Laboring Humans: Giving Birth to Large-Brained, Large, Helpless Babies

Why is having a baby so tricky for human women? Childbirth in our species is uncomfortable at best, dangerous at worse and usually scary. How did our species evolve a reproductive system that has such characteristics? In fact, death in childbirth was once a leading cause of death for women of reproductive age. Furthermore, infant mortality is higher than death of the mother. At many times and places in human history, infant or maternal mortality were commonplace events. In developed countries today, many women carry a literal scar as a reminder of medical intervention during childbirth in the form of a caesarean scar. Caesarean sections represent the use of culture — in this case, technology — to ameliorate the strong natural selection acting on adult female and infant morphology in humans. Admittedly, good arguments have been made that childbirth has been over-medicalized in the United States and that caesarean sections are performed more often than necessary (at rates of up to 50% in some countries). But it remains true that childbirth is a time in the life cycle when women and their babies are at increased risk of injury or death. Without getting into arguments about *how* risky, *how* painful or *how* awkward childbirth is for women and babies today, it is fair to say that this process, which is at best uncomfortable and at worst, dangerous, is one of the kinds of human features that the anthropologist Krogman meant when he talked about "the Scars of Human Evolution". In fact, he even mentioned childbirth directly, when he said:

> **We have expanded our brain case tremendously, and there can be no doubt that many of the obstetrical problems of Mrs. *H. sapiens* are due to the combination of a narrower pelvis and a bigger head in the species. How long it will take to balance that ratio we have no idea. It seems reasonable to assume that the human head will not materially shrink in size, so the adjustment will have to be in the pelvis: i.e., evolution should favor women with a broad roomy pelvis.**

Recognizing the risks and dangers that are implicit in the human birth process in no way means being an apologist for the extreme medicalization of childbirth that is seen in the US and some other nations today. On the contrary, an understanding of the selective pressures at work on the various aspects of human morphology and developmental timing that constrain the birth process help us to understand the cultural and social context in which human birth has evolved. In fact, some of what we have learned can help us to *de*-medicalize the way women have babies.

What may be most interesting about the unusual way we give birth, is that the context of human childbirth is different from that in other primates. Other primates generally give birth not only without

assistance from other members of their group but in isolation. But humans give birth with other people around to help out. Briefly, because of the size and shape of the human birth canal and the size and shape of our babies, the infant typically rotates as it passes through the birth canal and emerges with the newborn facing away from its mother. This stereotypical mechanism of birth in humans is not the only way babies are born or even the only way that babies are born without difficulty, but it is by far the most common way today — and importantly from an evolutionary perspective, it is the mechanism that is associated with the lowest risks to the mother and the infant. Trevathan argues that because of this rotation as well as a number of other characteristics of human birth, humans benefit from assistance during childbirth in a way that other primates do not. That help can come from many different individuals: midwives, a woman's more experienced sister or mother, or an obstetrician – sometimes even a husband! This help is an extension of what Hrdy refers to when she talks about humans as a species of allomothers, or alloparents, that is, people -- who are not the mother – who care for and provide for children. This social fabric of alloparents extends back in the life cycle at least to childbirth when women give birth with the assistance of others. The investment of other members of the group in the process of childbirth makes it more likely that there will be a successful outcome – that is, a healthy baby and mother. Of course, after birth, the demands of immature but relatively large-bodied infants for attention are very high and they benefit from the attention of those alloparents, as well.

In addition to the shape of our pelvis, there are a number of aspects of our morphology and our development that have an impact on the way we give birth. These include: the size of infants' brains at birth, the overall body size of our infants at birth, the breadth of infants' shoulders, the stage of development of our infants at birth, and (as already mentioned) the extent to which we assist each other during the process of labor and delivery. The evolutionary changes that occurred in each of these phenomena left legacies on the birth process that characterize how humans give birth today.

Early in hominid evolutionary history, the pelvis was dramatically modified as a result of a shift to habitual upright gait. This locomotor change had important consequences for the way we give birth. Tague and Lovejoy reconstructed childbirth in australopithecines who had a flat ,wide pelvis, proposing a mechanism of birth that is neither entirely ape-like, nor entirely human-like. This is not surprising given the mosaic nature of australopithecines with their human-like locomotion and ape-like brain size. Generally, when people talk about australopithecine pelvic morphology, they have assumed that because australopithecines did not have large brains they were not under selection from obstetric constraints. But the change in pelvic morphology required by the locomotor shift demanded a change in the

mechanism of birth. That is, although the pelvis was dramatically restructured because locomotion changed, that morphological change had obstetric consequences.

Obviously, the human infant's head which fits tightly within the birth canal represents a significant challenge to the birth process. But another dimension of the infant body that sometimes creates difficulty during childbirth would have also been an issue for australopithecines. Trevathan has pointed out that humans like all apes, have broad rigid shoulders. Humans have a tight fit between the birth canal and the neonate. Furthermore, the birth canal changes shape over its length. As a result, the head typically rotates during delivery so that its longest axis will be accommodated by the birth canal's largest diameter, which is transverse at the inlet and anterior-posterior further down. Our neonates' broad rigid shoulders also typically follow this same route, so that after the head has emerged from the birth canal, the body rotates to allow the shoulders to take advantage of the same longest axes at each plane of the birth canal. This complex occasionally creates a dangerous condition that obstetricians call shoulder dystocia, in which the shoulders get stuck or impacted in the birth canal. This occurs more commonly in larger infants, but can occur in small ones as well. It can lead to a range of injuries for mothers or infants. Today, midwives and physicians often try a series of maneuvers such as changing a mother's posture to alleviate the obstruction, or may even resort to breaking an infant's clavicle to ensure that it can pass through the birth canal. Nonhuman apes do not experience shoulder dystocia because their birth canals are large relative to the size of their infants' bodies. Although australopithecine neonatal brains may have passed through the birth canal in a transverse orientation, their shoulders (which, like ours, were at right angles to the longest axis of the head) would have had to pass through the same way. Hence they may have experienced some aspects of the rotation of modern human birth. We know that some changes in the birth mechanism must have taken place by the time of australopithecines and that neonatal cranial size is not the only reason for obstetrical adaptations of the birth mechanism. It is reasonable to suppose that a bipedal, broad-shouldered species giving birth to large bodied infants would have had different obstetrical constraints than a quadrupedal one and hence may have pelvic changes to accommodate those constraints.

Although human newborns may seem tiny to first-time parents, the size ratio of newborn human babies to their mothers is big compared to that of other primates. Gorilla newborns average about 2.7% of their mother's body weight, chimpanzees 3.3% — and human newborns about 6.1 % of the size of their mothers. This fact accounts for some of the costs associated with carrying human babies around *in utero* but also after they are born. De Silva has argued that this high infant-mother body mass ratio has

characterized humans and our close relatives for a long time, probably since the time of australopithecines.

Even though our babies have heads that fit tightly within the birth canal, humans today give birth to newborns who have completed only a small percentage of adult brain growth at the time of birth. On average, human babies are born with brains that are about 29% of their completed adult size. The comparable figures for monkeys are 50-65% and 40-47% for apes. Many nonhuman primates, like chimpanzees, are born at the inflection point in the growth curve, where brain growth slows down. But humans continue to grow at fast fetal rates of growth for some months after they are born. This is what Ashley Montagu meant when he said that humans have "exterogestate fetuses". Our babies continue to grow like fetuses outside the womb. This is possible because we are able to continue to incubate them culturally and protect them from the environment. DeSilva and Lesnik have shown that this pattern of giving birth to helpless babies probably dates back to the period in evolutionary history when significant brain expansion took place in our ancestors.

Finally, there is good evidence from modern clinical environments that it is not only physical support that helps women in childbirth to have successful outcomes. Emotional support during labor and delivery is important too and there is strong evidence that shows that women who receive emotional support during childbirth have lower rates of all types of intervention from clinicians. The implication is that women who give birth without emotional support and their babies are at greater risk than those surrounded by familiar supportive people. This is hardly surprising given the socially supportive environment in which women have been birthing for many hundreds of thousands of years at a minimum and perhaps much longer.

The imperfect and risky way that humans give birth is, as Krogman thought, the result of our evolutionary history. But it seems to me more a trade-off between competing constraints than the scar of an imperfect evolutionary process. Our cultural adaptation in the form of social, clinical and emotional support ameliorates the risks of childbirth and helps us to take care of the large, helpless babies that are the outcome of our particular way of giving birth.