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Short Communication

From the borders of Viability: a 21-year Western Australian Experience of Outcomes in Infants born between 22-22+6 weeks Gestation

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INTRODUCTION

Resuscitation at the borders of viability, particularly at <23 weeks gestation, remains a common ethical dilemma for clinicians. Some of these challenges include: whether to provide lifesaving treatment at limits of viability after considering what is in the best interest of child and family, risks of severe impairments, quality of life, costs, amalgamation into being an independent and productive community member and finally who should decide about resuscitation.

Limited knowledge about survival and long-term neurodevelopment in this vulnerable subgroup of extremely preterm (EP) infants presents a challenge to neonatologists in counselling parents [1]. Furthermore, there are variations in resuscitation guidelines, in different countries eg; Sweden, Japan, and Germany have a uniformly active approach to infants born at 22-24 weeks gestation whereas life-saving treatment is not offered before 24 weeks in France, and the Netherlands [2]. Variations in practices at borderline viability exist in different centres such as those in USA where states like Iowa offer active management at 22 weeks. UK has recently (in 2019) updated their viability guidelines to consider offering resuscitation to infants at 22 weeks gestation. In Australia, there is state-wide variation in resuscitation guidelines (www.bettersafercare.vic.gov.au/) where some states (Victoria) consider active management from 22 weeks while others including Western Australia (WA) have no uniform approach.

Considering these variations, we aimed to assess the outcomes of infants born between 22^{+0} to 22^{+6} weeks gestation, whose parents opted for full resuscitation, in our sole tertiary referral hospital over the last 21 years. Data from this project will be used to revise our hospital guidelines and develop an evidence-based care guideline for borderline viability in WA.

METHODS

Design and setting

Retrospective data review at the sole tertiary perinatal centre in WA.

Eligibility criteria

All preterm infants born between 22^{+0} to 22^{+6} weeks gestation and who were admitted to the neonatal intensive care unit (NICU) between January 2000-December 2021 after full resuscitation.

Data extraction

Data on all births (22^{+0} to 22^{+6} weeks) were obtained from the King Edward Memorial Hospital (KEMH) Data Collections Statutory Registers (Midwifery Notification System). Data from admissions to NICU was sourced from Neonatal database (NeoBase). Long-term outcome data (cerebral palsy/ CP, intellectual disability, vision or hearing impairment, neuro-behavioural issues) was retrieved from Neonatal Follow Up System (NFS) Database.

RESULTS

There were 71 infants born between 22^{+0} and 22^{+6} weeks at KEMH from January 2000- December 2021. Following parental discussion, 12 (17%) were fully resuscitated and admitted to NICU; rest (n=59; 83%) were not offered active management. Detailed demographics of the admissions are given in **Table 1a**.

There were five survivors (42%), six died at ≤72 hours of life and one died following overwhelming sepsis at 21 days; none were offered redirection to comfort care. There were no deaths after discharge from NICU. All five survivors were assessed till five years of age with no loss to follow up. Details of short-term complications and long-term neurodevelopment in survivors are given in **Table 1b**. Most were free from major disability as per our definitions (**Table 1b**).

DISCUSSION

Survival after full resuscitation and admission to the NICU following parental discussion was 42% in infants born between 22-22+6 weeks at our tertiary referral centre in WA. At follow-up, most survivors were free of major impairment. A complete course of steroids, female gender and singleton pregnancy seemed to favour survival, whereas birth weight

Table 1a: Demographics of survivors and non-survivors.

	Non-survivors (n=7)	Survivors (n=5)
Years of birth	2001, 2002, 2015 (twins), 2017 (twins), 2021	2001, 2004, 2010, 2010, 2012
Median (IQR) gestation (weeks)	22.5 (22-22.6)	22.6 (22.3-22.6)
Birth weight (grams)	500 (430-655)	540 (376-640)
Complete antenatal steroids	2/7 (28.6%)	3/5 (60%)
Male gender N(%)	6/7; (85.7%)	1/5 (20%)
Multiple	4/7 (47%)	0 (0%)
SGA	1/7 (14%)	0 (0%)
Ethnicity	Caucasian (86%), Indigenous (0%), African (14%)	Caucasian (60%), Indigenous (40%)
Cause of death	Severe IVH (28%) Respiratory failure (43%) LOS (29%)	-

Table 1b: Short and long-term outcomes of survivors.

Short-term complications	**Number (%)**
NEC stage II	1 (20)
CLD needing steroids	2 (40)
LOS	5 (100)
ROP needing treatment	2 (40)
IVH grade 3 or 4	0
PVL	0
Significant PDA needing pharmacotherapy	4 (80)
Median (IQR) length of stay (days)	133 (120-201)
Long-term neurodevelopment	
Cognitive outcomes Normal @Mild (>1-2 SD below mean) @Moderate (>2-3 SD below mean) @Severe (>3 SD below mean)	 4 (80%) 1 (20%) 0 0
Cerebral palsy	0
Hearing impairment	1 (20%)
Blindness	0 (0%)
Autism	0 (0%)
ADHD	2 (40%)
@Overall disability	
None	3 (60%)
Mild	2 (40%)
Moderate	0
Severe	0

Abbreviations: CLD: chronic lung disease, IVH: intraventricular haemorrhage, LOS: late onset sepsis, NEC: necrotising enterocolitis, PDA: patent ductus arteriosus, PVL: periventricular leukomalacia, ROP: retinopathy of prematurity, SD: standard deviation

@Disability definitions: Mild disability was defined as cognitive score>1-2 standard deviations (SD) below the test mean +/ ambulant cerebral palsy (GMFCS level I/II) +/ unilateral deafness. Moderate impairment was defined as cognitive scores >2-3 SD below the mean +/ GMFCS level III CP (ambulant with aids) +/ bilateral deafness needing amplification. Severe impairment was defined as cognitive scores>3 SD below the mean +/ GMFCS level IV/V CP +/ blindness (vision <6/60). Autism was not specifically assessed but classified as a severe outcome if known to be present and diagnosed by standard multidisciplinary team assessment.

Assessments offered: 12 and 36-months corrected age: Griffiths Mental Developmental Scale (GMDS 0-2 years and GMDS-Extended Revised/ ER 2-8 years till December 2016 and then Griffiths-3 from January 2017 till date), 24-months corrected age (Bayley Scales of Infant and Toddler Development (BSID-2nd and 3rd edition) and 5-years chronological age (Weschler Preschool and Primary Scale of Intelligence-3rd edition/ WPPSI-III).

had no impact. It is important to note that only 17% of infants were offered resuscitation and most were towards end of 22nd week. Furthermore, we acknowledge our study limitations in data originating from a single-centre, duration being 21 years over which perinatal management has shown contemporary advances (antenatal steroids, antenatal magnesium sulphate, high-risk deliveries in a well-equipped centre, advanced cardio-respiratory management, neurocritical monitoring, antibiotic stewardship, sepsis prevention bundles, early initiation and progression of feeds, introduction of routine probiotics, early intervention etc), lack of data on those who were not resuscitated and a small sample size.

Survival and long-term outcomes at lower limit of borderline viability are variable. A metanalysis summarized survival and impairment risk for infants born between 22^{+0} to 27^{+6} weeks in high income countries (n=65 studies; 9 databases) with 24% survival, severe impairment in 36.3%, some impairment in 77% and intact survival only in 1.2% [3]. The EPIPAGE-2 and EXPRESS cohorts reported 0.7% and 9.8% survival at 22 weeks [1,4]. Of the survivors from the EXPRESS study, 40% had mild to no disability, and 60% had moderate to severe disability at 2.5 years however, risk for survival with severe disability at 6.5 years increased to 92% for children born at 22 weeks [1]. Another meta-analysis (n=31 studies, 2226 infants born at 22 weeks and managed actively) reported 11% survival without major morbidity and 37% survival without major impairment [5].

In their population-based cohort study of all 22-24 weeks gestation live births (2009-2017), in Victoria, Boland et al reported active management of 10 of 191 live births (5%) at 22 weeks and none survived till one year of age [6].'The centre effect' has been reported to influence outcomes with an emphasis of role of clinician attitude towards borderline viability and active perinatal management [7].

As clinician attitude plays a significant role in infant survival at this gestation, ongoing reporting of outcomes from this group of children will be important to help incorporate this knowledge into clinical practice.

CONTRIBUTOR'S STATEMENT

GAJ conceptualised and designed the study, created study instrument, collected and analysed data, drafted the first manuscript and reviewed and revised the manuscript. SAA assisted in data collection and analysis and reviewed and revised the manuscript. EH, LG and MS assisted in interpreting data and reviewing and revising the manuscript. All authors approved the final manuscript as submitted and agree to be accountable for all aspects of the work.

DATA AVAILABILITY

All data are available on reasonable request from the first author.

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There are no competing interests to declare.

ETHICS DECLARATION

Institutional approval from the Governance Ethics Knowledge and Outcomes (GEKO) committee was obtained (approval number: 2022-000413).

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