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Post-Separation Evaluation of Conjoined Twin Babies: A Case Report

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Abstract: Conjoined twins are a rare condition, occurring in approximately 1 per 50,000 to 100,000 live births. Long-term follow-up is essential to evaluate post-surgical outcomes, including organ function and surgical scar. We reported a case of thoraco-omphalopagus conjoined twins who underwent successful separation surgery in 2023. The most recent evaluation in August 2025 showed excellent developmental progress in both twins across motor, cognitive, and psychosocial domains. However, the second twin developed a keloid along the surgical scar. Liver function tests were normal in both twins, although alkaline phosphatase levels were elevated. Thoracic computed tomography revealed elongation of the xiphoid process in the second twin, while abdominal imaging demonstrated normal liver following resection of the fused liver. In conclusion, continuous long-term evaluation after separation surgery is vital to detect potential abnormalities at an early stage.
Keywords: conjoined twins; separation surgery; thoraco-omphalopagus; long-term follow-up; postoperative outcome

INTRODUCTION

Conjoined twins are a rare congenital anomaly occurring in approximately 1 per 50,000–100,000 live births.[1, 2] Thoraco-omphalopagus, involving fusion from the sternum to the anterior abdominal wall, is among the most common forms.[2,3] Advances in multidisciplinary management and surgical techniques have improved survival outcomes. As conjoined twins often share vital organ such as liver, careful separation and postoperative evaluation are required. Long-term follow-up is essential to detect possible deformities or organ abnormalities that may occur after surgery.[3,4] We reported the long-term outcomes of thoraco-omphalopagus twins separated in 2023 to assess the postoperative condition and development.

CASE REPORT

A five-year-old pair of thoraco-omphalopagus twins attended routine long-term follow-up after their 2023 separation surgery, which involved liver, chest wall, and abdominal reconstruction. The initial operative details were reported previously.[1,2] Both girls demonstrated excellent growth and developmental progress in motor, cognitive, language, psychosocial, and emotional aspects.

The second twin presented with asymptomatic prominence of the xiphoid area and a linear keloid along the surgical scar (Figure 1). Thoracic computed tomography (CT) scans with and without contrast revealed no intrathoracic abnormalities. Three-dimensional reconstruction demonstrated mild asymmetry of the hemithoraces and a slightly convex chest wall consistent with non-pathological post-surgical bone remodelling (Figure 2). Liver function tests were within normal limits except for mildly elevated alkaline phosphatase levels (317 U/L and 265 U/L). Overall, both twins remained healthy with normal organ function and excellent postoperative recovery during long-term follow-up.



Figure 1. The clinical condition of patients and their surgical scars. (Fig. A1-A3: first twin; B1-B3: second twin.)
Fig. A1-A3: There was keloid formation along the surgical scar, the xiphoid area was normal
Fig. B1-B3: The surgical scar developed minimally, the xiphoid area was more prominent

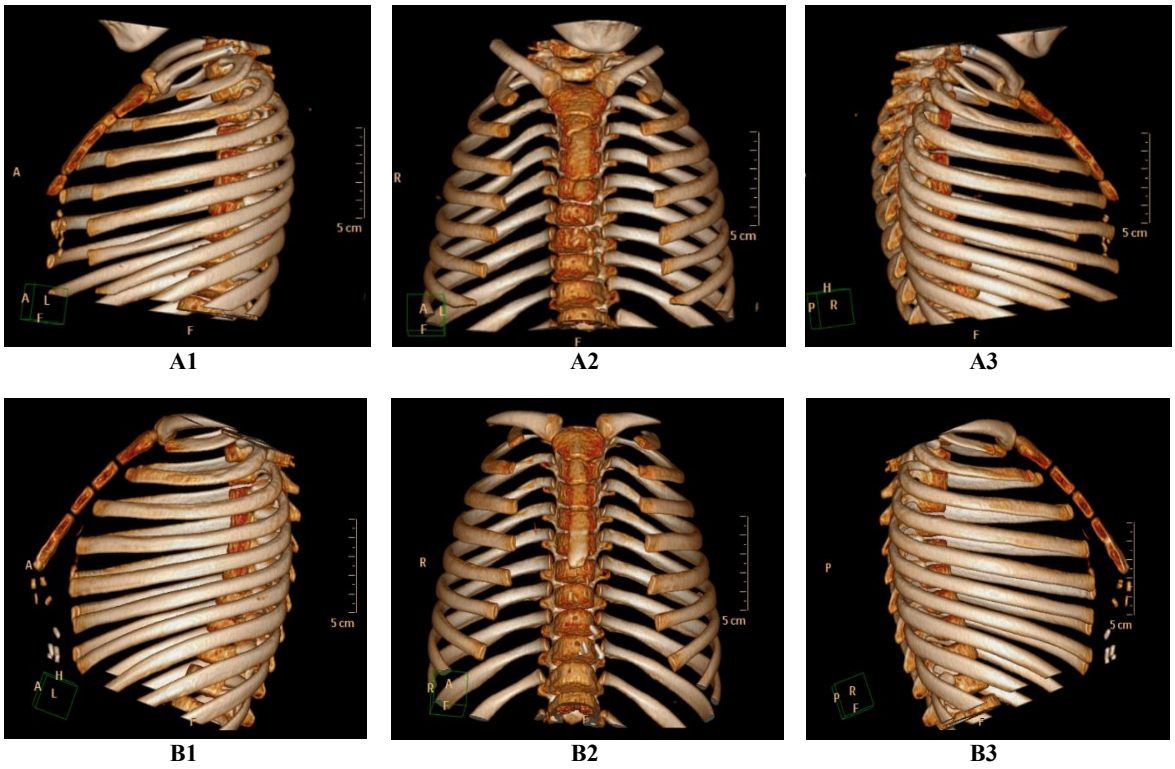


Figure 2. Results of three-dimensional reconstruction thoracic ct-scan of conjoined twins (Fig. A1–A3: first twin; B1-B3: second twin)
Both hemithoracices were asymmetric, the chest wall was more convex since birth, and there were post-surgery bone morphology changes.
B1: There was elongation of the xiphoid process in twin B, but it remained within normal limits

DISCUSSION

This case report presents excellent long-term outcomes following the separation of thoraco-omphalopagus conjoined twins, demonstrating successful reconstruction and normal developmental trajectories. The findings align with contemporary literature on conjoined twin separation surgery and warrant discussion across several clinical domains. The successful separation and long-term survival of both twins represent a significant achievement, given that thoraco-omphalopagus twins have historically shown surgical success rates of approximately 50%. A systematic review of 158 sets of thoracopagus and thoraco-omphalopagus twins revealed that 71 sets were non-operable and all subsequently expired, while 82 sets underwent surgery with 83 babies surviving. Post-separation survival rates generally range from 60-66%, though outcomes vary significantly based on the extent of organ sharing and complexity of shared cardiac anatomy. The timing of separation at appropriate age and medical stability, combined with multidisciplinary team expertise, contributes substantially to favorable outcomes.[5–7]

Both patients have xiphoid area prominence, that were more profound in the second twin, and a three-dimensional reconstruction of the thoracic CT scan found xiphoid area prominence. It can occur occur due to the instability of the ribs and sternum during surgical manipulation, which leads to the reactive tissue overgrowth of the parasternal cartilage. Another literature stated that secondary protrusion of the lower sternum may occur following cardiac surgery with midline sternotomy in infants and toddlers.[8] The optimal timing of conjoined twin separation is three months. Still, it may extend up to 3 years for work-up completion of the anatomy assessment of shared organs to achieve accurate pre-operative planning and rehearsal. Our patients had conjoined twin separation at 2 years old, and it was considered an elective separation, which has a higher survival rate than emergency separation (80% vs 30%). Although elective separation surgery has a higher survival rate and

favorable outcomes with detailed pre-operative evaluation, the data on potential complications of elective separation surgery are still lacking. Recently, there has been no literature about the xiphoid area prominence after elective conjoined twin separation, but this finding may highlight the need for further studies regarding the impact of patients' age on conjoined twin separation surgery and the incidence of xiphoid area prominence along with its' factors.[8]

Other than xiphoid area prominence, the second twin also had a keloid along the surgical scar. Keloid is a difficult-to-treat clinical condition due to its high recurrence rate. Chest skin is the body area that is most likely to develop keloids. A study found that 44.39% of keloids occur on the chest and are more common in women. Each patient has different clinical presentations, sizes, and lesions of chest keloid. The keloid may appear small initially, but it may increase in size and spread to other areas with time. The course of chest keloid lesions is affected by several factors, such as genetic factors, triggering factors (the size of the surgical wound), time, and iatrogenic factors. Close observation is required and there are three types of keloid, (1) group A: the patients only have one or single some small keloid in 5- 10 years, indicating the extremely slow of disease course; (2) group B: the keloid is increasing continuously with time; and (3) group C: several lesions were developed in the short time, occurs due to the presence of triggering factors therefore the managing the triggering factors can improve the symptoms (DWACK syndrome). In this case, our patient was categorized into group B. Chest keloid has some treatment approaches that are determined based on the size and number of lesions, starting from conservative to surgery, but surgery should not be done for anterior chest keloid because it may worsen the keloid. Radiotherapy and laser should be avoided because they can trigger neoplastic transformation and worsen the keloid, respectively. The conservative management of chest keloids is intra-lesion triamcinolone (ILT), intra-lesion chemotherapy (ILC), and contact cryotherapy with or without ILT/ILC. Intra-lesion triamcinolone is the first line for initial, papular, and linear keloids. Intra-lesion triamcinolone can be considered for the second twin because the keloid lesion was in the anterior chest and had a linear shape.[9,10]

Liver is the most common fused organ in omphalopagus cases (80%). Omphalopagus is the least complex conjoined twin and the most feasible one for separation surgery, with a favourable long-term prognosis, but liver separation needs to be done carefully to minimize the risk of bleeding, vascular thrombosis, and biliary complications due to high anatomy variants of conjoined twins. Liver separation was successful, and no liver dysfunctions were detected.[1,11]

It should be noted that normal ALP levels have a tetraphasic pattern in healthy children. The ALP levels reach their highest levels in infancy and puberty. The ALP levels will decline starting from 12 years of age in girls. Turan et al showed that the mean ALP levels of 516 U/L in healthy female children ages 4 – 5 years. Alkaline phosphatase is mainly expressed in the liver, intestines, bone, placenta, and proximal convoluted tubules in the kidney. The ALP levels can be used as an osteoblastic activity marker, and this may be the reason why growing children have higher levels of ALP than adults.[12] Other than physiologic reasons, Siu et al reported that ALP may increase due to pathological disorders such as biliary obstruction of small-for-size syndrome that lead to cholestasis due to ongoing liver regeneration. In this case, our patients did not have any biliary disorders; therefore, ALP may increase due to liver regeneration. A thorough pre-surgery evaluation and long-term evaluation are crucial for improved outcomes of liver resection.[13]

Villarreal et al also reported that there was no liver dysfunction after liver separation. Liver resection is a high-risk procedure, particularly for neonates and infants.[1] There are some pathophysiological changes after liver resection, starting from mild transient abnormalities to life-threatening complications such as post-resection liver failure (PLF). The risk factors of PLF are the presence of liver parenchymal disease and/or low residual liver volume. Some liver biochemical parameters, such as transaminase, bilirubin, serum creatinine, lactate, glucose, albumin, C-reactive protein, gamma globulin transferase (GGT), and ALP may increase after liver resection, and their increase was influenced by several factors.[1,13]

Our patients did not have pre-surgery liver dysfunction. There were no biliary disorders or

liver parenchymal comorbid disease; also, the surgical bleeding was minimal, therefore hepatocyte regeneration went well, and there was no liver dysfunction. The increased ALP levels in our cases (317 U/L and 265 U/L) were physiologic since our patients were growing children without any pre-surgery liver dysfunction. The liver regeneration process was probably another reason for increased ALP levels in our patients.[14,15]

Long-term surveillance remains essential for separated conjoined twins, as ongoing health issues related to shared physiology and surgical reconstruction may emerge over time. Recommended monitoring includes periodic imaging to assess chest wall stability and growth, liver function testing given the shared hepatic anatomy pre-separation, and developmental assessments to ensure continued age-appropriate progression. Musculoskeletal deformities develop in a significant proportion of children following thoracic surgery, though most remain subclinical, emphasizing the importance of continued orthopedic surveillance. The current clinical presentation of both twins demonstrates successful medium-term outcomes, with appropriate management strategies available for the identified keloid formation and continued monitoring indicated for skeletal development and organ function.

CONCLUSION

The thorough pre-surgery, intra-surgery, and post-surgery evaluations with multidisciplinary management lead to excellent outcomes of separation surgery of conjoined twins. Regular clinical follow-up with growth and development evaluations with post-surgery rehabilitation is required to improve the long-term outcomes of separation surgery.

Conflict of Interest

The authors declare no conflict of interest in this study.

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