Effect of inguinal hernia on the thickness and blood flow of spermatic cord in boys

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ABSTRACT

Objective To evaluate the effect of inguinal hernia (IH) on the spermatic cord using spermatic cord ultrasonography (SCU).

Methods From January 2016 to January 2017, boys with IH who received SCU at the start of open herniorrhaphy (OH) were enrolled in this study. The age and weight at SCU, width of the spermatic cord (SC-W), peak systolic velocity (PSV) in the spermatic artery (SA-PSV) and velocity in the pampiniform plexus (PP-V), and the interval between the initial and the second OH in boys with metachronous inguinal hernia (MIH) were recorded, and the relationship among them was studied. Boys with unilateral IH comprised the IH group, and boys with MIH comprised the MIH group. Boys with polydactylysm served as the control.

One-way analysis of variance tested the differences among groups. Spearman’s r tested the relationship between SC-W in the MIH group and the interval.

Results A total of 80 boys were enrolled in this study (IH group 29, MIH group 26, and control group 25). SA-PSV and PP-V in the treated side were all highly correlated to the interval in a curvilinear manner. PSV was positively correlated with SC-W in boys with IH, and PP-V was negatively correlated; herniorrhaphy could reverse the impairment.

Introduction

Pediatric inguinal hernia (IH) is the most common congenital defect in daily practice. An IH or hydrocele may impair testicular blood flow, and preoperative testicular blood flow in the hernia-sided testicle is significantly reduced compared with the normal-side testicle.¹⁻³ Fortunately, the blood flow is normalized through herniorrhaphy.³ As far as we know, no previous study has investigated the blood flow of hernia-sided spermatic cord. Thickened spermatic cord that accompanies IH in boys is well documented, but whether herniorrhaphy can reverse this phenomenon is unknown yet.⁴ The effect of IH on the spermatic cord is still unclear. Ultrasonography is a safe and non-invasive method to visualize and evaluate the spermatic cord,⁵ ⁶ so we evaluated the effect of IH on the spermatic cord using spermatic cord ultrasonography.

METHODS

From January 2016 to January 2017, boys aged 1–2 years with IH who received an ultrasound examination at the start of open herniorrhaphy in the operation room of the Department of Ambulatory Surgery were enrolled in this study. The age and weight at spermatic cord ultrasonography, sonographic width of the spermatic cord, peak systolic velocity (PSV) in the spermatic artery (SA-PSV) and velocity in the pampiniform plexus (PP-V), and the interval between the initial and the second open herniorrhaphy (interval) in boys with metachronous inguinal hernia (MIH) were recorded, and the relationship among them was studied. Boys with initial unilateral IH comprised the IH group, and boys with MIH comprised the MIH group. Twenty-five boys with polydactylysm served as the control.

Spermatic cord ultrasonography

Both sides of the spermatic cord were examined by one radiologist (attending doctor) and her assistant (fellow) in the operation room of the Department of Ambulatory Surgery using a 7.5 MHz linear transducer at the start of open herniorrhaphy. The radiologist was blind to the clinical diagnosis, but her assistant was not. Grayscale ultrasound was performed to show long-axis section of the spermatic cord, then color Doppler flow imaging was performed to show the flow signal with the scale adjusted to 2 mm/s. The cremaster muscles were clearly shown (hyperechoic by grayscale ultrasound). At the external ring, we measured the diameter between the inner edges of the cremaster muscles. The diameter of the cord was recorded. The velocities of the spermatic artery (the largest one) and the pampiniform plexus were measured by
Table 1  Comparison of age and weight among groups

| Group          | Age (month) | Weight (kg) |
|---------------|-------------|-------------|
| IH group      | 16.9±2.9    | 11.3±1.7    |
| MIH group     | 18.3±3.9    | 11.7±1.6    |
| Control group | 17.5±4.0    | 10.7±1.8    |

F value 1.046  P value 0.356

Values are mean±SD. One-way ANOVA was performed among groups, and there was no significant difference between groups according to Dunnett’s T3 analysis following one-way ANOVA. ANOVA, analysis of variance; IH, inguinal hernia; MIH, metachronous inguinal hernia.

Table 2  Comparison of velocity in spermatic cord vessels (cm/s) among groups

| Variables | IH group | MIH group |
|----------|----------|-----------|
|          | Hernia side | Normal side | Hernia side | Treated side | Control | F value | P value |
| SA-PSV*  | 7.90±2.07 | 5.60±1.55 | 8.20±1.40 | 6.27±1.02 | 6.48±1.92 | 12.603 | < 0.001 |
| PP-V†    | 2.75±0.65 | 3.68±1.03 | 2.71±0.64 | 3.17±0.59 | 3.24±1.13 | 6.295 | < 0.001 |

Values are mean±SD.

*One-way ANOVA (SA-PSV among the IH group, MIH group and control).
†One-way ANOVA (PP-V among the IH group, MIH group and control).

ANOVA, analysis of variance; IH, inguinal hernia; MIH, metachronous inguinal hernia; PP-V, velocity in pampiniform plexus; SA-PSV, peak systolic velocity in spermatic artery.

Open herniorrhaphy

The procedures were performed under caudal anesthesia combined with intravenous anesthesia. Briefly, a small transverse dermatoglyphic incision was made on the hernia side, and then the Scarpa’s fascia was spread. The external oblique was kept intact and the cord was identified near the external ring. As soon as the sac was identified and opened, and the deferent duct and vessels were bluntly separated toward the neck of the sac. Then, the sac was only doubly ligated without resection, and the thickness of the empty sac was measured. Finally the incision was closed with one single suture.

Statistical analysis

Continuous data are expressed as mean±SD and were analyzed using one-way analysis of variance (ANOVA) followed by least significant difference (LSD). Logistic regression was used to assess the association between the width of the treated side spermatic cord, SA-PSV and PP-V and the interval, respectively. Spearman’s rank correlation coefficient (Spearman’s r) was used to examine the relationship among the width of the spermatic cord, the interval, and velocities of spermatic vessels. P<0.05 was considered statistically significant. Statistical analyses were performed with SPSS (IBM SPSS Statistics V.22).

RESULTS

A total of 80 boys were enrolled in this study (IH group, n=29; MIH group, n=26; and control group, n=25). The age and weight at spermatic cord ultrasonography were not significantly different among the groups (table 1). The sonographic widths of hernia-sided spermatic cord of the IH group, normal side of the IH group, treated side of the MIH group, and the control were 0.61±0.12 cm, 0.14±0.04 cm, 0.25±0.11 cm, and 0.15±0.04 cm, respectively (one-way ANOVA, p<0.001). Significant differences were identified in SA-PSV and PP-V, respectively, among the groups (one-way ANOVA, p<0.001). Furthermore, SA-PSV in the hernia side of the IH group (7.90±2.07 cm/s) was faster than the control group (6.48±1.92 cm/s; LSD following one-way ANOVA, p=0.002), in the normal side (5.60±1.55 cm/s) was slightly slower than the control (LSD following one-way ANOVA, p=0.055), and there was no significant difference in SA-PSV between the treated side of the MIH group (6.27±1.02 cm/s) and the control (LSD following one-way ANOVA, p=0.650). PP-V in the hernia side of the IH group (2.75±0.63 cm/s) was slower than the control (3.24±1.13 cm/s; LSD following one-way ANOVA, p=0.036), there was no significant difference between the normal side (3.68±1.03 cm/s) and the control (LSD following one-way ANOVA, p=0.057), and there was no significant difference in PP-V of the treated side of the MIH group (3.17±0.59 cm/s) and the control group (LSD following one-way ANOVA, p=0.752) (table 2).

Following herniorrhaphy, the widths of the treated side spermatic cord, SA-PSV, and PP-V were all associated with the interval in a curvilinear manner (r²=0.833, p<0.001; r²=0.317, p=0.005; and r²=0.748, p<0.001, respectively) (figures 1 and 2). SA-PSV, PP-V, and the width of the spermatic cord was highly correlated to the interval (Spearman’s r=−0.581, p=0.002; r=0.865, p<0.001; and r=−0.902, p<0.001, respectively). SA-PSV and PP-V was highly correlated to the width of the spermatic cord (r=0.621, p=0.001 and r=−0.790, p<0.001, respectively).

DISCUSSION

The spermatic cord is composed of the pampiniform plexus, testicular artery, cremasteric artery, artery of the ductus deferens, lymphatic vessels, testicular sympathetic pulse wave Doppler (PWD). SA-PSV and PP-V were also recorded at the external ring level.

Open herniorrhaphy

The procedures were performed under caudal anesthesia combined with intravenous anesthesia. Briefly, a small transverse dermatoglyphic incision was made on the hernia side, and then the Scarpa’s fascia was spread. The external oblique was kept intact and the cord was identified near the external ring. As soon as the sac was identified and opened, and the deferent duct and vessels were bluntly separated toward the neck of the sac. Then, the sac was only doubly ligated without resection, and the thickness of the empty sac was measured. Finally the incision was closed with one single suture.
Figure 1  Correlation between the interval during the initial and the second open herniorrhaphy and the width of the treated side spermatic cord.

Figure 2  Correlation between the interval during the initial and the second open herniorrhaphy and blood flow of the treated side spermatic cord vessels. PP-V, velocity in pampiniform plexus; SA-PSV, peak systolic velocity in spermatic artery.
Competing interests None declared.

Patient consent for publication Not required.

Ethics approval This retrospective study was approved by the Institutional Review Board of the Children's Hospital, Zhejiang University School of Medicine.

Provenance and peer review Not commissioned; externally peer reviewed.

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