

Research Progress of Triage Standard for Pediatric

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Abstract: Pediatric emergency pre-examination triage plays a vital role in pediatric emergency treatment. At present, many international emergency triage systems have been standardized, but there is still a lack of unified standard emergency pediatric triage system in China. Some hospitals in China are changing from "branch triage" to "hierarchical triage" mode, and begin to try to establish triage tools suitable for their own conditions. The purpose of this paper is to briefly introduce the commonly used pediatric emergency triage assessment tools and their clinical applications, to provide useful reference for improving pediatric emergency pre-detection triage.

1. Introduction

Pre-detection and triage of children's emergency treatment refers to the first link of children's emergency treatment. Children are quickly and accurately evaluated according to the types and severity of their diseases, and the order of treatment is determined ^[1], so as to win more emergency treatment time for them, achieve full and reasonable utilization of emergency resources, and ensure the effect of treatment ^[2]. Pediatric crowding in emergency department is common, and relevant studies and surveys show that up to 80% of pediatric emergency patients receive non-emergency treatment ^[3-4], and the proportion of non-emergency patients is too large to delay the treatment of real emergency patients. In order to orderly emergency work and fully and reasonably allocate emergency medical resources and space, an efficient emergency triage system is needed ^[5]. At present, China has not yet formed a unified, authoritative pediatric emergency pre-examination triage ^[6] optimization of emergency pre-examination triage is particularly important. The purpose of this paper is to briefly introduce the commonly used pediatric emergency triage assessment tools and their clinical applications, as well as to provide useful reference for improving pediatric emergency pre-detection triage.

2. International and China pretest triage standards

2.1. International pediatric emergency triage standards

2.1.1. Canadian pediatric emergency pre-screening triage scale

In 1997, the Canadian association of emergency physicians (CAEP) and the national association of emergency department nurses (NENA) jointly formulated the emergency level 5 emergency engineering scale (CTAS) Canadian Triage and Acuity Scale, Canada, most provinces in Canada, the application of this system is a mandatory ^[7]. In 2001, CAEP cooperate with NENA and Canadian academy of pediatrics, puts forward the Canadian pediatric emergency preview triage scales (Canadian Pediatric Emergency Triage and Acuity Scale, PedCTAS) ^[8], PedCTAS is a five-level triage scale suitable for pediatric children derived from adult pre-screening triage. PedCTAS divides pediatric emergency pre-screening triage into five levels. Physiological methods are adopted: appearance, neurological signs, respiratory rate, heart rate, perfusion, etc., are evaluated, and complex symptoms are used to assign treatment levels. In the literature review, van Veen et al. evaluated PaedCTAS as an effective pediatric emergency triage tool with moderate reliability ^[9].

2.1.2. Improved early preview grade children modified early warning score

Modified Pediatric Early Warning Score (MPEWS) is an improvement on the basis of Pediatric Early Warning Score (PEWS) ^[10], according to the particularity of children, evaluation indexes such as body temperature are added on the basis of PEWS, so that triage personnel can evaluate the behavioral awareness, cardiovascular system, respiratory system and body temperature of children, so as to facilitate a faster, more comprehensive and more targeted assessment of the disease. The score ranges from 0 to 12 points, and the higher the score, the more serious the disease of the child. Zhao Yun et al.'s investigation showed that the sensitivity and specificity of MPEWS to the diagnosis of possible death were 95.13% and 41.73%, respectively ^[11].

2.1.3. Manchester triage scale

Manchester Triage Scale (MTS) began to be applied to emergency departments in the UK, Portugal, Germany and other countries in 1997. In 2014, the Manchester Standards advisory group revised the Manchester scale guidelines to add pediatric content ^[12]. The MTS consists of 55 fixed triage flow charts, 49 of which apply to pediatrics. MTS uses 5 levels of triage to divide patients into 5 levels. The triage level is red needed to be treated immediately, orange within 10 minutes, yellow within 60 minutes, green within 120 minutes, and blue within 240 minutes ^[12-13]. The disadvantage of MTS triage is that there are many processes and complex contents, and triage nurses are required to be familiar with the specific contents of the flow chart, which requires high requirements for triage nurses.

2.1.4. Emergency Severity Index (ESI)

The Emergency Severity Index originated in the United States in 1998, and the first version of ESI was applied to clinical practice in 1999. The second, third, and fourth editions were updated in 2000, 2001, and 2005 respectively ^[14]. In 2012, Gilboy et al. ^[15] revised and updated ESI based on the fourth edition for pediatric use emergency pre-screening triage. ESI is divided into 5 levels based on the general state, vital signs, severity of the disease and expected medical resources required ^[16], and the severity of the child decreases from grade 1 to grade 5. Triage nurses conduct triage at four decision points: A, whether life needs to be saved urgently, if so, it is rated as level 1;

B, can you wait? If the child must be treated within 15 minutes, it is rated as level 2; C, assessment of medical resources, such as ECG monitoring, diagnostic tests, specialist consultations, etc. Estimated that those who urgently need a resource are level 4, and those who do not need it are level 5; D, whether the vital signs are stable, if yes, triage is level 3, if vital signs are not stable, triage is level 2. ESI can quickly classify children and is convenient to use, reducing the subjectivity of the triage process, which can achieve rapid triage in the case of a large number of pediatric emergency children but a few triage personnel.

2.1.5. Pediatric Assessment Triangle (PAT)

The Pediatric Assessment Triangle (PAT) is a rapid assessment tool that uses only visual and auditory cues, requires no equipment and takes 30-60 seconds to complete^[17]. The PAT is evaluated for appearance, work of breathing, and circulation to the skin (A-B-C). In 2014, PAT was included in the third edition of the Children's Prehospital Emergency Referral Course (PEEP)^[18], published jointly by the National Association of Emergency Medical Technicians (NAEMT) and the American Academy of Pediatrics. The original A-B-C was revised to C-B-C, where C stands for consciousness, B stands for breathing, and C stands for skin color. PAT was created to provide an easy-to-remember tool. It is used to rapidly assess infants and children with acute illness and injury, thereby producing an accurate overall impression of the child, helping to determine the pathophysiology of the child and the urgency of treatment, and facilitating initial targeted therapeutic rescue^[19]. Gausche-Hill et al. evaluated the use of PAT by caregivers in 1168 patient visits in Los Angeles County, California^[20]. The caregiver's impression of instability based only on PAT showed a sensitivity of 77% and a specificity of 90%. The overall PAT evaluation was consistent with field management, and kappa was 0.93^[21].

2.2. Chinese Pediatric Emergency Triage Standards

2.2.1. Grading and Screening Criteria for Emergency Pediatrics

In 2019, Shen Xiaoling et al.^[22] developed the pediatric emergency pre-examination triage standard based on Jin Jingfen's^[23] mainland adult emergency pre-examination triage standard^[22-26]. The triage criteria for pediatric emergency pre-examination include single objective indicators (pulse, respiratory rate, oxygen saturation, consciousness, body temperature, pain score, blood pressure (above 5 years old), capillary refill time, etc.), symptom and sign indicators (cardiac arrest, respiratory arrest, airway obstruction or asphyxia, etc.), and comprehensive indicators refer to the triage of children to the corresponding level according to the PEWS score. According to the triage standard, the disease of children is divided into four levels according to the severity of the disease. Grade I is an emergency patient who needs immediate rescue. Grade II was acute and severe patients, and the waiting time was <10min; Grade III patients were emergency patients with a waiting time of <30min; IVa was a sub-emergency patient with a waiting time of <60min; IVb was a non-emergency patient with a waiting time of <120min^[26]. Through an applied study, Fu Rong et al.^[26] found that the consistency between the minute hand results of triage nurses and the triage results of pediatric experts was $\geq 80\%$, which reflected the scientific and accurate nature of the standard.

2.2.2. Expert Consensus on Pediatric Emergency Pre-examination and Triage (Shanghai)2022

Expert Consensus on pediatric emergency pre-examination and triage in Shanghai^[27] includes principles of pediatric emergency pre-examination, selection of triage tools, triage process, response time limit and overtime re-evaluation, and grading standards. The consensus recommendation is as

follows: 1. Grade 1 to 2 children are first triaged according to pediatric evaluation triangulation (PAT). The response time of grade 1 children is immediate, and the response time of grade 2 children is within 15min. The maximum response time of grade 1 to 2 children is more reliably correlated with the pre-examination results, which are not affected by the flow of emergency children, the number of medical staff and other factors [28]. Then, a combination of primary and objective indicators (body temperature, pulse, oxygen saturation, capillary filling time, and symptoms and signs are recommended) was used to triage grade 3 to 5 children. Among them, children with unstable vital signs were admitted to the emergency room for evaluation in grade 1 to 2, and the response time of grade 3 to 5 was improved on the basis of CTAS. The response time of grade 3 was extended to ≤ 1 h, grade 4 to ≤ 2 h, and Grade 5 to ≤ 4 h, which was more in line with the allocation of domestic emergency resources. Given the complexity of child pre-screening triage, this consensus needs to be gradually improved through more clinical practice and clinical research, to effectively and reliably detect real critical children and rationally allocate and utilize pediatric emergency medical resources.

3. Summary

The accuracy of triage has a great impact on the clinical outcome of critically ill children, and it is particularly important to quickly triage and accurately identify critically ill children within a limited time. Children with a high risk of early-stage disease deterioration should be given priority treatment for critically ill children, which can not only reduce the safety risk of emergency children, but also maximize the utilization of emergency resources and fundamentally improve the efficiency of emergency triage. There are many viewpoints worth learning from in the pediatric emergency triage standards used at home and abroad. Combining the effective domestic and foreign triage tools with China's national conditions, the pediatric emergency triage standards suitable for China are developed, so that the triage personnel can master effective quantitative indicators and improve the overall level of pediatric emergency triage in China, which can not only ensure the safety of children's medical treatment. It can also maximize the utilization of emergency medical resources. Next it is necessary to develop a standard of emergency pre-examination and triage suitable for pediatrics in China, improve the efficiency and accuracy of pediatric emergency triage continuously, and carry out clinical practice and research, to popularize it widely.

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