

Adults with corrected oesophageal atresia: is oesophageal function associated with complaints and/or quality of life?

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Abstract The aim of this study was to evaluate oesophageal function after correction of oesophageal atresia in adults, and to investigate the association between complaints, oesophageal function and quality of life (QoL). Twenty-five adults were included who participated in previous follow-up studies, during which complaints of dysphagia and gastro-oesophageal reflux (GOR), results of upper gastrointestinal endoscopy, oesophageal biopsies and QoL had been collected. Manometry was performed in 20 patients, 24 h pH-measurements were performed in 21 patients. pH-values (sample time 5 s) were calculated using criteria of Johnson and DeMeester. Associations were tested with ANOVA and χ^2 -tests. Ten patients (48%) reported complaints of dysphagia, seven (33%) of GOR. The amplitude of oesophageal contractions was low (<15 mmHg) in four patients (20%). pH-measurements showed pathological reflux in three patients (14%). Patients reporting dysphagia more often had disturbed motility ($P = 0.011$), and lower scores on the domains “general health perceptions” (SF-36) ($P = 0.026$), “standardised physical component” (SF-36) ($P = 0.013$), and “physical well-being” (GIQLI) (0.047). No other associations were found. This study shows a high percentage of oesophageal motility disturbances and a moderate percentage of GOR after correction of oesophageal atresia. Patients reporting

dysphagia, whom more often had disturbed motility, seemed to be affected by these symptoms in their QoL.

Keywords Oesophageal atresia · Long-term follow-up · Manometry · pH-measurements · Quality of life

Introduction

At present, the survival rate of patients with oesophageal atresia (OA) is approximately 95% [1, 2]. With the decreased mortality, the interest in morbidity, especially the long-term results after correction of OA, has increased over the years.

Several long-term follow-up studies have shown that long lasting gastro-oesophageal reflux (GOR) is a frequent problem after correction of OA, although intestinal metaplasia, as its theoretical consequence, is rare [3–6]. In these studies, GOR has been either diagnosed by upper gastrointestinal (GI) endoscopy with biopsies, by 24 h pH-measurements, or by both, showing varying degrees of GOR. Besides pH-measurements, oesophageal manometry has been performed in several studies, showing oesophageal motility disturbances in most patients [7–10]. The true impact of this finding on individual daily life is not clear.

In our centre, we have performed several long-term follow-up studies in a relatively large group of patients after correction of OA [5, 6]. Patients underwent upper GI endoscopy with biopsies and quality of life (QoL) measurements [11].

The first aim of this study was to evaluate the presence of GOR and oesophageal motility problems in a group of our adult patients treated for OA.

The second aim was to investigate if there was an association between complaints, oesophageal function, and

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QoL-measurements. This association has not been investigated before. Because of the influence of complaints of dysphagia and GOR on daily life, we hypothesised that patients with complaints have a poorer QoL than patients without complaints.

Patients and methods

Twenty-five patients over 18 years of age who participated in previous follow-up studies after correction of OA [5, 6, 11], and gave informed consent to participate, were included in this study. In these previous studies, data regarding the results of upper GI endoscopy, biopsies of the distal oesophagus, and QoL had been collected. From the QoL study, we used the results of the Medical Outcome Study 36-Item Short-Form Health Survey (SF-36) and of the gastro-intestinal quality of life index (GIQLI) [12, 13]. After approval of the study protocol by the Medical Ethical Committee, all patients received a written invitation to participate in the study.

All patients who gave their informed consent, underwent manometry and pH-measurements and were asked if they experienced difficulties swallowing solid foods (dysphagia) or experienced heartburn or retrosternal pain (GOR-related complaints). Oesophageal manometry was performed using the UPS-2020 measurement stationary system (MMS, Enschede, The Netherlands) with software version 7.

The pressure was measured with the Unisensor Microtip catheter type 8304-00-9980-D with three pressure transducers on a 5 cm distance from each other. The lower oesophageal sphincter basal or resting pressure (LOSP) and relaxation after swallowing, the motility in the oesophageal body after at least six wet swallows of 5 ml water, and the upper oesophageal sphincter pressure (UOSP) and relaxation were calculated. The amplitude of oesophageal body contractions was categorized as “low” (<15 mm Hg), “moderate” (15–35 mm Hg), or “normal” (>35 mm Hg). The encountered oesophageal motility disorders were classified according to the guidelines proposed by Spechler et al. [14]. Based on the basal LOSP, LOS relaxation, peristaltic wave progression, and distal wave amplitude, oesophageal motility disorders were classified into four categories: (1) “inadequate LOS relaxation”, (2) “uncoordinated contraction”, (3) “hypercontraction”, and (4) “hypocontraction” or “ineffective oesophageal motility”.

pH-measurements were performed using the Comfortec dual channel pH probe (Sandhill Scientific), which was positioned with the pH measurement points 5 and 20 cm above the manometrically established upper border of the LOS. The position of the probe was checked by X-ray. Ambulatory pH measurement was performed during 24 h using the GORD pH-recorder (Sandhill Scientific) with a

sample time of every 5 s. The pH values were calculated using the criteria of Johnson and DeMeester [15].

The data were entered into a database and analysis was performed using SPSS (Statistical Package of the Social Sciences) 10.0.1 for Windows. We tested for association between functional results and QoL by applying ANOVA and χ^2 -tests or Fisher’s exact tests.

Definitions

Before testing for association, the results of functional tests were dichotomized. If upper GI endoscopy showed a normal oesophagus or grade I oesophagitis (according to the modified system of Savary-Miller) [16], this was scored as “normal”. Grade II oesophagitis or worse was scored as “abnormal”. If the biopsies of the distal oesophagus showed normal oesophageal epithelium or mild reflux oesophagitis (according to Ismael-Beigi) [17], this was scored as “normal”. Moderate oesophagitis or worse was scored as “abnormal”. As all patients were diagnosed as having “ineffective oesophageal motility”, this variable could not be used. Instead, we used the amplitude of oesophageal body contractions as a measure of outcome of manometry, because decreased amplitude implies a defective peristaltic function of the oesophagus. The results were dichotomized as “normal” or “abnormal” (moderate or low amplitude). The results of pH-measurements were also dichotomized as “normal” or “abnormal” (minor or pathological reflux).

Results

Patient characteristics

Patient characteristics are described in Table 1. All patients had undergone a primary end-to-end anastomosis for Gross’ type C OA. Two patients were using proton-pump inhibitors, they stopped taking their medication two days before the start of the study.

Unfortunately, it was impossible to perform manometry and pH-measurements in four patients. In one patient it was impossible to introduce the catheter through the nose due to resistance of the patient, who decided to withdraw from the study. In three out of four patients it was impossible to introduce the catheter due to oesophageal stricture. All of these three patients had been treated for anastomotic stricture in childhood, one patient had undergone anti-reflux surgery in childhood. Two of these three patients had complaints of dysphagia at the time of the study. The stricture of these three patients was treated with dilatation. Since dilatations may influence the results of manometry and pH-measurements, no measurements were performed

Table 1 Patient characteristics of 25 patients participating in the study

	Mean (range) or n (%)
Age (years)	28.5 (18–42)
Gender	
Male	16 (64%)
Female	9 (36%)
Concomitant congenital anomalies	
None	17 (68%)
Present	8 (32%)
Anorectal malformations	3 (12%)
Cardiac malformations	4 (16%)
Vertebral malformations	1 (4%)
Limb malformations	2 (8%)
Other malformations	2 (8%)
Anti-reflux procedure in past	
No	23 (92%)
Yes	2 (8%)
Anastomotic stenosis in past	
No	18 (72%)
Yes	7 (28%)
Current educational status	
Primary school	1 (4%)
Basic high school	9 (36%)
Advanced high school	7 (28%)
University	5 (20%)
Unknown	3 (12%)

in these patients. Due to a technical failure, the data of the manometry of one patient could not be retrieved.

Dysphagia was reported by 10/21 patients (48%), GOR-related symptoms were reported by 7/21 patients (33%).

Manometry

The data of 20 patients could be analyzed. The upper oesophageal sphincter (UOS) responded normally to swallowing in all patients. Mean UOS pressure was 30.8 ± 15.5 mm Hg.

Oesophageal contractions were observed in all patients. One or more propulsive contractions were observed in 14/20 patients. All patients showed one or more non-transmitted contractions. Retrograde contractions were observed in 7/20 patients. Mean minimum oesophageal body amplitude pressure was 20.7 ± 13.4 mm Hg. Mean maximum oesophageal body amplitude pressure was 32.0 ± 15.5 mm Hg. The amplitude of oesophageal body contractions was low (<15 mm Hg) in 4 patients (20%), moderate (15–35 mm Hg) in 10 (50%) and normal (>35 mm Hg) in 6 (30%).

In all patients, the LOS showed complete relaxation upon swallowing. Mean LOSP was 13.1 ± 7.2 mm Hg.

According to the guidelines of Spechler et al., all patients were classified as having “ineffective oesophageal motility” [16]. The LOS pressure was normal and LOS relaxation was complete in all patients. Wave progression varied from normal to absent progression, and the distal wave amplitude was low in $\geq 30\%$ of wet swallows (data not shown).

pH-measurements

The data of 21 patients could be analyzed. The results are described in Table 2. pH-measurements showed a normal pattern in 17 patients (81%), minor reflux in 1 (5%), and pathological reflux in 3 (14%). In both of the patients who were taking proton-pump inhibitors, pH-measurements showed pathological reflux.

Associations

The association between symptoms and results of endoscopy, oesophageal biopsies, manometry, pH-measurements and QoL is shown in Table 3. Patients reporting dysphagia, more often had disturbed motility ($P = 0.011$). These patients also had significantly lower scores on the domains “general health perceptions” ($P = 0.026$), and “standardised physical component” ($P = 0.013$) of the SF-36; and on the domain “physical well-being” ($P = 0.047$) of the GIQLI.

No association was found between complaints of GOR and quality of life; nor between the results of endoscopy and the results of pH-measurement and/or manometry; nor between the results of oesophageal biopsies and the results of pH-measurement and/or manometry (data not shown). Problems with the initial surgical repair in childhood (i.e. anastomotic leak or stricture needing dilatation) did not influence the findings in the current study.

Discussion

The results of the present study confirm that oesophageal motility disturbances are frequently present after correction of OA. Low or moderate amplitude of oesophageal body

Table 2 Results of 24 h pH-measurements in 21 patients

	Proximal mean % \pm SD	Distal mean % \pm SD
Total time pH < 4	0.2 \pm 0.4	1.5 \pm 2.2
Upright time pH < 4	0.2 \pm 0.6	2.2 \pm 3.3
Supine time pH < 4	0.0 \pm 0.3	0.4 \pm 1.0

SD standard deviation

Table 3 Association between symptoms and results of endoscopy, oesophageal biopsies, manometry, pH-measurements, and quality of life

	Complaints			
	Dysphagia		GOR	
	Yes	No	Yes	No
Endoscopy				
Normal	9	9	6	12
Abnormal	1	2	1	2
Oesophageal biopsies				
Normal	6	5	4	7
Abnormal	3	5	2	6
Manometry				
Normal	0*	6*	1	5
Abnormal	10*	4*	6	8
pH-measurements				
Normal	10	7	5	12
Abnormal	0	4	2	2
SF-36 scales				
Physical functioning	86.5 (19.2)	94.1 (8.3)	96.7 (5.2)	88.1 (16.4)
Physical role-functioning	77.8 (38.4)	100.0 (0.0)	83.3 (40.8)	92.9 (20.6)
Emotional role-functioning	77.8 (44.1)	96.7 (10.1)	83.3 (40.8)	90.5 (27.5)
Bodily pain	78.2 (26.3)	92.5 (13.9)	85.5 (24.5)	86.3 (20.5)
General health	63.6 (23.6)**	84.6 (15.1)**	86.7 (14.8)	70.2 (22.7)
Vitality	50.0 (15.4)	52.3 (12.9)	58.3 (13.3)	48.2 (13.2)
Social functioning	88.9 (22.0)	93.2 (18.8)	97.9 (5.1)	88.4 (23.2)
Mental health	82.7 (15.7)	81.5 (16.7)	87.3 (12.5)	79.7 (17.0)
SF-36 component summary scales				
PCS	49.5 (7.4)***	56.4 (3.4)***	55.6 (4.9)	52.3 (6.9)
MCS	49.0 (10.9)	49.5 (7.4)	50.3 (7.9)	48.8 (9.5)
GIQLI scales				
Physical well-being	21.2 (3.1)****	24.5 (3.7)****	23.3 (3.8)	22.9 (3.9)
GI symptoms	64.1 (8.5)	68.6 (7.8)	68.0 (6.5)	66.0 (9.0)
Social well-being	12.0 (1.7)	12.2 (0.4)	12.0 (0.6)	12.1 (1.3)
Emotional well-being	15.1 (1.5)	15.9 (0.5)	15.5 (1.0)	15.6 (1.2)
Total score	112.4 (13.3)	121.3 (9.6)	118.8 (10.3)	116.6 (12.9)

Data are shown as *n*, or mean (standard deviation)

GOR gastro-oesophageal reflux, SF-36 Medical Outcome Study 36-Item Short Form Health Survey, PCS physical component summary, MCS mental component summary, GIQLI gastro-intestinal quality of life index

* $P = 0.011$, ** $P = 0.026$,

*** $P = 0.013$, **** $P = 0.047$

contractions were found in 14/20 patients (70%), all patients showed one or more non-transmitted contractions, and retrograde contractions were observed in 7/20 patients (35%). All patients met the manometric features of “ineffective oesophageal motility”, as described by Spechler et al. [14]. The manometric findings in the present study are comparable to those described in other studies [7–10].

Based on pH-measurements, the prevalence of GOR in the current patient group is lower than expected. pH-measurements showed minor or pathological reflux in 4/20 patients (20%). None of these patients had undergone anti-reflux surgery in the past. In other studies, the prevalence of GOR based on pH-measurements varies from 17 to 54% [7–9]. Unfortunately, the criteria used for diagnosing GOR and the age of the patient groups studied also vary between studies.

The question is, what the influence is of the disturbed oesophageal motility and GOR found in previous studies on the daily life of adults with corrected OA. This is the first study in which complaints and QoL after correction of OA have been combined with long-term studies of oesophageal function: endoscopy, oesophageal biopsies, manometry and pH-measurements. Patients reporting dysphagia more often had disturbed motility, and showed significantly lower scores on the domains “general health perceptions” and “standardised physical component” of the SF-36, and on the domain “physical well-being” of the GIQLI. However, GOR-related complaints were not associated with disturbed oesophageal function, and did not influence QoL. It is important to consider that this group of patients has grown up with these symptoms, and may probably have gotten used to it. The fact that complaints of

dysphagia affect the QoL and GOR-related complaints do not affect QoL may be explained by the influence of these complaints on daily activities such as eating.

Motility problems after correction of OA were first reported by Haight [18] in 1957. The main cause of the abnormal oesophageal motility after correction of OA is not clear. Some studies propose a congenital nervous abnormality as the cause of motility disturbances. In the foetal rat model for OA, abnormalities were found in the course and branching pattern of the vagal nerves [19]. However, an acquired cause is also suggested, i.e. surgical damage to vagal fibres that innervate the oesophagus [20]. Abnormal oesophageal motility can cause symptoms of dysphagia. It can also worsen the effects of GOR, since malfunction of the peristaltic pump will result in a delayed clearance with a longer period of stasis of refluxed material in the oesophagus.

In conclusion, this study shows a high percentage of oesophageal motility disturbances and a moderate percentage of GOR after correction of OA. Only patients reporting dysphagia, who more often had disturbed motility, appeared to be affected by these symptoms in their QoL.

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