± 13.0; p < 0.0001) (Fig. 2a). Patients with a score of less than 105 were considered symptomatic in literature [27,33]. Pertaining to the mean score of healthy controls, 91.3% of adult patients presented with lower scores than controls.

Comparing the scores of adult patients and controls with regard to different GIQLI dimensions, patients particularly scored lower in the dimension “symptoms” (Fig. 2b). However, due to incomplete data of the historical control group (no standard deviation available in literature) [34], statistical analysis with regard to the different GIQLI dimensions was not possible.

### Table 1

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Pediatric patients (n = 63)</th>
<th>Adult patients (n = 27)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current age [years]</td>
<td>8.6 ± 4.9</td>
<td>26.4 ± 7.1</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>52%</td>
<td>63%</td>
</tr>
<tr>
<td>Female</td>
<td>48%</td>
<td>37%</td>
</tr>
<tr>
<td>Gestational age [weeks]</td>
<td>35.4 ± 3.0</td>
<td>37.7 ± 2.1</td>
</tr>
<tr>
<td>Prematurity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(≤ 36 weeks of gestation)</td>
<td>62.2%</td>
<td>44.4%</td>
</tr>
<tr>
<td>Birth weight [g]</td>
<td>2131 ± 709</td>
<td>2579 ± 478</td>
</tr>
<tr>
<td>Associated malformations</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-None</td>
<td>6.5%</td>
<td>0%</td>
</tr>
<tr>
<td>-Present</td>
<td>93.5%</td>
<td>100%</td>
</tr>
<tr>
<td>Anorectal malformations</td>
<td>15.2%</td>
<td>44.4%</td>
</tr>
<tr>
<td>Cardiac malformations</td>
<td>56.2%</td>
<td>55.5%</td>
</tr>
<tr>
<td>Vertebral anomalies</td>
<td>13.0%</td>
<td>33.3%</td>
</tr>
<tr>
<td>Limb malformations</td>
<td>17.4%</td>
<td>44.4%</td>
</tr>
<tr>
<td>Urogenital malformations</td>
<td>30.4%</td>
<td>22.2%</td>
</tr>
<tr>
<td>Tracheal malacia</td>
<td>34.8%</td>
<td>11.1%</td>
</tr>
<tr>
<td>Down Syndrome</td>
<td>8.7%</td>
<td>0%</td>
</tr>
<tr>
<td>Other malformations</td>
<td>60.5%</td>
<td>55.5%</td>
</tr>
<tr>
<td>Current educational status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nursery/school/university/profession</td>
<td>70%</td>
<td>85%</td>
</tr>
<tr>
<td>School for special education</td>
<td>16%</td>
<td>4%</td>
</tr>
<tr>
<td>Living at home</td>
<td>13%</td>
<td>11%</td>
</tr>
<tr>
<td>Living in a special care facility</td>
<td>1%</td>
<td>0%</td>
</tr>
</tbody>
</table>

There were no statistical differences between the two groups except for the percent age of adult patients versus age of adult patients, p < 0.05.)
Group of participants, 30% presented with suspected depression (self-report).

2.5. WHO-5 Questionnaire/Data in parents of pediatric patients

A raw score below 13 indicates, by definition, poor well-being and is an indication for testing for depression [31, 32].

Questions about disease-specific symptoms:

1. "Do you have difficulties or pain when swallowing?" (self-report) resp. "Does your child have difficulties or pain when swallowing?" (proxy-report).
2. "Do you have symptoms like retching, vomiting, sweating, nausea, or abdominal pain after ingestion?" (self-report) resp. "Does your child have symptoms like symptoms like retching, vomiting, sweating, nausea, or abdominal pain after ingestion?" (proxy-report).
3. "Do you have symptoms like heartburn or regurgitation?" (self-report) resp. "Does your child have symptoms like heartburn or regurgitation?" (proxy-report).
4. "Do you suffer from recurrent respiratory infections (such as bronchitis, pneumonia) that must be treated with antibiotics?" (self-report) resp. "Does your child suffer from recurrent respiratory infections (such as bronchitis, pneumonia) that must be treated with antibiotics?" (proxy-report).

Allocating adult patients to subgroups, GIQLI was significantly lower compared to healthy controls after any type of surgical treatment (Fig. 2c). In patients after delayed esophageal anastomosis, GIQLI score was significantly lower compared to healthy controls (105.4 ± 13.7 vs. 125.8 ± 13.0; p = 0.029). The group of patients who underwent esophageal replacement also presented with reduced scores compared to reference group (107.5 ± 13.1 vs. 125.8 ± 13.0; p = 0.002). Moreover, patients after major surgical revision presented with a significantly lower GIQLI score compared to healthy individuals (103.8 ± 7.2 vs. 125.8 ± 13.0; p = 0.002). The group of patients undergoing multiple esophageal dilatations after primary anastomosis did not present with a significant difference compared to controls. There were no significant differences between the 4 groups.

2.4. WHO-5 Questionnaire/Data in adult patients (self-report)

General well-being was evaluated using the WHO-5 questionnaire with a total raw score of maximum 25. There are no reference values for healthy individuals available in literature. WHO-5 scores of adult patients (self-report) and of parents of affected pediatric patients (self-report) were assessed. Adult patients (n = 26) presented with a score of 15.5 ± 4.0 of maximum 25. Out of these patients, 23% scored below 13 (Fig. 3a). A raw score below 13 indicates, by definition, poor well-being and is an indication for testing for depression [31, 32].

2.5. WHO-5 Questionnaire/Data in parents of pediatric patients (self-report)

Parents of pediatric patients up to the age of 18 years (n = 63) presented with a score of 15.5 ± 5.3 of maximum 25. Out of this group of participants, 30% presented with suspected depression (Fig. 3b).

2.6. KIDSCREEN27 Questionnaire/Data in children (self-report)

In the KIDSCREEN27-dimensions physical and psychological well-being, autonomy and parent relation, and school environment, pediatric patients did not score significantly different from healthy controls in self-report. The only significant difference observed was reduced social functions in affected children compared to healthy individuals [46.1 ± 12.9 vs. 50.3 ± 8.9; p = 0.01] (Fig. 4a).

Table 2

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Adult patients</th>
<th>Pediatric Patients</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dysphagia</td>
<td>96.2%</td>
<td>33.9%</td>
<td>p &lt; 0.001</td>
</tr>
<tr>
<td>Dumping</td>
<td>51.9%</td>
<td>57.1%</td>
<td>p = 0.643</td>
</tr>
<tr>
<td>Reflex symptoms</td>
<td>96.1%</td>
<td>60.3%</td>
<td>p &lt; 0.001</td>
</tr>
<tr>
<td>Recurrent respiratory infections</td>
<td>44.4%</td>
<td>61.9%</td>
<td>p = 0.126</td>
</tr>
<tr>
<td>Cough</td>
<td>88.5%</td>
<td>98.4%</td>
<td>p = 0.781</td>
</tr>
</tbody>
</table>

Disease-specific symptoms were assessed by open questions. Dysphagia and reflex symptoms occurred significantly more frequently in adult patients (n = 27) compared to pediatric patients (n = 63). For comparison, the historical GIQLI score of 168 healthy individuals was involved with a mean score of 125.8 and a standard deviation of 13.0 [27].

Due to incomplete data in the historical control group [34], statistical analysis with regard to the different GIQLI dimensions was not possible. c) Gastrointestinal Quality of Life (GIQLI) scores of adult patients with complex esophageal atresia (EA) and/or complicated course of EA after anastomosis given for the 4 dimensions: physical well-being, emotions, social functions, and symptoms. Comparison between adult patients with (n = 27) and healthy controls (n = 70) [34].

Allocating pediatric patients to subgroups according to surgical treatment, delayed esophageal anastomosis was associated with favourable HRQoL (Fig. 4b). With regard to physical well-being, these patients scored significantly better than controls [64.0 ± 10.4 vs. 52.4 ± 8.7; p = 0.001], children after esophageal replacement [51.4 ± 5.7; p = 0.008], children after major surgical revision [52.0 ± 6.9; p = 0.026], and children undergoing multiple esophageal dilatations after anastomosis [50.2 ± 9.7; p = 0.04]. With regard to the dimension autonomy and parents, delayed esophageal anastomosis was associated with better QoL scores compared to controls.
[61.6 ± 11.6 vs. 52.1 ± 9.1; p = 0.015] and to the group of patients after esophageal replacement [61.6 ± 11.6 vs. 50.6 ± 5.9; p = 0.031]. After multiple esophageal dilatations, social functions in these patients were impaired compared to healthy children [38.7 ± 17.2 vs. 50.3 ± 8.9; p = 0.0001] and patients after delayed esophageal anastomosis [54.8 ± 8.8; p = 0.019].

2.7. KIDSCREEN27 Questionnaire/Data in children (proxy-report)

In the KIDSCREEN27-dimensions physical well-being, autonomy and parent relation, social support and peers, and school environment, pediatric patients did not score significantly different from healthy controls in proxy-report (= parents' evaluation about their children's
status) (Fig. 4a). The only difference observed was a better psychological well-being in pediatric patients (in parental evaluation) compared to healthy controls (in parental evaluation) [54.4 ± 10.6 vs. 50.8 ± 9.2; p = 0.003]. Analyzing the subgroups of proxy-reports, patients after esophageal replacement scored significantly worse in the dimension physical well-being compared to patients after delayed esophageal anastomosis [46.4 ± 7.8 vs. 53.2 ± 8.4; p = 0.03] and to patients who underwent multiple esophageal dilatations after anastomosis [53.8 ± 9.9; p = 0.025].

3. Discussion

Esophageal atresia is a heterogeneous entity ranging from uncomplicated short-gap to complex long-gap EA. Irrespective of the gap length, any type of EA may result in a complicated course requiring special interventions. We investigated patients who had undergone reconstruction of complex EA or who had a complicated course after anastomosis. Our definition of a complicated course of EA includes not only long-gap EA mostly resulting in delayed esophageal anastomosis, but also patients undergoing esophageal replacement, major surgical revision, or stenosis after primary anastomosis requiring multiple esophageal dilatations. Adding up all patients of our collective with EA and any kind of TEF, the number of these patients is identical with the number of patients having pure EA. As it was our aim to evaluate the long-term course of only complicated/complex EA, the incidence of different types of EA in our study differs from the distribution in the general population.

Surgical management of long-gap EA or a complicated course of EA requiring special surgical interventions represents a major challenge [2,5,10] and the long-term surgical results are poorly studied. Little is known about the impact of long-term health-related morbidity on the overall well-being [13,24] and the long-term QoL of those patients [20,21].

Several authors reported on QoL in adult patients after EA repair [12,13,24]. In most of those studies, no differences in the overall physical and mental health between EA patients and healthy individuals were described, but adult EA patients reported a lower level of general health and less vitality [12–14,21,24]. Koivusalo et al. identified a normal QoL in most adult survivors after EA repair. They postulated that morbidity from esophageal functional disorders and respiratory problems with/without other acquired diseases impairs HRQoL in 15% of patients with EA [12]. However, in this study, not only complicated EA, but also cases of uncomplicated EA had been investigated. Deurloo et al. showed in their series of 97 adult patients after EA repair that these perceive their generic and disease-specific QoL to be good [13]. In another series, the same authors presented 25 adult patients who had undergone a primary end-to-end anastomosis for EA reporting dysphagia. These patients presented with disturbed motility and significant lower scores in the domains “general health perception”, “standardized physical component”, and “physical well-being”. This is in line with our data. We demonstrated that single
disease-specific symptoms were present in 44%–96% of adults. The most frequent symptom was “dysphagia” which negatively affected HRQoL in adults in our series. Deurloo et al. postulated that gastroesophageal reflux did not influence QoL [24] also applying the Gastro-Intestinal Quality of Life Index (GIQLI) for evaluation. This is inconsistent with our results as we demonstrated that the symptom “gastroesophageal reflux” is almost as common as the symptom “dysphagia” in adult patients. Sistonen et al. also demonstrated that the overall occurrence of dysphagia and symptomatic gastroesophageal reflux was significantly higher among their patients versus among controls [11]. This may indicate that gastroesophageal reflux in patients with EA might be underestimated in some studies [11,19,35] and requires a follow-up protocol. In this study, the role of anti-reflux treatment was not specifically questioned in the list of disease-specific symptoms. Nonetheless, this might be a relevant aspect with regard to HRQoL. Therefore, the role of anti-reflux medication and anti-reflux surgery should be included in future studies.

Investigations of QoL in patients with complex EA are scarce [20,21]. Ure et al. examined QoL and functional results of 8 adult patients after colon interposition for long-gap EA revealing “acceptable” long-term functional results [20]. Moreover, their data showed that specific symptoms such as regurgitation, diarrhea, or bloating led to a considerable impairment of QoL. Using the same validated tool to assess HRQoL, our data are in line with Ure’s findings as GIQLI scores of adults after cEA repair were significantly reduced compared to healthy individuals, irrespective of the surgical procedures performed for reconstruction.

In 2010, Peetsold et al. published a study measuring HRQoL after correction of uncomplicated EA in children aged 6–18 years using CHQ-CF87 [25]. The authors demonstrated that – due to a high incidence of concomitant congenital abnormalities and gastrointestinal symptoms – general health of EA patients was reduced in childhood and early adolescence when compared to a reference population [25]. In contrast, our results revealed that general HRQoL in children and adolescents after repair of cEA was not reduced compared to healthy controls in both self- and proxy-report. Differences between the two studies might be due to the use of different questionnaires as well as different patient populations. Peetsold investigated only children with uncomplicated EA.

In the present series, general well-being of both adult patients and parents of affected pediatric patients was impaired. Parents of affected children presented with very low scores with almost one third being classified as potentially “depressive”. Therefore, presence of a complicated course of EA seems to have a considerable impact on not only the patient but the whole family. This highlights our obligation to focus on the family surrounding of this patient.

A number of surgical techniques have been introduced to reduce the distance between the upper and lower esophageal segment to allow anastomosis in cases with long-gap EA [9,10,22,23,36–39] and the optimal method of esophageal reconstruction remains controversial [9,10,14,15,21–23,41,42]. Numerous authors have investigated functional long-term results after esophageal reconstruction. It has been postulated that the conservation of the native esophagus is associated with the best postoperative results [1,3,35]. Satisfactory functional results have also been reported for different methods of esophageal replacement [15,20,40], but a comparative analysis is lacking. Even though functional results in the study of Ure et al. on QoL in patients after colon interposition were satisfactory, GIQLI scores were significantly lower in patients after colon interposition compared to healthy controls [20]. Ludman and Spitz reported that gastric transposition for EA did not impair QoL in their series of 28 children and adolescents [21]. Comparing a group of patients after primary gastric pull-up with patients who had undergone previous unsuccessful attempts of anastomosis, the patients after primary procedure experienced fewer disease-specific symptoms. However, as a modified version of the GIQLI had been used in this study, QoL analysis was not validated and thus, their findings are not comparable to our results. In our series, adult EA patients after secondary reconstruction, but not after reconstruction with subsequent multiple esophageal dilatations, had reduced QoL compared to healthy controls. Variance analysis failed to detect any differences in long-term QoL between delayed esophageal anastomosis, esophageal replacement, major surgical revision, or multiple esophageal dilatations after anastomosis.

In the subgroup of pediatric patients (self- and proxy-report), delayed esophageal anastomosis appeared to be the most favourable group with regard to QoL as physical well-being was significantly better than in all other groups.

It has been postulated that QoL scores in EA patients may be better than QoL scores in healthy populations [14,43]. Coping strategies could be more efficient in congenital diseases than acquired conditions such as cancer or other gastrointestinal conditions in adults for whom the instruments had been validated [16]. This phenomenon has been reported by Legrand et al. who demonstrated in their series of 81 EA patients that affected children had a better QoL than those with other chronic diseases such as diabetes or asthma [16].

Discrepancy in our study between HRQoL in pediatric and adult patients might be due to the fact that patients experience symptoms and reduced functions from the neonatal period on. They might have integrated them into their life. While growing, differences to healthy individuals might be either reflected or functional results might have objectively worsened. This is well in line with the findings of Peetsold et al. who have recently shown in their series of 37 pediatric EA patients that increasing age negatively affects HRQoL [25].

The high participation rate of 98% in our study compares superior to other QoL series for EA, e.g. 82% for Deurloo et al. [13], or 70% for Legrand et al. [16]. This might be due to highly dedicated group of patients which are not only registered, but active participants in the patient support group.

There are no data available with regard to HRQoL of patients registered in a support group. The fact that this study collective consists of KeKS members might have biased our results. Patients with long-term problems might have registered with the support group, and patients without long-term problems might have not. However, the number of patients with a complicated course of EA in a single department is limited, and thus, the employment of the KeKS database gave us the unique opportunity to recruit this large series of patients. The authors wish to underline that the conclusions drawn are only valid for the selected group of patients registered in a support group.

Furthermore, there is a potential statistical uncertainty due to different QoL measures. Nonetheless, there are currently no comparable measures available to assess pediatric and adult patients’ QoL. Finally, we did not focus on the impact of associated malformations of HRQoL. This would have been methodologically too challenging. Certainly, all sorts of associated malformations might have a negative influence on HRQoL. However, as they are frequent particularly in complicated/complex EA, the authors believe that these patients should not be excluded from the study collective for this reason.

We suggest to perform large randomized controlled studies in order to evaluate patients’ HRQoL in a more precise and standardized way.

This is the largest follow-up study evaluating HRQoL after a complicated course of EA in pediatric and adult patients registered in a patient support group. In this selected group of patients, advanced age may negatively affect HRQoL due to an increase of disease-specific symptoms. In contrast, HRQoL seems to be good in children. Therefore, a systematic follow-up should be continued into adulthood at least every two years. According to symptoms and disease-related problems, investigations should be performed on an individual basis. Barrett’s metaplasia and/or esophageal cancer have not been reported in our patient collective. However, these are major risk factors after repair of EA necessitating long-term surveillance beyond childhood.
Long-term HRQoL in children who underwent delayed esophageal anastomosis seems to be significantly better when compared to children who underwent other types of surgical reconstruction. Our data indicate that saving the esophagus may result in a best possible HRQoL.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at http://dx.doi.org/10.1016/j.jpedsurg.2013.11.008.

References