Original Article

Five-Year Experience of Anorectal Malformation with Oesophageal Atresia in Tertiary Care Hospital

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Abstract

Aim: We had done this study for TEF with Anorectal malformation and TEF with no Anorectal malformation in terms of age, sex, surgical outcomes and mortality. **Materials and Methods:** This was a retrospective review of cases with clinical data (from April 2012 to April 2017). The participants of this study were 236 patients who had been diagnosed and managed for ARM. Among these patients, 25 patients associated with EA were selected as the subject patient group. **Results:** The incidence of tracheoesophageal fistula with ARM was 11.1%. The study has more male preponderance. All cases are of Type c except two cases of Type a. According to the classifications of ARMs, there were two cases with rectourethral fistula and eight cases with rectoperineal fistula and covered anus in the males. In females, there was a varied distribution of seven cases. There was one case (4%) presenting as a part of the Vertebral anorectal malformation cardiac tracheoesophageal renal and limb anomalies (VACTERL) association, which is the representative example of a complex anomaly. Most of the cases died due to cardiac problem and pneumonitis (due to delayed presentation). **Conclusion:** The study concludes the experience of EA (±fistulae) with ARM, their distribution, incidence and outcome of the tertiary care centre.

Keywords: Anorectal malformation with oesophageal atresia, rectoperineal fistulae, tracheoesophageal fistulae, vertebrae anorectal malformation cardiac tracheoesophageal fistulae renal anomalies limb anomalies (VACTERL)

Introduction

Anorectal malformations (ARM) occur approximately in 1/1500–1/5000 live births.[1,2] They may occur alone, but they can commonly have other associated anomalies or occur as a part of the combined anomaly. The treatment involved may be complicated by a need to address the associated anomalies, in addition to the ARMs. Furthermore, the problems of these associated anomalies could have more of an impact on the morbidity and mortality before and after surgical treatment.

The frequency of associated anomalies in other organs is known to be approximately 40%–70% in the decreasing order of the urogenital system, musculoskeletal system and cardiovascular system.[3,4] In addition, anomaly in other parts of the gastrointestinal system can occur concomitantly, and a prompt treatment is required in such situations when the neonate's life is threatened. In particular, when an oesophageal atresia (EA) accompanies the ARMs, the complex of surgical procedure and the difficulty of situational post-operative management must be considered.

Thus, we conducted the present study to analyse the characteristics of and treatment results in neonates with ARMs associated with EA.

Materials and Methods

This was a retrospective review of cases with clinical data (from April 2012 to April 2017).

The participants of this study were 236 patients who had been diagnosed and managed for ARMs in the Neonatal Intensive Care Unit, Paediatric Surgery Department of SS Hospital, BHU Varanasi, from April 2012 to April 2017. Among these patients, 25 patients associated with EA were selected as the subject patient group.

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Methods

A retrospective study was conducted using the clinical data of the 236 patients. First, clinical aspects such as the type of ARMs and the frequency of other associated anomalies were compared between the groups with and without EA. Comparative analysis of the clinical characteristics of ARMs associated with EA, as well as the processes of management and the methods, and results for the treatment in neonatal period were performed.

Results

Comparison of groups with and without oesophageal atresia

Among the 236 patients with ARMs, there were 25 patients with EA and 211 patients without it; the male-to-female ratio was 2.5:1 (18:7) and 1.18:1 (109:92), respectively. Regarding the type of ARMs, there were 10 and 100 cases of low-type malformation, which is correctable through a single procedure, in the group with and without associated EA. There were 13 and 40 cases of high-type malformations with EA or without atresia that is managed by staged or single-stage abdominoperineal pull-through operation, respectively. There were 2 and 41 cases of intermediate ARMs with and without atresia. Cloacal anomaly was identified in 14 ARM without EA [Table 1].

Table 1: Clinical aspects according to accompanying oesophageal atresia

	ARM with TEF ($n=25$)	ARM ($n=211$)
Sex (male:female)	18:7	119:92
High ARM	13	40
Intermediate ARM	2	14+27
Low ARM	10	65+51
Cloaca	0	14

ARM: Anorectal malformation, TEF: Tracheoesophageal fistula

Clinical characteristics of anorectal malformations associated with oesophageal atresia

There were 25 neonates with EA, accounting for 11.1% of the total patients. Of them, male was 18 and female was 7; there was more preponderance in male in occurrence. According to the classifications of ARMs, there were two cases with rectourethral fistula and eight cases with rectoperineal fistula and covered anus in the males. In the females, there was a varied distribution of seven cases in, two cases in the rectovaginal fistula and one case in the rectovestibular fistula and four cases of anovestibular fistulae (low type). In cases of EA, there were three cases of Type A EA without tracheoesophageal fistula (TEF), but most cases were Type C EA with TEF [Table 2].

Table 2: Demographic and clinical characteristics of anorectal malformations associated with oesophageal atresia

Case	Sex	GA (week)/ BW (g)	Type of ARM	Type of oesophageal atresia
1	Male	38/2300	H	C
2	Female	28/1000	AVF	C
3	Female	37/2200	AVF	C
4	Male	34/1400	H	A
5	Male	30/1300	H	C
6	Male	40/2300	H	C
7	Male	37/2400	L	C
8	Male	38/2500	L	C
9	Female	37/2100	AVF	C
10	Male	33/2000	I	C
11	Male	34/1800	H	A
12	Male	33/1800	H	C
13	Male	40/2500	I	C
14	Male	39/3000	H	C
15	Female	39/2000	L	C
16	Female	36/2350	Rectovaginal	C
17	Male	37/2500	L	C
18	Female	38/2300	Pouch	C
19	Male	37/2300	I	C
20	Male	37/2400	L	C
21	Male	37/2200	H	C
22	Male	34/2300	L	C
23	Female	36/2300	Pouch	C
24	Male	40/2500	H	C
25	Male	38/2300	L	A

ARM: Anorectal malformation, AVF: Arteriovenous fistulae, BW: Birth weight, GA: Gestational age, H: High L: Low, I: Intermediate

Distribution of associated anomalies

Associated anomalies in other organ system were confirmed in all the study cases and more than three associated anomalies were observed, especially in ten cases. When considering the frequency by organ system, there were six cases involving the cardiovascular system; three duodenal atresia; one malrotation, two Meckel's diverticulum and one ileal atresia. In particular, there was one case (4%) presenting as a part of the Vertebral abnormalities, Anal atresia, Cardiac anomalies, Tracheoesophageal fistula, Oesophageal atresia; Renal and Limb anomalies (VACTERL) association, which is the representative example of a complex anomaly. There were two cases of Down syndrome. However, in ARMs without EA, there was a relatively low frequency of associated anomalies (23%), as compared to that in the study (64%) subject group; on the other hand, there were a few cases of autosomal abnormalities [Table 3].

Managements and results in the neonatal period

In five cases, a primary correction was done, three cases primary repair and abdominoperineal pull through and two cases undergone primary repair and diverting colostomy. In six cases, anoplasty and a primary correction for EA were performed concurrently. Diverting colostomy was performed first in five cases; one case had a delayed diagnosis of EA and the other case had concomitant perforation in the gastrointestinal tract. Two cases undergone primary repair for

atresia after posterior sagittal anorectoplasty. The remaining three of anovestibular with atresia undergone primary repair and delayed repair for anorectal malformation. The remaining three patients were confirmed to be dead due to associated anomalies in the other organs, without having received other surgical treatments [Table 4].

Management and clinical results in neonatal periods

There were 6 mortality cases in 25 patients (mortality rate, 24%). Three cases died pre-operative without undergoing surgery. A more detailed observation showed that three cases, a previously described case of death without surgical interventions, in which a female neonate with VACTERL association who was born at 28 weeks of gestation with a birth weight of 1000 g and rest two come after 7 days with respiratory failure.

In the other two cases, the cause of death was a heart problem due to associated cardiac anomalies and one of these cases was confirmed to be a male neonate in whom a diagnosis of EA was delayed because of a perforation in the gastrointestinal tract. Overall, for the 22 cases with receiving a correction surgery in the neonatal period, 3 cases of death were observed in the post-operative period. The cause of death in these cases was confirmed to be attributable to other associated anomalies rather than the disease of focus in the present study. Meanwhile, in the patients with ARMs without EA, five cases of death were observed (mortality rate, 2.33%). This was not a case of neonatal period, but due to a heart problem developed in the follow-up period after the final operation [Table 4].

Table 3: Comparison of associated anomalies between two types

Organ system	ARM with TEF	ARM
CVS	6	15
DA	3	8
Malrotation	1	1
Meckel's diverticulum	2	2
Down syndrome	2	5
Ileal atresia	1	2
VACTERAL	1	2

ARM: Anorectal malformation, TEF: Tracheoesophageal fistula, CVS: Cardiovascular system, DA: Duodenal atresia, VACTERAL: Vertebral anorectal malformation cardiac tracheoesophageal renal and limb anomalies

Table 4: Management and clinical outcome

Method of management	Result (mortality)
Primary repair+ colostomy (2)	0
Primary repair after colostomy (5)	1
Primary repair after PSARP (2)	0
Primary repair + APPT (3)	1
Primary repair + anoplasty (6)	0
Primary repair + anal dilation for AVF (4)	1
No treatment (3)	3 (pre-operative)

PSARP: Posterior sagittal anorectoplasty, AVF-Anovestibular fistulae, APPT: Abdominal perineal pull through

Discussion

The most frequently associated anomalies with EA ± TEF are cardiac (49%) and ARMs (15%).[5-8]

Although it is difficult to directly compare the types of associated anomalies because of their varied natures, cases associated with EA are known to some extent because of their clinical importance. Associated EA in patients with ARMs may occur alone or as a part of complex anomaly, and its incidence is reported approximately in 8%–11%.[3,9]

The incidence rate in the present study was 11.1%, which was not largely different from that in other reports. Moreover, associated anomalies other than ARMs and EA were observed in all patients. The majority of these anomalies were problems of the cardiovascular or urogenital systems, and they were not largely different from those reported in previous studies.[10]

However, a relatively higher frequency of anomalies was observed in the patients with EA than in those without EA. Thus, given that additional associated anomalies were observed in all patients, it is suggested that the management of ARMs associated with EA will require more caution and efforts than the management of patients presenting with ARMs alone. Although many factors may be involved in the occurrence of these anomalies, it may be thought that ARMs and EA are types of midline defects, which present along the body. These defects occur as results of the combination of deficits in mesodermal migration and endodermal defects.[11,12]

On the other hand, in the VACTERL association, there are two different explanations involving it; genetic factors and external environmental factors. First, the genetic factor model has been supported through animal experiments, and it proposes the formation of anomalies due to genetic mutations that induce signalling pathway abnormalities.[13-15]

Second, it is thought that external environmental factors such as maternal diabetes, hormonal exposure during infertility treatments and exposure to toxic factors negatively influence the morphological development of the foetus, leading to malformations in the foetus.[16-19]

In our study, we could not identify any factors, such as chromosomal defects, which may induce this anomaly, but it is necessary to be supposed to think about an adequate investigation of these factors.[20] However, since the incidence of the disease itself is not very high, there are still many limitations to investigate directly.

In general, associated anomalies occur more frequently in high-type of ARMs than in low-type malformations; the frequency is also higher in males than in females.[7] In our study, for ARMs associated with EA, the gender distribution was more common in male, with a 2.25:1 male-to-female ratio. In the case of male, most of ARMs were low- or high type with rectourethral fistula (6/18, 33.3%) and high (7/18,

38.88%) and mainly low-type malformations in female (4/7, 57.11%). This finding showed a different distribution in cases of ARMs without EA. A relatively high frequency, 28.6%, of the cases occurred as a part of the VACTERL association, which may be considered as a result of multiple congenital malformations. In addition, considering the report that the frequency of concomitant gastrointestinal atresia is four times as high in VACTERL association than in the cases with a single anomaly of ARM, this can also be inferred as a result of simple primary malformation due to deficits in the organ formation process, in addition to the previously mentioned disease occurrence process.[21-23]

In the management of a complex anomaly, the correlation with life support must be considered primarily in the neonatal period, and it is essential to do appropriately a staged procedure. Ultimately, when considering its clinical results, the complicated nature of the surgical procedure and appropriate surgical approaches must be considered in managing a case of ARMs associated with EA. In this study, the majority of the surgical treatments administered in the neonatal period were a staged procedure with good results, and there were no major differences compared to other reports.[24] Although the mortality rates after appropriate treatments are relatively low in the cases of simple ARMs and EA, the total mortality rate observed in the present study was 24%, a very high frequency compared to that in other gastrointestinal anomalies. In particular, when compared to ARMs without EA, it can be concluded that this high mortality rate is attributable to complications associated with other anomalies, rather than the disease itself. Two of the three deaths (pre-operative) in our study were caused by heart problems during observation after the primary surgery in the neonatal period and one death in VACTERL associations without surgical intervention. Thus, it could be inferred that the influence of other associated anomalies was greater than that of ARMs and EA. Meanwhile, diverting colostomy was performed initially in one patient of three who died post-operative. Each case involved a delayed diagnosis of EA or concomitant gastrointestinal perforation. Because of these complications, complex surgical procedures were unavoidable, and one case involved with gastrointestinal perforation resulted in death during the post-operative recovery period. This indicates that a more careful and timely diagnosis based on clinical and radiological findings is necessary before the primary operation.

Conclusion

ARMs associated with EA, whether alone or as a part of a complex syndrome, had a relatively high frequency of associated anomalies in other organs, as well as a high mortality rate. It may be suggested that a staged and multidisciplinary approach is essential in the management of neonates with this anomaly. In addition, reasonable treatments considering these possibilities may lead to improved outcomes by preventing delays in the diagnosis of ARMs associated with EA, as well as the development of serious complications.

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Conflicts of interest

There are no conflicts of interest.

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