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Physiological birth: how it works

AIMS Journal, 2023, Vol 35, No 1

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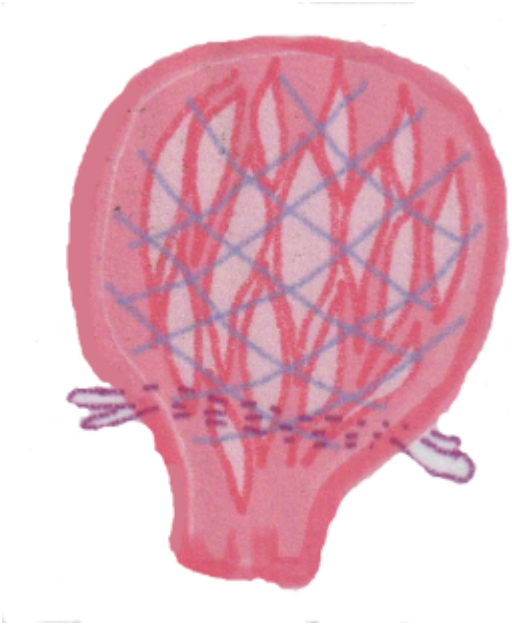
By Alex Smith

These days, it is easy to believe that birth is a medical procedure rather than simply being the final day or two of a physiological process that has been unfolding since conception. As a culture, we have become a little hoodwinked by the medical model of care and literally lost sight of birth as a physiological process - a process that, not always, but more often than not, could safely unfold within the course of the woman's normal daily round without any need for clinical supervision, latex gloves, protocols and partograms. In this article I hope to lift the 'hood' to take a look at just a few ways in which the pregnant body adapts in readiness to give birth safely and smoothly when trusted to do so in the time that it takes.

> *Childbirth is a physiological process that can be accomplished without complications for the majority of women and babies.*1

Starting with the womb: The womb or uterus is a bag of muscle that sits in the pelvis supported by the pelvic floor muscles and anchored to the pelvis, like a hot air balloon to the ground, by the uterine ligaments. When no baby is in residence, the womb is about the size of a small pear, but in pregnancy it can stretch and grow to the size of a large watermelon. The womb contracts every 15 to 20 minutes throughout life (otherwise it would atrophy) and, in labour, these contractions become so powerful that they make the womb the strongest muscle in the human body.



The womb is made of layers of muscle fibres. Longitudinal fibres are represented in the image above by the pale pink shapes, diagonal fibres are represented by the blue lines, and circular fibres, present in the lower part of the womb, are represented by the purple 'drawstring'.

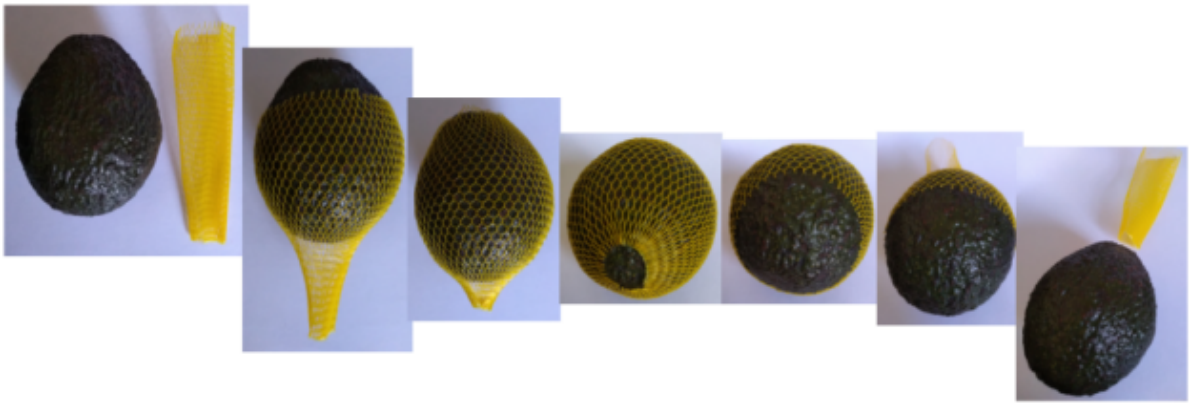
The opening of the womb, the area below the drawstring, is called the cervix. This can be felt at the top of the vagina like a circular doughnut. The passage through the cervix, the os, tends to face towards the back wall of the vagina, while the body of the womb lies forward over the bladder. In the non-pregnant state, the cervix feels firm like the tip of the nose, but very early in pregnancy the hormones progesterone and relaxin prepare the womb and soften maternal tissues making them stretchier. As a result, the cervix starts to feel softer like the lips, the uterine ligaments relax, and the womb becomes less contractile or more *quiescent*, allowing both the womb and the baby to grow. At the same time, the circular 'drawstring' fibres remain contracted keeping the opening of the womb closed and the baby safe and warm inside.

The softening effect of relaxin also allows the mother's rib cage to expand in pregnancy, requiring bras to be loosened long before there is any pregnancy bump. This facilitates the increase in lung capacity that is required to supply oxygen to the 45% (on average) increase in maternal blood volume. These*vital* changes happen within the privacy of the mother's body, without question or doubt. We may worry about losing the baby of course, but because no one is measuring or monitoring ribcage expansion, blood volume increase or relaxin levels, we give those aspects little if any thought and generally trust our bodies to know what to do.

If we imagine the womb as a knitted grow-bag for the baby, the cervix is its polo-necked opening. Originally made of a firm aran yarn, the cervix changes in pregnancy to cashmere with shirring elastic or lycra. The vast majority of labour, from the first twinges to the final hour or two before the baby emerges, is concerned with the further softening, shortening and opening up of the polo-neck cervix wide enough

for the baby to ease through into the vagina. *There is no injury happening during this time*; it is simply a series of muscular contractions driven by the hormone oxytocin. As oxytocin increases, the contractions become stronger, longer and closer together -*and still no injury*. This pattern of increasingly powerful waves of tightening is a welcome sign that the body knows just what to do. As the waves get stronger, levels of maternal endorphins increase. Endorphins are hormones that are chemically very similar to morphine but without the side effects. They act as a natural analgesia and help the mother to feel calm and relaxed and even quite sleepy as labour reaches its strongest phase[2]

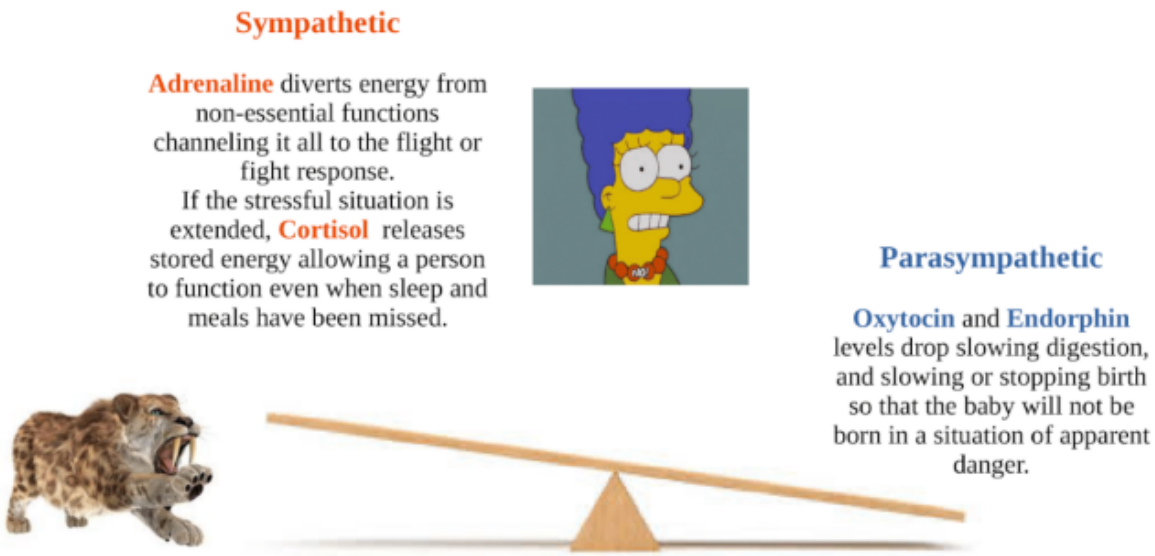
Contractions and retractions: When a muscle contracts, the muscle fibres shorten and fatten, and as the muscle relaxes the fibres become long and thin again. The womb contracts in this way throughout every day of a woman's life, but as pregnancy advances, the mother may feel these every-day contractions as an intermittent tightening sensation. During each wave of tightening her belly will feel firmer to touch, similar to the feel of the contracted biceps of a champion weightlifter through a jacket sleeve. In labour, however, the nature of the contractions change and when each contraction fades away the fibres get long and thin again - *but not quite as long as before the contraction*. This means that there is a gradual shortening of the longitudinal fibres with every labour contraction. This phenomenon is called retraction. Retraction has the effect of pulling the cervix up and then open. The longer and stronger the contraction, the greater the retraction. Retraction also reduces the space inside the womb. This has the effect of pushing the baby lower and lower with the firm pressure of the baby's head on the internal os assisting in the opening of the cervix.

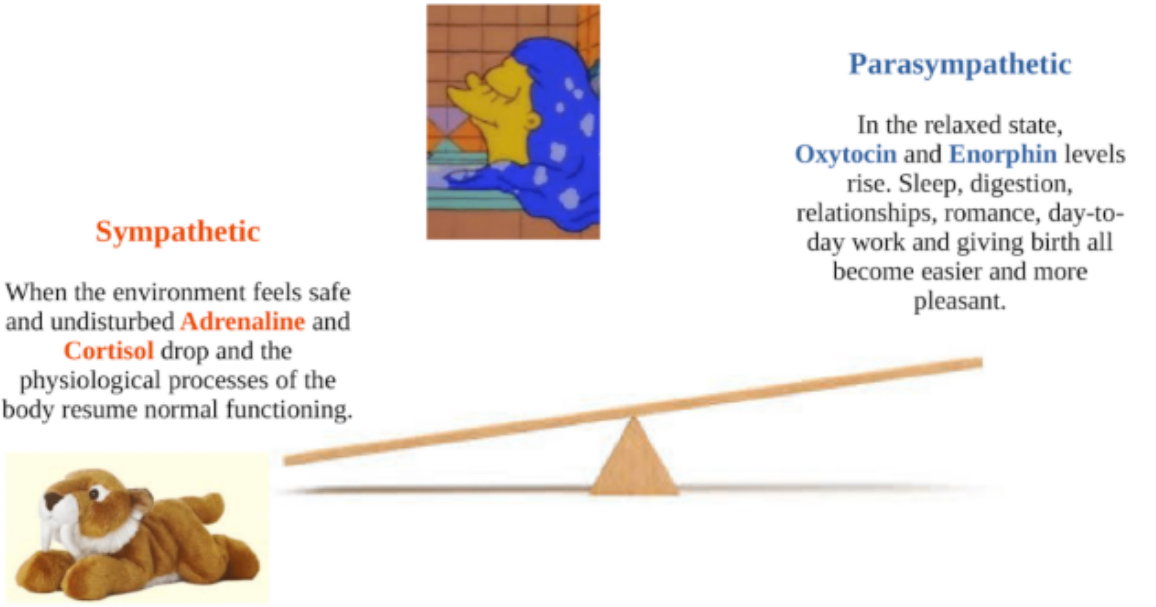


As the yellow net 'womb' is pulled upwards, its long 'cervix' neck shortens and then opens until the avocado 'baby' can pass through.

Contractions and the autonomic nervous system[3]: In order for the cervix to open smoothly, the 'drawstring' circular fibres need to relax. If the environment feels strange or if the mother feels watched, *the sympathetic branch* of her autonomic nervous system automatically produces stress hormones that will come to her aid. Adrenaline provides her with the power to confront a situation or to flee, tightening the 'drawstring' in order to give her time to find a place of safety and privacy before the baby arrives. The sympathetic branch works with the parasympathetic branch as a see-saw. When adrenaline goes up, oxytocin goes down, thus slowing or stalling labour. It is never a case of the mother being too stressed;

adrenaline is her super-power in a stressful environment. Human beings are mammals and physiological birth requires the same quiet and undisturbed environment that we prepare for our animal friends, if it is to proceed in the smoothest and safest way.





Gap junctions and the active stage of late pregnancy: There is a transitional phase of activity in late pregnancy when the body is changing from working to keep the baby in, to working to help the baby out. This phase can happily stop and start (or continuously trickle) for many hours or days while all the final

behind-the-scenes preparations are made. When this activity is noticeable (it isn't always) it is referred to as prodromal labour or as the latent stage of labour, but it may be better to think of it as*the active stage of late pregnancy* and to carry on with normal life accordingly.

It may also be helpful to think of labour as a concert, and this late pregnancy activity as the orchestra in place and tuning-up as the audience arrives. The lights are on, people are taking their seats and chatting excitedly, there is a lot going on, but, even if you have never been to a concert before, you know this isn't it. Then, at a certain point, when all is ready, the lights dim, a hush descends, and the conductor comes onto the stage. Now, the discoordinate sounds of instruments being tuned are replaced by stronger, rhythmic and coordinated waves of sound that eventually swell up and fill the entire hall leaving you feeling completely absorbed and focused - now you know for sure that this is it. The conductor in my analogy represents a physiological change that takes place just before and throughout a labour*that starts spontaneously*. At this point of readiness, gap junctions or connexins appear between the muscle cells of the womb, increasing in size and number as labour progresses. Gap junctions allow messages to be passed between the cells so that their activity (their contracting) becomes more coordinated, and thus, more effective. This of course has implications for labours induced before the body is ready.



Physiology and the length of pregnancy: when does the concert start?No one really knows for sure why labour starts when it does but there is growing evidence that babies play a significant part by sending chemical messages to their mothers' bodies that they are ready to be born, and that labour starts spontaneously when both mother and baby are prepared, physically and neuro-hormonally, for optimal labour, birth, and early postnatal wellbeing.4 The length of a normal healthy pregnancy varies widely and 'term' (when the baby is considered to be mature) is given in the text books as being between 37 and 42 weeks of pregnancy, a range of 35 days. A study in 2013 looking at the natural length of human pregnancies agreed with this figure.5 It is important to note though that they excluded babies born before 37 weeks (when many babies born shortly before this time are ripe and ready to go), and they excluded babies born by caesarean section or induction before the natural onset of labour, with twenty-four percent of respondents later reporting medical interventions that had artificially shortened their pregnancy. Therefore we have no idea how long those pregnancies would have been and so the study, while confirming that the usual 40 week mark is only one day within a wide range, does nothing to show us the true limits of that range.

Birth environment and the mind-body connection: Thinking of the 'tuning-up' phase as a normal phase

of late pregnancy (rather than early labour) means that the labour 'clock' has not started ticking in our minds, and that carrying on with normal life feels little different from carrying on through any of the other 'minor discomforts' of pregnancy. Amish women in America, who tend to have shorter (and apparently easier) labours, carry on with the housework, only calling the midwife when the birth seems close.6 Unless we are living in danger, the normalcy of the home environment and home routines has a positive effect on the physiological process because this is generally where we are at our most relaxed - and at our least inhibited. The thinking brain has little to do with it. The older part of the brain listens to our sensory input and when things look, sound, feel, smell and taste like home, stress hormones are at their lowest and the autonomic nervous system is balanced in favour of supporting the birth process. However, the older brain also listens to our beliefs so that, even at home, if each wave of tightening is greeted by the belief that labour is inherently impossible or dangerous, or that the sensations of normal labour are insufferable, the balance may tip the other way until the mother is helped to feel confident and safe again. Thus, not only is it the physical environment that affects the physiological process, but also the cultural environment from which the mother has shaped her belief system. Furthermore, the beliefs of her birth attendants will also have an affect on labour progress. Other people's doubt and fear is very infectious and once 'breathed in', it becomes our own.



A first time mother and her seconds-old baby. This young mother grew up within a family culture that trusted the birth process. She planned her homebirth environment according to her deeply held beliefs.

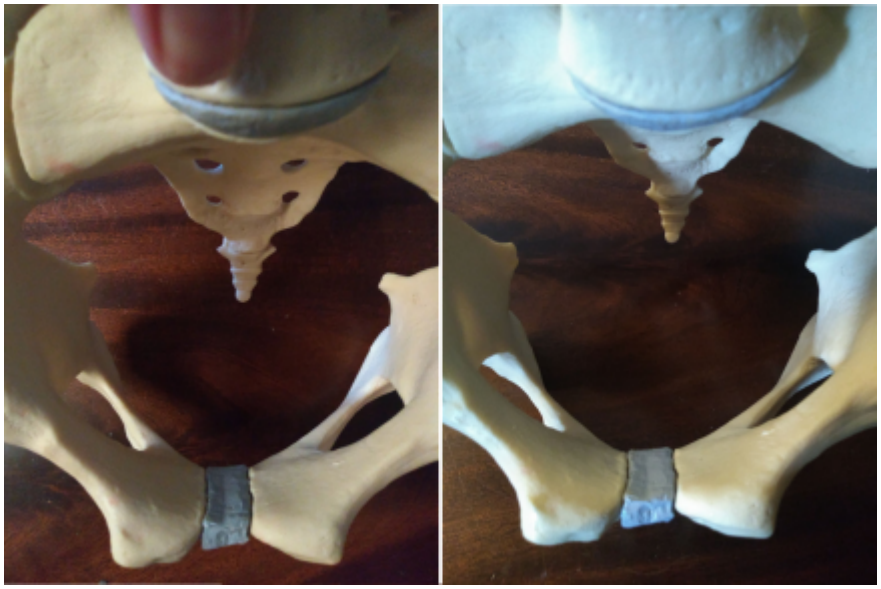
Continuing the journey from the womb and out into the mother's arms Eventually, the tissues of the cervix and lower segment of the womb have been gathered up leaving the cervix fully open, the lower wall of the womb quite thin, but the roof of the womb, the fundus, thick with muscle fibre. With the polo-neck cervix effectively pulled over the baby's head, further contractions utilise the fundus as a piston gently but powerfully guiding the baby downwards, through the vagina and into the mother's waiting arms. The powerful womb could easily do all the work, especially when the mother is in her most comfortable position, kneeling or on all fours perhaps, and especially when she feels unrushed and

undisturbed. She may well have an urge to bear down but, unwatched and in complete privacy, would only follow her instincts. In this way, both the work of the womb and the instinctive pushing of the mother can be regarded as part of the physiological process. On the other hand, forced, extended pushing, directed by the midwife or doctor, is not part of the physiological process. It is a technique or intervention called Valsalva pushing (after an 18th century doctor) and carries risks without improving outcomes.[7] It is not part of evidence-based practice and, although still widely employed, it is not routinely recommended.

Making room for the baby: Many women worry about how their baby will be able to travel through and emerge from what feels like such a narrow passage. This is how it happens - the widest part of a baby is the head and, with chin on chest (the position of our head when pulling on a tight jumper), the head is about 10 cm or 4" across, roughly the size of a grapefruit. The baby's head is able to mould, with the skull bones (that are not fused at birth) slightly overlapping as required to fit through the mother's pelvis.

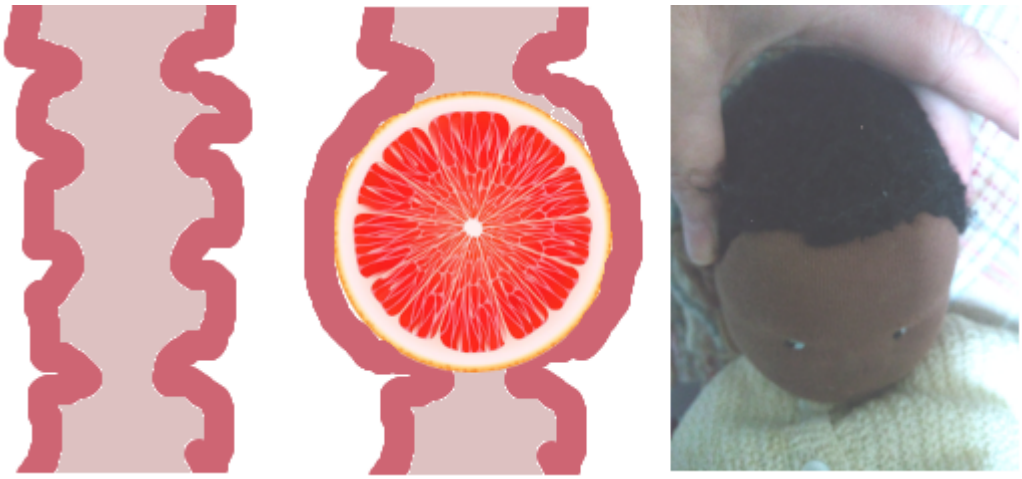


The pelvis, thanks to the stretchy effect of the pregnancy hormones, is able to expand, increasing its capacity by 30% when the mother is upright. When she is unwatched and unrushed, the mother instinctively moves in a way that makes further space available. For example, she may lean forwards, or raise one knee, or stand and raise alternate feet. In a strange and clinical environment, and with other people watching and directing her, she is unlikely to tune into these instinctive behaviours. Thus, privacy is required to fully support the physiological process.



In the picture to the left, the pelvis is positioned as if the mother is standing; in the picture to the right, as if she is standing and leaning forwards. This movement is seriously hampered when the mother is sitting or lying down.

The squidgy slippery baby (widest bit about 10 cm - the distance between your thumb and middle finger when they form a C shape) is travelling through the mother's expandable pelvis cushioned by the walls of the vagina. The vagina is not a smooth tube of tissue; it is made of horizontal folds of tissue called rugae. Rugae can unfold like an accordian and then, thanks to relaxin, stretch further still to make room for even the plumpest baby. The sensations during this last phase of the birth are felt in the back passage at first, and then, as the baby turns around the curve in the pelvis and presses onto the pelvic floor, the sensations move too and the mother feels them as stinging or burning around the entrance to her vagina. These feelings naturally prompt the unwatched and undisturbed mother to move closer to the floor to be ready to receive her baby.



The physiological process plans for every baby to be born on a natural life-support machine The baby

is born and gathered into the mother's arms. Meanwhile, the placenta is still attached to the inside of the womb and functioning as before. As long as the cord is not clamped, and while it is still pulsating, the baby will be receiving oxygen via the placenta providing a back-up supply while breathing becomes established. At birth the cord and placenta hold about one third of the baby's blood volume. As the blood continues to circulate from the baby to the placenta and back, over the next few minutes, more and more is left in the baby - very much like the tide coming in. Deferring cord clamping benefits even the tiniest babies.8 Stem cells in the cord are also drawn into the baby during this time and these are believed to be beneficial.9 After some time, the cord stops pulsating and gradually becomes whiter and flatter. The blood vessels close on their own and there would be no actual need to clamp or tie the cord once they have. The physiological process has that covered.

During this time the mother's natural instinct is to hold her baby close to her body. This skin to skin contact has huge benefits for the baby during the transition from womb to world. The temperature of the skin on the mother's chest is thermo-responsive to the baby, ensuring that the baby is warmed or cooled as needed to maintain an optimal temperature, and doing this more effectively than a radiant heater. We have known this since at least 1980,10 and it is true even for very premature babies.11 Skin to skin contact also regulates the baby's breathing, heart rate and glucose levels helping to maintain physiologic stability. This is true for all babies, even very tiny babies and those requiring special care12 These benefits are probably the result of lowering stress levels in the baby.13

The birth of the placenta: During a physiological birth the womb remains contracted after the baby is born and the waves of contractions cease for a while. This gives the mother and baby time to recover themselves and for the baby to find the breast for the first time. As long as there is no bleeding, and as long as the mother remains well, it does not matter whether this phase lasts a few minutes or a few hours. 14 Eventually, rhythmic contractions resume and, because the baby is no longer inside, the womb can contract down much more, thus reducing its internal surface area causing the placenta to peel away. The mother often responds to this fresh activity by wanting to become more upright again. The placenta drops down through the vagina and is expelled easily followed by an amount of blood from where the placenta had been attached. Further bleeding is then controlled by the diagonal muscle fibres of the womb contracting tightly around the bleeding vessels acting as 'living ligatures'. New mothers have a naturally higher level of clotting factors in their blood and this also helps to lower their risk of bleeding heavily after a birth. As with the earlier phases of labour, the physiological process works best when the mother feels unobserved and unrushed. Interacting with her baby in warmth and privacy will leave her awash with oxytocin helping the womb to contract, the placenta to separate and the physiological process to be completed in the safest possible way.

Author Bio: Alex is an editor for the AIMS journal, a grandmother and great grandmother, and witness to some truly wonderful physiological births. She has close to half a century's experience as a childbirth educator.

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14 Editor's note: The current UK medical definition of retained placenta is when it hasn't been born within 30 minutes following medical management, and within 60 minutes during a physiological birth. https://patient.info/doctor/retained-placenta. However, there are many anecdotal reports of delays of many hours without any problems. Patience and lack of disturbance is usually followed by the safe arrival of the placenta when the body is ready.