Severe abuse of infants – an evolutionary price for human development?

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Child abuse has been researched extensively and causes are usually found to arise from a large spectrum of psychological, socio-economic and cultural factors. This article evaluates infant abuse from an evolutionary perspective. It compares brain growth and neurological development of human infants with that of other primates, and relates these findings to infant abuse. The extra-uterine brain development in the early years of childhood, together with the greater vulnerability of the child as a result of immature neuro- and motor development as well as an 'unprotected and growing brain', may be an overlooked but important evolutionary reason for human infant abuse.

After studying the history of child abuse for the best part of his life, and spending decades on an in-depth analysis of childhood and society, Lloyd deMause[1] concluded that the history of humanity is founded on the abuse of children.

Just as family therapists today find that child abuse often functions to hold families together as a way of solving their emotional problems, so too the routine assault of children has been society's most effective way of maintaining its collective emotional homeostasis.

The effects of childhood abuse have been well documented.[2-4] Adverse childhood experiences are known to result in social, emotional and cognitive impairment and adoption of health-risk behaviour, and can therefore lead to disease, disability and social problems and ultimately even early death.

Indeed, *Homo sapiens* seems to have a poor record when it comes to violence against infants and children, as child abuse homicides, abandonment and neglect statistics prove.[5] Parents seem to be the greatest perpetrators of violence against children (80%), while mothers and fathers appear to be equally involved in the murder of small children.[6]

From an evolutionary perspective, child abuse and neglect can be viewed as a form of discrimination against offspring in circumstances unfavourable to parental care, as described in the parental investment theory.[7]

According to this theory, parents with poor or unstable resources or children with physical or mental handicaps would be more prone to child maltreatment,[8] with infants and young children at greater risk of abuse than older children.[9] However, many of these theories had their basis in research conducted on fish, birds and non-primate mammals and have recently been criticised.[10]

Contrary to common perception, other primates have been observed to deliberately harm their own offspring even while living in stable and undisturbed social groups,[5] and indeed recent studies suggest that the spontaneous occurrence of infant maltreatment in monkeys may be a close approximation to child maltreatment.[11]

The intention of this article is to contribute to a wider understanding of child abuse by focusing on the differences between *Homo sapiens* and other primates. It is important to acknowledge that an attempt to 'explain' child abuse is not an attempt to 'excuse' it.[12] Explaining a behavioural pattern such as child abuse does not alter perpetrator responsibility. It is important, however, to understand all its potential origins in order to use this knowledge to design strategies to prevent it.

Evolutionary view of human development

Hominids originated 5 million or more years ago, but the rapid increase in brain size did not occur until 2 million years ago. In order to cope with the increasingly dangerous environment, selection pressure advantaged those individuals with a higher level of ingenuity, which was needed to cope with a progressively drier and less protected environment.

Additionally, the shift towards bipedalism, probably at least partly as a result of the need to gather, scavenge or hunt for food in progressively drier vast savannah grasslands, resulted in energetically more efficient refashioned pelvis and hip bones. However this also produced a restricted pelvic canal through which the human baby is born.[13]

It has also been suggested that these two competing trends in our evolutionary history resulted in the inevitable consequence of a developmentally earlier birth.[14] Therefore the human brain is required to enlarge for a significant part outside the maternal body. The human brain almost doubles in size in the first year after birth.

Human babies only reach a state of development comparable with chimpanzee newborns at the age of 18 months.[15] The fact that the mother has to carry the child over a longer period of

time in order to let it develop outside her body may have led to her becoming stronger and heavier, thereby decreasing the degree of sexual dimorphism, common in other apes.

Human babies, therefore, acquire the mobility and independence of a newborn chimpanzee (our closest evolutionary relative) only at the age of about 18 months.

This derived adaptation of giving birth to highly dependent infants is known in the anthropological literature as exterogestation[16] or secondary altriciality.[17,18] This adaptation was a necessity since individual human encephalic development was limited by obstetric constraints on brain size. In Table I age of adulthood, gestation period and brain size of chimpanzees, gorillas and humans are compared.

Human brain development

Significant growth of the head occurs during the first years of life. The neonatal skull initially has 44 bones, with a number of these bones fusing together to make single bone elements. The adult skull comprises 22 bones.

At birth, the neurocranium appears large relative to the face. It is approximately 25% of its adult size (41% in chimpanzees), whereas the face is only 10 - 15% of its adult size. By the end of the second year the neurocranium has reached approximately 75% of its adult size. Fig. 1 shows two human skulls – the one on the left is of a neonate, and the one on the right is of an approximately 1-year-old infant.

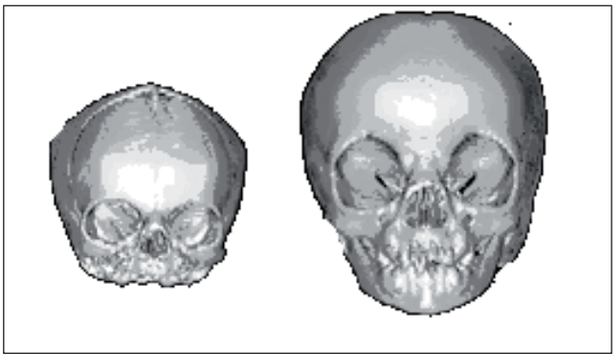

Fig. 1. Facial views of the skulls of a neonate (left) and of a 1-year-old baby (right), highlighting the substantial growth of the brain during the first year of life.

Growth of the neurocranium is directly related to expansion of the brain. The bones of the neurocranium are joined by fibrous sutures, which permit growth along the edges of the bones. The sutures are relatively wide at birth, with large gaps where two or more sutures meet. These areas are called fontanelles, and are often referred to as a baby's 'soft spots'. The brain in these areas is not covered by bone and is therefore very vulnerable to any trauma. Eventually, the bones at each suture fuse. The metopic suture between the left and right frontal bones normally fuses relatively early (from 3 to 7 years).

Child abuse

Child abuse has only recently been reported in detail, with sporadic reports in the early medical literature.[19,20] In 1946 Caffey described a syndrome including long bone fractures, intracranial haemorrhage and trauma, which he connected with child abuse.[21] In 1962 the term 'battered child syndrome' was introduced, alerting doctors worldwide to the possibilities of child abuse in their patients.[22] In 1992 the term 'shaken baby syndrome' was popularised by Duhaime. Trauma is the leading cause of childhood deaths worldwide.[23] The majority of children die as a result of head injuries.[24] While bigger children are often the victim of falls and motor vehicle-related injuries, one of the most common causes of severe head injuries in children under the age of 2 years is non-accidental injury.[25] In fact, child abuse and neglect occur predominantly in the age categories between 0 and 18 months (Fig. 2).[26]

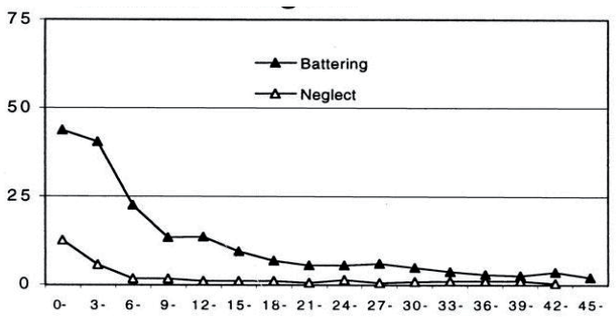

Fig. 2. Incidence of assault and neglect as a function of age in 3-monthly intervals.

Over the last two decades much research has indicated that abuse of small children is very different from that of older children and tends to be of a more severe nature than maltreatment of older children. Size (or age) of the victim appears to be one of the major determining factors in the vulnerability of the victim as well as his or her prognosis after the assault. Nearly all infanticide takes place under the age of 18 months.

Discussion

Recently, an association has been claimed between the acquired ability to reliably kill from a distance and the human social revolution, about 2.0 - 2.5 million years ago.[27] In this article we argue that the association between young infant age and severe abuse and/or infanticide results from increased vulnerability.[5]

TABLE I. COMPARISON OF GROWTH, GESTATION PERIOD AND BRAIN SIZE OF CHIMPANZEES, GORILLAS AND HUMANS

	Chimpanzees	Gorillas	Humans
Adulthood (yrs)	7	7	18
Average gestation age (mo.)	7.5	8.5	9
Brain size at birth (% of adult)	41		25

If one compares the development of the human child with the development of other primates, there are a significant number of important differences, which may lead to increased vulnerability of the human child.

Long period of extra-uterine growth. Intra-uterine growth is a typical feature of mammals. The fetus 'floats' in amniotic fluid within the uterus, which provides an extraordinary form of protection. Furthermore, the fetus is protected by the maternal abdominal wall and the extra care the mother is likely to take as a result of the heavy abdominal load. As a result intra-uterine injuries are extremely rare. However, since a significant part of human growth is postponed until after birth, the child is not protected by this mechanism for the major part of its growth. The human child also takes a long period to mature to adulthood, approximately 18 years, compared with only 7 years in chimpanzees.[28]

Explaining a behavioural pattern such as child abuse does not alter perpetrator responsibility.

Extra-uterine brain development. Significant human brain development occurs in the first 3 years after birth. The brain is particularly vulnerable to injuries during the initial 18 months after birth as a result of the rapid brain growth, ongoing synaptogenesis as well as dendritic arborisation. The reason why much human brain growth takes place outside the uterus is mainly the incapacity for the (progressively larger) fetal head to pass through the bipedal pelvis. Brain development is the most intricate and delicate process in human development and it is this in particular that makes the infant vulnerable.

Immature skeleton and growing skull. When a child is born, the majority of calvarial bones are not yet ossified, and are relatively pliable and soft, and therefore the cranium is unable to protect the brain adequately. Additionally, because the extra-uterine head growth is significant, the vault bones are not yet united and there are large spaces (fontanelles) between the bones. This makes the neonatal brain more vulnerable.

Immature neurodevelopmental state. Since a significant part of human brain development occurs postnatally, the human neonate is born in an immature neurodevelopmental condition. Unlike other primates, therefore, human neonates are unable to grasp effectively, move or protect themselves in any meaningful way, rendering them defenceless and therefore more vulnerable to abuse. It is known from animal studies that abuse is associated with maternal protectiveness and control and that abuse by the mother is more likely to occur when the infant fails to respond.[29,30] This can be aggravated when the mother was orphaned herself,[31] or when conflicts or extragroup disturbances occur.[32] Human studies have also indicated that children with mental retardation are abused more often[33] and it is therefore reasonable to assume that greater dependency of the human child on parental care might lead to increased frustration and exhaustion compared with other more maturely born primates.

Lloyd deMause introduced the term 'poison container'. According to him the main psychological mechanism that operates in all child abuse involves the use of children as 'poison containers' – receptacles into which adults project disowned parts of their psyches so that they can control these feelings in another body without danger to themselves.

From comparison with infants of other primates it appears rather obvious that the human infant is more vulnerable to this type of abuse as a result of a number of evolutionary factors.

Conclusion

Although child abuse has been extensively researched and causes are usually found to arise from a large spectrum of cultural and socio-economic factors as well as psychological characteristics, it is our opinion that a significant part of human child abuse might result from aspects of the evolutionary process, finally shaping the human species.

This opinion is in accordance with the earlier notion of the child as a 'poison container' as described by Lloyd deMause, but extends his premise deep into prehistoric times. The extra-uterine brain development in the early years of childhood, together with the greater vulnerability of the child as a result of immature neuro- and motor development, as well as having an 'unprotected and growing brain', may comprise a set of overlooked but important evolutionary factors contributing to the otherwise 'inexplicable' phenomenon and effects of human child abuse.

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