

Unwanted Intra-operative Penile Erection During Pediatric Hypospadiasis Repair

Comparison of Propofol and Halothane

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Purpose: To compare the erectile effect of propofol and halothane on unwanted intra-operative penile erection (UIOPE) during pediatric hypospadiasis repair.

Materials and Methods: One hundred and seventeen boys who were in the age range of 6 months to 6 years and referred for hypospadiasis repair to our referral teaching hospital were included in this randomized clinical trial. Patients were randomly assigned to one of the two study groups before anesthesia induction. Anesthesia was maintained with a continuous intravenous infusion of propofol and inhalational halothane in the propofol (*P*) and halothane (*H*) groups, respectively. Data regarding the patients' age, weight, pre- and intra-operative chordee, UIOPE, anesthesia time, surgery time, hematoma formation, and wound infection were collected. The Chi-Square and Fisher's exact tests were used for comparison.

Results: No statistically significant differences were noted regarding age, weight, and pre- and intra-operative chordee between the two groups. The incidence of UIOPE (10.34% versus 57.63%; *P* = .000), anesthesia time (174.15 ± 15.02 versus 181.26 ± 15.19; *P* = .012), and surgery time (162.34 ± 12.99 versus 167.69 ± 13.90; *P* = .034) were significantly lower in group *P* compared with group *H*.

Conclusion: The use of propofol during hypospadiasis surgical repair is more safe and effective than halothane in preventing UIOPE and reducing surgery and anesthesia time.

Keywords: anesthesia, propofol, halothane, child, penile erection

INTRODUCTION

Hypospadias repair is a relatively common pediatric urological procedure. In which, correction of the chordee is an important step.⁽¹⁾ If chordee is not diagnosed by history taking and physical exam in the pre-operative visit, drug-induced artificial erection or via saline injection into the corpora cavernosa is done at the beginning of surgical repair.⁽¹⁾ Thereafter, any erection during surgery is unwanted and very troublesome to perform the procedure.^(2,3)

Unwanted intra-operative penile erection (UIOPE) is mostly idiopathic; however, it may be caused by anesthesia.^(2,3) Penile engorgement can occur because of blood pooling and vascular resistance changes during general or neuroaxial anesthesia.^(4,5) Although the effects of anesthetic medications and methods have been widely studied on the female genitalia, especially on the uterine blood flow, its specific effects on the male genitalia and UIOPE have not been completely discussed.⁽⁶⁾

To the best of our knowledge, only two studies have reported penile erection during remifentanyl anesthesia in children⁽⁷⁾ and UIOPE and its management.⁽³⁾ Due to different mechanisms of anesthetic drugs and methods, it seems that these drugs have different effects on UIOPE. General anesthesia with volatile or total intravenous anesthesia (TIVA) has been commonly used for hypospadias surgery. In our current clinical practice, we used propofol or halothane for the maintenance of pediatric anesthesia. This clinical trial was designed to compare the erectile effects of propofol and halothane during pediatric hypospadias repair.

MATERIALS AND METHODS

Patients and Study Design

One hundred and seventeen boys in the age range of 6 months to 6 years, who had referred for surgical hypospadias repair and had American Society of Anesthesiologist (ASA) Physical Status class I, were enrolled in this randomized clinical trial. Prior to the study, the approval of the university's Ethics Committee and the institutional review board of the tertiary referral teaching hospital, Shahid Sadoughi University of Medical Sciences, Yazd, Iran, was obtained.

Patients with airway abnormalities and adverse reactions to

the study drugs were excluded. The study was designed as a randomized, investigator-blinded study. Only the anesthesiologist was aware of the study groups. All medications were administered by the attending pediatric anesthesiologist, who was familiar with the medications and the protocol.

Anesthesia and Study Drugs

From March 2006 to January 2009, all patients received a standardized anesthetic protocol with fentanyl 2 µg/kg IV and midazolam 0.05 mg/kg for premedication. After pre-oxygenation by face mask and O₂ 100%, anesthesia was induced with thiopental 4 mg/kg and atracurium 0.5 mg/kg. Tracheal intubation was performed after 3 minutes.

The patients were randomly assigned to one of the two study groups using a sealed envelope technique before anesthesia induction. Anesthesia was maintained with a continuous intravenous infusion of propofol 100 µg/kg/min and inhalational 0.5 to 1 MAC halothane in the propofol (P) and halothane (H) groups, respectively. Both groups received nitrous oxide (N₂O) 50% + O₂ 50% during the maintenance of anesthesia. Intravenous ringer was the standard fluid management for intra-operative fluid maintenance and the replacement of fluid deficits in patients with insufficient oral fluid intake. The following drugs were used in the study: thiopental (Sandoz GmbH, Kundl, Austria), propofol emulsion (Fresenius Kabi Austria GmbH, Austria), fentanyl, midazolam, and Atracurium (Glaxo Wellcome S.P.A Parma, Italy).

Monitoring was done using standard anesthesia monitors. In the pre-operative visit, chordee was diagnosed by manual compression in the perineum and penile shaft. After the induction of anesthesia and before the beginning of anesthesia maintenance, classic artificial erection was induced by injecting saline into the corpora cavernosa.

Unwanted intra-operative penile erection, which was defined as increase in size without hardness (grade 1 of the Erectile Hardness Grading Scale [EHGS]) during urethral reconstruction was recorded by the surgeon⁽⁹⁾. All surgical procedures were performed by an attending pediatric surgeon. Finally, halothane and propofol were discontinued and the effect of atracurium was reversed by the administration of neostigmine 60 µg/kg and atropine 20 µg/kg.

Data regarding the patients' age, weight, pre- and intra-oper-

ative chordee, UIOPE, anesthesia time (time from induction of anesthesia to endotracheal extubation), surgery time (time from beginning of surgery to the end of bleeding control), hematoma formation, and wound infection were recorded by the pediatric surgeon.

Statistical Analysis

The sample size for each group was calculated to be 57 (power = 90%, type 1 error = 5%, and significant difference = 25% for UIOPE). Chi-Square and Fisher's exact tests were used to analyze data related to occurrence and frequency of pre- and intra-operative chordee and UIOPE during surgery in both groups. P values less than .05 were considered statistically significant. Continuous data, including age, weight, anesthesia time, and surgery time were analyzed using independent sample Fisher's exact t test, and expressed as mean \pm standard deviation. All statistical analyses were done by SPSS software (the Statistical Package for the Social Sciences, Version 16.0, SPSS Inc, Chicago, Illinois, USA).

RESULTS

Of 117 patients, 58 (50.43%) were assigned to group P and 59 (49.57%) to group H. The patients' characteristics (Table 1) and their intra- and postoperative data (Table 2) were compared. The patients' characteristics and pre- and intra-operative chordee of both groups were well-matched. The type of hypospadias and kind of operation were similar in the studied groups (Table 1).

Six patients in group P and 34 in group H had UIOPE during surgery (10.34% versus 57.63%, $P = .000$). Anesthesia (174.15 ± 15.02 versus 181.26 ± 15.19 , $P = .012$) and surgery (162.34 ± 12.99 versus 167.69 ± 13.90 , $P = .034$) times were significantly lower in group P compared with group H (Table 2). If the patients were divided in two groups according to the incidence of UIOPE, the differences between surgery and anesthesia times would be statistically significant ($P = .000$ and $P = .000$, respectively).

The risk difference between the two groups and the number needed to treat (NNT) were 47.29% and 2.11, respectively. Hematoma formation and wound infection were not found in the patients of the two groups.

Table 1. Comparison of patients' characteristics between the studied groups.

Variables	Group P (n = 58)	Group H (n = 59)	P
Age (mean \pm SD), mo	37.90 \pm 21.78	37.05 \pm 21.88	.834
Weight (mean \pm SD), kg	18.85 \pm 7.63	18.09 \pm 7.00	.575
Pre-operative chordee, n (%)	40 (68.97%)	39 (66.10%)	.740
Intra-operative chordee, n (%)	41 (70.69%)	42 (71.19%)	.952
Type of hypospadias (Operation)			
Distal third (Mathieu)	7	7	.973
Glandular (MAGPI)	4	4	.980
Coronal (MAGPI)	3	4	.714
Mid shaft (Snod gross)	5	5	.977
Proximal type (Snod gross or TIP)	4	3	.680
Redo operation (Snod gross or TIP)	35	36	.941

SD indicates standard deviation; MAGPI, meatal advancement with glandoplasty and increment; and TIP, transverse incised plate.

DISCUSSION

Unwanted intra-operative penile erection during penile surgery is a challenge for the surgeon. Penile engorgement and concurrent complications, such as excessive bleeding and surgical trauma leading to delayed surgery, complicate penile surgery.^(2,3)

We found that general anesthesia with propofol infusion may be more effective in decreasing the incidence of UIOPE, anesthesia time, and surgery time during hypospadias repair as well as postoperative nausea and vomiting compared with halothane. Based on the NNT^(2,11) and number needed to harm (0) in UIOPE, this study shows that the use of propofol during hypospadias surgical repair can be more safe than volatile anesthetics.

Studies on the effects of halothane on the female genitalia, especially on the uterine blood flow, show that halothane can increase uterine blood flow and bleeding during surgical procedures, such as cesarean section. Thus, it has been recommended to decrease halothane concentration after delivery.⁽⁶⁾ During anesthesia, the autonomic nervous system is depressed. Therefore, sympathetically-mediated vasoconstriction may subside and vascular engorgement may occur requiring deeper levels of anesthesia to prevent UIOPE.

Volatile anesthetics increase uterine,⁽⁶⁾ nasal sinuses,^(4,5) and cerebral blood flows.⁽⁸⁾ Penile blood flow is probably increased by changing penile vascular resistance with or without decreasing outflow drainage and increasing penile blood

Table 2. Comparison of propofol and halothane during hypospadias surgery.

	Group P (n = 58)	Group H (n = 59)	P
UIOPE, n (%)	6 (10.34%)	34 (57.63%)	.000
Surgery time (mean ± SD), min	162.34 ± 12.99	167.69 ± 13.90	.034
Anesthesia time (mean ± SD), min	174.15 ± 15.02	181.26 ± 15.19	.012
Hematoma formation, n	0	0	NS
Wound infection, n	0	0	NS

UIOPE indicates unwanted intra-operative penile erection; SD, standard deviation; and NS, not significant.

volume; hence, penile engorgement and UIOPE could occur. In an anesthetized patient, effect of tactile stimulation could suppress, except in early stages and light anesthesia. Neuroaxial and general anesthesia with volatile agent or TIVA may induce vasodilatation and pooling of blood in the venous sinuses of the penis. Therefore, penile engorgement during anesthesia is not uncommon.^(2,3)

Inhalational anesthetics, such as halothane, are widely used in pediatric patients. Various volatile anesthetics have different effects on the circulation of different organs. Their effects on the uterine,⁽⁶⁾ cardiovascular,^(9,10) nasal sinuses,^(4,5) and brain⁽⁸⁾ circulation have been studied. Halothane decreases vascular resistance in the uterus leading to increased uterine blood flow and blood volume.⁽⁶⁾

The vasodilatation induced by anesthetics in the heart and brain is mediated by oxygen free radicals participation,⁽¹¹⁾ EDRF/cGMP-mediated vascular smooth muscle relaxation,⁽¹²⁾ potassium channel blockade,⁽¹⁰⁾ and adenosine triphosphate-sensitive.

The main methods to prevent UIOPE include use of deeper levels of anesthesia with a simultaneous induction of hypotension by sodium nitroprusside, dorsal nerve block paralysis, corporeal aspiration with or without shunting procedures, and ketamine, phenylephrine, epinephrine, amyl nitrate, terbutaline, noradrenaline, metaminol, and epinephrine administration.⁽¹³⁻¹⁵⁾

Several studies have suggested that propofol reduces the incidence of postoperative nausea and vomiting and results in shorter emergence times.^(15,16) Currently, propofol TIVA is more expensive than anesthesia with inhalational halothane

and N₂O. Considering the costs of treating postoperative nausea and vomiting and the costs of increased recovery room stay after inhalational anesthesia, TIVA could be cost-effective.^(16,17) Considering a reduction in anesthesia time, surgery time, complication of surgery, and probably, bleeding, use of propofol can cover its higher cost in comparison with inhalational anesthesia.

We did not observe any of the above-mentioned complications during the surgery. However, this could be because of the small volume of bleeding. Therefore, this variable was not measured because.

CONCLUSION

According to our findings, the use of propofol during hypospadias surgical repair is more safe and effective than halothane in preventing UIOPE and reducing surgery and anesthesia time. However, further studies are suggested to compare the effects of other anesthetic drugs and methods to find the safest one.

CONFLICT OF INTEREST

None declared.

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