Clinico-Etiological Profile of Children Admitted with Head Injury in a Tertiary Health Care Centre During the COVID Pandemic

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Abstract

Background The mechanism of injury, type of pathology, mode of management and specific problems, in the pediatric age group make these a unique population. The COVID-19 pandemic and lockdown caused a significant reduction in the number of road traffic accidents during the same period and the resultant number of head injuries in children.

Methods This was a descriptive study of 76 consecutive pediatric patients admitted with head injury between June and December 2020. Children under 18 years with head injury admitted in our hospital were included.

Results The most common etiology of pediatric head injury was found to be fall from height (61.8%) followed by road traffic accidents (27.6%). The most common age group affected was 1 to 5 years with a mean of 6.3 ± 5 years. Road traffic accidents were commonly seen in the 15 to 18 age group. **The Glasgow Outcome Score (GOS) of 1 (death)** was seen in one patient (1.3%) and low disability in 98.7% of patients.

Conclusion Falls formed the most important cause of pediatric head injury during this pandemic, and carefulness on the part of parents can help avoid dangerous consequences for the children. Recovery with minimal disability was observed in approximately all cases in this study. The number of severe traumatic brain injury was very low in this study. This can be attributed to the COVID-19 pandemic causing significant reduction in road traffic accidents and the number of severe head injury

Keywords
- pediatric head injury
- GCS
- GOS

Introduction

Traumatic brain injury in children and adolescents is a major public health problem in many countries in the world. In the United States, the annual incidence is said to be approximately 400 per 100,000 constituting a major cause of death and disability. The male to female ratio is approximately 1.8:1 and increases to 2.2:1 when children ages 5 to 14 years are considered. The proportion of brain injury caused by road traffic accidents increase with age from approximately 20% in children ages 0 to 4 years up to 66% in adolescents. Pedestrian or bicycle-related injuries more likely affect younger children, whereas adolescents are more often injured in road traffic accidents.[1–3] The COVID-19 pandemic caused a significant reduction in road traffic accidents and the number of severe head injury. Indeed, during this COVID-19 pandemic, fewer vehicles have been observed on roads. An overall reduction of 32% in road accidents, 33.5% in fatalities, and 33.6% in injuries was reported in 2020 as compared to 2019, as per the road

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accident statistics compiled by the Technical Support Group of Kerala Road Safety Authority from data sourced from the State Crime Records Bureaus. The lockdown has resulted in a significant reduction in the number of road traffic accidents. Statistics suggest that roughly about 10,000 lives have been saved by the lockdown in India in 1 month due to road traffic accidents as against a loss of 200 lives due to coronavirus.[4–10] The mechanisms of injury in the majority cases of infants, toddlers, and young child brain injury are related to assaults or child abuse and falls. The majority of children among these age groups were found to have mild head injury .Traumatic brain injury (TBI) is a main cause of functional disability and death in children worldwide. A report from Europe showed that, among children with blunt head trauma, the rate of fatal and nonfatal TBI was 0.5 and 5.2 per 1000 children, respectively.[11] Younger children are most likely to incur a TBI from falls, whereas adolescents with TBIs are most commonly injured in MCs and sports-related trauma.[12] In India over 40% population is under 15 years of age and belongs to the pediatric age group. The increase in the number of vehicles and road traffic accidents in India also significantly contribute to increase in pediatric head injuries.[13,14] The magnitude of the problem is therefore, immense. The mechanism of injury, type of pathology, mode of management and specific problems, in the pediatric age group makes these an entirely different management problem compared to that the adult population. The above points justify the need for a special consideration of pediatric head trauma.

Aims and Objectives

This study aims to study the clinico-etiological profile and outcome of children admitted with head injury during the COVID-19 pandemic and lockdown period.

Methods

This was a descriptive study planned in the Department of Neurosurgery and Paediatric Surgery of Govt. Medical College, Thiruvananthapuram of all admitted pediatric head injuries.

Inclusion Exclusion Criterion:

Children under 18 years of age, admitted in our hospital with head trauma were included. Children with low mechanism falls and those who sustained minor contusion injuries to the face and scalp were excluded.

Duration

The study was conducted for 7 months, between June 2020 and December 2020.

Consent

Informed consent was taken from the parents of all patients. Informed assent was taken for children between 12 and 18 years of age

Ethical Issue

Ethical clearance was obtained from the Institutional Ethics Committee.

Study Factors

All consecutive cases satisfying the inclusion criteria were studied. The following was collected as part of the injury surveillance: Demographic details included the child's age and gender. The intent of injury (unintentional, assault, self/harm, or unknown) and the primary cause of injury (fall, motor vehicle crash, sports injury, interpersonal violence or others) was documented. If the child was involved in a motor vehicle crash, it was recorded if he was a pedestrian, cyclist, motor vehicle front or back passenger, motorbike front or back passenger. Details surrounding the object involved in the trauma and the location of the injury was studied. Clinical examination, neurological examination with GCS score and pupillary reactivity, presence of any other injuries, CT findings were noted. Details regarding surgery was noted. Outcome of the patient at discharge based on Glasgow Outcome Score (GOS) was noted.

Calculation of Sample Size

$$\text{Sample Size} = \{Z^{2^*}(p)^*(q)\}/\Delta^2$$

The sample Size for the study is estimated using the above formula. Substituting the values- where Z value for the confidence level chosen = 1.96 (for 95% confidence level from standard normal distribution);

$p = 0.06$ (pediatric TBI[15]

$$q = 1\text{-}p = 1\text{-}0.22 = 0.94$$

Δ = margin of error which is acceptable = 0.05 (or 5%)

The sample size calculated to be 88.

Even though the sample size calculated was found to be 88, the ongoing COVID pandemic which was rampant in 2020 caused a significant reduction in the number of pediatric head injuries being admitted in our institution and hence the sample size obtained during that period was 76.

Statistical Analysis

Data were entered in the excel spread sheet. Descriptive statistics of the explanatory and outcome variables was calculated by mean, standard deviation for quantitative variables, frequency and proportions for qualitative variables. Inferential statistics such as Chi-square test was applied for categorical variables. The level of significance was set at 5%. Any other necessary tests found appropriate was dealt at the time of analysis based on data distribution.

Results

Seventy-six patients, all under 18 years of age were included in the study from June 2020 to December 2020. The detailed

distribution of patient and treatment characteristics among the study population is as follows.

Mode of Injury

Fall from height (61.8%) was the most common mode of injury in this study. This was followed by road traffic accidents, which contributed about 27.6%. Fall of objects included fall of jackfruit, coconut and television over the head. Others included head hitting against another child's head when the child was playing.

Table 1 Percentage distribution of the sample according to the mode of injury

Mode of injury	Count	Percentage
RTA	21	27.6
Fall from height	47	61.8
Fall of object over head	6	7.9
Others	2	2.6

Age and Sex Distribution

The children were classified into four age groups. 1) infants (0-1year), 2) toddlers and pre-scholers (1-6 years), 3) school going (6-15 years), 4) adolescents (15-18 years)[14,16–18]

The most common age group affected were the toddlers and pre-schoolers (46.1%), followed by the school going group (30.3%). In all, 64.5% of all children were males and the rest females.

Table 2 Percentage distribution of the sample according to age

Age	Count	Percentage
0-1 year	21	27.6
1-6 years	47	61.8
6-15 years	6	7.9
15-18 years	2	2.6
Mean ± SD	6.3 ± 5	

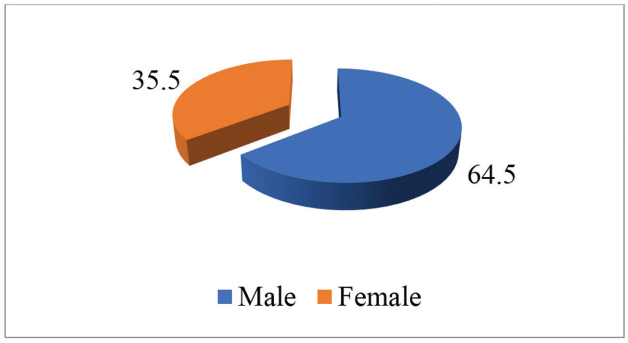

Fig. 1 Percentage distribution of the sample according to sex.

Severity of Head Injury Based on Glasgow Coma Scale (GCS) on Admission:

Severity of head injury based on GCS[19,20] was classified into mild (13-15), moderate (9-12), and severe (3-8). Mild head injury was seen in 92.9%, moderate (3.9%), and severe (3.9%).

Table 3 Percentage distribution of the sample according to severity of head injury based on GCS on admission

Severity of head injury based on GCS.	Count	Percentage
Mild head injury (GCS 13-15)	70	92.1
Moderate head injury (GCS 9-12)	3	3.9
Severe head injury (GCS 3-8)	3	3.9

Presence of Other Associated Injuries

Associated injuries such as orthopaedic injuries were seen in 10.5%, abdominal and chest injuries in 1.3%, whereas most patients showed no significant associated injuries.

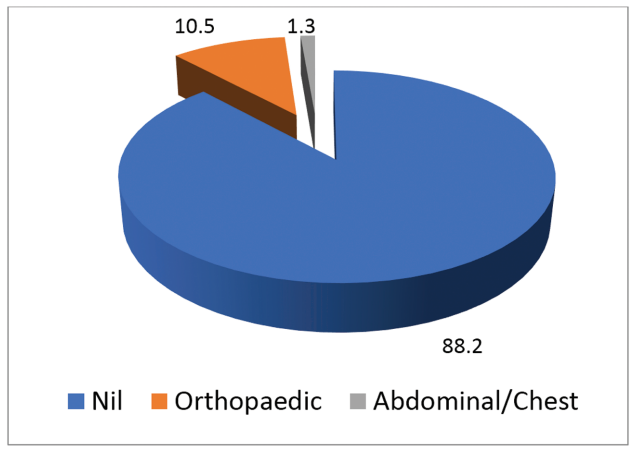

Fig. 2 Percentage distribution of the sample according to other injuries.

CT Findings

Skull bone fractures were seen in the majority (56.6%), followed by SDH (31.6%), hemorrhagic contusions (18.4%), EDH (14.5%), pneumocephalus (10.5%), SAH (9.2%), brain edema (7.9%), intraventricular hemorrhage (2.6%), diffuse axonal injury (1.3%).

Single CT finding was seen in 46 patients (60.5%) and multiple findings in 30 patients (39.5%).

Management of Patient:

Among the 76 patients studied, only 1 was operated (1.3%). This patient underwent evacuation of EDH, whereas 98.7% of patients were managed conservatively.

Duration of Stay in the Hospital

The mean duration of stay in the hospital was 4.6 days ± 1.7.

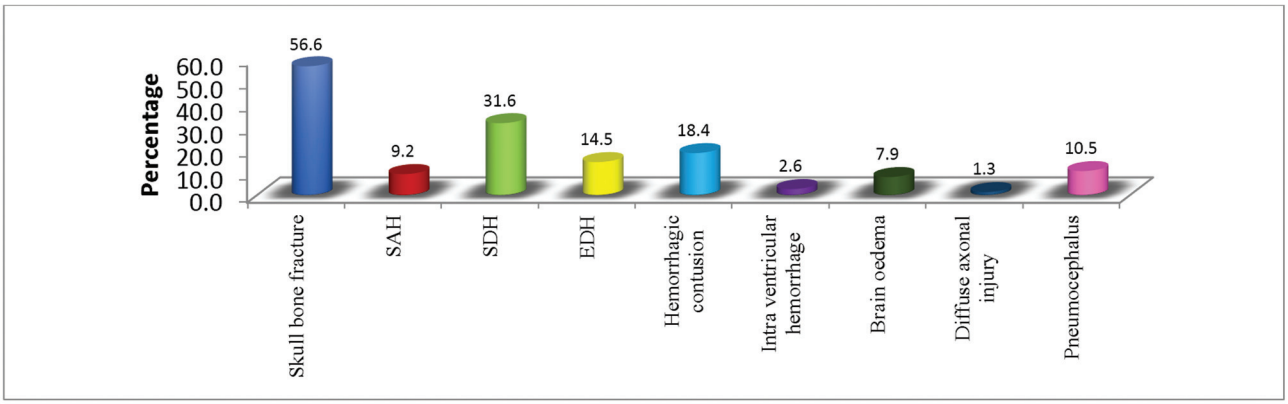

Fig. 3 Percentage distribution of the sample according to CT findings.

Table 4 Percentage distribution of the sample according to duration of stay in hospital

Duration of stay in hospital	Count	Percentage
1–3 days	18	23.7
4–6 days	49	64.5
7–10 days	9	11.8
Mean ± SD	4.6 ± 1.7	

Glasgow Outcome Score (GOS) on Discharge

The **GOS**[21,22] **of 1 (death)** was seen in 1 patient (1.3%) and low disability in 98.7% of patients. These outcome parameters were mainly because of the majority of mild head injury cases that were noted.

Table 5 Percentage distribution of the sample according to GOS on discharge

GOS on discharge	Count	Percentage
Death	1	1.3
Low disability	75	98.7

Discussion

The study was conducted between June and December 2020 of all pediatric TBI patients under 18 years of age, and the sample size obtained was 76. Sample size calculated as per the reference study[15] was 88. The reduction in the number of cases was probably due to the COVID-19 pandemic, which was active during the study period significantly reducing the number of road traffic accidents and the number of patients being admitted in our hospital. As per our in-house data that showed that there were more than 100 patients during the same duration in the previous year. **A comparison of the data collected retrospectively in 2019 between the same period (June–December) shows the significant difference when compared to the present study data. The table is shown below.**

The etiology included fall from height 61.8%, road traffic accidents 27.6%, fall of object on the head which included things such as coconut, jackfruit, and television. In all, 7.9% and others such as head hitting another child's head, attempted hanging 2.6%. However, road traffic accidents were the most common etiology in the previous year. According to Tan RMR, Ganapathy et al's "Paediatric emergency department attendances during COVID-19 and SARS in Singapore,"[23] the reduction in road traffic accidents during the COVID-19 period when compared to the previous year were comparable to our study. Sanford, Zagoryet al[24] also showed a similar reduction in RTAs compared to previous years. The distribution according to age < 1 year; 10.5%, 1–5 years; 46.1%, 6–14 years; 30.3%, 15–18 years; 13.2%. However, the most common age group was between 15 and 18 years (39.5%) in other studies[15] conducted during the pre-COVID times. No similar data were found in the literature during the COVID period.

The distribution of etiology among the age group was found be in the less than 1 year age group; the most common mode of injury was fall from height, 1 to 5 years it was fall from height, 6 to 14 years was fall from height and 15 to 18 years was road traffic accidents. The above difference in the mode of injury and the age group affected when compared to the previous year from our data and other similar studies[15,24] may be attributed to the COVID 19 pandemic that caused a significant reduction in the number of road traffic accidents and the closure of schools during the same period, which resulted in reduction in RTAs leading to accidental falls being the most common mode of injury. Gender distribution included 64.5% males and 35.5% females .The type of head injury based on GCS was found to be; mild head injury seen in 92.1%, moderate head injury in 3.9%, and severe head injury (3.9%). Associated injuries such as orthopaedic injuries were seen in 10.5%, abdominal and chest injuries in 1.3%, whereas most patients showed no significant associated injuries. The CT findings of patients studied showed skull bone fractures in the majority (56.6%) followed by SDH (31.6%), hemorrhagic contusions (18.4%), EDH (14.5%), pneumocephalus (10.5%), SAH (9.2%), brain edema (.9%), intraventricular hemorrhage (2.6%), diffuse axonal injury (1.3%). This was comparable to other studies

Table 6 Comparison of pediatric head injury admissions of 2020 (June–December) with the same duration in the previous year (June–December 2019) in our Institution

	2019 (June–December)	2020 (June–December)
Total admissions during this period	122	76
Male:female	79:43	49:27
Mode of injury		
1. RTA	1. 78 (63.9%)	1. 21 (27.6%)
2. Fall from height	2. 36 (29.5%)	2. 47 (61.8%)
3. Fall of objects over head	3. 6 (4.9%)	3. 6 (7.9%)
4. Others	4. 2 (1.6%)	4. 2 (2.6%)
Age group		
1. 0–1 year	1. 12 (9.8%)	1. 21 (27.6%)
2. 1–6 years	2. 37 (30.3%)	2. 47 (61.8%)
3. 6–15 years	3. 22 (18.03%)	3. 6 (7.9%)
4. 15–18 years	4. 51 (41.8%)	4. 2 (2.6%)
GCS on admission		
1. Mild head injury (GCS 13–15)	1. 98 (80.3%)	1. 70 (92.1%)
2. Moderate head injury (GCS 9–12)	2. 8 (6.5%)	2. 3 (3.9%)
3. Severe head injury (GCS 3–8)	3. 16 (13.1%)	3. 3 (3.9%)
CT Findings		
1. Skull bone fractures	1. 60.2%	1. 56.6%
2. SDH	2. 42.5%	2. 31.6%
3. Hemorrhagic contusions	3. 16.9%	3. 18.4%
4. EDH	4. 22.3%	4. 14.5%
5. Pneumocephalus	5. 9.6%	5. 10.5%
6. SAH	6. 17.4%	6. 9.2%
7. Brain edema	7. 6.2%	7. 7.9%
8. Intraventricular hemorrhage	8. 2.3%	8. 2.6%
9. Diffuse axonal injury	9. 1.6%	9. 1.3%
Management		
1. Surgery	1. 12 (9.8%)	1. 1 (1.3%)
2. Conservative	2. 110 (90.1%)	2. 75 (98.7%)
Mean duration of stay in hospital		
1. 1–3 days	1. 36 (29.5%)	1. 18 (23.7%)
2. 4–6 days	2. 67 (54.9%)	2. 49 (64.5%)
3. 7–$>$10 days	3. 19 (15.5%)	3. 9 (11.8%)
GOS on discharge		
1. GOS 1 (death)	1. 3 (2.4%)	1. 1 (1.3%)
2. GOS 2 (vegetative state)	2. 0 (0%)	2. 0 (0%)
3. GOS 3 (severe disability)	3. 2 (1.6%)	3. 0 (0%)
4. GOS 4 (moderate disability)	4. 11 (9%)	4. 0 (0%)
5. GOS 5 (good recovery)	5. 106 (86.8%)	5. 75 (98.7%)

as well as our previous years data which also showed skull bone fracture in the majority of patients studied.[15] Outcome of patients with head injury were on the basis of management, which was surgical or conservative management, duration of stay in the hospital, and outcome at the time of discharge based on the Glasgow Outcome Score (GOS). Among the 76 patients studied, only 1 was operated (1.3%). This patient underwent evacuation of EDH, whereas

98.7% of patients were managed conservatively. The mean duration of stay in the hospital was 4.6 ± 1.7 days. **The GOS of 1 (death) was seen in one patient (1.3%) and GOS of 5 (low disability) in 98.7% of patients.** These outcome parameters were mainly because of the majority of mild head injury cases which were noted. The 2019 data also showed higher incidence of mild head injury and comparable data in relation to the GOS outcomes.

Limitations of the Study

The GOS was only considered at the time of discharge and further follow-up was not done. The sample size was less when compared to the expected as per calculations based on other studies.[15]

Conclusion

The study results show fall from height as the most common cause of pediatric head injury with male preponderance, followed by road accidents and various other mechanisms. Our data show that the number of domestic accidents has significantly increased during the COVID period compared with the previous year. Home safety and injury prevention measures in the house hold environment must be reinforced at the community and emergency department level alongside infection control measures for this pandemic. Falls formed the most important cause of pediatric head injury and slight carefulness on the part of parents can help avoid disastrous consequences for the children. Recovery with minimal disability was observed in approximately all cases in this study. The number of severe traumatic brain injury was very low in this study. This can be attributed to the COVID-19 pandemic causing significant reduction in the RTAs and the number of severe head injury. Existing research that has examined effects of indicators on road safety has generally found reductions in road fatalities during this COVID 19 period. These days, almost many school children are capable of handling motor vehicles and incidence of road traffic accidents are also increasing year by year with an exception this time. Hopefully, this study helps to understand and provide guidance or formulate new regulations in relation to road safety and awareness thereby preventing severe head injuries associated with road traffic accidents and the resulting morbidity associated with it.

Consent to Participate

Informed consent was obtained from all parents of children included in the study. Informed assent was taken from patients between 12 and 18 years as per the WHO requirement.

Consent for Publication

The participants have consented to the submission of data obtained for the study to the journal.

Ethical Approval

Ethical committee approval was obtained prior to starting this study.

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Conflict of Interest

None declared.

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References

1 Langlois JA, Rutland-Brown W, Thomas KE. The incidence of traumatic brain injury among children in the United States: differences by race. J Head Trauma Rehabil 2005;20(03):229–238
2 Kraus JF, Rock A, Hemyari P. Brain injuries among infants, children, adolescents, and young adults. Am J Dis Child 1990;144(06): 684–691
3 Levin HS, Aldrich EF, Saydjari C, et al. Severe head injury in children: experience of the traumatic coma data bank. Neurosurgery 1992;31(03):435–443, discussion 443–444
4 Lamm R, Choueiri EM, Kloeckner JH. Accidents in the U.S. and Europe: 1970-1980. Accid Anal Prev 1985;17(06):429–438
5 Lloyd L, Wallbank C, Broughton J. A collection of evidence for the impact of the economic recession on road fatalities in Great Britain. Accid Anal Prev 2015;80:274–285
6 Wegman F, Allsop R, Antoniou C, et al. How did the economic recession (2008-2010) influence traffic fatalities in OECD-countries? Accid Anal Prev 2017;102:51–59
7 Yannis G, Papadimitriou E, Folla K. Effect of GDP changes on road traffic fatalities. Saf Sci 2014;63:42–49
8 Road traffic accidents 2019, Accessed September 30, 2022, at: https://morth.nic.in/sites/default/files/Click_for_the_Sundar_Committee_Report_on_Road_Safety_and_Traffic_Management.pdf
9 Radhakrishnan A "Dip in road accidents by 32% in 2020". The Hindu [Kerala] February 12, 2021. Accessed September 30, 2022, at: www.thehindu.com/news/national/kerala/dip-in-road-accidents-by-32-in-2020/article33823330
10 Sarla GS. COVID diaries: an Indian perspective. J Med Res Surg. 2020;1(03):1–3
11 Da Dalt L, Marchi AG, Laudizi L, et al. Predictors of intracranial injuries in children after blunt head trauma. Eur J Pediatr 2006; 165(03):142–148
12 Faul M, Xu L, Wald MM, Coronado VG. Traumatic brain injury in the United States: emergency department visits, hospitalizations and deaths 2002–2006. Atlanta (GA): Centers for Disease Control and Prevention, National Center for Injury Prevention and Control; 2010
13 Mahapatra AK. Monitoring on pediatric head injuries patients. Neurology India (Suppl) 1995;43:67–70
14 Sambasivan M. Epidemeology-pediatric head injuries. Neurology India (Supple) 1995;43:57–58
15 El-Menyar A, Consunji R, Al-Thani H, Mekkodathil A, Jabbour G, Alyafei KA. Pediatric traumatic brain injury: a 5-year descriptive study from the National Trauma Center in Qatar. World J Emerg Surg 2017;12:48
16 King DR. Trauma in infancy and childhood: initial evaluation and management. Pediatr Clin North Am 1985;32(05): 1299–1310
17 Moront ML, Williams JA, Eichelberger MR, Wilkinson JD. The injured child. An approach to care. Pediatr Clin North Am 1994;41 (06):1201–1226
18 Ghosh, Arijit & Chattopadhyay, Aniruddha & Ghosal, Jayanta & Sarkar, Sumanta. (2022). Traumatic brain injury in pediatric

patients –Clinical manifestations and outcome. Asian Journal of Medical Sciences 13:208–212 Doi: 10.3126/ajms.v13i12.44425
19 Teasdale G, Jennett B. Assessment of coma and impaired consciousness. A practical scale. Lancet 1974;2(7872):81–84
20 Reilly PL, Simpson DA, Sprod R, Thomas L. Assessing the conscious level in infants and young children: a paediatric version of the Glasgow Coma Scale. Childs Nerv Syst 1988;4 (01):30–33
21 Jennett B, Snoek J, Bond MR, Brooks N. Disability after severe head injury: observations on the use of the Glasgow Outcome Scale. J Neurol Neurosurg Psychiatry 1981;44(04): 285–293
22 Jennett B, Teasdale G, Galbraith S, et al. Severe head injuries in three countries. J Neurol Neurosurg Psychiatry 1977;40(03): 291–298
23 Tan RMR, Ganapathy S, Tyebally A, et al. Paediatric emergency department attendances during COVID-19 and SARS in Singapore. Ann Acad Med Singap 2021;50(02):126–134. Doi: 10.47102/annals-acadmedsg.2020500
24 Sanford EL, Zagory J, Blackwell JM, Szmuk P, Ryan M, Ambardekar A. Changes in pediatric trauma during COVID-19 stay-at-home epoch at a tertiary pediatric hospital. J Pediatr Surg 2021;56(05): 918–922. Doi: 10.1016/j.jpedsurg.2021.01.020