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Is there an ideal age for hypospadias repair? A pilot study

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Abstract *Objective:* To assess whether repairing hypospadias before or after 18 months affects psychological adjustment, health-related quality of life (HRQoL) and surgical outcome. *Patients and methods:* Seventy-seven boys aged 6–17 years were assigned to one of two groups, according to whether they had a hypospadias repair before or after the age of 18 months. The surgical outcome was assessed using the pediatric penile perception score by non-involved urologists. A psychologist interviewed the patients to assess HRQoL and gender-role behavior. The child's psychological adjustment was assessed with a questionnaire for parents.

Results: The surgical outcome and complication rate were not significantly different between groups. A covariance analysis of HRQoL, gender-role behavior and psychological adjustment as a function of age at the last operation with current age as covariant was performed, but differences did not reach significance.

Conclusion: This study does not provide evidence to support recommendations concerning the ideal age for hypospadias repair. In the absence of evidence of a benefit of early surgery, anesthesia-related risk factors must be considered when operating in very early infancy. Large, prospective studies, measuring surgical and psychological outcome with similar instruments to those presented may reveal whether there is a true ideal age for hypospadias surgery.

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Introduction

The aim of hypospadias repair is to improve the well being of patients throughout their entire lives. Surgery is intended to change the anatomy such that the penis looks normal, and allows normal micturition and unimpaired sexual function. The assumption is that early successful

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surgical correction allows for optimal development of boys with hypospadias and thereby contributes to a good quality of life and normal psychological adjustment. However, there are several risk factors. Hypospadias repair may not yield perfect results and patients must cope with residual deficits such as scars, esthetical imperfections and a circumcised penis. Surgery itself, together with anesthesia, hospitalization, separation from the parents and postoperative pain, can be stressful and interact with the child's short- and long-term adjustment. These factors may become more important if a child has repeated operations due to two-stage repairs or after complications [1,2].

Several studies have demonstrated that boys with hypospadias suffer from negative genital appraisal and sexual inhibitions, and that self-reported health-related quality of life (HRQoL) can be diminished [3–5]. There is general agreement that, at certain ages, a child may be more vulnerable to psychological distress related to surgery [2,6]. Therefore, recommendations have been published regarding the ideal age for hypospadias repair. In 1987, Duskova and Helclova assessed boys operated for hypospadias and provided evidence that the psychological outcome was superior when surgery was finished before the age of 8–10 years [7]. Other studies have confirmed that, from a surgical and psychological point of view, hypospadias repair should be completed before the teenage years [8]. However, the current practice is to operate at a much younger age, and the American Academy of Pediatrics considers the age between 6 and 12 months to be the best time for surgery for hypospadias [6]. This takes into account that surgery at a very early age has the advantage that the child's 'defective status' within the family is not prolonged [9]. Emotional development, acquisition of body image and sexual identity as well as cognitive development begin in early childhood. Genital awareness and a period of special emotional risks occur around the age of 18 months and therefore it was suggested to complete surgery before this age [2,9–11]. Although the theoretical basis for hypospadias repair in this age group is good, no scientific evidence has been provided to support the postulated psychological benefit.

The aim of this pilot study was to test the hypothesis that hypospadias surgery before 18 months is associated with a better surgical and psychological outcome. It was therefore necessary to evaluate whether surgery at an early age yields similar surgical results when compared to operations at an older age and whether the anesthetic morbidity remains unchanged. Eventual benefits of surgery at a very young age on the child's development must also be assessed and carefully balanced against surgical and anesthetic risk factors.

Materials and methods

Patients

Children and adolescents who underwent hypospadias repair at the University Children's Hospital, Zurich between 1991 and 2005 with a current age between 6 and 17 years were eligible to be included in this cross-sectional study. Exclusion criteria were: genital surgery within the last 12

months before the onset of the study, current or planned secondary treatment for hypospadias, signs of a disorder of sex development other than hypospadias, chronic systemic disease or insufficient command of the German language.

For evaluation of the surgical and anesthetic outcome, patients were assigned to two groups according to whether they were younger or older than 18 months at their first operation. To assess the psychological outcome, patients were assigned according to their age at the last operation assuming that the final operation was the most relevant psychological stress factor. The cut-off point of 18 months was chosen based on hypothesis-driven psychological recommendations by Schultz et al. [11] and surgical recommendations by Manzoni et al. [10].

The study was approved by the institutional research ethical committee.

Surgical outcome

The complication rate was assessed from the patient's records, including all complications that led to reoperations, i.e. fistulae or stenosis. Furthermore, the pediatric penile perception score (PPPS) was assessed as an objective outcome parameter by six blinded urologists. This instrument was developed for this study and has been published [12]. Briefly, it consists of four items: configuration and position of the meatus, configuration and appearance of the glans, appearance of the shaft skin and mucosal collar, as well as general penile appearance. Every item can be assessed according to a four-point Likert scale ranging from very dissatisfied (0 points) to very satisfied (3 points), and the PPPS can be calculated as the sum of the single items (0–12 points). The non-involved urologists were asked to evaluate standard photographs of the patients taken previously by the examining urologist. Their scores were averaged to obtain an objective outcome measure.

Psychological outcome

Patients were assessed in a standardized interview by a psychologist. HRQoL, psychological adjustment, penile self-perception and gender-role behavior were measured as outcome variables, and an analysis of covariance as a function of current age and age at final operation was performed. The perception of the penis by the patient himself (self-reported PPPS) is not an objective outcome parameter but reflects his expectations in relation to the surgical outcome. Therefore, the PPPS as perceived by the patient was included in the psychological outcome. In previous publications [4,12,13] the instruments were described in detail and also validated.

Health-related quality of life

Self-reported HRQoL of the children was assessed with the TNO-AZL Child Quality of Life Questionnaire [14]. This contains health and emotional scales, each of them including autonomic, physical, motor, cognitive, social and emotional functions. To obtain a total score for quality of life, all items of the scales were added resulting in a maximum score of 192 points.

Psychological adjustment

Psychological adjustment was assessed with the Child Behavior Checklist [15], a questionnaire, that was filled out by the patients' mothers. Higher scores indicate a greater number or intensity of behavior problems. Out of the 120-item instrument, only the scales for internalizing and externalizing behavior problems and the total behavioral problems score were used. The checklist was chosen because of its widespread use and high reliability and validity.

Gender-role behavior

This was assessed with a questionnaire that was developed for children up to the age of 12 years by Ijntema and Cohen-Kettenis [16]. It includes hobbies, friends, clothing and self-attribution of gender characteristics. Patients are asked to choose one out of three gender-typical items (e.g. which is your favorite sport? football/swimming/ballet). A total score is calculated from 31 questions, ranging from 31 to 93 with higher values indicating a more masculine behavior. The instrument shows large gender differences with an excellent Cronbach's α of 0.92.

Self-reported penile perception

Patients expressed their penile perception in an interview with a psychologist. Evaluation was performed with the same formula as for the PPPS that was assessed by the urologists.

Statistical analyses

Data were analyzed using the statistical package SPSS for Windows, release 14.0 (SPSS Inc, Chicago, IL, USA). All analyses were performed with two-sided tests. A P -value <0.05 was considered significant. For categorical comparisons, χ^2 -tests were used. In the case that $>20\%$ of the cells showed an expected frequency <5 , Fisher's exact test (Z) was applied. For group comparisons regarding the psychological outcome variables, covariance analyses with current age as a covariate were performed since all variables were significantly associated with the patients' current age. In addition, eta-squares were computed to have a measure of the degree of effect of the independent on the dependent variable. However, for group differences in the surgical outcome a rank covariance analysis had to be performed since according to Levene's test the PPPS of the urologists showed inhomogeneous variances.

Results

Characteristics of the sample

A total of 102 patients fulfilled the inclusion criteria and 77 (75%) participated in the study together with their families. Fifty-six patients allowed a physical examination and standard photo documentation by a pediatric urologist. Sixty-eight patients were assessed by a psychologist in a standard interview and 69 mothers filled in a questionnaire. Twenty-two out of 77 patients were younger and 55 older than 18 months at their first operation. The distribution of hypospadias according to severity was similar in

both age groups, with 50.0% ($n = 13$) distal hypospadias, 40.9% ($n = 7$) penile hypospadias and 9.1% ($n = 2$) penoscrotal hypospadias in those operated young, and 54.6% ($n = 35$), 43.6% ($n = 19$) and 1.8% ($n = 1$), respectively, in those operated later; with no significant difference between the groups ($Z = 2.19$, $P = 0.32$). No significant difference between the two groups was found regarding participation rate ($\chi^2 = 2.80$, $P = 0.09$).

Surgical outcome

Independent urologists assessed the surgical results with the PPPS. No significant difference was found between the scores of patients who had their first surgery before 18 months and those patients who were operated at a higher age (PPPS = 7.31 vs 6.54; $P = 0.88$, $F = 0.02$). The reoperation rate was high in both groups, being 31.8% ($n = 7$) in the group of patients operated before 18 months and 30.9% ($n = 17$) in the group of patients operated after 18 months; again with no statistical difference between the groups ($\chi^2 = 0.01$, $P = 0.938$) (Table 1).

Psychological outcome

Health-related quality of life

No significant difference in HRQoL was found between patients operated before and after 18 months (Table 2).

Psychological adjustment

No significant difference in psychological adjustment was found between patients operated before or after 18 months (Table 2). Analysis of T-scores showed that of the patients whose surgical treatment was completed before the age of 18 months, three (15.0%) had externalizing and three (15.0%) internalizing behavioral problems in the borderline/clinical range. Of the patients who had their final surgery at the age of 18 months or later three (6.12%) had externalizing and 11 (22.45%) internalizing behavioral problems in the borderline/clinical range ($T \geq 60$). Group differences did not reach significance ($P = 0.35$ and $P = 0.74$). Furthermore, the psychological outcome was assessed specifically for boys who were operated between the age of 18 and 36 months, since this age group appears to be particularly vulnerable [11]. However, group differences for HRQoL ($F = 0.21$, $P = 0.65$), psychological adjustment ($F = 0.06$, $P = 0.81$) and gender-role behavior ($F = 1.83$, $P = 0.18$) did not reach significance when compared to boys

Table 1 Surgical outcome.

	Age at 1st operation <18 months	Age at 1st operation ≥ 18 months	P
Reoperation rate	31.8% ($n = 7$)	30.9% ($n = 17$)	0.94 $\chi^2 = 0.01$
Urologist PPPS: mean (SD)	7.31 (2.22)	6.54 (1.94)	0.88 $F = 0.23$

Reoperation rate and outcome measured with the pediatric penile perception score (PPPS) by independent urologists.

Table 2 Psychological outcome.

Source	Mean (SD)	df	F	P	η^2
Self-reported HRQoL					
Age (covariate)		1	6.47	0.01	0.10
Age at final operation		1	3.06	0.09	0.05
<18 months (<i>n</i> = 12)	151.84 (15.02)				
≥18 months (<i>n</i> = 52)	160.41 (14.04)				
Psychological adjustment					
Age (covariate)		1	8.56	0.01	0.12
Age at final operation		1	0.15	0.70	0.00
<18 months (<i>n</i> = 13)	17.58 (15.47)				
≥18 months (<i>n</i> = 52)	19.46 (14.71)				
Gender-role behavior					
Age (covariate)		1	0.09	0.77	0.00
Age at final operation		1	2.41	0.13	0.05
<18 months (<i>n</i> = 12)	71.66 (5.37)				
≥18 months (<i>n</i> = 34)	68.77 (4.97)				
Patient's PPPS					
Age (covariate)		1	6.00	0.02	0.09
Age at final operation		1	0.23	0.88	0.01
<18 months (<i>n</i> = 11)	9.25 (2.24)				
≥18 months (<i>n</i> = 50)	9.66 (2.09)				

Adjusted means, standard deviations and analysis of covariance of self-reported health-related quality of life (HRQoL), psychological adjustment, gender-role behavior and patient's pediatric penile perception score (PPPS) as a function of age at final operation, with current age as a covariate.

operated at other ages. A further statistical analysis was performed after exclusion of all patients who underwent more than one operation. In this case, group differences between those operated before and after the age of 18 months did not reach significance either for HRQoL ($F = 3.63$, $P = 0.06$), psychological adjustment ($F = 0.08$, $P = 0.78$) or gender-role behavior ($F = 0.43$, $P = 0.52$).

Gender-role behavior

Only 46 children could be evaluated with regard to their gender-role behavior, because the instrument is validated only up to the age of 12 years. The difference between the patients operated before and after 18 months did not reach significance (Table 2).

Self-reported PPPS

Patients after hypospadias repair expressed high satisfaction with regard to penile self-perception, irrespective of their age at surgery, with no significant difference between the two groups (Table 2).

Discussion

This study failed to provide evidence that the psychological or surgical outcome of hypospadias repair is affected if surgery is completed before the age of 18 months. Therefore, an ideal age for hypospadias repair could not be identified.

Discussions on timing of hypospadias repair are based on the assumption that the outcome can be affected by

choosing an optimal age for surgery. The age at which an optimal surgical outcome can be achieved is not necessarily identical to the age at which the psychological adjustment is affected least or at which the anesthesia risk is minimized. Therefore, the surgical outcome, anesthesia-related risks and psychological adjustment must be assessed separately and balanced against each other.

New techniques, refinement of pre-existing procedures and subspecialization have contributed to lower complication rates after hypospadias surgery over the last years [10]. The widely observed trend to operate on younger children has occurred in parallel. It seems reasonable to assume that age is not a relevant surgical factor in preschoolers, as penile growth is moderate with only about 3 mm per year between the age of 6 months and 5 years [17]. While evidence was provided that the surgical outcome is superior when boys are operated before the age of 10 years [8], to our knowledge no study has provided evidence that hypospadias repair at a very young age is a surgical risk factor by itself. Qualifying the success of hypospadias surgery by the lack of complication is insufficient as this alone does not fulfill the patient's or surgeon's expectations. Since no accepted instrument has been available to objectively assess the surgical result after hypospadias repair, studies on age-related risks are missing as well. The results of this study, demonstrating that the complication rate and objective surgical result when measured with the PPPS are not affected by surgery at a young age are reassuring. However, clear limitations of this study must be addressed: the cross-sectional design is not optimal, since the study covers a time period when techniques of hypospadias repair have evolved, including the introduction of new techniques such as the TIP (tubularized incised-plate) repair. Not only have the techniques evolved, but also the complication rate was higher for the first years after the introduction of new techniques, thus leading to a higher complication rate during the study period than at present. Furthermore, the number of patients in the study is low, particularly for evaluating complication rates.

The in-depth analysis of the psychological outcome of our hypospadias patients in comparison with a group of boys after hernia repair in a previous publication has demonstrated a significant and clinically relevant impairment of their HRQoL [4], whereas their psychological adjustment and psychosexual function were not affected [13]. The present study demonstrates that the psychological outcome was not affected whether the boys were operated or reoperated until or beyond the age of 18 months. This contradicts the above-mentioned current theories. The reason may be that surgery-related psychological stress factors are less dramatic than assumed previously, if parent-child separation is minimized [18] and if children are supported by their families and professionals. It is important to recognize that psychosocial factors, like for example whether a boy is teased about his penis, are more important predictors of the HRQoL of a patient than medical variables, as for example complications or surgical outcome [4]. The limitation of this study due to the small number of patients must be emphasized. There were small differences between the two groups that might reach significance in a larger study.

Our data suggest that, from a psychological point of view, choosing the time of surgery as early as possible is unlikely to negatively affect a child's development, particularly if prolonged separation from the parents is avoided. However, anesthesia-related risk factors and morbidity must not be overlooked. Since anesthesia-related morbidity and adverse effects are very rare, the number of patients in this present series is not large enough to assess this risk. Yet this issue is not specific to hypospadias patients, and large series with children undergoing general anesthesia have been published to assess eventual age-related risks. In multiple earlier and recent studies it has clearly been shown that neonates and infants (age <1 year) have a significantly higher perioperative anesthetic morbidity and mortality [19–26]. Part of this morbidity can be explained by major life-threatening malformations; however, reduced respiratory and cardiovascular reserves in this age group have a significant negative effect making anesthesia of children <1 year more demanding. In the general trend towards operating on ever younger patients these findings have had little influence. Recently, a new concern about anesthesia in very young infants has been brought up. Neurodegeneration caused by common anesthetic agents in developing brain structures has been documented in several animal models [27]. Although the applicability of animal data to clinical anesthesia practice remains uncertain, worries remain that subtle but prolonged changes in behavior, including learning impairment, could result after general anesthesia in early infancy. Therefore, a possible benefit of early surgery must be well balanced against these real and potential anesthesiological risks, when deciding on the timing of hypospadias repair.

Conclusion

This study cannot provide evidence to support recommendations for an ideal age since the psychological and surgical outcome were not affected significantly, when patients were operated before 18 months. Present recommendations assume that genital surgery after the age of 18 months can have age-specific negative effects on a child's psychological development, so that surgery at an early age is recommended. However, in the ongoing trend to repair hypospadias ever earlier in infancy, potential increased anesthetic risk factors within the first year of life should be considered. Prospective studies, measuring the surgical and psychological outcome with similar instruments to those presented in this study may reveal whether there is truly an ideal age for hypospadias surgery.

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