Original Article

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Esophageal Atresia and Tracheoesophageal Fistula: Study of Various Factors Affecting Leak Rate

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Abstract

Introduction: Esophageal atresia (EA) and tracheoesophageal fistula (TEF) is the most common congenital anomalies encountered in pediatric surgery.

Materials and Methods: This prospective study was performed in patients of EA and distal TEF undergoing corrective surgery over a period of 2-year. The study comprised 40 consecutive patients of EA and distal TEF. In this prospective randomized trial, we analyzed the risk factors leading to anastomotic dehiscence in patients after surgery. Various risk factors associated with increased incidence of anastomotic leakage such as increased age at presentation, weight at presentation, associated anomalies, gap length, lower pouch mobilization, tension at anastomosis, and post-operative ventilation has been implicated to a variable extent.

Results: We analyzed the risk of anastomotic leakage associated with each factor and compared with overall leak rate. We found that anastomotic tension was the most significant risk factor followed by lower pouch mobilization and long gap. The anastomotic tension was the most significant risk factor followed by lower pouch mobilization and long gap for leak.

Conclusion: Age at presentation and birth weight had an impact on survival but not on anastomotic healing. Lower pouch mobilization and gap length increase the chances of anastomotic dehiscence. Overall leak rate was 25% study series.

Key words: Anastomotic leak, Anastomotic tension, Esophageal atresia, Gap length, Post-operative ventilation

INTRODUCTION

Esophageal atresia and tracheoesophageal fistula (EA and TEF) is one of the most common congenital anomalies encountered in pediatric surgery. The most common abnormality is a blind upper pouch with a fistula to the trachea or bronchus from the lower esophagus, occurring in approximately 87% of the patients. EA and TEF are frequently associated with anomalies of the musculoskeletal, cardiovascular, gastrointestinal, and genitourinary systems. Prognosis of a patient with EA and TEF depends on the weight of the patient, day of presentation, associated anomalies, and ventilatory dependence.[1] Esophageal gap length, anatomy of the defect and physiological status are the other factors guiding the therapy.[2]

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The complications of esophageal anastomosis are major or minor leaks, recurrent TEF, and significant strictures. Depending on the criteria used for the definition of leakage, the incidence varies widely from 4% to 36%.[3-6] The anastomotic leak rate as reported in several Indian series varies from 16% to 35%.[4,5,7] Mortality rates after anastomotic leak, however, are very high in developing countries (60-80%) as compared to the developed countries (0-25%).[6] Factors, which increase the risk of

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anastomotic leakage are the use of silk sutures, tension at anastomosis, interference with blood supply of anastomosis from over-zealous dissection of the distal esophagus and a wide gap.[3,6] A gap of more than 3 cm between the upper and lower pouches before mobilization is considered as a long gap.[5] Leak rate in this group has been reported to be 100%.[3]

In this study, we studied various factors affecting leak rate in EA and TEF and studied their effect on survival of such patients.

MATERIALS AND METHODS

This study was performed prospectively in 40 patients of EA and distal TEF.

Inclusion Criteria

1. Weight more than 2 kg and full term gestation
2. Aged 3 days or less at the time of admission
3. Preoperatively maintained adequate oxygen saturation without mechanical ventilation
4. Patients did not have associated major cardiac or other life-threatening anomalies.

Exclusion Criteria

Patients with long gap and patients dying within 72 h of surgery were excluded.

A detailed clinical performa was filled up for each patient incorporating details such as weight, sex, day of presentation, birth history, antenatal diagnosis, associated anomalies, immediate postnatal management, history of feeding, respiratory distress, pre-operative pneumonia, pre-operative ventilator dependence, and inotropic support requirement. A thorough clinical examination was performed for proper assessment of other systems to rule out cardiac, gastrointestinal anomalies and major pneumonia. The patients were resuscitated and prepared for surgery as per the standard protocol. A right posterolateral thoracotomy was done through the fourth or fifth intercostal space. Esophageal anastomosis was performed using 5/0 Vicryl sutures. Post-operative ventilation was used whenever indicated. Anastomotic healing was checked by the clinical examination of the chest, respiratory rate, ventilatory parameters, chest tube inspection and radiological examination of the chest. A contrast swallow was performed on 5th post-operative day, and the oral feeds commenced once a leak free patency of the esophagus was established. A statistical analysis was done by χ^2 test and Fisher's exact test.

The Institute Ethical Committee had approved the study.

RESULTS

Table 1 denotes the Risk factors for anastomotic leak. The anastomotic tension was the most significant risk factor followed by lower pouch mobilization and long gap for leak (Figure 1).

DISCUSSION

Since, the first successful repair of EA and TEF in 1941 by Haight, the outcome has gradually improved.[8]

Although the overall mortality has declined, anastomotic leakage and its complication still continue to occur. The main determinant of prognosis of patients of EA and TEF is anastomotic leak which, in turn, is influenced by the anastomotic tension.[6,9]

This prospective randomized controlled study of 40 cases of EA and TEF, we studied the various factors affecting anastomotic leak and their effect on survival of patients.

Table 1: Risk factors for anastomotic leak

Characteristics	Individual leak rate No. (% age)	Overall leak rate (% age)	*P* value
Age >1 day (*n*=19)	4/19 (21)	25	0.721
Weight <2.5 kg (*n*=30)	7/30 (23)	25	0.689
Presence of associated anomalies (*n*=15)	4/15 (26.6)	25	1.0
Gap length			
2-3 cm (*n*=19)	6/19 (31.5)	25	0
>3 cm (*n*=9)	4/9 (44.4)	25	0.019*
Lower pouch mobilization (*n*=15)	7/15 (46.6)	25	0.024*
Tension at anastomosis (*n*=18)	9/18 (50)	25	0.002**
Post-operative ventilation (*n*=29)	9/29 (31)	25	0.233

*Significant, **Highly significant

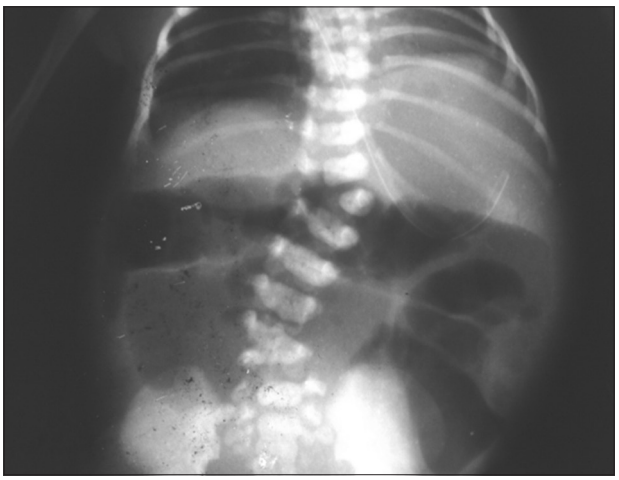

Figure 1: Radiograph showing hemivertebra associated with Esophageal atresia and tracheoesophageal fistula

Age at Presentation and Sex

In this series, patients who presented on the 1st day of life had better survival as compared to those who presented late. This finding was contrary to the Western reports[2,10] but consistent with various Indian series.[11,12] Leak rate was not found significantly different in patients who presented late. Male patients formed the predominant group. The rate of survival in female babies was 66.6%, whereas 80% of the male babies survived. Survival in male patients was better as compared to the female neonates.

Birth Weight

The rate of mortality was 33.3% in patients whose weight was between 2 kg and 2.5 kg. The survival rate in patients with more than 2.5 kg weight was found to be 100%. However, the weight was not found to be significantly affecting the leak rate. In western reports, low birth weight does not seem to affect survival, contrary to the reports of Indian series.[10,13] In Indian setup Waterston classification is still relevant, and weight is a significant factor in neonatal survival.[14]

This reflects delayed and faulty diagnosis, absent neonatal transport facility and lack of sufficient neonatal intensive care infrastructure.

Associated Anomalies

Associated anomalies were found in 37.5% of patients which is quite comparable with other Indian reports.[4,7,11,12] Survival in patients without associated anomalies was obviously found to be better than in patients with associated anomalies. Most of the anomalies were cardiac (53%).

History of Feeds before Surgery and Antenatal Diagnosis

Babies who were fed before attending the hospital did not have increased mortality. Even if the patients were fed before the presentation to the hospital, leak rate was not found to be significantly different in these patients as compared to those who were not fed, as seen in other published reports also.[14] Antenatal diagnosis was possible in only 5 patients. However, 29 out of 40 were hospital deliveries. Antenatally, the presence of polyhydramnios led to the suspicion of EA being present.

Gap Length, Tension at Anastomosis, Lower Pouch Mobilization and their Relationship to the Leak Rate

Overall leak rate in our series was 25% which is comparable with other Indian series.[4,11,12] In patients with gap <2 cm, leak rate was 0% in whereas in intermediate (2-3 cm) and long gap (>3 cm), overall leak rates were 31% (6 out of 19) and 44% (4 out of 9) respectively. Our results are comparable with report of Brown *et al.* who reported leak rate of 31% in patients of long gap and 25% in intermediate gap.[15] Similar reports were obtained in Indian series by Sharma *et al.* who reported leak rate of 32% in long gap.[4] Mortality rate in patients with long gap was higher.

Tension on anastomosis is considered a significant factor in predicting leak rate and has been proven in other series as well.[3,6] Lower pouch mobilization was done in 15 patients, and leak rate in these patients was 46.6% as compared to overall leak rate of 25%. However, the results were not statistically significant.

Post-operative Ventilation

Mortality rate was higher in patients who required ventilatory support for more than 10 days. The patients who required post-operative ventilatory support (9 out of 29), (31%) had anastomotic leak more often than the patients who were not ventilated postoperatively (1 out of 11), (9%).

Analysis of Risk Factors for Anastomotic Leak

Various risk factors associated with increased incidence of anastomotic leakage such as increased age at presentation, weight at presentation, associated anomalies, gap length, lower pouch mobilization, tension at anastomosis and post-operative ventilation have been described in the literature.[2,11,14,16-18] and have been implicated to a variable extent. We analyzed the risk of anastomotic leakage associated with each factor and compared the overall leak rate (Table 1).

A total of 40 patients who formed basis of this study were operated by 11 pediatric surgeons in all. Out of 10 patients who had anastomotic leak, 6 were operated by senior residents and 4 by consultants. Although technical expertise is one of the factors affecting outcome in EA and TEF, including anastomotic dehiscence but this factor was difficult to control in our set up. For a more reproducible outcome, an extended study with more number of patients is required.

CONCLUSIONS

Age at presentation and birth weight had an impact on survival but not on anastomotic healing. Lower pouch mobilization and gap length increase the chances of anastomotic dehiscence. Overall leak rate was 25% study series. Overall survival rate was 77.5%. Anastomotic tension is a significant risk factor for dehiscence.

REFERENCES

1. Cudmore RE. Esophageal atresia and tracheoesophageal fistula. In: Lister J, Irving IM, editor. 3rd Neonatal Surgery. London: Butterworth and Co., (Published) Ltd.; 1990. p. 231-58.
2. Chowdhury SR, Ashcraft KW, Sharp RJ, Murphy JP, Snyder CL, Sigalet DL. Survival of patients with esophageal atresia: Influence of birth

weight, cardiac anomaly, and late respiratory complications. J Pediatr Surg 2001;36:1419-21.
3. Chittmittrapap S, Spitz L, Kiely EM, Brereton RJ. Anastomotic leakage following surgery for esophageal atresia. J Pediatr Surg 1992;27:29-32.
4. Sharma AK, Kothari SK, Goel D, Sharma SB, Aggarwal LD, Chaturvedi V. Morbidity and mortality with reference to gap between two segments in esophageal atresia. J Indian Assoc Pediatr Surg 1997;2:67-70.
5. Tripathy PK, Rao KL, Chowdhary SK, Men P, Mahajan K, Samujhé R, *et al.* Lower pouch mobilization in long gap esophageal atresia. J Indian Assoc Pediatr Surg 2004;9:172-8.
6. McKinnon LJ, Kosloske AM. Prediction and prevention of anastomotic complications of esophageal atresia and tracheoesophageal fistula. J Pediatr Surg 1990;25:778-81.
7. Bendi G, Chowdhary SK, Rao KL. Esophageal atresia with traeheoesophageal fistula – An audit. J Indian Assoc Pediatr Surg 2004;9:126-30.
8. Spitz L. Esophageal atresia: past, present, and future. J Pediatr Surg 1996;31:19-25.
9. Nagaya M, Kato J, Niimi N, Tanaka S, Iio K. Proposal of a novel method to evaluate anastomotic tension in esophageal atresia with a distal tracheoesophageal fistula. Pediatr Surg Int 2005;21:780-5.
10. Poenaru D, Laberge JM, Neilson IR, Guttman FM. A new prognostic classification for esophageal atresia. Surgery 1993;113:426-32.
11. Mohan NV, Rajamani G, Kumaran V. Prognostic indices in esophageal atresia with tracheoesophageal fistula. J Indian Assoc Pediatr Surg 1999;4:23-30.
12. Gangopadhyay AN, Apte AV, Mongha VK. Is retropleural drainage necessary after definitive repair of esophageal atresia and tracheoesophageal fistula? J Indian Assoc Pediatr Surg 2003;8:86-90.
13. Farkash U, Lazar L, Erez I, Gutermacher M, Freud E. The distal pouch in esophageal atresia -- To dissect or not to dissect, that is the question. Eur J Pediatr Surg 2002;12:19-23.
14. Eradi B, Narsimhan KL, Rao KL, Grover A, Samujh R, Chowdhary SK, *et al.* Waterston: Classification revisited – Its relevance in developing countries. J Indian Assoc Pediatr Surg 2003;8:58-64.
15. Brown AK, Tam PK. Measurement of gap length in esophageal atresia: A simple predictor of outcome. J Am Coll Surg 1996;182:41-5.
16. Driver CP, Shankar KR, Jones MO, Lamont GA, Turnock RR, Lloyd DA, *et al.* Phenotypic presentation and outcome of esophageal atresia in the era of the Spitz classification. J Pediatr Surg 2001;36:1419-21.
17. Das S. Management of esophageal atresia with or without tracheoesophageal fistula - History and its current status. J Indian Assoc Pediatr Surg 2004;9:123-5.
18. Spitz L. Esophageal atresia. Lessons I have learned in a 40-year experience. J Pediatr Surg 2006;41:1635-40.

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