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# Acute Lymphoblastic Leukemia misdiagnosed as lethal child neglect

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**Abstract:** Lethal child neglect is a rare cause of death in industrialized countries. Starvation and dehydration are peculiar signs of such abuse even if it is mandatory to exclude organic diseases that may mimic neglect. A 4 months-year-old infant started vomiting at his home and then collapsed in a local hospital, where he expired. The mother stated that baby had had symptoms (fever, vomit and diarrhea) but she was afraid to seek medical care. At autopsy, clear signs of dehydration were found. Histological examination showed a T-cell lymphoblastic infiltrate of the organs with foci of bronchopneumonia in lungs. The results of autopsy suggested that the cause of death was a Cancer-Cachexia-Syndrome from an Acute Lymphoblastic Leukemia. The manner of death was attributed to natural death. In the present article, crime scene investigations as well as medical history, autopsy findings, and possible liability of the parents in determining child's death are discussed.

**Key Words:** forensic science, forensic pathology, lethal child neglect, acute lymphoblastic leukemia, lymphoma, natural disease.

Types of child maltreatment include physical abuse, sexual abuse, emotional/psychological abuse, and neglect. Child neglect is defined as the failure of a caregiver to adequately provide safety, food, clothing, shelter, education, protection, medical/dental care, and supervision for a child in his/her care [1-4].

The Japanese Medico Legal Society definition of child abuse is not limited to physical or sexual abuse, but also includes situations in which medical intervention is delayed and neglect especially with respect to nutrition [2].

In fact, deliberate starvation of infant or child is a severe form of abuse, even though it is very uncommon and rare, especially in industrialized countries [5]. The resolution of an apparent death by starvation requires consideration of home and environment.

Nevertheless, underlying protein losing or malabsorbitive syndromes must be excluded along with other diseases that can result in emaciation, including cystic fibrosis, panhypopituitarism, panhypogammaglobulinemia, pyloric stenosis, glycogen storage diseases, global developmental delay/motor conditions, and many others [6-13].

In these cases, careful scene investigation, review of medical records, complete autopsy with skeletal survey, toxicology, chemical and metabolic testing is requested [2, 13].

## Case report

A male infant aged 4 months was found unresponsive at home and transported to a local hospital in Southern Italy, where he expired in

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Emergency Department. Physicians noticed child's cachectic state with signs of dehydration and malnutrition, so they alerted the police officers and a legal autopsy was requested.

A total body radiographic examination showed no fractures and no cranial calcifications.

The studies of the clothing (a sleepsuit) and bedding of the baby showed that they were urine-soaked and vomit-covered, but his bodily hygiene was quite good.

Livor mortis was slightly expressed in the posterior and declive regions of the corpse, while rigor mortis was absent. Food material leaked from the oral and nasal orifices. On external examination, were found to be slightly retarded.

The child weighed 4000 g for a length of 62 cm, for an expected weight of about 5800 g and length of 59 cm. According to De Toni's auxological method, the baby had the auxological measures of a 1/2 - month - old infant. This auxological method is based on biometric tables that show the average height and weight normal for both sexes, looking at what age matches the height and the weight [14]. There were signs of major dehydratation (Figure 1) such as sunken eyes and hypotonia, marked skin folds, and depressed anterior fontanella.

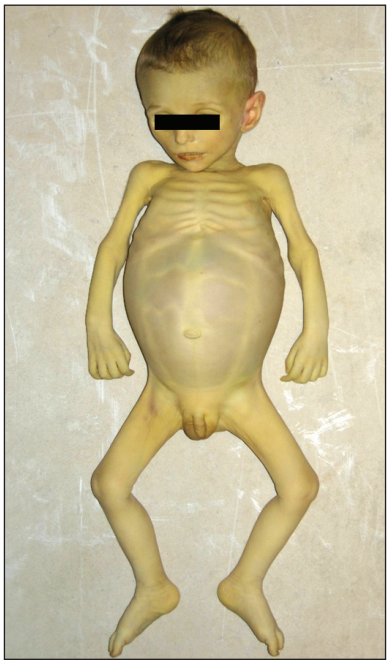

**Figure 1.** The body of the child with signs of dehydration and malnutrition.

The skin was inelastic, thin, and wrinkled, with jaundice. The baby had also focal alopecia, well-demarcated ribs and prominent bony planes. Small decubitus ulcers were present on the scapular and sacral regions. The muscles of the head, face, trunk, and lower and upper extremities were flaccid; serosal and mucous membranes were dry. The abdomen was globular.

At autopsy, there was no subcutaneous or omental fat, with a severe atrophy of skeletal muscles (Figure 2). When the cavities were opened, there was no serous effusion or internal malformation.

The brain was oedematous and congested; the heart was normal such as the timus. The lungs were congested and oedematous. The liver had increased volume and weigth (461 g), with superficial and deep parenchyma with a grainy aspect and numerous white and red spots that modified the normal hepatic lobular structure.

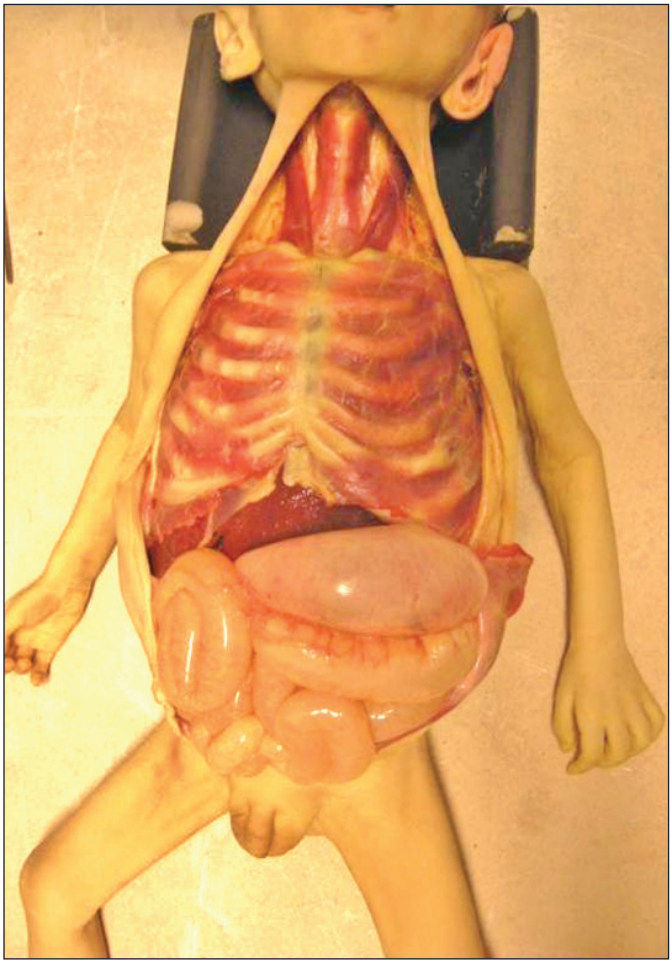

**Figure 2.** At autopsy, no subcutaneous or omental fat, severe atrophy of skeletal muscles, no serous effusion or internal malformation.

The spleen weighed 31 g and appeared congested; the kidneys presented an increased consistency with grainy aspect and focal red spots. Adrenals had a hemorragic aspect. Food material was found in esophagus and larynx but not in the trachea and deep air-ways. Stomach was full of analogous abundant brownish food debris.

The intestine was empty and swollen, with reddish discloroured mucosa. No skin, bone or internal lesions suggesting physical violence were observed.

Microscopic examination of hematoxylin and eosin stained sections of the liver, kidneys, adrenals and spleen showed an extensive infiltration by lymphoblasts. In many sections, particularly in the liver and the kidneys, the normal architecture of the organ was totally obliterated by the lymphoblastic infiltrate (Figure 3, Figure 4, Figure 5).

Section of bone marrow showed effacement by the lymphoblastic infiltrate. Immunocytochemical studies on hepatic and renal samples revealed that cells were positive for the enzyme terminal

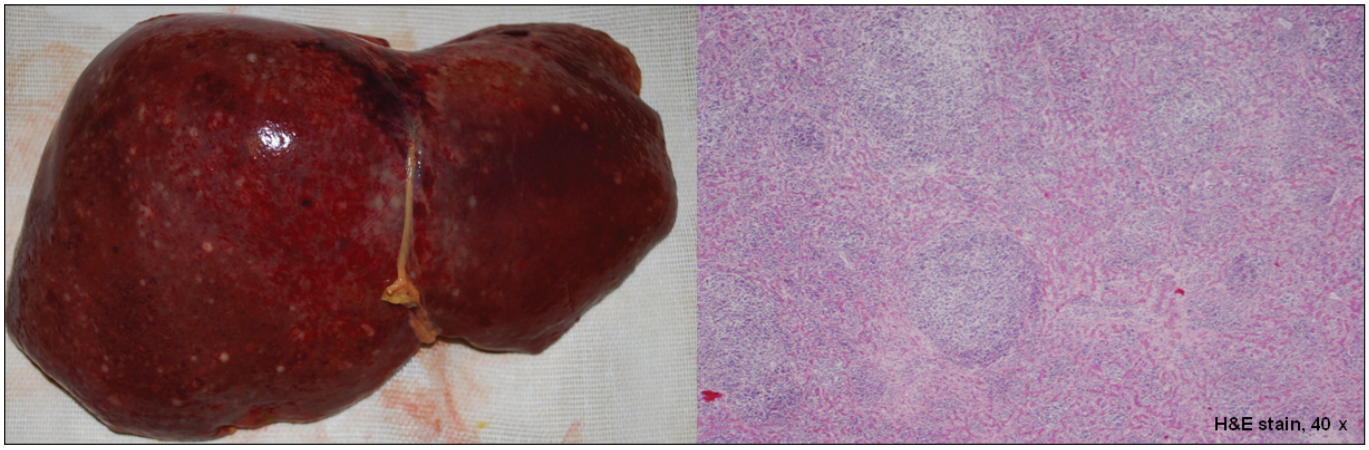


**Figure 3.** The liver: grainy aspect of the parenchyma with numerous white and red spots; at microscopic examination of hematoxylin and eosin (H&E) stained sections, normal architecture of the organ was totally obliterated by the lymphoblastic infiltrate.

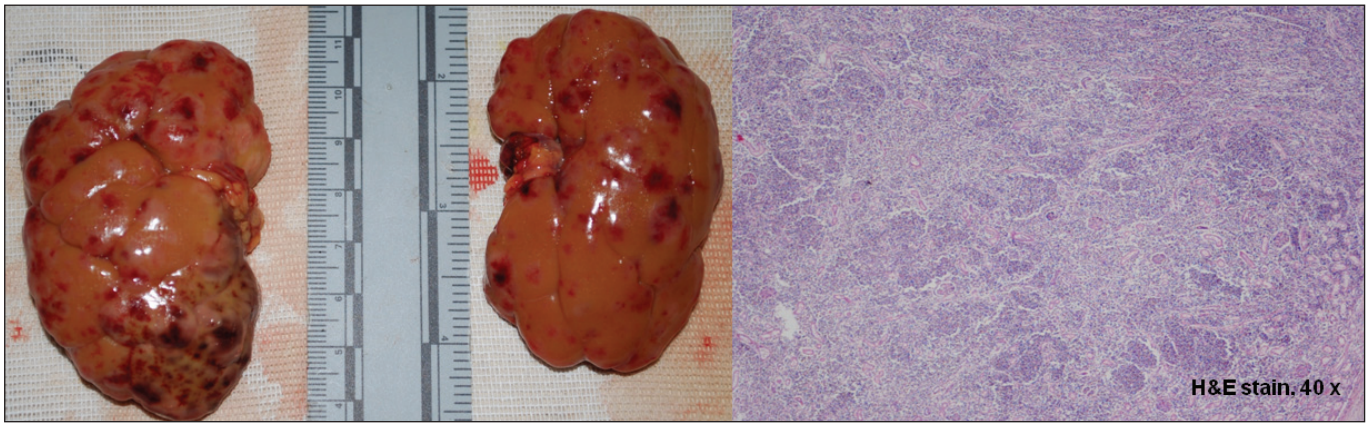


**Figure 4.** The kidneys: grainy aspect and focal red spots; microscopic examination of hematoxylin and eosin (H&E) stained sections showed an extensive infiltration by lymphoblasts.

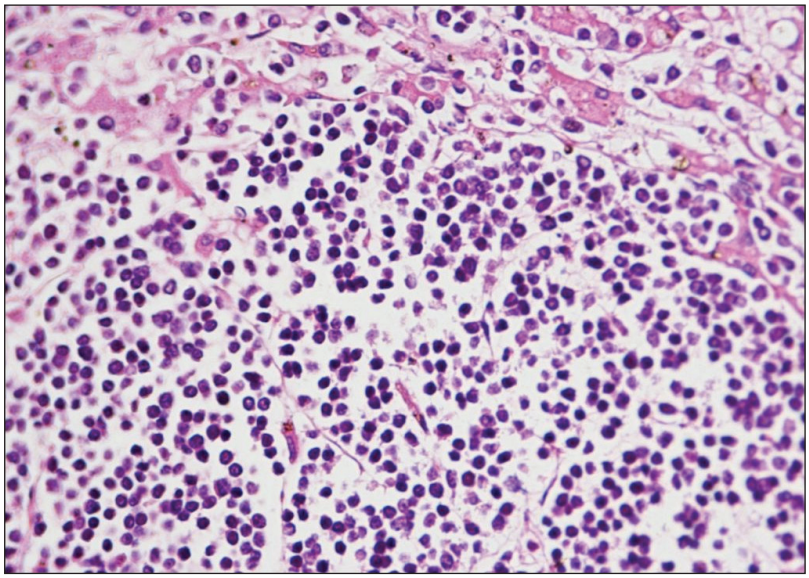

**Figure 5.** Microscopic examination (lower magnification) of hematoxylin and eosin (H&E) stained sections of liver.

deoxynucleotidyl transferase (TDT) (Figure 6) and negative for myeloperoxidase, and that they don't have B-cell markers (CD 10 negative and CD 20 negative). This staining pattern was diagnostic of a T-cell Acute Lymphoblastic Leukemia of childhood.

The stomach and bowel were not alterated. Microscopic examination of section of the lungs showed multiple foci of bronchopneumonia with evidence of aspiration. No toxic substances were present in blood and urine.

The cause of death was attributed to a cachexia related with a T cells Acute Lymphoblastic Leukemia.

**Background**

After the 38-week pregnancy, complicated by Toxoplasmosis, the baby's birth weight was 2940 g and length 49 cm, with an Apgar score of 8 followed by 9 at the age of 5 min. The results of a complete blood count showed a white blood cell count of 18.9 thousand/mm3 at birth, non-pathological value at birth.

After the birth, because of Toxoplasmosi, the physicians prescribed a strict follow up, but these controls were never executed by his 22-year-old mother, and the child was never treated by a pediatrician.

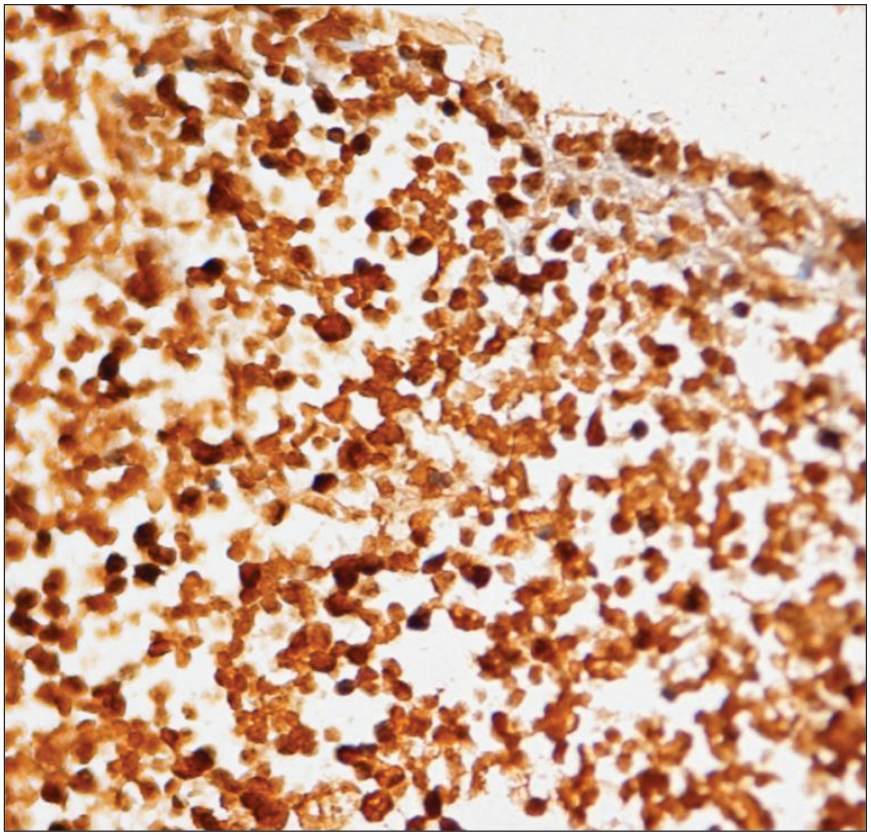

**Figure 6.** Immunocytochemical analysis on hepatic sample, revealing cells positive for the enzyme terminal deoxynucleotidyl transferase (TDT).

The family (of extremely low socioeconomic status) was occasionally followed by social care workers because the children, although in good health, did not attend school regularly and had no medical follow-up.

Anamnestic data, concerning the cares provided to the victim, revealed that the mother did not breastfed the baby and he was given infant formula and oatmeal for the first month, since his birth. At about the age of 2 months, semolina was added, given alternatively with meat and fruit homogenized. No abnormal event concerning her son's health was described by the mother.

Regarding the 2-week period before the death, the mother reported that the infant had had fever, vomiting, diarrhoea and that he appeared "skeletal" and jaundiced, but she was afraid to seek medical care because fearful of legal action against her.

She reported continuing to feed the infant with oatmeal and tea, even if the child continued to vomit. After baby's death, crime scene investigation showed the extremely poor living conditions of their house.

Finally, the mother was charged with homicide, because of deprivation of medical care contributing to the death of a minor.

**Discussion**

The initial detection of a case of a malnutrition due to lethal child neglect when the victim exhibits a clear wasted or starved appearance, must be confirmed by an interdisciplinary approach [4]. First of all, forensic pathologist has to perform a complete and impartial examination of the case, in the light of a careful judgmental interpretation of the liability of the family.

The exclusion of any mimickers of abuse or neglect are necessary, because preexisting illness has to be ruled out or in, using pathological, histological, and any available medical record data.

In this particular case, the Authors describe an undiagnosed and untreated T-cell Acute Lymphoblastic Leukemia (ALL) in a cachectic 4-month-old infant. These events are rarely seen today, even if a similar case has been previously described by McClain et al. in a 2-year-old female, in which a possible child abuse/neglect was suspected [15].

The ALL/Lymphoblastic Lymphoma is rare under 1 year. Infants with ALL comprise approximately 2% to 5% of all cases. Numerous studies of infants have reported that the youngest infants (ages 0 to 6 months) have the worst outcome.

In fact, despite the progressive improvement in Event-Free Survival (EFS) outcome achieved for the majority of children with ALL treated on increasingly intensive multiagent chemotherapy regimens, the outcome for patients less than 1 year of age remains decidedly low. ALL in infancy is frequently associated with presenting features such as fever, pallor, lymphadenopathy, hepatosplenomegaly, hyperleukocytosis, massive organomegaly, and CNS disease, as well as immunophenotypic coexpression of myeloid associated antigens and lack of expression of CD10 [16].

Compared with precursor B-cell ALL, T-cell malignancies are associated with unfavourable features. The use of more intensive treatment regimens has significantly improved the outcome in children with T-ALL [17].

At diagnosis of childhood ALL/LL, Anorexia-Cachexia Syndrome (ACS) may occur, presenting with anorexia, weight loss, wasting of muscle and adipose tissue, hyperlipidemia, and other metabolic abnormalities. ACS is a complex metabolic process

experienced by up to 80% of patients suffering from advanced stages of cancer.

Furthermore, cachexia is defined as an advanced starvation state resulting from decreased food intake and hormonal/metabolic abnormalities characteristic of the interaction between tumor and host. The literature documenting anorexia and cachexia in pediatric patients with cancer is quite limited. However, children appear to be at greater nutritional risk than adults because of high protein and energy requirements and limited caloric reserves [18-21].

In the case presented by the Authors, the baby had an advanced cancer with massive organomegaly and consequent cachexia syndrome.
Blood values at birth suggest that the child was not sick at birth.

The mother did not describe any abnormal event concerning her son's health in his brief life. In this case, the issue raised is if the mother would have altered the poor child's prognosis adversely, not affording optimum medical care, although in Italy monthly check-up visits for infants is obligatory. The Authors think that a medical check-up could have recognized the pathology, and an appropriate treatment would probably would have given the child a chance of survival, even if patients 6 months of age or older had significantly better outcomes, compared with those ages 3 to 5 months or less than 3 months [16]. In fact, numerous studies stated that because of the progressive improvement in EFS outcome achieved for these children treated on chemotherapy, the outcome is positive on average from 25 to 35% of cases [22, 23].

On the other hand, the malnutrition of the child occurred because food intake was of inadequate quality to meet the protein and energy needs of the organism [24], and probably worsened the anorexia-cachexia syndrome derived by ALL with a diarrhea-syndrome.

## Conclusion

Cases of suspected child neglect which ultimately are determined to result from natural diseases are extremely rare. In particular, medical causes of malnutrition include cancer, congenital lesions, as well as malabsorption and malassimilation syndrome. Diagnosis is based on appropriate clinical, anthropometric, radiological, anatomopathological, and biological findings, together with a full investigation of the scene and case history, past medical history, and social and family history.

In the case presented, an early recognition with appropriate treatment of ALL would probably give the child a chance of survival. Is it due to be considered natural death or lethal neglect?

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