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Management of Esophageal Atresia and Tracheoesophageal Fistula in North Queensland

Margaret E. Dunkley, Katarzyna M. Zalewska, Edward Shi, Harry Stalewski,

Department of Surgery, The Townsville Hospital, Townsville, Queensland, Australia

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Esophageal Atresia and Tracheoesophageal Fistula occurs in approximately 1/3500 births.[1,2] The aim of management is to surgically ligate the fistula and anastomose the esophageal segments as soon as possible after birth.[3] While the management of EA and TEF has evolved over the last four decades, it continues to remain a challenging problem in specialized pediatric centers and even more so beyond such environments.[4]

There has not previously been any report of treatment of neonates with EA and TEF in provincial Australia. The present study aimed to review the outcomes of management of EA and TEF in a provincial center and therefore examine the factors that support the ongoing practice of managing neonates with EA and TEF in the provincial pediatric surgical unit of The Townsville Hospital in North Queensland. The information might provide a base for efficient and effective service provision planning within the Australian health care environment.

Materials and Methods

This study has been undertaken to examine and document the outcomes in the management of EA and TEF in a provincial hospital in North Queensland and to compare the results with those achieved in a designated specialized children's hospital.

This was a nonrandomized comparative study with one study group location being The Townsville Hospital (TTH) and the other being Sydney Children's Hospital (SCH). The selection of patients with EA and TEF from the two centers was based on the assumption that applicable comparisons could be made between the 2 study groups. A study period of a solo practicing surgeon at the provincial hospital, TTH, was compared with a comparable surgeon in a specialized children's hospital, SCH.

Data from TTH was retrieved by retrospective chart review for patients treated between 1990 and 2007. The patients were identified from examining the TTH pediatric surgeon's records and also by undertaking a search of TTH medical records

Corresponding author: Dr. Margaret Dunkley, The Townsville Hospital, 100 Angus Smith Drive, Douglas, Townsville, Queensland, Australia 4814.
Tel.: +61 407811900; E-mail: dr.memorrow@gmail.com

Table 1 Total number of cases of EA and TEF, including "H" type TEF and EA. Also showing 2 cases transferred to a specialized pediatric center

Hospital	Total number of cases	Fistula type: Proximal atresia, distal fistula	Fistula type: H type fistula	Fistula type: Other	Transfers to other centers
TTH	33	28	3	1 unknown (transferred); 1 EA with proximal and distal TEF	2
SCH	33	29	3	1 (proximal TEF, distal atresia, long gap)	0

database. Data from SCH was kept prospectively for patients treated between 1986 and 2003.

The information collated included preoperative data of medical record number (MRN), sex, date of birth (DOB), birth weight, gestational age, associated anomalies, Waterston group, and type of EA/TEF. The outcomes measured included time from birth to operation, leak rates, recurrence rates, presence of stricture and need for dilation, rates of gastro-esophageal reflux disease (GERD) requiring fundoplication and mortality. The number of patients that needed to be transferred from TTH to a specialized children's hospital for management were also reviewed.

Results

Both the SCH and TTH surgeon had similar operative timeframes of 17 years. We found that both centers used a similar operative technique.

The study arms had a similar number of cases: 33 in TTH and 33 in SCH. We have excluded 4 cases from TTH and 3 cases from SCH because they had H-TEF or isolated EA (Table 1). The management of these is different to that for EA with TOF.

The preoperative characteristics of gestational age, birth weight, presence of maternal polyhydramnios, sex proportions, and plurality were almost identical between the 2 hospitals as seen in Table 2.

The Waterston scores were comparable between the 2 hospitals, with an almost equal percentage of Waterston group B neonates in both hospitals. There were slightly more group C neonates in SCH than TTH and a correspondingly higher number of group A neonates in TTH (Table 3).

SCH had one clinically significant leak. There were no leaks in TTH. Recurrence was identified in 1 case in both TTH and SCH. Postoperative strictures were more likely to have endoscopic dilatation in TTH than SCH. Gastrostomy rates were 17% in TTH versus 27% in SCH. SCH had a higher rate of fundoplication compared with Townsville (30% vs. 7%; Table 4).

Mortality was comparable, with only 1 death occurring in both study arms (Table 4).

The time elapsed between birth and operation was about 22 hours in both hospitals (Table 4).

Two cases of EA and TEF were transferred out of TTH (Table 1). One case was to the nearest pediatric tertiary referral center when TTH's sole pediatric surgeon was away on leave. The other case had a severe cardiac condition and was immediately transferred to a pediatric cardiothoracic unit where he died prior to surgery.

Discussion

EA and TEF are congenital abnormalities that are thought to occur because of a defect in the development of the foregut into the esophagus and trachea at about the fifth week of gestation.[5,6] Approximately half of all infants affected by EA and TEF also have other congenital abnormalities, with cardiac malformations being the most common.[7] The survival of neonates with EA and TEF is largely dependent on the presence of associated congenital anomalies, together with prematurity and low birth weight.[8] The last 4 decades has seen an increase in

Table 2 Comparison of preoperative characteristics of infants suffering from EA and TEF in TTH and SCH

Hospital	Mean gestational age, mo	Mean weight, g	Sex, female/male ratio	Presence of other anomalies, *n* (%)	Plurality, twins/singletons ratio
TTH	37.21	2626	10:19 (34% F)	18 (62)	3:27 (10% twin)
SCH	36.5	2520	10:20 (33% F)	25 (83)	2:27 (7% twin)

Table 3 The Waterston score of infants in TTH compared with SCH

Group	Characteristics	TTH, *n* (%)	SCH, *n* (%)
A	Birth weight >2500 g and well	12 (40)	9 (30)
B	Birth weight 1800–2500 g and well, or any weight with moderate pneumonia or anomalies	11 (37)	12 (40)
C	Birth weight <1800 well, or any weight with severe pneumonia or congenital anomaly	6 (21)	9 (30)

The Waterston score stratifies mortality risk based on birth weight, pneumonia, and associated congenital anomalies. Infants in group A have the best prognosis.

survival of infants with EA and TEF to around 90%. This is largely due to improvements in neonatal support due to advances in neonatology, neonatal anesthesia, nutritional support, and antimicrobial therapy.[9]

The authors acknowledge that while EA and TEF are among the most common congenital abnormality, these abnormalities occur infrequently.[1] So although conducted over nearly 2 decades, the study size is too small to compare the data statistically. However, this study demonstrates the trend that management at TTH is comparable with SCH when the clinical outcomes of leak, recurrence, and mortality are considered. Further, the data demonstrated here is similar to current published literature[10] (Table 4).

This study did demonstrate that the rate of postoperative stricture was higher in TTH than SCH. This may be due to a higher incidence of eosinophilic esophagitis (EoE). Recently a retrospective case analysis has demonstrated that approximately 17% of EA patients suffer from EoE.[11] These patients were more likely to suffer from persistent reflux symptoms and also more likely to have complications, including recurrent anastomotic stricture. The data in our study has demonstrated a higher rate of antireflux surgery in SCH when compared with TTH. The higher rate of antireflux surgery may result in a decreased rate of EO and therefore stricture. This requires further investigation.

With 620 beds, Townsville Hospital is the largest provincial hospital in Australia and is the major tertiary referral and teaching hospital for North Queensland. The neonatal unit is the only level 6 inpatient service outside of Brisbane and provides for infants in North Queensland requiring neonatal care, including neonatal surgery. As a level 6 referral center, TTH also has a responsibility to outlying health facilities within the geographical boundaries of north to the Torres Strait, west to the Queensland border, and south to Sarina. With 50 cots, the unit admits approximately 900 babies per year. Together with Retrieval Services Queensland (RSQ), it provides the neonatal retrieval/transport service and undertakes over 100 retrievals a year. All infants requiring cardiac and eye surgery are transferred to Brisbane. The management of neonates with EA and TEF is therefore occurring within the Queensland Health Clinical Capability Framework.

The majority of neonates in the TTH arm of this study were transferred in from distant peripheral hospitals; however, the time elapsed between birth and definitive surgery is similar in both TTH and SCH. This indicates an efficient retrieval and transport system. It is also important to note that if the patients had to be transferred to the next closest pediatric hospital 1400 km away, the time to treatment would increase significantly. The expertise of the neonatal and pediatric team negates the need for transfer after operative management. Further, they also provide long-term management of any complications or associated congenital problems.

There are some benefits that are very hard to measure in a clinical study but are nevertheless worthwhile mentioning in the context of management of health problems in a provincial hospital. With patients being managed closer to home, not only are public health costs reduced, but so is the

Table 4 The outcomes after EA and TEF repair in TTH and SCH, also demonstrating the outcomes in current literature. The time to operation has also been included in this data

Hospital	Postoperative clinical leak	Recurrence of fistula	Postoperative stricture	Antireflux procedure	Death	Time to operation
TTH	0	1 (3.4%)	17 (59%)	2 (7%)	1 (3.4%)	22.5 h
SCH	1 (3.4%)	1 (3.4%)	4 (13%)	9 (30%)	1 (3.4%)	23.3 h
Current literature	10–21%	3%	18–50%	10–58%	6%	Not available

wider social cost and the emotional and financial impact on individual families.

EA and TEF were successfully managed in the provincial pediatric unit in TTH. Survival and outcomes were similar to those of a specialist children's hospital. Therefore, this demonstrates that The Townsville Hospital pediatric neonatal and surgical service provides effective treatment comparable with that of a world-class metropolitan facility.

This study supports the ongoing management of these neonates closer to home and may assist health managers to structure service delivery in provincial Australia, thus reducing the overall burden of these health problems on our public health system and society. With the right factors in place, management of EA and TEF in North Queensland should continue to be rewarding for clinicians, patients and their families.

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