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ORIGINAL PAPER

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Recommended clinical evaluation of infants with an apparent life-threatening event. Consensus document of the European Society for the Study and Prevention of Infant Death, 2003

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Abstract Infants with an apparent life-threatening event (ALTE) should not be treated nor monitored without a detailed medical evaluation, as different medical causes may be responsible for the initial clinical presentation. Standard and specific evaluation procedures are listed to help identify a cause for the ALTE. The most frequent problems associated with an ALTE are digestive (about 50%), neurological (30%), respiratory (20%), cardiovascular (5%), metabolic and endocrine (under 5%), or diverse other problems, including child abuse. Up to 50% of ALTEs remain unexplained. The finding of medical or surgical anomalies leads to specific treatments. Surveillance programmes with the use of home monitoring devices may be undertaken, preferably with cardiorespiratory monitors, and when possible, with event monitors, although no currently available home monitoring device is free of false alarms or offers complete protection. Long-term follow-up programmes of infants with an apparent life-threatening event contribute to adapt medical attitudes to the child's needs and to confirm the medical diagnosis. *Conclusion*: A systematic diagnostic evaluation, together with a comprehensive treatment programme, increases survival and quality of life for most affected infants.

Keywords Apnoea · Apparent life-threatening event · Death · Sleep · Sudden infant death

Abbreviations *ALTE* apparent life-threatening event · *SIDS* sudden infant death syndrome

Introduction

Infants presented to medical attention following an apparent life-threatening event (ALTE) remain a challenge for the clinician despite continuous improvement in diagnostic and surveillance procedures [1, 2, 38, 40, 44,54]. A review of the world literature available between 1992 and 2002 has been conducted through Medline. This paper summarises the conclusions of a dedicated work party organised by the European Society for the Study and Prevention of Infant Death (ESPID) to agree on guidelines for the management of infants with an ALTE.

Definition

Infants with an ALTE present to medical attention because of an acute and unexpected change in behaviour that alarmed the care giver. The initial episodes can occur during sleep, awake, or feeding. They are most commonly described as some combination of apnoea, colour change (cyanotic or pallid, occasionally plethor), marked change in muscle tone (limpness, rarely rigidity), choking or gagging [41]. In most cases the observers reported that the episode appeared potentially life-threatening or they thought the infant had died, and that a prompt intervention was associated with normalisation of the child's

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appearance. In some cases, the episode was of short duration and resolved spontaneously.

The term ALTE was coined to describe the chief complaint and to replace the previously used "near-miss for sudden infant death syndrome (SIDS)" infants, debated as too precisely indicating an association with the SIDS [41].

Relationship between apparent life-threatening event and sudden infant death syndrome

It has not been demonstrated that infants with an ALTE are really near-miss SIDS cases. The heterogeneity of both ALTE and SIDS infants renders comparison between both conditions difficult [23,50]. Factors responsible for difficulties in comparing studies of ALTE infants include varied types of presenting spells, incomplete histories, varied terminology, inconsistent efforts to identify causes of the episodes, dependence on untrained observers, validity of parents to correctly perceive a true life-threatening event [34,35], and lack of follow-up programmes. Some history-based studies failed to outline significant differences between both ALTE and SIDS groups regarding preceding family or personal history. Infants with an ALTE were, however, 1 to 3 weeks younger than the SIDS victims and benefited more favourable circumstances at the time of the event, such as being found during daytime or sleeping supine [20, 25, 28, 29, 38,53]. If following an initial ALTE, some infants were reported with extreme cardiorespiratory events [1], a relationship with SIDS could involve only a fraction of all SIDS cases as less than 10% of future SIDS victims had presented a cyanotic or pale episode during sleep at some time before death [9, 34, 38,54].

Frequency of apparent life-threatening events

The frequency and the prevalence of ALTEs are unknown. A study from New Zealand reported a mean annual admission rate for ALTE of 9.4/1000 live births, with no change parallel to that of the decreased SIDS rate [38]. This hospital admission-based study did, however, not report the milder or fully recovered ALTEs not admitted to hospital.

Clinical evaluation of infants with an apparent life-threatening event

ALTE is a clinical presentation. As such, it requires a systematic and thorough evaluation to assess the cause of the event. Only if no medical or surgical cause sufficient to explain the event is found will an ALTE be described as unexplained or idiopathic. Follow-up of the infant can also contribute to ascertainment of the correct clinical classification of the ALTE.

The severity of an ALTE relies only on the history provided by the witness and on physical examination. When first examined, an infant may still present with persistent limpness, colour change or abnormal state of alertness. However, the infant may appear entirely normal on physical examination. The reports of the observers are difficult to appraise because of anxiety and lack of professional experience. Observers can overestimate the severity of the incident as the child's unresponsiveness may be due to a deep sleep state, or underestimate the severity because of rapid response to effective early intervention. The value of the reports increases when multiple observers describe similar observations. However, a detailed history and physical examination are of paramount importance and the extent of the medical evaluation and treatment depends on the index of clinical suspicion. The presence of markers of hypoxia, such as arterial pH, lactic acid, liver enzymes or urinary hypoxanthine can contribute to document the severity of an ALTE.

History of the event

Questions addressed to the person witnessing the ALTE aim at a precise description of the event. The following information should be collected in all cases (Table 1).

Physical examination of the infant

A detailed physical examination should include special attention to neurological, respiratory, or cardiac abnormalities. General tonus, a careful neurological examination, and a developmental assessment must be done. Blood pressure should be measured, while head circumference weight and height values should be plotted on a growth chart. Facial dysmorphism responsible for partial a complete upper airway obstruction needs to be determined [22,55].

Further evaluation of the infant

Hospitalisation is determined on the basis of the initial history and physical inspection. When the ALTE appears to have been benign and the child is normal when evaluated immediately thereafter in the practice or emergency department, hospital admission may not be required. If the episode appears to be significant with intense stimulation, or when physical examination is not completely normal, or the importance of the event remains doubtful, the infant should be hospitalised for further medical evaluation and observation, and be placed on continuous cardiorespiratory and/or oxygen saturation monitoring with memory capability.

During hospitalisation, further evaluation will depend on the presenting symptoms and physical examination. An ALTE can be a symptom of many disorders. As much

Table 1 History of the ALTE

1. Personal and family history
As in any clinical evaluation, a precise prior medical history must also be obtained, including pregnancy, birth conditions, neonatal period, usual behaviour, sleep and feeding habits, whether breast or bottle-fed
Medical or surgical problems and treatments as well as previous evaluations should be described
A family history is collected and should include characteristics of other siblings with an ALTE, early deaths, genetic, metabolic, cardiac or neurological problems
Parents' age and body mass index, smoking and drinking habits. Usual medical treatments in the preceding 7 days should also be detailed, as well as for any other caretaker (grandparents, babysitter)
2. Daily life conditions
Usual sleep conditions should be described, including sleep position when placed down for sleep and when found, bedding, ambient temperature, use of pacifiers or sedative medications, sleeping attire, bedding materials
3. Events immediately preceding the ALTE
The events and minor symptoms that preceded the ALTE, including recent episodes of fever, illness, medications, immunisation, sleep deprivation, or change in daily life routine
4. Description of the ALTE
The precise time when the ALTE occurred and the time since last feeding
The exact place where the ALTE occurred: the child's cot, parents' bed, parents' arms, bathroom, a sofa, a car
The state of the infant when the event began: asleep or awake
If asleep, the child's body position, type of bedding, whether the face was covered or free
The presence of specific sleep conditions, such as bed-sharing and with whom (parents, children, other bed partner)
If awake, whether the child was being fed, handled (specify position, e.g. kinking of neck), crying, being bathed
The reason that led to the discovery of the infant with an ALTE (noise, unusual cry)
Who discovered the ALTE and who witnessed it
The child's appearance when found: consciousness, muscle tone, colour, respiratory efforts, choking, gasping, emesis (bloody or otherwise), sweating, limb or eye movements, pupil size, skin or rectal temperature
Any intervention (such as gentle stimulation, shaking, CPR) and the child's response
The estimated time of recovery
The estimated duration of the event

Table 2 ALTE: main causes identified

1. Metabolic and endocrine problems
Gastro-oesophageal reflux
Infection
Volvulus
Intussusception
Dumping syndrome
Chemolaryngeal reflex
Aspiration and choking
2. Neurological problems
Convulsive disorders (isolated or associated with intracranial haemorrhage, hydrocephalus, developmental deficits or hypoxia)
Intracranial infection
Intracranial hypertension (brain tumour, subdural haematoma, or congenital metabolic disease)
Vasovagal reflexes (breath-holding spells or other causes of enhanced vagal responses)
Congenital malformations of the brainstem
Muscular problems (myopathy)
Congenital central alveolar hypoventilation
3. Respiratory problems
Airway and pulmonary infection (respiratory syncytial virus, pertussis or *Mycoplasma* infection)
Congenital airway abnormalities (Pierre-Robin syndrome, airway cysts, angiomas, or malacia)
Airway obstructions (inspiration of vomit or foreign material)
Obstructive sleep apnoea
4. Cardiovascular problems
Heart rhythm abnormalities (Wolff-Parkinson-White, long Q-Tc syndromes, or other heart rhythm abnormalities)
Congenital cardiac malformations
Abnormalities of great vessels
Myocarditis
Cardiomyopathy
5. Metabolic and endocrine problems
Anomalies of mitochondrial fatty acid oxidation (medium chain acyl-CoA dehyrogenase deficiency).
Urea cycle defects (arginase deficiency)
Galactosaemia
Leigh or Reye syndrome
Nesidioblastosis
Menkes syndrome
6. Other conditions
Nutritional errors (excess feeding volumes)
Medications
Accidental smothering and asphyxia
Accidental carbon monoxide intoxication
Drug toxicity
Child abuse
Munchausen by Proxy syndrome
7. Idiopathic ALTE

as 50% to 70% of ALTEs are explained by some medical or surgical issue [14, 27, 28, 29, 32, 42, 47, 48, 49,54]. The main clinical diagnostic groups responsible for the ALTE, as reported in the literature, are listed in decreasing order of frequency, as follows (Table 2).

Digestive problems

Almost 50% of all ALTEs have been related to digestive problems [28, 32,49]. Gastro-oesophageal reflux is frequently present in infancy and should not be assumed too easily as a final explanation for the ALTE [4]. A lack of temporal relation between acid reflux and apnoea has been reported [7,31]. When reflux and apnoea are associated, the latter is predominantly of the obstructive type [29]. The role of non-acid gastric reflux is still debated. ALTEs of digestive origin usually occur during, or shortly after feeding, and may be accompanied by vomiting, coughing or choking.

Neurological problems

Neurological problems account for up to 30% of explained ALTEs [28, 32,49]. Diagnosing seizures may require repeated EEG recordings and may be based on the clinical history if EEG recordings are non-diagnostic.

Seizures induced by hypoxaemia may be witnessed by transient sinus tachycardia [26]. In a young infant, intracranial infection may develop with few symptoms. Major episodes of pallor or cyanosis, hypotonia or opisthotonus may follow vasovagal reflexes in case of breath-holding spells or other causes of enhanced vagal responses. Rare congenital malformations of the brainstem may be associated with apnoea and heart rate abnormalities. ALTE characteristics of neurological origin have been described as apnoeic, choking, hypotonic or rigid with abnormal body movements, and may well occur while awake. ALTEs related to vasovagal responses usually occur while the child was awake, and crying [32].

Respiratory problems

About 20% of explained ALTEs result from respiratory problems [28, 32,49]. Obstructive sleep apnoea has been found in association with infections, such as CMV or influenza, anatomical or lymphatic tissue abnormalities, as well as allergies or sleep deprivation. Medications, such as phenothiazines or barbiturates enhance the potential for obstructive sleep apnoea in infants. Obstructive sleep apnoea can be idiopathic in young infants, and is more frequently found in premature newborns [17]. Obstructions occur at the laryngeal level [45]. Significant anaemia has been associated with apnoea, especially in previous preterm infants [17]. These infants were usually found apnoeic and flaccid. A history of noisy breathing or snoring and/or excessive sweating during sleep can be found in infants with airway obstructions [31].

Cardiovascular problems

These conditions account for about 5% of ALTEs. Some of these infants had a history of episodes of apnoea, with pallor, cyanosis, limpness, retarded growth, or excessive sweating during sleep [13,32].

Metabolic and endocrine problems

Congenital metabolic abnormalities account for about 2% to 5% of ALTEs [28, 32,49]. A variety of conditions have been reported including anomalies of mitochondrial fatty acid oxidation, such as medium chain acyl-CoA dehydrogenase deficiency, leading to sudden and unexpected hypoketotic hypoglycaemia, liver failure and acidosis [5]. The disease is associated with various mutations. Urea cycle defects, such as arginase deficiency, lead to acute encephalopathy with brain oedema. Most of these conditions are triggered by fasting and are accompanied by vomiting, hypotonia, lethargy and coma. Such a diagnosis should especially be suspected in cases of atypical age for ALTE (over 1 year), history of repeated life-threatening events, or previous infant deaths in the family [6].

Other conditions

Rarer conditions for an ALTE include nutritional errors, such as excess feeding volumes leading to acute regurgitations, or adverse effects following the administration of medications. Accidental smothering and asphyxia in the crib, accidental carbon monoxide intoxication, drug toxicity or sepsis in non-febrile infants should also be excluded. This group of conditions accounts for less than 5% of all ALTEs.

Less than 3% of ALTEs appear to be related to child abuse [32,46]. The diagnosis of child abuse is straightforward when signs of neglect or trauma are present such as bruises or burns, bone fractures or retinal haemorrhage [8,46]. Suspicion is raised with a history of recurrent ALTEs in families with previous histories of apnoea of infancy who have been seeking attention from various health professionals. The presence of previous SIDS victims at an unusually late age in the family, as well as the repeated finding of fresh blood in the nose or mouth following the ALTE, may heighten suspicion of abuse. In younger infants, the finding of fresh blood in the nose or mouth has not been useful in distinguishing SIDS from intentional suffocation. Recurrent attacks of ALTE that occur only in the presence of the same caregiver, but witnessed shortly by others who are called for help, may also raise suspicion of Munchausen by Proxy syndrome.

Idiopathic apparent life-threatening events

Up to 50% of all ALTEs remain unexplained, despite history and complete evaluation. These were reported as idiopathic or unexplained ALTE. The most frequent symptoms reported for this subgroup of infants include apnoea, hypotonia, hypothermia, and colour change (intense pallor or cyanosis) [32].

Recurrent apparent life-threatening events

Recurrent ALTEs have been associated with obstructive sleep apnoeas, digestive, neurological anomalies, metabolic disorders, Munchausen by Proxy, or imposed suffocation [6].

Evaluation procedures

The clinical evaluation must be conducted with paediatric expertise and full access to diagnostic resources to determine a clear-cut diagnosis. A multidisciplinary approach as well as a case-conference are highly recommended. Finding a medical condition does not, however, necessarily establish causality for the ALTE [41].

There is no standard minimal work-up in the evaluation of an ALTE. The paediatrician should individualise

and decide upon appropriate investigations to be performed according to the individual presenting history and physical examination findings. The following procedures summary is intended only as a guide for the clinician and further examinations may be indicated based on the results of the initial evaluations (Table 3).

Viral and bacterial evaluation refers to the agents most frequently responsible for the development of apnea, such as respiratory synctial virus, parainfluenza or influenza viruses, as well as *Haemophilus* or pertussis bacteria.

The study of acid gastro-oesophageal reflux is usually done with pH probes located in the distal region of the oesophagus. Intraluminal impedance to identify non-acid gastric reflux is a technique not yet widely used. Cardiac autonomic control has been evaluated by spectral analysis of the heart rate and on challenges based on oculocardiac or tilt stimuli [19].

When a metabolic problem is suspected, blood glucose, pH, acetone and ammonia should be tested. Lactic and pyruvic acid levels need to be evaluated. Newborn screening Guthrie spot cards can be resubmitted for analysis.

Some teams have advocated the use of covert video surveillance to witness imposed suffocation or other parental behaviour associated with fabricated ALTEs [24]. Intraocular haemorrhages, subdural haematoma and diffuse axonal injury with acute cerebral oedema are found in the shaken baby syndrome [10]. Laboratory tests can identify toxic substances administered to the infant. Skeletal imagery can identify previous or multiple lesions.

Whole night polygraphic sleep studies are conducted to assess respiratory, cardiac or neurological abnormalities during sleep [3]. EEG recordings contribute to the scoring of sleep or wake state; thoracic and abdominal movement recordings are used for the analysis of breathing and apnoea characteristics; heart rate is recorded from ECG sensors; oxygen sensors inform on oxygen saturation values during sleep and following apnoea; gross body movements are scored by actigrams, as well as by artifacts on the other leads. Polygraphic sleep recordings are not required in most infants with an ALTE [21,25]. Sleep studies have generally been considered not to predict risk for SIDS, although some authors reported that polygraphic studies contribute to predict later acute life-threatening events [12,14]. When the recording of cardiorespiratory and sleep characteristics is indicated, such as for the detection of suspected obstructive sleep apnoea, polysomnography is the optimal investigation [41]. The pneumogram is not an appropriate test in this situation. Specifically, the sleep study includes a recording montage with EEG, EOG, EMG, nasal and oral airflow detection, end tidal carbon dioxide, haemoglobin saturation, ECG and heart rate. In contrast, the pneumogram consists of two channels of

Table 3 Procedures

Standard procedures	Potential diagnosis
Complete child and family history	
Medical examination of the infant	
Complete blood count, pH, inflammatory tests	Infection, anaemia, asphyxia
Blood electrolytes, urea, calcium, phosphate	Dehydratation, hypo- hypercalcaemia
Blood glucose	Hypoglycaemia
Virology and bacterial screening	Infection
Nasopharyngeal aspirate	Upper airway infections
Urinalysis and culture, liver enzymes	Infection, metabolic screening
Chest X-ray film	Infection, cardiomegaly
Electrocardiogram	Arrhythmias, QTc anomaly
Stool culture	Infection
Ocular examination	Abuse, shaken infant
Specific procedures	
Spinal fluid examination	Infection, haemorrhage, metabolic study
Skull X-ray film	Fracture, hypertension
Electroencephalogram	Seizure
Brain CT scan or MRI	Mass (tumour, haematoma)
Oesophageal pH monitoring	Gastro-oesophageal reflux
Oesophageal barium study (or CT scan)	Anatomical abnormalities
ENT study, laryngoscopy	Airway obstruction or abnormality
Echocardiography	Congenital malformation, cardiac function
Metabolic work-up	Congenital metabolic abnormality
Skeletal survey	Fractures, malformations
Toxicology	Intoxication, drug effects
Craniofacial study and X-ray film	Facial dysmorphism
Sleep polygraphic study	Cardiorespiratory, neurological or oxygenation abnormalities
Tilt or other autonomic tests	Excessive autonomic responses
Video surveillance	Abuse, Munchausen by Proxy

recording: an ECG and a device that records movement of the chest wall or upper abdomen, but does not measure airflow or oxygen saturation. The recording of oxygen saturation alone is still debated. As an alternative, pneumograms are done with pulse oximetry and nasal airflow in some centres. For the polysomnography, overnight studies are usually preferred to afternoon naps, to reduce the risk of missed events and to capture the timing of the circadian cycle when deepest sleep is most likely to occur. Interpretation of the recording requires adequate expertise [11].

Most of the above techniques are available in paediatric tertiary care centres. Their use, as well as that of other more sophisticated procedures, depends on medical judgement. Other and newer evaluation techniques can be considered for research purposes.

Treatment and surveillance of infants with an apparent life-threatening event

Medical or surgical treatment

When a specific cause for an ALTE is found, appropriate medical or surgical treatment is initiated. Respiratory stimulants, such as methylxanthine, sometimes used to treat apnoea of infancy, or anti-reflux drugs have not been shown to prevent the occurrence of ALTEs. Some treatments may be associated with significant side-effects. Xanthines aggravate gastro-oesophageal reflux [51], delay arousal, decrease ventilatory responsiveness [37,41], and favour the development of seizures [16].

Home monitoring

Event monitors are preferred to standard devices not having memory capability, as they contribute to the evaluation of the significance of eventual cardiac or respiratory alarms [52,53]. Event monitors able to analyse the ECG contribute to identifying false alarms [14]. Cardiorespiratory monitors are preferred to apnoea monitors, that only sense breathing movements and are generally considered unfit for the protection of infants at risk [2]. The effectiveness of cardiac monitoring alone has been considered, since prolonged hypoxia can develop before significant bradycardia. None of the currently available home memory monitors will reliably detect obstructive apnoea [2]. Oxygenation monitors have been recommended as alternatives to cardiorespiratory monitoring as they detect physiological compromise that might be related to central and/or obstructive apnoea events [46].

Although some infants have died while monitored at home with event recorders [36,43], it has been suggested that home monitoring can effectively protect infants considered at higher risk for SIDS, or to contribute to define the infant's propensity for repetitive events. Home monitoring has been suggested to prevent the repetition of severe hypoxic attacks in some infants and improve developmental outcome. The effectiveness of home monitoring in reducing the risk for SIDS has, however, not been established for any risk group, including preterm infants, siblings of SIDS victims, and infants with an ALTE.

There are at present no universally accepted criteria to determine which infant should be monitored at home. Randomised allocation of cardiorespiratory monitoring devices in selected groups of high-risk patients has not been reported. Routine monitoring of normal infants is generally not considered medically indicated [41]. Infants usually enter a home monitoring programme because of the presence of clinical symptoms, specific history, identified disease or condition with a high risk of repetitive apnoea or bradycardia. Some groups restricted the use of cardiorespiratory monitors to infants with documented obstructive sleep apnoeas for which no specific treatment could be offered. Other groups implemented monitoring surveillance for infants with an idiopathic ALTE or only those who had received vigorous resuscitation, a fraction of all ALTE infants studied [2].

Monitoring can also be considered for infants who could benefit from home surveillance because of specific conditions that make them vulnerable to airway compromise, such as upper-airway malformations or tracheostomy. These children also require the use of pulse oximeters as the traditional transthoracic impedance monitor will not detect airway obstruction. This group of condition includes neurological and metabolic disorders, as well as idiopathic disorders affecting respiratory control (congenital central hypoventilation syndrome), and infants with chronic lung disease (bronchopulmonary dysplasia), especially those requiring supplemental oxygen, continuous positive airway pressure, or mechanical ventilation. It has been suggested that if home monitoring of premature infants is elected, it usually may be discontinued after 46 weeks' post-menstrual age, or because of the persistence of apnoea, monitoring may be continued beyond that time in some infants [2,44].

When the decision to monitor an infant is taken, a programme must be available that includes complete and continuous medical, psychological and technical support. Staff should always be available for direct or telephone consultation. Re-admission for investigation is warranted in infants with severe or multiple recurrent events. Such a programme is required for the adequate care of the infant, follow-up and decrease in stressful impact of home monitoring on family life [18]. Over-the-counter delivery of monitors must therefore be discouraged. Parents should be counselled regarding the purpose of home cardiorespiratory monitoring and realistic expectations of what it can and cannot contribute to the infant's well-being [2]. Since apnoea, bradycardia, and recurrent clinical events are most likely to occur during the 1st month of monitoring, particular care should be given during the early weeks of home monitoring [12, 14,44]. Parents should be instructed in standard cardiopulmonary resuscitation techniques and not to shake their infant

during stimulation. A care plan including periodic reassessment of historical, physical, developmental, and laboratory data is advised [2]. All infants must benefit from safe sleep practices, including supine sleep, with the face free, in a moderately heated room, and avoidance of exposure to tobacco smoke. Care should be taken that these recommendations are applied, as despite ''back-to-sleep campaigns'', safe sleep conditions are not universal among child care providers [33, 38,39].

Monitoring of an infant with an ALTE is usually terminated following a 6-week period free of recurrent events, typically when the infant is at least 6 months old. Some centres confirm the child's progression to healthy characteristics by performing control sleep studies before weaning from the monitor, especially when repeated obstructive apnoea had previously been documented [32]. The use of event recording monitors has replaced routine polysomnograms to determine the safety of discontinuing home monitoring in other centres. This technique contributes to reduce the duration of home monitoring when no significant events are documented [14].

Follow-up of infants with an ALTE

The potential for infants with identified causes for the initial ALTE to develop normally depends on the nature and severity of the event. If status epilepticus follows an hypoxic ischaemic episode, prognosis can be poor. Appreciation of each child's condition depends also on the promptness of examination after the event, as both transitory abnormalities and late-onset symptoms can occur. For infants with an unexplained or idiopathic ALTE, the outcome is not predictable. One study reported that infants who responded only to resuscitation and had recurrent episodes or develop a seizure disorder have a risk of death above 25% [42]. We cannot, however, exclude the possibility that metabolic, cardiac or neurological affections, as well as child abuse were included in these high-risk infants. Other long-term prospective studies reported normal cognitive and behavioural development up to 10 years following the ALTE [30]. Conflicting reports in the evaluation of outcome can be due in part, to the small number of children studied, the definition of ''idiopathic ALTE'', the extent of initial medical evaluation, and the heterogeneity of the ALTE group.

Conclusions

Because of the heterogeneity of the ALTE group, a detailed medical evaluation is needed to identify the cause of an ALTE. The most important part of the evaluation is the history taken from the parents or caregivers. A detailed description of the circumstances preceding and surrounding the ALTE is mandatory. Further valuable information may be gained by collecting information on family lifestyle and child care practices. The medical examinations are organised following an evidence-based clinical approach. The finding of medical or surgical anomalies can lead to specific treatments or surveillance programmes [15]. The use of home monitoring depends on clinical indications and local strategies. Long-term follow-up programmes contribute to support for families, to adapting medical attitudes to the child's needs and to confirming or modifying the medical diagnosis. A systematic diagnostic evaluation of infants with an ALTE, together with a comprehensive treatment programme, should increase survival and quality of life for most affected infants.

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