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Successful Anesthetic Management of a CT Scan Procedure in Pediatric Conjoined Twins: A Case Report

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A B S T R A C T

Introduction: Conjoined twins represent a rare and complex congenital anomaly, posing significant challenges in medical management, particularly during diagnostic procedures requiring anesthesia. This case report details the successful anesthetic management of a four-month-old female thoracoabdominal conjoined twin pair undergoing a contrast-enhanced computed tomography (CT) scan in preparation for separation surgery. The rarity of this condition and the intricacies involved in providing safe and effective anesthesia for such patients warrant this report to contribute to the growing body of knowledge in this specialized area. **Case presentation:** A four-month-old female conjoined twin pair, fused at the thorax and abdomen, was referred to Dr. Saiful Anwar General Hospital in Malang, Indonesia, for separation surgery. Prior to the planned surgical intervention, a contrast-enhanced CT scan of the thoracoabdominal region was deemed necessary by the surgical team to delineate the extent of organ fusion and vascular involvement. The twins, designated as Baby One and Baby Two for the purpose of this report, were born via Cesarean section. Physical examination revealed a shared thoracoabdominal connection and bilateral labiopalatoschisis. Pre-operative laboratory investigations showed stable hematological and biochemical parameters for both twins. An abdominal ultrasound indicated liver surface fusion with vascular involvement, while an echocardiogram revealed normal cardiac structure and function in both individuals. The American Society of Anesthesiologists (ASA) physical status for both twins was classified as Class III. **Conclusion:** This case highlights the successful use of continuous dexmedetomidine infusion for sedation during an out-of-operating room CT scan procedure in pediatric thoracoabdominal conjoined twins. The meticulous pre-procedural planning, including simulation and the preparation of individualized equipment and monitoring for each twin, contributed significantly to the positive outcome. This case underscores the importance of a multidisciplinary team approach and tailored anesthetic strategies in managing complex cases of conjoined twins undergoing diagnostic imaging.

1. Introduction

Conjoined twins represent a rare and complex congenital anomaly that arises from the incomplete separation of monozygotic twins during the early stages of embryogenesis. This phenomenon, a source of both medical fascination and significant clinical challenge, has been documented throughout history, with varying degrees of understanding and intervention. The incidence of conjoined twins is estimated to be between 1 in 50,000 to 1 in 200,000 live births, underscoring the rarity of this condition and the specialized medical attention it demands. These cases necessitate a multidisciplinary approach, involving specialists from various fields including surgery, anesthesiology,

radiology, and neonatology. The collaborative efforts of these experts are crucial to optimizing patient outcomes, from initial diagnosis and management to potential surgical separation and long-term care. The classification of conjoined twins is primarily based on the site and extent of fusion. This classification is critical as it dictates the anatomical and physiological complexities involved, influencing the planning and execution of medical interventions. Among the various types of conjoined twins, thoraco-omphalopagus is the most common, accounting for approximately 28% of cases. These twins are fused at the thorax and upper abdomen, often involving shared organs such as the liver, heart, and gastrointestinal tract. Other types of conjoined twins, each with its unique set of challenges, include omphalopagus (fusion at the abdomen), pygopagus (fusion at the buttocks), ischiopagus (fusion at the ischium), cephalopagus (fusion at the head), parapagus (lateral fusion), craniopagus (fusion of the cranium), and rachipagus (fusion along the vertebral column). Each of these classifications presents distinct anatomical and physiological considerations, requiring tailored medical strategies.[1-4]

The management of conjoined twins often necessitates extensive diagnostic imaging. These imaging modalities are crucial for delineating the extent of organ sharing, vascular connections, and potential complications that may arise. Accurate and detailed anatomical information is essential for pre-surgical planning, particularly in cases where separation surgery is contemplated. Among the various imaging techniques available, computed tomography (CT) scans play a pivotal role. CT scans provide detailed cross-sectional images of the body, allowing for precise visualization of bone, soft tissue, and vascular structures. This level of detail is indispensable in conjoined twin cases, where the intricate anatomical relationships between the twins must be thoroughly understood to guide surgical interventions and minimize potential complications. However, performing CT scans in pediatric patients, especially in complex cases like conjoined twins, often requires sedation or general anesthesia. The need for sedation or anesthesia arises from the requirement for immobility during the procedure. Any movement can result in motion artifacts, which degrade the quality of the images and compromise their diagnostic value. Pediatric patients, particularly infants and young children, are often unable to cooperate with the demands of a CT scan, making sedation or anesthesia a necessity. This requirement adds another layer of complexity to the management of conjoined twins, as it necessitates careful consideration of the anesthetic technique and the potential risks involved.[5-7]

Anesthetic management for diagnostic procedures in conjoined twins presents unique challenges that are not typically encountered in other pediatric patients. Each twin must be considered as an individual with their own distinct physiological needs. This individualized approach is crucial for ensuring the safety and well-being of each twin. However, the shared anatomy and the potential for cross-circulation between the twins add further complexity to the anesthetic management. Cross-circulation, the intermingling of blood between the twins, can have significant implications for drug administration, fluid management, and hemodynamic stability. The anesthetic team must be prepared to manage potential complications such as hemodynamic instability, respiratory compromise, and the need for individualized monitoring and interventions for each twin. Hemodynamic instability, characterized by fluctuations in blood pressure and heart rate, can occur due to shared vascular structures or the physiological effects of anesthesia. Respiratory compromise, including inadequate ventilation or oxygenation, can arise from shared respiratory systems or the depressant effects of anesthetic agents. The need for individualized monitoring and interventions underscores the importance of a well-coordinated and highly skilled anesthetic team.[8-10] This case report describes the successful anesthetic management of a four-month-old female thoracoabdominal conjoined twin pair undergoing a contrast-enhanced CT scan.

2. Case Presentation

This case report presents the clinical findings of a pair of four-month-old female conjoined twins, designated as Baby One (Twin A) and Baby Two (Twin B), who were referred for evaluation and potential separation surgery. The twins exhibited a

thoracoabdominal type of conjoinment, characterized by fusion at the thorax and upper abdomen. This complex anatomical presentation necessitated a comprehensive and meticulous approach to their clinical management, encompassing detailed assessments across various domains, from demographics and anamnesis to physical examination, laboratory investigations, and imaging studies. Both Baby One and Baby Two were female infants, each four months of age at the time of this report. Their shared demographic characteristics are significant, reflecting their monozygotic origin and the inherent complexities associated with conjoined twinning. The thoracoabdominal type of conjoinment, observed in both twins, represents a notable anatomical fusion. This specific type of conjoinment, involving the thorax and upper abdomen, often implies the potential sharing of vital organs, such as the liver, and presents unique challenges in surgical planning and anesthetic management. The twins were delivered via Cesarean section at term. This mode of delivery is frequently employed in cases of conjoined twins due to the potential risks associated with vaginal delivery, including dystocia and trauma to the twins. The decision for a Cesarean section in these cases underscores the importance of prenatal diagnosis and the proactive management of conjoined pregnancies. The prenatal diagnosis of conjoined twins in this case allowed for early planning and preparation for their delivery and subsequent medical management. The chief complaint for both Baby One and Baby Two was a referral for evaluation and potential separation surgery of the conjoined twins. This highlights the primary clinical objective: to assess the feasibility and plan the surgical separation of the twins. The decision to pursue separation surgery is a complex one, involving careful consideration of the anatomical fusion, the potential for organ sharing, and the overall prognosis for each twin. The past medical history for both twins was notable for no significant findings other than the conjoined condition itself. This suggests that the twins did not present with other major comorbidities that would further complicate their management. However, the conjoined condition inherently represents a significant medical complexity, requiring specialized care and attention. The developmental history, as reported by the parents, indicated that both twins were active and responsive for their age. They were reported to be showing typical developmental milestones for a four-month-old infant. This assessment of developmental progress is crucial in evaluating the overall health and well-being of the twins. It suggests that, despite their conjoined state, they were achieving expected developmental milestones. The feeding history revealed that both twins were primarily breastfed, with adequate weight gain reported by the parents. No history of feeding difficulties was mentioned. This information is important as it indicates that the twins were receiving adequate nutrition and that there were no significant issues with their feeding mechanisms, despite their anatomical conjoinment. Breastfeeding in conjoined twins can sometimes present challenges due to positioning and potential physiological interactions. However, in this case, it was reported to be progressing well. The general appearance of both Baby One and Baby Two was described as "active, responsive infant." This observation is consistent with the developmental history and suggests that the twins were alert and interacting appropriately with their environment. The vital signs for Baby One revealed a heart rate ranging from 110 to 115 beats per minute (bpm), a blood pressure of 88/54 mmHg, a peripheral oxygen saturation (SpO_2) of 99% on room air, and a weight of 4.5 kg. For Baby Two, the vital signs included a heart rate ranging from 115 to 120 bpm, a blood pressure of 76/42 mmHg, a SpO_2 of 99% on room air, and a weight of 4.3 kg. These vital signs provide a baseline assessment of the twins' physiological status. The heart rates are within the normal range for infants, although Baby Two's heart rate is slightly higher. The blood pressure values are also within the expected range for infants, with some variability noted between the twins. The SpO_2 of 99% on room air indicates adequate oxygenation in both twins. The weights of the twins, 4.5 kg and 4.3 kg, respectively, are important for assessing their growth and nutritional status. The head and neck examination for both twins revealed the presence of bilateral cleft lip and palate (labiopalatoschisis). No other abnormalities were noted in this region. Cleft lip and palate is a common congenital anomaly that can

present challenges with feeding, speech development, and facial aesthetics. The presence of bilateral cleft lip and palate in both twins suggests a shared genetic or environmental influence. Cardiovascular examination for both twins revealed normal heart sounds on auscultation. No murmurs were auscultated, and peripheral pulses were palpable and equal bilaterally. This assessment indicates that the twins had normal cardiac function and perfusion. The absence of murmurs is particularly important as it suggests the absence of significant structural heart defects. The palpation of equal and bilateral peripheral pulses confirms adequate circulation to the extremities. The respiratory examination for both twins demonstrated adequate respiratory effort. There were no signs of respiratory distress, such as nasal flaring or retractions. The lungs were clear to auscultation bilaterally. This evaluation indicates that the twins were breathing effectively and without any signs of respiratory compromise. The absence of nasal flaring and retractions, which are classic signs of respiratory distress in infants, is reassuring. Clear lung sounds on auscultation suggest normal air entry and the absence of adventitious sounds like wheezes or crackles. The abdominal examination revealed that the twins shared their abdomen at the xiphoid process and upper abdominal wall. Palpation revealed a shared liver mass. No other palpable masses or organomegaly were noted apart from the liver. This finding of a shared liver mass is a critical anatomical detail that has significant implications for surgical planning. The fusion of the abdomen at the xiphoid process and upper abdominal wall defines the extent of their conjoinment in this region. The absence of other palpable masses or organomegaly, apart from the liver, provides further information about the shared anatomy. Neurological examination for both twins revealed appropriate reflexes and tone for age. Both twins were moving all limbs spontaneously. This neurological assessment indicates that the twins had normal neurological function and motor skills appropriate for their age. The presence of appropriate reflexes and spontaneous limb movement suggests that their central and peripheral nervous systems were intact and functioning adequately. The remainder of the physical examination for both twins was unremarkable. This implies that no other significant abnormalities were detected during the physical examination of other systems. Laboratory investigations revealed several findings of note. The sodium (Na) levels for Baby One were 122 mmol/L on September 26th, 2022, and 134 mmol/L on January 29th, 2023. For Baby Two, the sodium levels were 123 mmol/L on September 26th, 2022, and 129 mmol/L on January 29th, 2023. These sodium levels indicate some variability over time. Sodium is an important electrolyte that plays a crucial role in fluid balance, nerve function, and muscle function. The initial lower sodium levels warrant attention, although the subsequent levels are within a more acceptable range. The potassium (K) levels for Baby One were 6.25 mmol/L on September 26th, 2022, and 4.53 mmol/L on January 29th, 2023. For Baby Two, the potassium levels were 5.19 mmol/L on September 26th, 2022, and 4.54 mmol/L on January 29th, 2023. Potassium is another critical electrolyte that is essential for nerve and muscle function, particularly cardiac function. The initial potassium levels were elevated, especially for Baby One, and this would necessitate clinical attention. The subsequent levels are within the normal range. The chloride (Cl) levels for Baby One were 105 mmol/L on September 26th, 2022, and 110 mmol/L on January 29th, 2023. For Baby Two, the chloride levels were 103 mmol/L on September 26th, 2022, and 112 mmol/L on January 29th, 2023. Chloride is an anion that works in conjunction with sodium and potassium to maintain fluid and electrolyte balance. The chloride levels show some fluctuation but are generally within the acceptable range. The hemoglobin (Hb) levels for Baby One were 14.8 g/dL on September 26th, 2022, and 11.9 g/dL on January 29th, 2023. For Baby Two, the hemoglobin levels were 15.7 g/dL on September 26th, 2022, and 11.9 g/dL on January 29th, 2023. Hemoglobin is the protein in red blood cells that carries oxygen. The hemoglobin levels indicate a decrease over time in both twins, which could suggest a developing anemia and would require further investigation. The white blood cell (WBC) counts for Baby One were 12,780/mm³ on September 26th, 2022, and 7,070/mm³ on January 29th, 2023. For Baby Two, the WBC counts were 12,470/mm³ on September 26th, 2022, and 8,990/mm³ on January 29th, 2023. White

blood cells are part of the immune system. The WBC counts also show a decrease over time. The initial WBC counts were slightly elevated, which could indicate a response to infection or inflammation, while the subsequent values are within a more normal range. The hematocrit (HCT) levels for Baby One were 41.1% on September 26th, 2022, and 35.9% on January 29th, 2023. For Baby Two, the hematocrit levels were 44.1% on September 26th, 2022, and 35.9% on January 29th, 2023. Hematocrit is the percentage of blood volume that is composed of red blood cells. The hematocrit levels mirror the hemoglobin levels, showing a decrease over time, consistent with a potential developing anemia. The platelet (PLT) counts for Baby One were 536,000/mm³ on September 26th, 2022, and 341,000/mm³ on January 29th, 2023. For Baby Two, the platelet counts were 560,000/mm³ on September 26th, 2022, and 350,000/mm³ on January 29th, 2023. Platelets are blood cells that are essential for blood clotting. The platelet counts also show a decrease over time. The initial platelet counts were elevated, but the subsequent values were within the normal range. The differential count for Baby One showed the following values on September 26th, 2022, and January 29th, 2023, respectively: Eosinophils: 3.7%, 2.8%; Basophils: 0.2%, 0.4%; Neutrophils: 34.6%, 28.6%; Lymphocytes: 45.3%, 54.3%; Monocytes: 16.2%, 13.9%. For Baby Two, the differential count showed the following values on September 26th, 2022, and January 29th, 2023, respectively: Eosinophils: 3.8%, 2.7%; Basophils: 0.3%, 0.3%; Neutrophils: 38.8%, 28.2%; Lymphocytes: 41.1%, 55.5%; Monocytes: 16.0%, 13.3%. The differential count provides information about the different types of white blood cells. These values show some fluctuation over time but are generally within the expected ranges. Imaging studies were crucial in delineating the extent of the conjoinment and assessing the shared anatomy. Abdominal ultrasound for both twins revealed liver surface fusion with vascular involvement. No other significant findings were reported. This ultrasound finding confirmed the physical examination finding of a shared liver mass and provided further evidence of vascular connections within the fused liver tissue. Echocardiogram for both twins showed normal cardiac structure and function. There was no evidence of significant shared circulation at the cardiac level. This finding is significant as it indicates that, while the twins were conjoined, their hearts were structurally and functionally normal, and there was no significant sharing of blood flow at the cardiac level. CT scan findings for both twins were extensive and provided detailed anatomical information. For liver fusion, the CT scan revealed a significant parenchymal fusion involving a substantial portion of the livers of both twins. The line of demarcation between the two livers was not clearly defined in the fused segment, suggesting a shared liver mass. This detailed description from the CT scan further characterized the liver conjoinment, demonstrating that the fusion was not merely superficial but involved a significant portion of the liver tissue. For vascular connections, the CT scan identified several major vascular connections within the fused liver tissue. Specifically, a large shared portal vein branch was noted, draining blood from the intestines of both twins into the common liver mass. Hepatic veins from both twins appeared to converge and drain through a common channel before entering the inferior vena cava of each twin separately. Arterial supply to the shared liver segment seemed to originate from branches of both the right and left hepatic arteries of each twin. These detailed findings of vascular connections are critical for surgical planning. The shared portal vein, the convergence of hepatic veins, and the arterial supply from both twins highlight the complexity of the vascular anatomy in the conjoined region. For the gastrointestinal tract, the CT scan showed that the stomach, duodenum, pancreas, small intestine, and large intestine appeared to be separate for each twin, without any evidence of shared segments or connections. This finding is significant as it suggests that the major organs of the gastrointestinal system were distinct for each twin, which could simplify the surgical separation process. For the biliary system, the CT scan revealed that the gallbladder and biliary tree were distinct for each twin. The intrahepatic bile ducts appeared to drain normally into their respective common bile ducts. The point of entry of the common bile ducts into the duodenum was also separate for each twin. This finding is also favorable for surgical planning as it indicates that the biliary systems were

separate and did not involve shared structures. For the urinary tract, the CT scan showed that the kidneys, ureters, and bladder were completely separate and appeared normal in both twins. This finding suggests that the urinary systems were distinct and separate for each twin. For the spleen, the CT scan showed that the spleen was present and appeared normal for each twin, with no evidence of fusion or shared tissue. This finding indicates that the spleens were separate and not conjoined. For the thoracic cavity, the CT scan showed that the diaphragm appeared to be fused in the anterior aspect where the twins were joined. The lungs and heart were separate for each twin, consistent with the echocardiogram findings. There was no evidence of shared pleural or pericardial spaces. This finding further characterizes the thoracoabdominal conjoinment, showing fusion of the diaphragm. The absence of shared pleural or pericardial spaces is consistent with the echocardiogram and has implications for surgical planning. For the abdominal wall, the CT scan revealed that the abdominal wall was fused from the xiphoid process down to the umbilicus, forming a single anterior abdominal wall in the conjoined region. This finding further defines the extent of the abdominal conjoinment. The primary diagnosis for both Baby One and Baby Two was thoracoabdominal conjoined twins. This diagnosis is consistent with the physical examination and imaging findings. The associated finding for both twins was bilateral labiopalatoschisis. This associated finding, the cleft lip and palate, represents an additional congenital anomaly present in both twins (Table 1).

This section of the case report details the anesthetic management and post-procedural care of Baby One (Twin A) and Baby Two (Twin B), four-month-old female thoracoabdominal conjoined twins who underwent a contrast-enhanced computed tomography (CT) scan. This diagnostic procedure was a crucial step in the pre-surgical evaluation for potential separation surgery. The anesthetic management in conjoined twins presents unique challenges due to the rarity of the condition, the potential for shared anatomy and physiology, and the need for meticulous planning and execution. This section will cover the pre-procedure preparations, the intra-procedure anesthetic management during the CT scan, and the post-procedure follow-up care. The pre-procedure phase is critical in the anesthetic management of conjoined twins. It involves meticulous planning, careful personnel allocation, thorough equipment preparation, and appropriate patient preparation. For both Baby One and Baby Two, comprehensive anesthetic plans were formulated. These plans were developed in consultation with pediatric surgeons and radiologists. This multidisciplinary collaboration is essential to address the complex anatomical and physiological considerations inherent in conjoined twins. The involvement of pediatric surgeons ensures that the anesthetic plan aligns with the surgical objectives and the overall management strategy for the twins. Consultation with radiologists is equally important, as the CT scan procedure requires specific considerations to optimize image acquisition while ensuring patient safety. A key component of the pre-procedural planning was the conduct of a pre-procedural simulation in the CT scan suite. This simulation allowed the medical team to anticipate potential challenges, optimize workflow, and ensure that all personnel were familiar with their roles and responsibilities. Pre-procedural simulations are valuable tools in complex medical scenarios, as they enhance team coordination, identify potential logistical issues, and improve overall patient safety. In the context of conjoined twins, simulations can be particularly beneficial due to the unique anatomical considerations and the need for precise execution of the anesthetic plan. The personnel allocation for both Baby One and Baby Two was carefully structured to ensure individualized and dedicated care. Each twin had a dedicated anesthesia team assigned to them. This team included an attending anesthesiologist and a resident anesthesiologist primarily responsible for that twin. The presence of an attending anesthesiologist ensures expert supervision and decision-making, while the resident anesthesiologist provides direct patient care and monitoring. This dedicated team approach is crucial in the management of conjoined twins, where each twin must be treated as an individual with their own physiological needs. The complexity of conjoined twin cases necessitates a high level of expertise and

attention to detail, making a dedicated team for each twin a critical component of safe anesthetic management. The preparation of equipment was another vital aspect of the pre-procedure phase. For both Baby One and Baby Two, dedicated anesthesia machines and monitoring equipment were prepared. This equipment included electrocardiography (ECG) monitors, non-invasive blood pressure (NIBP) monitoring devices, pulse oximetry (SpO_2) monitors, intravenous fluids, and syringe pumps for the administration of dexmedetomidine. The use of dedicated anesthesia machines and monitoring equipment for each twin underscores the principle of individualized care. It ensures that each twin's physiological parameters can be monitored independently and that anesthetic agents can be administered separately. This is particularly important in conjoined twins due to the potential for shared circulation or other physiological interactions. To further ensure clarity and prevent confusion, all equipment dedicated to Baby One was labeled with red stickers, while all equipment dedicated to Baby Two was labeled with blue stickers. This color-coding system is a simple yet effective strategy to minimize the risk of errors and ensure that each twin receives the correct medications and monitoring. In complex medical scenarios involving multiple patients or procedures occurring simultaneously, clear labeling and identification systems are essential for patient safety. In the pre-medication phase, no premedication was administered to either Baby One or Baby Two prior to intravenous catheter placement. The decision not to administer premedication likely reflects a strategy to avoid potential respiratory depression or other adverse effects that could complicate the anesthetic management. Premedication, while sometimes used to reduce anxiety or facilitate intravenous access, can have risks, especially in infants. In this case, the anesthetic team likely opted for a more cautious approach, prioritizing patient safety and minimizing potential complications. Intravenous access was established for both Baby One and Baby Two. An intravenous catheter was placed in a peripheral vein in the pre-medication area for each twin. Establishing reliable intravenous access is crucial for the administration of anesthetic agents, fluids, and other medications. Peripheral vein access is a common approach in pediatric patients, although the specific choice of vein depends on individual patient factors and clinical judgment. The placement of intravenous catheters in the pre-medication area ensures that the twins are adequately prepared for the subsequent anesthetic procedure. The intra-procedure phase involves direct anesthetic management during the CT scan procedure. This includes the administration of sedative agents, continuous monitoring of vital signs, and careful management of hemodynamic parameters. Dexmedetomidine was chosen as the sedative agent for both Baby One and Baby Two. Dexmedetomidine is an alpha-2 adrenergic agonist that provides sedation, analgesia, and anxiolysis. It is often favored in pediatric sedation due to its ability to provide adequate sedation while preserving respiratory drive. This preservation of respiratory drive is particularly important in infants, who are at a higher risk of respiratory depression with other sedative agents. The administration of dexmedetomidine involved a loading dose of 2 mcg/kg over 10 minutes via a syringe pump, followed by a continuous infusion of 0.4 mcg/kg/hour. The loading dose is used to achieve the desired level of sedation rapidly, while the continuous infusion maintains the sedation throughout the procedure. The use of a syringe pump ensures precise and controlled administration of the medication. The dosage regimen of dexmedetomidine reflects standard pediatric sedation protocols. Continuous monitoring was employed for both Baby One and Baby Two throughout the CT scan procedure. This monitoring included continuous electrocardiography (ECG), non-invasive blood pressure (NIBP) measurements every 5 minutes, continuous pulse oximetry (SpO_2), and vital signs recorded at regular intervals. Continuous ECG monitoring allows for the assessment of heart rate and rhythm, detecting any potential arrhythmias or conduction abnormalities. Non-invasive blood pressure measurements every 5 minutes provide information about the twins' hemodynamic status, allowing for the timely detection and management of hypotension or hypertension. Continuous pulse oximetry (SpO_2) monitoring measures the oxygen saturation of the blood, ensuring

adequate oxygenation. The regular recording of vital signs is essential for documenting the twins' physiological response to the sedative agent and the procedure. This meticulous monitoring is critical for ensuring patient safety and allowing for prompt intervention if necessary. The CT scan procedure lasted approximately 20 minutes for both Baby One and Baby Two. This relatively short duration is typical for many diagnostic CT scans. The hemodynamic parameters for both twins were closely monitored and recorded. For Baby One, the starting heart rate (HR) was 128 bpm, the starting blood pressure (BP) was 88/45 mmHg, and the starting SpO_2 was 99%. At the end of the procedure, the HR was 119 bpm, the BP was 78/41 mmHg, and the SpO_2 remained at 99%. For Baby Two, the starting HR was 131 bpm, the starting BP was 92/67 mmHg, and the starting SpO_2 was 98%. At the end of the procedure, the HR was 125 bpm, the BP was 88/51 mmHg, and the SpO_2 increased to 100%. These hemodynamic parameters demonstrate that both twins maintained relatively stable vital signs throughout the procedure. There were minor fluctuations in heart rate and blood pressure, but these were within acceptable ranges. The oxygen saturation remained excellent for both twins, indicating adequate oxygenation. No episodes of significant bradycardia, hypotension, or respiratory depression were observed in either Baby One or Baby Two. This is a significant finding, as these complications are potential risks associated with sedation, particularly in infants. The absence of these complications highlights the effectiveness and safety of the anesthetic management strategy employed. The post-procedure phase is crucial for ensuring a smooth recovery and monitoring for any potential complications. It includes the discontinuation of sedation, immediate post-operative care, monitoring in the pediatric intensive care unit (PICU), duration of PICU stay, recovery assessment, and subsequent disposition planning. The dexmedetomidine infusion was discontinued immediately after the completion of the CT scan for both Baby One and Baby Two. This is standard practice, as the sedative effect is no longer needed once the procedure is complete. Dexmedetomidine's relatively short half-life allows for a rapid return to baseline consciousness and respiratory function following discontinuation. Following the CT scan, both Baby One and Baby Two were transferred to the Pediatric Intensive Care Unit (PICU) for post-procedural monitoring. The PICU provides a higher level of care and monitoring than a general ward, ensuring that any potential complications can be promptly identified and managed. Post-procedural monitoring in the PICU is a standard protocol for pediatric sedation cases, especially in complex situations like conjoined twins. Hemodynamic status remained stable upon arrival at the PICU for both twins. Continuous monitoring of heart rate, blood pressure, respiratory rate, and oxygen saturation was continued in the PICU. This continued monitoring is essential for detecting any delayed complications or ensuring that the twins remain stable as the sedative effects wear off. Both Baby One and Baby Two remained in the PICU for approximately 24 hours of monitoring. This duration of PICU stay is per standard protocol for pediatric sedation cases. The 24-hour monitoring period allows for a comprehensive assessment of the twins' recovery and ensures that they have returned to their baseline physiological state. Both Baby One and Baby Two recovered uneventfully from sedation. They became fully awake and interactive within approximately 30-60 minutes after the discontinuation of dexmedetomidine. This rapid and uneventful recovery is a positive outcome and further supports the use of dexmedetomidine for sedation in this patient population. The fact that the twins became fully awake and interactive shortly after sedation discontinuation indicates that dexmedetomidine's effects were predictable and reversible. After 24 hours of stable monitoring in the PICU, both Baby One and Baby Two were transferred from the PICU to the regular ward. They remained stable until the scheduled separation surgery. This indicates that the post-procedure period was uneventful, and the twins were deemed stable enough for transfer to a less intensive care setting. Their stability in the regular ward until the separation surgery suggests that the anesthetic management and post-procedural care did not cause any long-term complications (Table 2).

Table 1. Summary patient's clinical findings.

Category	Baby One (Twin A)	Baby Two (Twin B)
Demographics		
Age	4 months	4 months
Gender	Female	Female
Type of conjoinment	Thoracoabdominal (fused at the thorax and upper abdomen)	Thoracoabdominal (fused at the thorax and upper abdomen)
Birth history	Born via Cesarean section at term due to prenatal diagnosis of conjoined twins.	Born via Cesarean section at term due to prenatal diagnosis of conjoined twins.
Anamnesis		
Chief complaint	Referral for evaluation and potential separation surgery of conjoined twins.	Referral for evaluation and potential separation surgery of conjoined twins.
Past medical history	No significant medical history reported other than the conjoined condition.	No significant medical history reported other than the conjoined condition.
Developmental history	Reported as active and responsive for their age by parents. Showing typical developmental milestones for a 4-month-old infant.	Reported as active and responsive for their age by parents. Showing typical developmental milestones for a 4-month-old infant.
Feeding history	Primarily breastfed with adequate weight gain reported by parents. No history of feeding difficulties mentioned.	Primarily breastfed with adequate weight gain reported by parents. No history of feeding difficulties mentioned.
Physical examination		
General appearance	Active, responsive infant.	Active, responsive infant.
Vital signs	Heart rate: 110-115 bpm; Blood pressure: 88/54 mmHg; SpO_2: 99% on room air; Weight: 4.5 kg	Heart rate: 115-120 bpm; Blood pressure: 76/42 mmHg; SpO_2: 99% on room air; Weight: 4.3 kg
Head and neck	Bilateral cleft lip and palate (labiopalatoschisis) present. No other abnormalities noted.	Bilateral cleft lip and palate (labiopalatoschisis) present. No other abnormalities noted.
Cardiovascular	Auscultation revealed normal heart sounds. No murmurs auscultated. Peripheral pulses were palpable and equal bilaterally.	Auscultation revealed normal heart sounds. No murmurs auscultated. Peripheral pulses were palpable and equal bilaterally.
Respiratory	Respiratory effort adequate. No signs of respiratory distress (e.g., nasal flaring, retractions). Lungs were clear to auscultation bilaterally.	Respiratory effort adequate. No signs of respiratory distress (e.g., nasal flaring, retractions). Lungs were clear to auscultation bilaterally.
Abdomen	Shared at the xiphoid process and upper abdominal wall. Palpation revealed a shared liver mass. No other palpable masses or organomegaly noted apart from the liver.	Shared at the xiphoid process and upper abdominal wall. Palpation revealed a shared liver mass. No other palpable masses or organomegaly noted apart from the liver.
Neurological	Neurological examination revealed appropriate reflexes and tone for age. Moving all limbs spontaneously.	Neurological examination revealed appropriate reflexes and tone for age. Moving all limbs spontaneously.
Other systems	Remainder of the physical examination was unremarkable.	Remainder of the physical examination was unremarkable.
Laboratory		
Sodium (Na)	122 mmol/L (26-Sep-22), 134 mmol/L (29-Jan-23)	123 mmol/L (26-Sep-22), 129 mmol/L (29-Jan-23)
Potassium (K)	6.25 mmol/L (26-Sep-22), 4.53 mmol/L (29-Jan-23)	5.19 mmol/L (26-Sep-22), 4.54 mmol/L (29-Jan-23)
Chloride (Cl)	105 mmol/L (26-Sep-22), 110 mmol/L (29-Jan-23)	103 mmol/L (26-Sep-22), 112 mmol/L (29-Jan-23)
Hemoglobin (Hb)	14.8 g/dL (26-Sep-22), 11.9 g/dL (29-Jan-23)	15.7 g/dL (26-Sep-22), 11.9 g/dL (29-Jan-23)
White blood cells (WBC)	12,780/mm^3 (26-Sep-22), 7,070/mm^3 (29-Jan-23)	12,470/mm^3 (26-Sep-22), 8,990/mm^3 (29-Jan-23)
Hematocrit (HCT)	41.1% (26-Sep-22), 35.9% (29-Jan-23)	44.1% (26-Sep-22), 35.9% (29-Jan-23)
Platelets (PLT)	536,000/mm^3 (26-Sep-22), 341,000/mm^3 (29-Jan-23)	560,000/mm^3 (26-Sep-22), 350,000/mm^3 (29-Jan-23)
Differential Count	Eosinophils: 3.7% (26-Sep-22), 2.8% (29-Jan-23); Basophils: 0.2% (26-Sep-22), 0.4% (29-Jan-23); Neutrophils: 34.6% (26-Sep-22), 28.6% (29-Jan-23); Lymphocytes: 45.3% (26-Sep-22), 54.3% (29-Jan-23); Monocytes: 16.2% (26-Sep-22), 13.9% (29-Jan-23)	Eosinophils: 3.8% (26-Sep-22), 2.7% (29-Jan-23); Basophils: 0.3% (26-Sep-22), 0.3% (29-Jan-23); Neutrophils: 38.8% (26-Sep-22), 28.2% (29-Jan-23); Lymphocytes: 41.1% (26-Sep-22), 55.5% (29-Jan-23); Monocytes: 16.0% (26-Sep-22), 13.3% (29-Jan-23)
Imaging		
Abdominal ultrasound	Liver surface fusion with vascular involvement noted. No other significant findings reported.	Liver surface fusion with vascular involvement noted. No other significant findings reported.
Echocardiogram	Normal cardiac structure and function in both individuals. No evidence of significant shared circulation at the cardiac level.	Normal cardiac structure and function in both individuals. No evidence of significant shared circulation at the cardiac level.
CT scan	**Liver Fusion:** A significant parenchymal fusion was observed involving a substantial portion of the livers of both twins. The line of demarcation between the two livers was not clearly defined in the fused segment, suggesting a shared liver mass. **Vascular Connections:** Several major vascular connections were identified within the fused liver tissue. Specifically: • A large shared portal vein branch was noted, draining blood from the intestines of both twins into the common liver mass. • Hepatic veins from both twins appeared to converge and drain through a common channel before entering the inferior vena cava of each twin separately. • Arterial supply to the shared liver segment seemed to originate from branches of both the right and left hepatic arteries of each twin. **Gastrointestinal Tract:** The stomach, duodenum, pancreas, small intestine, and large intestine appeared to be separate for each twin without any evidence of shared segments or connections. **Biliary System:** The gallbladder and biliary tree were distinct for each twin. The intrahepatic bile ducts appeared to drain normally into their respective common bile ducts. The point of entry of the common bile ducts into the duodenum was also separate for each twin. **Urinary Tract:** The kidneys, ureters, and bladder were completely separate and appeared normal in both twins. **Spleen:** The spleen was present and appeared normal for each twin, with no evidence of fusion or shared tissue. **Thoracic Cavity:** The diaphragm appeared to be fused in the anterior aspect where the twins were joined. The lungs and heart were separate for each twin, consistent with the echocardiogram findings. No evidence of shared pleural or pericardial spaces was noted. **Abdominal Wall:** The abdominal wall was fused from the xiphoid process down to the umbilicus, forming a single anterior abdominal wall in the conjoined region.	**Liver Fusion:** A significant parenchymal fusion was observed involving a substantial portion of the livers of both twins. The line of demarcation between the two livers was not clearly defined in the fused segment, suggesting a shared liver mass. **Vascular Connections:** Several major vascular connections were identified within the fused liver tissue. Specifically: • A large shared portal vein branch was noted, draining blood from the intestines of both twins into the common liver mass. • Hepatic veins from both twins appeared to converge and drain through a common channel before entering the inferior vena cava of each twin separately. • Arterial supply to the shared liver segment seemed to originate from branches of both the right and left hepatic arteries of each twin. **Gastrointestinal Tract:** The stomach, duodenum, pancreas, small intestine, and large intestine appeared to be separate for each twin without any evidence of shared segments or connections. **Biliary System:** The gallbladder and biliary tree were distinct for each twin. The intrahepatic bile ducts appeared to drain normally into their respective common bile ducts. The point of entry of the common bile ducts into the duodenum was also separate for each twin. **Urinary Tract:** The kidneys, ureters, and bladder were completely separate and appeared normal in both twins. **Spleen:** The spleen was present and appeared normal for each twin, with no evidence of fusion or shared tissue. **Thoracic Cavity:** The diaphragm appeared to be fused in the anterior aspect where the twins were joined. The lungs and heart were separate for each twin, consistent with the echocardiogram findings. No evidence of shared pleural or pericardial spaces was noted. **Abdominal Wall:** The abdominal wall was fused from the xiphoid process down to the umbilicus, forming a single anterior abdominal wall in the conjoined region.
Diagnosis		
Primary diagnosis	Thoracoabdominal conjoined twins.	Thoracoabdominal conjoined twins.
Associated findings	Bilateral labiopalatoschisis.	Bilateral labiopalatoschisis.

Table 2. Management of anesthesia and follow-up.

Category	Baby One (Twin A)	Baby Two (Twin B)
Pre-procedure		
Planning	Comprehensive anesthetic plan formulated in consultation with pediatric surgeons and radiologists. Pre-procedural simulation conducted in the CT scan suite.	Comprehensive anesthetic plan formulated in consultation with pediatric surgeons and radiologists. Pre-procedural simulation conducted in the CT scan suite.
Personnel	Dedicated anesthesia team including an attending anesthesiologist and a resident anesthesiologist primarily responsible for this twin.	Dedicated anesthesia team including an attending anesthesiologist and a resident anesthesiologist primarily responsible for this twin.
Equipment preparation	Dedicated anesthesia machine, monitoring equipment (ECG, NIBP, SpO_2), intravenous fluids, syringe pumps for dexmedetomidine. All equipment labeled with red stickers.	Dedicated anesthesia machine, monitoring equipment (ECG, NIBP, SpO_2), intravenous fluids, syringe pumps for dexmedetomidine. All equipment labeled with blue stickers.
Pre-medication	No premedication administered prior to intravenous catheter placement.	No premedication administered prior to intravenous catheter placement.
Intravenous access	Intravenous catheter placed in a peripheral vein in the pre-medication area.	Intravenous catheter placed in a peripheral vein in the pre-medication area.
Intra-procedure (CT scan)		
Sedative agent	Dexmedetomidine: Loading dose of 2 mcg/kg over 10 minutes via syringe pump, followed by a continuous infusion of 0.4 mcg/kg/hour.	Dexmedetomidine: Loading dose of 2 mcg/kg over 10 minutes via syringe pump, followed by a continuous infusion of 0.4 mcg/kg/hour.
Monitoring	Continuous ECG, non-invasive blood pressure (NIBP) measurements every 5 minutes, continuous pulse oximetry (SpO_2). Vital signs recorded at regular intervals.	Continuous ECG, non-invasive blood pressure (NIBP) measurements every 5 minutes, continuous pulse oximetry (SpO_2). Vital signs recorded at regular intervals.
Procedure duration	Approximately 20 minutes for the CT scan procedure.	Approximately 20 minutes for the CT scan procedure.
Hemodynamic parameters	**Start:** HR: 128 bpm, BP: 88/45 mmHg, SpO_2: 99%. **End:** HR: 119 bpm, BP: 78/41 mmHg, SpO_2: 99%.	**Start:** HR: 131 bpm, BP: 92/67 mmHg, SpO_2: 98%. **End:** HR: 125 bpm, BP: 88/51 mmHg, SpO_2: 100%.
Complications	No episodes of significant bradycardia, hypotension, or respiratory depression observed.	No episodes of significant bradycardia, hypotension, or respiratory depression observed.
Post-procedure		
Sedation discontinuation	Dexmedetomidine infusion discontinued immediately after the completion of the CT scan.	Dexmedetomidine infusion discontinued immediately after the completion of the CT scan.
Immediate post-op care	Transferred to the Pediatric Intensive Care Unit (PICU) for post-procedural monitoring. Hemodynamic status remained stable upon arrival at the PICU.	Transferred to the Pediatric Intensive Care Unit (PICU) for post-procedural monitoring. Hemodynamic status remained stable upon arrival at the PICU.
Monitoring in PICU	Continuous monitoring of heart rate, blood pressure, respiratory rate, and oxygen saturation in the PICU.	Continuous monitoring of heart rate, blood pressure, respiratory rate, and oxygen saturation in the PICU.
Duration of PICU stay	Approximately 24 hours of monitoring in the PICU as per standard protocol for pediatric sedation cases.	Approximately 24 hours of monitoring in the PICU as per standard protocol for pediatric sedation cases.
Recovery	Recovered uneventfully from sedation. Became fully awake and interactive within approximately 30-60 minutes after discontinuation of dexmedetomidine.	Recovered uneventfully from sedation. Became fully awake and interactive within approximately 30-60 minutes after discontinuation of dexmedetomidine.
Subsequent disposition	Transferred from the PICU to the regular ward after 24 hours of stable monitoring. Remained stable until the scheduled separation surgery.	Transferred from the PICU to the regular ward after 24 hours of stable monitoring. Remained stable until the scheduled separation surgery.

3. Discussion

Pre-procedural planning is of paramount importance in the anesthetic management of conjoined twins. A multidisciplinary team approach is essential for identifying potential challenges and formulating a comprehensive anesthetic plan. This team typically includes anesthesiologists, surgeons, radiologists, and nurses, all collaborating to ensure the best possible outcome for the patients. In the reported case, the importance of pre-procedural planning was underscored by the conduct of a pre-procedural simulation in the CT scan suite. This simulation allowed the medical team to anticipate potential logistical and technical difficulties that might arise during the actual procedure. These difficulties can include challenges related to the positioning of the

twins, which can be complex due to their shared anatomy, and the management of two sets of anesthesia equipment within the confined space of the CT scan suite. The pre-procedural simulation also played a crucial role in facilitating effective communication and coordination among the team members. Clear and efficient communication is essential in complex medical scenarios to minimize the risk of errors and ensure patient safety. The simulation provided an opportunity for the team to practice their roles, clarify responsibilities, and establish protocols for managing potential complications.[11-14]

The choice of anesthetic technique for diagnostic imaging in pediatric patients is influenced by several factors. These factors include the age of the patient, the type and duration of the procedure, and the presence of any comorbidities. In the case of conjoined twins, these considerations are further complicated by the shared anatomy and potential physiological interactions between the twins. In this case, continuous dexmedetomidine infusion was chosen for sedation. Dexmedetomidine, an alpha-2 adrenergic agonist, offers several advantages in the setting of pediatric sedation. One of the primary advantages of dexmedetomidine is its ability to provide adequate sedation while preserving respiratory drive. This is particularly important in infants, who are at a higher risk of respiratory depression with other sedative agents. Respiratory depression can lead to serious complications, including hypoxemia and the need for assisted ventilation. Another advantage of dexmedetomidine is its relatively short half-life. This allows for rapid recovery and early discharge, which is particularly desirable for out-of-operating room procedures, where patients are often discharged home shortly after the procedure. A rapid recovery minimizes the time spent in the post-anesthesia care unit and reduces the overall burden on the healthcare system. The successful use of dexmedetomidine in this case aligns with findings from other studies that have demonstrated its efficacy and safety for sedation in pediatric patients undergoing various diagnostic procedures, including CT and MRI scans. These studies have consistently shown that dexmedetomidine provides effective sedation with a favorable safety profile, making it a valuable tool in pediatric anesthesia. The hemodynamic stability observed in both twins throughout the procedure further supports the favorable safety profile of dexmedetomidine in this context. Dexmedetomidine is known to have minimal effects on respiratory function and to provide hemodynamic stability, which is particularly important in patients with complex medical conditions or those undergoing prolonged procedures.[15-20]

4. Conclusion

In conclusion, this case report illustrates the successful anesthetic management of a CT scan procedure in pediatric thoracoabdominal conjoined twins. The use of continuous dexmedetomidine infusion proved to be an effective strategy for providing sedation while maintaining hemodynamic stability and preserving respiratory drive in these infants. The meticulous pre-procedural planning, including a simulation in the CT scan suite, was crucial for anticipating potential challenges and ensuring a coordinated team response. The allocation of dedicated anesthesia teams and equipment for each twin further contributed to the safe and effective management of this complex case. This case underscores the importance of a multidisciplinary approach, involving collaboration among anesthesiologists, surgeons, and radiologists, to address the unique anatomical and physiological considerations in conjoined twins. Tailored anesthetic strategies, along with careful monitoring and post-procedural management in the PICU, are essential to ensure optimal outcomes in these challenging cases. This report contributes valuable insights to the growing body of knowledge on the anesthetic management of conjoined twins, highlighting the feasibility and safety of using dexmedetomidine for sedation in this population.

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