Turkish Journal of Pediatric Surgery 2026;40(1):8-15
https://doi.org/10.62114/JTAPS.2026.216

Turkish Journal of Pediatric Surgery

Original Article

OPEN ACCESS

Comparison of laparoscopic transfascial knot tying and open repair of Morgagni hernia

Tunç Tığlı, Tutku Soyer, Özlem Boybeyi

Morgagni hernia (MH) is a rare defect located in the anterior-central (retrosternal) portion of the diaphragm, comprising approximately 3-5% of all congenital diaphragmatic hernias.[1] It was first described by Giovanni Battista Morgagni in 1761.[1-3] The condition is characterized by herniation of abdominal organs through the foramen of Morgagni into the thoracic cavity. Morgagni hernia typically occurs on the right side; this is thought to be due to the protection of the left diaphragm by the pericardium.[3] Clinical findings are variable, ranging from asymptomatic cases to presentations with dyspnea, recurrent respiratory tract infections, vomiting, and abdominal pain.[3,4] Diagnosis is usually made with chest radiography; thoracic computed tomography (CT) may also be used for further confirmation.[1,3]

Morgagni hernia is frequently associated with congenital anomalies, particularly Down syndrome and congenital heart disease.[5] Therefore, all diagnosed cases should be evaluated

Abstract

Objectives: This study aimed to compare the outcomes of the laparoscopic transfascial suturing technique with open surgical repair in pediatric Morgagni hernia (MH) cases and to evaluate the association between recurrence and patient-related factors.

Patients and methods: Between January 2018 and December 2024, 19 pediatric patients (11 males, 8 females; median age: 11 months; range: 5 to 67 months) who underwent surgical repair for MH were retrospectively reviewed and divided according to surgical technique into an open surgery group (OS, n = 9) and a laparoscopic group (LP, n = 10), and clinical outcomes were compared. Patient age, sex, presenting symptoms, imaging findings, associated anomalies, surgical technique, operative time, recurrence, and length of hospital stay were evaluated. Non-parametric tests were used due to the small sample size. Effect sizes were calculated to supplement *p*-values.

Results: The admission symptoms were recurrent respiratory tract infections in seven cases in each group ($p = 1.00$). Associated congenital anomalies were present in seven cases in the OS group and eight cases in the LP group ($p = 1.00$). No intraoperative complications were observed in either group. One patient in the LP group experienced minor postoperative morbidity. The mean total operation time was comparable in both groups (OS: 92.78 ± 33.83 min, LP: 96 ± 22.21 min; $p = 0.591$; Cohen's d = 0.11). The mean hospital stay was significantly shorter in the LP group compared to the OS group (3.5 ± 0.71 days *vs.* 6.67 ± 3.42 days; $p = 0.009$; Cohen's d = 1.28). Three patients with Down syndrome experienced recurrence in the LP group. Reoperation was performed in all three cases.

Conclusion: These preliminary findings suggest that laparoscopic transfascial repair provides a shorter hospital stay compared to open repair in pediatric MH, with comparable operative times. However, the risk of recurrence may be higher in patients with associated anomalies, particularly Down syndrome. Given the small sample size and retrospective design, these results should be interpreted with caution. Larger, multicenter prospective studies are warranted to validate these observations and establish definitive guidelines for surgical approach selection.

Keywords: Down syndrome, laparoscopy, Morgagni hernia, pediatric, recurrence, transfascial suturing.

Received: December 29, 2025
Accepted: February 23, 2026
Published online: March 25, 2026

Correspondence: Tunç Tığlı, MD.

E-mail: tunctgl@gmail.com

Department of Pediatric Surgery, Hacettepe University Faculty of Medicine, Ankara, Türkiye

Citation:

Tığlı T, Soyer T, Boybeyi Ö. Comparison of laparoscopic transfascial knot tying and open repair of Morgagni hernia. Turkish J Ped Surg 2026;40(1):8-15. https://doi.org/10.62114/JTAPS.2026.216.

in a multidisciplinary manner. Surgical treatment is recommended even in asymptomatic cases.[6] In addition to open abdominal or thoracic approaches, laparoscopic techniques can also be utilized. Laparoscopic surgery is increasingly preferred due to less postoperative pain, shorter hospital stay, and cosmetic advantages.[7,8] Several systematic reviews and meta-analyses have compared the outcomes of open and laparoscopic approaches in pediatric MH. Lauriti et al.[7] demonstrated that laparoscopic repair offered advantages in terms of morbidity and recovery time. More recently, Oumarou et al.[9] reported, based on an institutional series accompanied by a systematic review of the literature, that recurrence after MH repair was more commonly observed in patients with Down syndrome and/or those with previous cardiac surgery. Sarikaya et al.[4] compared the laparoscopic-assisted extracorporeal suture technique with open repair and also reported shorter hospital stay with the laparoscopic approach. Furthermore, Okur et al.[5] described alternative laparoscopic techniques, including single-incision approaches.

Despite these contributions, the existing literature remains limited in several aspects. First, there is no consensus regarding technical details such as excision of the hernia sac, suturing technique, and use of mesh in laparoscopic repair.[1] Secondly, the specific impact of patient-related factors, particularly Down syndrome and other associated anomalies, on recurrence risk has not been sufficiently explored in the context of different surgical approaches. Although the association between recurrence and associated anomalies has been reported, no study has specifically examined this relationship in the context of laparoscopic transfascial suturing versus open repair.[9]

Based on these considerations, we hypothesized that associated anomalies, rather than the surgical approach itself, may be the primary determinant of recurrence following MH repair. Therefore, this retrospective study was conducted to compare the outcomes of the laparoscopic transfascial suturing technique with open surgical repair in pediatric MH cases, with particular emphasis on identifying patient-related risk factors for recurrence.

PATIENTS AND METHODS

Study design and patient selection

This retrospective cohort study was conducted at the Department of Pediatric Surgery Hacettepe University Faculty of Medicine between January 2018 and December 2024. A total of 19 pediatric patients (11 males, 8 females; median age: 11 months; range: 5 to 67 months) who underwent surgical repair for Morgagni hernia were included in the study and allocated into two groups according to the surgical technique: the open surgery group (OS) (7 males, 2 females; mean age: 14.2 months; range, 5 to 38 months) and the laparoscopic group (LP) (4 males, 6 females; mean age: 19.1 months; range, 6 to 67 months). Inclusion was limited to patients younger than 18 years with a diagnosis of MH confirmed by chest X-ray and/or thoracic CT who underwent surgical repair at our institution. Patients with traumatic diaphragmatic hernias, posterolateral (Bochdalek) hernias, or incomplete medical records were excluded. Due to the retrospective design of the study, the requirement for written informed consent was waived by the Institutional Ethics Committee. The study protocol was approved by the Hacettepe University Non-Interventional Clinical Research Ethics Committee (Date: 27.12.2022, Approval no: GO:2022/22-05). The study was conducted in accordance with the principles of the Declaration of Helsinki.

Medical records were reviewed retrospectively, and data, including age, gender, presenting symptoms, associated congenital anomalies, surgical technique performed, operative time, recurrence status, and length of hospital stay, were recorded. The patients who underwent laparoscopic MH repair were allocated to the laparoscopic group (LP, n = 10), and those who underwent open MH repair were allocated to the open surgery group (OS, n = 9). The choice of surgical approach was based on surgeon preference, patient characteristics, and the chronological shift toward laparoscopic technique over the study period. All surgical procedures were performed by the same surgical team. The groups were compared for surgical details and postoperative outcomes.

It should be acknowledged that this study was not randomized; allocation to surgical groups was based on surgeon preference and institutional

experience over time. As a retrospective analysis, blinding was not applicable. The potential influence of a learning curve effect on outcomes, particularly in the LP group, is recognized as a limitation, given that the surgical team's experience with the laparoscopic transfascial technique evolved over the study period.

Surgical technique

Open repair: The open MH repair was performed via a supraumbilical median incision. After entering through the layers and opening the peritoneum, the diaphragmatic hernia located beneath the sternum was identified. The herniated abdominal viscera (commonly liver or colon) were reduced into the abdominal cavity. The hernia defect was repaired primarily using interrupted non-absorbable U-stitches, approximating the edges of the diaphragmatic defect to the posterior aspect of the sternum and anterior abdominal wall. The remaining portions of the diaphragm were inspected to ensure no additional defects. After hemostasis, the layers were closed in anatomical planes.

Laparoscopic repair: The laparoscopic repair was performed using three trocars: one 5 mm optical trocar placed at the umbilicus and two 5 mm working trocars positioned in the left lower quadrant. After establishing pneumoperitoneum, the hernia defect was identified in the midline retrosternal region. The herniated viscera were reduced into the abdominal cavity. Any adhesions between the falciform ligament and diaphragm were carefully divided using an advanced energy device, LigaSure™ (Medtronic, Minneapolis, MN, USA). The transfascial suturing technique was employed using non-absorbable sutures (Ethibond) passed percutaneously through the skin, anterior abdominal wall, and diaphragm. Typically, 4–6 interrupted U-stitches were placed to approximate the diaphragmatic edges to the posterior aspect of the sternum and anterior abdominal wall. The sutures were tied subcutaneously. Laparoscopic inspection confirmed complete closure of the defect without any residual opening, and the procedure was completed without complications.

The transfascial suturing technique was preferred over intracorporeal suturing methods for several reasons: (1) it allows the surgeon to achieve strong tissue approximation by tying knots extracorporeally, which provides more reliable tension control; (2) it reduces operative time compared to intracorporeal knot tying, especially in a small operative field adjacent to the sternum; and (3) it avoids the need for mesh, which is particularly desirable in the pediatric population due to growth considerations and the potential for mesh-related complications.[8] The hernia sac was not excised in the LP group due to the risk of inadvertent injury to adjacent structures in the limited retrosternal space, and since sac excision has not been consistently shown to reduce recurrence.[1]

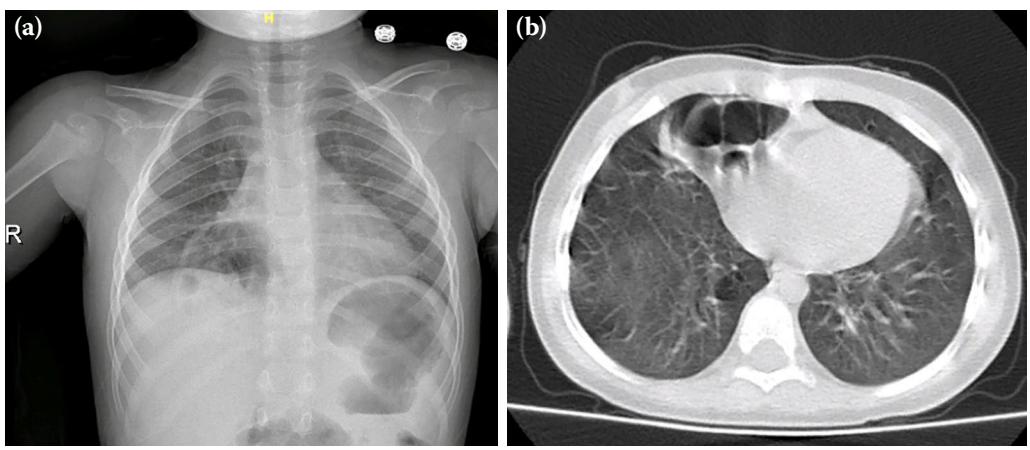

Figure 1. Chest X-ray **(a)** and computed chest tomography **(b)** of a representative case with Morgagni hernia. The chest X-ray demonstrates a retrosternal radiolucent area in the right hemithorax consistent with bowel herniation. The CT scan confirms the presence of abdominal viscera herniating through the anterior diaphragmatic defect into the thoracic cavity.
CT, computed tomography.

Statistical analysis

Statistical analyses were performed using IBM SPSS version 20.0 software (IBM Corp., Armonk, NY, USA). Given the small sample size (n = 19), non-parametric tests were used for group comparisons. The Mann-Whitney U test was employed for continuous variables (age, operative time, hospital stay), and Fisher's exact test was used for categorical variables (sex, admission symptoms, associated anomalies, recurrence). Descriptive statistics were presented as mean ± standard deviation (SD) and median (interquartile range, IQR) for continuous variables, and as frequency and percentage for categorical variables. A *p*-value of less than 0.05 was considered statistically significant.

No a priori power analysis was performed, as this was a retrospective analysis of all available cases at our institution. The small sample size (n = 19) limits the statistical power of the study, and the findings should be interpreted accordingly.

RESULTS

The admission symptoms were recurrent respiratory tract infections in 14 (73.7%) patients, and five (26.3%) patients were asymptomatic.

TABLE 1
The demographic and clinical characteristics of the patients

No	Group	Age (months)	Sex	Pulmonary infection	CXR (PA)	CT	Associated anomaly	Recurrence	Operation time (min)	Hospital stay (days)
1	OS	9	Male	No	Bowel Herniation	No	Yes	No	120	4
2	OS	11	Male	Yes	Consolidation	Yes	No	No	80	4
3	OS	5	Male	Yes	Consolidation	No	Yes	No	75	4
4	OS	29	Female	Yes	Consolidation	No	Yes	No	160	8
5	OS	6	Male	No	Bowel Herniation	No	Yes	No	60	7
6	OS	9	Male	Yes	Consolidation	Yes	No	No	120	8
7	OS	7	Female	Yes	Bowel Herniation	No	Yes	No	60	8
8	OS	14	Male	Yes	Bowel Herniation	Yes	Yes	No	90	3
9	OS	38	Male	Yes	Bowel Herniation	Yes	Yes	No	70	14
10	LP	18	Female	Yes	Bowel Herniation	No	Yes	Yes	80	3
11	LP	10	Male	Yes	Consolidation	Yes	Yes	No	120	4
12	LP	7	Female	No	Bowel Herniation	Yes	Yes	No	100	4
13	LP	25	Female	Yes	Bowel Herniation	Yes	No	No	80	3
14	LP	6	Male	Yes	Consolidation	Yes	Yes	Yes	110	5
15	LP	15	Male	Yes	Bowel Herniation	No	Yes	Yes	60	4
16	LP	6	Female	No	Bowel Herniation	No	Yes	No	70	3
17	LP	22	Female	Yes	Bowel Herniation	No	No	No	120	3
18	LP	67	Female	No	Bowel Herniation	No	Yes	No	120	3
19	LP	15	Male	Yes	Bowel Herniation	No	Yes	No	100	3

CXR, chest X-ray; PA, posteroanterior; CT, computed tomography; OS, open surgery; LP, laparoscopic.

TABLE 2
Comparison of patients who underwent LP or OS repair of Morgagni hernia

	Open surgical repair (n = 9)			Laparoscopic repair (n = 10)				
	n	%	Mean ± SD	n	%	Mean ± SD	*p*	Effect size
Age (months)			14.2 ± 11.48			19.1 ± 18.09	0.437	Cohen's d = 0.32
Sex Male Female	 7 2	 77.8 22.2		 4 6	 40 60		0.170	OR = 5.25
Admission symptom Pulmonary infection Asymptomatic	 7 2	 77.8 22.2		 7 3	 70 30		1.00	
Associated anomalies	7	77.8		8	80		1.00	OR = 1.14
Down syndrome	0	0		3	30		0.211	-
Mean operation time (min)			92.78 ± 33.83			96 ± 22.21	0.591	Cohen's d = 0.11
Number of recurrences	0	0		3	30		0.211	-
Postoperative morbidity	0	0		1	10		1.00	-
Mean hospital stay (days)			6.67 ± 3.42			3.5 ± 0.71	**0.009**	Cohen's d = 1.28

LP, laparoscopic; OS, open surgery; SD: standard deviation; OR, Odds ratio. Statistical comparisons were performed using Mann-Whitney U test for continuous variables and Fisher's exact test for categorical variables. A p-value < 0.05 was considered statistically significant (bold). Effect sizes are presented as Cohen's d for continuous variables and odds ratios for categorical variables. Odds ratios were calculated as LP *vs.* OS (reference group: OS). For sex, the event category was "female"; for associated anomalies, the event category was "presence of anomaly."

Chest X-ray was performed in all cases, and thoracic CT was performed in eight (42.1%) cases, revealing retrosternal hernia, as shown in Figure 1. Echocardiography (ECHO) was performed in 15 (78.9%) patients, and cardiac anomalies were detected in five of them (33.3%). Associated congenital anomalies were detected in a total of 15 (78.9%) patients. The demographic characteristics and clinical findings of the cases are summarized in Table 1.

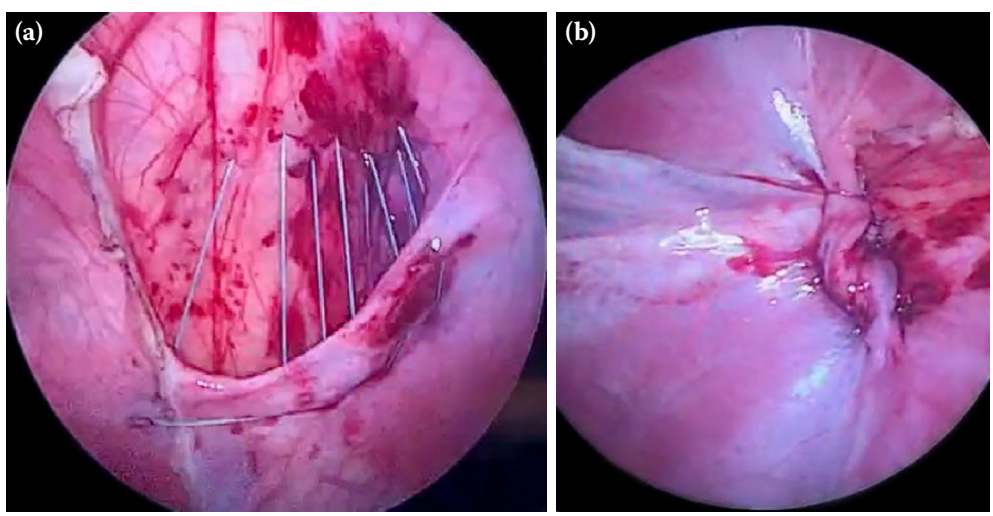

Figure 2. Intraoperative views during Morgagni hernia repair. **(a)** Open surgical repair showing the retrosternal diaphragmatic defect with non-absorbable U-stitches placed to approximate the diaphragmatic edges to the posterior sternum and anterior abdominal wall. **(b)** Laparoscopic view demonstrating the transfascial suturing technique, with non-absorbable U-stitches placed percutaneously to close the defect.

TABLE 3
Subgroup analysis of recurrence according to Down syndrome status

	Down syndrome (n = 3)			No Down syndrome (n = 16)			
	n	%	Mean ± SD	n	%	Mean ± SD	*p*
Recurrence	3	100		0	0		**0.001**
Surgical group							0.211
LP	3			7			
OS	0			9			
Mean age (months)			13.0 ± 6.24			17.5 ± 16.29	1.000

SD: standard deviation; LP, laparoscopic; OS, open surgery; Statistical comparison was performed using Fisher's exact test for categorical variables and the Mann-Whitney U test for continuous variables. A *p*-value < 0.05 was considered statistically significant (bold).

The summary of the comparison between groups is given in Table 2. The LP and OS groups were comparable regarding the mean age of the patients (19.1 ± 18.09 *vs.* 14.2 ± 11.48 months; $p = 0.437$; Cohen's d = 0.32), admission symptoms, and male-to-female ratio ($p = 0.170$; OR = 5.25, 95% CI 0.72–38.16). Associated congenital anomalies were present in seven cases (77.8%) in the OS group and eight cases (80%) in the LP group ($p = 1.00$; OR = 1.14, 95% CI 0.13–10.23). All cases in the LP group were managed by laparoscopic transfascial knot tying. None of the patients required conversion to open repair, as shown in Figure 2. Sac resection was performed only in two cases (22.2%) in the OS group. No intraoperative complications were observed in either group. One patient in the LP group experienced minor postoperative morbidity.

The mean total operation time was comparable in both groups (OS: 92.78 ± 33.83 min, LP: 96 ± 22.21 min; $p = 0.591$; Cohen's d = 0.11, indicating no clinically meaningful difference). The mean hospital stay was significantly shorter in the LP group compared to the OS group (3.5 ± 0.71 days *vs.* 6.67 ± 3.42 days; p=0.009; Cohen's d = 1.28, representing a large effect size).

Three patients (15.8% overall; 30% of the LP group) experienced recurrence, all in the LP group. All three patients had Down syndrome. No recurrence was detected in the OS group. The recurrence rate difference between groups did not reach statistical significance ($p = 0.211$), which is expected given the limited sample size and insufficient statistical power to detect differences in uncommon events.

Subgroup analysis: Down syndrome

A subgroup analysis was performed to examine the relationship between Down syndrome and recurrence. Among the 19 patients, the three patients with Down syndrome were all in the LP group. All three (100%) experienced recurrence, while none of the 16 patients without Down syndrome had recurrence (0%). This difference was statistically significant ($p = 0.001$, Fisher's exact test). The re-operation was performed with an open approach in two cases and a laparoscopic approach in one case. At the last available clinical evaluation, no further recurrence was documented. Details of the subgroup comparison according to Down syndrome status are provided in Table 3.

It should be noted that the small sample size significantly limits the interpretability of *p*-values in this study. The statistical comparisons should be considered hypothesis-generating rather than definitive, and the observed differences may not be replicated in larger cohorts.

DISCUSSION

Morgagni hernia is a rare type of congenital diaphragmatic hernia, typically located on the right side, and can remain asymptomatic until late childhood.[1] While clinical symptoms are highly variable, recurrent respiratory tract infections, vomiting, abdominal pain, and dyspnea are among the most frequently reported findings.[2,3] Consistent with these findings, respiratory tract infections were detected in 14 of 19 patients (73.7%) in our series. In addition to chest radiography as the primary diagnostic method, more detailed evaluations are

performed with advanced imaging techniques such as thoracic CT and ECHO.[4] In our series, chest radiography was performed in all patients, CT in eight patients, and ECHO in 15 patients. Associated congenital anomalies were detected in a total of 15 (78.9%) patients, a rate consistent with previous studies reporting a high prevalence of associated anomalies in MH patients. Surgical repair constitutes the cornerstone of MH treatment. Although open surgeries have been accepted as the gold standard for many years, laparoscopic approaches have been increasingly preferred in recent years due to less postoperative pain, early oral intake, shorter hospital stay, and cosmetic advantages.[5,6] In the systematic review by Lauriti et al.,[7] laparoscopic repair was reported to provide advantages in terms of morbidity and recovery time. More recently, Sarikaya et al.[4] compared the laparoscopic-assisted extracorporeal suture technique with open repair and confirmed the benefits of minimally invasive approaches. The results of the present study are consistent with these findings, as the hospital stay was significantly shorter in the LP group.

In the present study, no significant difference was observed between groups in terms of operative times. This finding may be attributed to technical issues such as instrumentation time and equipment problems. The requirement for special techniques, such as transfascial suturing in minimally invasive repair, may also be one of the factors affecting operative time.[8]

The choice of transfascial suturing technique in our laparoscopic approach warrants discussion. Several laparoscopic methods have been described for MH repair, including intracorporeal suturing, percutaneous intracorporeal ring suturing, and single-incision techniques with cystoscope forceps assistance.[2,5] We preferred the transfascial suturing technique in that it provides reliable extracorporeal knot tying with strong tissue approximation, reduces the need for advanced intracorporeal suturing skills, and avoids the use of mesh in pediatric patients. Compared to intracorporeal suturing, the transfascial approach may offer more consistent suture tension, which is critical for a durable repair in the limited retrosternal space.[8] However, this technique may be associated with palpable subcutaneous knots, and long-term comparative data between different laparoscopic methods remain lacking.

Regarding the surgical outcome, a notable finding was that recurrence was observed only in three patients in the LP group. No recurrence was detected in the OS group. The potential link between recurrence and surgical technique should be carefully examined. Karadağ et al.[1] associated recurrence development with factors such as whether the hernia sac was excised, the suturing technique used, and the need for mesh. In our study, non-absorbable sutures were used for MH repair, both in open and laparoscopic cases. The sutures were placed in an interrupted 'U' stitch manner either under direct vision in open repair or direct laparoscopic vision, which should provide comparable repair strength. The sac excision was not performed in the LP group, whereas the hernia sac was excised in two patients in the open group. While sac excision has been proposed to reduce recurrence by eliminating the lead point for re-herniation, the evidence for this remains inconsistent. The absence of sac excision in our laparoscopic cases may have contributed to the observed recurrences, although this cannot be concluded definitively, given the confounding presence of Down syndrome in all recurrent cases.

Notably, all three patients who experienced recurrence had Down syndrome, which was the possible cause of increased recurrence risk in the present study. Patients with Down syndrome are known to have generalized connective tissue laxity, hypotonia, and poor tissue quality, which may compromise surgical repair integrity regardless of the approach used. The recent study by Oumarou et al.,[9] based on an institutional series accompanied by a systematic review of the literature, reported that recurrence after MH repair was more commonly seen in patients with Down syndrome and/or those with previous cardiac surgery. Our subgroup analysis showed that all patients with Down syndrome experienced recurrence compared to 0% of patients without, further supporting this association. These findings suggest that the demographic and clinical profile of the patient, rather than the surgical technique, may be the primary determinant of recurrence. Future studies should explore whether additional reinforcement measures, such as mesh augmentation or biological patches, may be warranted in this high-risk population.

This study has several important limitations that must be acknowledged. First, the retrospective

design inherently introduces selection bias, as the choice of surgical approach was not randomized but rather based on surgeon preference and chronological trends. Second, the small sample size (n = 19) substantially limits the statistical power of our findings. The absence of an a priori power analysis means that the study may be underpowered to detect clinically meaningful differences, particularly for uncommon outcomes such as recurrence. The p-values reported should therefore be interpreted with caution, and the findings should be considered hypothesis-generating rather than definitive. Third, all surgeries were performed by the same surgical team, and the potential influence of a learning curve on outcomes, particularly in the earlier laparoscopic cases, cannot be excluded. Fourth, the uneven distribution of Down syndrome patients between groups represents a significant confounding factor. Lastly, the lack of standardized long-term follow-up protocols and retrospective, chart-based ascertainment may have underestimated late recurrences.

In conclusion, these preliminary findings suggest that laparoscopic transfascial suturing repair provides a shorter hospital stay compared to open repair in pediatric MH, with comparable operative times. However, recurrence was observed exclusively in patients with Down syndrome, suggesting that patient-related factors, rather than surgical technique, may be the primary determinant of recurrence risk. Given the small sample size and retrospective nature of this study, these results should be considered as preliminary observations that require validation. Larger, multicenter prospective studies with adequate statistical power and longer follow-up periods are warranted to establish definitive conclusions regarding the optimal surgical approach and to identify patients at higher risk for recurrence.

Data Sharing Statement: The data that support the findings of this study are available from the corresponding author upon reasonable request.

Author Contributions: T.T.: Contributed to the idea/concept, design, data collection and processing, analysis and interpretation, literature review, writing the article, critical review, references and fundings, and materials; T.S.: Contributed to the idea/concept, design, control/supervision, analysis and interpretation, and critical review; Ö.B.: Contributed to the idea/concept, design, data collection, control/supervision, analysis and interpretation, literature review, writing the article, critical review, references and fundings, and materials.

Conflict of Interest: The authors declared no conflicts of interest with respect to the authorship and/or publication of this article.

Funding: The authors received no financial support for the research and/or authorship of this article.

AI Disclosure: The authors declare that artificial intelligence (AI) tools were not used, or were used solely for language editing, and had no role in data analysis, interpretation, or the formulation of conclusions. All scientific content, data interpretation, and conclusions are the sole responsibility of the authors. The authors further confirm that AI tools were not used to generate, fabricate, or 'hallucinate' references, and that all references have been carefully verified for accuracy.

REFERENCES

1. Karadag CA, Erginel B, Yildiz A, Kaba M, Demir M, Sever N. Laparoscopic repair of Morgagni hernia in children. J Pediatr Surg 2023;58:1670-3. doi: 10.1016/j.jpedsurg.2023.01.045.
2. Karaaslan B. Could the percutaneous intracorporeal ring suturing method be the primary surgical option for the treatment of Morgagni hernia in children? Acad J Health Sci 2023;38:103-7. doi: 10.3306/AJHS.2023.38.05.103.
3. Golden J, Barry WE, Jang G, Nguyen N, Bliss D. Pediatric Morgagni diaphragmatic hernia: A descriptive study. Pediatr Surg Int 2017;33:771-5. doi: 10.1007/s00383-017-4078-3.
4. Sarikaya M, Özcan Siki F, Gündüz M, Sekmenli T, Çiftci İ. Comparison of double-port laparoscopic-assisted extracorporeal suture technique and open surgical repair for Morgagni hernia. Turk J Med Sci 2024;54:989-94. doi: 10.55730/1300-0144.5877.
5. Okur MH, Aydoğdu B, Azizoğlu M, Arslan S, Bayram S, Basuguy E. Comparison of single-incision laparoscopic percutaneous and cystoscope forceps assisted Morgagni hernia repair techniques. J Pediatr Surg 2024;59:1089-93. doi: 10.1016/j.jpedsurg.2023.11.015.
6. Tan YW, Banerjee D, Cross KM, De Coppi P, Blackburn SC, Rees CM, et al. Morgagni hernia repair in children over two decades: Institutional experience, systematic review, and meta-analysis of 296 patients. J Pediatr Surg 2018;53:1883-9. doi: 10.1016/j.jpedsurg.2018.04.009.
7. Lauriti G, Zani-Ruttenstock E, Catania VD, Antounians L, Lelli Chiesa P, Pierro A, et al. Open versus laparoscopic approach for Morgagni's hernia in infants and children: A systematic review and meta-analysis. J Laparoendosc Adv Surg Tech A 2018;28:888-93. doi: 10.1089/lap.2018.0103.
8. Lim L, Gilyard SM, Sydorak RM, Lau ST, Yoo EY, Shaul DB. Minimally invasive repair of pediatric Morgagni hernias using transfascial sutures with extracorporeal knot tying. Perm J 2019;23:18.208. doi: 10.7812/TPP/18.208.
9. Oumarou M, Panait N, El Khoury E, Hamidou Z, Pinol J, Barila Lompe P, et al. Recurrence of anterior congenital diaphragmatic hernia after laparoscopic repair in children. Pediatr Surg Int 2024;40:166. doi: 10.1007/s00383-024-05739-4.