

# Thoracic Segmental Spinal Anaesthesia for Colostomy in a Child with Severe Acute Malnourishment: A Case Report

S SREYA SRI<sup>1</sup>, JATIN B PATEL<sup>2</sup>

## ABSTRACT

Thoracic Segmental Spinal Anaesthesia (TSSA) is an emerging regional technique that provides targeted neuraxial blockade, offering a compelling alternative to general anaesthesia in paediatric patients with significant co-morbidities. By injecting local anaesthetics at the thoracic level, clinicians can achieve precise sensory blockade of specific dermatomes while minimising haemodynamic fluctuations and avoiding the risks associated with airway manipulation and general anaesthetic neurotoxicity. The present case report describes the successful use of TSSA in a 1.5-year-old female weighing only 5 kg, presenting with a low-type Anorectal Malformation (ARM) and recto-vestibular fistula. The patient exhibited severe malnutrition (below the 3<sup>rd</sup> percentile), delayed developmental milestones, anaemia, and a history of recurrent respiratory infections. Preoperative ultrasound further revealed a solitary kidney. Given the patient's compromised respiratory status and the potential impact of general anaesthesia on her already delayed neurodevelopment, a segmental spinal anaesthesia approach was selected for the planned colostomy. Under sedation with ketamine and midazolam, a 25 Gauge paediatric spinal needle was used to administer 0.5 mL of isobaric levobupivacaine with 0.5 mcg dexmedetomidine at the T12-L1 interspace. A sensory level of T6-L4 was achieved. The two-hour procedure remained haemodynamically stable with minimal blood loss. Postoperatively, the patient showed complete reversal of the blockade within one hour and was discharged following an uneventful two-week recovery. The current case highlights that TSSA as one of the effective anaesthetic strategy for high-risk, malnourished paediatric patient.

**Keywords:** Developmental disabilities, Dexmedetomidine, Haemodynamics, Levobupivacaine, Preoperative care

## CASE REPORT

A 1.5-year-old female child presented to the Pre-Anaesthetic Check-up (PAC) clinic with primary complaints (as told by her mother) of stools coming from genital area since birth, failure to gain weight according to the age, delayed crawling and failure to speak according to her age. The child was planned for colostomy in view of ARMs. The weight of the child at presentation was 5 kilograms and length was 65 cm, both of which will fall below 3<sup>rd</sup> percentile of the weight-to-age and height to age charts given by World Health Organisation (WHO) [1]. Her head circumference was 38 cm, chest circumference was 41 cm and mid arm circumference was 12 cm, which can be seen as severe malnutrition. The patient was classified as American Society of Anaesthesiologists (ASA) III physical status.

The child was born at 35 weeks via emergency caesarean section in view of preterm labour and pregnancy-induced hypertension. The birth weight was 1.5 kilograms. History of admission to Neonatal Intensive Care Unit (NICU) after birth due to low birth weight was present. At birth, the patient has passed meconium within 24 hours of life through the fistula. The surgery in the neonatal period was deferred due to low birthweight and lack of consent from the parents. The patient was also on laxatives to facilitate the passage of stools. In the first six months of life, stools were passed at least once a day through the fistula, when solid food was introduced at around six months the frequency of stools decreased.

General physical examination showed dry skin, sunken eyes, sparse hair, pallor and pitting oedema. The patient had delayed language and motor milestones. The child's gross motor examination revealed significant delays: sitting with support was achieved after 11 months, and crawling at 14 months. She was unable to stand or walk even with support, and running, a milestone expected by 18

months, had not been attained. Similarly, she exhibited fine motor delays, achieving a palmar grasp at 14 months rather than the typical seven months; advanced movements, such as scribbling or imitating vertical strokes, were absent. Language milestones were also lagging; she began speaking bisyllabic words at 13 months instead of 10 months and lacked the expected minimum vocabulary of 10 words for her age. Finally, social milestones were delayed, as she only learned to wave "bye-bye" at 14 months which expected at 10 months and remained unable to use a spoon independently.

The patient was also admitted to hospital multiple times in the recent past for Upper Respiratory Tract Infection (URTI). Respiratory system examination revealed coarse crepitations. Paediatric reference was advised in view of auscultation findings and for optimising nutritional status. The patient was admitted to the PICU in view of severe iron deficiency anaemia and Severe Acute Malnourishment (SAM). She was started on Formula 75 (F-75) and vitamin supplementation preoperatively. Serum electrolytes were gradually corrected over a week. The patient was scheduled for a colostomy after a week of admission. The patient was nebulised with salbutamol every 12 hourly. Two units packed red cells were transfused. The investigations of the patient are enumerated in [Table/Fig-1].

Preoperatively, the patient was given two hours of nil by mouth order for clear liquids. Blood grouping and cross matching was done and one unit packed red cells was made available. On the day of surgery, the patient's basal vital parameters were noted: Heart rate was 109 beats per minute, Blood pressure was 90/60 mmHg and SPO<sub>2</sub> was 98% on room air. The child was given premedication in the preoperative ward. Intravenous cannula of 24 G and 26 G were secured in the right and left hand, respectively. Injection ketamine 5 mg and injection of midazolam 0.2 mg were given intravenously. Oxygen 2 lit/min was supplemented with nasal prongs. The patient

Category	Test parameters	At admission	On the day of surgery
Complete blood count	Haemoglobin	6.9 g/dL	9 g/dL (Low)
	Platelets	7,50,000 cells/cumm	2,60,000
	WBC (White Blood Cells)	18,500 cells/cumm	9,000
Liver function tests	Total bilirubin	0.4	0.4 mg%
	Indirect bilirubin / direct bilirubin	0.3/0.1 mg%	0.3 /0.1 mg%
	LDH	659 IU/L	548 IU/L
	SGOT/SGPT	32/11 IU/L	40/12 IU/L
	Serum albumin	2.2 g/dL	2.7 g/dL
	Total protein	3.3 g/dL	4.1 g/dL
Kidney & Electrolytes	Serum creatinine	0.3 mg/dL	0.4 mg/dL
	Serum sodium (Na+)	132 mmol/lit	138 mmol/lit
	Serum potassium (K+)	3.0 mmol/lit	3.3 mmol/lit
	Serum chloride (cl-)	102 mmol/lit	109 mmol/lit
	Serum calcium	7.2 mg/dL	8.6 mg/dL
	Serum magnesium	1.2 mg/dL	1.7 mg/dL
	B12	280 pg/mL	
	Ferritin	2.50 ng/mL	
Coagulation	PT & INR	13.5 and 1.1 sec	14 sec and 1.2 sec
Imaging (ECHO)	2D Echocardiogram	No abnormalities	
Imaging (USG)	Abdominal ultrasound	Solitary kidney	
		Distended rectum. Largest diameter measuring 3.5 cm	
Peripheral blood smear	Severe anisopoikilocytosis Microcytic and hypochromic RBCs Few target cells and normocytes seen Severe degree microcytic and hypochromic anaemia with mild leukocytosis and thrombocytosis		

**[Table/Fig-1]:** Preoperative blood investigation of the patient.

LDH-Lactate Dehydrogenase; SGOT-Serum Glutamic Oxaloacetic Transaminase; SGPT-Serum Glutamic Pyruvic Transaminase; PT&INR-Prothrombin Time & International Normalized Ratio

was shifted to a prewarmed operation theatre. All the necessary monitors like Electrocardiogram (ECG), SPO<sub>2</sub>, blood pressure, and temperature, were attached. Intravenous isolyte-P was started. In the lateral position under all aseptic precautions, segmental spinal anaesthesia was administered At T12-L1 interspace using a 25G paediatric spinal needle. 0.5 mL 0.5% (0.5 mg/kg). Isobaric Levobupivacaine with 0.5 mcg (0.1 mcg/kg). Dexmedetomidine was given using a 2 ml disposable syringe after the clear flow of CSF was noted. Then the patient was made to lie supine. The level of anaesthesia was checked by the pinprick method after the initial two minutes followed by every three minutes. A level of T6 to L4 was achieved in nine minutes. The surgery lasted for two hours without any significant events. The child was supplemented with intravenous injection of ketamine 2 mg twice during the surgery (total 4 mg). A 60 mL packed red cells were started, which was continued in the postoperative period. Vital parameters remained stable throughout the procedure and blood loss was 30 mL. The child was shifted to the PICU for postoperative monitoring. Complete reversal of the subarachnoid blockade was seen after one hour. The postoperative period was uneventful. Postoperative pain was monitored using the FLACC (Facial Expression, Leg Movement, Activity, Cry, Consolability) scale every two hours. For the initial six hours, the patient remained comfortable with scores ranging from 0 to 2. Following this period, Intravenous (i.v) Paracetamol 75 mg was given every eight hours. There were no complications of spinal anaesthesia. The patient was shifted to the ward the following day. The patient was nil by mouth for six hours following surgery. After which she was given F-100 (120 mL/kg/day), breast feeding and a soft diet and discharged in a stable condition after two weeks when her weight was 5.9 kilograms.

## DISCUSSION

The ARM is commonly encountered congenital issues in children. They either present solely or in association with VACTERL (Vertebral, Anal, Cardiac, Tracheoesophageal/Esophageal, Renal, Limb). The diversity in presentation necessitates different treatment approaches [2]. The patient in this case had low type malformation with recto vestibular fistula for which, preliminary temporary colostomy was planned. Surgery for colostomy can be carried out both in spinal and in general anaesthesia. General anaesthesia is widely practiced in the paediatric population [3]. Anatomical differences, difficult technique, risk of spinal cord injury, need for sedation, make paediatric neuraxial block a second choice [4]. It is usually preferred in presence of upper airway infections, airway hyper reactivity, where general anaesthesia has shown to cause increased hospital stay, postoperative ventilator requirement and increased morbidity. The patient had chest congestion with adventitious sounds due to frequent respiratory infections which made general anaesthesia less favourable. Study by Von Ungern-Sternberg BS et al., has shown that children with recent Upper Respiratory Tract Infection (URTI) are at a significantly higher risk for respiratory adverse events, such as laryngospasm and bronchospasm, under general anaesthesia [5]. The decision to use regional anaesthesia is supported by this literature suggesting that neuraxial blocks avoid airway instrumentation entirely, thus bypassing the hyper-reactive airway responses common in malnourished children with poor chest condition. Moreover, the neurotoxicity of general anaesthesia in developing brains is an area of concern [4]. The patient needs a staged surgical correction where general anaesthesia given repeatedly may impact the cognition and neurological development. Davidson AJ et al., in their landmark study General Anaesthesia compared to Spinal anaesthesia (GAS) trial suggested that brief exposure to sevoflurane may not be harmful at age two [4]. But, in this case the patient already presented with baseline developmental delays. Thus, employing TSSA avoided the use of volatile anaesthetics entirely, ensuring the most protective neurodevelopmental strategy possible. The need for systemic opioids and concerned adverse effects like respiratory depression, nausea, vomiting, itching are also effectively eliminated with the use of regional anaesthesia [6].

Segmental spinal anaesthesia is a technique where the local anaesthetic is injected in subarachnoid space at the level of thoracic vertebra to target a sympathetic block of few thoracic segments [6]. Segmental spinal anaesthesia is superior to spinal anaesthesia in terms of haemodynamic stability, less systemic absorption of drugs, quicker effect and faster block regression [6]. Surgical stress response is well controlled by the use of neuraxial anaesthesia anaesthesia compared to general anaesthesia because the stress hormones and catecholamine release is less due to direct blockade of nociceptive pathways[7,8]. Addition of adjuvants like clonidine or dexmedetomidine not only enhances the duration of the neuraxial block but aids in superior pain management. The use of Dexmedetomidine in this case as an intrathecal adjuvant provided prolonged postoperative analgesia and block quality which can be correlated to study by Fares KM et al., who compared dexmedetomidine to fentanyl in paediatric spinal blocks for gastrointestinal surgeries and proved that dexmedetomidine provides a longer-lasting sensory block with lower FLACC scores postoperatively [9].

Protocol for segmental spinal anaesthesia is not well documented for the paediatric population. Paliwal N et al., in his case series explained the role of segmental spinal anaesthesia for paediatric gastrointestinal surgeries and noted the stable haemodynamics and better intraoperative analgesia [6]. Segmental spinal anaesthesia in this case also provided a similar effect in terms of maintaining stable vital parameters [6]. Lumbo-sacral sparing in segmental spinal adds to the advantage of well-preserved preload there by maintaining the heart rate and blood pressure [7]. Well experienced anaesthetist and controlled block height prevents adverse block of intercostal muscles of respiration.

The TSSA requires low drug volume mainly due to smaller nerve roots and Cerebrospinal Fluid (CSF) volume in thoracic spinal segments compared to lumbar segments. The use of Low drug volume also prevents the occurrence of Local Anaesthesia Systemic Toxicity (LAST) especially in malnourished or small-for-gestational-age infants who are at high-risk due to low alpha-1 acid glycoprotein levels. Polaner FE et al., in his study confirmed that using targeted segmental techniques allows the clinician to use the Minimum Effective Dose (MED) which stays below the toxic plasma threshold thereby reducing the risk of toxicity [10].

Malnourishment plays a negative role in achieving optimal postoperative outcomes and better recovery. Presence of malnourishment causes slow lung growth and improper alveolar maturation. It is also seen that malnutrition makes children more susceptible to infections and reduced immunity adds to the recurrence and chronicity. This was clearly evident preoperatively as the patient had chronic respiratory tract infections [11]. Anaemia is most commonly seen in the malnourished group. Preoperative assessment of haemoglobin is mandatory and arrangements of blood and blood products to be done. The patient also had preoperative anaemia for which packed red cells infusion was done. Reduced liver capacity leads to hypoproteinaemia, hypoalbuminaemia and oedema as seen in investigations [12]. Higher incidence of surgical site infection due to delayed tissue regeneration and wound healing adds to longer postoperative stay. The patient had a single kidney as evident in the Ultrasonography (USG). Regional anaesthesia used in this case offered better renal protection compared to general anaesthesia. Muscle relaxants whose action is prolonged due to reduction in the muscle mass is also avoided with regional anaesthesia.

Various scores are available to assess the nutritional status in the adult population, development of such scores in paediatric nutritional assessment is necessary. Soyer T et al., applied Preoperative Nutrition Score (PONS) which is a commonly used scale in adult population for paediatric surgery and found it efficient in identifying the paediatric malnutrition preoperatively [13]. This patient also presented with classic PONS high-risk indicators: a weight-for-age below the 3rd percentile, clinical evidence of hypoalbuminemia and reduced oral intake. Enhanced Recovery After Anaesthesia (ERAS) principles are routinely practiced in adult population but very few ERAS guidelines have been developed for paediatric population [13]. Absence of universal guidelines for routine preoperative screening of malnourishment, preoperative nutritional rehabilitation, postoperative nutritional planning in paediatric surgical patients is a concern and mandates studies.

## CONCLUSION(S)

The anaesthetic management of a case involving SAM poses significant challenges due to involvement for various organ systems. This case highlights the meticulous multidisciplinary perioperative management. The use of TSSA helped in overcoming the problems caused by malnourishment despite the burden of paediatric perioperative care. TSSA approach is viable and under reported anaesthesia technique which can be used for high risk paediatric population. Continued research in developing better protocols to improve the safety and application of this technique is necessary.

## REFERENCES

- [1] World Health Organization. WHO child growth standards: Length/height-for-age, weight-for-age, weight-for-length, weight-for-height and body mass index-for-age: Methods and development. Geneva: World Health Organization; 2006. 312 p.
- [2] Mathew P, Gupta AK, Gupta R, Sharma D. Anorectal malformations: Early outcome analysis in a tertiary care center in India. *J Neonatal Surg.* 2021;10:01-05.
- [3] Gupta A, Usha U. Spinal anesthesia in children: A review. *Journal of Anaesthesiology Clinical Pharmacology.* 2014;30(1):10-18. Doi:10.4103/0970-9185.125687.
- [4] Davidson AJ, Disma N, de Graaff JC, Withington DE, Dorris L, Bell G, et al. Neurodevelopmental outcome at 2 years of age after general anaesthesia and awake-regional anaesthesia in infancy (GAS): An international multicentre, randomised controlled trial. *Lancet.* 2016;387(10015):239-50.
- [5] Von Ungern-Sternberg BS, Boda K, Chambers NA, Rebmann C, Johnson C, Sly PD, et al. Risk assessment for respiratory complications in paediatric anaesthesia: A prospective cohort study. *Lancet.* 2010;376(9743):773-83. Doi: 10.1016/S0140-6736(10)61193-2.
- [6] Paliwal N, Khan IA, Shahi RK. Thoracic segmental spinal anaesthesia for laparoscopic surgeries in pediatric patients: A retrospective case series. *Cureus.* 2025;17(3):e81320.
- [7] Bosenberg A. Benefits of regional anaesthesia in children. *Paediatr Anaesth.* 2012;22(1):10-8.
- [8] Ponde V. Recent trends in paediatric regional anaesthesia. *Indian J Anaesth.* 2019;63(9):746-53.
- [9] Fares KM, Mohamed SA, Abd El-Rahman AM, Abdelmham RM, Osman AM. Analgesic effect of intrathecal fentanyl vs dexmedetomidine as adjuvants to bupivacaine following abdominal surgery for cancer in children, a randomized trial. *Pain Medicine.* 2020;21(11):2634-41.
- [10] Polianer DM, Taenzer AH, Walker BJ, Bosenberg A, Krane EJ, Suresh S, et al. Pediatric Regional Anesthesia Network (PRAN): A multi-institutional study of the use and incidence of complications of pediatric regional anesthesia. *Anesth Analg.* 2012;115(6):1353-64.
- [11] Williams DGA, Molinger J, Wischmeyer PE. The malnourished surgery patient: A silent epidemic in perioperative outcomes? *Curr Opin Anaesthesiol.* 2019;32(3):405-11. Doi: 10.1097/ACO.0000000000000722.
- [12] Roberts K, Brindle M, McLuckie D. Enhanced recovery after surgery in paediatrics: A review of the literature. *BJA Educ.* 2020;20(7):235-41. Doi: 10.1016/j.bjae.2020.03.004.
- [13] Soyer T, Tıgılı T, Yıldırım D, Onat PS, Boybeyi Ö, Gülşen HH. The use of preoperative nutrition score to predict malnutrition in children. *Clinical Nutrition ESPEN.* 2023;58:568-9.

### PARTICULARS OF CONTRIBUTORS:

1. Assistant Professor, Department of Anaesthesia, Smt. B.K. Shah Medical Institute and Research Center, Dhiraj General Hospital, Sumandeep Vidyapeeth Deemed to be University, Vadodara, Gujarat, India.
2. Professor, Department of Anaesthesia, Smt. B.K. Shah Medical Institute and Research Center, Dhiraj General Hospital, Sumandeep Vidyapeeth Deemed to be University, Vadodara, Gujarat, India.

### NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:

Dr. Jatin B Patel,  
Pipariya Ta. Waghodia, Vadodara-391760, Gujarat, India.  
E-mail: lahni.1996@gmail.com

### AUTHOR DECLARATION:

- Financial or Other Competing Interests: None
- Was informed consent obtained from the subjects involved in the study? Yes
- For any images presented appropriate consent has been obtained from the subjects. No

### PLAGIARISM CHECKING METHODS: [Jain H et al.]

- Plagiarism X-checker: Nov 30, 2025
- Manual Googling: Mar 21, 2026
- iThenticate Software: Mar 23, 2026 (1%)

### ETYMOLOGY: Author Origin

EMENDATIONS: 8

Date of Submission: **Nov 03, 2025**

Date of Peer Review: **Jan 07, 2026**

Date of Acceptance: **Mar 25, 2026**

Date of Publishing: **Jul 01, 2026**