Two year neurodevelopmental outcome following neonatal repair of esophageal atresia

Gunn JK, Greaves S, Hutchinson EA, Kelly LM, Moran M, Chisholm AK and Hunt RW

Background
As survival with esophageal atresia (EA) has improved over the last two decades, research has begun to focus on the long-term morbidity in these children. Frequent problems with respiratory and gastrointestinal dysfunction and orthopaedic complications are reported. The very small number of studies examining neurodevelopmental outcomes in this group have reported reduced intelligence and increased frequency of behavioural and emotional problems.

Objective
The neurodevelopmental trajectory of children with EA in Australia is largely unknown. We sought to determine the ‘typical’ neurodevelopmental outcome of 2-year-old children who had undergone surgical repair of EA during the newborn period.

Methods
In 2009-11, 68 neonates (41 male) with EA were admitted to the Neonatal Unit at the Royal Children’s Hospital (Melbourne). Two had long-gap EA and the remainder had short-gap EA with a distal fistula. All surgical repairs were open procedures. Peri-operative cranial ultrasound and karyotype were routinely performed. Demographic data were obtained from a clinical database.

Neurodevelopmental assessment
At the age of two years, the families of the children were invited to attend a neurodevelopmental follow-up clinic. Seven (10%) infants died due to complications of extreme prematurity (2), complex congenital heart disease (2); severe hypoxic brain injury (prior to surgery) (1); long-gap EA, trisomy 21 and refractory chylothorax (1); sudden death at 16 months (1).
Six inpatient patients were not offered follow-up, nine children were lost to follow-up and four declined. The Bayley Scales of Infant and Toddler Development, 3rd edition (BSID-III) were administered to 42 two-year-olds. Normative data equate to a mean ± standard deviation (SD) of 100 ± 15. A neurological examination was also undertaken.

Analysis
Descriptive statistics were utilised. Mean ± SD and median (interquartile range) are reported for parametric and non-parametric data respectively. T-tests were used to compare demographic variables in those with developmental delay.

Results
Mean birth weight of 42 children assessed was 2.7 ± 0.8 kg, including 12 (29%) who were below the 10th percentile for gestational age. Mean gestational age at birth was 37.7 ± 2.6 weeks (range 32-42 weeks). Median age at surgery was 1 (IQR 0-2) day and hospital length of stay was 24 (14-40) days. Gastrostomy formation and delayed oesophageal repair occurred in the patient with long-gap EA and one preterm patient. Table 1 shows associated congenital anomalies identified in 62% of the patients (excluding isolated PDA). One patient had a paternally-inherited chromosomal anomaly identified.

Imaging
All infants underwent cranial ultrasound imaging at 2 ± 1 days, one revealing a dysplastic corpus callosum. Thirteen had brain MRI at 32 (IQR 10-70) days after birth. Six had mild brain abnormalities, three with subsequent developmental delay.

Neurodevelopment
At 2.4 ± 0.3 years of age, 42 children were assessed with the BSID-III. Mean cognitive, language and motor composite scores were 101 ± 13, 101 ± 16 and 99 ± 12 respectively. Seven (17%) children had developmental delay (score <85) including motor delay (7), language delay (4) and cognitive delay (3). One (included) was unable to be assessed due to CHARGE syndrome and profound deafness (assigned scores of 55). All other patient scores were >70. Mean birth weight and gestational age were significantly lower and length of stay longer in those with developmental delay (any score <85) compared with those without delay (Table 2). Mean Bayley composite scores were 103.6 ± 10.7 in infants >37 weeks at birth compared with 89.1 ± 13.3 in those <37 weeks gestation (p<0.001) (Figure 1).

Conclusions
Neurodevelopment at two years in survivors of OA is not different from test norms. Patient factors such as mild prematurity, rather than cerebral imaging, are likely to identify children at highest risk of subsequent impairment.