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An evaluation of spinal anesthesia results in pediatric patients undergoing pilonidal sinus surgery: a retrospective study

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ABSTRACT

Aims: The aim of this retrospective study was to evaluate the efficacy, side-effects, and complications of spinal anesthesia (SpA) in children undergoing pilonidal sinus surgery with SpA.

Methods: The records of pediatric patients who underwent pilonidal sinus surgery with SpA from January 2019 to March 2023 were retrospectively evaluated from the database in the Samsun University Samsun Maternity & Children's Training and Research Hospital, Department of Anesthesiology and Reanimation, Türkiye. Children's sociodemographic characteristics, clinical and vital signs, motor block duration, operative time, and complications were recorded.

Results: Eighty-one patients underwent pilonidal sinus surgery with SpA, 54 (66.7%) boys and 27 (33.3%) girls, with a mean age of 14.38±1.29 years. The patients' mean body mass index was 26.83±1.1 $kg.m^{-2}$, and the success rate was 96.3% (n=78). Eleven (13.6%) patients received supplemental anesthesia among the 78 procedures completed using SpA. The incidence of complications was 5.1% (n=4). Intraoperative hypotension developed in two cases and postoperative vomiting in two, all of which resolved with no sequelae.

Conclusion: Our retrospective analysis suggests that pediatric SpA is a safe and effective technique for children undergoing pilonidal sinus surgery. However, further prospective studies are warranted to confirm these findings.

Keywords: Anesthesia, children, spinal anesthesia, surgery, pilonidal sinus

INTRODUCTION

Spinal anesthesia (SpA) provides safe and effective anesthesia and analgesia for surgical procedures without the need for airway intervention.[1] It has a number of advantages over general anesthesia and lowers the risk of cardiorespiratory events (such as hypoxemia, bradycardia, and hypotension) associated with general anesthesia in neonates and young infants, as well as smaller adults during the course of minor surgical procedures. The advantages of SpA in pediatric patients include a rapid onset, the provision of adequate motor and sensory block, and reducing pain and the stress response to surgery.[2,3]

However, both anesthesiologists and surgeons have traditionally been reluctant to apply SpA in the pediatric population.[4] A survey study revealed that the unwillingness to apply SpA for routine pediatric surgical procedures is multifactorial in nature. One factor that possibly contributes to such reluctance among surgeons may be the idea that SpA is technically difficult and entails a longer preoperative time.[5] The technique also has a number of disadvantages, particularly the fact that as many as 10% of SpAs in very young children will require conversion to general anesthesia due to various unanticipated events. Other limitations include its limited effect duration (90 min) and the potential need for additional anesthetics.[3,6,7]

The aim of this retrospective study is to share our experiences with SpA in children undergoing pilonidal sinus surgery and to evaluate the side-effects and complications associated with the procedure. This paper also discusses our hypothesis was concerning whether or not SpA is safe and effective in pediatric patients. Our primary aim is to evaluate our results for pediatric SpA performed by us due to pilonidal sinus surgery and the complications thereof. Our secondary aim is to discuss our clinical findings in the light of the current literature.

METHODS

This retrospective study was carried out with the permission of Samsun University Clinical Researches Ethics Committee (Date: 15.02.2023, Decision No: 2023/3/2). All procedures were carried out in accordance with ethical rules and the principles of the Declaration of Helsinki.

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Study Population

Data from patients who underwent pilonidal sinus surgery with SpA at the Samsun University, Samsun Maternity and Children's Training and Research Hospital, Department of Anesthesiology and Reanimation, Türkiye, between January 2019 and March 2023 were examined retrospectively. Patients with histories of pilonidal sinus surgery under SpA were included in the study. Individuals aged over 18, receiving general anesthesia, or undergoing additional procedures together with pilonidal sinus surgery (appendectomy, tonsillectomy, herniorrhaphy, orchiopexy, circumcision, etc.) were excluded.

SpA procedure

Appropriate hydration was performed prior to SpA. The children undergoing SpA were kept in the lateral decubitus position by a technician, particular attention being paid to lumbar kyphosis to ensure optimization of the puncture conditions (Figure 1). Patients were sedated when needed. The intrathecal space was accessed at the L4-L5 or L5-S1 levels via median puncture under sterile conditions by means of 25 mm, 25-gauge, or 26-gauge Quincke spinal needles (Figure 2). Once return of the cerebrospinal fluid was observed, a mixture of 0.5% hyperbaric bupivacaine (0.3 mg per kg body-weight) was administered. The needle was then extracted, after which the patient was placed in position for surgery. The success of SpA (in terms of loss of autonomic or motor response to external stimuli) was confirmed through gentle tactile stimulation of the thigh by means of a forceps before the procedure commenced. The Modified Bromage scale was applied to assess the motor block component, a value of 0 representing no motor block present, 1 an inability to stand unassisted, 2 the ability to flex the ankle, but not the knee, and 3 complete motor block in a fully awake child.[8] Surgery was performed on patients with block levels of T10 or higher.

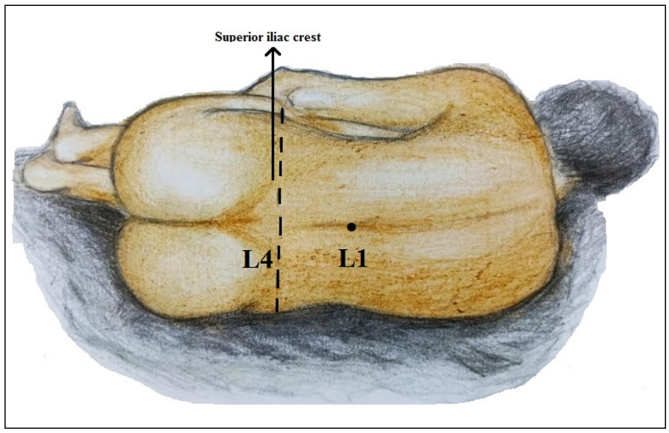

Figure 1. The lateral decubitus position for spinal anesthesia in children

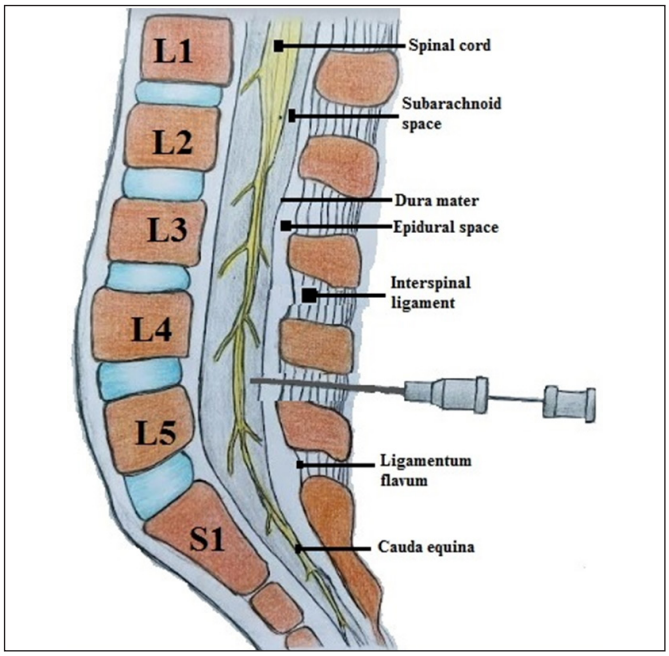

Figure 2. The spinal anesthesia technique using the L4-L5 segment

The procedure was discontinued in case of failure following two punctures. SpA was regarded as unsuccessful in these cases, and general anesthesia was performed instead.

All SpAs were performed by anesthetists with at least three years' experience in this area. The technique was not performed by anyone other than a specialist physician in our center.

Sedation for Spinal Puncture

Children who were agitated, fearful, or hyperactive in the preoperative period were given intravenous midazolam (0.05 mg per kg body weight) to ensure the reliability and success of the spinal block.[9]

Supplemental Anesthesia

Supplemental anesthesia was defined as the additional use of intravenous anesthetics throughout the perioperative period following an initially successful spinal puncture. Children who were agitated, fearful, or hyperactive in the intraoperative period received continuous intravenous infusion of remifentanil (0.05 µg per kg body-weight at the beginning of the operation and 0.025 µg per kg body weight for maintenance).

Perioperative Care

All the children in this study were routinely monitored throughout the procedure and up to discharge. All cases' vital signs were recorded every 5 min in the operating room and also in the recovery room. Hypotension was defined as 30% decrease of baseline systolic blood pressure, or mean arterial pressure (MAP) less than 60 mm-Hg as described by Santana et al.[9] Fluid bolus or vasoactive medication use and respiratory adverse event rates were investigated from the perioperative

care records. The medical staff closely monitored all the patients in terms of apnea. Postoperative oxygen supplementation requirements were defined as any requirement for non-invasive oxygen delivery, such as via nasal oxygen cannula, to ensure that oxygen saturation levels were maintained above 92%.

Data Collection

Clinical data including sex, age, body mass index (BMI), American Society of Anesthesiologists (ASA) grade, number of punctures, time to complete block, supplemental anesthesia, blood pressure values, rescue analgesia, duration of operation, complications of SpA, and length of hospital stay were analyzed.

All parents/guardians provided detailed, signed forms agreeing to the use of their children's clinical details for scientific purposes, a formal requirement in our hospital.

Statistical Analysis

Data analysis was performed on SPSS version 25 software (Statistical Package for Social Sciences- IBM Corp., Armonk, NY, USA). Nominal variables were expressed as frequencies and percentages, and continuous variables as mean±standard deviation.

RESULTS

Eighty one patients with a mean age of 14.38±1.29 years were included in the study. Fifty-four (66.7%) of the patients were boys and 27 (33.3%) were girls, with a mean BMI in the total patient group of 26.83±1.1 $kg.m^{-2}$.

SpA was initially attempted for all 81 procedures. Spinal needle placement failure occurred in three (3.7%) patients who subsequently received general anesthesia. Seventy-eight cases were completed using SpA, 18 (22.2%) of which were briefly sedated to permit successful spinal puncture. Lumbar puncture was successfully achieved at the first attempt in 75 (96.2%) patients, and at the second attempt in three (3.8%).

Mean operative time was 75.8±8.96 min, mean motor block development time 7.68±1.01 min, and the time for the motor block to fade was 63.93±6.03 minutes (Table 1). Motor block developed in all patients.

Eleven (13.6%) of the 78 children who underwent SpA received additional anesthesia with the application of a laryngeal mask during surgery due to early returning motor block or autonomic responses. Four of these children were girls and seven were boys (p=0.819). The mean age of the girls was 13.5±0.57 years and that of the boys was 13.57±0.78 years. There was no significant age difference between the boys and girls (p=0.878). Clinical data for the patients who received additional anesthesia are shown in Table 2.

Table 1. Detailed information of patients in the study

Clinical variables	Values
Total number	81
Age (years, mean±SD)	14.38±1.29
Sex, girl (N, %)	27, 33.3%
Body mass index (kg/m^2, mean±SD)	26.83±1.1
ASA classification (N, %)	
ASA 1	64, 79%
ASA 2	17, 21%
Sedation for spinal puncture (N, %)	18, 22.2%
Number of puncture (mean±SD)	1.02±0.21
Motor block development time (min, mean±SD)	7.68±1.01
Motor block duration (min, mean±SD)	63.93±6.03
Supplemental anesthesia (N, %)	11, 13.6%
Operative time (min, mean±SD)	75.8±8.96
Hospital stay (day, mean±SD)	1.07±0.26

ASA: American Society of Anesthesiologist, SD: standard deviation

Table 2. Clinical data for the patients who underwent additional anesthesia

Clinical variables	Values
Total number	11
Age (years, mean±SD)	13.54±0.68
Sex, girl (N, %)	4, 36.3%
Body mass index (kg/m^2, mean±SD)	27.25±0.69
ASA classification (N, %)	
ASA 1	8, 72.7%
ASA 2	3, 27.3%
Sedation for spinal puncture (N, %)	6, 54.5%
Number of puncture (mean±SD)	1
Motor block development time (min, mean±SD)	7.75±1.24
Motor block duration (min, mean±SD)	63.9±5.95
Operative time (min, mean±SD)	79.54±7.77
Hospital stay (day, mean±SD)	1.09±0.3

ASA: American Society of Anesthesiologist, SD: standard deviation

Hemodynamic parameters were evaluated in terms of normal limits for all age groups. Hypotension was defined as a decrease in MAP below 35 mm-Hg. Hypotension was determined in two patients (aged 12 and 16 years) during observation and postoperative vomiting in two (aged 13 and 14), and our overall complication rate was 5.1%. No postoperative apnea, bradycardia, desaturation, or post-dural puncture headache (PDPH) was observed in any case.

DISCUSSION

This study evaluated the effectiveness of spinal anesthesia in children undergoing pilonidal sinus surgery. A success rate of 96.3% and a complication rate of 5.1% were determined. Sedation was applied to 18 (22.2%) patients before SpA. Mean time to motor block development was 7.68±1.01 min, mean duration of motor block was 63.93±6.03 min, and the supplemental anesthesia rate was 13.6%. SpA has previously been used effectively in pediatric pilonidal sinus surgery and has

numerous clinical advantages over general anesthesia. These include less intraoperative desaturation and bradycardia, higher minimum systolic blood pressure with fewer intervention requirements, less heat loss, a lower incidence of postoperative early apnea, shorter anesthesia times from the conclusion of surgery to leaving the operating room, and shorter times to first feed.[3,11]

An examination of the literature shows that pediatric SpA enjoys a high success rate. Studies with a similar design to the present research have reported success rates of 97.5-100%.[3,10-12] The success rate in the present study was 96.3%, a figure compatible with previous research in the literature.

While pediatric SpA may entail complications such as hypotension, vomiting, bradycardia, desaturation, PDPH, or postoperative apnea, the rates are low. Desaturation, one of the most important complications, was reported at a rate of 2% by Eizaga Rebollar et al.[3] Caliskan et al.[12] reported a complication rate of 3.4%, PDPH being the major complication. Kantekin et al.[13] reported a rate of 4.8%, the most important complication being foot drop. The complication rate in the present study was 5.1%. These included hypotension in two children and postoperative vomiting in two, but no bradycardia, desaturation, or postoperative apnea were observed. In terms of complication rates, this study is consistent with the previous literature.

The incidence of PDPH is lower in children than in adults due to increased production and turnover of cerebrospinal fluid, low cerebrospinal fluid pressure, and highly elastic dura.[11] Previous studies have reported an overall incidence of 4-5% (similar to that in adults) in the 2-15 year age group, with symptoms being generally mild and severe headache being highly unusual (0.1%).[10,14,15] Imbelloni et al.[16] detected PDPH in three (1%) children in their extensive study of 307 patients. Caliskan et al.[12] reported mild headache not fully compatible with PDPH criteria in one case (1.1%). Kantekin et al.[13] encountered no PDPH in their study. No PDPH was also observed in the present research, and this is also consistent with the literature and other studies from Türkiye.

Remifentanil infusion was initiated as an additional anesthetic agent for maintenance of anesthesia in 13.6% of patients with laryngeal masks. Figures of 35% were reported by Caliskan et al.[12] 17.4% by Kantekin et al.[13] and 22% by Baltrak and Soyalp.[14] The figure for supplemental anesthesia in this study was thus slightly lower than in other research from Türkiye.

SpA can be performed on children in either the seated or lateral decubitus positions.[17,18] In the present study, SpA was performed with all patients in a seated position. Varying local anesthetic agents and doses have been reported in SpA applications in pediatric cases.[19,20] Isobaric or hyperbaric bupivacaine (0.5%) are still the most popular agents for pediatric SpA.[11] Eizaga Rebollar et al.[3] determined differing local anesthetic doses in different age groups depending on the length of surgery based on their seven-year experience. According to that study, hyperbaric 0.5% bupivacaine may be recommended as a local anesthetic with an operative time of <60 min, isobaric 0.5% bupivacaine or levobupivacaine with an operative time of 60-75 min, and isobaric 0.5% bupivacaine with epinephrine 1:200,000 in case of operative times of 75-90 min. Local anesthetic doses of 0.5 mg/kg for <5 kg body weight, 0.4 mg/kg for 5-15 kg, 0.3 mg/kg for >15 kg were also recommended. Similarly in their review study, Gupta and Saha[11] described 0.3 mg/kg hyperbaric bupivacaine (0.5%) as an appropriate dose in children weighing >15 kg. In the present study, hyperbaric 0.5% bupivacaine was employed at a dose of 0.3 mg/kg, a figure within the clinical dose range reported for pediatric cases in the previous literature.

This retrospective study has a number of limitations. One involves the retrospective and single-center nature of the research. It was also not possible to evaluate children's pain levels in the postoperative period due to missing data. Another limitation of this study in terms of determining the true complication rate is that patients only presented to us in case of a problem after the second day postoperatively. However, we also think that this study is particularly valuable due to the limited number of existing publications concerning pediatric SpA.

CONCLUSION

With a high success rate of 96.3% in the present study, an acceptable mean motor block development time of eight minutes, its permitting a comfortable procedure over a mean 75 minutes, and low complication rate, SpA represents an alternative general anesthesia method in pediatric patients undergoing pilonidal sinus surgery. However, further prospective studies with larger populations and longer follow-up times are now needed to validate such findings.

ETHICAL DECLARATIONS

Ethics Committee Approval: The study was carried out with the permission of Samsun University Clinical Researches Ethics Committee (Date: 15.02.2023, Decision No: 2023/3/2).

Informed consent: Because the study was designed retrospectively, no written informed consent form was obtained from patients.

Referee Evaluation Process: Externally peer reviewed.

Conflict of Interest Statement: The authors have no conflicts of interest to declare.

Financial Disclosure: The authors declared that this study has received no financial support.

Author Contributions: All the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

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