A profile of children with traumatic brain injury admitted to the paediatric intensive care unit of Red Cross War Memorial Children's Hospital in Cape Town, South Africa, between 2015 and 2019

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Background. Paediatric traumatic brain injury (TBI) is a public health problem with high morbidity and mortality.
Objectives. To highlight risk factors and describe associated morbidity and mortality of children admitted with TBI to the Paediatric Intensive Care Unit (PICU) at Red Cross War Memorial Children's Hospital, Cape Town.
Methods. We retrospectively documented the hospitalisation of all children with TBI admitted into our PICU between 2015 and 2019.
Results. Of 320 children identified, 314 were enrolled: 267 (85%) had severe TBI (Glasgow Coma Scale (GCS) ≤8), 36 (11.5%) moderate TBI (GCS 9 - 12) and 11 (3.5%) mild TBI (GCS ≥13). Median age was 6.5 (interquartile range (IQR) 3.5 - 8.9) years; 194 (61.8%) were male. Motor vehicle collisions accounted for 75% (235) of injuries. Two hundred and seventy-nine (88.9%) children were invasively ventilated for a median of 4.5 (IQR 1 - 8) days; 13.9% (38/273) had a failed extubation and 10.8% (30/277) required tracheostomies. One hundred and sixty-three children (52.2%, *n*=312) had intracranial pressure monitoring. Almost a third (81/257) required vasopressor support. Approximately 40% (113/286) developed trauma-related seizures; 15.4% (44/286) required a thiopentone infusion and 6% (17/280) a decompressive craniectomy. Common complications were as follows: 12.2% developed post-extubation stridor (34/279), 10.5% a hemiparesis (33/314) and 6.4% diabetes insipidus (19/298). Median PICU stay was 4 (IQR 1 - 10) days, and hospitalisation 11 (IQR 5 - 21) days. Ninety-three (29.6%) children were transferred for further rehabilitation; 38 (12.1%) died.
Conclusion. Children admitted to our PICU with TBI had considerable morbidity and mortality, but this is a marked improvement since the 1990s. Enhanced primary preventive strategies, especially for motor vehicle collisions, are imperative to prevent TBI in children.
Keywords. PICU, TBI, risk factors.

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Contribution of the study
Paediatric traumatic brain injury (TBI) is associated with considerable morbidity and mortality. Through our profile of children with TBI admitted to PICU, we hope to contribute to future guidance and interventions to improve the quality of care in this subset of patients.

Paediatric traumatic brain injury (TBI) is a major global public health problem associated with high morbidity and mortality in children and adolescents.[1] International paediatric TBI data from 1995 to 2015 indicate that males are more commonly affected, with a median age at injury of 6.8 (mean ages 3.2 - 10.4) years, with a bimodal distribution peaking in very young children (0 - 3 years) and adolescents (15 - 18 years). More than 80% of paediatric TBIs are classified as mild TBI (Glasgow Coma Scale (GCS) ≥13), with severe TBI (GCS ≤8) accounting for between 3% and 7% of all TBIs in most populations. Motor vehicle collisions (MVCs) (6 - 80%) and falls (5 - 87%) are the most common mechanisms of injury, and mortality rates across all severities of TBI range from 1 to 7%, or between 2.8 and 3.8 children per 100 000 annually.[2,3]

In recent years, there has been a major uptake in both adult and paediatric TBI-related research, with specific interest in improvement of patient management and the prevention of secondary brain injury and resultant morbidity, poor functional outcomes, and mortality. Despite cutting-edge advances in neuromonitoring and medical interventions, with marked improvement in the outcomes of this population group in the past three decades, there is scope for further progress.

Our aim was to document the profile of children with TBI admitted to our Paediatric Intensive Care Unit (PICU), with a special focus on the risk factors, morbidity and mortality. This could guide future planning and interventions to improve the quality of care in this subset of patients.

Methods

Study sample

Red Cross War Memorial Children's Hospital (RCWMCH) is a dedicated paediatric tertiary hospital in South Africa. It is the regional referral centre for all paediatric major trauma and brain injury cases in the public health sector in Western Cape Province. The hospital's 22-bed

combined medical-surgical PICU has ~1 400 admissions annually, of which the annual average of trauma- and TBI-related admissions are ~135 and 50 - 60, respectively.

We conducted a retrospective descriptive review of all the children with TBI admitted into the PICU at RCWMCH between 1 January 2015 and 31 December 2019.

Inclusion and exclusion criteria

All children with TBI admitted to the PICU during the study period were eligible for enrolment. Exclusion criteria included previous enrolment in the study, unavailability of any inpatient notes, and confirmed brainstem death prior to PICU admission.

Data collection

All admissions to the RCWMCH PICU from 1 January 2015 to 31 December 2019, as contained in a specifically designed Microsoft Access database detailing all PICU admissions data, were reviewed for eligible participants by running a directed search/query on the 'Primary Diagnosis' and 'Diagnosis' fields. Folders of possible participants were requested from the records department and all candidates with available folders were enrolled. In cases where full folders were not available, data were collected from the neurosurgery database and PICU discharge summaries. Data collected included demographics (sex, age, referring centre); TBI severity (GCS-guided into mild (GCS ≥13), moderate (GCS 9 -12) and severe (GC S≤8)); mechanism of injury; associated injuries; type and duration of brain monitoring in PICU; incidence and management of trauma-related seizures; duration of invasive and non-invasive ventilatory support, including need for tracheostomy; PICU complications, including ventilator-associated pneumonia, catheter-related blood stream infections, pressure sores, deep venous thrombosis and endocrine complications such as diabetes insipidus (DI). Duration of PICU and hospital stay, as well as PICU and hospital mortality, were collected as measures of outcome.

Data collection and management was performed using secure, web-based REDCap (Research Electronic Data Capture) electronic data capture tools hosted at the University of Cape Town.

The investigator populated all case report forms using patient medical folders, the National Health Laboratory Service database and the Picture Archiving and Communications Systems (PACS) radiology database.

Statistical analysis

Microsoft Office Excel 2015, TIBCO Statistica version 14 (TIBCO Statistica, USA) and SPSS Statistics for Windows version 28 (IBM, USA) were used for data analysis. The characteristics of the patients were described using standard descriptive analysis, including measures of central tendency (mean, median, proportions) and dispersion (standard deviation, interquartile ranges (IQR) and 95% confidence intervals).

More in-depth analysis was conducted using Mann-Whitney *U* testing to describe measures of central tendency on non-parametric data, as well as *chi square* and Fisher's exact tests for categorical data to review factors associated with ventilation duration, PICU and hospital stay, as well as mortality. A *p*-value <0.05 was deemed statistically significant.

Ethical considerations

The study was performed in concordance with the principles set out in the Helsinki Declaration. Ethics approval was obtained from the Human Research Ethical Committee (HREC) of the University of Cape Town (ref. no. 135/2021) and the RCWMCH research committee, prior to commencement of data collection.

Results

Two hundred and thirty-two full folders were reviewed. The data for the remaining 82 participants were collected from the neurosurgery database and PICU discharge summaries. This accounts for the denominator differences in certain data fields.

Demographics

Of the 320 children identified, 314 were enrolled into the study: 267 (85%) were classified as having severe TBI (GCS ≤8), 36 (11.5%) moderate (GCS 9 - 12) and 11 (3.5%) mild TBI (GCS ≥13) (Fig. 1).

The children comprised 61.8% boys (194/314), had a median age of 6.5 (IQR 3.5 - 8.9) years, and road traffic collisions accounted for 75% of all TBIs. Children were mostly referred from Khayelitsha District Hospital (*n*=33, 10.5%), Worcester Hospital (*n*=21, 6.7%) and Mitchell's Plain District Hospital (*n*=17, 5.4%). Fifty-three children (16.9%) were brought directly to the RCWMCH Trauma Centre.

Ten (3.2%, *N*=314)children had an acute life-threatening event requiring cardio-pulmonary resuscitation (CPR) after their injury. Six (60%, *n*=10) of these events occurred prior to PICU admission.

Injuries

Twenty percent (64/314) of the children enrolled in the study had an isolated TBI. Two hundred and three children were admitted to RCWMCH PICU with polytrauma (≥2 severe injuries in at least two areas of the body), 171 (84.2%) of them with an associated head injury.

Skull fractures were present in 51.3% (161/314) of cases. The most common associated injuries were facial fractures (including frontal, mandibular, maxillary and orbital fractures) in 52 (16.5%) children, 38 (12.1%) femur fractures and 27 (8.6%) tibia/fibula fractures, 29 (9.2%) pneumothoraces, 25 (8%) lung contusions, as well as 22 (7%) haemothoraces. Additional injuries were not statistically associated with higher risk of death ($p>0.05$).

Course in PICU

Children were admitted to the RCWMCH PICU at a median of 9 (IQR 7.1 - 12.9, *n*=232) hours after injury; with statistically no difference between those who survived, and those who died ($p=0.829$). Table 1 summarises the major general, first tier and second tier interventions (as documented in the Management of pediatric severe traumatic brain injury: 2019 Consensus and guidelines-based algorithm for first and second tier therapies[4]), as well as outcomes of children with severe and those with mild/moderate TBI.

Complications and morbidity

Table 2 summarises the most common complications and morbidities encountered.

Seizures

Eighty-six children (30%, *n*=286) developed trauma-related seizures within 24 hours, 4 (1.4%) between 24 and 72 hours, and 12 (4.2%) after 72 hours. Seizures were diagnosed clinically as not all patients in our setting undergo an electroencephalogram (EEG; 27/234, 11.5%), cerebral function monitoring (CFM; 29/233, 12.4%) or both (10/232, 4.3%). Five children had seizures on EEG, and 9 on CFM. Three of the 10 children monitored with EEG and CFM had confirmed electrical seizures on both modalities. Phenobarbitone (78.8%, 89/113) was the treatment of choice, followed by levetiracetam and sodium valproate (9/113, 8%) each, and phenytoin (6.2%, 7/113). Levetiracetam use

Table 1. Profile of children by traumatic brain injury severity

	All children (*N*=314)	Severe TBI (GCS ≤8) (*n*=267, 85%)	Mild/moderate TBI (GCS ≥9) (*n*=47, 15%)	*p*-value
Demographics				
Male, *n* (%)	194 (61.8)	167 (62.5)	27 (57.4)	0.306
Age median (IQR), years	6.5 (3.5 - 8.9)	6.6 (3.6 - 9)	4.2 (2.9 - 7.4)	0.027
Mode of injury, *n* (%)				0.369
1 MVC pedestrian	168 (53.5)	143 (53.6)	25 (53.2)	
2 MVC passenger	67 (21.3)	61 (22.8)	6 (12.8)	
3 Fall	30 (9.6)	22 (8.2)	8 (17)	
General interventions				
ICP monitors, *n* (%)	163 (51.9)	158 (59.2)	5 (10.6)	<0.001
Noradrenaline, *n* (%)	81/257 (31.5)	78/215 (36.2)	42, 3 (7.2)	<0.001
Ventilated (IPPV) in PICU, *n* (%)	279 (88.9)	257 (96.3)*	22 (46.8)	<0.001
Packed red cell transfusion, *n* (%)	102/241 (42.3)	91/198 (46)	11/43 (25.6)	<0.001
First-tier interventions				
Hypertonic saline, *n* (%)†	122/236 (51.7)	133/194 (68.6)	9/42 (21.4)	<0.001
Neuromuscular blockade, *n* (%)	16/234 (6.8)	16/192 (8.3)	0	0.005
EVD *n* (%)	15/287 (5.2)	15/241 (6.2)	0	0.046
Second-tier interventions				
Thiopentone infusion, *n* (%)	44/286 (15.4)	43/240 (17.9)	1/46 (2.2)	0.004
Decompressive craniectomy, *n* (%)	17/280 (6.1)	17/234 (7.3)	0	0.017
Outcomes				
PICU duration median (IQR), days	4 (1 - 10)	6 (1 - 11)	1 (1 - 3)	<0.001
Hospitalisation duration median (IQR), days	11 (5 - 21)	11.5 (5 - 22)	8 (4 - 15)	0.077
PICU mortality, *n* (%)	38 (12.1)	37 (13.9)	1 (2)	0.019

TBI = traumatic brain injury; GCS = Glasgow Coma Scale; IQR = interquartile range; MVC = motor vehicle collision; ICP = intracranial pressure; IPPV = intermittent positive pressure ventilation; PICU = paediatric intensive care unit; EVD = external ventricular drain;.
*Three children with severe TBI never ventilated, 4 extubated prior to PICU admission, 2 extubated on arrival in PICU.
†Hypertonic (5%) saline is standard of care at RCWMCH; mannitol is not routinely used.

Table 2. Complications and morbidities

	All children	
	n	*n* (%)
Trauma-related seizures (clinical)	286	113 (39.5)
Post-extubation stridor	279	34 (12.2)
Failed extubation	273	38 (13.9)
Tracheostomy	279	30 (10.8)
Hospital-acquired infection	309	88 (28.5)
CLABSI	308	16 (5.2)
VAP	279	63 (22.6)
Hemiparesis	314	33 (10.5)
Diabetes insipidus	298	19 (6.4)
Deep vein thrombosis	297	9 (3)
Transferred for further inpatient rehabilitation on RCWMCH discharge	314	93 (29.6)

CLABSI = central line-associated bloodstream infection; RCWMCH = Red Cross War Memorial Children's Hospital; VAP = ventilator-associated pneumonia.

only became more prominent in our setting after the study period. Seizure treatment was started at a median of 1 day post insult (IQR 0 - 1 day).

Respiratory and ventilatory complications

Children were ventilated for a median of 4.5 (IQR 1 - 8, *n*=268) days: 5 (IQR 1 - 9) days in those with severe TBI (*n*=246) and 1.5 (IQR 0 - 7) days in mild/moderate TBI (*p*=0.045).

Patients failed extubation owing to severe upper airway obstruction/stridor (32/38, 84.2%), increased work of breathing (13/38, 34.2%), and depressed level of consciousness (3/38, 7.9%).

The main reasons for a tracheostomy included prolonged ventilation (14/30, 46.7%), failed extubation/inadequate airway protection (19/30, 63.3%), and stridor (11/30, 36.7%). Tracheostomies were performed at a median of 15 (IQR 12 - 19, *n*=27) days post injury and required for a median of 17 (IQR 14 - 22.5 *n*=20) days before successful decannulation. Failed extubation and tracheostomy were associated with a statistically significant longer duration of IPPV, PICU stay and duration of hospitalisation ($p<0.001$).

Eleven of the 279 ventilated children (4%) had an accidental/self-extubation: 9 (81.8%) occurred prior to PICU admission and 2 (18.2%) during their PICU stay. Three children (1%, *n*=279) required re-intubation for a blocked endotracheal tube, one (0.4%) sustained hypoxic brain injury due to very difficult intubation with multiple failed attempts, and another (0.4%) presented with an oesophageal intubation from the referring centre.

Infective complications

One hundred and eleven children (40% of the 279 ventilated children) admitted to PICU with TBI developed a respiratory tract infection; 56.8% (63/111) of these were classified as having a ventilator-associated pneumonia (VAP). Sixteen children (5.2%, *n*=306) developed a central line-associated bloodstream infection (CLABSI) (Fig. 2).

Bacteria were most frequently cultured from tracheal aspirates. The most common organisms in the ventilated children were methicillin-

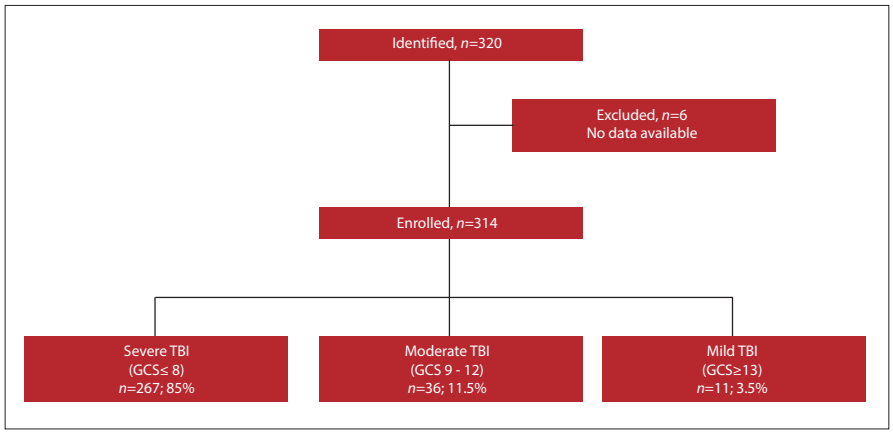

Fig. 1. Recruitment process. (GCS = Glasgow Coma Scale).

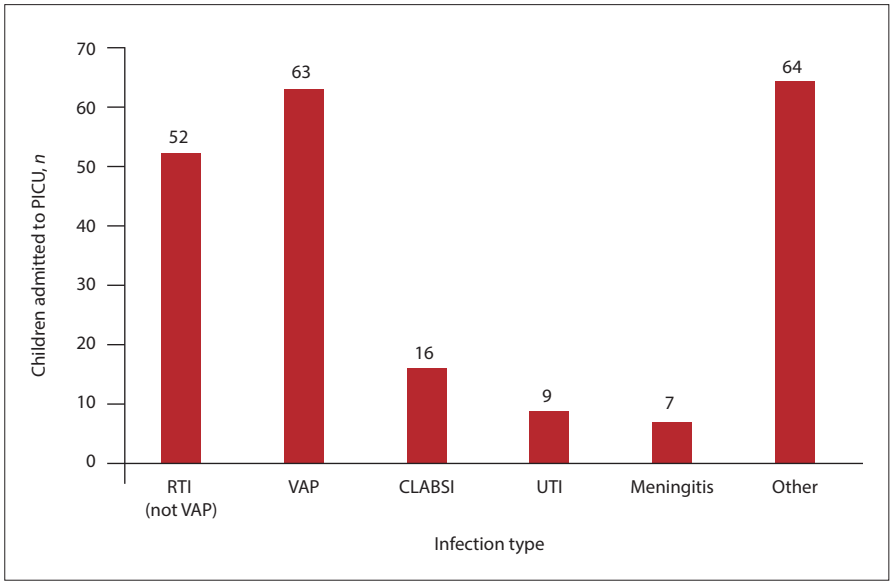

Fig. 2. Infections in children admitted to PICU with TBI. (PICU = paediatric intensive care unit; TBI = traumatic brain injury; VAP = ventilator-associated pneumonia; CLABSI = central line-associated bloodstream infection; UTI = urinary tract infection).
Other: presumed sepsis (50); wound site infection (10); eye infection (2); sinusitis (1); ventriculitis (1).

sensitive *Staphylococcus aureus* (MSSA) in 12.9% of the children (36/279) and *Haemophilus influenzae* in 11.8% (33/279).

Eighty patients (26.8%, *n*=299) received no antibiotic treatment, while 95/267 (35.6%) of those with severe TBI, and 5/36 (13.9%) with moderate TBI, received second-line antibiotics (piperacillin-tazobactam, amikacin, ertapenem, meropenem, vancomycin). No-one with mild TBI required second-line antibiotics.

Diabetes insipidus

Nineteen children (6.4%, *n*=298), all with severe TBI (7.5% of 252), were diagnosed with diabetes insipidus (DI) using urine output >4 mL/kg/h and raised serum sodium criteria. There was a paucity in central DI-corroborating urine osmolality tests (5/19, 26%) and urine-specific gravities (3/19, 16%). The diagnosis was made on day 1 (IQR 1 - 2.5) after injury, with a median serum sodium of 158 (IQR 151 - 161, *n*=15). Eighteen of the children (94.7%, *n*=18) received at least one dose of desmopressin, median 1 (IQR 1 - 2) dose. Hypertonic (5%) saline was administered in half of these children (10/19), which may skew the validity of these results and underestimate possible iatrogenic hypernatraemia.

Mortality

TBI deaths (38/314, 12.1%) in our cohort, all but one due to severe TBI, accounted for 71.7% of the total of 53 trauma-related deaths during the 5-year study period. Life-sustaining treatment was withdrawn in 22 of the 38 children (57.9%): 20 (52.6%) due to brainstem death and 2 (5.3%) because f poor neurological prognosis. Fig. 3 presents a breakdown of deaths by mechanism of injury and Table 3 for factors associated with outcomes in children with severe TBI.

Discussion

The basic profile of children with TBI admitted to RCWMCH PICU has remained mostly unchanged over the past 30 years. Children are still mostly male, ~6 years of age, with the most common mechanism of injury remaining motor vehicle collisions at 75%, with pedestrian-vehicle collisions making up the majority of these at 53.5% of total TBIs. A positive finding, however, is that mortality rates have decreased markedly from 57% in the early 1990s to 14.6% between 2006 and 2011 to 12% (38/320) between 2015 and 2019. This decline in mortality is attributed to the increased zeal and precision in the approach to the medical and surgical management of TBI over time.[1]

As mortality rates slowly decline, TBI-related morbidity and the prevention thereof have become an area of increased interest, as survivors of especially severe childhood TBI often have enduring physical, cognitive and behavioural impairments. These disabilities frequently require long-term care and cause financial burden to families.[5,6]

Severe TBI is especially of concern, as from the outset these children were ventilated longer (p=0.045) and had a longer PICU stay (p<0.001) than those with mild/moderate TBI.

A systematic review and meta-analysis by Mariajoseph *et al.* [7] on the incidence and risk factors for post-traumatic epilepsy following paediatric TBI concluded that early seizures (before 7 days), severe TBI and intracranial haemorrhage were risk factors for post-traumatic epilepsy,and adult data from Taiwan showed that patients with post-traumatic epilepsy had a twofold higher risk of mortality. [8] In our cohort, post-traumatic seizures were associated with younger age, a longer ventilation time and PICU stay (p<0.001), but not hospital stay (p=0.216). There was no associated increase in mortality. Children with severe TBI admitted to RCWMCH are not routinely started on prophylactic anti-seizure medication but reviewed on a case-to-case basis.

Pulmonary complications after TBI are common and occur in up to 30% of cases. [9] Although post-extubation stridor may be a consequence of neurological compromise, preventive measures such as choosing the correct endotracheal tube size, monitoring the cuff pressure of cuffed endotracheal tubes, appropriate sedation techniques and adequate nursing may prevent its frequency and

severity.[10] In the ICU arm of the Collaborative European Neurotrauma Effectiveness Research in Traumatic Brain Injuries (CENTER-TBI) study in adults admitted to 54 participating centres in 19 countries in Europe, 31.8% (433/1 358) received a tracheostomy at a median (IQR) time of 9 (5 - 14) days after ICU admission.[11] This is much higher than the 30 (10.8%) in our cohort where tracheostomies were also performed later, at 15 (IQR 12 - 19) days post injury. However, the CENTER-TBI largely studied adult TBI and tracheostomy in children appears to be less frequently applied, as shown in the propensity matched analysis by McLaughlin *et al.*,[12] where tracheostomies were placed in 6% of 6 101 children with severe TBI from the United States National Trauma Data Bank (2007 - 2015). Early tracheostomy (before 15 days post injury) was associated with reduced complications and shorter hospitalisation. Despite prolonged ventilation and hospital stay, all children with failed extubation and tracheostomy were discharged from RCWMCH.

It is concerning to note that 11 children had an accidental extubation; nine of them prior to PICU admission, with an additional 10 requiring CPR (6 pre-hospital). Careful attention needs to be paid to safety and sedation practices in these children, especially in the pre-hospital setting. Standardised protocols need to be set up and readily available and staff need proper training in the management of these patients.

Infections, including CLABSIs and VAPs, contribute to PICU morbidity and length of stay.[13,14] This was corroborated by our cohort, where VAP and probable HAI was associated with a statistically significant longer duration of ventilation, PICU stay and total hospitalisation stay, as well as morbidity and mortality ($p<0.001$). This is in keeping with data from the CENTER-TBI study,[15] as well as VAP data from a US paediatric TBI study between 2009 and 2012 that reviewed the epidemiology, risk factors and microbiology of VAP in children admitted to PICU with TBI.[14] Similarly to our study, they found MSSA (34%) and *H. influenzae* (22%) to be the most commonly isolated organisms. In our cohort, VAP was associated with TBI severity, sedation (morphine and midazolam), thiopentone infusion, as well as use of noradrenaline, hypertonic saline, and neuromuscular blockade ($p<0.05$).

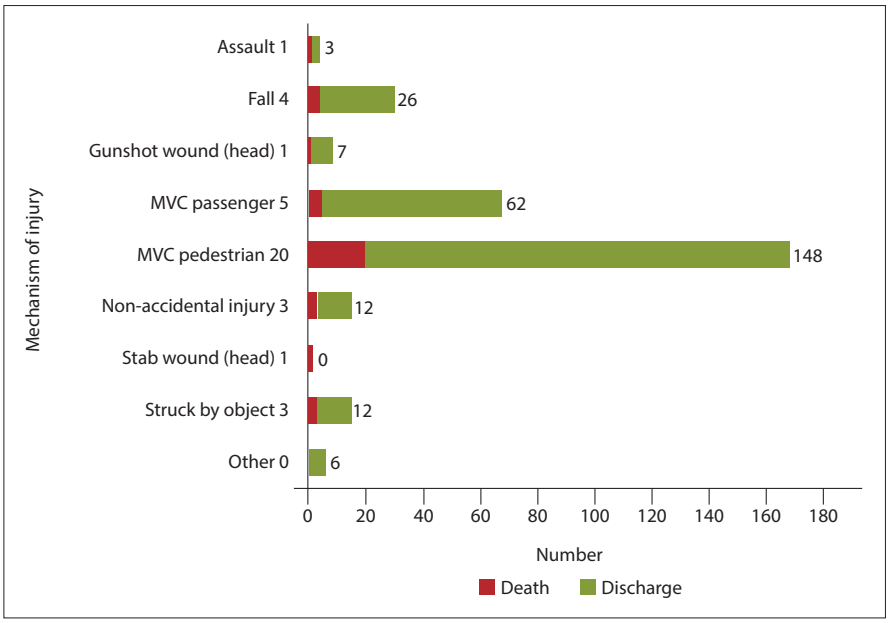

Fig. 3. Outcome in children with TBI by mechanism of injury. (MVC = motor vehicle collision; TBI = traumatic brain injury).
Other: fell from moving train (2); wall/closet fell on child; cycled into wall (1); unknown (1).

Table 3. Factors significantly associated with outcome in children with severe TBI

	Discharged (*N*=230, 86.1%)		Died (*N*=37, 13.9%)		
	N/n		*N/n*		*p*-value
General measures					
Vasopressors and inotropes					
Noradrenaline *n* (%)	180	52 (28.9)	35	26 (74.3)	<0.001
Adrenaline *n* (%)	175	11 (6.3)	33	19 (57.6)	<0.001
Maintenance fluids and feeds					
Crystalloid boluses *n* (%)	230	27 (11.8)	37	12 (32.4)	<0.001
First-tier interventions					
EVD *n* (%)	205	9 (4.4)	36	6 (16.7)	0.004
Second-tier interventions					
Thiopentone infusion *n* (%)	205	32 (15.6)	35	11 (31.4)	0.042
Decompressive craniectomy *n* (%)	197	11 (5.6)	35	6 (17.1)	<0.001
Complications					
Diabetes insipidus *n* (%)	217	8 (3.7)	35	11 (31.4)	<0.001
Infective complications					
VAP *n* (%)	224	59 (26.3)	35	2 (5.7)	0.02
Outcomes					
PICU stay median (IQR) days		7 (2 - 12)		1 (1 - 4)	<0.001
Hospital stay median (IQR) days	185	14 (7 - 25)		1 (1 - 4)	<0.001

TBI = traumatic brain injury; EVD = external ventricular drain; VAP = ventilator-associated pneumonia; PICU = paediatric intensive care unit; IQR = interquartile range; *N/n* = denominator if different from *N* total for column.

Central DI is known to be associated with increased severity of TBI, raised intracranial pressure, as well as high mortality.[15] Our findings were no different, with DI being associated with severe TBI, and an increased risk of death and longer PICU stay ($p<0.05$), but not with increased duration of ventilation ($p=0.074$) or hospitalisation ($p=0.654$). Our findings may be biased by the lack of corroborating urine osmolality and urine-specific gravity measurements in all cases, as well as our use of hypertonic 5% saline in 50% of the presumed DI cases.

The case fatality rate for children with TBI in Africa is considerably higher for all grades of severity of injury when compared with the US.[16] The mortality rate in children with severe TBI ranges between 16% and 22.8% in high-income countries.[17,18] At 13.9% (37/267), ours compares favourably. Most deaths are still from motor vehicle-related causes (25/38, 65.8%), followed by assault (4/38, 10.5%) and non-accidental injury (3, 7.9%). Use of adrenaline and noradrenaline infusions, administration of crystalloid boluses, need for external ventricular drain placement and/or decompressive craniectomy, and the presence of DI were all risk factors for death ($p<0.05$), most likely as they were indicators of the severity of the children's clinical condition and treatment required.

We recognise the possible bias caused by retrospective file review, including the effect the missing folders may have on our data. Strengths of this study lie in that RCWMCH PICU is the only dedicated centre for children with TBI requiring ICU care in the Western Cape. This assisted with standardisation of treatment of all patients, as well as contributed to a reasonable sample size.

Conclusion

Although outcomes have improved compared with historical data and international reports, children admitted to the RCWMCH PICU with TBI had considerable associated morbidity and mortality. Enhanced primary preventive strategies, especially for motor vehicle collisions, are imperative to prevent TBI in children.

Infective complications, such as ventilator-associated pneumonias, are important to prevent and the use of good aseptic practices and bundled care is important.

Future local research should include the long-term follow-up and neurodevelopmental outcomes of children admitted with TBI in our setting, with analysis of the resultant financial and social burden.

Declaration. None.

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Author contributions. EdP conceived the project, collected data, conducted data analysis, drafted and revised the manuscript. SS and AAF conceived and supervised the project, drafted and revised the manuscript.

Data availability. The datasets generated and analysed during the current study are available from the corresponding author on reasonable request. Any restrictions or additional information regarding data access can be discussed with the corresponding author.

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Conflicts of interest. None.

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