

## A Rehab Doc's Take on Brain Injury

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My answer to this is basically that kids all have an underlying and incredibly powerful drive to grow, develop, and learn. They will use whatever brain tissue they have and do as much as possible with it. All of us know kids with severe progressive neurodegenerative diseases who for years went undiagnosed because they were making as much progress as they did despite it for so long. And we all know that when kids with hydranencephaly, having just a little basal and gangliar tissue, will use it to connect with and recognize caregivers, enjoy some music, etc...I guess they save what they've got for the truly important things in life!! A bad looking CT or MRI is just a picture of an injured brain, and does not in itself tell you exactly how much that brain can still do, or predict lifespan.

The other, related part of this answer is "plasticity". The younger the brain the less committed certain parts are to doing certain specialized functions. Plasticity is not infinite and it is not a free lunch. For example, kids with right hemiparetic cerebral palsy don't have aphasia like an adult with a left sided cortical stroke and right hemiparesis most often does. But the child with CP is more likely to have some spatial-perceptual and learning or milder language problems. For the amount of brain tissue lost, the child's hemiparesis will also be a lot milder than the adult's but there will generally be at least a little. This is why people in general are amazed at what a child who has a hemispherectomy can do and how "normal" they look...but some parents, who were expecting totally normal, have been disappointed with their real results.

So there's not a lot of white matter. So what there is works a little overtime to get through what messages it can. When not enough messages that control excess tone are getting through (when it comes to motor functions especially, the cortex is largely inhibitory in function) we see a lot of spasticity and basically we try various ways to send the message to relax with the various medications and such we use. Then whatever messages to move a certain part a certain way can get through will better be able to accomplish something. White matter also has some function in learning, connecting the different areas of gray matter together and connecting the hemispheres with each other. The "diffuse axonal injury" seen after head trauma is largely a white matter injury, disrupting lots of connections, and generally results in overall inefficiency of operation of the brain. Exactly how new connections get established and how brain function continues to improve over months to years afterwards is still more than a little mysterious.

Remember that the resolution of even the best neuroimaging is still a little limited. There are many things we could not see on CT scans that we can see now on MRIs but you can't see down to the level of an individual nerve cell by any means. The famous cases where the

person was thought to have hydroencephaly but actually had severe hydrocephalus with enough cortex to learn algebra would be less likely to be mistaken today; these were recently brought up in an ethics discussion for a baby with hydranencephaly and the question was brought up whether the shunt should be done just to see if in fact this was the case instead. This is no longer at all likely; and in a way, that was the wrong reason to do the shunt. The point is that the child obviously had capability to have a quality of life despite the obvious limitations and needed the shunt to live and to avoid having a huge head that would have limited mobility and care. (That's what persuaded the neurosurgeon to do it.)

So remember that every brain is designed to grow and develop, and even an injured brain will grow and develop to whatever extent is possible. Your child's abilities and potential to maximize them matter more than the picture of how the brain looks. Also, this has come up before on this list-but if someone is diagnosed with mental retardation (about 50% of people with CP have some degree of MR) it does not mean they cannot learn. It means that they may learn more slowly, require more repetitions, may have to be more explicitly taught things that others just learn "naturally". We all face the challenge of pointing out that the cup is  $\frac{3}{4}$  full instead of empty-there is a world out here that tends to see it as either 100% full or nothing.

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