Definition and Prevalence

Traditionally, hemiplegia or hemiparesis, is defined as a central “unilateral” palsy that only affects one side of the body, almost always of “spastic” type (Aicardi and Bax 2009), while the word “hemidystonia” is more adequately used to define the dyskinetic form. With respect to cerebral palsy (CP), a distinction is made between a *congenital form* of hemiplegia, when the lesion occurs before the end of the neonatal period (within the first four weeks of life), and an *acquired form*, when the lesion provoking hemiplegia occurs later, within the first three years of life. According to the main case studies published (Hagberg and Hagberg, 2000), congenital forms amount to 70-90% of childhood hemiplegia, while acquired forms only amount to 10-30%. In a recent review conducted by the SCPE (Surveillance of Cerebral Palsy in Europe) working group, the prevalence of unilateral spastic hemiplegia accounted for about 0.6 per 1000 live births and it did not change significantly over time (Krägeloh-Mann, 2009). Hemiplegic forms are the most common expression of CP (more than 38% of cases) and the second in terms of frequency, after diplegia, in premature infants (around 20% of cases) (Hagberg et al. 1996; Himmelmann et al. 2005).

In many cases of hemiplegia (around 30-40%, according to Hagberg) it is not possible to trace back, in the infant’s personal or family history, the etiopathogenic factors that determined the cerebral lesion. This can be confirmed for normal term infants, while for premature infants, who later develop hemiplegia, pre- or perinatal factors are frequently and significantly correlated to the lesion (Cioni et al. 1999). In both normal term infants and premature infants multiple genetic and environmental factors can play an important role in lesion etiopathogenesis, acting in a negative way (“detrimental” elements) and in a positive way (“protective” elements). Among them are thrombophilic factors, which are particularly relevant in the outbreak of cerebral infarction in normal term infants (Mercuri et al. 2001). However, it is difficult to establish a linear correlation between a genetic factor of the coagulation chain (for example Leiden factor V), and a complex syndrome like hemiplegia, determined by many factors and containing multiple and different clinical pictures (Smith et al. 2001). The lesion has long been thought to be driven by nonhemato-
logic maternal and perinatal events. Conversely, recent studies have indicated that plasma-phase risk factors, such as Leiden factor V, elevated lipoprotein (a), and mutations in MTHFR, may have an important role in the pathogenesis of perinatal stroke, if not always in the risk of recurrence. The latter is only about 2% according to the largest follow-up study to date. Nonetheless, when strokes do recur, they tend to be associated with the presence of plasma-phase risk factors in the affected child. Authors are therefore suggesting that a small percentage of children with a first perinatal stroke may benefit from anticoagulation therapy, both to prevent stroke recurrence as well as occurrence of a second, non cerebral thrombotic event (Grabowski et al. 2007).

Neuroimaging, especially magnetic resonance imaging (MRI), enabled, also in the field of childhood hemiplegia, very encouraging studies on the natural history of the lesion and the factors determining it, although this section of neurology is only at the beginning of its development. Negative MRI in children with congenital hemiplegia, as reported by some authors (Wiklund, 2000; Krägeloh-Mann, 2004, 2007, 2009; Korzeniewski et al. 2008; Robinson et al. 2008), is rare (Cioni et al. 1999). The scanning may probably be judged as normal due to a mistake in MRI execution, timing, or to poor quality of the images obtained (Korzeniewski et al. 2008). The most frequent lesions of hemiplegia in children can be subdivided into malformation groups (cysts of different nature, schizencephaly, other disorders of neuronal migration, etc.), periventricular lesions (leukomalacia), atrophy and dilatations of the lateral ventricle, especially at the level of the atria, cortico-subcortical lesions (porencephalic cysts, areas of perilesional gliosis), diencephalic lesions (affecting basal ganglia, thalamus, internal capsule) and diffuse lesions, as a result of infant cranial trauma. The above-mentioned lesions can be grouped according to the type observed by pathologists, through neuroimaging and timing, that is to say the development stage during which they become patent (pre-, peri- or postnatal).

Krageloh-Mann (2004, 2007, 2009) classified MRI results according to the etiopathogenetic patterns in four groups:

1: brain maldevelopments, or “1st and 2nd trimester patterns”, presumed to occur in utero, such as lissencephaly, pachygyria, polymicrogyria, focal cortical dysplasia or unilateral schizencephaly, accounted for 16%;

2: periventricular white matter (PWM) lesions related to the early 3rd trimester of pregnancy and the pre-term infant, such as periventricular leukomalacia (PVL) defects following intraventricular hemorrhage (IVH) or periventricular hemorrhagic infarctions, accounted for 36%;

3: cortical or deep gray matter lesions that occur towards the end of gestation “late 3rd trimester patterns” and peri or neonatally, such as basal ganglia/thalamus lesions, parasagittal injury, multicistic encephalomalacia and middle cerebral artery infarcts, were noted in 31%;

4: miscellaneous patterns considered abnormal but not meeting the above criteria were seen in 7%. Again, there was a clear difference between pre-term and term infants: PWM lesions occurred significantly more often in pre-term than in term (86% vs 20%, p<0.001) infants and cortical gray matter lesions significantly less often (0 vs 41%; p<0.01). Brain maldevelopments occurred in pre-term nearly as often as in term infants (14% vs 16%, p>0.05).