

Child Abuse from the Clinical Forensic Aspect

Dehling, Kim Laura

Master's thesis / Diplomski rad

2023

Degree Grantor / Ustanova koja je dodijelila akademski / stručni stupanj: **University of Rijeka, Faculty of Medicine / Sveučilište u Rijeci, Medicinski fakultet**

Permanent link / Trajna poveznica: <https://um.nsk.hr/um:nbn:hr:184:312690>

Rights / Prava: [In copyright](#)/[Zaštićeno autorskim pravom.](#)

Download date / Datum preuzimanja: **2024-10-10**



Repository / Repozitorij:

[Repository of the University of Rijeka, Faculty of Medicine - FMRI Repository](#)



UNIVERSITY OF RIJEKA

FACULTY OF MEDICINE

**INTEGRATED UNDERGRADUATE AND GRADUATE UNIVERSITY STUDY OF
MEDICINE IN ENGLISH**

Kim Laura Dehling

CHILD ABUSE FROM THE CLINICAL FORENSIC ASPECT

GRADUATION THESIS

Rijeka, 2023

UNIVERSITY OF RIJEKA

FACULTY OF MEDICINE

**INTEGRATED UNDERGRADUATE AND GRADUATE UNIVERSITY STUDY OF
MEDICINE IN ENGLISH**

Kim Laura Dehling

CHILD ABUSE FROM THE CLINICAL FORENSIC ASPECT

GRADUATION THESIS

Rijeka, 2023

Thesis mentor: Prof. dr. sc. Dražen Cuculić, MD, PhD

Co-mentor: Marina Bralić, MD, PhD

The graduation thesis was graded on _____ in _____, before the Committee composed of the following members:

1. Associate Professor Kovičjka Matušan Ilijaš, MD, PhD (Committee Head)
2. Associate Professor Dora Fučkar Čupić, MD, PhD
3. Full Professor Dražen Kovač, MD, PhD

The graduation thesis contains 42 pages, 0 figures, 2 tables, 31 references.

Acknowledgement

I would like to thank my mentor, Professor Dražen Cuculić, for his help in this work and the interesting lectures in forensic medicine, my co-mentor Marina Bralić for helping me as well, along with my family and friends to always stay by my side.

TABLE OF CONTENTS

1. INTRODUCTION	1
2. AIMS AND OBJECTIVES	2
3. TYPES OF PHYSICAL CHILD ABUSE	3
3.1 NON-ACCIDENTAL BRAIN INJURY (NABI).....	3
3.2 BATTERED CHILD SYNDROME.....	7
3.2.1 TYPES OF INJURIES IN A BATTERED CHILD	8
3.2.1.1 ABDOMINAL AND THORACIC INJURIES.....	9
3.2.1.2 CUTANEOUS MANIFESTATIONS	10
3.2.1.2.1 SKIN LESIONS	10
3.2.1.2.2 BURNS.....	11
3.2.1.2.3 BITE WOUNDS.....	13
3.2.1.3 SKELETAL MANIFESTATIONS OF CHILD ABUSE	14
3.3 FACTITIOUS DISORDER IMPOSED ON ANOTHER (FDIA, MUNCHAUSEN SYNDROME BY PROXY)	15
3.4 DIAGNOSTIC METHODS	16
3.5 SUDDEN INFANT DEATH SYNDROME	17
3.6 MURDER OF A CHILD.....	18
3.6.1 NEONATICIDE	19
3.6.2 INFANTICIDE.....	20
4. SEXUAL ABUSE OF CHILDREN AND MINORS.....	21
4.1 MEDICAL INDICATORS OF CHILD SEXUAL ABUSE	22
4.1.1 FINDINGS ON EXTERNAL SEXUAL ORGANS	23
4.1.2 ANAL FINDINGS	24

4.2	SEXUAL INDICATORS OF CHILD SEXUAL ABUSE.....	24
4.2.1	SEXUALLY TRANSMITTED DISEASES AS A CONSEQUENCE OF ABUSE.....	24
4.3	APPROACHING THE SEXUALLY ABUSED CHILD	25
5.	CHILD NEGLECT	28
5.1	PHYSICAL NEGLECT	28
5.1.1	MEDICAL NEGLECT.....	29
5.1.2	DENTAL NEGLECT.....	30
5.2	PSYCHOLOGICAL NEGLECT.....	31
6.	PSYCHOLOGICAL MALTREATMENT	33
7.	REPORTING CHILD ABUSE.....	35
8.	DISCUSSION	36
9.	CONCLUSION.....	36
10.	SUMMARY.....	38
11.	CITED LITERATURE	39
12.	CURRICULUM VITAE.....	42

List of abbreviations and acronyms

ALTE – Apparent life-threatening event

ALT – Alanine aminotransferase

AST – Aspartate aminotransferase

aPTT – Partial thromboplastin time

cCT – Cerebral computed tomography

cMRI – Cerebral magnetic resonance imaging

COPD – Chronic obstructive pulmonary disease

CPR – Cardiopulmonary resuscitation

CSA – Child sexual abuse

CT – Computed tomography

ECC – Early childhood caries

FDIA – Factitious disorder imposed on another

GA1 – Glutaric aciduria type 1

HIV – Human immunodeficiency virus

HSV-2 – Herpes simplex virus type 2

IgE – Immunoglobulin E

INR – International normalized ratio

ISAP – International Standardized Autopsy Protocol

MRI – Magnetic resonance imaging

NABI – Non-accidental brain injury

NAI – Non-accidental injury

SBS – Shaken baby syndrome

SIDS – Sudden infant death syndrome

TORCH – Toxoplasmosis, Other infections, Rubella virus, Cytomegalovirus, Herpes Simplex virus

1. INTRODUCTION

Child maltreatment comprises the conscious or unconscious action of harming a child and is an unfortunate facet of pediatrics and clinical forensic medicine. It includes the action of physically, psychologically, and sexually abusing a child, as well as neglect. Neglect encompasses the active or inactive overlooking of the needs of the child and may happen in the medical, dental, educational, mental, or physical field. Additionally, parents, family members or caregivers may fail to adequately supervise their child and may expose them to dangerous environments, such as domestic violence, cigarette smoke or a criminal activity. (1–3)

The Center for Disease Control and Prevention in the US estimated in 2012 the number of 3.4 million children being referred due to abuse or neglect, whereas the latter is with 78% the most common type of maltreatment, followed by physical abuse (18%) and sexual abuse (9%). Eleven percent of victims experienced some other kind of maltreatment, including emotional abuse and acts of omission like failure to supervise. (4) This data is mostly in correlation with the statistics of the National Institute of Child Abuse and Neglect from 1998, whereas they recorded that 53.5% of maltreated children were suffering from neglect and 22.7% were victims of physical abuse. (1) While in 1998 there was a fatality rate of 1.6 per 100,000 children recorded, in 2012 the rate of children dying due to maltreatment was 2.2 per 100,000 children. (1, 4) These statistics show that child maltreatment is still an ongoing problem and likely to be underreported. The German forensic pathologist Michael Tsokos therefore claimed that if there would be a candle burning for each murdered child, all cemeteries in Germany would be brightly lit. (5) The estimated number of unreported cases could be high due to an inadequate documentation through police and child protection services as well as a statistical gap within the medical field. There is a low documentation of the ICD-10 code T74.X and therefore physical injuries due to abuse aren't reflected realistically. (3)

Victims are mostly children up to 3 years of age (27% in 2012), with infants experiencing the most abuse (21.9 per 1,000 children). The rate of children being maltreated is then decreasing with age, with girls being more prone to experiencing abuse compared to boys in all ages. (4) Most commonly the perpetrators are primary caregivers like social, biological, adoptive or stepparents, but siblings or grandparents may also be involved in committing child

maltreatment. Fewer than 2% of perpetrators were substitute caregivers like teachers, babysitters or facility staff. (4, 3, 1)

Females are more common to maltreating children (54%), however in severe maltreatment cases, harm with or without a fatal outcome is more commonly executed by males. (4)

Furthermore, perpetrators of sexual abuse are mostly men, however it should not be underestimated that women are also able to sexually abuse their children. In cases of neglect there is usually no gender preference noted. (1, 6)

Risk factors for perpetrators include mental illness of one parent, substance abuse, domestic violence, low education or socioeconomic status and a personal history of the caretaker of abuse during childhood. It is important to note however, that most families with those risk factors are not maltreating their children and that child abuse is also common in households where there are none of these risk factors. Moreover, there should be a high degree of suspicion even though the physician can identify themselves with the caretaker. Families of a higher socioeconomic status, preferably white and with no mentioned risk factors could therefore be easily overlooked. (1, 3) Children have a higher risk of assault when they are prematurely born, chronically ill or have some kind of disability and therefore require more care. The risk is also increased by 50% if the child has experienced some kind of abuse before, as well as the transgenerational continuation of violence mentioned previously. (3)

Pediatricians and emergency doctors should at all times be aware of child maltreatment happening and should keep an open mind on alternate explanations. Suggestive clues of child abuse include a developmental delay of the child including speech, not seeking treatment on time, the explanation doesn't match the injuries or is constantly changing, injuries in different stages of healing, the caretaker reacts aggressively or impassively, and a frozen watchfulness from the child. (1, 7)

2. AIMS AND OBJECTIVES

This graduation thesis aims to provide a comprehensive overview about different types of child abuse, including its clinical presentation, differential diagnoses, and the consequences for the child. Furthermore, it highlights the importance of an early detection and intervention by the physician, as child abuse can have devastating long-term effects physically, psychologically, and emotionally on the child, leading up to death in the worst case. The

ultimate goal of this summary paper is to promote further dialogue and eliminate any doubts a physician can have when being presented with a suspicious case. In addition, this thesis aims to sensitize any doctor and health care worker about the prevalence of child abuse, in order to think about child abuse as a differential diagnosis in the first place.

3. TYPES OF PHYSICAL CHILD ABUSE

Physical child abuse comprises non-accidental injuries (NAI) that may be temporary or permanent. The presentation may range from mild injuries like bruises or scratches to serious injuries with a possible fatal outcome. (8) Physical abuse may happen acutely in stressful situations when one parent is overwhelmed, angered, jealous or there are private problems. However, it is most often a recurring phenomenon that happens over a greater timespan and most often leaves physical, but also mental traces. (7) There should be a clear distinction between injuries that happen accidentally and injuries that are non-accidental. Therefore, a thorough anamnesis and physical examination should be done at all times. A suspicious anamnesis includes seeking out of a pediatrician or emergency doctor at the latest possible time, a frequent change of physicians and other doctors, inadequate injuries that are not in concordance to the developmental age of the child (i.e., a baby that is not able to even crawl having bruises) and explanations of injuries that don't fit the pattern of injuries or are frequently changing. While weird accidents do happen from time to time, the way the injury presents itself can be very helpful to establish a diagnosis. It may only become difficult when there is a presentation of innocent lesions that are mimicking abuse like congenital dermal melanocytosis, a condition previously known as Mongolian blue spots, which is rather common in the Asian population. An extensive knowledge about differential diagnoses should therefore also be kept in mind. (3, 8)

3.1 NON-ACCIDENTAL BRAIN INJURY (NABI)

Non-accidental brain injury (NABI) constitutes the most common cause of death due to physical abuse in children. A child suffering from non-accidental brain injury may both display intracranial injuries as well as any bodily injuries of the skull. (3, 8)

Victims of non-accidental brain injury are mostly infants ranging from the age of two to six months and display a higher risk of victimization if their parents are typically young, have a

high load of stress, frustration, if they are not sleeping enough and display a lack of social support. Most often the perpetrators are male parents (80%) and infants are more at risk if they are born prematurely and have an increased duration and frequency of crying. (3) The crying child will then be held by the arms or torso and will be forcefully shaken from front to back. Injury resulting from this forceful action is known as Shaken Baby Syndrome (SBS). If the primary caretaker is additionally throwing or swinging the child against a hard surface or edge, the injury was previously known as Shaken Impact Syndrome. (3, 8) For a fatal outcome, however, it is not important for the child to experience any kind of impact. The injury of the baby's brain due strong acceleration and deceleration forces are enough in SBS to kill a child. It is noteworthy, that the baby must be shaken so violently, that even outsiders would interpret it as dangerous. Infants with an average age of five months are not able to hold their head independently, due to insufficiently developed neck muscles, as it is relatively heavy in relation to the body. Furthermore, their brain is relatively free to move within the skull, which ultimately leads to tearing of the non-stretchable cortical bridging veins. The bridging veins are located between the brain and dura mater and a tearing usually results in subdural hemorrhage. This hemorrhage often measures only ten to 15 milliliters and might therefore not be visible on CT. (1, 3, 7) On top of that, forcefully shaken infants may exhibit subarachnoid and retinal hemorrhages, the latter being able to result in visual impairment that will permanently affect the child. Unlike in traumatic events, due to the sagittal shearing movements, SBS might also cause tearing of the bridging veins in the area of the falx cerebri and will show interhemispheric bleeding as well. Severe consequences for the child might be caused by diffuse axonal injury and the resulting brain edema, as the child's brain is still incompletely myelinated, and axons can be torn. Cytotoxic-inflammatory changes to the brain tissue can even aggravate the brain edema. (1, 3)

Additional injuries include retinal injuries, where a pronounced retinal bleeding may be seen. A severe consequence of SBS can be retinoschisis, where a separation of the retina in at least two separate layers occurs, up to retinal detachment and vitreous hemorrhage, which ultimately leads to blindness and therefore poses a permanent injury.

In most cases, NABI doesn't show any outwardly injuries and needs a precise physical examination from the forensic pathologist or pediatrician. Even though rare, injuries that can additionally accompany non-accidental brain injury may be injuries of the head like skull fractures or cephalic hematomas, as well as extracranial injuries like rib fractures, metaphyseal fractures, and fractures of the humerus from holding the child forcefully at the

upper arms, which often show hematomas in the form of the fingers gripping the child. Hematomas on the thorax are also possible. (3)

Table 1: Symptoms of Non-Accidental Brain Injury

Acute symptoms	Long-term consequences
<ul style="list-style-type: none"> - Vomiting - Poor appetite - Problems with feeding - Inability to regulate body temperature - Lethargy - Poor tone - Depressed reflexes - Irregular breathing up to apnea - Seizures - Exitus lethalis (25% of infants) 	<ul style="list-style-type: none"> - Cerebral palsy - Epilepsy - Hearing and visual disturbances - Microcephaly - Developmental disorders: speech development, psychomotor developmental delay, behavioral abnormalities, memory and attention difficulties, difficulty in school/learning disorders

Non-accidental brain injury is suspected in cases of seizures, impaired consciousness, bulging fontanelles due to an increased intracranial pressure and temporary respiratory arrest due to lesions within the brain stem. After suffering from NABI, 25% of children die within a few days to one week, whereas the remaining 75% of cases result in permanent damage such as intellectual or physical disability, cerebral palsy, impaired vision up to blindness and epilepsy. The severity of injuries is generally greater in younger children. Caretakers may excuse the inflicted harm by claiming that they attempted to calm the child, did bouncing games, helped the child when it was coughing, tried to calm it down or tried to rescue it during respiratory arrest.

Suspected abuse in children always needs a very careful medical history, including the exact time of onset of symptoms, how the child was behaving before symptom onset, if any other pre-existing conditions and disabilities were present, if the child showed problems with feeding or displayed poor appetite and if it's screaming a lot, as it poses a large risk factor.

In order to protect themselves, parents entering the doctor's office often state that the child fell from the changing table or bed, it was dropped clumsily or pushed down by older siblings.

As injuries can look similar, it is often difficult to distinguish between a malicious intent or a true accident, and the exact sequence of events is difficult to reconstruct. However, it is important for parents and caregivers to provide a safe environment and to always be vigilant, as an ignorance of such may falls into the category of acts of omission. (7)

For non-accidental brain injury, a cerebral MRI including the spinal canal may be method of choice, as it is more sensitive than a cerebral CT, while a CT should be recommended in emergencies. The cMRI typically shows supratentorial and bilateral subdural hematoma, signs of intracerebral parenchymal injury, and cerebral edema. Within the visualization of the entire spine, there may be small lesions along the bone and within the ligaments, as well as subdural hematomas. As the child poses with rather unspecific symptoms like vomiting, poor feeding and lethargy - symptoms that may also be present in a septic infant or due to dehydration in severe gastroenteritis - only further underline the importance of a good anamnesis. Thus, a cMRI should be performed in seriously ill infants where the etiology is still unclear.

Furthermore, to not miss any retinal bleeding, a fundoscopy needs to be done and an X-Ray skeletal screening is useful for the detection of multiple fractures, including old ones.

Unless the child suffered from severe trauma like in the case of a car accident or if it fell from a great height, non-accidental brain injury will often be a clear diagnosis if the anamnesis and diagnostics were done correctly and thoroughly. In children where physical abuse is a confirmed diagnosis, no further diagnostics need to be done for differential diagnoses. There are some diseases that may mimic non-accidental brain injury at the beginning, with specific lab tests however, they can be quickly ruled out. (3)

An inherited, autosomal recessive disorder, that may mimic NABI, is glutaric aciduria type 1, where the child is deficient for glutaryl-CoA dehydrogenase. Cerebral imaging often shows widened subarachnoidal spaces, as the disease often presents with macrencephalic macrocephaly. The non-stretchable cortical veins can then be even after minimal trauma easily torn and cause subdural hematoma suspicious of abusive head trauma. However, the amino acids, which the body is unable to break down, often accumulate in the basal ganglia and can point to GA1. In addition to its specific laboratory testing and work-up, the disease is tested for at birth in many countries, hence quickly ruling out child abuse. (9)

Other differential diagnoses include arteriovenous malformations with the presence of spontaneous intracerebral hemorrhage, various coagulation disorders and Menkes disease, a very rare disease in newborns, which often presents with diffuse bleeding, fractures due to

osteoporosis and degeneration of the brain. Menkes disease is an X-linked recessive disease and most commonly affects boys with the body being unable to metabolize copper correctly. (3, 10)

In cases of non-accidental brain injury, child protective services and if necessarily, the police, must be always informed, as the risk of recurrence for affected infants and other siblings is very high. A suspicion of the baby being violently shaken must therefore always be investigated. As there is a clear correlation between increased phases of the baby crying and the parent violently shaking the child, risk factors like a high mental load and stress of the parents should be minimized and the caregiver should be well educated. Prevention of non-accidental brain injury includes education of the caregivers about the physiological function of crying and that the child crying doesn't mean that the infant is rejecting the parents. Additionally, they should be taught about the dangers of shaking the child, like a very high mortality rate of 25% and rate of 40% of children suffering from permanent disabilities such as developmental disorders, intellectual disabilities, visual deficits up to blindness and sustained epilepsy. The caregiver should also be educated that in the case of a crying baby, they should first rule out obvious reasons like hunger, a full diaper, any kind of pain, the infant being too cold or too warm. They are safe to use pacifiers and should first try to calm the child by speaking to it in a quiet voice or by going for a walk. If the child is still crying tirelessly, strategies to relieve the caregiver's stress include asking for support or another caregiver to look after the child, placing the infant safely in its bed and leaving the room to soothe oneself, as well as seeking out a pediatrician for help. (3, 11)

3.2 BATTERED CHILD SYNDROME

Battered child syndrome encompasses the child having different injuries in different stages of healing that result from physical abuse over a longer period of time. The child can also present older fractures in different stages of healing on X-ray.

Additional to the suspicious anamnesis and clinical presentation, the child may present with a fixed, motionless gaze and observes the environment without any emotional involvement. This phenomenon of "frozen watchfulness" is due to the child interpreting the environment as potentially dangerous and reacts by silence, withdrawal, aggression and can show a severe delay in developing language, as well as experiencing psychosomatic disorders. (3, 7)

3.2.1 TYPES OF INJURIES IN A BATTERED CHILD

Children with battered child syndrome can have a broad range of injuries such as soft tissue injuries, any cutaneous manifestations like burns, hematomas, bite marks and abdominal as well as thoracic injuries. While internal injuries are not as frequent, they are the second most common cause of death in abused children, right after non-accidental brain injuries. (3) Soft tissue injuries are most often caused by blunt forces, hitting the child with the flat hand or fist, kicking the abused child, or hitting it with objects and pulling or twisting of body parts like the arms or legs. The child can then show skin abrasions, bruises, lacerations and dislocations. Hematomas and lesions of uniform age in a typical location should not arouse any suspicion, unlike multiple injuries, bruises in different stages of healing and new fractures accompanying healed fractures. Grouped injuries, meaning more than three injuries at the same time on the same bodily part, should immediately alert the physician.

When children are falling down, the injuries often present on exposed places like the chin, forehead, nose, knee, shin, ankle, elbow, palm of the hand or back of the head. This principle also applies to falls on the head. Distinctive for abuse is the upper arm and thigh, the inner side of extremities, the buttocks and the back and the extensor side of the forearm, as it typically presents a defensive wound when the child is automatically raising its arm to protect itself. In the case of using an object to hit the child, the object can sometimes be identified by the type of imprint it leaves on the child. The intracutaneous bleeding will then present as a double-streaked contusion with a central paleness. This way a hand-slap mark can also imprint on the body or face of the child. Additional injuries on the head of the child include any swelling above the hat brim line and pulled-out clumps of hair. Monocular periorbital hematomas and racoon eyes are extremely rare in children and pose a direct consequence of a forceful blow on the eye of the child, whereas the only other way of etiology would be a skull base fracture. Abrasions will most possibly be noted and in severe cases the direct hit on the orbit will result in a blow-out fracture.

Otoscopy also poses an important tool in discovering child abuse, as blunt blows on the ears can result in bleeding of the tympanic membranes up to perforation. Direct hits to the mouth can lead to any types of injuries of the mucosa, loosening or the loss of teeth and a torn lingual frenulum. (1, 7)

3.2.1.1 ABDOMINAL AND THORACIC INURIES

Abdominal and thoracic injuries are the second most common cause of death in abused children after brain hemorrhage. When a child presents with visible bruises that are able to be produced by falling onto objects, they should always be questionable for punches or kicks. Possible injuries include liver or spleen lacerations, and injuries of the gastrointestinal tract including the pancreas. Due to the positioning of the pancreas, it is only damaged due to accidents like a bike or car accident and if damaged, inflicted trauma should be included in the differential diagnosis. Traumatic injuries of the lungs including hemothorax are relatively seldom, even though rib fractures can pose as an accompanying symptom. (1, 7) When blunt force is applied, the child doesn't necessarily manifest external signs of injury, there might be only mild signs like a bloated abdomen or vomiting. Peritonitis and sepsis linked to abdominal injuries can manifest already within a few hours, while hematomas and a following intestinal obstruction might take a few days to detect. In younger children, the diagnosis may only rely on the suspicion of the physician, while older children may be able to reconstruct the event that caused the injury. Imposed abdominal trauma may result in multiple injuries in 18% to 37% of affected children. (1)

Internal injuries in children can only occur with severe violence, therefore the pathophysiology of the injury is crucial. In accidental trauma the anamnesis of the child always includes big forces like falls from a great height, traffic accidents and being kicked by a horse for example. Typical organs affected by accidental injuries are parenchymal organs like the kidneys and spleen, whereas non-accidental injuries affect hollow organs and the liver equally. While the liver can sometimes also be injured accidentally, in child abuse there will often be injuries of the left liver lobe with missing abdominal hematomas. (7) When there is damage to the liver, the child may show tenderness upon palpation, pain and elevated liver enzymes like AST and ALT. (1)

An intramural duodenal hematoma without any suitable medical history is strongly suspected of abuse, as the physically abused child needs to endure forceful punches and kicks in order to have such strong intra-abdominal pressure fluctuations to cause damage to the duodenum, as it is a fixed structure within the anterior epigastrium. When strong acceleration-deceleration forces are applied, like throwing the child, there may be even a rupture of the mesenteric root, posing an urgent medical emergency, as parents often present to the emergency department rather late, with the child already suffering from severe peritonitis. (1, 7)

Children under the age of four years with suspicious internal injuries should get an abdominal ultrasound, a skeletal survey to rule out older injuries, either an abdominal MRI or CT, extensive laboratory work and if suspected of abusive head trauma, further imaging like a cMRI or cCT. (3)

3.2.1.2 CUTANEOUS MANIFESTATIONS

3.2.1.2.1 SKIN LESIONS

Cutaneous manifestations of physical abuse include hematomas and abrasions of the skin, signs of sharp violence like in gunshot or stab wounds, bite marks and thermal injuries. As children want to explore their surroundings and usually are very active, hematomas are quite common. That is why it is important to differentiate the type, localization, and the underlying mechanism precisely. In children that are not able to walk yet, any type of hematoma must always arouse high suspicion. If the child is able to walk or run, there are certain places that are more exposed to the environment and therefore more prone to be hit accidentally. Such localizations include the back of the head, forehead, nose and chin. Exposed parts of the extremities include the lateral part of the hip, the knees, shin, elbow, palmar part of the hand and dorsal part of the lower arm. Injuries of the dorsal part of the lower arm are quite common when a child accidentally falls or hits something, but this site must always be precisely examined in the way that a child may raise its arm in defense to the assailant.

Depending on the depth of the vascular injuries, a hematoma can become visible immediately until days after the forceful impact, as regions with loose tissue, like the area around the eye, need less time to show a bruise than areas with dense tissue. Therefore, it is not possible to make a reliable statement about the time of origin on the basis of the color gradient in hematomas. It is only reliable that a yellowish bruise must be older than 18 up to 24 hours after trauma, as it progresses from red or purple to blue and then to a greenish or yellow color. In physical abuse, the skin is affected up to 90 percent of time, however as mentioned previously, cutaneous signs of physical abuse don't necessarily manifest in abdominal and thoracic injuries.

Hematomas suspicious for abuse are often found on other parts of the body like the eyes, ears, cheek, any parts of the oral cavity and oral mucosa, neck, genitalia, the dorsal part of the hand, the inside of the arms, the posterior part of the lower extremity including the buttocks and calves, as well as the back and the ventral sides of the abdomen and thorax. Clustered

hematomas in different stages of healing, hematomas with clear shape by imprinting of an object, a combination with fractures, burns, NABI and in the premobile infant must always be suspicious for physical abuse. In the case of the caregiver choking or strangulating the child, it can have redness, swelling and local abrasions on the neck. It is less common for the child to have circular strangulation marks on the neck, but petechial hemorrhages of the face and conjunctiva can be present. (1, 3)

In infants and toddlers that are mobile, a mnemonic can be used to help in raise concerns regarding child abuse. The tool for clinical decision in bruises is called “TEN-4-FACESp”. It is an acronym that stands for “Torso, Ears, Neck, four months or younger, Frenulum, Angle of Jaw, Cheeks, Eyelids, Subconjunctivae and patterned bruises”. If any of these anatomic regions or other variables like age and the bruises being multiple apply, physical abuse of the child is very likely. (12)

The implemented diagnostics performed in a child with skin lesions are similar to the previously mentioned diagnostic procedures, including again a throughout anamnesis, a complete physical examination for further skin injuries and if necessary, a skeletal survey. In children younger than six months, a fundoscopy and cMRI should also be performed. It is only necessary for children above the age of six months if the skeletal survey shows additional fractures. As this kind of physical abuse often leaves visible marks, it is very important to perform a photo documentation in the case of child abuse. In order to avoid wrong accusations of the caregiver in the case of any bleeding diathesis, the laboratory diagnostics should always include a complete blood count, INR, fibrinogen and aPTT. In the case of abnormalities, Factor VIII, IX and XI should be tested for in male patients to rule out X-linked recessive hemophilia, as well as diagnostic testing for Von Willebrand disease should be run. A very rare bleeding disorder might be Factor XIII deficiency, so it should also be included in the laboratory panel for bleeding disorders. (13)

3.2.1.2.2 BURNS

Willful scalding or burns happen on the hands, feet, the genital or buttock area and are due to dousing or immersing the child in hot water, placing it on a hot object, extinguishing a cigarette on any body part and burning the mouth of the child through feeding it hot food. (7)

Approximately 50% of all thermal injuries in Europe affect children, whereas up to ten percent of thermal injuries are non-incident and constitute an important part of physical abuse. (3, 14)

There are several skin diseases with a similar presentation that need to be excluded first. Such skin diseases include Lyell's syndrome, where there is a blistering detachment of the epidermis, bullous dermatosis, allergies, and impetigo. However, the presentation of the burn marks and the affected part of the body will be different.

Accidental burns typically show no sharp boundaries, they are irregular and asymmetrical in its presentation and may show runoff marks, for example when a child is accidentally dousing itself in hot water by pulling a hot pot from the stove. Here the scalds will be present on the front and possibly also on the palms, and a presentation of the back of the hand would be more unlikely.

Deliberate burns often show clear boundaries, for example by placing a sitting child into a hot tub. Here a clear water level mark will be found on the buttocks, back or distal extremities. When the child is being forced by placing its feet or hand into hot water, clear stocking or glove-shaped burns will also be present. It is possible that the edged may be irregular shaped and some scalds in the form of splashes are possible depending on the movement of the water and the resistance to injury of the child. Furthermore, the depth of the affected body parts usually presents in an equal manner and as the child is trying to protect itself, it is quite common for it to completely flex its extremities. Therefore, the flexion side of the extremities and skin folds will often be spared. Moreover, if a child is immersed forcefully into water, the caretaker often presses the child so forcefully against the floor of the bathtub, that the buttocks will be spared due to the cooler surface of the tub. The central sparing is then known as "Doughnut sign". (7, 15)

Within the pediatric population, the three most common types of thermal injuries are scalds, contact and flame burns, with scalds being the most presented within the emergency department in Europe (35% to 80%). Contact burns are the second most common thermal injuries in children with a frequency of 13% to 47% independently if the injury was accidental or intentional. (14)

Intentional contact burns often show distinctive features of the causative agent like the triangular imprint of an iron or a rod-shaped imprint of a hair straightener or domestic heater. Cigarette burns show also clear demarcated edges and follow a distinctive pattern, likewise

they are most often multiple and present on the hand including the fingers, or the trunk of the child. Cigarette embers are usually up to 450 degrees Celsius hot and show a diameter of about 1cm after a few seconds. The lesion will be round, with a pale center and hyperemic margin. Later in the presentation there might be burn blisters and necrosis, and healing shows a rounded lesion with increased pigmentation and a scarred center. Any person would never be so long in contact with a cigarette to have this kind of presentation, so clear features are always indicators of physical abuse. (7, 15)

In conclusion, symmetrical scalds or burns of any kind, as well as sparing of skin folds, clear demarcation lines and an equal depth of injury always substantiate suspicions of intentional abuse. In unintentional scalds, the depth of the injury will be the greatest where the hot liquid has been in contact with first and will decrease with the liquid running down the affected body part. Children accidentally touching hot objects, will instinctively withdraw their body part that has come into contact with the item, limiting the depth and extent of the injury, whereas the palms are often affected, with the joints of the hands spared. It is also unlikely for children to have burns on the sole of the feet, as they would immediately trash or remove their feet from the hot surface or water in the case of immersion. (15)

Additional to the physical examination and throughout documentation of injury, it is also important to assess the child's motor and cognitive development, in order to be able to estimate if the described accident of the child was possible to happen. Non-accidental thermal violence is a severe form of physical abuse and further abuse is always likely. A good anamnesis and forensic documentation are important, as even in the case of accidental injury, it is common that the caretakers were not supervising their children correctly or neglecting it. (3, 15)

3.2.1.2.3 BITE WOUNDS

A special form of hematomas are bite wounds, which show clear imprints of the teeth of the perpetrator and can be accompanied by breaches of the skin barrier. Bite wounds can be inflicted due to other people like the caregiver or siblings and due to the child with the bite mark itself. It is therefore important to note the localization of the bite mark and to reconstruct if it is possible for the child to have bitten itself there. In adults, the distance between the incisors usually amounts to a distance bigger than 2.5 cm, whereas bite marks inflicted by children measure a distance of less than 2.5 cm. The imprint of teeth generally won't be of the

same depth in all places and the bite mark can include the upper and the lower arch of the jaw. Moreover, due to suctional forces, petechial hemorrhages will often be noted in the center of the mark.

A photo documentation using a scale is obligatory, as it can give information about the set of teeth. Following photo documentation, the distance between the incisors of the bite mark is then measured and in order to have correct results, the photo documentation can be repeated after 24 hours if severe swelling is present. (1, 7)

Due to the contamination of the bite wound with saliva, a swab checking for ABO blood group antigens may also result in reliable evidence. (1)

3.2.1.3 SKELETAL MANIFESTATIONS OF CHILD ABUSE

Fractures in children are a common symptom of child abuse, the prevalence ranging from 11% to 55%, and indicate severe abuse, as a considerable force is required for the child to sustain a fracture. Any type of fracture can be caused by abuse due to the difference in size between the adults and the child, and a following unequal distribution of force. Fractures of the long bones in all age groups show the highest prevalence of 76%, followed by skull and rib fractures (8% each). The younger the child is, the more skepticism a bony lesion must arise, as an infant that is not mobile, is unlikely to sustain a fracture accidentally. A statement that is often expressed by the caregiver as an excuse in small children is the fact, that the arm of the child got stuck in between the bars of its cot or that a sibling inflicted the fracture. Rib fractures constitute the most common type of bony lesions in infants with a prevalence of 35% to 60% and account a prevalence of 5% to 27% of inflicted fractures in the pediatric population. (3, 16)

Fractures of the femur are evident in about 20% of fractures in children suffering from child abuse. The pathophysiology of the injury often includes forceful twisting or moving of the child's leg. Another long bone injured through the mechanism of forceful pulling or swinging, includes the humerus, and often shows diaphyseal fractures that are oblique or spiral in their presentation. (1)

Other suspicious fractures include multiple fractures at different stages of healing, bilateral and multiple rib fractures, epiphyseal or metaphyseal detachment in long bones, fractures located posteriorly and laterally, scapular fractures and fractures of the sternum. A helpful

tool to distinguish between the radiological evidence and the statement of the caretaker or child are subperiosteal hemorrhages. Subperiosteal hemorrhages happen due to the action of tensile and shearing forces and calcification of these hematomas between the periosteum and bone need approximately two weeks. (7, 16) Frequent accidental fractures in childhood include the distal forearm, the elbow, the ankle and clavicle. Accidental injury of the collarbone is quite present with a frequency of 2% to 10% and most often the middle third will be affected. A fracture of the lateral third of the clavicle may therefore suggest a history of abuse. (1, 3)

Differential diagnoses in skeletal manifestations of physical child abuse include rickets, Menkes syndrome, liver and kidney diseases, familial hypocalciuric hypercalcemia, and hyper IgE syndrome, as all the aforementioned diseases show an increased risk for bone fractures. However, if the X-Ray, the anamnesis of the child and family, as well as laboratory findings and both the physical and neurological examinations are inconspicuous in its presentation, the child is most likely suffering from physical child abuse. Laboratory testing for differential diagnoses include a complete blood count, serum calcium, phosphate and alkaline phosphatase, parathyroid hormone, copper and ceruloplasmin, liver enzymes and bilirubin, total IgE and 25-hydroxycholecalciferol. An X-Ray presents the method of choice for diagnosis and if multiple fractures or fractures of the skull are present, a funduscopy and cMRI should be conducted as well. If a child is under the age of three, a skeletal survey needs to be done as well, as they present the most common type of victims in abuse, while suspicious findings should be followed up with an cerebral MRI. (3, 4)

3.3 FACTITIOUS DISORDER IMPOSED ON ANOTHER (FDIA, MUNCHAUSEN SYNDROME BY PROXY)

Factitious disorder imposed on another, also known as Munchausen syndrome by proxy, is a very complex disease, where most often the mother of the abused child acts as the perpetrator. It is a rather rare disease and happens only in 0.5 of 100,000 of children. (1) The perpetrator is often knowledgeable about the medical field and acts through the child (by proxy) to receive emotional attention and care. The abused child is most often healthy, however preexisting (chronic) diseases or disabilities can be severely aggravated by repeated medical, invasive procedures, where the diagnostic and therapeutic management can be potentially harmful. (7)

The mother can create either real illness in the child, for example by feeding it large amounts of salt resulting in hypernatremia, or simulate an illness by giving a wrong medical history and submitting contaminated materials for examination like urine or stool. In previous cases, laxatives, insulin, and other agents have been used to produce illness in the child by intentionally poisoning it, resulting in a mortality of 9% to 11%. In 8% of children, permanent disabilities like failure to thrive, developmental delay and other types of non-accidental injuries will be present. (1)

A severe form of FDIA includes an “Apparent Life-Threatening Event” (ALTE), where the child is found cyanotic or pale, with periods of apnea and a change of muscle tone. It occurs most often due to an underlying gastrointestinal or neurological problem. However, it can also be a result of child maltreatment, where the mothers often place a piece of cloth, plastic, or hand in front of the mouth of the infant. Due to the loss of consciousness, CPR will most often be performed, where the mother heroically saves the child. Those life-threatening events usually leave no detectable traces, and a renewed abuse can be fatal. (7, 17)

The goal of the mother is to receive attention and affection through the repeated medical examinations and are thus very cooperative. Symptoms are usually only present in the presence of the perpetrator and can’t be explained, while treatments remain ineffective. (7)

Due to the seemingly overprotective nature of the mother and the child having, albeit unexplainable, symptoms, the diagnosis of FDIA remains a challenge within the hospital setting. A court order can therefore help in the diagnosis, as the child will be separated from the mother and without the infliction of illness, the physical condition of the child is bound to improve. (1)

3.4 DIAGNOSTIC METHODS

For a correct diagnosis and legal consequences in favor of the child, a thorough anamnesis is required when examining a child. Children under the age of two to three years should be examined all over the body, including the anogenital area, and any suspicious lesions should be documented either with pictures using a scale, or with body schemes. Later on, a physical examination should be targeted. To look for new and healed fractures, a skeletal screening can be done, and a computed tomography can give insights to the etiology and severity of head injuries. Due to retinal hemorrhages, an otoscopy should always be performed when suspecting Shaken Baby Syndrome. (7)

3.5 SUDDEN INFANT DEATH SYNDROME

Sudden Infant Death Syndrome (SIDS) belongs to one of the most common causes of death in infancy and usually happens between the second and fourth month of life. It is called sudden infant death syndrome, as its etiology remains still unknown even when there is a thorough investigation and autopsy performed. There is a certain number of risk factors pertaining to SIDS, including prone position of the baby, covering the head of the infant, moist clothing or hair due to sweating of the child, smoking throughout the pregnancy and after, not breastfeeding the infant, and a young mother. Currently there are more than 120 hypotheses regarding SIDS with the most likely etiology being any respiratory dysfunction due to an abnormal brainstem or a dysfunction within the serotonergic system in the brain. The death of the infant always occurs during sleep and children are often found lying in a prone position.

As a result of passive outflow of hemorrhagic pulmonary edema in prone position, a trace of blood from the mouth and nose can leave a blood stain on bed sheet, arousing suspicion. The questions that have to be asked are often perceived as inappropriate by those affected and a certain compassion must be shown. An inspection by a forensic pathologist should take place as soon as possible. Parents who have lost their child to SIDS are often plagued by feelings of guilt in addition to the pain of losing the child, as they are unsure if they weren't unintentionally responsible for the death of their child. They think that they might have overheard the child screaming or that it suffocated. An autopsy can be helpful in dealing with feelings of guilt, as those feelings can be alleviated by the diagnosis of SIDS. The autopsy is carried out according to an internationally standardized protocol (ISAP) in order to be able to compare findings internationally. Even if the cause of death did not represent a malignant intention, an autopsy is always necessary to rule out a infanticide or child abuse, as well as any internal causes. (7, 18)

The autopsy for infants with SIDS often shows fine, frothy foam in the airways, lung edema that can be hemorrhagic, dystelectases and atelectasis while segments of the lung may be hyperinflated, infection of the upper respiratory tract, intrathoracic petechiae, an empty bladder and a blood-filled right ventricle and atrium. (7)

Table 2. Differential diagnoses of SIDS.

Death due to natural causes	Death due to unnatural causes
Infections <ul style="list-style-type: none"> - Pneumonia - Meningitis and encephalitis - Gastrointestinal infections - Myocarditis - Sepsis 	Suffocation <ul style="list-style-type: none"> - By closing of the airway (with or without using a soft object) - Through compression on the thorax - Through aspiration of gastrointestinal contents
Metabolic diseases <ul style="list-style-type: none"> - MCAD deficiency 	Non-accidental brain injury
Congenital anomalies <ul style="list-style-type: none"> - Cardiac anomalies, cardiomyopathies - Endocardial fibroelastosis - Vascular malformations 	Factitious disorder imposed on another with fatal outcome
Hyperthermia due to internal causes	Hyperthermia due to external causes
Reye syndrome	Poisoning
Bronchopulmonary dysplasia	Any other type of physical abuse

3.6 MURDER OF A CHILD

In 2012 in the United States, a rate of 2.2 per 100,000 children died due to maltreatment, with neglect posing the most common type of abuse in 70% of cases. Furthermore, the killed child experienced physical abuse at a rate of 44%, often in combination with other types of abuse. More than 70 percent of killed children are under the age of three. While girls are more prone to experiencing child abuse, when it pertains to filicide, boys have a slightly higher fatality rate than girls (2.5 per 1000,000 vs. 1.9 per 100,000 children). (4)

3.6.1 NEONATICIDE

Neonaticide compromises the death of a child within 24 hours after birth. It is often carried out by young mothers that lied or forgot about their pregnancy. The mother can either repress or conceal their pregnancy and a distinction is important due to the legal consequences.

Mothers that repress their pregnancy have an inability to assume guilt, as they possess a subjective certainty of not being pregnant. There is either an absence or a reinterpretation of the signs of pregnancy, as the mother continues with her activities that can easily lead to social situations revealing her pregnancy. Such situations include sports, nude bathing, going to the sauna and an unchanged sexual activity. As there are cases of women having a cryptic pregnancy without showing any signs and symptoms that are typical for pregnancy, they might be actually and sincerely surprised when they enter labor. (7, 19)

In a concealed pregnancy, the mother has a suspicion and feels strongly to not have the child. They apply strategies to hide their pregnancy and it often leads to neonaticide, as they are able to plan in advance. The dead infant is then buried or hidden somewhere close to the mother, like their freezer or within the backyard. As they are actively hiding their pregnancy and are conscious about it, their culpability is much higher than in women with a cryptic pregnancy.

In both cases, the newborn infant may be killed through different methods like closing of airway, drowning, strangulation, blunt or sharp force and hypothermia. It is crucial to prove if a live birth took place. Signs of a newborn child include vernix caseosa, meconium, a torn or remnants of the umbilical cord, and a caput succedaneum. To be able to live, it is essential that the baby weighs at least 500 milligrams, that there are no causes of death that are explained by labor like intracranial bleeding, there are no severe deformities, or any intrauterine, possible lethal infections like TORCH.

To prove if the baby has been living, the inhalation and ingestion of air is of utmost importance. Before extracting the organs during autopsy, the respiratory and gastrointestinal system will be closed off, so no air can enter through external manipulation. The system will then be separately placed into water. The lung flotation test can only be positive, meaning that the lung floats at the top, if there was clear ventilation or vigorous inhalation happening. A false positive result is possible, if there was any other kind of ventilation taking place, for example by performing CPR, artificial respiration or by putrefactive gases. When an inhalation of water, for example by holding the neonate under water, was happening, the result can be false negative. The process of burking, meaning the perpetrator putting pressure

to the thorax of the victim and synchronously closing of the mouth and nose of the victim, can also lead to false negative results. (7, 20)

The gastrointestinal system also provides insight into how long the newborn was living. As well as with the lung flotation test, it can be false positive if the child was reanimated, or putrefaction has already occurred. If there is air only within the stomach or duodenum, the neonate was alive for only few minutes. Air usually needs up to six hours to pass the whole small intestine, so if the small intestine is inflated up to the cecum, the child was alive for at least six hours. The inflation of the whole gastrointestinal system, including all parts of the colon, usually takes up to twelve hours.

To exclude a false positive result due to putrefaction, approximately 25g of the right lobe of the liver can also be put in in water. The process of putrefaction might be similar to the lung and can therefore be used as reference. (20, 21)

In order to diagnose the biological mother or father, DNA analyses are conducted by using short tandem repeat genotyping or mitochondrial DNA of the child's corpse. (7)

3.6.2 INFANTICIDE

As previously described, neonaticide comprises the murder of the child within 24 hours after delivery. Infanticide typically describes the act of killing a child within their first year of life. Filicide, however, comprises the death of a child regardless of their age. The number of unreported cases is likely very high, and the rate of infanticide can range from 2.4 to 7.0 per 100,000 children in the global north (Great Britain, United States of America, Canada, New Zealand). (21)

Infanticide can either be carried out deliberately or passively, and is typically carried out by the mother or at least with their consent. Active infanticide includes any means of physical abuse with a deadly outcome, head injuries or letting the child starve or become dehydrated on purpose. A child can be passively killed by omitting the caretaker's responsibility of supervising the child, by neglecting it and through inadequate nutrition. When caretakers actively kill their female baby, it is referred as gendercide. It is a common practice in poor countries, where families can't afford to have a girl and men still possess the role of the breadwinner. (22)

While 95% of neonaticides involve newborns that were born outside the hospital, 92% of infanticides involve children that were born in a clinic. This further perpetuates the idea that the profile of perpetrators is different, as neonaticides are most often conducted by women that concealed their pregnancy. Infanticides, on the other hand, mostly involve mothers that gave birth to their child within the hospital and voiced alarming signals to their environment and even sought institutional help. (21)

4. SEXUAL ABUSE OF CHILDREN AND MINORS

Sexual abuse of children mostly happens in a familiar environment and involves children of all ages, yet it mostly happens to schoolchildren. Child sexual abuse (CSA) is mostly a repeated offense and girls are more often affected by CSA compared to boys (70:30). (7) Nevertheless, in the case of sexual abuse of male adolescents, due to current stigmatization, they are less likely than girls to seek help. (1)

Pedophilia is a disorder of sexual preference starting in puberty and involves sexual fantasies or urges involving a minor. A person suffering from pedophilic disorder doesn't necessarily act upon their urges, instead they often seek professional help. Therefore, sexual abuse of children and minors most often reflects an abuse of power, as children pose simple victims. The perpetrator is almost always known to the victim, unlike the "creepy stranger" one would read about in the news. The family member or friend enacts authority over the child and can make it believe that sexual acts between the victim and perpetrator are normal and found in every family. Children most of the time don't talk about any sexual assault or try to communicate it differently. The child finds itself in a conflict of loyalty towards the perpetrator and its own burden and can be silenced through threats of physical violence, by bribery through gifts, money, or special permits. It is quite common that both the perpetrator and child have an agreement on silence, and it may be scared of abandonment if it breaks that agreement. (1, 7)

As sexual abuse doesn't necessarily only involve penetration, there might be no physical evidence. A spontaneous allegation being voiced by a child should therefore always be taken seriously. Additionally, there may be a range of nonspecific symptoms. Psychosomatic symptoms include abdominal pain, bed wetting and defecation, migraine, behavioral and sleep disorders, failing at school, (illegal) substance abuse, self-harm and eating disorders. Any knowledge about sex inadequate for their age and sexual provocative behavior poses also

as an alarming sign. Psychiatric disorders like neurotic disorders, anxiety, depression and suicide attempts may also manifest due to CSA. (7, 8)

Sexual abuse can be divided into three categories, including an attempted or completed sexual act, abusive sexual contact, and noncontact sexual abuse. Sexual acts always involve the genitals of either the victim or perpetrator. There may be direct genital on genital contact (penis to vulva, anus, or penis), however mouth on genital contact is also included in the definition of sexual acts. Penetration, no matter how slight, may involve the vulva, anus, or mouth of the victim through the genitals of the perpetrator, as well as the mouth, fingers or other objects that are used by the offender. A sexual act is also possible towards the caregiver, as they can coerce the child to touch or masturbate the perpetrator. (2)

Abusive sexual contact excludes any kind of penetration. It includes intentional touching of certain body parts directly or indirectly by the caregiver towards the child or vice versa. It is very difficult to have any medical evidence in abusive sexual contact, as the perpetrator most often is interested in having repeated sexual contact with the victim. Body parts that are touched or kissed inappropriately include the genitalia, anus, groin, breast, inner thighs, and buttocks of the child.

Noncontact sexual abuse or “hands off” sexual abuse includes exhibitionism, voyeurism and deliberately showing the child pornography. The usage of sexual language towards the child online or offline is also included in this category, as well as any prostitution or depiction of the child in a sexual manner either photographic or cinematic. A new form of sexualized violence is the phenomenon of cybergrooming, where abusers are seeking direct contact towards the child via (video) chat, messengers, or social media, with the intent of meeting the victim for “hands on” sexual abuse or contact. (2, 3)

4.1 MEDICAL INDICATORS OF CHILD SEXUAL ABUSE

Medical indicators of child sexual abuse include non-localizable abdominal pain, injuries, swelling, redness, soreness and itching of the genital area, as well as unexplained bleeding, urogenital inflammation, a presence of foreign bodies and discharge. In the anal area there might also be discharge with and without signs of inflammation and any signs of injury. (7)

4.1.1 FINDINGS ON EXTERNAL SEXUAL ORGANS

Findings on external sexual organs are only present in 5% to 10% of girls. The presentation in girls depends highly on age and other factors like hormonal levels, and is susceptible to variations. Initially, the hymen usually presents as bright pink and bulging membrane with an annular appearance and will change to a semilunar appearance until puberty. However, it is important to keep the variations like a cribriform or microperforated hymen in mind, in order to not wrongly accuse somebody. It is essential to note that the width of the hymenal opening is of no informational value, as tampons, masturbation, gymnastics, running or stretching does not necessarily cause injury or widening of the hymen. The physician should also refrain from using the medical term “virgo intacta”, as non-physicians then often suggest that no penetration has taken place. A study on 36 pregnant teenagers showed that only 6% of them showed clear signs of prior penetration.

The anogenital findings that arise in CSA are highly variable and depend on various factors, such as type and frequency of abuse, if any objects were used, the age of the victim and how strongly the victim was trying to defend itself. Thus, relevant factors are the presence of pain, the time that has passed since the last assault and if there is any (vaginal) bleeding. (23)

In abused girls, there might be erythema and itching of the genital area, as well as abrasions. In intercrural intercourse, meaning that the perpetrator pushes his penis between the thighs of the child without necessary penetration, there might be redness and swelling of the perineum, as well as the labia. The child perceives this often as rather painful and might be unsure if penetration has actually happened. (8) If penetrative intercourse has taken place, there is usually a rupture of the hymen from the free hymenal margin to the base of the vaginal wall at three to nine o'clock, leaving a V-shaped notch or cleft. However, the higher the estrogen level, the more extensible the hymen becomes, therefore an intact hymen does not exclude sexual intercourse. Moreover, the hymen has the ability to even heal in prepubertal girls and only complete tears of the hymen usually persist.

Genital injury is only found in 1% to 3% of boys and often take on the form of abrasions, fissures, bite marks, and small petechiae on the shaft of the penis or even glans penis. Furthermore, there might be the presence of a teared frenulum of the penis. (23)

4.1.2 ANAL FINDINGS

Immediate consequences of anal penetration include swelling, bruising, reddening, fissures, and deep perianal tears. A “reflex anal dilatation” is still discussed controversially, as repeated sexual abuse does not necessarily lead to an opening of the anal sphincter. An abnormal anal sphincter tone does not distinguish between the direction of movement and dilatation may happen when stool is present in the lower rectum. However, a relaxation of the anal sphincter more than 2 cm without the presence of feces may present as evidence.

Fissures need to be distinguished from the prominent folds of the anal canal and occur when the anal canal is stretching above its elastic limits. While it was previously thought that fissures occur in the presence of constipation, there is still insufficient evidence to proof this claim.

An anoscopy can be used to visualize internal injuries, as well as secure forensic evidence in the form of bodily fluids. Unfortunately, the presence of semen in the anal canal or rectum is uncommon. (8, 23)

4.2 SEXUAL INDICATORS OF CHILD SEXUAL ABUSE

4.2.1 SEXUALLY TRANSMITTED DISEASES AS A CONSEQUENCE OF ABUSE

Sexual abuse in children is often difficult to prove and even though sexually transmitted diseases are only present in 1% to 4% of children, they might be the only hint and evidence of sexual abuse. The presence of *Neisseria gonorrhoeae*, *Chlamydia trachomatis*, *Trichomonas vaginalis* and HIV are highly specific for sexual abuse, as long as there was no vertical transmission or consensual sexual contact between teenagers. (23) While the presence of *Molluscum contagiosum* is considered a sexually transmitted disease in adolescents and adults, in children they may spread through the contact of infected materials like towels or clothes and is no longer seen as evidence. Moreover, in the case of condyloma acuminata caused by the presence of HPV, a study from Greece showed that vaginal samples were positive in 47.4% of sexually active adolescents, followed by 26.8% of adolescents that were not sexually active. 34.5% of prepubertal girls were also screened positive for HPV, therefore a positive result of HPV should arise suspicion and should lead to further investigation but does not prove to be definite evidence. (24)

The Center for Disease Control and Prevention determined that urine for nucleic acid amplification proves enough material in order to test for *Neisseria gonorrhoea* and *Chlamydia*

trachomatis. However, by taking a vaginal, anal, pharyngeal, and cervical swab, the physician can cultivate a gonococcal culture or searches for chlamydia through polymerase chain reaction. A vaginal swab may also be useful in the instant detection of trichomonas via microscopy. In order to proof that the child is infected by hepatitis B or C, syphilis and HIV, serology must be done. In the absence of specific signs and symptoms of STDs and vaginal discharge, screening is usually not recommended in order to minimize the cost of screening and to keep side effects from the prophylactic drugs to a minimum. (23, 24)

4.3 APPROACHING THE SEXUALLY ABUSED CHILD

In order to protect the child adequately from sexual abuse, it must be clear who the perpetrator is, before one talks to the caregivers about the sexually abused child. Otherwise, the child may experience even more pressure to maintain secrecy. A video documentation of the anamnesis should take place and the child should be asked open ended questions in order to least possible influence the child and its statement. The interrogation should follow a clear sequence and a reconstruction of events should take place through the episodic memory of the child. In some countries, there are also specific trained nurses for the medical history, called Pediatric sexual Assault Nurse Examiner (P-SANE). The National Institute of Child Health and Human Development also published its NICHD-protocol, which can be a helpful tool in the forensic interview. Younger children may show that sexual abuse has taken place through specific drawings or by reenacting the event with dolls. A repetition of the anamnesis should be avoided, as it can re-traumatize the child from the events. (3, 7)

Physical examination remains a crucial tool for identifying signs of abuse, however in sexual abuse, there should be no forced medical examination in children and the physician should explain in advance what and why they are examining the child and ask for permission. Ideally, it should be conducted by staff that is experienced in examining a sexually abused child and the whole examination should be done in a gentle manner, as children tolerate the procedure then much better. (23) The whole body of the child should be examined in the way to establish a familiar setting of going to the doctors, as well as to detect any further injuries like bite marks or hickeys. Previously, the physical examination in child sexual abuse was conducted under general anesthesia, today it is only carried out to detect injuries requiring acute treatment or when suspecting internal injuries. The physical exam seldomly reveals clear findings, as many forms of sexual abuse such as kissing, caressing, oral sex,

masturbation or showing the child pornography, leave no physical traces. Although physical violence is rare, as the children are supposed to be docile for the abuse to continue, it is nevertheless very important to conduct a careful physical exam. (7, 8)

The anogenital and pediatric gynecological examination is an important tool for assessing cases of sexual abuse in children, even though findings are rare. The ideal time for an examination is within the first 24 hours after an assault, but it can still be effective up to 7 days afterwards, depending on the situation. However, the longer time has passed from the assault, the less likely it is that physical findings will be present, as there is a high healing rate of the genital organs. In females, the gynecological examination in a forensic setting should be carried out by a physician having specialized pediatric gynecological and general pediatric knowledge, including the knowledge of normal findings and standard variants. The gold standard for pediatric gynecological examination is the use of a video colposcope, which allows for documentation of the examination and evaluation by a second trained person through peer review. Classification of findings is mostly based on the Adams classification, which includes over 50 anogenital and other physical or infectious findings of child sexual abuse.

The examiner carefully visualizes the hymen using either the separation technique or the traction technique. If the hymen is already opened, a foley catheter is inserted and inflated to expose the hymen fully. The main types of the hymen include the annular, semilunar, fimbriated, cribriform, septate, microperforated and imperforated hymen and therefore show variants that may look like abuse in inexperienced physician with no pediatric gynecological knowledge. The findings of the examination depend on the child's condition, the technique used for representation and the position of the child. Therefore, any conspicuous findings in the supine-frog position need to be verified in the knee chest position. During an anal area examination in children of both sexes, the child is placed in a supine position, knee chest position and lateral decubitus position. The optimal position to examine the male genitalia, is if the child is standing or in a supine position. (1, 7, 23)

The procedure after acute sexual assault in children and adolescents is rather time critical in order to prevent pregnancy, sexually transmitted diseases and to secure evidence. Seldomly there are critical injuries that need to be treated and a child should never be forced to do a physical examination. Evidence of sexual abuse can be found in 3% to 15% of cases and traces of ejaculate can be used for the detection of DNA or prostate-specific antigen. Taking a

sample should ideally occur within 24 hours of the incident, but it is also possible later. After more than seven days, only clothes, bed linen and other textiles can be used, here traces of sperm can be found even after months. Collected material for the detection of DNA include urine, clothing stored in paper bags and biological material under the fingernails. To ensure that evidence is secured correctly, it is important to cut the fingernails of all five fingers, decontaminate the scissors thoroughly beforehand and to preserve the fingernails of the right and left hand in a separate envelope. Further swabs may be needed, such after kissing, licking the neck or breast of the victim or to secure ejaculate on the abdomen or back. Furthermore, when removing traces of secretions from the skin, it is important to correctly indicate whether a swab of sperm or saliva was taken. Pubic hair will also be combed out and taken.

Sexually transmitted diseases such as syphilis, HIV and gonorrhea can also be indicators of abuse, especially if not acquired perinatally or by blood transfusion. More commonly, the presence of Herpes Simplex Virus 2 (HSV-2), Chlamydia trachomatis, Trichomonas vaginalis and condylomas in the case of HPV may be detected. Fresh defloration injuries as well as old defloration injuries also count as evidence, while the latter often presents with notches up to the vaginal wall, scarring or sections without hymenal tissue at the position of three to nine o'clock when the child is lying down. Perianal tears up to the sphincter ani externus muscle can also indicate abuse, as can pregnancy, eyewitnesses, photo or video documentation and confessions of the perpetrator. Accident-related injuries include falls onto objects and injury caused by playground equipment, however, as in all cases about child abuse, if the described accident doesn't fit the medical findings, it should always arouse skepticism.

Additional to approaching the sexually abused child in a medical manner, it is of utmost importance to assess the mental health status of the child and to offer for counselling and therapeutic help, with trauma-focused cognitive-behavioral therapy showing high effectiveness in randomized trials. (3, 7, 23) It is important to note a "denial-numbing latency period" of the adolescent that might experience posttraumatic stress disorder when forming its sexual identity in puberty. While all adolescents that have experienced CSA show an increase in the probability to suffer from depression and suicidal ideation, this case is especially high in males, as they might suffer from stigmatization, and shows an urgency in providing of safety and counseling. (1)

5. CHILD NEGLECT

Neglect can have detrimental consequences on a child's physical, emotional and mental development. Neglect is characterized by a failure to provide for the child's basic needs and is typically carried out by the primary caretaker. It is important to note, however, that neglect can only be carried out, if the caretaker has the necessary means to fulfill the child's needs but refuse to do so. Unfortunately, little to no attention, inadequate care, poor nutrition and too little protection or no supervision from the caretaker can lead to bad teeth, malnutrition, neglect of the child's hygiene, up to retardation in development both physically and emotionally, a disturbance of adequate language development, a fear of relationships or lack of distance. (3, 7)

5.1 PHYSICAL NEGLECT

Children have diverse needs for a healthy development and neglect can have severe consequences on their physical, emotional, and mental well-being. According to a retrospective survey of adults, around 40% of adults report having experienced neglect at least once during their lifetime. (25) The risk factors for neglect are the same as for any other type of abuse, however there is usually no difference in gender of the parent. Physical neglect can take many forms, including inappropriate nutrition of the child leading to underweight, failure to thrive, and in extreme cases up to irreversible disturbances of brain development. Furthermore, it may also lead to its opposite like overweight or obesity. The failure to provide the child with appropriate clothing, inadequate personal hygiene, a lack of an own sleeping place or personal retreat, as well as lack of protection against dangers such as passive smoking, consumption of harmful or excessive media, and an inadequate sleep rhythm is also a form of physical neglect. It is less common that a child is being willfully neglected in the way that the child needs to follow rigid educational methods or ideological attitudes like strict reduction diets or withholding food as punishment. This type of willful neglect will therefore often be mixed with mental abuse.

In order to address neglect, it is important to have a quantitative assessment, as every parent should be allowed to make a mistake, like forgetting to pack the child's school lunch for example. The responsible physician should ask themselves, if there is a risk of harm to the physical, intellectual, or emotional development of the child, as well as if the child is having consequences within society due to neglect. For a correct assessment, a multidisciplinary team consisting out of a pediatrician and psychologist is often needed, as there need to be tests for the psychological development of the child, as well as a social analysis of the family

resources. Different child protection services can be provided in order to assist the family. If there is a lack of willingness to cooperate or the custodians lack insight into the problem, further measures of a family court may be necessary, up to including the withdrawal of custody.

The prognosis depends on the type and severity of neglect and in cases of physical deprivation of some needs, the children are often able to restore their deficiencies. Nevertheless, many cases of neglect will cause permanent damage, especially for the intellectual development of the child. In the case of a difficulty of the child to flourish properly, it is important to also keep some organic disorders like malabsorption syndrome or metabolic syndromes in mind. (3)

5.1.1 MEDICAL NEGLECT

Medical neglect includes the lack of perceiving and adequately responding to a health problem in a child and statistically accounts for only 2% of notifications to child protection services within the US, while accounting 5.7% of deaths in abused children. (26)

Risk factors for medical neglect include religious, cultural, or ideological reasons of the parents to refuse specific or necessary medical measures, like refusing blood transfusions in children. Parents may also have negative experiences with members of the health care system or a fundamental mistrust and therefore refuse to go to doctor's appointments or to vaccinate their children. Parental overstrain or mental illnesses of the parents may also lead to a neglect in medical care and missing of regular check-ups.

In the case of having untreated or inadequately treated underlying diseases, it is important to educate the parent about the long-term consequences like in diabetes mellitus type 1 or epilepsy. When the caretakers are refusing medical necessary diagnostics and therapy like medication or physiotherapy, the physician must assess if the child is at risk of harm due to parental omission of help. Here a clear anamnesis needs to be conducted in order to exclude possible comprehension problems, as well as education and emphasis about the diagnosis and the needed therapy for the child needs to be done.

A hindrance of caretakers to seek medical help is lack of opportunities due to language barriers for example, great shame in seeking help in different religious or cultural aspects, as well as informed dissent, where the guardian is refusing a medical procedure due to strongly

believing in information that has no evidence-based fundament. If the detailed information about the possible consequences for their child is not enough to sway the parent, it is possible in milder cases for the physician to closely observe the child instead of immediately starting of therapy. In acute cases or where a severe impairment of the child is foreseeable, it is important to report to the child protection services and consult a family court if necessary. (3)

5.1.2 DENTAL NEGLECT

Oral health is an important part of overall health and includes a fresh breath, an age-appropriate oral development, the ability to chew and eat different foods and speak clearly, as well as the ability the absence of inflammation of pain of all the organs of the oral cavity like the teeth, tongue, salivary glands, temporomandibular joints and the jawbone and gums. A socially acceptable smile and corresponding dentofacial profile is also included in oral health. Dental neglect defines the neglect of necessary oral hygiene of the child, including dental treatment ensuring an adequate functioning of the oral cavity and an absence of pain and infection. A prerequisite for dental neglect is that there must be an adequate access to dental care and the oral health is endangered due to intentional or unintentional misconduct of the guardians. Dental neglect is not able to be diagnosed due to a certain number of decayed teeth or other specific diseases of the mouth, and might have a high rate of unknown cases, as literature often only includes dental neglect when there are cases of general neglect or abuse and not by itself.

Consequences of a poor dental and oral hygiene include caries, periodontitis, canker sores with severe pain, chronic inflammation, and loss of function. With the teeth being a central feature of the face, oral hygiene also expresses a social function, with visible damage or speech defects being able to lead to social withdrawal and exclusion, as well as a decline in academic performance. Halitosis can also lead to the aforementioned negative effects, and the child may express a decreased self-esteem with an impaired functioning in forming relationships up to mental illnesses. Aside from the psychological and social component, present pain due to a decayed tooth or other types of inflammation can lead to an impaired food intake with malnutrition or a lack of specific nutrients being the consequence.

In dental neglect, caregivers often present rather late to the dentists in the case of serious findings. Additionally, the dentist will find no improvement in oral hygiene from the previous visit and the therapeutic recommendations were insufficiently implemented, if even at all.

Diagnosis of dental neglect may include Early Childhood Caries (ECC) in dental examination, which is classified into three types according to Wyne. The mild to moderate form, ECC type I, includes an isolated carious lesion on the molars or the incisors and often happens between the second to fifth year of life. In the moderate to severe form, there will be caries lesions on the incisors in the upper jaw and depending on the age of the child, also on the molars. Early Childhood Caries type III usually occurs between age three to five and almost all teeth are affected, including the lower incisors. It is important to note, that excessive sucking on the bottle can lead to a malformation of the teeth and jaw of the child and that some underlying diseases such as cyanotic heart defects or a cleft lip or palate can lead to an increased risk for caries. An intensive education of the parents is then needed. Black stain is a harmless discoloration of the teeth caused by chromogenic bacteria, where exogenous dye in black, green or orange deposits along the neck of the tooth or the gum line. It is common in children aged five to 15 and usually regresses in adulthood. This condition should not be confused with dental neglect, as there is no correlation between bad dental hygiene, as black stain can be easily removed by professional cleaning of the teeth.

The risk of having bad teeth in abused or neglected children is eight times higher than in the control group and dental neglect is often accompanied by other types of abuse. It is important to treat the teeth first and to educate the caregivers about their consequences and obligations for long-term success. If the parents are unwilling to cooperate and more violence is suspected, a pediatrician and the child protection services should be contacted. (13)

5.2 PSYCHOLOGICAL NEGLECT

Psychological neglect involves persistent or extreme disregard for a child's needs. Children have basic needs for safety and security, and a family environment that is free from hostility and violence. They also need a constantly available and stable caregiver who provides benevolent attention in order to develop acceptance and a healthy self-esteem. Children additionally require age-appropriate autonomy and independence, which includes exploring the environment and relationships outside the family, as well as individual development within parental boundaries and rules, and no unreasonable responsibilities or restrictions. (13)

According to population studies, the prevalence of emotional neglect is at least 13% in Germany, with underreporting being likely. (25) Psychological neglect expresses severe psychopathological and neurobiological consequences, with children often unable to regularly

control their affect and expressing an inability to interact with their peers in a healthy manner. Neurobiological explanatory models, most often conducted on animals, show that severe neglect manifesting through chronic stress and decreased stimulation, can lead to a dysregulation of the hypothalamic-pituitary-adrenal axis, the parasympathetic nervous system and the catecholamine system. As a consequence, there will be an inhibition of axonal and neuronal development, as well as a decreased differentiation and volume of the hippocampus, corpus callosum and amygdala, resulting in an impairment to adequately process stress, as well as the frustration tolerance, impulse control, reward system, attachment, and empathy. In addition, children will be even in relaxed situations on high alert to possible threats, and the neurobiological models suggest, that there is also a disturbed awareness of reality.

The clinical picture of psychological neglect includes behavioral problems such as lack of sympathy and interest on the part of the child, a withdrawn or aloof behavior, and externalizing, aggressive behavior with advancing age. Mental developmental disorders such as impairment of cognitive, social-emotional, and speech development, an increased vulnerability, and impairment of the IQ have also been observed, leading to deficits in memory, brain volume and the ability to learn. These impairments correlate with the intensity and duration of neglect and are especially severe if physical neglect is also present. There are also cases of psychosocial dwarfism with a delay in fusing of the epiphyseal plates due to emotional deprivation. A long-term consequence poses mental illness in adolescence and adulthood, as well as a transgenerational transmission of child abuse and neglect. (3, 13)

The developmental milestones of neglected or emotionally abused children can vary depending on age, with developmental disorders, a delay in development of speech and age-inappropriate behavior, like suckling on the thumb when the child is older, being present in all age groups. In infants aged up to 20 months, an insecure-avoidant or insecure-disorganized appearance and especially cognitive developmental delay are observed. The infant may react passively and withdrawn to its environment. Children aged 20 to 30 months show less social interaction, negative behavior when playing and a decreased memory performance. These traits may also be present in children aged three to four years, with an inability to express and describe emotions. Poor peer relationships, with the child struggling to maintain a healthy relationship towards its friends, are common in children that are four to five years old. They may also express an emotional numbness in the form of freezing and show an overly friendly approach to strangers. Their ability to notice negative emotions in other people is also stronger and will lead to an increased counter-reaction on their part. Children that are five to

six years old, express negative interactions within their relationship towards their parents, perceive themselves as angry, while they are often seen as sad or hurt and may show bad behavior in the form of stealing or cheating. Children above the age of seven are often aggressive, have low self-esteem, are easily stressed with a lack of self-control and can't regulate their emotions properly. There might be attention-seeking and self-injurious behavior, as well as depression, eating disorders, personality disorders and a difficulty in adapting at school, as well as an impairment in solving tasks.

The diagnosis of psychological neglect should be done by a multidisciplinary team with a focus on the interaction between parent and child, the attachment behavior of the child, if there are any non-organic failures to thrive and developmental delays, as well as social, emotional, or motor problems of the child. As younger children are not able to express clear signs of psychological and emotional neglect, an early diagnosis is often rare, however some screening questionnaires for the assessment of emotional neglect and abuse are available.

It is important to distinguish if the parent is willfully neglecting the child or just unable to, as the intervention differs. A local child protection program should always be contacted and if the parents are willing to learn, they can attend special education programs or family counseling centers. It is important that a multidisciplinary team consisting of a physician, psychologist, as well as child protection services and family court are deciding upon the intervention for a better future of the child. (13)

6. PSYCHOLOGICAL MALTREATMENT

Psychological maltreatment poses a different kind of threat towards children, as it often doesn't lead to any bodily traces except for psychosomatic symptoms. This type of maltreatment encompasses both emotional and psychological abuse.

Caregivers actively impair the psychological well-being of children or may fail in creating an appropriate and supportive environment, which is immensely important for growing up. Psychological maltreatment is always a chronic situation, as it takes place in the child's immediate environment and is often associated with physical abuse. Subtle cases of maltreatment include family members wanting to fulfill their wishes through a child and ignore the child's own personality and predispositions, as it is often seen in child celebrities. (3, 7)

There was a rise of 5.7% of cases of child maltreatment registered in 2016 in Germany, whereas psychological ill-treatment comprised a share of 28.4%. (27) Psychological and emotional ill-treatment can take on many faces. It ranges from indirect abuse by destroying beloved items or torturing pets up to rejection or devaluation of the child. The latter can be instilled verbally or nonverbally through instilling feelings of guilt in children, by setting unrealistic requirements, ridiculing or discriminating the child, by ignoring its demands or leaving it alone, up to more hostile methods like humiliation or using verbal violence toward the child. Children can also be easily instrumentalized, for example in parental conflicts or to engage in criminal behavior like stealing. Threats, locking the child in a room or penalties that are inadequate to the child's mistakes also belong into the category of maltreatment. Other forms include isolation like restricting the child's freedom of movement, deliberately keeping it away from contact with peers or hobbies, deprivation of love, letting the child witness partner violence up to overprotective behavior that conveys powerlessness and dependence of the child. (3)

Risk factors are similar to the risks of a child experiencing physical abuse or neglect. There might be transgenerational passing along of pattern of violence, parents might feel overwhelmed, suffer from psychiatric disorders (especially Cluster B type of personality disorders), and may have any history of substance abuse. Social risk factors are poverty, the parents being young, experiencing no social support or being a single parent. Any physical or mental disabilities as well as prematurity pose also as risk factors for the child to experience abuse.

While there may be no physical traces of abuse, abused children often show similar signs and symptoms in their development as neglected children even after the passage of several years. They might have issues with language development compared to their peers, might be easily scared and in infants it is common for them to watch their environment without any emotions.

Long-term consequences of psychological maltreatment are an impaired development of the child's identity and their self-worth. They might form an unhealthy attachment style like the anxious-insecure, avoidant-insecure and disorganized-insecure attachment behavior. (3, 28)

Psychological maltreatment deprives the child of an environment, in which it can practice social interaction and build an inner structure and sense of security. They often have an impact on their physical, social, emotional, and cognitive development, as the body is responding to chronic stress with permanently elevated cortisol levels, also leading to

decreased academic and cognitive performances. Psychologically abused children have a higher risk for substance abuse and personality disorders, and also express an increased risk for cardiovascular diseases, apoplexy, COPD, diabetes mellitus type 2 and hepatitis. (29, 30)

As in all cases of abuse and neglect, a detailed anamnesis is of utmost importance and should be conducted with the extended environment if possible. As psychological abuse shows a chronic pattern, a long-term observation of the behavior of the child is necessary.

Additionally, schooled personnel should assess the quality of interaction between the caregiver and the child in different situations. In children aged 12 to 20 months, it is also possible to draw some conclusions about their attachment style depending on how they react when being separated from their primary caretaker for a short time and left alone with a stranger. As described previously, children around the age of four to five that are acting overtly friendly towards strangers should also arouse suspicion.

Similarly to psychological neglect, a multidisciplinary team is needed for the treatment and intervention of the maltreated child. Depending on the age of the child, its wishes and views should also be taken seriously, and early interventions are very crucial in order to have a better prognosis. (3)

7. REPORTING CHILD ABUSE

In the event of maltreatment, sexual abuse or a lack of parental cooperation, a separation of the perpetrator and victim needs to occur. The welfare of the endangered child has a higher legal interest than medical confidentiality and child protective services must be consulted and informed. Even though the family acts as perpetrators, they might be informed about a report in advance, in order to maintain a constructive relationship and refrain another family member of being hurt. The physician should make it clear that the described abuse is not in correlation with the accidents, but in order to avoid negative confrontation, the physician should not refer to the parents as abusers. If further proceedings have been clarified, the child can be discharged into the further care of child protection services, living with another family member or foster care during legal investigation. If the child continues to live with its perpetrators, close medical check-ups should be conducted, in order to be able to intervene renewed if there is a failure to thrive or the physician notes new injuries. (1, 7)

8. DISCUSSION

This overview of child abuse highlights the prevalence and severity of child abuse, posing a real threat to public health, as there is a variety of factors leading to child maltreatment. Even though there is a lot of literature talking about child abuse, it is still an underreported issue that needs to be addressed much more, especially the fact that child abuse is almost in all cases conducted by the direct family and affects especially younger children..

In the subject of pediatrics during medical studies, it is often covered only for a short amount of time and future physicians will be unable to access the right tools in order to confirm abuse and report it to legal services. (31)

When encountering child abuse, there might be a variety of differential diagnoses that need to be kept in mind. Therefore, assessment tools like the Adams classification in child sexual abuse or the “TEN-4-FACESp” acronym provide helpful tools in the diagnosis of child abuse. Furthermore, a consequential usage of the correct ICD-code would offer a useful instrument for a correct assessment of child abuse internationally.

9. CONCLUSION

Child abuse is a significant public health issue affecting approximately 3.4 million of children and adolescents worldwide. Neglect poses the most common type of child abuse, followed by physical and then sexual child abuse. Abuse is mostly carried out by the primary caretakers like the biological, adoptive or stepparents and the myth of the stranger abusing a child, remains due to a very low prevalence just that – a myth. Only in less than 2% was maltreatment carried out by secondary caretakers like facility staff or teachers. While most of the perpetrators are women, severe cases of child abuse and child sexual harm remains at the hand of male persons with girls being more prone to maltreatment in all age groups.

Most of the victims are younger than the age of three, with infants experiencing the most abuse, making it difficult to establish a correct diagnosis if no physical harm is present. Therefore, especially in cases of neglect and sexual abuse, the latter leaving only seldomly any physical traces, it is very important to seek for an explanation if the child shows abnormalities in development of speech, motor skills, emotional knowledge and control, and in the case of child sexual abuse, shows abnormal knowledge about sexual intercourse or even mentions an event. In infants, a frozen watchfulness, meaning the child is watching

impassively the environment, can also be an indicator of abuse, as well as young children being overtly friendly and intrusive to strangers.

Neglect can be conducted either willingly or through acts of omission and it is important to note that if the family is missing the available resources due to a poor socio-economic status, one would not talk about neglect. Unfortunately, risk factors for all kinds of child abuse include a low socioeconomic status, mental illness of one guardian, domestic violence, and a personal history of abuse in the perpetrator. Additionally, the child is more susceptible to maltreatment if it was born prematurely and has a history of chronic disease or a permanent disability.

Physical abuse most often occurs over a longer period of time and arouses suspicion if the physical examination doesn't match the reported way of injury and anamnesis. A special danger for infants poses non-accidental brain injury, as it often results in death and poses a real threat to the permanent health of the child. In order for the child to suffer from NABI, it must be shaken violently back and forth by the caregiver, in a manner that even strangers can notice that it poses a real threat to the child. Risk factors for non-accidental brain injury include the parent having a high mental load and stress, being young and a lack of social support.

Child sexual abuse often occurs in a familiar environment over a longer period of time and reflects an exertion of power over the victim. Given that CSA doesn't necessarily involve penetration, it often shows only mild to no physical findings in the child.

The thesis aimed to underline the importance of a good physical examination in children and medical history, as any unusual findings should lead to a search of differential diagnoses with child abuse being kept in mind. Physicians should be aware of the risk factors of child abuse, as the impact of child abuse can be devastating, leading to physical, psychological, and emotional trauma that can persist into adulthood.

The stated risk factors have strong implications for the prevention and intervention of child abuse. Given the high prevalence in parents with a poor socioeconomic status, parental substance abuse and mental health issues, it is important to address the underlying risk factors with targeted interventions on a broader level, with awareness and education about child abuse among parents, caregivers and the community being only a part of it. Despite its magnitude, the prevention of child abuse should be made a political priority, which may result

in a decrease of transgenerational violence, and both supports the parents, by tackling the problem at its roots, as well as the children in a way of prevention.

An understanding of child abuse and further addressing of the issue is critical to promote health and well-being of children, preventing long lasting negative outcomes. Additionally, a multi-disciplinary approach, involving health care workers, child protection services and law enforcement is also of utmost importance. Collaboration and communication between these groups are critical in identifying and appropriately responding to child abuse, as well as providing support and resources to affected children and families.

10. SUMMARY

Child abuse refers to the deliberate or unintentional harm caused to a child, including physical, psychological maltreatment, as well as sexual abuse and neglect. Neglect is the most common type of maltreatment, involving the failure to adequately care for the needs of a child and may occur physically, psychologically, as well as within the medical care and education. The prevalence of neglect is followed by physical abuse and then sexual abuse. Child abuse is mainly perpetrated by the primary caregivers, with mental illnesses, substance abuse, domestic violence and a low socioeconomic status being a risk factor. Children that were born prematurely or suffer from chronic diseases or other disabilities, as well as those that have experienced abuse before, are at a higher risk for assault. Suggestive clues of child abuse include developmental delay, injuries in different stages of healing, and an unusual behavior of the child or parent. Even in the case of physical abuse, there might be no external manifestations, therefore pediatricians and emergency doctors should always be vigilant about child abuse and consider it as an alternative explanation.

Key words: child abuse, child sexual abuse, physical abuse, neglect, battered child syndrome

11. CITED LITERATURE

1. Olshaker JS, Jackson MC, Smock WS, editors. Forensic emergency medicine. Philadelphia: Lippincott Williams & Wilkins; 2001.
2. Paulozzi LJ, Leeb RT, Melanson C, Simon TR, Arias I. CHILD MALTREATMENT SURVEILLANCE: Uniform Definitions for Public Health and Recommended Data Elements: Centers for Disease Control and Prevention; 2008 [cited 2023 May 23]. Available from: URL: https://www.cdc.gov/violenceprevention/pdf/CM_Surveillance-a.pdf.
3. Ewert J, Berthold O, Heimann T, Onken C. Kinderschutzmedizin; 2023 [cited 2023 May 22]. Available from: URL: <https://next.amboss.com/de/article/mP0V2T>.
4. Child Maltreatment: Facts at a Glance; 2014 [cited 2023 May 23]. Available from: URL: <https://www.cdc.gov/violenceprevention/pdf/childmaltreatment-facts-at-a-glance.pdf>.
5. Tsokos M, Guddat S, Gößling A. Deutschland misshandelt seine Kinder. Vollständige Taschenbuchausgabe. München: Droemer; 2019. (Droemer Taschenbuch).
6. Straus MA, Douglas EM. Concordance Between Parents in Perpetration of Child Mistreatment: How Often Is It by Father-Only, Mother-Only, or by Both and What Difference Does It Make? Trauma Violence Abuse 2019; 20(3):416–27.
7. Hochmeister M, Grassberger M, Stimpfl T. Forensische Medizin für Studium und Praxis: 10 Tab. 2., aktual. Aufl. Wien: Maudrich; 2007.
8. Roberts R, Evans JV. CLINICAL FORENSIC MEDICINE | Child Abuse. In: Encyclopedia of Forensic Sciences. Elsevier; 2000. p. 368–74.
9. Vester MEM, Bilo RAC, Karst WA, Daams JG, Duijst WLJM, van Rijn RR. Subdural hematomas: glutaric aciduria type 1 or abusive head trauma? A systematic review. Forensic Sci Med Pathol 2015 [cited 2023 May 23]; 11(3):405–15. Available from: URL: <https://link.springer.com/article/10.1007/s12024-015-9698-0>.
10. National Institute of Neurological Disorders and Stroke. Menkes Disease; 2023 [cited 2023 Jun 1]. Available from: URL: <https://www.ninds.nih.gov/health-information/disorders/menkes-disease>.
11. Lind K, Toure H, Brugel D, Meyer P, Laurent-Vannier A, Chevignard M. Extended follow-up of neurological, cognitive, behavioral and academic outcomes after severe abusive head trauma. Child Abuse Negl 2016 [cited 2023 Jun 1]; 51. Available from: URL: <https://www.sciencedirect.com/science/article/abs/pii/S0145213415002690?via%3Dihub>.
12. Stanley Manne Children’s Research Institute. TEN-4-FACESp; 2022 [cited 2023 Jun 4]. Available from: URL: <https://research.luriechildrens.org/en/community-population-health-and-outcomes/smith-child-health-outcomes-research-and-evaluation-center/tricam/ten-4-facesp/>.
13. Kinderschutz Leitlinie. AWMF S3+ Leitlinie Kindesmisshandlung, -missbrauch, -vernachlässigung unter Einbindung der Jugendhilfe und Pädagogik (Kinderschutzleitlinie): AWMF online; 2019 [cited 2023 Jun 1]. Available from: URL:

https://register.awmf.org/assets/guidelines/027-0691_S3_Kindesmisshandlung-Missbrauch-Vernachlaessigung-Kinderschutzleitlinie_2022-01.pdf.

14. Brusselaers N, Monstrey S, Vogelaers D, Hoste E, Blot S. Severe burn injury in Europe: a systematic review of the incidence, etiology, morbidity, and mortality. *Crit Care* 2010 [cited 2023 May 30]; 14(5):R188. Available from: URL:

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3219295/>.

15. Alison Gray. Care of Burns in Scotland: Paediatric Guideline; Non Accidental Burns and Scalds in Children. National Services Scotland; 2019 [cited 2023 Jun 2]. Available from: URL: <https://www.cobis.scot.nhs.uk/wp-content/uploads/2019/03/2019-Non-Accidental-Burns-and-Scalds-in-Children.pdf>.

16. Walker A, Kepron C, Milroy CM. Are There Hallmarks of Child Abuse? I. Osseous Injuries. *Acad Forensic Pathol* 2016 [cited 2023 Apr 26]; 6(4):568–90. Available from: URL: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6474500/>.

17. Choi HJ, Kim YH. Apparent life-threatening event in infancy. *Korean J Pediatr* 2016 [cited 2023 May 30]; 59(9):347–54. Available from: URL: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5052132/>.

18. Plötzlicher Säuglingstod: Sudden Infant Death Syndrom, SIDS; 2023. Available from: URL: <https://next.amboss.com/de/article/T406iT>.

19. WebMD Editorial Contributors. What Is Cryptic Pregnancy?; 2023 [cited 2023 May 29]. Available from: URL: <https://www.webmd.com/baby/what-is-cryptic-pregnancy>.

20. Amboss.com. Thanatologie: (Wissenschaft vom Tod); 2023 [cited 2023 May 29]. Available from: URL: <https://next.amboss.com/de/article/vP0AgT?q=lungenschwimmprobe#S8XyN->.

21. Laura Bechstein. Lungenbelüftung bei Neugeborenen und Totgeburten: Vergleich von CT-Dichten und Schwimmprobe. München: Medizinischen Fakultät der Ludwig-Maximilians-Universität zu München; 2020 [cited 2023 May 29]. Available from: URL: https://edoc.ub.uni-muenchen.de/25602/1/Bechstein_Laura.pdf.

22. Naviaux A-F, Janne P, Gourdin M. Psychiatric Considerations on Infanticide: Throwing the Baby out with the Bathwater. *Psychiatr Danub* 2020 [cited 2023 May 30]; 32(Suppl 1):24–8. Available from: URL: https://www.psychiatria-danubina.com/UserDocsImages/pdf/dnb_vol32_noSuppl%201/dnb_vol32_noSuppl%201_24.pdf.

23. Herrmann B, Banaschak S, Csorba R, Navratil F, Dettmeyer R. Physical Examination in Child Sexual Abuse: Approaches and Current Evidence. *Dtsch Arztebl Int* 2014; 111(41):692–703.

24. Adams JA, Farst KJ, Kellogg ND. Interpretation of Medical Findings in Suspected Child Sexual Abuse: An Update for 2018. *J Pediatr Adolesc Gynecol* 2018; 31(3):225–31.

25. Witt A, Brown RC, Plener PL, Brähler E, Fegert JM. Child maltreatment in Germany: prevalence rates in the general population. *Child Adolesc Psychiatry Ment Health* 2017 [cited

- 2023 May 29]; 11:47. Available from: URL: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5621113/>.
26. U.S. Department of Health & Human Services, Administration for Children and Families, Administration on Children, Youth and Families, Children's Bureau. Child Maltreatment 2021; 2023 Feb 9 [cited 2023 Jun 1]. Available from: URL: <https://www.acf.hhs.gov/sites/default/files/documents/cb/cm2021.pdf>.
27. 2016: Anstieg der Verfahren zur Kindeswohlgefährdung um 5,7 %; 2017 [cited 2023 May 30]. Available from: URL: https://www.destatis.de/DE/Presse/Pressemitteilungen/2017/10/PD17_350_225.html.
28. Rhona Lewis. Types of Attachment Styles and What They Mean; 2020 [cited 2023 May 30]. Available from: URL: <https://www.healthline.com/health/parenting/types-of-attachment#examples>.
29. Norman RE, Byambaa M, De R, Butchart A, Scott J, Vos T. The long-term health consequences of child physical abuse, emotional abuse, and neglect: a systematic review and meta-analysis. PLoS Med 2012 [cited 2023 May 22]; 9(11):e1001349. Available from: URL: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3507962/>.
30. Felitti VJ, Anda RF, Nordenberg D, Williamson DF, Spitz AM, Edwards V et al. Relationship of childhood abuse and household dysfunction to many of the leading causes of death in adults. The Adverse Childhood Experiences (ACE) Study. Am J Prev Med 1998 [cited 2023 May 22]; 14(4):245–58. Available from: URL: [https://www.ajpmonline.org/article/S0749-3797\(98\)00017-8/fulltext](https://www.ajpmonline.org/article/S0749-3797(98)00017-8/fulltext).
31. Al-Qahtani MH, Almanamin HH, Alasiri AM, Alqudaihi MH, AlSaffar MH, Yousef AA et al. Child Abuse and Neglect Awareness among Medical Students 2022 [cited 2023 Jun 23]; 9(6). Available from: URL: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9221984/>.

12. CURRICULUM VITAE

Kim Laura Dehling was born on the 9th of September 1996 in Schwäbisch Gmünd, Germany. In 2012, she spent one year in a Canadian high school in Belleville, focusing on learning English and participating in extracurricular activities like theater and arts. She successfully completed her Abitur in 2016 in Schwäbisch Gmünd and worked for a year as an emergency medical technician as part of a federal voluntary service at Arbeiter-Samariter-Bund in Merklingen, where she managed medical emergencies as a first responder. She started her studies in 2017 in Rijeka, Croatia, where she is currently studying medicine in English. During her studies she liked to spend her time outdoors, reading or painting and started learning Croatian and Korean, with her goal to travel to Korea one day.