SNAKEBITE IN CHILDREN

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General

Anatomical, physiological, and behavioural differences make the diagnosis and treatment of snakebite in children a challenging task, especially when they are very young. The inability to give a proper history and the smaller body mass of a child presents unique problems when planning treatment. The dose of venom injected by the snake would be the same as that delivered to an adult victim, needing the same amount of antivenom to neutralise its effects. However, we have noticed that envenoming in children is not as severe as that in adults, for reasons that are still not understood.

As snakes deliver the same volume of venom whether biting an adult or a child, the antivenom dose for a child is the same as that for an adult. However, the smaller body mass necessitates appropriate adjustments to the total volume of fluid used to administer it. This is a challenge when treating very young children, although rarely encountered.

Some examinations and tests performed on adults may be impractical or inappropriate for use on children. The recommendations given below are based on our experience in a paediatric unit. There are only a few published studies on snakebite in children, compared to those regarding adults, and these are inadequate to provide data for evidence-based recommendations.

Epidemiology of Paediatric snakebite

Few studies have been performed on paediatric snakebite per se. The results reported in four papers are quoted below:

"26% of snakebites in Sri Lanka are in children under 15 years. 301 cases of snakebite in infants and children were investigated. 93% of these cases ended fatally." (Anslem de Silva et al, 1983)

"(In a paediatric ward) … venomous snakes accounted for 41% of bites … 32% by vipers and 9% by elapids … deaths occurred in 5% of bite victims … bitten by common kraits (*Bungarus caeruleus*)." (Roshini Karunanayake et al, 2014)

"… Ceylon krait (*Bungarus ceylonicus*) ... is a highly venomous endemic species inhabiting in the wet zone and some parts of the intermediate climatic zones of Sri Lanka ... its bites are rare and limited to five case reports in the literature ... We report two paediatric cases of proven Ceylon krait bites ... children were 1½ and 13 years old and developed neuroparalysis without progressing to respiratory failure and recovered. Both the children were administered Indian polyvalent antivenom which has not developed against endemic Ceylon krait venom ..." (Rathnayaka et al, 2021)

" The global burden of snakebite is large, disproportionately affecting children who live in low-income settings, and often leads to permanent physical and psychological sequelae. Due to their smaller size, children often present with more severe effects of snakebite, owing to their lower volume of distribution relative to the mass of injected venom. This higher ratio of venom to body mass can result in more rapid and severe neurotoxicity, coagulopathy and severe local tissue damage ..." (Le Geyt et al, 2021)

Diagnostic challenges in children

History taking

When dealing with a young child, the history of the circumstances leading to the bite, taken from a third person—a parent or guardian—may not be as accurate as the history from an adult. Allowance should be made for inaccuracies if the identity of the offending snake is to be based on such information.

Neuro-muscular paralysis

Most instances of envenoming by kraits resulting in neurotoxicity occur late in the night when children are asleep. Assessment of ptosis and muscular weakness is difficult in a sleepy child. Weakness of the trunk and proximal muscles may present before ptosis manifests. Such weakness of muscles should be actively assessed from time to time as it would not be obvious in a child lying on its back.

When monitoring breathing, chest expansion is as important as the respiratory rate. It may be possible to get an older child to cough and assess its strength as in an adult, but progressive reduction of chest expansion is a very useful early sign of impending respiratory failure in small children. Monitoring the heart rate and the arterial oxygen saturation (SaO2) are vital in the assessment of respiratory failure. Monitoring the respiratory rate alone may be misleading in some cases as the efficacy of breathing (chest expansion) is more affected than the effort of breathing (respiratory rate) in acute neuromuscular paralysis.

Envenoming

The thin skin and delicate tissues in children makes them more vulnerable to the effects of local envenoming to manifest, especially in Hump-nosed viper and Cobra bites. It appears that severe systemic envenoming is less common in children than in adults—an observation that needs confirmation with appropriate studies.

Management challenges in children

Use of antivenom

The antivenom dose for children is the same as that for adults. However, the fluid volume in which the antivenom is administered should be restricted in young children and infants. It should be borne in mind that repeated doses of anti-serum increases the risk of serum sickness in low body weight children.

Ten vials of antivenom (the standard dose in both adults and children) diluted in 400ml of saline (= total volume 500 ml) can cause fluid overload in small children of weight <10kg. It is therefore recommended that the 10 vials of antivenom diluted in 100 ml (= total volume 200 ml) be infused over 2 hours. An alternative would be to administer each vial dissolved in 10 ml as a direct infusion* over 1 hour, using an infusion pump (*Refer the manufacturer's leaflet for verification before direct infusion).

If signs of fluid overload develop (such as facial puffiness or signs of heart failure) frusemide (0.5 mg/kg iv) can be considered.

Management of antivenom reactions

Administration of adrenaline at the onset of early signs of anaphylaxis prevents severe consequences. The adrenaline dose differs from the adult dose; the paediatric dose being 0.01ml/kg of 1: 1000 adrenaline given IM.

A high degree of suspicion and anticipation of anaphylaxis helps early detection. Appropriate preparedness for the management of anaphylaxis should be made before the commencement of antivenom infusion, including having the correct dose of adrenaline drawn up in a syringe by the bedside.

Persistent prolonged WBCT

Prolonged persistent whole blood clotting time (20WBCT) without bleeding manifestations in a clinically stable child needs further assessment before repeating antivenom. Prothrombin time and further assessment of coagulopathy should be done. The benefits and risks of giving antivenom in this situation should be evaluated. A high serum dose given to a small body mass may cause problems with excess doses of antivenom. Unnecessary repeated administration of antivenom is discouraged. Fresh Frozen Plasma (FFP) can be considered in the management of persistent coagulopathy. (The benefits of FFP in correcting coagulability have not been proved, although often used for this purpose

Management of acute respiratory paralysis

Acute respiratory paralysis due to neurotoxins is common in krait bite. Prolonged ventilation is required in the management of most patients. If respiratory failure is present, intubation and mechanical ventilation should be done without delay.

Ventilation should be the priority before commencement of antivenom administration. A reaction to antivenom in a patient with respiratory paralysis who is not being ventilated will lead to a poor clinical outcome. In krait bite with impending respiratory paralysis, intubation before starting antivenom has the advantage of avoiding problems associated with laryngospasm resistance due to anaphylaxis.

If the SaO_2 is falling, start high flow oxygen immediately. However, this action should not delay mechanical ventilation if it is indicated. Routine administration of high flow O_2 in patients with normal SaO_2 may mask or delay the diagnosis of respiratory failure.

Pain management

Pain management should be given special attention in children due to their low pain threshold.

Pain should be assessed ideally with a standard pain assessment tool.

NSAID's should be avoided when there is a risk of coagulopathy. Paracetamol can be given for mild to moderate pain (dose 15 mg/kg per dose, maximum 4 doses per day, should not be repeated within 6 hours).

For severe pain, morphine can be given once the diagnosis of snake bite is confirmed. Morphine can be given orally, subcutaneously, or intravenously, in a dose of 0.1 mg/kg, repeated every 2-4 hours as needed.

Resuscitation

Resuscitation algorithms are different in children. Advanced paediatric guidelines and protocols should be referred. [Advanced Paediatric Life Support (APLS) guidelines UK and Australia.]

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