Fetal Growth Restriction

Professor Susan Walker
Head of Department

"Babies who are small have got a three-to-four-fold increased risk of antenatal or intrapartum stillbirth."

Transcribed directly from MOGCAST Episode 12. Listen here:
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"Hi everybody. Welcome to this episode of the MOGCAST. My name's Sue Walker. I'm Professor of Maternal Fetal Medicine based at the Mercy Hospital for Women and I'm the Head of Department of O&G at the University of Melbourne.

I'm loving doing these MOGCASTs and I hope you're enjoying them as well. And today I'm going to be talking about a really important topic and one that's very close to my heart, that is fetal growth restriction.

It's one of the most important conditions in pregnancy and you'll see we spend a lot of time in antenatal clinic screening for and thinking about whether a baby is achieving its growth potential or whether it might be small. And the reason that it's important is that it's sort of been said that if you're born small you keep dying all your life. What do we mean by that?

Well, babies who are small have got a three-to-four-fold increased risk of antenatal or intrapartum stillbirth. Among survivors, particularly those born preterm, they have a more complicated course in the nursery. Childhood survivors have an increased risk of neurodevelopmental impairment and indeed there is a lifelong legacy of placental insufficiency. With babies who are born small having an increased risk of adult diseases such as hypertension, diabetes, osteoporosis, cardio and cerebrovascular disease, and early death.

So, turns out, first nine months are the most important nine months of our life. And importantly, we would like those nine months to go right through to full term and to have a well-grown baby.

Okay, so I think something that often causes a bit of confusion is this overlap between being small for gestational age, that is a baby who's under the 10th centile for the number of weeks that it is, compared to fetal growth restriction, where this is really a failure of a baby to achieve its genetic growth potential, most commonly due to utero placental insufficiency.

Because not all small babies are experiencing placental insufficiency, although a lot of them are. But other reasons that a baby might be small is simply constitutional. A small baby of a very small mum. Or it might be that there are other factors that are going on with the baby which means that that is going to consistently restrict its growth.

And by this, I mean things like congenital infection, genetic or chromosomal abnormalities or structural abnormalities. These might be things that we call intrinsic to the fetus. There are things about this fetus that meant it was never going to have the potential to be well-grown. But most of the time we're talking about deprivational growth restriction. That is where the placenta is failing to supply sufficient oxygen and calories to maintain the nutritional and oxygen needs of the baby. And that's what I'm going to focus most on today.

So, as I say, it's a big and important condition and so we need some kind of approach, so I'm just going to signpost for you where we're going. First thing we need to think about in every pregnancy is, are there risk factors? The second thing we need to think about is what do we do to screen for fetal growth restriction even if there aren't underlying risk factors. I'm going to spend a few minutes talking about ultrasound, which is really the mainstay of diagnosis and surveillance. And then we're going to talk about timing, mode of delivery, and what happens after birth.

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“We screen for size, and we screen for wellbeing. ”

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Okay, so first things first, let's think about the pregnant patient we see and considering whether they might have risk factors for placental insufficiency or fetal growth restriction.

So, the risk factors might be maternal conditions. These might be things like diabetes or hypertension or people who've got underlying connective tissue disease, lupus or other major medical problems. There might be exposures during pregnancy that we know impair placental blood supply. So, things like smoking or other illicit drugs. We should look at the past obstetric history and see whether previous babies have gone to full term and whether they've been well grown because this is going to be a really important predictor of what's going to happen this time.

And then we need to look at risk factors that might exist in the current pregnancy. Is this a multiple pregnancy, for example, where we know that FGR rates are higher among both twins? Or affecting just one twin. Or have there been conditions like antepartum haemorrhage, so bleeding during the pregnancy, which we know can affect placental function and therefore supply to the baby.

Okay, so that's the first thing. Let's assess and see if she's got any underlying risk factors. The second thing we need to do then is think about growth restriction in every patient that we see in the antenatal clinic and in the labour ward because many, many women who have a small baby don't have any of those red flags in their history.

So, in terms of screening for fetal growth restriction, I guess we have two very broad tests that we do. We screen for size, and we screen for wellbeing. So, in terms of screening for a small baby, that is a small baby, we would do a symphysis fundal height measurement, which should be approximately equal to the number of weeks in gestation in centimetres.

So, this means that we do a symphysis fundal height measurement at every antenatal visit, and we should also do it when someone is admitted to labour ward, at least have a clinical assessment of “do I think that this baby feels like it's well grown and there's adequate fluid around it?”. So, we're assessing the whole uterine contents there.

So, symphysis fundal height, we should be doing that at every antenatal visit after 24 weeks. And then in terms of fetal wellbeing, we should be asking the mum, “have you noticed the baby is moving well?” Now, decreased fetal movements is a really difficult symptom to sort out. And I sometimes think that people must wonder, why do they keep asking me about whether the baby is moving well? They must be just kind of interested in what my baby's behaving like. But actually, what you and I know is the reason we ask that is what we're really asking is have you perceived a reduction in non-essential fetal activity related to hypoxia? All right, no one thinks that's what we're asking, but that's what we're asking.

So, it's quite a nonspecific symptom, but again, we should be asking everybody about it. Are you happy that the baby is moving well at every visit and every encounter in the emergency department?

Okay, so let's assume now that we've identified a pregnancy we think might be at risk either because of preexisting risk factors or because on screening we think gosh that baby feels small.

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“We should just have in the back of our mind, is there an underlying cause for this baby to be small?”

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All right, the symphysis fundal height is more than two centimeters below the gestational age in weeks so now we're going to turn to ultrasound, which is really the mainstay for diagnosis of fetal growth restriction.

And at the ultrasound, we're really going to be thinking about four things. First of all, what's the fetal size? Secondly, what's the fetal growth like? Thirdly, is there an underlying cause for this baby to be small that we can detect? And finally, what about fetal wellbeing? That is, is the baby adequately oxygenated as far as we can tell on ultrasound at this moment?

Okay, so let's go back over those four things. So in terms of doing an ultrasound for fetal size, this involves taking measurements of the baby. So, we take two head measurements, the biparietal diameter and the head circumference. We measure the abdominal circumference or around the baby's waist, and we do a femur length.

And then these four measurements are just put into a multiple regression equation, and it spits out an estimated fetal weight. And we usually say that estimate of fetal weight will be accurate within plus or minus 15%, although it can be out by a bit more than that if a mum's technically very challenging to scan, or if the baby's at the extremes of size, either very big or very small.

Okay, so now we've got a fetal size; now, what we need to do is convert that to a centile. So, we go to our charts, or our centile calculator and we say, okay, this baby is 1,800 grams at 34 weeks. What centile is that? And it might say this baby is on the 35th centile and the abdominal circumference, which is the most sensitive marker of growth restriction, is on the 20th centile, for example.

Okay, so now we've got a comparison of what is this baby's size like compared to its gestation matched peers? The second thing we might be able to get from the ultrasound then is an assessment of fetal growth. Now this is predicated on having had a previous scan, but certainly high-risk pregnancies, for example, multiple pregnancies, would always have scans at 24, 28, 32 and 36 weeks.

So this means that you can compare centiles between scans. So babies that, for example, have gone from the 80th to the 20th centile, I would be quite worried about growth restriction, even though it hasn't crossed that arbitrary threshold of being small for gestational age under the 10th centile.

Okay, so we've now looked at fetal size and we've looked at fetal growth. The third thing we should always be thinking about when we're doing a scan of a small baby, and particularly a baby that is quite small in early pregnancy, by that I mean less than 32 weeks, we should just have in the back of our mind, is there an underlying cause for this baby to be small? And as I said, the things that we should be thinking about is, are there signs that the baby might have had a congenital infection like toxo or CMV? Are there any signs that would suggest a genetic or chromosomal abnormality in the baby, and we should look back to aneuploidy screening for some clues about that. And are there any structural abnormalities that we might have missed at the 20-week scan that we should take another look at? But most commonly, what we will be doing when we're trying to identify the cause of smallness, especially as I say in early onset FGR, that is less than 32 weeks, is we'll be looking at the Doppler blood flow patterns.

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And the main Doppler blood flow pattern that we look at is blood flow in the umbilical artery. That is the two arteries that run from the baby to the placenta, where they pick up the oxygen and calories, and that returns through the umbilical vein to the fetus. And if the placenta is not functioning well, the blood flow in the umbilical artery will be encountering resistance.

And as you get resistance in the placenta, it will of course affect the lowest pressure phase of the cardiac cycle first. That is, it will impact on diastolic flow. So you will get a reduction in diastolic flow where there is placental insufficiency. Manifest by increased placental blood flow resistance. So this will be reported as an elevated SD ratio, so higher systole over diastolic ratio, or an increased umbilical artery pulsatility index. That suggests there's increased resistance in the placental bed and that is restricting blood flow from the fetus to the placenta. If there's more resistance, then we might get what we call absent end-diastolic flow. That is where there is no flow at all during the lowest pressure phase of the cardiac cycle, that is during diastole. And if there's even more placental resistance than that, we get what we call reversed end-diastolic flow. That is where the placental resistance is so high, the blood actually gets, starts being pushed back towards the fetus during the lowest pressure phase of the cardiac cycle.

Okay, so I do think that the umbilical artery Doppler is probably the most important Doppler that we use when we're assessing a small baby. It's really going to be in your back pocket to make an evaluation of, “do I think that this is most likely a small baby due to utero placental insufficiency”. And if the umbilical artery Doppler is abnormal, that will almost certainly mean the answer is yes.

Okay. So, that's given us a bit of an overview on what might be the cause of smallness; placental insufficiency versus underlying things, infection, genetic, chromosomal problems, structural problems and so forth. And now we need to get a bit of an assessment of fetal wellbeing. And on ultrasound, again, that's going to rely on Doppler assessments.

So, as I've said, the umbilical artery Doppler can give you an idea of whether there's progressive placental dysfunction, but we also look at the middle cerebral artery Doppler. This is looking at blood flow in the baby's brain. And we know that the baby's blood vessels will dilate in the baby's brain in response to hypoxia. That is the baby makes very smart decisions where there's reduced oxygen supply. It says cold hands, warm heart. The only thing I need to get out of this alive is a beating heart, a thinking brain and cortisol for my adrenal glands. So those three circulations get preferential vasodilatation in the setting of placental insufficiency. And of those circulations, the easiest one to interrogate with ultrasound is the middle cerebral artery. So, we’re looking for evidence that is dilated and that's manifest by a middle cerebral artery pulsatility index being reduced.

And the final Doppler that we have a bit of a look at is the ductus venosus. It's one of the three shunts of fetal life, and this is the vessel that will dilate that comes off the umbilical vein. It will dilate so that more oxygenated blood is rapidly transited through to the right atrium and streamed across the foramen ovale to the left atrium, left ventricle, and therefore to the brain and periphery. And so, the ductus venosus will dilate in early response to hypoxia to try and get more blood to those critical circulations. And the ductus venosus can also give us an idea, because it's very close to the right atrium, it can give us an idea if we're starting to run into impaired cardiac function. And that would be manifest by an absent or reversed A wave in the ductus venosus.

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So, don't want you to get too bogged down in those Dopplers, but it's just useful to have a bit of an idea of what are the circulations we look at in the fetus and how can they give us a bit of a guide as to fetal wellbeing.

The other indices of fetal wellbeing are amniotic fluid assessment, and we might measure that doing an amniotic fluid index, where we measure the four quadrants of amniotic fluid, deepest pocket in each, and that should be somewhere between 5 and 25. Or more commonly, we would use the deepest vertical pocket. So, the single pocket of amniotic fluid and making sure that that's more than 2 centimetres.

And finally, there's the biophysical profile. You've all delivered babies now and you've looked at assigning APGAR scores to them. That is, are they roaring? Are they a flexed little bunch of anger when they've just been delivered? Are they breathing? Are they moving well? And these are the sort of things that we're translating into fetal life when we do the biophysical profile. We're looking to see, is the baby moving well? That is, are we seeing trunk movements and are we seeing limb movements from extension back to flexion? Is there good tone in the baby? Are we seeing good breathing movements? Is the amniotic fluid assessment okay? And is the CTG normal? So that's the fifth element of the biophysical profile. And that's the fetal heart rate monitoring, which you will have seen both in labour and in the antenatal course. Okay, so they’re our assessments of fetal wellbeing.

Let's go on to our fourth thing. We've talked about risk factors. We've talked about screening for FGR. We've talked about diagnosis, with ultrasound being the mainstay. Let's now talk about surveillance. And surveillance we've really covered a little bit in the last little session because we're going to be really relying on CTG and ultrasound parameters of fetal wellbeing to help us decide on the timing of delivery.

In preterm FGR, we're trying to get every day and every gram that we can but without running the risks of a baby becoming hypoxic, acidotic then leading to asphyxia and ultimately to stillbirth. So, this is why we need to increase the frequency of surveillance with babies who are very small and where there are already marked Doppler abnormalities. And we would use a CTG or something like the ductus venosus Doppler to time delivery in preterm fetal growth restriction.

At term, I guess the imperative to keep the pregnancy going is not quite there because we're not trying to balance in-utero risks versus the risks of prematurity. So, once we're getting closer to term if we've got a small baby and particularly if there are other risk factors or if there are some significant abnormalities identified on the ultrasound, then we should be thinking about moving towards delivery.

Okay, so it will be a bit of an individualised surveillance program for a baby who's identified to be small. And what that surveillance program looks like will depend a bit on whether we think that this is fetal growth restriction, that is placental insufficiency, and it will depend on what gestation the baby is and how bad those parameters of fetal wellbeing are such that we think that deterioration could happen in a shorter period of time.

Okay, so that's surveillance. I promise you we're getting towards the end.

Okay, so let's now talk about timing and mode of delivery.

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> “My acronym for preterm in general is S.T.A.T.I.N.G. Steroids, Transfer, Antibiotics, Tocolysis, Intrapartum care, Neuroprotection, and Give more blood. ”

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So how we deliver babies who are small will depend again a lot on fetal condition and gestational age. If we've got a really small baby who looks like they're really struggling with abnormal Doppler's, we've made a decision we're going to deliver it prematurely for fetal indications, then that baby is not going to tolerate a prolonged induction process and the hypoxic challenge of labour. And so, most of these babies will be delivered by caesarean section.

As we get closer to term fetal growth restriction, for example, we've just got a baby that's a bit small, amniotic fluid is down, then of course we will give that baby a trial of labour because mum's much more likely to labour successfully as we're close to term and probably that baby's got enough reserve and we can reliably look at its wellbeing by using continuous electronic fetal monitoring, that is CTG, in labour. But nevertheless, we should be thinking about monitoring our small babies carefully.

And as I say, sometimes we haven't even picked that they're small until they arrive on the labour ward. So, each time someone arrives on the labour ward, we should just run through our mind, do I think this mum's got risk factors or does this baby feel small? Because that's an indication for continuous monitoring during labour, just because labour itself is a little bit of a hypoxic challenge.

Okay, so when we're dealing with preterm FGR can I remind you of my little acronym, which is S.T.I.N.G., right? So S is for steroids. So, if we're going to be delivering before 34 weeks, we should be giving corticosteroids to enhance fetal lung maturity. T is for transfer. Alright, so if you're in a non-tertiary centre and you've got a very small baby at 32 weeks or whatever, then don't forget that you need to transfer them down to a tertiary centre.

I is intrapartum care. So that's talking about mode of delivery, are we going to attempt a vaginal birth, that we need to do continuous electronic fetal monitoring, or is the baby in a breech presentation, or condition is pretty compromised, and we think that baby would be safer delivered by caesarian section.

N is for neuroprotection, so magnesium sulfate, if we're going to deliver a baby electively before 30 weeks, we should give that beforehand. And don't forget corticosteroids, of course, are neuroprotective as well. And then G is my final one, S.T.I.N.G, steroids, transfer, intrapartum care, neuroprotection. And G is imaginatively, I'm afraid, for ‘Give more blood’. By that I mean delayed cord clamping. Just remember preterm babies, they benefit from delayed cord clamping. Alright, so that's S.T.I.N.G. That's my acronym for preterm FGR.

While we're here, my acronym for preterm in general is S.T.A.T.I.N.G. Steroids, Transfer, Antibiotics, Tocolysis, Intrapartum care, Neuroprotection, and Give more blood. Alright, so that's just a little side element on preterm birth there.

Okay, so we've talked about timing and mode of delivery, and now we just need to think about postnatal care. And in terms of postnatal care, particularly where it's been preterm FGR and it's been quite a complicated pregnancy, we need to debrief the mum and the family. What happened? Why? What did the placental histology show? How has the baby gone after delivery? We also need to talk about recurrence in a future pregnancy. Are there underlying causes that we should be thinking about? Again, particularly if it was severe preterm FGR. Just think about should we be doing antiphospholipid screen and looking a bit harder to see why this baby was small.

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And then we would discuss how we would manage a subsequent pregnancy; increased surveillance, timely delivery when it was indicated. And many, but not all people would propose giving aspirin to reduce the risk of a subsequent baby being small for gestational age.

Okay, so I'm very sorry that has been proven to be quite a long podcast, but it's a big topic. But fetal growth restriction, as I say, it's one of my favourite topics. I love working with these families. It's great balancing the fetal risks in utero versus the neonatal risks born preterm. And in these pregnancies, particularly with preterm growth restriction, we've also got to think about the mum because these have got quite a high chance of mums developing preeclampsia as well.

So, they're a delight to look after these families, but you'll be involved in lots of fetal growth restriction, risk assessment, both in terms of taking a history for risk assessment, doing the symphysis fundal height. If you find the baby feels small, don't hesitate to call for the ultrasound. The ultrasound will do the biometry, get an estimate of fetal weight, an estimate of fetal weight centile, and assess the baby's growth.

And then we're going to go and look a bit more generally at the baby to see, can we find a cause for the baby being small, or do we think it's just placental insufficiency? And finally, measures of fetal wellbeing. So Doppler examinations, fluid assessment, biophysical profile. Surveillance is going to be based around ultrasound and CTG as we're trying to decide how can we maximise gestation but also optimise fetal condition at delivery.

And timing and mode of delivery will be a bit contingent on what's the presentation, what's the gestation. What's maternal wellbeing? What's fetal wellbeing? Those same four rules that apply for all planned end to a pregnancy, whether we're going to go for induction or cesarean section. Don't forget S.T.I.N.G. Steroids, Transfer, Intrapartum care, Neuroprotection, Give more blood with delayed cord clamping.

And don't forget that these can be really very intense pregnancies and the patient and her family will often need debriefing afterwards. And this is particularly at this time, at the moment, we're in the middle of the COVID pandemic, where often partners have not been able to come for ultrasounds or for consultations and it's just important that we don't leave anyone behind.

Okay. So that's it from me. That's a little podcast on fetal growth restriction. I really hope you're enjoying these podcasts. We're loving putting them together for you. And please, if you've got any topics you'd like covered or you've got feedback about this or other podcasts, don't hesitate to get in touch with us.

Okay. Hope you have a fantastic day, whatever you're doing today in labour ward, in clinic, in theatre and bye for now.”