OUTCOMES OF VSD REPAIR ON PATIENTS WEIGHT LESS THAN 5 KG

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ABSTRACT:

Background: Congenital heart disease (CHD) is a range of structural anomalies of the heart, which affect around 1% of births. Individuals with CHD often require complex life-saving surgeries in infancy and lifetime follow-up. Very few studies have been focused on the relationship between the weight at repair and early and late outcomes. Most surgeons would prefer to correct the VSD before 6 months of age, however medical therapy is generally used in neonates, low weight young infants, and low birth-weight babies primarily because of technical concerns about the fragility of the common atrioventricular valve (CAVV) tissue.

Aim of the Work: to evaluate the impact of weight less than 5 kg at operation on mortality and morbidity in patients with ventricular septal defect undergoing surgical closure. We conducted a systematic review and meta-analysis of 5 studies including neonates with weight at surgery less than 5 kilograms.

Patients and Methods: Application of inclusion and exclusion criteria to study abstracts yielded 5 articles. A total of 20 studies were identified from the database search. After review, a total of 5 studies were selected.

Results: In the current study, we assessed the mortality rate among the five studies. The mortality rate among the five studies ranging from 0% to 4.16% Residual VSD ranged from 0% to 19.42%. The five studies ranged in publication from 2004 to 2021. There were three retrospective studies included in our systematic review and two prospective studies. There were 2933 neonates included in this study. The sample size ranged from 48 to 2473. Among them there were 1259 males and 1674 females.

Conclusion: In conclusion, despite the advancements in surgical devices and techniques, lower body weight was significantly associated with increased risks of the composite end point within 30 days after surgery. The risks of mortality from 0% to 4.16% Residual VSD ranged from 0% to 19.42% which could be a valid threshold with acceptable risk. These findings are useful for patient counseling and might aid in facilitating understanding of the risk of surgery.

Keywords: VSD.

INTRODUCTION:

Congenital heart disease is the second leading cause of death in infancy and childhood. Heart defects are among the most common congenital defects in neonates and childhood **(1)**.

The incidence of congenital heart defects is estimated at 4-8 per 1000 births**(2)**. Ventricular septal defect (VSD) is the most

common form of congenital heart disease (CHD)[3].

The 40% birth prevalence of isolated VSD worldwide is reported to vary from 2.6 to 5.0 per 1000 live births[4].

Although the roles of environmental and genetic factors in the pathogenesis of VSD have been identified[5]

The etiologies of VSD are not clear. Now, proteomic technique is an important to offer etiology study by providing an integrated view of diseases at the protein level at a certain time. The proteome reflects all proteins that may be related to certain genes and allows a more detailed status[6].

With an incidence of 2–5%, the ventricular septal defect (VSD) is the most common congenital malformation of the heart. Therefore, VSD repair is the most commonly performed pediatric cardiac operation[7].

Repair of VSD before age 2 can prevent damage to the heart and lungs. Without repair before age 2, the damage becomes permanent and gets worse over time. A study found that age did not increase the risk of complications, but younger age was associated with prolonged hospital stay. Lower age and weight could lead to difficult visualization and extensive dissection with an increased surgical risk and prolonged hospital stay. Despite these findings, the prognostic effect of age and weight of children with multiple VSDs remains controversial[8].

Recent reports have indicated a very low incidence of postoperative complications. Nevertheless complications still occur and it is important to identify associated risk factors. With the introduction of device closure of VSD, contemporary results of surgical repair are necessary to provide current benchmarks of treatment. It was found that young age (<6 months) and low bodyweight were risk factors for complications. This, however, contrasts with data published. Therefore, risk factors for a complicated course after VSD closure vary between canters[9].

Optimizing patient selection and timing for surgical intervention on VSD is obscured by a lack of a standardized definition of procedural variables and the paucity of multi-institutional studies. A small single-center study reported that young age (<6 months) and low body weight (<5 kg) are the major risk factors for complication. However, the contemporary outcomes in infants with VSD have not been studied extensively. As a consequence, the decision of when to offer corrective surgery for infants born with VSD is variable, and it remains challenging to define the patient parameters that provide the greatest probability of a successful outcome while minimizing the risk of complication[9].

The purpose of this study was to evaluate the results of surgical VSD closure and to evaluate weight as a risk factor for a complicated course. However, the risk analysis of these proteins relative to VSD and their diagnostic value has not been further assessed in these studies.

AIM OF THE WORK:

To evaluate the impact of weight less than 5 kg at operation on mortality and morbidity in patients with ventricular septal defect undergoing surgical closure. We conducted a systematic review and meta-analysis of 5 studies including neonates with weight at surgery less than 5 kilograms.

PATIENTS AND METHODS:

A systematic review of studies published in English between January 2004 and March 2021 was performed using the PubMed database (MEDLINE) with the following terms searched: “ventricular septal defect,” “surgical septal defect closure,” “neonatal,” and “less than 5 kg” From this search list, 20 studies were most relevant and fulfilled the predetermined criteria were selected

independently by 2 reviewers and entered into an electronic database (Table 1).

Ethical Consideration:

Prior consent from the patient to be part from this study. Consent from the surgeon to get information and use it in this study. Refer the citations to their original authors and avoid plagiarism**.**

Table (1): Studies selected using previous search words.

First author	Year of publication	Title
Bang[10]	2016	Detachment of the tricuspid valve for ventricular septal defect closure in infants younger than 3 months
Prifti[11]	2004	Repair of complete atrioventricular septal defects in patients weighing less than 5 kg
Ramgren[12]	2020	Long-term outcome after early repair of complete atrioventricular septal defect in young infants
Lee[13]	2021	Tricuspid valve detachment for ventricular septal defect closure in infants <5 kg: should we be hesitant?
Li[14]	2015	Safety and Efficacy of Ventricular Septal Defect Repair Using a Cosmetic Shorter Right Lateral Thoracotomy on Infants Weighing Less than 5kg
Alsoufi[15]	2015	Results of Primary Repair Versus Shunt Palliation in Ductal Dependent Infants With Pulmonary Atresia and Ventricular Septal Defect
Lee[16]	2020	Surgical Options for Pulmonary Atresia with Ventricular Septal Defect in Neonates and Young Infants
Dimagli[17]	2022	Surgical outcomes of post-infarct ventricular septal defect repair: Insights from the UK national adult cardiac surgery audit database.
Aydemir[18]	2013	Results for surgical closure of isolated ventricular septal defects in patients under one year of age
Amin[19]	2019	Early outcome of ventricular septal defect closure in infants under five kilograms of bodyweight
Ergün[20]	2019	Risk factors for major adverse events after surgical closure of ventricular septal defect in patients less than 1 year of age: a single-center retrospective
Hoque[21]	2019	Surgical Repair of VSD and their Short Term Outcome in a Tertiary Care Hospital
Inohara[9]	2019	The effect of body weight in infants undergoing ventricular septal defect closure: A report from the Nationwide Japanese Congenital Surgical Database
Cresti[22]	2017	Incidence and natural history of neonatal isolated ventricular septal defects: Do we know everything? A 6-year single-center Italian experience follow-up
Ashfaq[8]	2010	Is early correction of congenital ventricular septal defect a better option in a developing country
Anderson[23]	2013	Contemporary outcomes of surgical ventricular septal defect closure
Liu[24]	2018	Evaluation of Different Minimally Invasive Techniques in Surgical Treatment for Ventricular Septal Defect
Parikh[25]	2019	Incidence of ESKD and Mortality among Children with Congenital Heart Disease after Cardiac Surgery
Sakai-Bizmark[26]	2019	Impact of pediatric cardiac surgery regionalization on health care utilization and mortality
Shi[27]	2007	Surgical treatment for ventricular septal defect in infants under 5 kg of body weight

Prospective and retrospective (randomized and nonrandomized) studies reporting data on closure of congenital VSD in infant with weight less than 5 kilograms, using any type of device, and with well-defined follow-up (based on electrocardiographic and echocardiographic assessments) were included.

We excluded single-case studies, series of cases of fewer than 5 patients, and studies on acquired post–myocardial infarction or posttraumatic VSD. Studies without follow-up or with a significant lack of data were also excluded. To avoid potential duplicate or overlap- ping results, the list of all studies selected in the first step were reviewed by 2 authors and another one so far not involved in study selection. In that step, 6 duplicated studies were found and excluded.

The whole detailed process used for study screening and selection is illustrated in the PRISMA flow diagram (Figure 7). Application of inclusion and exclusion criteria to study abstracts yielded 8 articles. A total of 200 studies were identified from the database search. After review, a total of **5** studies were selected.

Successful implantation was defined as correct and stable placement with satisfactory effects confirmed by imaging. The success rate was obtained from the articles that featured this information or otherwise calculated.

Types of outcome measures:

hospital stay, residual VSD, re-exploration and mortality.

Statistical Considerations:

we computed weighted estimates and 95% confidence intervals (CIs) of morbidity, intensive care unit duration, and residual VSD by random-effects meta-regression analysis. We computed χ^2 and I^2 statistics of heterogeneity. An I^2 value >50 was considered indicated the presence of heterogeneity. Pooled risk ratios were calculated using a random-effects model to obtain a robust estimate of morbidity, intensive care unit duration, and residual VSD. In contrast to classic regression, in meta-regression the smallest unit of observation is the individual study, not the individual patient. Random-effects modeling accounts for both within- and between-study variability.

Higgins I-squared (I^2) statistical model was used to assess variations in outcomes of the included studies. I^2 less than 40% corresponded to low heterogeneity. Depending upon the strength of evidence for heterogeneity (P value from the Chi-square analysis), I^2 of 41-74% indicated moderate (P = 0.05) or moderate to severe (P = 0.05), and I^2 of 75% or higher suggested substantial heterogeneity.

Publication bias was illustrated graphically using a funnel plot. The methodological quality assessment of the included RCTs was performed using the Cochrane collaboration tool for the systematic review and meta-analysis, where each study was screened for five different types of bias (selection, performance, detection, attrition, and reporting bias). All statistical analysis was performed using the Digitize and the Cochrane Review Manager (RevMan) version 5.3.

RESULTS

Study selection: application of inclusion and exclusion criteria to study abstracts yielded 5 articles. A total of 200 studies were identified from the database search. After review, a total of 5 studies were selected. The PRISMA flowchart can be seen in Figure 1.

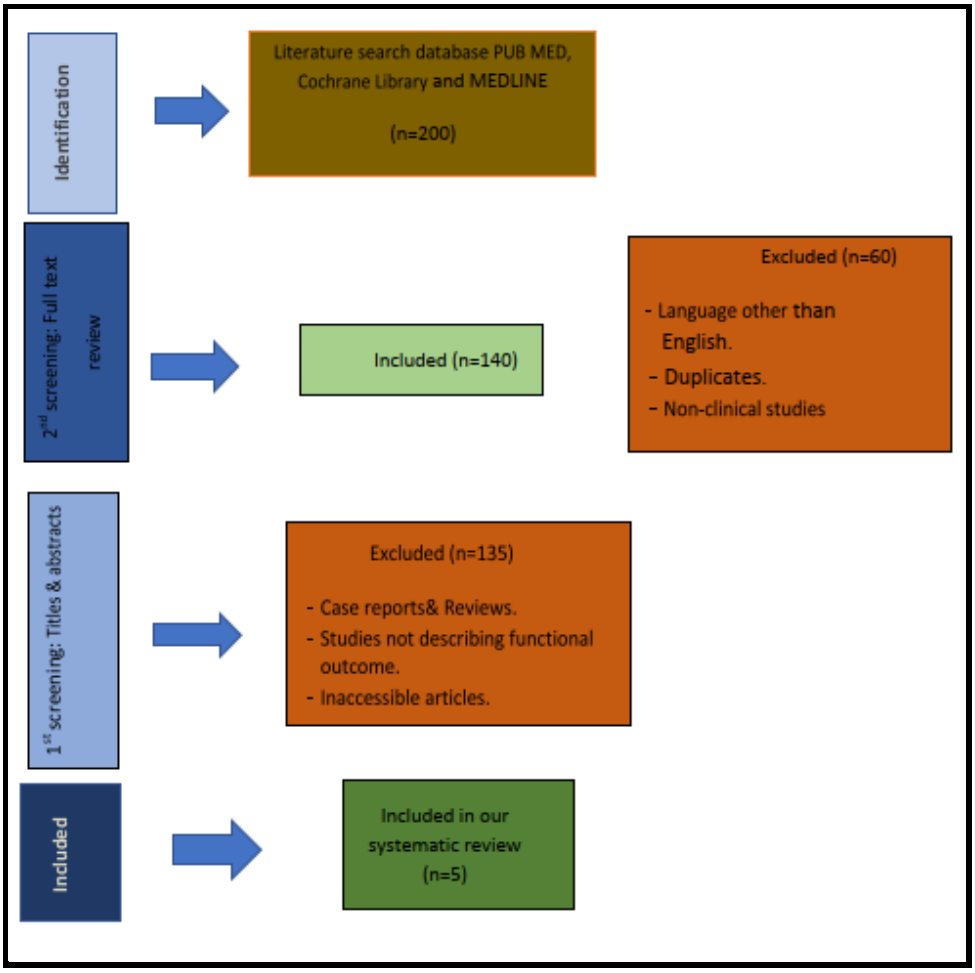

Figure (1): PRISMA flow diagram of eligible studies

Table (2): Summary of basic characteristics of the 5 studies included in our study.

First author	Weight (kg)	Year of publication	Type of study	Sample size (n)	Mean age (months)	Gender		Other diseases
						Male	Female	
Aydemir[18]	4.2	2013	Retrospective	177	5	86	91	NM
Amin[19]	4.4	2019	Prospective	48	5.9	16	32	Down syndrome=6
Ergün[20]	4.4	2019	Retrospective	185	5	98	87	Genetic syndromes =68(36.8%)
Hoque[21]	4.6	2019	Prospective	50	≤6months=28 (56%) >6months=22 (44%)	22	28	Pulmonary valve stenosis=4
Inohara[9]	4.00	2019	Retrospective	2473	7.4	1037	1436	Chromosomal abnormality =762

The basic characteristics of the studies included in this systematic review were showed in table 2. The five studies ranged in publication from 2013 to 2019. There were three retrospective studies included in our systematic review and two prospective studies. There were 2933 neonates included in this study. The sample size ranged from 48 to 2473. Among them there were 1259 males and 1674 females. In three studies **[25,26,8]** showed that patients had genetic syndromes.

Table (3): Literature appraisal using MINORS assessment tool.

First author	A clearly stated aim	Inclusion of consecutive patients	Prospective collection of data	Appropriate endpoints	Unbiased assessment of study endpoint	Appropriate follow-up period	Loss to follow-up less than 5%	Prospective calculation of study size	Total
Adymeir	2	2	0	2	1	1	2	0	10
Amin	2	2	2	1	1	2	2	0	12
Ergün	2	2	0	2	2	2	2	0	12
Hoque	2	2	2	2	1	2	2	0	13
Inohara	2	2	0	2	2	2	2	0	12

Results of the quality assessment using the MINORS tool can be seen in Table 6. The MINORS score the 5 included studies ranging from 10 to 13 out of 16 (Table 3).

Table (4): Preoperative measurements among the 5 studies.

First author	Weight (kg)	VSD size (mm)	VSD type	Pulmonary HTN
Aydemir[18]	4.2	Large=108 Moderate=60 Small=9	Perimembranous=150 Doubly committed juxta-arterial=13 Inlet=7 Muscular=5 Multiple=2	155(87.6%)
Amin[19]	4.4	8.61±2.28	Perimembranous=38 Muscular=7 Aubpulmonic=3	42(87.5%)
Ergün[20]	4.4	NM	Perimembranous=167 Doubly committed=4 Muscular=14	128(69.2%)
Hoque[21]	4.6	NM	Perimembranous=46 Doubly committed=4	NM
Inohara[9]	4.00	NM	Perimembranous=2079 Infundibular=185 Inlet=79 Muscular=78 Multiple=52	NM

In this review, patients had mean weight less than 5kg. Most of patients had peri-membranous, VSD followed by muscular type then doubly committed. ***Adymeir et al.*** **[18]** had Peri membranous 150, Doubly committed=13 and Muscular 5. ***Amin et al.*** **[19]** had peri membranous= 38 and muscular= 7. ***Ergun et al.*** **[20]** had perimembranous=167, doubly committed=4 and muscular=14. ***Hogue et al.*** **[21]** had perimembranous=46, and doubly committed=4. ***Ihohara et al.*** **[9]** had perimembranous=2079, infundibular=185, inlet=79, muscular=78 and multiple=52 (Table 4). Among three studies **[38–40]** more than half of patients had pulmonary hypertension.

Table (5): Operative data among the 5 included studies.

First author	Approach to VSD	Repair technique	Aortic cross clamp time (min)	Bypass time (min)	Operative time (min)
Aydmeir	Transpulmonary approach=177	Continuous closure with (PTFE) patch material	51.2±34.3	75±26.3	NM
Amin	Transatrial approach=43 Transpulmonary approach=5	Direct closure=4 Closure by bovine precaradiac patch= 6 Closure by gortex patch=38	45.75 ± 6.24	60.19 ± 6.15	142.02±13.44
Ergün	Transpulmonary approach=185	All VSDs were closed using a native pericardial patch and running suture technique	60.2±17.6	86.0±22.8	NM
Hoque	Transpulmonary approach=177	Patch repair=50	35 ± 6.85	70 ± 13.7	NM
Inohara	NM	VSD closure= 1884 Pulmonary artery banding=589	NM	NM	NM

Table 5 found that, most of studies patients were operated through transpulmonary approach, while in ***Amin et al.*** **(24)** patients were operated through transarterial approach. Aortic cross clamp time ranged from 35 to 60.2 minutes and bypass time from 60 to 86 minutes.

Table (6): Post-operative data among the 5 included studies.

First author	Postop mechanical ventilation (days)	Postop ICU stay (days)	Postop length of stay (days)
Adymeir	1.5±1.5	2.7±5	7.7±8.5
Amin	1.6 ± 2.1	10.50 ± 5.99	0.60 ± 1.36
Ergün	1.5(1-2)	3 (1-120)	7(5-27)
Hoque	0.4 (0-26)	3 ± 2	6 (3-43)
Inohara	NM	right lateral thoracotomy, median sternotomy	15 (11-23)

Postoperative mechanical ventilation ranged from 0 to 26 days. The mean intensive care admission was ranging from 1 to 120 days, while postoperative stay ranged from 3 to 43 days (Table 6).

Table (7): Post-operative complications among the 5 studies.

First author	Early reoperation	Mortality	Morbidity	Cardiac complications	Residual VSD
Adymeir	2(1.1%)	4(2.3%)	11(6.2%)	NM	0(0%)
Amin	3(6.25%)	2(4.16%)	Needed a blood transfusion=21(43.75%) PH=7(14.58%) Postoperative chest infection=5(10.4%	Temporary heart block postoperatively=5 (10.4%)	5(10.42%)
Ergün	6(3.2%)	0(0%)	Delayed sternal closure=4 (2.2%) Reintubation=12(6.5%) Infection=10(5.4%) Neurological event=0(0%) Respiratory event=19(10.2%) Renal failure=0(0%) Wound infection=2(1.1%) PH=9(4.9%)	Arrhythmia=17(9.9%) Decrease in left ventricular functions=2(1.1%)	6(3.2%)
Hoque	1(2%)	0(0%)	Chylothorax=1(2%)	Transient heart block=1(2%)	2(4%)
Inohara	80(3.3%)	18(0.7%)	Pulmonary hypertensive crisis=25(1%) Respiratory complication=50(2%) Acute renal failure=3(0.1%) Neurological complications=11(0.5%) Mediastinitis=14(0.6%) Deep wound infection=6(0.2%)	Cardiac arrest=16(0.6%) Circulatory instability requiring mechanical support=6(0.2%) Arrhythmia =13(0.5%)	NM

The mortality rate among the five studies ranging from 0% to 4.16% Residual VSD ranged from 0% to 19.42% (Table 7).

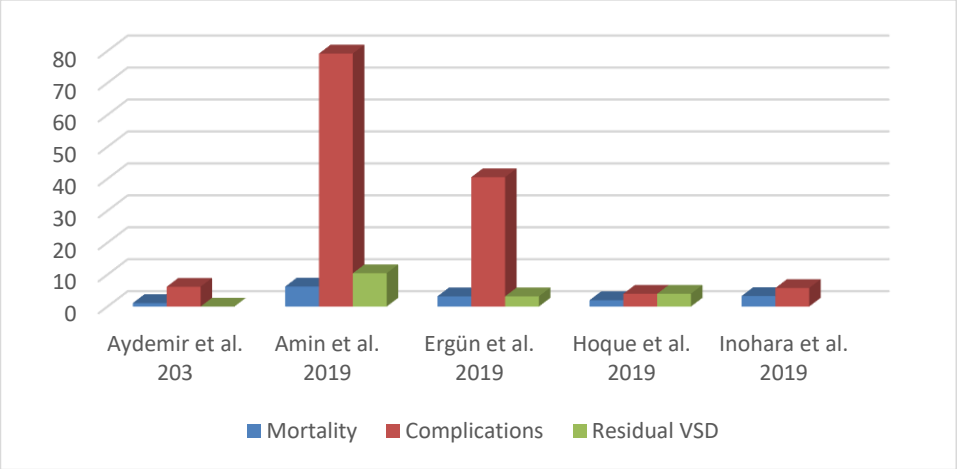

Figure (2): Prevalence of mortality, complications and residual VSD among 5 included studies.

A total of 3 studies allowed for estimating the weighted risk ratio between mortality rate. There was no significant heterogeneity across studies (I^2= 57%; P =0.10). The overall effect

was not statistically significant (p= 0.69). The pooled odds ratio for mortality rate as an outcome for surgical treatment of VSD among neonates with weight less than 5 Kg 2.25 {1.07, 4.73} (Figure 3).

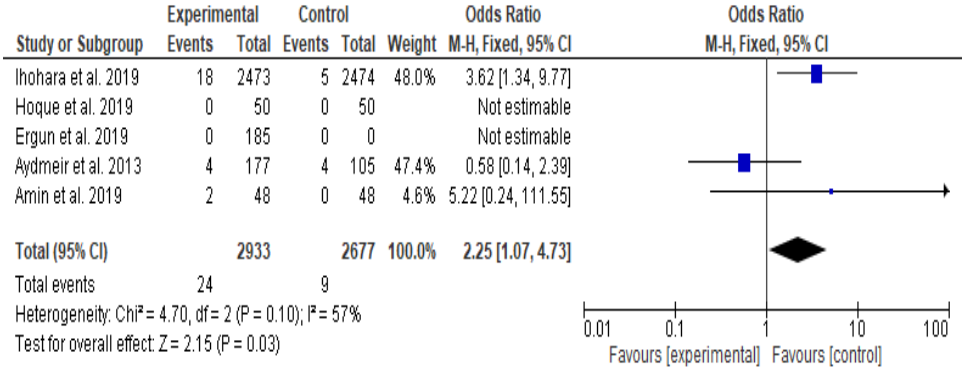

Figure (3): Random-effects meta-analysis of the mortality rate among 5 included studies.

A total of 4 studies allowed for estimating the weighted risk ratio between morbidity rate. There was no significant heterogeneity across studies (I^2= 0%). The overall effect was not statistically significant (p= 0.822). The pooled odds ratio for morbidity rate as an outcome for surgical treatment of VSD among neonates with weight less than 5 Kg 1.1 (Figure 9).

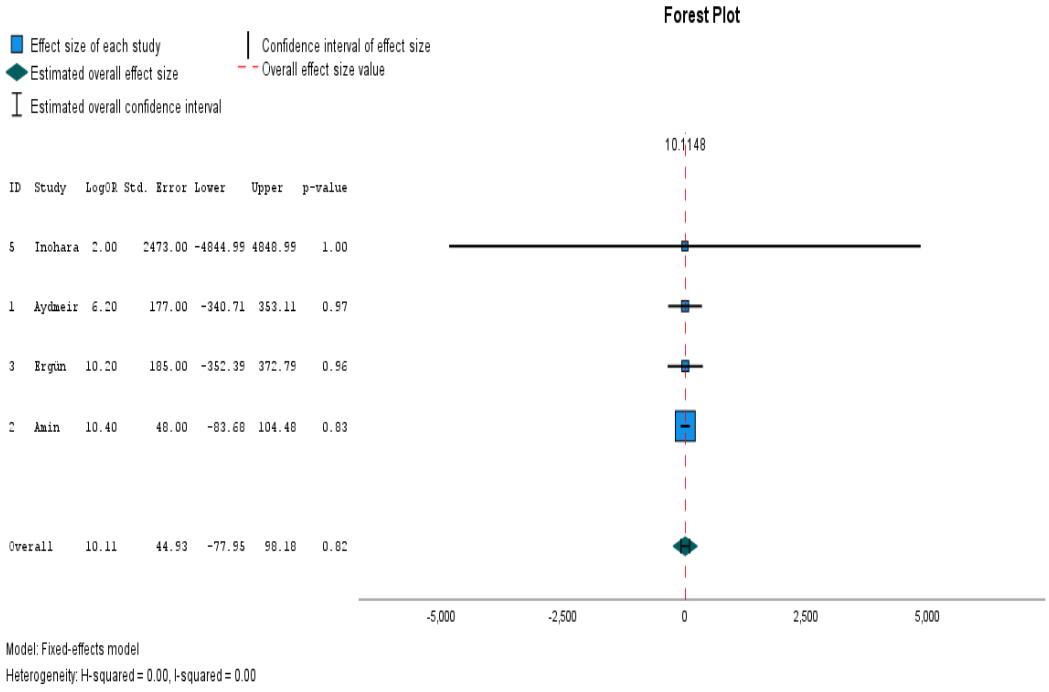

Figure (4): Random-effects meta-analysis of the morbidity rate among 5 included studies.

DISCUSSION:

Congenital heart disease (CHD) is the most common congenital malformation and 1 leading cause of infant mortality. The global incidence rate of CHD is 6.8 to 9.0 per 1000 live births [28]. Ventricular septal defect (VSD) is the most common CHD

occurring in about 30% of neonates with CHD and 7% to 10% in utero[29].

VSD may be isolated or multiple and is commonly associated with other cardiac defects. In fetal life, the association of VSD with chromosomal anomalies is about 10% to 30%, depending on the type and size of the defect[28]. This rate is significantly higher than after birth, mainly if the defect is large and extends to the inlet septum or, even, when associated with extracardiac defects[29].

VSD is one of the most common types of congenital heart malformation and is usually accompanied by cardiac capacity overload, pulmonary arterial hypertension, congestive heart failure, infectious endocarditis, and even Eisenmenger syndrome, some of which can be life-threatening [30].

Although patient outcomes after surgical closure of the VSD are excellent in terms of mortality and morbidity rates, risks of heart block or a residual shunt remain, which could be attributed to inadequate exposure of the defect. Exposure of the whole margin of the VSD, while preserving tricuspid valve (TV) function and the conduction axis, is a prerequisite for the successful repair of a VSD [31].

Very few studies have been focused on the relationship between the weight at repair and early and late outcomes. Most surgeons would prefer to correct the VSD before 6 months of age, however medical therapy is generally used in neonates, low weight young infants, and low birth-weight babies primarily because of technical concerns about the fragility of the common atrioventricular valve (CAVV) tissue [25].

During the last decades, surgical repair of ventricular septal defect (VSD) has progressively been undertaken earlier in life in order to avoid pulmonary hypertension and premature death. This has resulted in elective repair of VSD at 3-6 months of age as the contemporary standard management in many pediatric cardiac surgery centers. Early mortality using this approach has been reported to be less than 3.0% with a survival of approximately 90% at 10-year follow-up[32].

This systematic review aimed to evaluate the impact of weight less than 5 kg at operation on mortality and morbidity in patients with ventricular septal defect undergoing surgical closure. We conducted a systematic review of 5 studies including neonates with weight at surgery less than 5 kilograms.

The five studies included in this systematic review ranged in publication from 2013 to 2019. There were three retrospective studies included in our systematic review and two prospective studies. There were 2933 neonates included in this study. The sample size ranged from 48 to 2473. Among them there were 1259 males and 1674 females. In three studies [25,26,8] showed that patients had genetic syndromes.

In the current study, we assessed the mortality rate among the five studies. The mortality rate among the five studies ranging from 0% to 4.16% Residual VSD ranged from 0% to 19.42%.

A study by ***Parikh et al.*** demonstrated that the rates of mortality and morbidity are high in children undergoing congenital heart surgery. According to an observational cohort study, the mortality rate was about 5% in pediatric patients undergoing cardiac surgery during a 10-year follow-up and was much higher than that of the group of children without CHD and not undergoing surgery (0.1%)[25].

A study by ***Inohara et al.*** investigating the association between body weight at the time of surgery and in-hospital outcome in patients diagnosed with VSD who underwent surgical intervention at younger than 1 year of age. First, surgical

interventions were safely performed, and most cases (94.2%) were uncomplicated. Second, a lower body weight was consistently associated with a higher rate of composite end point including death and/or major complications within 30 days after surgery[9].

The rate of composite end point decreased along with increasing body weight and plateaued at approximately >4.5 kg, which could be a valid threshold for body weight at surgery with acceptable risks. Importantly, cases with approximately <4.5 kg of body weight had greater predicted risk regardless of age, suggesting that body weight might be a more decisive factor for a composite end point. Finally, PAB is still commonly used before surgical VSD closure or for the purpose of palliation in Japan, and its related mortality was 1.4% [9].

In contrast ***Meyer et al. (2017)*** declined that the patients with younger age (<1 year) suffered higher 30-day mortality following cardiac surgery than those with older age [32].

Also, the model by ***Crowe et al.*** across the spectrum of predicted risk, but there was evidence of underestimation of mortality risk in neonates undergoing operation from 2007[33].

In the current review, postoperative mechanical ventilation ranged from 0 to 26 days. The mean intensive care admission was ranging from 1 to 120 days, while postoperative stay ranged from 3 to 43 days.

The hospital stay in another series was affected by the age, weight, and number of VSDs closed [33]. Anderson and colleagues found a nearly double-fold increase in the length of hospital stay in patients who had repair below 6 months of age, and every 1-kg increase in the patients' weight decreased hospital stay by 2 days [23]. Similarly, a study found that age did not increase the risk of complications, but younger age was associated with prolonged hospital stay. Lower age and weight could lead to difficult visualization and extensive dissection with an increased surgical risk and prolonged hospital stay. Despite these findings, the prognostic effect of age and weight of children with multiple VSDs remains controversial [8].

Another study by Shi et al. from January 2000 to December 2005, 134 children patients with VSD and associated anomalies, who were under 5 kg of body weight and aged (3.9±1.9) months. One case died of arrhythmia and heart failure in the early stage of postoperation (mortality 0.7%). The most common postoperative complications were pneumonia [14], pulmo-nary hypertensive crisis [6], arrhythmia[4], low cardiac output[4], dropsy of thoracic cavity[1]. Followed up for 6 m-6 y, the development of all 133 cases was well. Two children with residual shunt got a spontaneous closure confirmed by echocardiography one year postoperatively [27].

In neonates with VSD, initial postnatal palliation with staged repair is more frequently practiced than performing an early primary repair. However, high operative and interstage mortality rates following a palliative procedure may be a rationale for attempting an initial primary repair [35].

Another studies reported that although current surgical outcomes of isolated VSD are excellent with low mortality and morbidity, young age and LW at the time of operation remain significant risk factors for poor patient outcomes [23&36].

Nonetheless, ***Bang et al.*** compared between group 1 neonates with VSD and detached tricuspid valve replacement while it was not detached in group 2. They revealed that TVD could be used safely for better exposure of the VSD without an increased risk of TR, even in infants younger than 3 months[10].

Lee et al. compared between infants <5 kg with VSD without more complex intracardiac lesions and who had undergone

VSD closure through the trans-atrial approach. They demonstrated that TVD can be safely performed, even in infants <5 kg[13].

With the appropriate indication, our results suggest that TVD may be a reasonable and valid option that has the advantage of providing better exposure to the VSD margin for successful VSD closure without causing morbidities, including TR progression. In addition, we believe that TVD might be considered more flexibly in infants with LW if VSD margin exposure is difficult to achieve [37].

We found that, most of studies patients were operated through transpulmonary approach, while in ***Amin et al.***[31] 43 patients were operated through transarterial approach. Aortic cross clamp time ranged from 35 to 60.2 minutes and bypass time from 60 to 86 minutes.

Also, ***Li et al.*** compared between infants who underwent a right lateral thoracotomy (right group) and 116 infants who underwent a median sternotomy (median group). They demonstrated that a shorter right lateral thoracotomy in infants provides adequate exposure to accurately repair VSD with excellent cosmetic and functional outcomes[38].

Similar operative and recovery processes were seen for right lateral thoracotomy and median sternotomy, without an increase in lung injury. Moreover, shorter incisions, and decreased drainage and blood transfusions show case the advantages of the right lateral thoracotomy approach as do excellent follow-up results. There was no early death among both groups [38].

Another study aimed to describe the trends and the risk factors associated with surgical VSD repair outcomes and to provide a clinical benchmark for percutaneous VSD closure strategies. Using the UK National Adult Cardiac Surgery Audit database, 1010 patients undergoing surgical VSD repair from 1996 to 2018. Both the number of surgical VSD repair and the mortality rate did not change significantly over the 23-year timeframe. Operative mortality was 38.9% overall and was higher when patients were operated within the first 6 h (75%) or the first 24 h (61.3%). Moreover, the mortality rate was similar among patients undergoing isolated VSD repair and VSD repaired combined with surgical coronary revascularization alone or with concomitant mitral valve procedures [17].

There were limitations in this systematic review resulting from limitations in the available evidence. The limited number of the studied cases and unavailability of a comparative study group with elder age and bigger weights as the policy in department is that all the VSDs are operated once presented to hospital, an ICU policy should be adopted to avoid unnecessary prolonged postoperative mechanical ventilation. In addition, the availability of a postoperative ward to avoid unnecessary postoperative ICU stay. Most of studies were retrospective studies. This due to was very few studies have been focused on the relationship between the weight at repair and early and late outcomes.

Conclusion:

In conclusion, despite the advancements in surgical devices and techniques, lower body weight was significantly associated with increased risks of the composite end point within 30 days after surgery. The risks of mortality from 0% to 4.16% Residual VSD ranged from 0% to 19.42% which could be a valid threshold with acceptable risk. These findings are useful for patient counseling and might aid in facilitating understanding of the risk of surgery.

Conflict of Interest:

The authors declared that there is no conflict.

REFERENCES:

1. **Chou HH, Chiou MJ, Liang FW et al.** Association of maternal chronic disease with risk of congenital heart disease in offspring. CMAJ [Internet]. 2016/10/11. 2016; 188(17–18):E438–46.
2. **Kucik JE, Nembhard WN, Donohue P et al.** Community socioeconomic disadvantage and the survival of infants with congenital heart defects. Am J Public Health [Internet]. 2014/09/11. 2014; 104(11):e150–7.
3. **Hoffman JIE.** Incidence of congenital heart disease: I. Postnatal incidence. Pediatr Cardiol [Internet]. 1995; 16(3): 103–13.
4. **van der Bom T, Zomer AC, Zwinderman AH et al.** The changing epidemiology of congenital heart disease. Nat Rev Cardiol [Internet]. 2010;8(1):50–60.
5. **Vecoli C, Pulignani S, Foffa I et al.** Congenital heart disease: the crossroads of genetics, epigenetics and environment. Curr Genomics [Internet]. 2014 Oct;15(5):390–9.
6. **Garg V, Kathiriya IS, Barnes R et al.** GATA4 mutations cause human congenital heart defects and reveal an interaction with TBX5. Nature [Internet]. 2003;424(6947):443–7.
7. **Roguin N, Du ZD, Barak M et al.** High prevalence of muscular ventricular septal defect in neonates. J Am Coll Cardiol [Internet]. 1995;26(6):1545–8.
8. **Ashfaq A, Zia HA, Amanullah MM.** Is early correction of congenital ventricular septal defect a better option in a developing country. J Pak Med Assoc. 2010;60(4):324.
9. **Inohara T, Ichihara N, Kohsaka S et al.** The effect of body weight in infants undergoing ventricular septal defect closure: A report from the Nationwide Japanese Congenital Surgical Database. J Thorac Cardiovasc Surg [Internet]. 2019; 157(3):1132-1141.e7.
10. **Bang JH, Park CS, Park JJ et al.** Detachment of the tricuspid valve for ventricular septal defect closure in infants younger than 3 months. J Thorac Cardiovasc Surg [Internet]. 2016;152(2): 491–6.
11. **Prifti E, Bonacchi M, Bernabei M et al.** Repair of complete atrioventricular septal defects in patients weighing less than 5 kg. Ann Thorac Surg [Internet]. 2004;77(5):1717–26.
12. **Ramgren JJ, Nozohoor S, Zindovic I et al.** Long-term outcome after early repair of complete atrioventricular septal defect in young infants. J Thorac Cardiovasc Surg [Internet]. 2021;161(6):2145–53.
13. **Lee JH, Cho S, Kwak JG et al.** Tricuspid valve detachment for ventricular septal defect closure in infants <5 kg: should we be hesitant? Eur J Cardio-Thoracic Surg [Internet]. 2021;60(3):544–51.
14. **Li G, Su J, Fan X et al.** Safety and Efficacy of Ventricular Septal Defect Repair Using a Cosmetic Shorter Right Lateral Thoracotomy on Infants Weighing Less than 5kg. Hear Lung Circ [Internet]. 2015;24(9):898–904.
15. **Alsoufi B, Mori M, McCracken C et al.** Results of Primary Repair Versus Shunt Palliation in Ductal Dependent Infants With Pulmonary Atresia and Ventricular Septal Defect. Ann Thorac Surg [Internet]. 2015;100(2):639–46.
16. **Lee WY, Kang SR, Im YM et al.** Surgical Options for Pulmonary Atresia with Ventricular Septal Defect in Neonates and Young Infants. Pediatr Cardiol [Internet]. 2020/05/06. 2020 Jun; 41(5):1012–20.
17. **Dimagli A, Guida G, Sinha S et al.** Surgical outcomes of post-infarct ventricular septal defect repair: Insights from the UK national adult cardiac surgery audit database. J Card Surg. 2022 Apr;37(4):843–52.

18. **Aydemir NA, Harmandar B, Karaci AR et al.** Results for surgical closure of isolated ventricular septal defects in patients under one year of age. J Card Surg Incl Mech Biol Support Hear Lungs. 2013;28(2):174–9.
19. **Amin S, Salah T.** Early outcome of ventricular septal defect closure in infants under five kilograms of bodyweight. J Am Sci. 2019; 15:92–7.
20. **Ergün S, Genç SB, Yildiz O et al.** Risk factors for major adverse events after surgical closure of ventricular septal defect in patients less than 1 year of age: a single-center retrospective. Brazilian J Cardiovasc Surg. 2019;34:335–43.
21. **Hoque KZ, Chowdhury MG, Islam A et al.** Surgical Repair of VSD and their Short Term Outcome in a Tertiary Care Hospital. Age (Omaha). 2019;5600:2000–86000.
22. **Cresti A, Giordano R, Koestenberger M et al.** Incidence and natural history of neonatal isolated ventricular septal defects: Do we know everything? A 6-year single-center Italian experience follow-up. Congenit Heart Dis [Internet]. 2017;13(1):105–12.
23. **Anderson BR, Stevens KN, Nicolson SC et al.** Contemporary outcomes of surgical ventricular septal defect closure. J Thorac Cardiovasc Surg [Internet]. 2013; 145(3): 641–7.
24. **Liu H, Wang Z, Xia J et al.** Evaluation of Different Minimally Invasive Techniques in Surgical Treatment for Ventricular Septal Defect. Hear Lung Circ [Internet]. 2018;27(3):365–70.
25. **Parikh CR, Greenberg JH, McArthur E et al.** Incidence of ESKD and Mortality among Children with Congenital Heart Disease after Cardiac Surgery. Clin J Am Soc Nephrol [Internet]. 2019/09/09. 2019; 14(10):1450–7.
26. **Sakai-Bizmark R, Mena LA, Kumamaru H et al.** Impact of pediatric cardiac surgery regionalization on health care utilization and mortality. Health Serv Res [Internet]. 2019/03/27. 2019; 54(4):890–901.
27. **Shi Z, Shu Q, Zhang Z wei.** [Surgical treatment for ventricular septal defect in infants under 5 kg of body weight]. Zhejiang da xue xue bao Yi xue ban = J Zhejiang Univ Med Sci. 2007; 36(6):610–3.
28. **Pahuja M, Schrage B, Westermann D et al.** Hemodynamic effects of mechanical circulatory support devices in ventricular septal defect: results from a computer simulation model. Circ Hear Fail. 2019;12(7):e005981.
29. **Bravo-Valenzuela NJ, Peixoto AB, Júnior EA.** Prenatal diagnosis of congenital heart disease: a review of current knowledge. Indian Heart J. 2018;70(1):150–64.
30. **Huang XS, Luo ZR, Chen Q et al.** A Comparative study of perventricular and percutaneous device closure treatments for isolated ventricular septal defect: A chinese single-institution experience. Brazilian J Cardiovasc Surg. 2019; 34: 344–51.
31. **Gałeczka M, Knop M, Fiszer R et al.** Late complete atrioventricular block after hybrid perimembranous ventricular septal defect closure in a neonate. Kardiol Pol [Internet]. 2018;76(10):1494.
32. **Meyer HM, Thomas J, Wilson GS et al.** Anesthesia-related and perioperative mortality: An audit of 8493 cases at a tertiary pediatric teaching hospital in South Africa. Pediatr Anesth [Internet]. 2017;27(10):1021–7.
33. **Crowe S, Brown KL, Pagel C et al.** Development of a diagnosis- and procedure-based risk model for 30-day outcome after pediatric cardiac surgery. J Thorac Cardiovasc Surg [Internet]. 2013; 145 (5):1270–8.

34. **Alshehri AA, Alshehri AM, Muthanna AA et al.** Long-term surgical outcomes after repair of multiple ventricular septal defects in pediatrics. Cardiothorac Surg [Internet]. 2021;29(1):20.

35. **Dodd JK, Jørgensen FS, Søndergaard L.** Live-Born Major Congenital Heart Disease in Denmark Incidence, Detection Rate, and Termination of Pregnancy Rate From 1996 to 2013. 2018;3(9):829–37.

36. **Scully BB, Morales DLS, Zafar F et al.** Current Expectations for Surgical Repair of Isolated Ventricular Septal Defects. Ann Thorac Surg [Internet]. 2010; 89(2): 544–51.

37. **Lee, Hong J, Cho S et al.** Tricuspid valve detachment for ventricular septal defect closure in infants < 5 kg : should we be hesitant ? 2021; 00(October 2020):1–8.

38. **Li G, Su J, Fan X et al.** Safety and Efficacy of Ventricular Septal Defect Repair Using a Cosmetic Shorter Right Lateral Thoracotomy on Infants Weighing Less than 5 kg. Hear Lung Circ. 2015; 1–7.

النتائج لعمليات اصلاح الثقب بين البطينين في الاطفال اقل من ٥ كيلوجرامات وزن

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الخلفية: أمراض القلب الخلقية هي مجموعة من التشوهات الهيكلية للقلب ، والتي تؤثر على حوالي 1٪ من المواليد. غالبًا ما يحتاج الأفراد المصابون بأمراض القلب التاجية إلى عمليات جراحية معقدة منقذة للحياة في مرحلة الطفولة ومتابعة مدى الحياة. ركزت دراسات قليلة جدًا على العلاقة بين الوزن عند الإصلاح والنتائج المبكرة والمتأخرة. يفضل معظم الجراحين تصحيح عيب الحاجز البطيني قبل 6 أشهر من العمر ، ومع ذلك ، يتم استخدام العلاج الطبي بشكل عام عند حديثي الولادة ، والأطفال الصغار منخفضي الوزن ، والأطفال منخفضي الوزن عند الولادة بشكل أساسي بسبب المخاوف الفنية بشأن هشاشة الصمام الأذيني البطيني الشائع منديل.

الهدف من العمل: لتقييم تأثير وزن أقل من 5 كجم عند العملية على الوفيات والمراضة في المرضى الذين يعانون من عيب الحاجز البطيني الذين يخضعون لإغلاق جراحي. أجرينا مراجعة منهجية وتحليل تلوي لـ 5 دراسات بما في ذلك حديثي الولادة الذين تقل أوزانهم عن 5 كيلوغرامات في الجراحة.

المرضى والطرق: أسفر تطبيق معايير التضمين والاستبعاد لدراسة الملخصات عن 5 مقالات. تم تحديد ما مجموعه 20 دراسة من البحث في قاعدة البيانات. بعد المراجعة ، تم اختيار ما مجموعه 5 دراسات.

النتائج: في الدراسة الحالية ، قمنا بتقييم معدل الوفيات بين الدراسات الخمس. تراوح معدل الوفيات بين الدراسات الخمس من 0٪ إلى 4.16٪ المتبقية من 0٪ إلى 19.42٪. تراوحت الدراسات الخمس في النشر من 2004 إلى 2021. كانت هناك ثلاث دراسات بأثر رجعي متضمنة في مراجعتنا المنهجية ودراستين مستقبليتين. كان هناك 2933 مولودًا مشمولين في هذه الدراسة. تراوح حجم العينة من 48 إلى 2473. وكان من بينهم 1259 ذكرًا و 1674 أنثى.

الخلاصة: في الختام ، على الرغم من التطورات في الأجهزة والتقنيات الجراحية ، ارتبط انخفاض وزن الجسم بشكل كبير بزيادة مخاطر نقطة النهاية المركبة في غضون 30 يومًا بعد الجراحة. تراوحت مخاطر الوفيات من 0 ٪ إلى 4.16 ٪ المتبقية من 0 ٪ إلى 19.42 ٪ والتي يمكن أن تكون عتبة صالحة مع مخاطر مقبولة. هذه النتائج مفيدة في تقديم المشورة للمرضى وقد تساعد في تسهيل فهم مخاطر الجراحة.