

High fibre and fluid intake increase the success of hypospadias surgery

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ABSTRACT

Introduction: Hypospadias is a congenital malformation of the urethral meatus in the ventral penis that requires surgery. Fibre and fluid intake can accelerate the healing process, act as an anti-inflammatory and support the success of surgery. Based on hypospadias objective scoring evaluation (HOSE) scoring, this study aims to determine whether a high-fibre diet and adequate fluid intake affect the outcome of hypospadias surgery.

Materials and Methods: This analytic observational study used a case-control study design on 104 post-operative hypospadias patients at Ulin and Siaga Hospital Banjarmasin from 2018 to 2023 with quota sampling. Data were collected using personal data forms with hypospadias objective scoring evaluation (HOSE) and semi-quantitative-food frequency questionnaire (SQ-FFQ), which were analysed using a multinomial logistic regression test.

Results: Patients with less-fibre-intake had a 99.10% lower chance of having an excellent surgical outcome than patients with moderate-fibre-intake (Adjusted Odds Ratio, Adj. OR: 0.009, 95% Confidence Intervals; 95%CI: 0.000, 0.249), and it was statistically significant. The study did not find any association between fluid intake and surgical outcome, this could be due to the fact that most of the patient had good fluid intake.

Conclusion: The study found that high fibre intake increases the success of hypospadias surgery.

KEYWORDS:

Hypospadias, fibre intake, fluid intake, HOSE, SQ-FFQ

INTRODUCTION

Hypospadias is a congenital malformation and tends to increase. The urethral meatus in the ventral penis is due to incomplete closure.¹ The world incidence is 1:250-300 births, and there is no exact data in Indonesia,^{2,3} including Banjarmasin. The tabularised incised plate (TIP) is the most common technique for treating distal type.^{4,5} Post-operative complications remain common, although surgical

techniques continue evolving.^{6,7} This is associated with technical factors, severity, patient condition, scarring, post-operative follow-up and infection.⁸

Nutrition and hydration support the immune system and reduce pressure during bowel movements, which is suspected to play a role in healing.^{9,10}

After hypospadias surgery, it was evaluated using the functional hypospadias objective scoring evaluation (HOSE) questionnaire.¹¹ HOSE objectively evaluates meatus location, shape, urine flow, erection and fistula.¹² Based on the HOSE scoring, there were limited studies about the effect of a high-fibre diet and good fluid intake on hypospadias surgery.

MATERIALS AND METHODS

Study Design and Participants

The study was an analytic observational case-control study design on patients undergoing hypospadias surgery.

Setting

The study population was aged between 0 and 18 years and undergoing hypospadias surgery at Ulin and Siaga Hospital Banjarmasin from 2018 to 2023.

Study Participants

This study used non-probability sampling techniques (quota sampling) that met the inclusion criteria: post-operative patients with hypospadias for at least six months from Ulin and Siaga Hospital Banjarmasin seen in 2018-2023 and have agreed to participate. Exclusion criteria include patients with incomplete medical records. This study involved two surgeons. A paediatric surgeon was the operator, and another surgeon was the advisor. The operator determines the type of operation. For the distal types, there was 1-stage, and for the proximal, there were two or multiple stages. Generally, the first and re-operation uses the tabularised incised plate (TIP) technique. Another technique was Mathieu and transverse preputial island flap (TPIF). Each category needs 30 samples and the minimum sample is 90 people based on the theory of Gay, LR and Diehl, PL.¹³

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Table I: Bivariate analyses for demographic data and baseline characteristic of the patients.

Characteristics	Surgical outcome of hypospadias			p value
	Good (n=41)	Adequate (n=33)	Poor (n=30)	
Operative age, years (mean ± sd)	3.49±2.56	5.88±2.37	9.63±2.14	0.001 ^{a*}
• <4 years, n (%)	26 (63.40)	7 (21.20)	0 (0.00)	0.001 ^{b*}
• ≥4 years, n (%)	15 (36.60)	26 (78.80)	30 (100.00)	
Interview age, years (mean ± sd)	5.59±2.31	8.58±2.30	12.20±2.82	0.001 ^{a*}
Domicile, n (%)				
• South Kalimantan	34 (82.90)	26 (78.80)	22 (73.30)	0.620 ^b
• Outside of South Kalimantan (Central Kalimantan and East Kalimantan)	7 (17.10)	7 (21.20)	8 (26.70)	
Type of hypospadias, n (%)				
• Glanular	23 (56.10)	6 (18.20)	7 (23.30)	0.001 ^{b*}
• Distal	14 (34.10)	11 (33.30)	12 (40.00)	
• Proximal	4 (9.80)	16 (48.50)	11 (36.70)	
Surgical technique, n (%)				
• TIP	37 (90.20)	25 (75.80)	21 (70.00)	0.086 ^b
• Non-TIP (Mathieu and TPIF)	4 (9.80)	8 (24.20)	9 (30.00)	
Surgical stage, n (%)				
• 1 stage	34 (82.90)	15 (45.50)	12 (40.00)	0.001 ^{b*}
• 2 stages	7 (17.10)	18 (54.50)	18 (60.00)	
Location of surgery, n (%)				
• Ulin Hospital Banjarmasin	12 (29.30)	7 (21.20)	4 (13.30)	0.276 ^b
• Siaga Hospital Banjarmasin	29 (70.70)	26 (78.80)	26 (86.70)	
Time of surgery, n (%)				
• 2022-2023	20 (48.80)	12 (36.40)	11 (36.70)	0.475 ^b
• 2020-2021	16 (39.00)	12 (36.40)	11 (36.70)	
• 2018-2019	5 (12.20)	9 (27.30)	8 (26.70)	
Other congenital abnormalities, n (%)				
• Present (fistula, cryptorchidism, webbed & buried penis, and hydrocele)	3 (7.30)	5 (15.20)	4 (13.30)	0.540 ^b
• Absent	38 (92.70)	28 (84.80)	26 (86.70)	
Complication based on type of hypospadias, n (%)				
• Fistula	2 (100.00)	2 (100.00)	2 (100.00)	0.287 ^b
Glandular	1 (50.00)	0 (0.00)	1 (50.00)	
Distal	1 (50.00)	0 (0.00)	0 (0.00)	
Proximal	0 (0.00)	2 (100.00)	1 (50.00)	
• Webbed penis	1 (100.00)	0 (0.00)	1 (100.00)	0.157 ^b
Glandular	1 (100.00)	0 (0.00)	0 (0.00)	
Distal	0 (0.00)	0 (0.00)	1 (100.00)	
Proximal	0 (0.00)	0 (0.00)	0 (0.00)	
• Buried penis	0 (0.00)	0 (0.00)	1 (100.00)	NA
Glandular	0 (0.00)	0 (0.00)	0 (0.00)	
Distal	0 (0.00)	0 (0.00)	1 (100.00)	
Proximal	0 (0.00)	0 (0.00)	0 (0.00)	
• Others	0(0.00)	3(100.00)	0(0.00)	NA
Glandular	0(0.00)	0(0.00)	0(0.00)	
Distal	0(0.00)	1(33.33)	0(0.00)	
Proximal	0(0.00)	2(66.67)	0(0.00)	
• Absent	38 (100.00)	28 (100.00)	26 (100.00)	0.007 ^{b*}
Glandular	21 (55.30)	6 (21.40)	6 (21.40)	
Distal	13 (34.20)	10 (35.70)	10 (35.70)	
Proximal	4 (10.50)	12 (42.90)	10 (38.50)	

TIP = Tabularised incised plate; TPIF = Transverse Preputial Island Flap; a = Kruskal-Wallis test; b = chi-square test; n = number; SD = standard deviation; NA = not applicable; *Statistically significant (p<0.05).

Participants Data

This data obtained from medical records included name of patient, place and date of birth, place and date of surgery, age at surgery, age at interview, house address, type of hypospadias, surgical technique employed, stage of surgery, other congenital abnormalities and telephone number as guide. The interviews were based on the HOSE questionnaire to assess the outcome of hypospadias surgery at least six months post-operatively and the semi quantitative-food frequency questionnaire (SQ-FFQ) modified by the Indonesian Food Consumption Table, FatSecret and

nutritional value, to identify the patient eating and drinking history.

The participants diet history was converted using the NutriSurvey application software to calculate the daily fibre and fluid intake. The calculation was based on the table of adequate fibre and fluid intake figures by the Ministry of Health of the Republic of Indonesia. The data is interpreted in percentages and categorical data and analysed to determine the effect of a high-fibre diet and adequate-fluid-intake on the hypospadias surgery. The fibre intake was categorised as

Table II: Odd ratio for surgical outcome of Hypospadias among fibre intake.

Fiber intake	Poor (n=30)	Adequate (n=33)	Good (n=41)	Surgical outcome of hypospadias							
				Adequate			Good				
				Crude OR (95%CI)	p-value	Adj. OR (95%CI)‡	p-value	Crude OR (95%CI)	Adj. OR (95%CI)‡	p-value	
Good, n (%)	0(0.00)	0(0.00)	0(0.00)	NA	NA	NA	NA	NA	NA	NA	NA
Moderate, n (%)	2(6.70)	11(33.30)	33(80.50)	1	0.442	0.101	0.115	1	0.069	0.009	0.005*
Less, n (%)	7(23.30)	17(51.50)	8(19.50)	0.442	0.359	0.101	0.115	0.069	0.012-0.399)	0.000-0.249)	
Deficit, n (%)	21(70.00)	5(15.20)	0(0.00)	0.043	0.007-0.261)*	NA	NA	NA	NA	NA	NA

n = number; OR = odds ratio; Adj. = Adjusted; CI = confidence interval; NA = not applicable; ‡Adjusted on age at surgery, type of Hypospadias, surgical technique, surgical stage, other congenital abnormalities and fluid intake; *Statistically significant (p<0.05).

Table III: Odd ratio for surgical outcome of Hypospadias among fluid intake.

Fiber intake	Poor (n=30)	Adequate (n=33)	Good (n=41)	Surgical outcome of hypospadias							
				Good			Adequate				
				Crude OR (95%CI)	p-value	Adj. OR (95%CI)‡	p-value	Crude OR (95%CI)	Adj. OR (95%CI)‡	p-value	
Good, n (%)	24 (80.00)	32 (97.00)	41 (100.00)	1	0.125	0.127	0.373	1	NA	1	NA
Less, n (%)	6 (20.00)	1 (3.00)	0 (0.00)	0.125	0.062	0.127	0.373	NA	0.001-11.938)	NA	NA

n = number; OR = odds ratio; Adj. = Adjusted; CI = confidence interval; NA = not applicable; ‡Adjusted on age at surgery, type of Hypospadias, surgical technique, surgical stage, other congenital abnormalities and fluid intake; *Statistically significant (p<0.05).

Good, Moderate, Less and Deficit. To increase the accuracy and reduce bias, the fibre and fluid intake chart determinations were carried out by medical students and supervised by nutritionists. The tool for measuring fibre and fluid intake is the most accurate tool that nutrition or food experts use to analyse consumption survey results quickly and can adjust to age and gender. The participants demographic data and essential characteristics were based on the medical student's HOSE scoring with good, adequate and poor categories.

Ethical Considerations

The study was approved the Ethics Committee of the Faculty of Medicine and Health Sciences, Lambung Mangkurat University (No. 265/KEPK-FK-ULM/EC/IX/2023), Research Ethics Committee (No. 217/X-Reg-Riset/RSUDU/23), and the Research Permit Hospital (No. 205/S1.Ked/Litbang/RSUDU/X/2023).

Data Analysis

The statistical analysis was performed using the International Business Machines Statistical Program for Social Science (IBM SPSS) version 29 for macOS. One-way ANOVA test was used for numerical and chi-square test for categorical data were. To assess the crude odds ratio (OR), Adjusted (Adj.) OR and 95% confidence interval (95% CI), a multinomial logistic regression test was conducted. All analyses used a 95% CI ($\alpha=0.05$) and were statistically significant, if the p-value <0.05 or the 95% CI did not include 1.00. To minimise bias, the surgeon(s) were not involved in the data analyses.

RESULTS

Characteristics

There were 104 patients who met the inclusion and exclusion criteria. Seventy-one patients (68.30%) were interviewed online, and 33 (31.80%) were interviewed at their home or at Siaga Hospital Banjarmasin. All study respondents agreed to participate in the study. Forty-one (39.40%) had good surgical outcome (HOSE score: 14-16), 33 (31.70%) had adequate (HOSE score: 12-13) and 30 (28.80%) had poor (HOSE score: 10-11) outcome.

The most common post-operative complication was a fistula where corrective surgery was required and there were no patient with meatal stenosis. Patient who had excellent result was in glandular and distal types. The operations on the proximal type need to be evaluated to provide better results in the future. (Table I).

Comparing Surgical Outcome based on characteristics of patients

The demographic data and the essential characteristics of the patients were compared with surgical outcome (Table I). Younger patient has better outcome (Good: 3.49 ± 2.56 years old vs. Adequate: 5.88 ± 2.37 years old vs. Poor: 9.63 ± 2.14 years old). Patients in the <4 years age group had a better operative outcome as compared to those ≥ 4 years.

There were no statistically difference in the surgical outcome based on where they lived. There was a statistically difference in the surgical outcome based on the type of hypospadias. The TIP was the most common technique employed. Based

on the stage of surgery, patients with stage 1 disease had a statistically better outcome compared to stage 2 disease. There were no difference in the surgical outcome based on where the surgery was completed, the time of the surgery and the presence of other congenital abnormalities.

Comparing fibre intake and surgical outcome

Table II showed univariate and multivariate analysis to assess the relationship between the effect of a high-fibre diet and hypospadias surgery outcomes. There was no patient in the category of good fibre intake. More patient with good surgical outcome had moderate (33, 80.50%) to less (8, 19.50%) fibre intake. Most of the patient with poor outcome had deficit (21, 70.00%) fibre intake.

Post-operative patients with less-fibre intake had a lower odds of a good outcome compared to those with moderate-fibre intake (Adj. OR: 0.009, 95%CI: 0.000, 0.249).. The data analysis showed that hypospadias surgery tends to have good surgical outcomes with a higher fibre intake.

Comparing the effect of Fluid Intake and surgical outcome

The univariate and multivariate analysis results to investigate the effects of adequate fluid intake and hypospadias surgery outcomes are presented in Table III. Most of the patient had good fluid with 100% of those with good surgical outcome, and 97% and 80% of those in the moderate and poor surgical outcome group respectively. There were no statistically significant between fluid intake and surgical outcomes.

DISCUSSION

Hypospadias is one of the most common congenital malformations that is increasing in prevalence.⁹ It is a mild form of 46XY abnormality in the development of masculine genital organs and is often associated with impaired primary sex formation or sexual activity in adulthood.^{14,15} Hypospadias can be a combination of any or all of three anatomical anomalies of the penis, which are: (1) urethral meatus in the ventral penis and more proximal than average (tip of glans penis), (2) penile curvature (chordee) and (3) ventral preputium deficiency.¹⁶⁻¹⁸

Nutrition and hydration are essential for post-operative hypospadias. Adequate fibre can support the immune system and reduce pressure during defecation.^{9,10} Children who had hypospadias surgery are at higher risk of UTI; hydration with adequate-fluid intake can help to reduce the risk of infection.^{19,20} Excess pro-inflammatory cytokines are released, resulting in a disturbance in wound healing.²¹ Fibre and fluids are essential in this process and can accelerate the healing wound process as an anti-inflammatory to reduce the risk of post-operative complications.^{9,22,23}

Patient's Characteristics

Children aged 6-18 months are recommended for surgery for psychological reasons, toilet training, consideration of penis size dimensions and post-operative complications. Operations over two years have more significant complications than those under two years. Poor compliance

with prescribed medication, increased activity and genital/stent awareness and sub-optimal stent anchorage or application of dressings are the main complication factors.²⁴ The first-year penis growth determines the success of the operation, and delaying surgery will be detrimental.¹⁶ More accessible care and less psychological disturbance are the advantages when operated before two years.²⁵

The glandular type has the mostly good-surgical results, at 56.1%. The distal type is more complex and lengthier in surgical procedures. The meatal position is not the only consideration in reconstruction. The distal hypospadias is challenging due to small glans, poor urethral plate, proximal spongiosis and ventral curvature.⁵ Around 11.5% of patients with minor congenital abnormalities did not significantly affect the surgery outcome. Understandably, minor congenital abnormalities have little influence on wound healing.

Effect of High-Fibre Diet on the Outcomes of Hypospadias Surgery
This study showed that good post-operative fibre and fluid intake increase surgery success for hypospadias. Good fibre consumption can provide good surgery outcomes. Patients with low fibre intake had a lower odds a good surgical outcome as compared to those with moderate-fibre-intake.

Constipation due to a low-fibre diet and the urinary catheter instillation stimulate straining and can cause mechanical stretching of the wound.²⁶ Wound healing is a unique process, including in hypospadias. Mechanical stretching improves wound healing to a certain degree, but excessive mechanical stretching can harm wound healing.²⁷ Usual wound stretch affects the wound healing pathway.²⁸ Fibre diet and stool softener are effective for treating constipation.²⁶

This study's results align with Novikasari and Sanjaya's study, which states that a specific nutritional diet is vital to the success and improvement of healing. Tissue formation will be optimal if dietary requirements such as fibre are fulfilled. Nutritional deficiency can inhibit recovery, increasing the risk of open wounds and infection.²⁹

Although it was not statistically significantly different, the results of this study support Almatier's theory, which states that there is a relationship between nutrition, fluids, acceleration of wound healing and the immune system.²⁹

Effect of Fluid Intake on the Outcomes of Hypospadias Surgery
Although not statistically significant in the analysis of the fluid effect on surgical outcomes, there is a relationship between good fluid consumption and the success of hypospadias surgery. Patients with less fluid intake also had an 87.3% lower chance of having an adequate surgical outcome than patients with good fluid intake.

The study results also support the Kayilioglu et al. study, in which adequate post-operative fluid intake is vital in providing adequate tissue perfusion, stabilising hemodynamics, and reducing morbidity.³⁰ Other studies state that fluids play a role in launching urine production and preventing tissue dehydration.^{31,32} The more fibre and fluid intake, the more successful hypospadias surgery.

STRENGTH AND LIMITATIONS

As far as the researchers know, this is the first study to analyse the effect of a high-fibre diet and fluid intake on the results after hypospadias surgery. This study has considered (adjusted) potential confounders, such as age of surgery, type of hypospadias, surgical technique, stage of surgery and other congenital abnormalities.

The study limitations are that the sample size was not large enough,^{33,34} and did not pay attention to confounding factors, including body weight and other nutritionally independent variables. Non-randomisation, absence of blinding, and interviewer/data analyser bias might also be issues in this study. The last bias was minimal because another data analyser had validated the statistical results. Prospective future research with a larger sample involving detailed dietary factors regarding protein, vitamins, zinc, and soluble or insoluble fibres, consume stool softener, randomised control trial and blinding interviewer and analyser will be done.

CONCLUSION

In conclusion, our findings demonstrated that fibre intake is an important component in hypospadias surgical outcome. Patients with less fibre intake showed a lower odds of having a good surgical outcome as compared to those with moderate fibre intake. The study did not find any significant statistic correlation between fluid intake and surgical outcome, this could be due to the fact that most of the patient had good fluid intake. High fibre and fluid intake increase the success of hypospadias surgery.

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