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The Spectrum Of Congenital Heart Diseases In Conjoined Twins: Current Evidence And Clinical Challenges

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Abstract: Conjoined twins represent one of the rarest and most complex congenital conditions encountered in perinatal medicine. Among the many challenges they present, congenital heart disease (CHD) stands out as the most critical determinant of survival, surgical feasibility, and long-term outcome. Compared with singletons and other multiple gestations, conjoined twins show a markedly higher prevalence of cardiac malformations, particularly in ventrally fused types such as thoracopagus twins. Cardiac involvement ranges from relatively simple defects, including septal or valvular abnormalities, to severe and often irreparable conditions such as shared atrial or ventricular chambers or a single functional heart.

This literature review synthesizes current evidence on the epidemiology, anatomical spectrum, diagnostic approaches, clinical management, surgical outcomes, and ethical considerations associated with CHD in conjoined twins. Published case series, pooled analyses, and contemporary reviews were examined to highlight patterns of cardiac anatomy, advances in prenatal and postnatal imaging, and factors influencing prognosis.

Available evidence consistently demonstrates that survival following attempted separation is closely linked to the degree of cardiac sharing. Twins with separate hearts or a shared pericardium have significantly better outcomes than those with complex intracardiac fusion. Advances in prenatal diagnosis, particularly fetal echocardiography and fetal magnetic resonance imaging, have improved early detection, anatomical characterization, parental counseling, and perinatal planning, although interpretation remains challenging due to altered hemodynamics and shared circulation. Elective separation undertaken after comprehensive multidisciplinary planning is associated with higher survival than emergency procedures, while non-operative and palliative approaches remain appropriate in cases incompatible with surgical correction.

CHD remains the primary prognostic factor in conjoined twins. Accurate cardiac assessment, individualized multidisciplinary care, and thoughtful ethical decision-making are essential to optimizing outcomes in this exceptionally vulnerable population.

Keywords: conjoined twins, cardiac fusion, fetal cardiac imaging, evidence-based management, shared circulation, surgical separation, perinatal ethics

Introduction

In perinatal medicine, conjoined twins are one of the rarest and most challenging congenital conditions. Although the occurrence is low, cardiac defects are disproportionately common among conjoined twins and are the key factor determining the success of

surgical separation and survival of these babies. In comparison to singletons and other multiple births, conjoined twins have a much higher birth prevalence of congenital heart disease (CHD), according to recent series and case-based reviews [1]. This highlights the fact that cardiac anatomy typically dictates candidacy for separation and long-term outcome.

From an anatomical standpoint, congenital heart disease in conjoined twins can vary widely. Some twins have relatively simple defects, such as septal defects or valve malformations. Others, especially thoracopagus twins, may share more complex structures, like a fused pericardium, common atrial or ventricular chambers, or even a true single (univentricular) heart.

Thoracopagus twins are more likely to have complicated intracardiac abnormalities and severe cardiac conjoining, which significantly lower the viability and success rates of elective separation procedures [2]. The degree of cardiac sharing and intracardiac morphology must therefore be precisely defined for prognostication.

Results documented in contemporary literature show that survival following an attempt at separation is variable and strongly correlated with the kind and degree of cardiovascular union: twins with only a shared pericardium or separable cardiac structures have significantly higher survival rates than those with complex, irreparable intracardiac lesions or a shared functional myocardium. Cardiac anatomy continues to be the primary predictor of mortality, and extensive pooled analyses and institutional series published since 2015 highlight that elective separations carried out with meticulous multidisciplinary planning result in higher survival than emergency procedures [3].

These clinical realities have driven advances in prenatal detection, imaging, and perioperative planning. High-resolution fetal echocardiography, coupled with cross-sectional imaging (MRI/CT) and three-dimensional reconstruction, is now routinely recommended to define the anatomy, guide counseling, and plan delivery and postnatal management. Nevertheless, even with contemporary imaging, interpretation is challenging because of complex spatial relationships, overlapping thoraco-abdominal organs, and altered hemodynamics between twins [3].

Lastly, contemporary research emphasizes that effective management of conjoined twins with congenital heart disease necessitates highly coordinated multidisciplinary care, including fetal cardiology, neonatology, pediatric cardiac surgery, anesthesiology, ethics, and specialized nursing, as well as frequently creative surgical techniques when separation is sought [3]. In the remaining sections of this review, the epidemiology and specific cardiac phenotypes will be summarized, diagnostic and imaging difficulties will be examined, and evidence regarding clinical care, surgical results, and ethical considerations will be synthesized.

Epidemiology & Spectrum of CHDs in Conjoined Twins

Conjoined twins, also known as Siamese twins, are described as identical monozygotic twins that are attached to each other but still aren't entirely separated from each other.[4] With a prevalence of 1.47 per 100,000 live births, it stands as one of the rarest congenital development anomalies, with a greater incidence reported in Southwest Asia, Africa and South America.[5] Although, these rates could be different among various ethnic groups. An estimated range of about 40-60% births are stillborn, and nearly a third of infants die in less than a day, however this incidence could be higher among spontaneous miscarriages. Having a ratio of 3:1, most live births are female, and conjoined twins are always of the same gender.[6] In more than half of conjoined twin births, fusion occurs at either the thorax or abdomen.[7]

Among monochorionic twins, the prevalence of congenital heart defects is six-fold higher than in dichorionic or other types of twin pregnancies.[8] Some cardiothoracic anomalies include dextrocardia, diaphragmatic hernia and anomalous pulmonary venous drainage (APVD). As twins share identical genotypes, they can also develop similar congenital defects, with 41% of cases resulting from pathophysiologic mechanisms related to the placenta.[8] There are no chromosomal abnormalities observed. The spectrum of congenital heart defects depends on the site of fusion. They develop due to fertilization of a single egg and sperm, and these twins share one placenta and one amniotic sac.[4]

Although the exact cause of conjoined twins remains unclear, incomplete separation or axis duplication leads to conjoined twins between days 13 to 15 of fertilization, known as the fission theory.[5],[7] Another theory, known as the fusion theory, explains that conjoined twins join at specific sites during embryonic development. The extent of separation depends on the stage of the bilaminar

embryonic disc. If separation occurs during this stage, conjoined twins could share the chorionic and amniotic membranes. However, if the division occurs after this stage, around week 3 or 4, they could share some internal organs.[6] Nonetheless, both the fission and fusion theories don't explain the complete spectrum of congenital defects among these twins.[4],[5]

Conjoined twins are divided into symmetric and asymmetric cases. In around 1 in 1,000,000 live births, asymmetric conjoined twins occur. Although this is very rare, one of the twins is comparatively less developed than the other due to an imbalance in the size of the embryonic disk. These embryonic disks impede with the growth of the twins as they develop.[9] Leading risk factors include family history, the use of alcohol and drugs, exposure to radiation, folic acid deficiency during pregnancy and environmental factors.[6] The degree of development is variable among each twin and is divided based on its topographical location. The most common site of fusion in symmetric conjoined twins is in the ventral region, with thoracopagus representing 19% of cases.[5] Other observed types include omphalopagus, thoraco-omphalopagus, ischiopagus, and parapagus. Additional morphologies of the limbs include dicephalus, tetrabrachius, and bipus.[6] The embryonic disks are connected in ventrally conjoined twins, and with increasing proximity, they share umbilical, abdominal, thoracic, and craniofacial features as well.

A rare cardiac complication observed is the Twin Reversed Arterial Perfusion (TRAP) sequence, having an incidence of 1 in 35,000 live births among conjoined twin pregnancies.[10] The TRAP sequence arises from anomalies associated with arterial and venous anastomoses with the placental circulation. It is characterized by a cardiac twin, in which one of the twins lacks a functional heart and the other twin having a functional heart that pumps circulation for both, known as the pump twin. The mortality rate can be as high as 100% in a cardiac twin, due to the receiving deoxygenated blood from the reverse blood flow, while in the pump twin, the rate can be 55%. This highlights the importance of early diagnosis and timely intervention, which is therefore extremely crucial in preventing fatal complications.[11]

Diagnostic Approaches and Imaging Challenges

The diagnosis of conjoined twins with congenital heart disease (CHD) poses a great challenge in fetal and pediatric imaging. The rarity of the condition, wide anatomical variability, recurrent merged cardiac and vascular structure, and associated prevalence of malformations are a few reasons for the challenges faced. Thus, imaging plays an important role in the early detection, prognostication, parental counseling, and both prenatal and postnatal treatment. The accuracy of the diagnosis relies heavily on a multifaceted and highly individualized approach. [12],[15]

Prenatal Ultrasound

Ultrasound remains the first line for screening and diagnosis of conjoined twins and associated cardiac anomalies. Advancements in transvaginal and Transabdominal ultrasonography has enabled earlier diagnosis. For example, a case reported by Liang et al. of thoracopagus conjoined twins sharing a single heart at 8 weeks' gestation, establishing that 7 – 8 weeks may serve as the earliest interval for ultrasound diagnosis.[13] This represents a significant improvement compared with earlier literature that placed the diagnostic window between 18- and 22-weeks' gestation, while more recent investigations have detected fetal anomalies in twin pregnancy as early as 11 – 13 weeks. [13]

As approximately 70% of conjoined twins die within 24 – 48 hours after birth or have fatal congenital abnormalities, early diagnosis is important [13] Early assessment helps identify the degree of fusion, evaluation of shared organs, optimization of obstetric management and timely parental counseling concerning prognosis along with options, such as early cessation of pregnancy when appropriate [13], thereby reducing maternal and fetal morbidity.

Routine ultrasound during gestation improves diagnostic accuracy. Primary scanning using five transverse cardiac views has proven to be highly effective in identifying fetal CHD in twin pregnancies.[12] Three-dimensional ultrasound (3D-US) gives better views on the site of fusion and the structures shared, especially in thoracopagus and thoraco-omphalopagus twins, which may improve anatomical understanding and prenatal counseling.[14] However, the diagnostic accuracy of ultrasound remains highly operator-dependent, and is influenced by their expertise, specifically in early gestation and complex cardiac anatomy.

Fetal Echocardiography

Fetal echocardiography is needed when conjoined twins are suspected during the initial screening. It enables a comprehensive look of heart structures, great blood vessels, blood flow, and heart functions, which is crucial for prognosis and management planning.

Every case of conjoined twins must be suspected to have a lack of two separate hearts. This is because of the variety of anatomical differences. Sub types, such as omphalo-ischiopagus twins face diagnostic and management challenges caused by cardiac and vascular connections between the twins.[16]

Fetal MRI

In addition to Ultrasound Fetal magnetic resonance imaging (MRI) has become a fundamental in the examination of conjoined twins. Though ultrasound is the first-line screening tool, fetal MRI provides detailed soft tissue imaging and contrast, along with a broader field of vision that allows for a clearer demarcation of shared organs and complex anatomical structures. MRI is especially beneficial when ultrasound findings are unclear or when accurate visualization of important structures like; heart, diaphragm, liver and blood vessels is needed.[18]

Several radiological case reports further confirm the usefulness of MRI. In a case of conjoined twins with thoraco–abdominal fusion, identified by ultrasound, an MRI was performed, upon which fused cardiac structures, liver and parts of the intestine were seen.[19]

These findings highlight that fetal MRI is essential for anatomical characterization and not merely a confirmatory tool. Making it effective in the assessment of prognosis, delivery planning and future postnatal surgical plans.

Postnatal Imaging Strategies

The evaluation of a conjoined twin with CHD, afterbirth, comprises imaging. It is deemed to be complementary and essential. Initial screening includes Echocardiography, cranial and abdominal ultrasound regardless of the type of conjunction. Chest and abdominopelvic radiography are used for a full-length anatomical assessment, during which pulmonary hypoplasia, lobar collapse, consolidations, or diaphragmatic herniation can be noted.[13]

Computed tomography (CT) and MRI are performed according to the conjunction type and are closely followed by the initial screening. They provide specified structural information, with echocardiography accurately identifying atrial or ventricular defects and correlated cardiac deviations.[13] Contrast-enhanced CT findings can support cardiac sharing. While ECG-gated CT improves evaluation of cardiovascular structures.

Cardiac MRI and digital Subtraction angiography are also likely, though they have been shown to be time-consuming and have limited extra value in some settings.[13]

Imaging limitations

Despite advances in imaging, significant limitations remain. The anatomical variability of conjoined twins is great and has yet to be studied in detail. The presence or the severity of malformation does not reflect the classification of the type of union. For instance, in the four-case series that involved two pair of omphalopagus twins; one pair had no associated abnormalities, while others exhibited complex malformations unrelated to the fusion site.[20] This signifies the importance for a detailed full-length imaging rather than a focused evaluation of the conjunction alone.

Even amongst thoracopagus twins, there are variations in the cardiac fusion, ranging from shared pericardium to severely malformed single hearts with atrial and ventricular unions.[2] The great inconsistency proves to be difficult in following a uniform diagnostic guideline. Which underlines the need for assessment based on individuality by experienced fetal cardiologists.

The interpretation of the imaging results is further complicated by overlapping structures, shared circulation and motion artifacts, particularly in early gestation. In cases of cardiac and vascular interdependence, advanced imaging tools may be insufficient to predict the prognosis and construct a treatment plan.

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Multidisciplinary Assessment and Future Imaging

The complexity of CHD in conjoined twins calls for the integration of an all-inclusive multidisciplinary team, involving obstetricians, fetal cardiologist, pediatric surgeons, anesthesiologists, and critical care specialists. The involvement of multidisciplinary assessment has been proven to be fundamental for rigorous parental guidance, potent pregnancy management and devising a suitable delivery plan and postnatal strategies. [14],[20]

Within recent years, there has been a rapid expansion in high-end cardiac imaging techniques. Advancements in echocardiography, cardiac MRI, CT, invasive angiography, as well as three-dimensional (3D) visualization techniques, including 3D printing, extended reality, holographic imaging, and digital twin technology are some of the recent technologies noted by state-of-art reviews. [13],[20],[21]

Although further studies are required, three-dimensional visualization has shown to be a critical tool for gaining insights into complex cardiac anatomy and procedural planning in CHD. [20]

Clinical management and perioperative challenges

As understood from the prior discussions, the rarity of conjoined twins complicates their clinical management. This is more so evident in cases of congenital heart diseases in conjoined twins, wherein termination of pregnancy is the advised route of management. Whilst an ethically difficult decisions to make, sharing of the heart and/or other complex abnormalities impede a safe separation. Specialists deploy thorough appraisal of the possible outcomes, and fully informed parental counselling, seeking to terminate the pregnancy in second trimester, especially in cases of anomalies incompatible with life. This allows for a more sheltered vaginal termination of pregnancy, bypassing caesarean and minimizing maternal risks [2].

In one of the earliest studies on CHDs in conjoined twins by McMahon and Spencer, 1262 cases of conjoined twins were reviewed, of which 834 cases (66%) reported cardiac defects in either one or both twins. The consensus of this study, and of similar subsequent studies was that these defects appeared more frequently in twins joined ventrally, and in cases of union at the rostral aspect of the embryonic disc [22]. Of the numerous types of conjoined twins discussed in the study, cephalopagus and thoracopagus twins demand careful evaluation. Cephalopagus twins commonly have both anterior and posterior aspects of the heart conjoined, whereas thoracopagus twins most often share one compound heart, with redundant chambers united both internally and externally, conceding varying communications and complicated patterns of blood flow.

While the predominant treatment strategy, surgical separation is very rarely successful and requires meticulous preparation. In the study by McMahon and Spencer [22], we noted no records of separation of cephalopagus twins. Conversely, among the cases of thoracopagus twins, surgery awarded no survivors in the 14 reported cases of shared atrial and ventricular chambers. The prognosis was more satisfactory when the anomaly was a simple interatrial channel, as was the case in 4 sets of twins. Three of the eight infants survived surgery, although all the twins with compound hearts or a single QRS complex succumbed to death after attempted separation.

Another study of interest published under pediatric cardiology discusses the case of a 19-year-old primigravida, who was seen for foetal consultation at 24 weeks of gestation, in line with suspicion of CHD of the foetus [26]. Upon evaluation, several deformities incompatible with life were noted, including but not limited to – large VSD with overriding aorta, pulmonary valve atresia, severely hypoplastic right ventricle and more. Following procedural conduct, both the twins were started on IV PGE1 as initial management. As observed both in this case and others demonstrating similar pathophysiology, PGE1 is primarily used to ensure weight gain in premature babies before surgery is attempted. On day 3 of life, Twin B suffered severe bradycardia and seizures and passed after multiple futile resuscitation attempts. This study further intensified the necessity of appropriate pre-operative diagnostic work-up, done in Twin A by means of cardiac catheterization and angiography. These evaluations revealed confluent but hypoplastic branch pulmonary arteries, and two large collateral vessels stemming from anterior descending aorta [26].

Other notable management strategies employed in cases of successful separation of conjoined twins with CHDs include - aortic coarctation repair with extended end-to-end anastomosis [26]. When compared with the standard end-to-end coarctation correctional procedure, the extended repair allows for lessened risks of re-coarctation, especially in neonate and infants. It involves excisions of

the coarcted aortic segment along with surrounding hypoplastic tissue, followed by tension-free re-anastomosis of the proximal and distal aorta.

Despite these advancements in clinical understanding and management, the overall success rate of separation remains a disturbing 50.6% [2]. Whenever the decision to continue the pregnancy is taken, the delivery must be through C-section at 36-38 weeks of gestation, to prevent stillbirth, dystocia and other vaginal injuries [2]. However, not all caesareans promise healthy births. The dismal prognosis of conjoined twins, especially thoracopagus, is primarily due to the high incidence of complex cardiac anomalies. In case of surgically inseparable hearts, the decision to sacrifice one twin can be made. In such instances, surgery aims to separate the twins by ligating the aorta and vena cava from the sacrificed twins and placing the entire heath and vascular tree in the surviving twin.

In a study by Spitz and Al Rabeeah, it was noted that sharing of the heart was limited to the pericardium in only 3 of 13 and 1 of 7 thoracopagus twin sets, further evincing the improbability of survival. Most twins undergoing vascular separation do not survive for a prolonged period, and demise within 2-6 weeks of such procedure, despite sacrificing onward twin in favour of the other [2].

In a detailed description of management of conjoined twins, Bindlish and Sawal discuss the multiplex complications associated with surgical management [23]. Providing safe anesthesia is the primary challenge. The peculiar positioning and evident prematurity of babies renders intubation seriously difficult, requiring several attempts. While nasal intubation is ideal to maintain stability and adequate gas exchange during shifting, full arterial and central venous access is non-negotiable, and should be obtained for proper monitoring and massive transfusions [2],[24].

To expedite surgery and minimize risks of hypovolemic shock, studies compel the implementation of two separate, colour-coded surgical teams, each in charge of one twin. The procedure must be overlooked by a skilled pediatric surgeon, to ensure overall coordination [23]. Planning of separation of conjoined twins is essential, since massive intra-operative blood loss is ascertained. Its replacement is always taxing, given the futility of ascribing blood lost by each twin. To prevent these complications caused by shared veins, pre-operative evaluation of vascular shunts and cross-circulation is imperative. Imbalances in cross-circulation have significant implications on anesthetic pharmacology, causing adversities in resuscitation and end-organ failure [23],[24]. Angiographic imaging helps gauge the fraction of cardiac output shared between the twins, and assessing this factor is vital, because heparin dosing before CPB may be compromised owing to unequal blood flow distribution [24].

Additionally, pulse oximetry (used to determine oxygen saturation) and capnography must be employed jointly with regular BGA. In most cases, despite diligent monitoring of ECGs, urine output, fluid and electrolyte balances etc., conjoined twins frequently perish due to intra-operative and postoperative stress, associated deformities and/or a shortage of material to hide bodily flaws, resulting in fatal infections [23].

A clinical analysis of Siamese twins treated in Krakow, Poland, from 1977 to 2006, reported that among 19 sets of conjoined twins, 9 sets of twins passed away, and of the 10 sets that underwent surgical separation, only one of each pair of 8 sets survived. Both twins of a set succumbed, and graciously, both of one pair (split abroad) survived [23].

Emergency separation, although not recommended, is reserved for situations in which either one or both twins develop serious complications such as rupture of exomphalos, liver injuries causing tremendous blood loss, volvulus and necrosis of intestines, cardiac instabilities or death of one twin [2]. Following such instances, it is crucial that patients undergo rigorous monitoring, given the prolonged ventilation, sedation and possibility of sepsis [2],[23]. Other points of concern requiring caution include arrhythmias, cardiac arrest and vascular thrombosis. Sustained anesthesia, as is necessitated by these procedures, rouses risks of hypothermia and ventilatory failure. Radiation exposure, and greater need for contrast administration also pose sizeable threats to these neonatal patients [24]. Literature review implicates cardiovascular and respiratory failure as persistent major risk factors for death after separation, with twins suffering from severe respiratory distress requiring mechanical ventilation soon after birth [24].

A common misconception in understanding management of CHDs in conjoined twins is assuming treatment is only bifold - either termination of pregnancy or surgical separation. However, several non-operative and palliative measures are available, despite their limited efficacy. These include hemodynamic stabilization, medications such as diuretics and inotropes (used to manipulate the strength of cardiac contractions), PGE1 to maintain ductal patency, ventilatory support, oxygen therapy and treatment of sepsis.

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These methods are used in cases of cardiac anomalies that preclude surgical separation and the likelihood of reconstruction of even one working heart [2]. Palliative care aims to better twins' life quality and attempts to ease discomfort in unseparated twins. Although their functional independence depends upon the complexity of separation and persisting health issues, healthcare workers, psychologists and counsellors can work together with the patients' primary support system to ensure positive outcomes [25].

Surgery

The management of pregnancy includes termination of pregnancy, or expectant management should be discussed thoroughly. Termination of pregnancy is recommended when the heart is shared, and other anomalies present are complex. These anomalies are often seen through echocardiography and ultrasonography. This should be done with parental counselling. Every case requires an Individualized approach; according to published reports, separation by surgery has limited access.[23]

The type of surgery required depends on the location, extent of complexity, and anatomical structures involved in the fusion. They are categorized depending on the body part involved in the fusion and are added with the suffix pagus.[23] Thoracopagus is characterized by a fused chest and upper abdomen. According to some authors, thoracopagus twins may have exomphalos and share organs, for instance, the heart (75%), pericardium (90%), liver (100%), bile ducts (25%), and upper small intestine (50%). *The overall success rate of separation is around 50.6%. The first case of antenatal ultrasound (US) detection of conjoined twins was reported in 1977, and the earliest antenatal diagnosis has been reported at 12 weeks of age* [2]

Each patient has a tailored way of surgery with planning and a coordinated team strategy. Two teams, each for one twin, are set up. A specialized pediatric surgeon is usually responsible for all that's there. Before the surgery begins, a precise assessment of the twins' anatomy and blood supply should be done.[23] Emergency separation is done when complications like exomphalos, cardiac instability, volvulus and necrosis of intestine or death of one of the twins are expected. While elective separation is done when the twins are physiologically stable and may be extended from 3 months to 3 years, depending on each case.[2]

Outcome

According to reports emergency separation in conjoined twins' survival rate is about 30% and in elective separation is much higher, going up to 80%. Other elements, such as the separation technique used, closure of the wound and reconstruction method, play a role in the outcome.[2]

In thoracopagus twins, the atria rarely ever remain caudal to the ventricles; instead, the ventricles may lie ventral and caudal to the atria, and this may be correlated with cardiac anomalies, including atrioventricular septal defects, aortic stenosis, and anomalous pulmonary veins. The poor prognosis of thoracopagus twins is usually due to congenital cardiac anomalies. In cases when the two hearts are impossible to separate surgically, the decision to terminate one of the twins is made. The separation then is carried out by ligating the aorta and vena cava of the terminated twin, and the heart and vascular tree are secured within the surviving twin.[2]

One of the most common organs shared in thoracopagus twins is the liver. Hepatic veins draining into the vena cava separately make the separation smoother. Identifying the biliary anatomy before surgery may be challenging, as the anatomy of the biliary system is complex and often obstructed and is only evident during surgery.[27]

Ethical Considerations

The key ethical themes discussed include beneficence, non-maleficence, Autonomy, justice, consent and other ethical principles.

Beneficence and non-maleficence are most often connected, as they involve obtaining the balance between acting in a patient's best interest and avoiding harm. The surgery may benefit one of the twins, and there is a possibility of causing harm to the other one. This may be reduced when the separation is an emergency case or when separation is inevitable to ensure one of the twins survives.

Apart from survival, non-maleficence must be considered from other ethical viewpoints. An argument was formulated that separation may threaten one or both twins and may result in a limited quality of life. However, remaining conjoined may lead to social discrimination. The potential benefits should be weighed against the post-surgical prognosis and quality of life is suggested.[28]

Autonomy and Consent

In cases when the twins lack the capacity to decide and more dilemmas are present; the parents are given the autonomy to make the decision. The parents should be involved consistently and provided with all information about the case. Religious and cultural beliefs should be respected as well. In situations where agreement cannot be reached or where further support is required, the court might interfere.[28]

Justice

This focuses on equally distributing shared organs and survival opportunities. The gains and losses should be balanced while considering the least harmful option in the separation.[28]

Conclusion

Congenital cardiac disease in conjoined twins has a significant impact on prognosis, mortality and the viability of surgical separation. This review emphasizes that the main factors influencing clinical decision-making are heavily dependent on the degree of cardiac complication. Compared to twins with extensive intracardiac fusion or a single heart, twins with distinct hearts or limited pericardial sharing have better survival rates and prognoses.

Early diagnosis and perinatal planning have been significantly improved, vastly owing to developments in medical imaging, including high-resolution fetal ECG, MRI, CT, and even newer visualization technologies.

Management is quite arduous and requires a myriad of resources. Non-operative and palliative methods are a suitable option in situations where surgical correction is not feasible. However, separation after careful planning provides better results than any emergency treatment. Overall survival rates are still low despite growing improvements in operative care, which vastly highlights the ongoing burden of CHD in the general population.

Moreover, clinical treatment is closely tied to ethical consideration, especially in examples of situations in which specialists are forced to make judgments about timely intervention, termination or in the unfortunate cases in which the survival of one twin may require sacrificing another. So, to make ethically sound decisions, respect for parental autonomy must be weighed against the concepts of beneficence, non-maleficence and fairness.

In conclusion, the prognosis is still determined by the congenital heart condition, where early cardiac evaluation, imaging advancements and coordinated multidisciplinary care are all imperative for the best results. To improve prognosis and management strategies, future advancements will depend on uniform reporting of cardiac phenotypes and outcomes and further advancements in clinical research.

DISCLOSURE

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Ethical approval

Ethical approval was not required for this study

Declaration of patient consent

Patient's consent was not required as there are no patients in this study.

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Conflicts of interest

There are no conflicts of interest.

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