An Elsevier Indexed Journal ISSN-2230-7346

Journal of Global Trends in Pharmaceutical Sciences

POISONING IN CHILDREN AND INVESTIGATION OF THE PREDISPOSING FACTORS

Bhavya E[1], Chakrapani B[1*], Rajanandh MG[2], Vijayakumar TM[3]

[1]Department of Pharmacy Practice, School of Pharmaceutical Sciences, Vel's Institute of Science Technology and Advanced Studies (VISTAS), Chennai
[2]Department of Pharmacy Practice, Faculty of Pharmacy, Sri Ramachandra Institute of Higher Education & Research, Chennai
[3]Department of Pharmacy Practice, SRM College of Pharmacy, SRM University, Chennai

***Corresponding author E-mail:** chakrispecial@gmail.com

ARTICLE INFO

Key Words

Children; Predisposing factors; Poisoning; Trauma; Victims

Access this article online Website: https://www.jgtps.com/ Quick Response Code:

ABSTRACT

The physical and emotional pain that results from injuries to children has spurred many investigators to catalog register and analyze the patterns of childhood trauma**.** Though the war between nations has come to an end, we are now involved in what has been described as an "uncivil" war. This modern day war kills children with guns, knives, drugs and vehicles. Trauma lurks both developed and underdeveloped nations but in different guises. Approximately 4.5 million children attend an accident and emergency department per year and three die every day as a result of accidents. Accidents cause more deaths between the ages of 1 & 14 than the next six leading causes combined. According to the child accident prevention trust, accidents were responsible for one out of every six hospital admissions in the age group of one to fifteen, one out of every five attendances in accident and emergency departments and one out of every eight consultations with family doctors. There was a prior assumption that understanding the dynamics of pediatric trauma will lead to prevention of trauma. Today we are cognizant of the many facts of pediatric trauma, yet trauma to children continues unabated. The cost to society is beyond measure and the emotional losses are staggering. Trauma to children cannot be stopped by cerebral understanding; rather the answer to this problem lies in the nation's ability to define its values and priorities. Hence this review was done to find out the predisposing factors for pediatric trauma victims.

INTRODUCTION

Injuries are the most common cause of death during childhood and adolescence beyond the first few months of life & represent one of the most important causes of preventable morbidity and mortality. The word "accident" implies an event occurring by chance, without pattern or predictability. The most common accidents referred to hospital consist of burns and Scalds, Road Traffic Accidents, Falls, Poisoning, Drowning, Suffocation & Electric shocks. [1]

Scope of the problem Injury death: Injury causes 45% deaths among 1-4 yr children and 3 times more death than the next leading cause, congenital anomalies. For the rest of childhood and adolescence up to the age of 19 yrs, 70% of deaths are due to injuries, more than all other causes combined. The leading cause of unintentional injury deaths in childhood were motor vehicle accidents (46%) with pedestrian injuries accounting for half of these. Other leading causes of death included suffocation & foreign bodies (14%), fires & flames (9%),

© Journal of Global Trends in Pharmaceutical Sciences

drowning & submersion (9%), falls (5%) & poisoning (3%). For every child who dies from an injury many more are admitted to hospital, attend accident & emergency department or general practitioners. Walsh et al conducted a study at new castle found that there were 6 deaths among children under age 16yrs, 904 hospital admissions, and 11,682 accident & emergency dept attendances in a population of 54,000.

Non fatal injuries:

20-25% children & adolescents receive medical care for an injury each year in a hospital emergency dept & at least an equal number are treated at physician's office. Of these 2.5% require inpatient care & 55% have short term temporary disability from their injuries. Falls are the leading cause of nonfatal injuries followed by burns & scalds & poisoning in the 0-4 yrs age group. [2]

Risk factors for childhood injuries:

Accidents are the end result of innumerable factors. They include age & sex of the child, his personality & intelligence, the result of imitation of others and the example set by his parents. They are related to his stage of development, his mobility, ability to reach for objects, to climb, his desire to learn & explore and above all his inability to know from experience the consequences of what he is doing. Accidents are liable to happen when the mother is at work, or having a baby, and or attending to someone who is ill, when her attention is momentarily distracted by someone telephoning or coming to door or when she is taking tranquilizing drugs which reduce her level of alertness. Other factors include hunger, fatigue, over activity, illness at home, parental failure to understand what to expect of children at different ages, change in environment (e.g. new house, a holiday), and imitation of parents, anger directed against parents, negativism & emotional deprivation. Pica is a factor leading to poisoning. Parents have to balance the need for protection against the need for the child to learn, beginning with absolute protection at birth, finishing with nearby complete independence by 10 yrs of age. Overindulgence and lack of discipline on the one hand & excessive strictness on the other hand, both lead to accidents. [3] Toddlers are at greater risk for burns, drowning, falls & poisoning. Young school aged children are at greater risk for pedestrian injuries, bicycle injuries, motor vehicle occupant injuries, burns & drowning. During teenage yrs there is a markedly increased risk from motor vehicle occupant trauma & a new risk from intentional trauma. Males have a higher rate of injuries than females. Poverty is one of the most important risk factors for childhood injuries. Children from poorer background are 5 times more likely to die as a result of accident than children from better off families. Robert et al showed that, the death rate of children from social class V, for fire & flames were 16 times more than children from most affluent background & 5 times more for pedestrian injuries, this difference also exists for cyclist injuries, falls & poisoning. Other factors include single parent families, teenage mother, family stress & multiple siblings. [4]

Falls:

Falls are by far the most common accidents at home[30]; they account for 44% of all accidents in children. Most falls involve tripping over at the same level. Most serious consequences result from falls between 2 levels, such as falling out of a pram, high chairs & falling from bed. The worst injuries are sustained when a child falls from greater height or lands on something hard, sharp or hot.In one study 68% were due to falls down steps as a result of baby walker. A study of 52 injuries from bunk beds showed that in 42% there were no protective rails, in 35% the fall occurred during sleep, 35% during play and in 15% while into & out of bed. As with most home injuries, falls were common in children between the age group 0-3 yrs & boys outnumbered girls. 50% sustained injury to the face & 10% suffered concussions. Head injury is the most common cause of death in children aged 0-15 Yrs.

Road traffic accidents:

RTA accounts for the largest no. of accidents occurring outside home & for more no. of injury deaths.Road accidents include collision with a car (by pedestrian or bicyclist), accidents to the occupants of a vehicle and bicycle mishaps. Of 227 new admissions in accident and emergency dept of Sheffield children's hospital in a 9 month period, 169 were accidents to pedestrians, 31 to cycle accidents & 27 to children in cars. [5]

© Journal of Global Trends in Pharmaceutical Sciences

Primary survey: During the primary survey the physician quickly assesses the victim of any life threatening injuries. Therefore the primary survey addresses the ABCDE; A- airway, B-breathing, C- circulation, D- neurological deficit, E- exposure of the patient & control of environment.

Airway & cervical spine: The cervical spine should be immobilized in neutral position using a stiff collar, head blocks & tape or cloth across the forehead, torso and thighs to restrain the child to a rigid back board. Secretions of mouth like blood & vomitus should be suctioned out. If it is necessary to open the airway, a jaw thrust without a head tilt is recommended. This minimizes cervical spine motion. Oro-pharyngeal airway in an unconscious child and naso-pharyngeal airway in a semi-conscious child may be inserted. If all these do not maintain the airway then endotracheal intubation is indicated. [9-11]

Pedestrian injuries:

Pedestrian injuries are one of the most common causes of traumatic deaths in children 5-9yrs & are the fourth leading cause of nonfatal injury hospitalization. Many of the injuries to toddlers & preschoolers are 'non traffic' meaning they occur in places like driveways & parking lots instead of on public roads. Boys outnumber girls as pedestrian fatalities by 2:1. Injuries most commonly occur during the time of 8-9AM & 3-6PM. This mid to late afternoon was the most common time for both weekdays & weekends, suggesting children at play and children getting to & from school by walk or to buses that take them to school. Nearly 30% of injuries were due to children being hit while crossing the street in a cross walk. Pedestrian injuries resulted in an average of 2 days of hospital stay, nearly 32% hospitalization for lower extremity injuries, 87% of them being fractures & one quarter of non fatal hospitalization was for a traumatic brain injury. The risk of pedestrian injuries is greater in the neighborhood with high traffic values, speeds greater than approximately 25mph, absence of play space adjacent to the home, household crowding & low socioeconomic status. [6]

Bicycle injuries: Boys are more likely injured in bicycle accidents than girls & the risk of bicycle injuries increases after the age of 10 with preschool children having the fewest and 10-14yrs old the greatest. The causes associated with bicycle injuries are losing control on a hill or a corner, skidding on gravel, hitting on object(dog ,car) , a hole in the road, doubling(having another child), speeding, slipping off(handlebars, saddle, pedal), mechanical faults & tricks(speeding, riding on one wheel, showing off). In one study by Illingworth et al, in 300 children with bicycle related injuries, 40 had fractures, 21 had concussion, and 18 had broken teeth & 131 injuries above the neck.

Motor vehicle occupant injuries:

Injuries to motor vehicle occupants are the predominant cause of motor vehicle deaths, in children & adolescents with the exception of 5-9yrs old in whom pedestrian injuries predominate. Proper use of restraint is the single most effective method for preventing serious & fatal injury. [7]

Management of multi trauma victim:

Trauma is classified by the number of significantly injured body parts (one /more), severity of injury (mild, moderate or severe) and the mechanism of injury (blunt/ penetrating). In children blunt trauma predominates. A multidisciplinary trauma team is the most effective in the care of an injured child. Members of the team include a team leader (Surgeon/ Pediatrician), surgeons, emergency medicine physicians, surgical sub-specialists, trauma nurses & paramedical personal.

Scoring systems: Scoring systems have been developed to predict the patient outcome [8].

A total of +12 score indicates no injury & -6 indicate fatal injuries. An inverse linear correlation exists between pediatric trauma score and mortality.

Breathing: Assessed by counting RR, visualizing the chest wall motion, depth & use of accessory muscles & auscultation for breath sounds. Also look for cyanosis and Oxygen saturation. If breathing is inadequate, bag-valve-mask ventilation is to be initiated followed by endotracheal intubation.

Circulation: Signs of hypo-volemic shock include tachycardia, weak peripheral pulses, delayed capillary refill, cool mottled skin & altered mental status. An individual may lose upto 25% of blood volume before BP declines. With losses greater than 25% hypotension ensues & greater than 50% can cause severe hypotension and may become irreversible.

© Journal of Global Trends in Pharmaceutical Sciences

Pediatric trauma score:

+2		+1	-1
Size	>20kg	10-20kg	<10kg
Airway	normal >90mmHG obtunded	maintainable 50-90mmHG comatose	unmaintainable Systolic BP <50mmHG CNS awake
Open wound	none	minor	major
Skeletal	none	closed fracture	open/multiple

Bleeding is managed by applying direct pressure to the external hemorrhage site. Intravenous access is established thro central vein or peripheral vein or interosseus route. Aggressive intravenous fluid resuscitation is started with 20ml/kg of isotonic crystalloid solution such as RL/NS. 3 boluses may be repeated if shock persists.10-15ml/kg of packed RBCs may be transfused for persistent shock. Surgery to stop hemorrhage is usually indicated if shock persists despite the above measures. [12-14]

Neurological deficit: Evaluation of the level of consciousness is done by determining the pupil size and reactivity, using GCS/AVPU scale. Head injuries account for 70% of pediatric blunt trauma deaths. Minimize secondary brain damage by ensuring adequate oxygenation, ventilation & perfusion and maintaining normal intracranial pressure and maintaining cerebral pressure.

Exposure/environment control: All the clothing should be cut away to reveal any injuries. Child may be hypothermic, so it should be treated with radiant heaters, heated blankets and IV fluids. [15]

Secondary survey: During secondary survey, the physician completes detailed head to toe physical examination.

Head trauma: A GCS/pediatric GCS score is assigned to every child. Patients with low GCS score 6-24 hrs after injury have poorer prognosis. Head CT scan without contrast medium enhancement has been the investigation of choice. Diffuse cerebral injury with edema is a common finding on CT scan. ICP monitoring should be done in children with low GCS <8 or with abnormal CT.

Cervical spine trauma: Bony injuries occur mainly from C1-C4 in children <8yrs & in upper & lower cervical spine are equally involved in older children. SCIWORA (cervical spinal cord injury without radiological abnormalities) occurs in approximately 20% of children with cervical spinal injuries. MRI is helpful in patients with SCIWORA. Initiating high dose IV methyl prednisolone within 8hrs of spinal cord injury improves motor outcome at 1 yr and is the standard therapy. [16]

Thoracic trauma: Chest injuries with fatal cardio pulmonary compromise are

- Tension pneumothorax
- Open pneumothorax
- Massive hemothorax
- Pericardial tamponade
- Flail chest
- Massive pulmonary contusion

Liver & Abdominal trauma

Spleen contusions, Hematomas & Lacerations account for the majority of intra abdominal injuries due to blunt trauma. The Kidney, pancreas & duodenum are relatively spared. Examine for distension & bruises, palpate for tenderness & perform a rectal examination. An abdominal CT scan with IV contrast medium enhancement rapidly identifies structural & functional abnormalities & is the investigation of choice. Indications for laparotomy include persistent hemodynamic instability, the need for repeated transfusions (~ 40ml/kg) and bowel perforation.

© Journal of Global Trends in Pharmaceutical Sciences

Lower genito urinary trauma

Perineum should be inspected, pelvic stability assessed and rectal examination should be performed. Scrotal or labial echymosis, blood at urethral meatus, gross hematuria & spuriously positioned prostate in adolescent male indicate urethral injury. A pelvic injury is also a marker of potential genito urinary injury. Retrograde cysto-urethrogram & CT scan pelvis & abdomen are used to determine the extent of injury. [17-19]

Extremity trauma

All limbs should be inspected for deformity, swelling & bruises, palpated for tenderness & assessed for active & passive range of motion, sensory function & perfusion.

Radiologic & laboratory evaluation

Routinely required investigations include X-ray lateral cervical spine, X-ray chest AP view, X-ray pelvis AP view, ABG, complete blood cell count, electrolytes, blood glucose, blood urea nitrogen, creatinine, amylase, liver function tests, prothrombin & partial thromboplastin time, blood typing & cross matching & urinalysis. [20]

Prevention

- ✓ Have a safety gate at the top & bottom of stairs.
- ✓ Children should not be allowed to play on stairs.
- ✓ Baby must never be left alone in baby chairs
- ✓ Children should be taught where to cross the road safely
- ✓ Use of car seat belts & cycle helmets should be emphasized.

Burns

Burn injuries are the 3rd leading cause of death in children younger than 5yrs.Scalds from boiling hot liquids cause most minor & major burns in children 1- 5yrs old & boys were burned twice as often as girls. Most injuries are due to toddlers pulling a pot of boiling liquid off the stove or a bathtub mishap. In children older than 5yrs, flames, chemicals & electrical burns constitute the prime cause in that order. [21] Because small children have three times the surface area to body mass ratio of adults, the evaporative water & heat loss in children is greater, so that fluid requirements are also increased.

Classification of burns

First degree burns-Involves only the epidermis & are characterized by swelling, erythema & pain. Pain resolves in 48-72hrs.

Second degree burns- Involves the entire epidermis and a variable portion of the second layer. Vesicle & blister formation are characteristic of second degree burns. A superficial second degree burns is extremely painful because a large no. of remaining viable nerve endings are exposed. Superficial 2nd degree burns heal in 7-14 days as epithelium regenerates in the absence of infection. Mid level to deep 2nd degree burns heals spontaneously if kept free of infection. Pain is less as fewer nerve endings remain viable.

Third degree or full thickness burns-These destroy the entire epidermis & dermis, leaving no cells to repopulate the damaged area. Wound heals only by wound contraction or skin grafting.

Indications for hospitalization

- Burns greater than 15% BSA.
- High tension wire electrical burns.
- Inhalation injury regardless of the size of BSA involved.
- Inadequate home situation.
- Suspected child abuse or neglect.
- Burns to hand, feet, face & genitalia.

Care of minor burns: The goals of minor partial thickness burns are to minimize the problems of pain, superficial infection, bothersome wound drainage & prolonged convalescence. [22]

- Application of cold towels soaked in ice water.
- Blisters to be left intact. Debridment of blisters is probably the most preferred approach for more extensive burns.
- Closed dressing may be applied by the traditional method of applying a layer of non adherent petrolatum gauze followed by bulky gauze dressings changed everyday or application of topical antibacterial cream such as silver sulphadiazine over the wound, then cover it with a relatively light dressing changed every 12-24 hrs.
- Burns of face & trunk are left open.

Care of major burns

Major Burns are defined as burns

© Journal of Global Trends in Pharmaceutical Sciences

requiring hospitalization. Traditionally major burns have been defined as burns involving > 20% BSA in infants, > 30% BSA in older children or associated with other forms of life threatening trauma.

Airway management- Airway patency must be ensured & endotracheal intubation done , if upper airway patency is jeopardized, gas exchange or work of breathing indicates need for mechanical ventilatory support or mental status is severely compromised to threaten airway. The diagnostic gold standard of inhalation injury is probably bronchoscopy, but h/o burn in closed space, physical findings of singed nasal hair, carbonaceous sputum or elevated carboxy HB may all indicate inhalation injury. X-ray evidence of atelectasis or widespread infiltrates are usually not evident until 12 hrs or more.

Fluid resuscitation-The primary goal of fluid resuscitation is to preserve & restore tissue perfusion without producing excessive edema beyond that is obligatory. It is known that greatest loss of fluid from capillary bed is during the first 4hrs after injury & that maximum accumulation of edema is in the first 12-24hrs in extensive burn injuries. [23-25] The modified BROOKE formula for calculation of fluid is as follows:

FIRST 24 HRS – RL SOLUTION 3ML/KG / %BSA (25-35% BURNS) & 4ML/KG /%BSA (>35%BURNS).

SECOND 24 HRS - 5% DEXTROSE IN 0.45 ML SALINE SOLUTION: ONE HALF TO THREE QUARTERS OF FIRST 24 HR REQUIREMENT OR 5% ALBUMIN SOLUTION AT 0.5ML/KG/ %BSA.

Guidelines for fluid replacement-
Hourly urine output
Vital signs, central venous pressure Clear sensorium
Adequacy of peripheral circulation Absence of lactic acidosis, hypothermia
Hct value, Sr.electrolytes, PH, glucose value.

Estimation of fluid loss beyond 48 hrs post burn- (evaporative water loss phase)

- Daily maintenance: 5% dextrose/ 0.2N saline according to individual needs.
- Evaporative water loss: 5% dextrose/ 0.2N saline solution 1-2ml/kg /% BSA /24hrs.
- Potassium supplementation as needed.
- Blood transfusion as needed.
- Guidelines for fluid needs in this phase
- Daily body weight
- Daily urine volume & specific gravity.
- Values of Sr.sodium, potassium, urea, Hct & osmolality.

Blood replacement

Thermal injury to the skin results in red blood cell loss in proportion to the size & depth of burn. Administration of blood is indicated if associated blood loss from other injuries is present.

Nutrition

The best route of nutritional supplementation is enteral feedings than parenteral route due to less infection. The aim is to provide an intake of 100Kcal/kg/24hrs & 23g/kg/24hrs of proteins.

Pain control

Pain is controlled with IV morphine or oral morphine , codeine or meperidine before any procedures or dressings.

Wound care

Escharotomy is indicated for circumferential full thickness burns of extremities & suspected peripheral circulatory compromise. Done best during the first 8-24 hrs after injury.

Infection control

Topical antibacterial agents like 1% SSD or 10% mafenide acetate are effective. Systemic antibiotics is used with infection of lungs, urinary tract or elsewhere or when invasive infection is detected in the burn wound by biopsy with a quantitative bacterial count of >105 organisms per gram of tissue. Pseudomonas is less common as a cause of infection. The opportunistic organisms such as enterobacter cloacae, providencia stuartii, serratia marascens, candida, phycomycetes & occasional viruses & more recently multi drug resistant staph.aureus has become more common. [26-28]

Skin grafting

Immediate auto grafting is done in the priority order as follows: face & neck, hands, arms, feet, legs & trunk.

© Journal of Global Trends in Pharmaceutical Sciences

Prevention

- Don't allow the child to play with fire or matches.
- Never leave electric iron plugged.
- Never leave hot teapots near the edge of table.
- Never pass hot tea or fluid in front of children.
- Always turn pan handles away from the front of stove.

Poisoning

The reported incidence of poisoning in children varies from 0.3-7.6% in various studies. More than 50% occurred in children 5yrs of age or younger. Almost all of these exposures is unintentional & reflect the propensity for children of this age group to put virtually anything in their mouth. More than 90% of toxic exposures in children occurred in the home & most involve only a single substance. Ingestion is the most common route of poisoning exposure & dermal, ophthalmic & inhalational routes occurring in about 6 cases each. Most common poisoning in our setup is kerosene followed by pesticides, corrosives & food poisoning. [29]

Management plan for poisoning:

Initial medical care

Initial attention should focus on life support especially cardio respiratory care. Initial treatment of shock, dysrrhythmias & seizures is the same as for any other critically ill child.

Preventing absorption:

Dermal & ocular decontamination can be accomplished by flushing the affected area with tepid water. A minimum of 10 min is recommended for ocular exposure. Soap & water can be used for dermal exposure. For inhaled toxins move the patient to fresh air & administer oxygen. Absorption of liquid drug products from stomach is within 30mts & solid forms within 1-2hrs.

Emesis

The only emetic routinely used is syrup of ipecac. The onset of emesis is usually 20-30mts after dosing. The recommended dosing is 10ml for infants 6-12 months of age, 15ml for children aged 1-12yrs & adults. Ipecac induced emesis is contraindicated after the ingestion of caustics, hydrocarbons & agents likely to cause rapid CNS & CVS symptoms.

Gastric lavage

This technique involves placing a tube into the stomach to aspirate contents followed by flushing with aliquots of fluid usually NS.

Activated charcoal

Activated charcoal has a larger adsorptive surface area. In vitro 10g of activated charcoal adsorbs 1g of toxin. Usual dose is 10-30g for a child & 30-100g for an adolescent. Some toxins including heavy metals, iron, lithium, hydrocarbons, cyanide & low molecular weight alcohols are not significantly bound to charcoal. [30]

Cathartics

Cathartics are commonly used in conjunction with activated charcoal to hasten the clearance of charcoal-toxin complex. Commonly used cathartics are sorbitol, magnesium sulphate & magnesium citrate.

Whole bowel irrigation

This involves instilling large volumes of polyethylene glycol electrolyte solution into the stomach to clean the entire GIT. This is successfully used to remove slowly absorbed products like iron or sustained release products.

Enhancing elimination of toxin:

Diuresis

Increasing the PH of the urine with soda bicarbonate increases the elimination of weak acids such as salicylates & Phenobarbital. Alternately, acidifying the urine increases the elimination of weak bases such as amphetamines & phencyclidine. This technique is termed ion trapping.

Dialysis

Hemodialysis & peritoneal dialysis has been used successfully to treat poisoning by methanol, ethylene glycol & large symptomatic ingestions of salicylate & theophylline. Dialysis is not useful for drugs that are either highly protein bound or has a large volume of distribution.

© Journal of Global Trends in Pharmaceutical Sciences

Hemoperfusion

It is a dialytic technique in which blood is passed thro a column of activated charcoal & resin. It has been used to treat large ingestions of salicylates, theophylline & few other selected agents. [31-33]

Antidotes

The antidotes may be physiological, chemical or physical. Chemical antidote combine with the poison & render it innocuous. Physiological antidotes counteract the effects of the poison on the metabolism & physiological functions of the body & thus prevent harmful effects. Physical antidote prevents the contact of poisonous substance with target organ or adsorbs the toxic compounds thus preventing their toxicity. Some of the antidote includes atropine & pralidoxime for organophosphorous poisoning, acetyl cysteine for paracetamol, flumazenil for benzodiazepines, naloxone for opioids, amyl nitrite for cyanides & so on.

Prevention

- Never leave medicines in child's reach.
- Cleaning agents, drugs & fuels should be locked & not to be stored in drinking bottles.
- Never store inedible products in shelves.

Drowning and near drowning: Death within 24hrs of submersion is termed Drowning and survival after more than >24hrs is termed Neardrowning, regardless of whether the victim later dies or recovers. The World Health Organisation estimated the 1998 worldwide drowning mortality to be 8.4/100,000. As a cause of death globally, Drowning ranks 11th for children < 5 yrs and 4th for children aged 5-14 yrs old.Risk factors for drowning include children <5yrs old and second highest being 15-19 yrs old and males predominate in all ages. Children younger than 1yr drowned mostly in domestic sites (78%) predominantly in bath tubs & 1-4 yrs old in artificial pools (55%). Children may also drown in buckets, toilets, washing machines, sinks & other common areas containing water. Concomitant medical conditions like epilepsy & mental & motor disabilities carry an increased risk of drowning. [34]

Pathophysiology & clinical features

After submersion in a liquid medium, suffocation & asphyxia may occur with or without pulmonary aspiration. Within few minutes, hypoxia & ischemia can rapidly lead to irreversible multi system injury & eventually death. Hyperglycemia may exacerbate CNS injury. Pulmonary aspiration leads to surfactant deficiency, V-Q mismatch, hypoxia & pulmonary insufficiency. Hyper natremia & hemo concentration occurs with sea water ingestion & hemodilution due to fresh water ingestion which may also be due to SIADH. Hypothermia (core temperature <35deg.C) is common after submersion. Hypothermia occurs as children have increased body surface area to mass ratio & decreased subcutaneous fat. [35-37]

Treatment

Two groups may be identified based on the responsiveness at the scene.

Category A- children who require minimal amounts of resuscitation at the scene commonly have good outcomes & low incidence of complications.

Category B- children in cardiac arrest, who require aggressive & prolonged resuscitation & have a high risk of multi organ system complication, major neurologic morbidity & death. The ABC's – airway, breathing & circulation of emergency resuscitation should be instituted. Sellick's maneuver may be used to prevent aspiration of gastric contents during positive pressure ventilation. Cervical spine injuries be thought & spine immobilized. If apnea, cyanosis, hypoventilation & labored breathing persist, endotracheal intubation & application of PEEP may improve the oxygenation. Rewarming measures should be started after measuring the core temperature, by removing the damp clothes, drying the skin, applying warm blankets, warm environment, warmed IV fluids & humidified oxygen. External rewarming measures be applied when core temp <34 deg C. Assess blood glucose periodically, if hypoglycemic, 0.5-1g/kg dextrose given as 10%solution & if hyperglycemic, avoid dextrose containing solutions initially.

Neurologic management

The most effective neuro intensive care measures in near drowning are the rapid restoration of adequate oxygenation, ventilation & perfusion & avoid hypo/ hyper glycemia. Fever & seizures are to be controlled as they increase oxygen requirement. [38]

Prognosis:

Scoring & classification systems as well as individual factors have been used to predict the outcome in near drowning. These are

- ✓ Historical variables such as submersion duration, interventions at the scene & patient temperature.
- ✓ Treatment variables such as need for CPR in the emergency department, apnea and pulselessness, resuscitation duration, GCS and progression, papillary responsiveness and brain stem reflex.
- ✓ Laboratory values like PH and glucose.

Prevention:

- ✓ Never leave water in a bucket in a floor
- ✓ Never leave the child alone in bath or to swim.
- ✓ Not to swim after a large meal
- ✓ Provide fence for swimming pools & artificial ponds & garden lily pond.

Foreign bodies

The proclivity of infants & children to place all manner of foreign bodies into their mouths, nose & ears frequently results in problems.

Ear/ nose foreign body

Insects may invade the external auditory canal, small objects such as peas, peanuts & paper may be inserted by the child. Draining, fever & bleeding may be seen. FB may be removed by irrigation with tepid water, using a water pik or a cerumen scoop, loop or bayonet forceps. [39]

Laryngeal & tracheal FB

Objects like peanut, popcorn or small objects may be aspirated. The stridor, wheezing & retractions that follow draws attention immediately to the possibility of aspiration. If the FB has lodged within the glottic opening, the child struggles to take in enough air with which to cough. At this point, Heimlich maneuver may dislodge the FB & restore the airway. Manual dislodgement of larger objects by an adult may be effective. Most aspirated FBs pass through the glottis & lodge in a bronchus or one of its branches. In this case a child often wheezes & continues coughing. The radiolucent FB is only evident on X-ray due to the ball valve effect which prevents egress of air from the involved lung. The ipsilateral diaphragm may be depressed & the intercostals spaces relatively widened by the effects of air trapping.

Esophageal FBs

FBs are commonly swallowed. Some lodge in the esophagus, the narrowest part of GIT being the cricopharyngeus muscle or superior constrictor of the esophagus. Anomalies of the esophagus can also cause the FB to lodge, including repaired esophageal atresia, vascular rings, esophageal webs & duplication cysts. The most common symptoms of a FB in esophagus are drooling, dysphagia & pain. X-ray long axis of a tracheal FB is vertically oriented whereas the axis of esophageal FB is transverse. Radiolucent objects are made visible by judicious use of contrast agents or USG. The advent of small batteries has added the dilemma of caustic ingestion to that of FB, when electrically exhausted. If there remains life in the battery, the electrical current may add to the local tissue damage. Ingested batteries that are not below the stomach will be removed. The advent of an integrated pediatric endoscopy system by Karl Storz has made retrieval of FB easier.

Gastro intestinal FBs

Approximately 95% of the ingested FBs reach the stomach & pass the remainder of GIT without causing obstruction. Exceptions include long objects such as tooth brush, an elongated key or a pencil. These objects are likely to get obstructed at the duodenum or ligament of TREITZ. BEZOARS are FBs that may obstruct the stomach or small intestine. They are composed of hair (trichbezoar), vegetable matter (phytobezoar), neonatal casein curd (lactobezoars) & are more common in emotionally disturbed & retarded children.

Prevention

- Children should not be allowed to run with food in mouth.
- Discard broken toys and batteries immediately.
- Inhibit the practice of catching peanuts by mouth after throwing in air.

Child abuse

Child abuse was brought to the attention of modern society by Caffey, who described a syndrome of multiple long bone fractures in infants associated with subdural haematoma. The battered child syndrome has many

© Journal of Global Trends in Pharmaceutical Sciences

manifestations, including physical and mental abuse, nutritional & hygienic neglect, sexual abuse, delayed treatment of illness & neglect of a child's safety. Most commonly the victims of abuse are younger than 2 yrs, when they have limited ability to communicate. More boys than girls are injured but far more girls are sexually abused. Premature children, children with complicated medical problems, stepchildren & children from low socio economic group are at particular risk. In three fourth of cases one or both parents are involved, mostly young parents under extreme financial & social stress. [40]

Diagnosis

Parents may bring the child for an injury that occured several days previously and may explain the injury spontaneous and unwitnessed. Almost always there is marked discrepancy between the history offered & the manifestations of injury. Parents may make visits to many different emergency departments to avoid detection by the same facility more than once. [41-45]

Patterns of injury

The characteristic patterns of injury in abuse in the order of frequency are

- Repetitive soft tissue injuries
- Contusions, abrasions, lacerations, burns.
- Evidence of repetitive fractures
- Solitary head injury/ subdural hematoma
- Visceral injuries.

Musculo skeletal manifestations of abuse

- Spiral fractures attributed to falls
- Sub periosteal calcification with no h/o injury
- Multiple fractures in various stages of healing.
- BUCKET-HANDLE fractures or epiphyseal metaphyseal separation with fragmentation from pulling or shaking forces.
- Unexplained fractures associated with chronic sub dural hematomas. [46]

Other manifestations include failure to thrive with marked nutritional deficiency & sexual abuse in 10-12 yrs old girls. The families are rehabilitated by means of long term psychiatric care and social service involvement.

Injury prevention: Injury prevention is described at various levels:

Primary prevention: Aimed at eliminating a trauma incident such as stop lights at intersections, window guards to prevent falls & fences around swimming pools.

Secondary prevention

It is the attempt to decrease the severity of injuries that have occurred.

Tertiary prevention

IT is aimed at reducing the consequences of injury after the injury has occurrence.

According to Haddon, there are three main factors in injury occurrence:

- ✓ The injured person or host
- ✓ The injuring mechanism or vehicle
- ✓ The environment in which the injury occurs [47]
- ✓ Implementation of prevention strategies has been done using the four "E"s: education, enforcement, engineering

Education- knowledge supports a change in behaviour such as drunk driving and use of seat belts.

Enforcement- Implementations of law mandating a preventive action.

Engineering- Engineering changes like incorporation of air bags may have greatest preventive effects.

Economic incentives- Efforts made by the government in laying smooth roads etc.

CONCLUSION

Prevention strategies need to be implemented through education, change in environment, empowerment and enforcement to bring down the rate of accidents which costs more lives and leaves children with functional impairment, psychological stress and financial burden to the family and nation.

REFERENCES:

1. Antony Ryan.Harvard school of public health, Boston 1992, epidemiology. Community health, 680- 685
2. Asif M, Shah SA, Khan F, Ghai R, Analysis of FB in children with respect to

age sex, type and presentation; Indian J . Paediatr 2003.
3. Baker SP, Motor vehicle occupant deaths in young children; Paediatrics 1979: 64: 860

4. Bannon MJ, CarterY H, Mason KT, Causes of fatal childhood Accidents in North Staffordshire; 1980-89 Arch Emerg med 1992: 9 : 357-366.

5. Basudeb, Accidental poisoning in children , Indian Pediatrics 1981, vol18 157-162.

6. Behrman, Kliegman, Nelson's textbook of pediatrics: 17th edition, 256-262.
7. Bodiwal A , Thomas P,Otorbusham A, Protective effects of rear seat restraints during car collision ;Lancet 1989:1:369.

8. British Medical Association, Accidents in home, London, B.M.A1964.
9. Carter.Y.H, Jones.P.W, Accidents among children under 5 yrs- a general practice based study in North Staffordshire, British J Of General practice, April 93,159-163.

10. Carty, Fractures Caused by child abuse, J. Bone joint surg 1993: 75B: 849.

11. Elizabeth, Nutrition and child development, 3rd edition, 2004: 385.
12. Elizabeth Towner; dept of child health, University of Newcastle; The accidental injury task force, Sep 2002.

13. Fitz Marice., Approach to multiple trauma: Pediatric emergency medicine 2nd edition 1997 p 224.

14. Ford.E.G, Trauma Triage; pediatric trauma: Initial Assessment & Management, 1994, 112.

15. Henrick Nordin 2002 " falling accidents among young children in Sweden" Swedish consumer agency; & EHLASS- the European home & leisure accident surveillance system.

16. Heycock, Community Medicine ;1972: 127: 15.
17. Illingworth CM , BMX compared with ordinary bicycle accidents, Arch Dis Child; 1985: 60: 461

18. James O Neil Jr, Principles of pediatric surgery, Mosby. 2nd edition 2004 p 197-204.

19. Johnson CF ,Inflicted injury Vs Accidental injury; The diagnosis of inflicted injury , Pediatr clin North Am;1990: 37 :791

20. Kavanagh CA , Banco L, The infant walkers, Am J.Dis child; 1982 : 136: 295.
21. Keith.W.Aschcraft, Pediatric surgery. W.B.Saunders, 3rd edition 2000 p 183.
22. Lynn Walton Haynes "pedestrian injuries to young children " Report 5, May 2002, California Dept of health services.

23. Markus Hubacher, 1994: accidents of children aged 0-16 yrs, report 24.
24. McIntire.M.S, handbook of accident prevention, Hagerstorm, Harper and Row 1980.

25. McQueen.I.A.G, Study of home accidents in Aberdeen. Edinburg, Livingstone, 1960.

26. Mukopadyay T, Childhood accidents update,1987; 34: 1346- 1356.
27. Murdock.R, Joyce Eva, Home accidents to children under 15 yrs: Survey of 910 cases, British medical journal,1974,3,103-106.

28. Navascues del Rio Ja , First Spanish Trauma Registry; Analysis of 1500 cases; Eur J.Pediatr Surg; 2000: 10(5); 310-8.

29. Ravinder K Gupta, Ritu Gupta, Home related accidents durint infancy ; J.K.Science: Volume VI,No 2, April- Jun 2004.

30. Roberts.I, 1997 "cause specific social class mortality differentials for child injury & poisoning in England & Wales" J.Epidemiology community health, 57.

31. Ronald.S, Illingworth, The normal child: tenth edition 381-395.
32. Royal society for the prevention of accidents 1998-2007; Edgbaston, Birmingam, U.K.

© Journal of Global Trends in Pharmaceutical Sciences

33. Scheiber RA, Thompson NJ, Developmental risk factors for childhood pedistrain injuries-Injury prevention, 2(Sep 1996) : 228 – 236.

34. Selbst SM, Baker M,Bunk bed injuries ; Am J.Dis child; 1989: 143 :430.

35. Sharples PM, Storey A, Aynsley Green A,Eyre J, Causes of fatal childhood accidents involving head injury in the Northern Region; 1979- 86 , BMJ 1990; 301: 1193-96.

36. Sitaraman S,Sharma S, Saxena S , Accidental poisoning in children, Indian Pediatr, 1985; Vol 22: 757-60.

37. Sogon.K.K, Sitaraman.S, Accidents in infancy & childhood, IP 1985, 22: 815-818.

38. Surjit Singh, Narang.A, Walia. BNS, Mehta.S, Latakumar: Accidental poisoning in children 10 yrs experience IP vol 18 : 163-166.

39. Tandon.J.N, Kalra.A, Kalra.K, Sahel.SC, 1988, profile of accidents in children Indian perspective, IP, vol 30, 765-69.

40. Tyser.P.A, Journal of the college of general practitioners: 1962, 5, 575.

41. Vinje M ,Children as pedestrians: Abilities and limitations: Accident analysis and Prevention, 13(1981) : 225-40.

42. Walsh.S, Javis.S, 1996 "Annual incidence of unintentional injury among 54,000 children" Injury prevention2 (1): 16-20.

43. Zucker man GB,Gregory PM,Santos Damiani SM :Predictors of death and neurologic impairment in pediatric submersion injuries,Arch pediatr adolesc Med 1998;152 : 134-40.

© Journal of Global Trends in Pharmaceutical Sciences